GeoReports

British Geological Survey

Example Report
BGS Wallingford

Ground Source Heat Pump - vertical open loop:

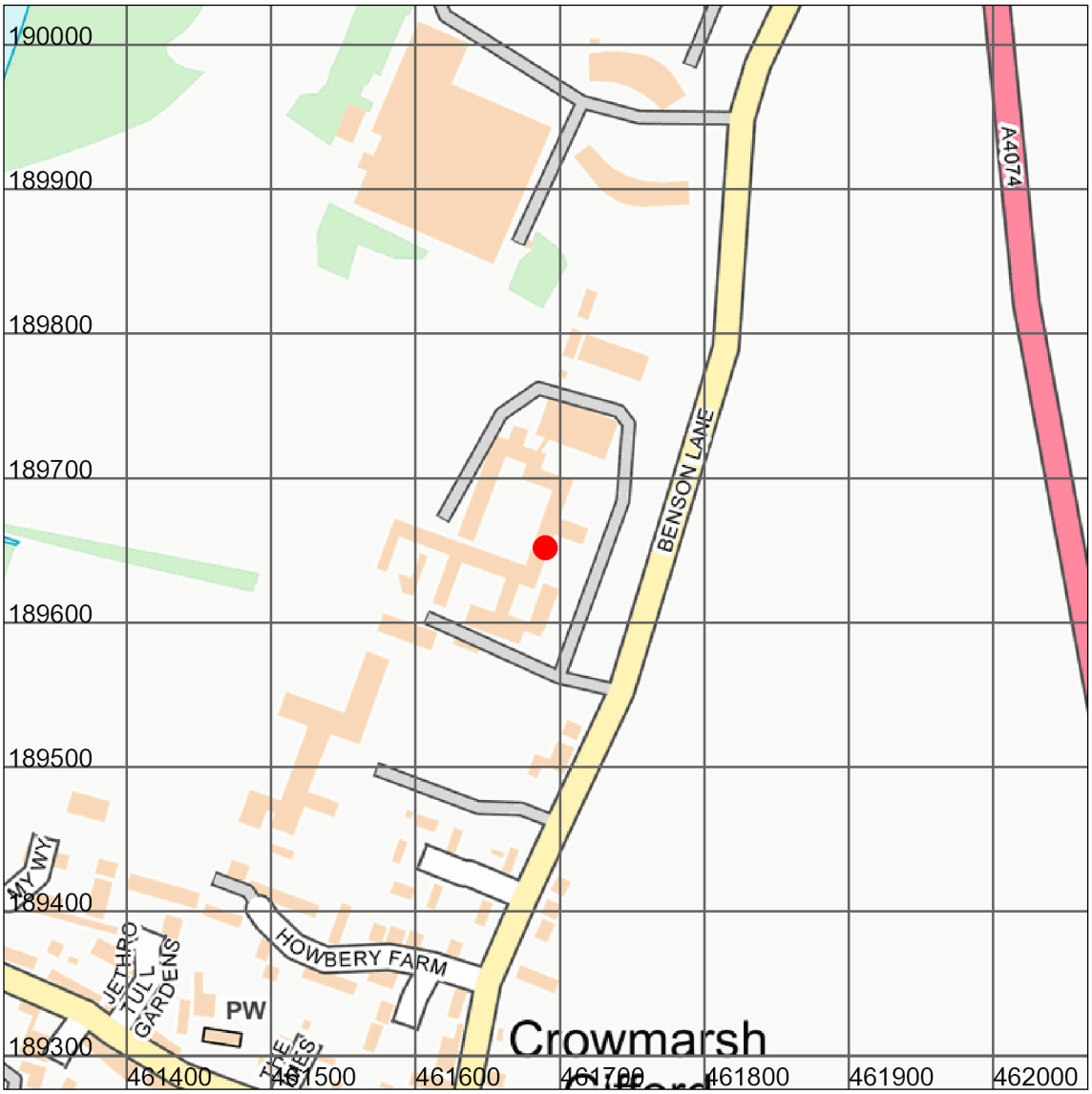
This report is designed for users proposing to install ground source heating using an open loop system. This report contains a description of the geological units found at depth beneath the site and an evaluation of the geological formations in terms of aquifer potential including groundwater yields, water levels and groundwater quality. It also contains recommendations on the design of the proposed abstraction and re-injection boreholes and information on the legal requirements.

Modules:
Geological Map Extracts
Borehole prognosis (point)
Groundwater Abstraction for Large Yields
Geoscience Data List

Report Id: ***GR_999999/1***

Client reference:

Search location



Search location indicated in red

Site Address:
British Geological Survey
Wallingford

Point centred at: 461690,189652

Geological Map Extracts 1:10,000 Scale

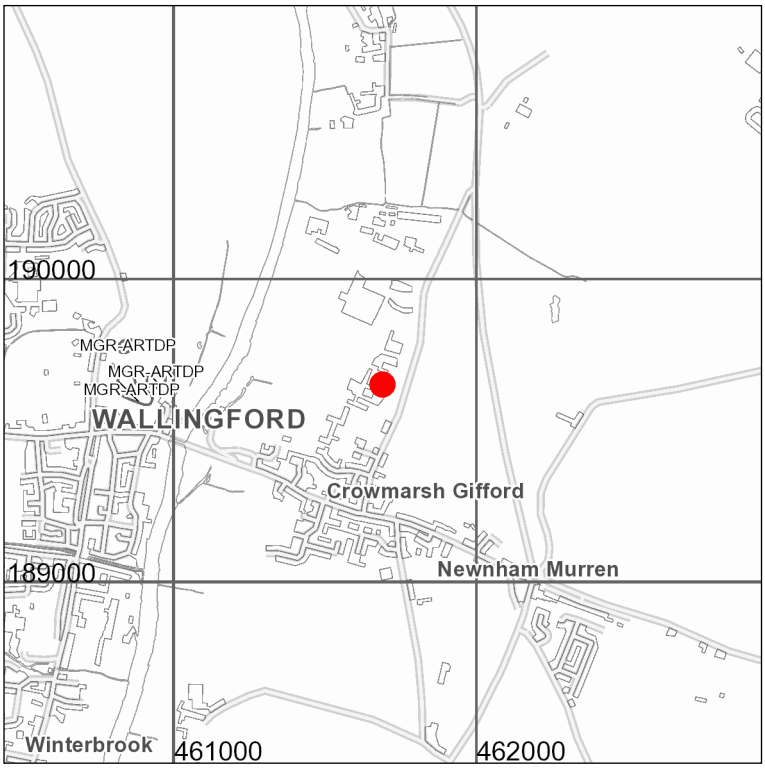
This part of the report contains extracts of geological maps taken from the 1:10 000 scale BGS Digital Geological Map of Great Britain (BGS Geology 10k). The geological information in BGS Geology is divided into four themes: artificial ground, landslide deposits, superficial deposits and bedrock, shown here in separate maps. The fifth 'combined geology' map superimposes all four of these themes, to show the uppermost geological formations.

