

ENVIRONMENT

Norris Jones Developments
Land off Hillock Lane
Gresford
Agricultural Land Classification Report

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Land off Hillock Lane
Gresford
Agricultural Land Classification Report

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1. INTRODUCTION

Instruction

- 1.1 BWB Consulting (BWB) was instructed by Norris Jones Developments (the Client) to produce an Agricultural Land Classification Report for the Land off Hillock Lane, Gresford, herein referred to as 'the site'.
- 1.2 This report has been produced to support a planning application for the first phase of a proposed residential development in Gresford, Wrexham comprising circa 125 to 135 homes.
- 1.3 It is understood that the site forms part of a wider proposed development area of 68.5 acres that may come forward in the future, depending on the progress of this initial application and has been promoted as part of the Wrexham Local Plan review process.

Objectives

- 1.4 The objectives of this Agricultural Land Classification Report are:
 - To describe the types of soils which may exist; and
 - To identify measures that could be taken to prevent, reduce and where possible offset any significant effects on the soils and the wider environment.

Legislation, Policy and Guidance

- 1.5 Technical Advice Note 6: Planning for Sustainable Rural Communities and Planning Policy Wales set out the land use planning policies of the Welsh Assembly Government in respect development involving agricultural land.
- 1.6 The Planning Policy Wales (PPWF) contains the following Paragraphs, which are considered relevant to this assessment:
 - Paragraph 3.54: Agricultural land of grades 1, 2 and 3a of the Agricultural Land Classification system (ALC)¹⁵ is the best and most versatile, and should be conserved as a finite resource for the future.
 - Paragraph 3.55: When considering the search sequence and in development plan policies and development management decisions considerable weight should be given to protecting such land from development, because of its special importance. Land in grades 1, 2 and 3a should only be developed if there is an overriding need for the development, and either previously developed land or land in lower agricultural grades is unavailable, or available lower grade land has an environmental value recognised by a landscape, wildlife, historic or archaeological designation which outweighs the agricultural considerations. If land in grades 1, 2 or 3a does need to be developed, and there is a choice between sites of different grades, development should be directed to land of the lowest grade.
- 1.7 The Wrexham Unitary Development Plan states the following:

- Paragraph 5.3: High quality agricultural land cannot readily be replaced and should not be irreversibly built upon unless there is no other lower quality site available. In the local context, grade 3a quality land is considered to be amongst the best and most versatile land and is given the same protection as higher grade land. In considering development affecting agricultural land, the agricultural implications will be considered together with environmental and economic aspects. In exceptional circumstances, where high quality agricultural land has to be taken, development should if possible avoid using the best managed land and land which has been improved through capital investment. Development proposals on land of Grades 1, 2 and 3a quality will require a specialist evaluation of the economic and environmental impact of the permanent loss of the land.

2. THE SITE

Site Location

- 2.1 The site is located at the land south of Hillock Lane in Gresford, Wrexham and is centred at National Grid Co-ordinates 336021, 354523. The location of the site is shown below in **Figure 2:1**.

Figure 2:1: Site Location Plan



Site Description

- 2.2 The site is an irregular shape and covers an area of approximately 15 acres (6.1 ha). The site currently comprises agricultural land. The site is surrounded by agricultural land with residential housing present to the north.

3. SITE CONDITIONS

Published Geology, Hydrogeology and Hydrology

Geology

- 3.1 BGS information indicates the site is directly underlain by superficial deposits of Glaciofluvial Sheet Deposits, Devensian (Sand and Gravel) over bedrock of the Kinnerton Sandstone Formation in the east of the site and the Salop Formation (Mudstone, Sandstone and Conglomerate) in the west of the site.
- 3.2 Based on the current and historical use of the site there is expected to be a thickness of Topsoil present across the site.

Hydrogeology

- 3.3 The Glaciofluvial Sheet Deposits and Salop Formation are both classified by the EA as Secondary A Aquifers. The Kinnerton Formation is classified as Principal Aquifer.
- 3.4 The eastern half of the site, where the Kinnerton Formation is mapped, is located within a Zone III - Total Catchment Groundwater Source Protection Zone; the western half is not.

Hydrology

- 3.5 The closest surface water feature to the site is a stream and pond approximately 270m south to the site.
- 3.6 Natural Resources Wales indicates the site is not located within a Flood Zone and the site is not noted to be affected by surface water flooding.

Previous Surveys

- 3.7 The closest surveys conducted to the site are located 300m and 600m west of the site. Both sites were classified as Grade 3a sites, with the western edge of the latter site indicated to be Grade 3b.
- 3.8 It is noted that near identical climatic data was used for this assessment (**Table 4:1**) and for the assessment 300m west. Droughtiness was indicated to be the limiting factor with the same geology as the subject site (Glaciofluvial Sheet Deposits)

4. SOILS ASSESSMENT

Sources of Information

- 4.1 The soils assessment has been prepared with reference to the following sources of public information:
- Soil Site Report (**Appendix 1**);
 - British Geological Survey (BGS) 1:50,000 Sheet 121, Wrexham, Solid and Drift, dated 1993;
 - Ordnance Survey contour information
 - Online BGS Viewer;
 - Climatological Data for Agricultural Land Classification by The Met. Office, dated 1989; and
 - Welsh Government Predictive Agricultural Land Classification (ALC) Map.