More information about BGS Geology 10k is available here http://www.bgs.ac.uk/products/digitalmaps/DiGMapGB_10.html and information on the BGS geological classification schemes here http://www.bgs.ac.uk/bgsrcs/. The maps are labelled with two-part computer codes that indicate the name of the geological unit and its composition. Descriptions of the units listed in the map keys may be available in the BGS Lexicon of Named Rock Units (http://www.bgs.ac.uk/lexicon/). If available, these descriptions can be found by searching against the first part of the computer code used on the maps. Please consult the legend and the codes on the map in areas of complex geology. If in doubt, please contact BGS Enquiries for clarification.

In the map legends the geological units are listed in order of their age, as defined in the BGS Lexicon, with the youngest first. However, where units are of the same defined age they are listed alphabetically and this may differ from the actual geological sequence.

Artificial ground

This is ground at or near the surface that has been modified by man. It includes ground that has been deposited (Made Ground) or excavated (Worked Ground), or some combination of these: Landscaped Ground or Disturbed Ground.



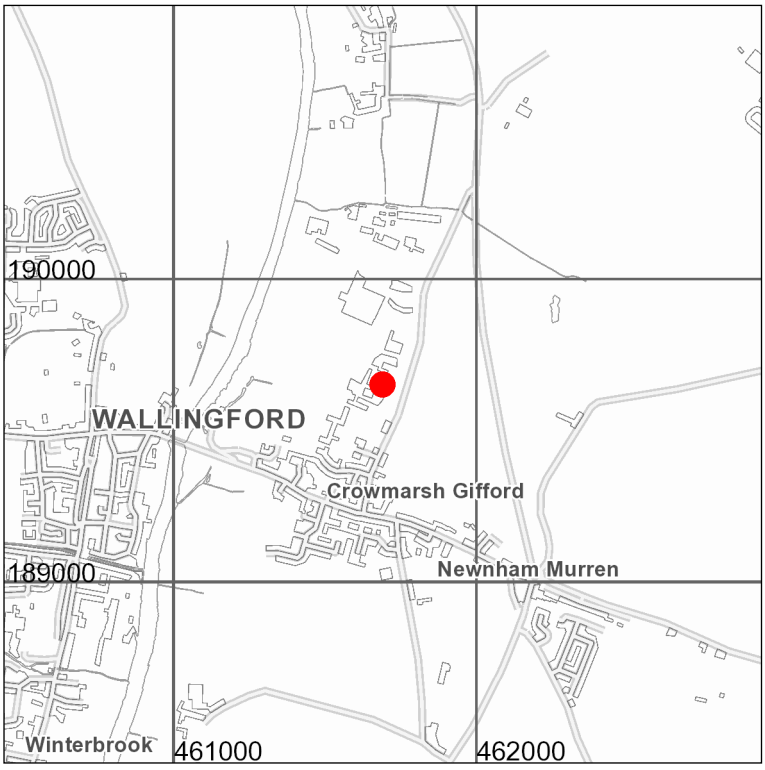
Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Key to Artificial ground:

Map colour	Computer Code	Name of geological unit	Composition
	MGR-ARTDP	MADE GROUND (UNDIVIDED)	ARTIFICIAL DEPOSIT

Landslide deposits

These are deposits formed by localised mass-movement of soils and rocks on slopes under the action of gravity. Landslides may occur within the bedrock, superficial deposits or artificial ground; and the landslide deposits may themselves be artificially modified.



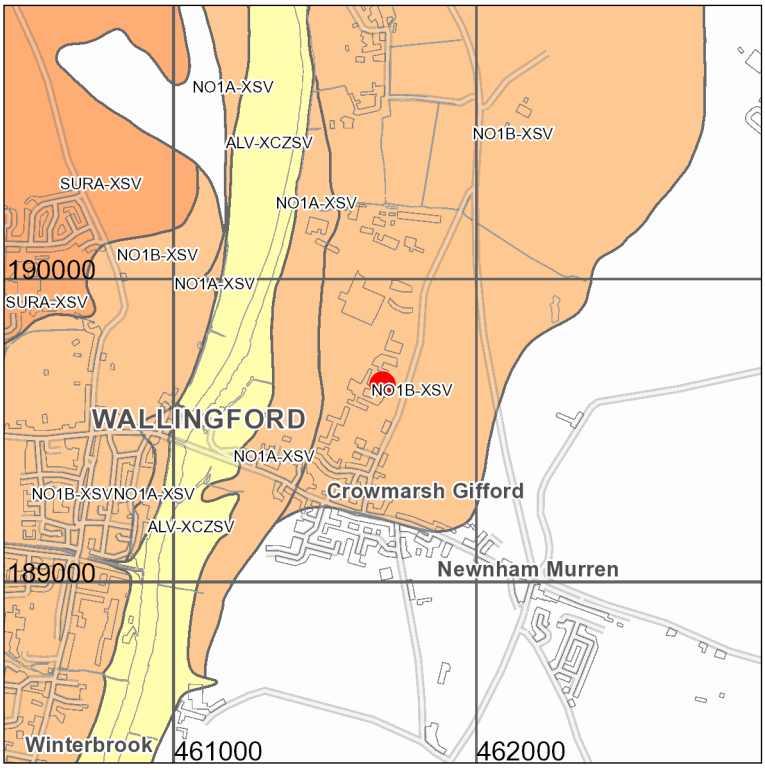
Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Key to Landslide deposits:

No deposits found in the search area

Superficial deposits

These are relatively young geological deposits, formerly known as ‘Drift’, which lie on the bedrock in many areas. They include deposits such as unconsolidated sands and gravels formed by rivers, and clayey tills formed by glacial action. They may be overlain by landslide deposits or by artificial deposits, or both.



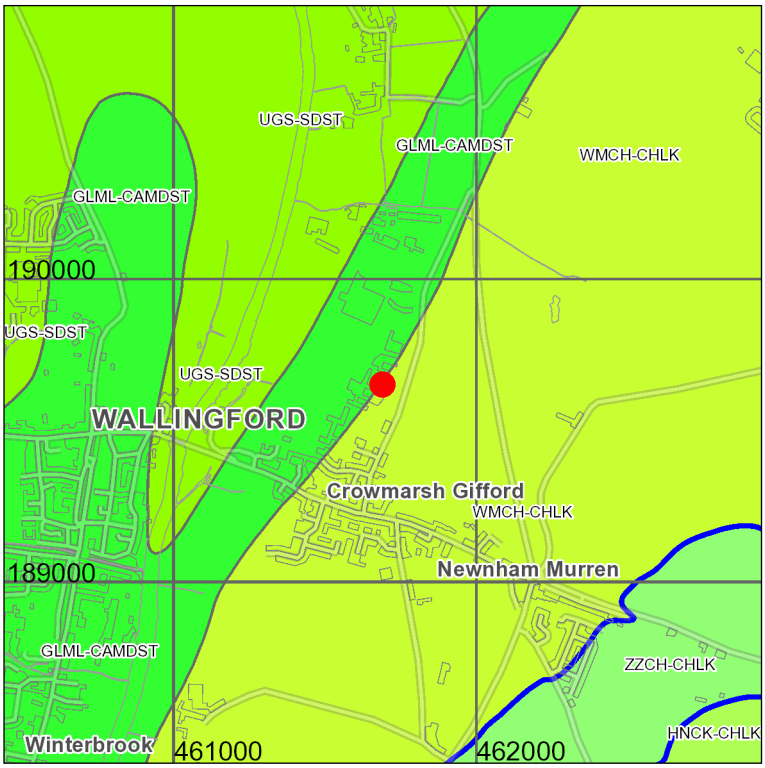
Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Key to Superficial deposits:

Map colour	Computer Code	Name of geological unit	Composition
	ALV-XCZSV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL
	SURA-XSV	SUMMERTOWN-RADLEY SAND AND GRAVEL MEMBER	SAND AND GRAVEL
	NO1A-XSV	NORTHMOOR SAND AND GRAVEL MEMBER, LOWER FACET	SAND AND GRAVEL
	NO1B-XSV	NORTHMOOR SAND AND GRAVEL MEMBER, UPPER FACET	SAND AND GRAVEL

Bedrock

Bedrock forms the ground underlying the whole of an area, commonly overlain by superficial deposits, landslide deposits or artificial deposits, in any combination. The bedrock formations were formerly known as the ‘Solid Geology’.



Search area indicated in red

Fault

Coal, ironstone or mineral vein

Note: Faults are shown for illustration and to aid interpretation of the map. Because these maps are generalised from more detailed versions not all such features are shown and their absence on the map face does not necessarily mean that none are present. Coals, ironstone beds and mineral veins occur only in certain rock types and regions of the UK; if present here, they will be described under ‘bedrock’ below.

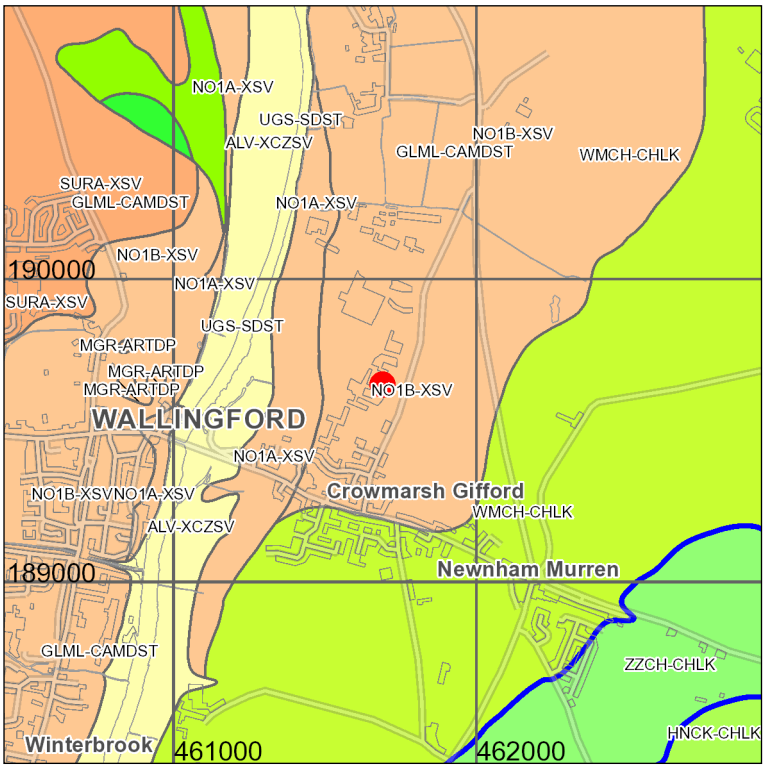
Scale: 1:25 000 (1cm = 250 m)

Key to Bedrock geology:

Map colour	Computer Code	Name of geological unit	Rock type
	HNCK-CHLK	HOLYWELL NODULAR CHALK FORMATION AND NEW PIT CHALK FORMATION (UNDIFFERENTIATED)	CHALK
	ZZCH-CHLK	ZIG ZAG CHALK FORMATION	CHALK
	WMCH-CHLK	WEST MELBURY MARLY CHALK FORMATION	CHALK
	GLML-CAMDST	GLAUCONITIC MARL MEMBER	CALCAREOUS MUDSTONE
	UGS-SDST	UPPER GREENSAND FORMATION	SANDSTONE

Combined 'Surface Geology' Map

This map shows all the geological themes from the previous four maps overlaid in order of age.



Scale: 1:25 000 (1cm = 250 m)
Search area indicated in red

Please see the Keys to the Artificial, Landslide, Superficial and Bedrock geology maps.

Borehole Prognosis

This module provides an evaluation of the expected geological sequence beneath a site to a depth appropriate for the specified use. This interpretation is based on the information available in the surrounding area. Due to natural geological variation the conditions encountered on drilling may differ. This module does not cover the possibility of artesian conditions or gas being encountered. (Information on artesian conditions is included in the 'Groundwater abstraction' and 'Hydrogeology – non abstraction' modules).