Fieldwork

- 4.2 Intrusive fieldwork was undertaken on 20th November 2019 and comprised the following works:
- Three Dutch auger boreholes to a maximum depth of 0.75m bgl (terminated due to impenetrable underlying gravels preventing the full depth of 1.2m being reached);
 - One hand-dug pit to a depth of 0.60m bgl (terminated due to impenetrable underlying gravels preventing the full depth being reached); and
 - Collection of soil samples for particle size distribution analysis at a UKAS accredited laboratory.
- 4.3 The investigation works were completed in the western area of the site, with no investigation conducted in the eastern third. Whilst an additional two hand augers would have been beneficial in the eastern area, based on the ground conditions being from the same geological unit (Glaciofluvial Sheet Deposits), for the purposes of this assessment, the logs from the western area have been extrapolated to cover this area.
- 4.4 One hand-dug pit was excavated to assess the physical properties of the soil, such as soil horizon layers, soil structure and stone content.
- 4.5 An exploratory hole location plan is presented as **Drawing 1**. Soil pit and auger profiles are presented as **Appendix 2**. The results of laboratory analysis for topsoil particle size distribution are presented as **Appendix 3**.

The ALC System

- 4.6 ALC assessments are made on the basis of the physical quality of land in accordance with the criteria and guidelines for grading contained in MAFF (1988) *Revised Criteria*

and *Guidelines for Grading the Quality of Agricultural Land*. The following information is also referred to as part of the assessment:

- Climatological Data for Agricultural Land Classification (Meteorological Office, 1989);
- Soil Survey Field Handbook (Hodgson, J.M. (Ed), 1997); and
- Munsell Soil Colour Chart.

4.7 The ALC system is based on the principle of 'most limiting factor' (Liebig's law of the minimum), where if a number of agricultural limitations exist the most limiting one determines the grade.

ALC Grades and Subgrades

4.8 The ALC grades and subgrades are defined as:

- **Grade 1 – excellent quality agricultural land:** land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.
- **Grade 2 – very good quality agricultural land:** land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The yield is generally high but may be lower or more variable than Grade 1.
- **Grade 3 – good to moderate quality agricultural land:** land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.
- **Subgrade 3a – good quality agricultural land:** land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, rapeseed, potatoes, sugar beet and the less demanding horticultural crops.
- **Subgrade 3b – moderate quality agricultural land:** land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops of high yields of grass which can be grazed or harvested over most of the year.
- **Grade 4 – poor quality agricultural land:** land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.
- **Grade 5 – very poor quality agricultural land:** land with very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

Climate Limitations

- 4.9 Climatic limitations are the first criteria when classifying land. The limitations are based on average annual rainfall (AAR) and accumulated temperature. Accumulated temperature (AT0) is calculated based on an established algorithm (Meteorological Office, 1989) for the critical growth period for most crops, January to June.
- 4.10 Estimated climatic data for the site was obtained from the Climatological Data for Agricultural Land Classification document, deriving an AAR of 754 and an AT0 of 1403 °C for the site (**Table 4:1**). Climatic data at the site indicate that no climatic limitations are present at the site, therefore the grade according to climate is Grade 1.
- 4.11 The Predictive ALC Mapping Tool also considered climate limitations to be Grade 1.

Table 4:1: Climate Data

Climate Parameter	Data
Average Altitude (mAOD)	65
Average Annual Rainfall (mm)	754
Median Accumulated Temperature above 0°C (January to June)	1403
Moisture Deficit for Wheat (mm)	100
Moisture Deficit for Potatoes (mm)	89
Mean Field Capacity Days (FCD)	175

Site Limitations

Gradient and Micro-Relief

- 4.12 Altitudes at the site range between 76m, in the north, and 72m, in the south, giving a gentle slope towards the south. No slope gradients at the site exceed 7°, therefore gradient is not a limiting factor and the grade according to gradient is Grade 1. The Predictive ALC Mapping Tool also considered gradient to be Grade 1.
- 4.13 No complex changes in slope angle over short distances were noted on-site therefore micro-relief is not identified as a limiting factor.

Risk of Flooding

- 4.14 The site is not located within a Flood Zone and is not noted to be affected by surface water flooding. Furthermore, the closest water feature is indicated to be approximately 270m south from the site; due to this, flooding is not considered a limiting factor.