Setting:

The site lies at an elevation of about 48 m above Ordnance Datum (OD) on the edge of the village of Crowmarsh Gifford. The proposed borehole site lies about 450 m east of the River Thames that flows approximately north to south at an elevation of about 44 m above OD. There are small drainage ditches in places on the nearby flood plain, and also a longer stream flowing from east to west, about 500 m north of the site.

Geology

It is anticipated that the following succession of strata will be encountered in an 150 m deep borehole below the site:

Unit	Typical composition	Potential for difficult ground	Thickness in metres	Depth in metres to the base of the unit
Artificial ground				
Made Ground	No Made Ground has been identified up to and including the most recent map compilation. However, owing to the development history of the site, it is likely that some Made Ground of limited thickness and variable composition (e.g. construction waste) may be present.		Up to 1	c. 1
Superficial deposits				
Northmoor Sand and Gravel Member (upper facet)	Sand and gravel	Possible running sands	Between 3 and 5	c. 5
Bedrock (below rockhead)				
West Melbury Marly Chalk Formation	Grey marly (clay-rich) chalk with thin limestone beds	Possible chalk dissolution	Up to 2	c. 6
Glauconitic Marl Member	Pale brownish-grey clay-rich chalk marl with grains of glauconite; commonly contains phosphatic pebbles		Up to 2	c. 7

Upper Greensand Formation	Dark green glauconitic sand and sandstone with a clay matrix underlain by whitish, micaceous, calcareous siltstone and fine-grained sandstone with some chert and siliceous sandstone (‘malmstone’)	Possible running sands	About 15	c. 22
Gault Formation	Grey, silty mudstone; silty towards top, gravelly at base		About 60	c. 82
Lower Greensand Group	Coarse-grained, ferruginous, quartzose sand with small quartzite pebbles; locally passes into sandy clay	Possible running sands	5 to 8	c. 88.5
Portland Formation	Sand and limestone	Possible running sands	Up to 2 (if present)	c. 89.5
Kimmeridge Clay Formation	Silty mudstones, some sandy		About 35	c. 124.5
Corallian Group	Sand, sandstone, limestone and mudstone	Possible running sands	About 25	c. 149.5
West Walton and Oxford Clay Formations	Mudstone		Over 90	to base

The borehole prognosis presented in the table above is the best estimate based upon available borehole information and regional knowledge. The paucity of deeper boreholes adjacent to the search site mean that much of the prognosis is estimated based upon regional knowledge and therefore carries a degree of uncertainty. Caution should therefore be used when using this prognosis. Additional uncertainty relating to the thickness for specific units where some regional variability is known, is indicated by qualifiers used within the table including ‘up to’ and ‘about’ or ‘if present’. Where uncertainty is indicated, the ‘Depth in Metres to the base of the unit’ is calculated based upon the median thickness within the uncertainty range.

The thickness of the Northmoor Sand and Gravel Member beneath the search site is not known with certainty because there are no

boreholes or trial pits at or adjacent to the site that penetrate the entire thickness of the natural deposits. Instead, a thickness of between 3 and 5 m is estimated based upon commonly observed thicknesses (not total thickness) in adjacent boreholes (e.g. SU68NW4) and regional understanding.

Similarly, there is some uncertainty relating to the thickness of specific bedrock units. In particular, the Portland Formation may be either thin or entirely absent from the succession.

The blue line in this table indicates ‘rockhead’, which is the base of superficial deposits. This is the ‘geological rockhead’, as distinct from the ‘engineering rockhead’, which is the base of ‘engineering soil’ (in the sense of BS5930:1999).

For further definitions of stratigraphic terms that appear in the table above, on our maps and in our publications please see ‘The BGS Lexicon’ www.bgs.ac.uk/lexicon

Information on the distribution of contaminated ground is not held by BGS but by the relevant Local Authority.

Potential drilling hazards considered at your site

This section of the report only describes geological hazards that might be directly encountered by drilling at this site.

Running sand conditions hazard

Running sand conditions occur when loosely-packed sand moves as a result of water flowing through the spaces between the sand grains. The pressure of the flowing water reduces the contact between the grains and they are carried along by the flow. Excavations or boreholes in water-saturated sand are likely to encounter running conditions: the sand will tend to flow into the void. This can lead to subsidence of the surrounding ground.

Groundwater Abstraction – Large yields

This module is designed for users proposing to drill a water borehole for the abstraction of large volumes of groundwater, possibly with associated reinjection. It is intended for users proposing to abstract more than 20 m^3/d for a water supply or open loop ground source heat pump system (or aquifer thermal energy storage scheme).

It contains an evaluation of the geological formations beneath the site in terms of aquifer potential including groundwater yields, water levels, direction of groundwater flow and groundwater quality. It also contains information on aquifer properties of the formations under the site and recommendations on the design of the proposed water borehole and information on the legal requirements.

Proposed yield is 200 m^3/d (cubic metres per day)
Proposed use is for an open loop ground source heat pump system

Groundwater Potential

A yield of 200 m^3/d is equivalent to 5.6 l/s (20 m^3/hr) pumping for 10 hours/day. This size of abstraction would require an Environment Agency licence.

The Northmoor Sand and Gravel Member is likely to be partially saturated, with a rest water level about 2 m below ground surface (about 46 m above OD), indicating that a saturated thickness of between 2 and 4 m is present below the site. The superficial deposits should be capable of supplying a reasonable yield as the base of the deposit is likely to lie below river level and hence it will probably be in hydraulic continuity with the River Thames. A borehole adjacent to the river at Howbery Park [SU69SW284; SU 6135 9007] was 5.2 m deep and assumed to abstract from the superficial deposits, it yielded up to 18.9 l/s (68 m^3/hr) for 2.1 m of drawdown after an unknown period of pumping in the 1960s. Water in these permeable deposits will be vulnerable to pollution from the ground surface. Water in the superficial deposits is shallow and hence the temperature is likely to vary both diurnally and seasonally.

The West Melbury Marly Chalk Formation and underlying Glauconitic Marl Member are both thin at this site and unlikely to provide any significant supply of water. Several of the boreholes in the area obtain their supplies from a mixture of the superficial sand and gravel deposits and underlying Upper Greensand Formation. The record for the production borehole at Hydraulics Research at Howbery Park [SU69SW297; SU 614 900] appears to indicate that the borehole had plain casing installed to 6 m, there was no casing between 6 m and 9 m through 2 m of clay and 1 m of gravels and sands (superficial deposits) which is unlikely, and then below 9 m, a further metre of gravels and sands and the Upper Greensand both had slotted casing installed against them. Another recent borehole [SU68NW328; SU 6166 8986]

at Howbery Park had slotted casing installed between depths of 5 and 23 m, against the basal 4 m of the superficial sands and gravels and the whole of the Upper Greensand. The borehole was drilled at 500 mm diameter and fitted with 330 mm diameter slotted casing and a sand pack. The blowout yield was 12.6 l/s.

The Glauconitic Marl may be of low permeability and this could hydraulically separate groundwater in the Northmoor Sand and Gravel Member from that in the Upper Greensand. One of the existing boreholes on the site [SU68NW302; SU 6154 8964] struck water in the superficial deposits at a depth of 2.8 m and also in the Upper Greensand at a depth of 6 m. It was plain cased to a depth of 11 m and is currently generally artesian, implying that at this site, the superficial deposits are not in hydraulic continuity with the Upper Greensand, the borehole recorded a 1.8 m thick clayey, sandy and glauconitic silt between 4.4 m and 6.2 m below ground level (presumably Glauconitic Marl Member).

Boreholes at Howbery Park have produced yields from the Upper Greensand of up to 15 l/s (54 m^3/hr) for an unknown drawdown, and 11.8 l/s (42.5 m^3/hr) for 12.5 m of drawdown during a 24 hour test from 20.3 m of saturated aquifer [SU69SW31; SU 6165 9023], and 13.6 l/s (49 m^3/hr) for 14.2 m of drawdown after 7 days pumping from 16 m of saturated aquifer [SU69SW286; SU 6167 9015].

Water from two 15-16 m deep boreholes into the Upper Greensand at Wallingford Pumping Station [SU68NW25; SU 6023 8951 and SU68NW259; SU 6028 8947] had a total hardness of 370 mg/l and 513 mg/l (as $CaCO_3$), respectively. Water from a 14 m deep borehole into Upper Greensand at Benson [SU69SW32; SU 635 921] had a pH of 6.9, a total dissolved solids content of 363 mg/l, total hardness of 274 mg/l (as $CaCO_3$), permanent (non-carbonate) hardness of 52 mg/l (as $CaCO_3$), chloride ion concentration of 21 mg/l, nitrate of 4.4 mg/l (as NO_3), and total iron 500 µg/l, of which none was in solution. However, two analyses from boreholes at Fairmile Hospital, Wallingford [SU58NE24; SU 5980 8604 and SU58NE26; SU 5975 8607], undertaken between 1948 and 1952, reported no iron. The temperature of water from the Upper Greensand should be similar to the mean annual air temperature, about 10-11°C, possibly with very small seasonal variations, as the top of the aquifer is less than 15 m below the ground surface.

Water in the Lower Greensand is confined by the overlying Gault and is likely to be brackish. The water level rose to 50 m above OD (pre 1910) in a borehole at Warborough [SU59SE24; SU 5975 9415] and overflowed (water level more than 48 m above OD) in 1882 at Shillingford [SU59SE21; SU 5956 9293].

The borehole at Warborough produced brackish groundwater with a total dissolved solids content of 7780 mg/l and that at Shillingford had a total dissolved solids content of 1396 mg/l, in both cases over half of this was attributable to sodium chloride with concentrations in excess of the recommended drinking water limits of

200 mg/l and 250 mg/l, for sodium and chloride, respectively; so unsuitable for potable use without treatment. Wells at Newington [SU62NW23; SU 6101 9640 and SU62NW28; SU 6100 9684] also encountered poor quality water in the Lower Greensand (or Portland Formation).

The water at the base of the Corallian aquifer at a depth of 114 m at Shillingford [SU59SE21; SU 5956 9293] was reported to be 'palatable' when drilled in 1885, but there is no analysis to ascertain whether it would be considered suitable for potable use nowadays; the yield was described as 'not sufficient'. However, a borehole at Stadhampton [SU69NW30; SU 6019 9854] overflowed with brackish water from the Corallian, yielding 1.4 l/s (5 m^3/hr) for a drawdown to 23 m below the surface after 2 days pumping. Another borehole nearby [SU69NW29; SU 6024 9853] overflowed at 0.2 l/s (0.7 m^3/hr) but again was not used due to the high salinity; this water had a total hardness of 143 mg/l (as $CaCO_3$), all temporary (carbonate).

Aquifer Properties Data

A search of our databases has produced the following relevant aquifer properties data from within a distance of about 20 km.

Small core samples of Upper Greensand at North Farm, Bockhampton [SU37NW8; SU 3321 7970] had a porosity of 27.8% and a hydraulic conductivity of 0.017 m/d.

The nearest transmissivity values for the Upper Greensand are for a site at Manor Road Pumping Station, Wantage [SU38NE19-21; SU 397 869] with a value of 30 m^2/d and Upton [SU58NW57-58; SU 510 874] with a value of 20 m^2/d. A borehole at Chinnor [SU79NW94; SU 745 982] penetrating 30 m of Upper Greensand had a transmissivity of 690 m^2/d and a storage coefficient of 8.1 x 10^{-4}.

Core samples from the Corallian beneath 187 m of overburden at Harwell [SU48NE92; SU 4680 8644] had a mean porosity of 23.7%.

Groundwater Vulnerability

The superficial Northmoor Sand and Gravel Member deposits are highly permeable and will be vulnerable to contamination occurring at the ground surface. The shallow water table means that any contaminants are likely to be transported rapidly through the unsaturated zone of the aquifer to the water table.

Groundwater in the Upper Greensand could be protected from surface pollution by the presence of the overlying, less permeable, Glauconitic Marl, however this is thin and has been breached locally by boreholes. Where the water level is artesian, surface pollution is unlikely to enter this aquifer.