Soil and Interactive Limitations

Published Soil Information

4.15 A summary of the soil characteristics is presented below, taken from the Soil Site Report (**Appendix 1**):

- Hydrology of soil type – Free draining permeable soils in unconsolidated sands or gravels with relatively high permeability and high storage capacity.
- Ground Movement Potential – Very Low
- Flood Vulnerability – Minor Risk
- Risk of Corrosion to Ferrous Iron – Non Aggressive
- Pesticide Leaching Risk – Sandy soil with low organic matter, groundwater at moderate depth.
- Pesticide Runoff Risk – Very low run off potential
- Potential for Pesticide Absorption – Very low potential
- Expected Crop and Land Use – cereals, sugar beet and potatoes or dairying
- Natural Soil Fertility – Low
- Local soil acidity (within 15km) – Mean pH of 5.6.

Soil Survey

4.16 The main soil properties which can affect the classification of soils are texture, structure, depth, stoniness and chemical fertility. Interactive limitations include soil wetness, droughtiness and soil erosion.

4.17 During the ALC Survey, three auger borings and one soil profile pit were completed, with two particle size distribution (PSD) tests undertaken within the soil pit. Information obtained during the site survey is presented below.

- Horizon 1
 - Thicknesses of Horizon 1 ranged from 0.28m and 0.35m with all positions being described as a sandy clay loam and slightly stony. Three of the four soil survey positions were described as a very dark brown colour (10YR 2/2) with one position (A03) identified as very dark greyish brown (10YR 3/2). Soil structure was angular blocky.
- Horizon 2
 - The thickness of Horizon 2 was not proven in any of the soil survey locations. Two locations, A01 and A02, described the horizon as dark brown (7.5YR 3/4), HP01 described it as strong brown (7.5YR 4/6) and A03 described it as very dark greyish brown (10YR 3/2). Textures of loamy sand or sandy loam were identified in HP01 and A02, with sandy clay loam in A01 and A03 with all locations being slightly stony. Soil structure was granular.
- Field capacity days (FCD) were reported as a value of 175.

- 4.18 Soil depth is not considered a limiting factor as pits/augers were able to advance beyond 60cm.
- 4.19 The soils are considered to be Grade 1. This is based on visual observations and supplemented by the laboratory data (**Appendix 3**).
- 4.20 The Predictive ALC Mapping Tool considered soil depth to be Grade 1.

Droughtiness

- 4.21 The soil droughtiness is derived from calculating the moisture balance of the soils with respect to wheat and potato crops. The moisture balance of the soils, based on the available water capacity and the moisture deficit, indicates that the soils are Grade 1/ Grade 2 with respect to droughtiness.
- 4.22 Due to the density of the underlying gravels, excavating the pits/augers to the target depths was not viable. Where necessary, the droughtiness calculations have used extrapolated data to the calculate available water capacity.
- 4.23 The Predictive ALC Mapping Tool considered droughtiness to be Grade 2.

Soil Wetness

- 4.24 Factors which are involved in assessing soil wetness are condition of the soil (disturbed or undisturbed), gleying in the subsoil and the presence of a slowly permeable layer in the top 0.80m of the soil. Due to the sand and gravel superficial deposits present on-site, the deepest depth accomplished at the site was 0.75m bgl, in A03. However, as the superficial parent material at the site is Glaciofluvial Sheet Deposits (sand and gravel), it is not expected that a permeable layer would be present within the top 0.80m of the soil. Therefore, due to the soil not being significantly disturbed or restored at the site, and no gleying being present in the subsoil, according to soil wetness the site is graded as a Wetness Class/ Grade 1 (Figure 6; Maff 1988).
- 4.25 The Predictive ALC Mapping Tool also considered soil wetness to be Grade 1.

5. CONCLUSION AND RECOMMENDATIONS

Soil Type

- 5.1 The soil assessment has indicated that soils at the site have been classified as Grade 2. The limitations were due to droughtiness. This is in line with the Predictive ALC classification which also indicated that droughtiness was the limiting factor.