Conclusion

Based on the evidence of other boreholes in the area, it is considered possible that a

large diameter borehole, drilled at a minimum of 400 mm diameter and completed at a minimum of 300 mm diameter, to just below the base of the Upper Greensand (about 30 m deep) could supply the required yield of 200 m^3/d over a 10 hour pumping period. The water should be of reasonable quality although iron may be present; this can be removed by aeration. A correctly designed and emplaced sand screen and filter pack will be required against the contributing horizons. The best chances of success will probably be a borehole that obtains water from both the superficial deposits (Northmoor Sand and Gravel Member) and the Upper Greensand; these two aquifers will require different screen sizes and sand packs.

If several boreholes were constructed to obtain a larger yield, it is possible that interference effects (between the zones of drawdown) could be significant as high rates of abstraction, accompanied by large water level drawdowns in each borehole, will be likely to induce depression of the water level over a broad zone, possibly extending for hundreds of metres. This interference will increase the total amount of drawdown in the boreholes and may consequently restrict the yield that can be obtained from each borehole. Interference effects can be minimised by the careful siting of additional boreholes, but this requires a detailed knowledge of aquifer properties beneath the site. Such information can only be obtained from data collected during a carefully conducted aquifer test that includes the monitoring of water levels in observation boreholes.

If it is planned to re-inject water into the aquifer, the injection borehole(s) should be sited as far away as possible from the abstraction hole(s), again to minimise hydraulic interference effects. There could also be thermal interference effects between the boreholes. However, if the system is used solely for cooling, thermal interference is likely to become a problem and in aquifer thermal energy storage schemes it is important that the thermal load is balanced.

The Environment Agency generally require the water to be returned to the same aquifer that it is abstracted from. However, due to the high water level and potentially overflowing conditions at least for part of the year, it may not be feasible to return water into the Upper Greensand aquifer. It is possible that the injection borehole would not accept water at the same rate that it was abstracted at, due to air entrapment and/or borehole clogging by particulate matter or growth of biofilms. It is recommended that the borehole headworks be installed above ground level to ensure adequate ventilation. Altering the temperature of the water may alter the solubility of different minerals and hence the water chemistry.

The hydraulic gradient induced by abstraction (drawdown) and reinjection (hydraulic mound) from two relatively closely spaced boreholes is likely to greatly exceed the natural hydraulic gradient. However for a cooling system, not all the heat added to the water will be dissipated via natural or induced groundwater flow and thermal conduction. A large proportion of the heat will be absorbed and stored in the rocks

themselves and may provide a useable source of heat. The converse would apply if the system was used primarily for heating purposes.

Due to the low hydraulic gradient at this site, heat advection due to groundwater flow may not significantly improve heat transfer in either the superficial Northmoor Sand and Gravel or Upper Greensand aquifers.

According to the geological maps, the geology, and therefore the borehole potential, does not vary significantly across the site. The chances of drilling a successful borehole are therefore similar across the site.

This borehole prognosis is primarily based on information held in the National Well Record Archive; this contains records of boreholes submitted at the time of drilling. Therefore, the information held is often historical in nature; the Environment Agency may hold more up-to-date information. Often the water quality data held is also historical in nature and will not have been analysed for trace elements that, if present, could be in concentrations greater than the current maximum admissible amounts for a potable supply.

Borehole Location, Construction, Testing and Legal Obligations

Location:

It is good practice to site a borehole as far away as possible, and preferably upslope, from any potential sources of pollution, including septic or fuel tanks, soakaways, slurry pits and areas of intensive grazing. A minimum distance of 50 m between a water borehole and any potentially polluting activity is recommended.

Construction:

For boreholes abstracting from the superficial deposits, the top few metres should be cased out (the depth of plain casing depending on the aquifer thickness at the specific site). A borehole abstracting water from a bedrock aquifer should be sealed off through the superficial deposits by installing a length of plain casing to at least 5 m below the upper surface of the bedrock. The casing should be grouted effectively to form a sanitary seal in order to minimise the risk of poor quality surface or shallow groundwater entering the borehole.

Testing:

Any new borehole should be subject to a pumping test to determine the yield and drawdown of the water level. For a borehole designed for a single domestic property, it is recommended that a pumping test of at least 3 hours duration, or at least as long as the anticipated daily pumping period, is carried out, during which both the pumping rate and water level are monitored. For domestic supplies for more than one property, a longer pumping test of at least 6 to 12 hours is more appropriate. For larger supplies the Environment Agency are likely to require a test of several days duration, as well as the monitoring of nearby water sources before, during and after

test pumping.

Water quality:
It is recommended that a water sample, taken during the final stages of the pumping test, is sent for full analysis to a reputable laboratory. They, or if a potable private supply is envisaged the Environmental Health Officer of the local council, should be able to advise on the range of analyses to be undertaken, which would normally include pathogenic indicator bacteria, iron, manganese and nitrate. An adequate and well-maintained disinfection treatment system would be considered advisable for any supply intended for potable use.

Legal requirements:
While BGS may assess the groundwater potential at this site, the prerogative of granting a licence rests with the Environment Agency, West Thames area. Currently all sources abstracting 20 m^3/d or more require an abstraction licence. A ‘Consent to Investigate Groundwater' must be obtained from the Environment Agency prior to a licensable borehole being drilled; this consent permits drilling and pump testing. If a borehole is drilled to more than 15 m depth, there is a statutory requirement (Water Resources Act, 1991) for the driller to supply full information to the Wallingford office of the BGS for inclusion in the National Well Record Archive. A form for supplying the required information is enclosed.

Maximum admissible concentrations and values for selected parameters in drinking water under the Private Water Supply (England) Regulations 2016 and Private Water Supply (Wales) Regulations 2017

Microbiological parameters	**Concentration or value**
Enterococci (number/100 ml)	0
Escherichia coli (E. coli) (number/100 ml)	0
Pseudomonas aeruginosa[(i)]	0
Colony count @ 22°C[(ii)]	100
Chemical parameters	**Concentration or value**
Arsenic (µg/l)	10
Benzene (µg/l)	1
Boron (µg/l)	1
Bromate (µg/l)	10
Chromium (µg/l)	50
Copper (mg/l)	2
Fluoride (mg/l)	1.5
Lead ((µg/l)	10
Mercury (µg/l)	1
Nickel (µg/l)	20
Nitrate (as mg/l NO_3)	50
Nitrite (as mg/l NO_2)[(iii)]	0.5
Pesticides-individual (µg/l)[(iv)]	0.1
Pesticides-total (µg/l)	0.5
Polycyclic aromatic hydrocarbons (µg/l)	0.1
Selenium (µg/l)	10
Trichloroethene and tetrachloroethene (perchloroethylene) (µg/l)	10
Total trihalomethanes (µg/l)	100
National requirements	**Concentration or value**
Aluminium (µg/l)	200
Colour (mg/l Pt/Co)	20
Iron (µg/l)	200
Manganese (µg/l)	50
Odour and taste	Acceptable to consumers and no abnormal change
Sodium (mg/l)	200
Tetrachloromethane ((µg/l)	3
Turbidity (NTU)[(v)]	4
Indicator parameters	
Ammonium (as mg/l NH_4)	0.5
Chloride (mg/l)	250
Clostridium perfringens (including spores) (number/100 ml)	0
Coliform bacteria (number/100 ml)[(vi)]	0
Colony count @ 22°C	No abnormal change
Electrical conductivity (SEC) @ 20°C (µS/cm)	2500
pH[(vii)]	≥6.5 and ≤9.5
Sulphate (mg/l)	250
Total organic carbon (TOC)	No abnormal change
Radioactive substances	**Concentration or value**
Indicative dose (mSv)	0.1
Radon (Bq/l)	100
Tritium (Bq/l)	100

Notes

(i) in bottled water
(ii) in bottled water, otherwise indicator parameter is no abnormal change
(iii) 0.1 mg/l at treatment works
(iv) except aldrin, dieldrin, heptachlor and heptachlor epoxide where the limit is 0.03 µg/l
(v) where influenced by surface water, 1 NTU indicator value
(vi) 0/250 ml for bottled water
(vii) not aggressive, ≥4.5 and ≤9.5 for bottles and containers

Geoscience Data List

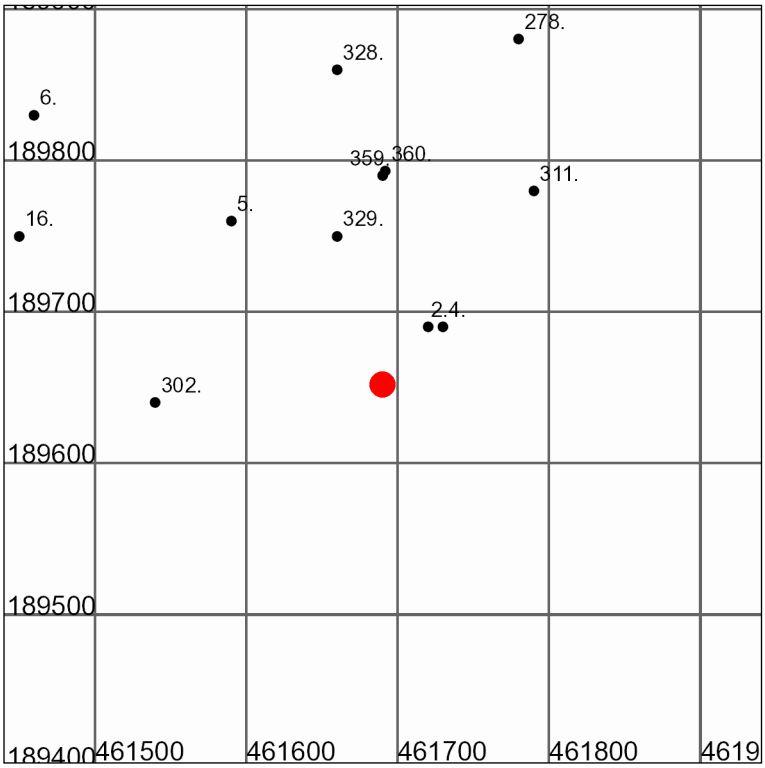
List of available geological data

This part of the report lists the principal data sets held in the National Geoscience Records Centre that are relevant to your enquiry and explains how to obtain copies of the records. Users can make their own index searches using the BGS web page (go to 'Online shops' at www.bgs.ac.uk). This will give access to the BGS Bookshop, Publications catalogue, GeoRecords (borehole browser) and GeoReports.

For current pricing see these internet pages or contact us using the list found at the back of this report.

Note that this report contains selective datasets and is not a definitive listing of all data held in BGS.

Borehole location map



Scale: 1:5 000 (1cm = 50 m)

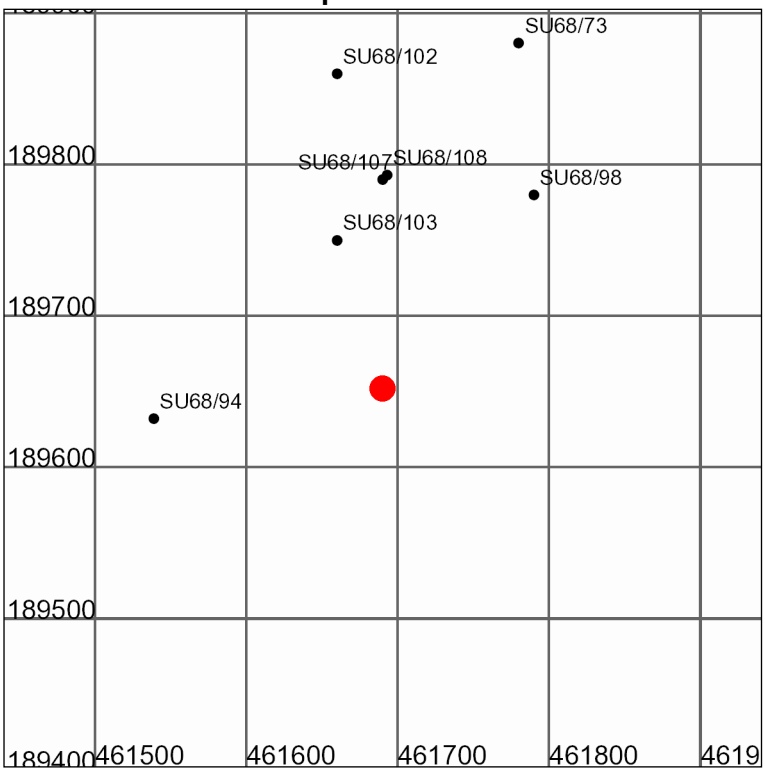
Borehole records

Number of records in map area: 12

In the following table a blank 'Length' field indicates that the borehole is confidential or that no depth has been recorded digitally.
Enquiry staff may be able to provide you with contact details for the originator if you wish to seek release of confidential information.