Mitigation Measures

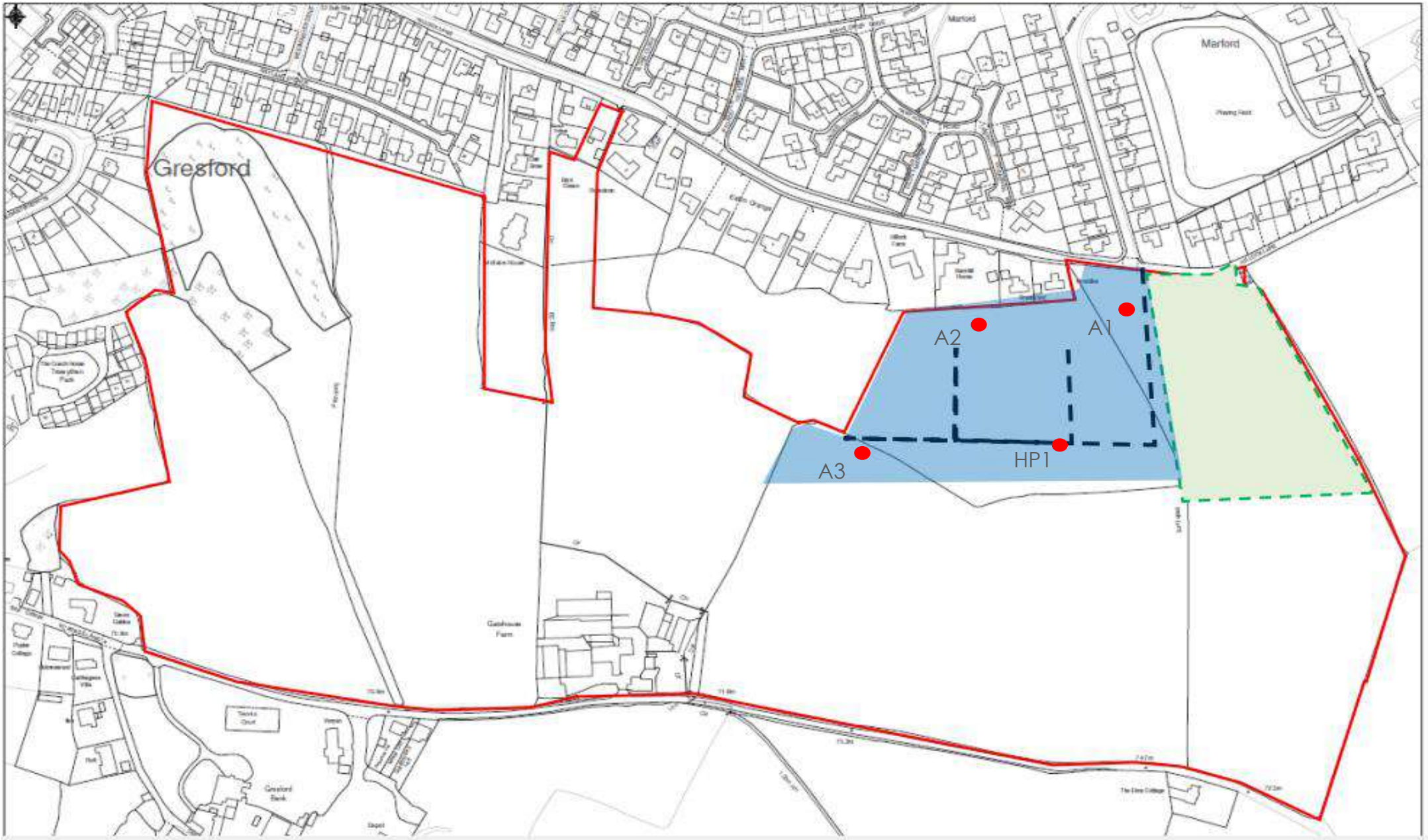
- 5.2 The principal adverse impact of the proposed development will be on the loss of best and most versatile (BMV) agricultural land. This assessment assumes that all of the agricultural land within the red line boundary of the site would lose its agricultural potential based on the proposed future site uses.
- 5.3 Impacts of future development on soil resources can be mitigated through the following:
- Re-use of soils displaced during construction in gardens, landscaping and open areas;
 - Ensuring the quality of soils retained on site and disposed of off-site is maintained by following best practice guidance on soil handling;
 - Disposal of surplus soils in a sustainable manner in accordance with the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (DEFRA, 2009). The Code of Practice offers guidance on:
 - Identifying existing soil resources on site;
 - On-site soil management;
 - Topsoil and subsoil stripping;
 - Soil stockpiling and placement;
 - Sourcing, importing and manufacturing topsoil;
 - Soil aftercare; and
 - Uses for surplus topsoil.

6. REFERENCES

- 6.1 'Agricultural Land Classification of England and Wales, Revised guidelines and criteria for grading the quality of agricultural land', Ministry of Agriculture, Fisheries and Food, dated October 1988
- 6.2 British Geological Survey 1:50,000 Sheet 121, Wrexham, Solid and Drift, dated 1993
- 6.3 British Geological Society online interactive Geology of Britain Viewer (Last accessed 28/11/2019): <http://mapapps.bgs.ac.uk/geologyofbritain/home.html?>
- 6.4 'Construction Code of Practice for the Sustainable Use of Soils on Construction Sites', DEFRA, dated 2009
- 6.5 [Welsh Government Predictive Agricultural Land Classification \(ALC\) Map 2; http://lle.gov.wales/map/alc2](http://lle.gov.wales/map/alc2)
- 6.6 '*Planning Policy Wales*, produced by the Welsh Government, dated December 2018
- 6.7 Tables of the evaluation of daily values of accumulated temperature above and below 42°F from daily values of maximum and minimum temperature, Meteorological Office, dated 1969

DRAWINGS

Drawing 1 – Investigation Location Plan



NOTES

1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE.
4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