Borehole registered no	Grid reference	Borehole name	Length (m)
SU68NW16	SU 61450 89750	HOWBERRY PARK CROWMARSH	4
SU68NW2	SU 61720 89690	HOWBERRY PARK BH6 BENSON OXON	8.83
SU68NW278	SU 61780 89880	HYDRAULICS RESEARCH STATION	2.59
SU68NW302	SU 61540 89640	WALLINGFORD TEST BORE, MACLEAN BUILDING	53
SU68NW311	SU 61790 89780	HR WALLINGFORD, HOWBERY PARK OBH	30
SU68NW328	SU 61660 89860	H R WALLINGFORD, HOWBERRY PARK	25
SU68NW329	SU 61660 89750	MACLEAN BUILDING, CROWMARSH GIFFORD	6
SU68NW359	SU 61690 89790	CEH WALLINGFORD WAL84	5
SU68NW360	SU 61692 89793	CEH WALLINGFORD WAL85	4.8
SU68NW4	SU 61730 89690	HOWBERRY PARK TH4 BENSON OXON	3.04
SU68NW5	SU 61590 89760	HOWBERRY PARK TH5 BENSON OXON	2.43
SU68NW6	SU 61460 89830	HOWBERRY PARK TH6 BENSON OXON	4.26

Water well location map



Scale: 1:5 000 (1cm = 50 m)

Water Well records

Number of records in map area: 7

All of these records are registered in the main Borehole Records collections (see Borehole Records Table and map above), but please note that some may be duplicate or part duplicate copies. This map shows records of water wells and boreholes in the National Well Record Archive held at Wallingford (WL) or Murchison House (MH). Each record has a Well Registration number which should be quoted when applying for copies.

Additional index information may be held for the Water Well Records as shown below, indicating the information that can be found on the well record itself. If fields are blank, then the well record has not been examined and its contents are unknown. A ‘Yes’ or a ‘No’ indicates that the well record has been examined and the information indicated is, or is not, present. This information should help you when requesting copies of records.

Water Well records

Well Reg No.	BH Reg No.	Name	Easting	Northing	Depth (m)	Date	Aquifer	G	C	W	Ch
SU68/73	SU68NW278/BJ	HYDRAULICS RESEARCH STATION	461780	189880	2.6		SUPERFICIAL DEPOSITS	No	Yes	Yes	No
SU68/94	SU68NW302/BJ	INSTITUTE OF HYDROLOGY, CROWMARSH GIFFORD	461539	189632	53	1979	UPPER GREENSAND FORMATION	Yes	Yes	Yes	No
SU68/98	SU68NW311/BJ	H R WALLINGFORD, HOWBERY PARK OBH	461790	189780	30	2004	UPPER GREENSAND FORMATION	Yes	Yes	Yes	No
SU68/102	SU68NW328/BJ	HOWBERRY PARK, WALLINGFORD	461660	189860	25	2008	SUPERFICIAL DEPOSITS and UPPER GREENSAND FORMATION	Yes	Yes	Yes	No
SU68/103	SU68NW329/BJ	MACLEAN BUILDING, CROWMARSH GIFFORD	461660	189750	6		NOT ENTERED	No	Yes	Yes	No
SU68/107	SU68NW359/BJ	CEH WALLINGFORD WAL84	461690	189790	5	2011	SUPERFICIAL DEPOSITS	Yes	Yes	Yes	No
SU68/108	SU68NW360/BJ	CEH WALLINGFORD WAL85	461693	189793	4.8	2011	SUPERFICIAL DEPOSITS	Yes	Yes	Yes	No

KEY:
Aquifer = The principal aquifer recorded in the borehole
G = Geological Information present on the log
C = Borehole construction information present on the log
W = Water level or yield information present on the log
Ch = Water chemistry information present on the log

Boreholes with water level readings
Number of records in map area: 1

Reference	Easting	Northing	Location	Start_date	End_date	Readings
SU68/73	461780	189880	HYDRAULICS RESEARCH STATION	1960	1971	15

Locations with aquifer properties
Number of records in map area: 0
BGS holds no locations with aquifer properties for the selected area

Site investigation reports
Number of records in search area: 4

Additional laboratory and test data may be available in these reports, subject to any copyright and confidentiality conditions. The grid references used are based on an un-refined rectangle and therefore may not be applicable to a specific site. Borehole records in these reports will be individually referenced within the borehole records collection, described above.

Number	Site investigation title
13340	WHITE CROSS FARM, WALLINGFORD
36074	PRIORY MEADOWS CROWMARSH
39056	HOWBERRY FARM CROWMARSH
54083	STATION ROAD INDUSTRIAL ESTATE WALLINGFORD

National Grid geological maps (1:10 000 and 1:10 560 scale)
Number of records in search area: 1

Map	Type	Survey
SU68NW	C	1974

County Series geological maps (1:10 560 scale)
Number of records in search area: 2

Map	Type	Published
Berkshire16SE		1910
Oxfordshire49SE	C	0

New Series medium scale geological maps (1:50 000 and 1:63 360 scale)
Number of records in search area: 2

Sheet number	Sheet name	Type	Published
254	Henley-on-Thames	C	1980
254	Henley-on-Thames	C	1905

Old Series one inch geological maps (1:63 360 scale)
Number of records in search area: 1

Sheet number	Sheet name	Type	Published
13	Bampton	S	1859

Hydrogeological maps (various scales)
Number of records in search area: 1

Map	Scale
South West Chilterns	1:100,000

Geological Memoirs

Number of records in search area: 1

Geological memoir	Date
Henley on Thames & Wallingford	1908

Technical reports

Technical reports may be available for this area. Please email sales@bgs.ac.uk for further information.

Waste sites

Number of records in search area: 0

Listing of some 3500 waste sites for England and Wales identified by BGS as part of a survey carried out on behalf of the Department of the Environment in 1973. Later information may be available from the Local authority.
BGS holds no records of waste sites for the selected area

BGS non-coal mining plans

Number of records in search area: 1

This listing shows mining plans, including abandonment plans. The coverage is not comprehensive.

Record Type	Plan No.	Title
KP	18191	WESTPHALIAN A & B OF THE COALFIELDS OF ENGLAND & WALES (INCLUDING CANONBIE)

Contact Details

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- Note that for some sites, the latest available records may be historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

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