LEGEND

- A1 ● Auger Location
- HP1 ● Hand Pit Location

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Project Title:
Land off Hillock Lane, Gresford

Drawing Title:
**Drawing 1 - Investigation Location
Plan**

Scale:	Date:	Drawn:	Authorised:
Not to Scale	Nov-19	JA	CR

Drawing Status:
FINAL

Drawing No:	Revision:
ABCxxxx/EN/001	R1

APPENDICES

Appendix 1 – Site Soil Report



Soil Site Report

Extended Soil Report

226483421

Easting: 336129

Northing: 354566

Site Area: 1km x 1km

Prepared for: Customer Services, Landmark Information Group

Date: 27 Nov 2019



Citation

Citations to this report should be made as follows:

National Soil Resources Institute (2019) Soils Site Report for location 336129E, 354566N, 1km x 1km, National Soil Resources Institute, Cranfield University. Accessed via:
<https://www.landis.org.uk/sitereporter>

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About this report

This Soil Site Report identifies and describes the properties and capacities of the soil at your specified location as recorded in the National Soil Map for England and Wales. It has been produced by Cranfield University's [National Soil Resources Institute](#).

The National Soil Map represents the most accurate and comprehensive source of information about the soil at the national coverage in England and Wales. It maps the distribution of soil mapping units (termed soil associations) which are defined in terms of the main soil types (or soil series) that were recorded for each soil association during field soil survey. Each soil association is named after its principal soil series and these bear the location name from where they were first described (e.g. Windsor). Each of these soil associations have differing environmental characteristics (physical, chemical and biological) and it is by mapping these properties that the range of thematic maps in this report have been produced.

Soil types and properties vary locally, as well as at the landscape scale. It is not possible to identify precisely the soil conditions at a specific location without first making a site visit. We have therefore provided you with information about the range of soil types we have identified at and around your selected location. Schematic diagrams are also provided to aid accurate identification of the soil series at your site.

Whilst an eight-figure national grid reference should be accurate to within 100m, a single rural Postcode can cover a relatively large geographical area. Postcodes can therefore be a less precise basis for specifying a location. The maps indicate the bounded area the reports relate to.

Your Site Soil Report will enable you to:

- identify the soils most likely to be present at and immediately around your specified location;
- understand the patterns of soil variation around your location and how these correlate with changes in landscape;
- identify the nature and properties of each soil type present within the area;
- understand the relevant capacities and limitations of each of the soils and how these might impact on a range of factors such as surface water quality.

Provided that this Site Soil Report is not modified in any way, you may reproduce it for a third-party.

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1. Soil Thematic Maps

This section contains a series of maps of the area surrounding your selected location, presenting a number of themes relating to the characteristics of the soils. These provide an overview of the nature and condition of the local soil conditions. It is these conditions that may be used to infer the response of an area to certain events (with the soil as a receptor), such as pollution contamination from a chemical spill, or an inappropriate pesticide application and the likelihood of these materials passing through the soil to groundwater. Other assessments provide an insight into the way a location may impact, by corrosive attack or ground movement, upon structures or assets within the ground, for example building or engineering foundations or pipes and street furniture.

Soil is a dynamic environment with many intersecting processes, chemical, physical and biological at play. Even soils 'sealed' over by concrete and bitumen are not completely dormant. The way soils respond to events and actions can vary considerably according to the properties of the soil as well as other related factors such as land-use, vegetation, topography and climate. There are many threats facing our national soil resource today and importance should be given to identifying the best measures aimed towards soil protection, ensuring the usage of soils in the most sustainable way. This report is therefore a useful snapshot of the soil properties for your given area, providing a summary of a broad range of ground conditions



Figure 1: Location of study area

1a Soils - Spatial Distribution



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Soils - Spatial Distribution Key



551d NEWPORT 1

Deep well drained sandy and coarse loamy soils.



711m SALOP

Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils

SOIL ASSOCIATION DESCRIPTION

Soil associations represent a group of soil series (soil types) which are typically found occurring together, associated in the landscape (Avery, 1973; 1980; Clayden and Hollis, 1984). Soil associations may occur in many geographical locations around the country where the environmental conditions are comparable. For each of these soil associations, a collection of soil types (or soil series) are recorded together with their approximate proportions within the association. Soil associations have codes as well as textual names, thus code '554a' refers to the 'Frilford' association. Where a code is prefixed with 'U', the area is predominantly urbanised (e.g. 'U571v'). The soil associations for your location, as mapped above, are described in more detail in Section 2: Soil Association Descriptions.

1b Hydrology of Soil Type (HOST)



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Hydrology of Soil Type (HOST) Key

-  5 Free draining permeable soils in unconsolidated sands or gravels with relatively high permeability and high storage capacity
-  24 Slowly permeable, seasonally waterlogged soils over slowly permeable substrates with negligible storage capacity

HOST CLASS DESCRIPTION

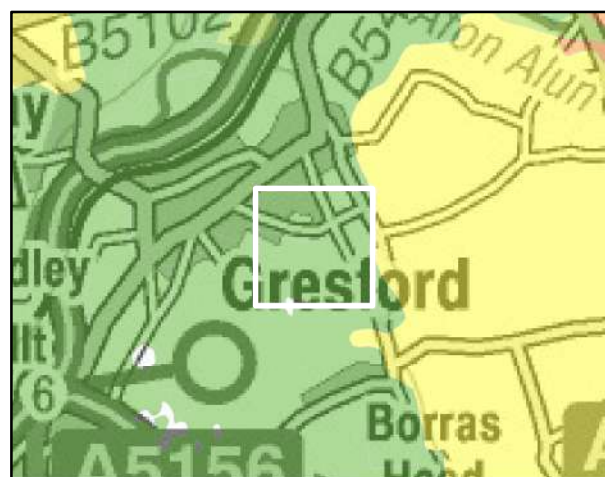
The Hydrology of Soil Types (HOST) classification describes the dominant pathways of water movement through the soil and, where appropriate, the underlying substrate. Eleven drainage models are defined according to the permeability of the soil and its substrate and the depth to a groundwater table, where one is present (Boorman et al, 1995). These are further subdivided into 29 HOST classes to which all soil series have been assigned. These classes identify the way soil water flows are partitioned, with water passing over, laterally through, or vertically down the soil column. Analysis of the river hydrograph and the extent of soil series for several hundred gauged catchments allowed mean values for catchment hydrological variables to be identified for each HOST class. The HOST classification is widely used to predict river flows and the frequency and severity of flood events and also to model the behaviour of diffuse pollutants (Hollis et al, 1995).

1c Ground Movement Potential



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Ground Movement Potential Key



1 Very low



3 Moderate

* If a High class is starred, a Very High ground movement potential is likely to be achieved if these soils are drained to an effective depth of at least two metres.

GROUND MOVEMENT POTENTIAL DESCRIPTION

Clay-related ground movement is the most widespread cause of foundation failure in the UK and is linked to seasonal swelling and shrinkage of the clay. The content of clay within the soils of your selected area has therefore a direct bearing upon the likelihood of ground movement.

Among the inorganic particles that constitute the solid component of any soil, clay particles are the smallest and defined as being less than 0.002 mm - equivalent spherical diameter (esd) in size. Clay particles occur in most kinds of soil but they only begin to exert a predominant influence on the behaviour of the whole soil where there is more than 35 per cent (by weight) of clay-sized material present.

Because clay particles are very small and commonly platy in shape they have an immense surface area onto which water can be attracted, relative to the total volume of the soil material. In addition to surface attraction or inter-crystalline absorption of water, some clay minerals, those with three layers of atoms (most other kinds of clay have only two layers of atoms) are able to absorb and hold additional water between these layers. It is these types of clay mineral, which are widespread in British soils and commonly known as smectites that have the greatest capacity to shrink and swell.

In a natural undisturbed condition, the moisture content of deep subsoil clay does not change greatly through the year and consequently there are no changes in volume leading to shrinkage and swelling. However, when clays are exposed at or near the ground surface and especially when vegetation is rooting in them seasonal moisture and volume changes can be dramatic. Plants and trees transpire moisture from the soil to support their growth and transfer necessary nutrients into their structures. Surface evaporation also takes place from soil and plant structures, and the combination of evaporation from surfaces and transpiration by plants and trees is termed evapotranspiration. Thus, the layer of soil material down to 2m depth into which plants will root is critical when assessing the vulnerability of land to subsidence.

Whenever soil moisture is continuously being replenished by rainfall, the soil moisture reserves will be unaffected by the removal of moisture by plants as there is no net loss. However, in many parts of Britain, particularly in the south and east, summer rainfall is small and is exceeded by evapotranspiration. Water reserves are then not sufficiently replenished by rainfall and so a soil moisture deficit develops. The water removed from a clayey soil by evapotranspiration leads to a reduction in soil volume and the consequent shrinkage causes stress in the soil materials leading in turn to stress on building foundations that are resting in the soil (Hallett, et al, 1994).

The foundations themselves may then move and thus cause damage to building structures. This problem can be exacerbated by the fact that the soil beneath the structure may not dry out uniformly, so that any lateral pressure exerted on the building foundation is made effectively greater. This assessment identifies the likelihood of soil conditions being prone to ground movement given these other factors.

1d Flood Vulnerability



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Flood Vulnerability Key



1 Minor risk

FLOOD VULNERABILITY DESCRIPTION

The inundation of properties by flood water can occur in a number of circumstances. Surface run-off can collect on low-lying land from upslope following heavy rainfall. More commonly rivers, lakes and/or the sea extend beyond their normal limits as a result of prolonged or intense rainfall, unusually high tides and/or extreme wind events. Water damage to properties and their contents is compounded by the deposition of sediment suspended in the flood waters. The spatial distribution of such waterborne sediment (or alluvium as defined in soil science) is one basis upon which land that has been subject to historical flooding can be mapped, and this forms a basis for present-day flooding risk assessment.

Both riverine and marine alluvium are identified as distinct soil parent materials within the British soil classifications. Combining soil map units that are dominated by soil series developed in alluvium across Great Britain identifies most of the land that is vulnerable to flooding. This assessment does not account for man-made flood defence measures, showing instead the areas where once water has stood.

1e Risk of Corrosion to Ferrous Iron



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Risk of Corrosion to Ferrous Iron Key



1 Non-aggressive



3 Moderately Aggressive

* If a class is starred, it is assumed that there are moderate amounts of sulphate in the soil. If there is abundant sulphate present, the soil may be one class more aggressive. Conversely, if there is very little sulphate, the soil may be one class less aggressive to buried ferrous iron.

RISK OF CORROSION TO FERROUS IRON DESCRIPTION

Buried iron pipes and other infrastructure corrode at rates that are influenced by soil conditions (Jarvis and Hedges, 1994). Soil acidity, sulphide content, aeration and wetness all influence the corrosivity of the soil. These factors are used to map 5 major classes of relative corrosivity.

1f Pesticide Leaching Risk



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Pesticide Leaching Risk Key



H2mo Sandy soil with low organic matter; groundwater at moderate depth



L q Impermeable soils over soft substrates of low or negligible storage capacity that sometimes conceal groundwater bearing rocks at depth

PESTICIDE LEACHING CLASS DESCRIPTION

The natural permeability and water regime of soils are influential in determining the fate and behaviour of pesticides applied to the crop and soil surface (Hollis et al, 1995). A system of vulnerability assessment was devised as part of the national system for Policy and Practice for the Protection of Groundwater. This divided soils into three primary vulnerability classes.

H - Soils of high leaching capacity with little ability to attenuate non-adsorbed pesticide leaching which leave underlying groundwater vulnerable to pesticide contamination.

I - Soils of intermediate leaching capacity with a moderate ability to attenuate pesticide leaching.

L - Soils of low leaching capacity through which pesticides are unlikely to leach.

The primary classes have been further subdivided into nearly forty subclasses. These subclasses, with their descriptions, are mapped above. These classes do not account for differences in land cultivation, which can also have a significant impact on pesticide behaviour.

1g Pesticide Runoff Risk



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Pesticide Runoff Risk Key



S2 High run-off potential.



S5 Very low run-off potential.

PESTICIDE RUNOFF RISK DESCRIPTION

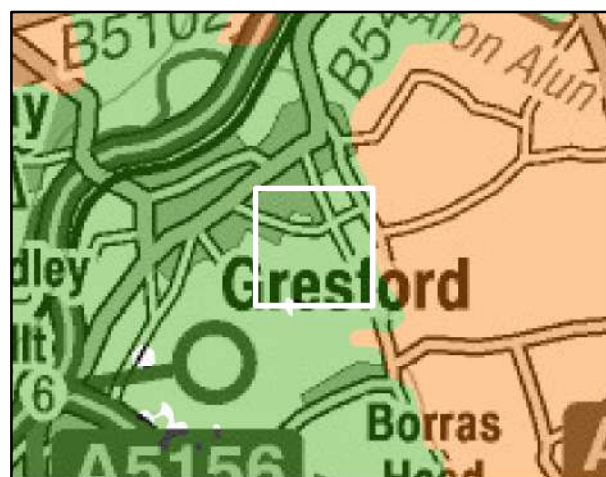
The physical properties and natural water regime of soils influence the speed and extent of lateral water movement over and through the soil at different depths (Hollis et al, 1995). As a result, soils can be classed according to the potential for pesticide run-off. Five runoff potential classes are identified for mineral soils and a further two for peat soils.

1h Potential for Pesticide Adsorption



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Potential for Pesticide Adsorption Key



m Moderate adsorption potential.



v Very low adsorption potential.

POTENTIAL FOR PESTICIDE ADSORPTION DESCRIPTION

The physical properties and natural water regime of soils influence the speed and extent of lateral water movement over and through the soil at different depths (Hollis et al, 1995). The mineral soil classes are further subdivided according to their potential for pesticide adsorption.

1i Hydrogeological Rock Type



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Hydrogeological Rock Type Key



22 till and compact Head



34 sand

HYDROGEOLOGICAL ROCK TYPE DESCRIPTION

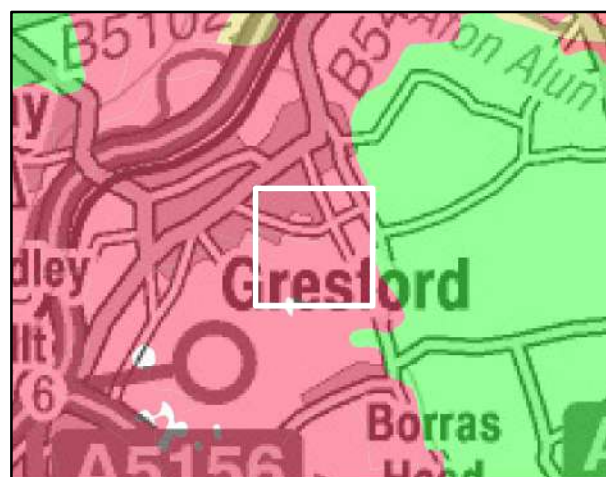
The hydrogeological classification of the soil parent materials provides a framework for distinguishing between soil substrates according to their general permeability and whether they are likely to overlie an aquifer. Every soil series has been assigned one of the 32 substrate classes and each of these is characterised according to its permeability (being characterised as permeable, slowly permeable or impermeable). For further information, see Boorman et al (1995).

1j Ground Water Protection Policy (GWPP)



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Ground Water Protection Policy (GWPP) Key

-  H2 Deep, permeable coarse textured soils of high leaching potential, which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential
-  L Soils in which pollutants are unlikely to penetrate the soil layer either because water movement is largely horizontal or because they have a large ability to attenuate diffuse source pollutants

GWPP LEACHING CLASS DESCRIPTION

The Ground Water Protection Policy classes describe the leaching potential of pollutants through the soil (Hollis, 1991; Palmer et al, 1995). The likelihood of pollutants reaching ground water is described. Different classes of pollutants are described, including liquid discharges adsorbed and non-adsorbed pollutants.

1k Soil Parent Material



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Soil Parent Material Key



85 Glaciofluvial drift



153 Reddish till

SOIL PARENT MATERIAL DESCRIPTION

Along with the effects of climate, relief, organisms and time, the underlying geology or 'parent material' has a very strong influence on the development of the soils of England and Wales. Through weathering, rocks contribute inorganic mineral grains to the soils and thus exhibit control on the soil texture. During the course of the creation of the national soil map, soil surveyors noted the parent material underlying each soil in England and Wales. It is these general descriptions of the regional geology which is provided in this map.

11 Expected Crops and Land Use



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Expected Crops and Land Use Key



135 Dairying on short term and permanent grassland, some cereals in drier districts.



283 cereals, sugar beet and potatoes; dairying on short term grassland in Cheshire and Wales.

EXPECTED CROPS AND LAND USE DESCRIPTION

Individual soils are commonly associated with particular forms of land cover and land use. Whilst the soil surveyors were mapping the whole of England and Wales, they took careful note of the range of use to which the land was being put. This map shows the most common forms of land use found on each soil unit.

1m Natural Soil Fertility



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Natural Soil Fertility Key



5 Low



10 Moderate

NATURAL SOIL FERTILITY DESCRIPTION

Soil fertility can be greatly altered by land management especially through the application of manures, lime and mineral fertilisers. What is shown in this map, however, is the likely natural fertility of each soil type. Soils that are very acid have low numbers of soil-living organisms and support heathland and acid woodland habitats. These are shown as of very low natural fertility. Soils identified as of low natural fertility are usually acid in reaction and are associated with a wide range of habitat types. The moderate class contains neutral to slightly acid soils, again with a wide range of potential habitats. Soil of high natural fertility are both naturally productive and able to support the base-rich pastures and woodlands that are now rarely encountered. Lime-rich soils contain chalk and limestone in excess, and are associated with downland, herb-rich pastures and chalk and limestone woodlands.

1n Simple Topsoil Texture



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Simple Topsoil Texture Key

 2 Loamy

 4 Sandy

SIMPLE TOPSOIL TEXTURE DESCRIPTION

Soil texture is a term used in soil science to describe the physical composition of the soil in terms of the size of mineral particles in the soil. Specifically, we are concerned with the relative proportions of sand, silt and clay. Soil texture can vary between each soil layer or horizon as one moves down the profile. This map indicates the soil texture group of the upper 30 cm of the soil. 'Light?' soils have more sand grains and are described as sandy, while 'heavy?' soils have few sand grains but a lot of extremely small particles and are described as clayey. Loamy soils have a mix of sand, silt and clay-sized particles and are intermediate in character. Soils with a surface layer that is dominantly organic are described as Peaty. A good understanding of soil texture can enable better land management.

1o Typical Habitats



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Typical Habitats Key



1 Acid dry pastures; acid deciduous and coniferous woodland; potential for lowland heath



17 Seasonally wet pastures and woodlands

TYPICAL HABITATS DESCRIPTION

There is a close relationship between vegetation and the underlying soil. Information about the types of broad habitat associated with each soil type is provided in this map. Soil fertility, pH, drainage and texture are important factors in determining the types of habitats which can be established. Elevation above sea level and sometimes even the aspect, the orientation of a hillslope, can affect the species present. This map does not take into account the recent land management, but provides the likely natural habitats assuming good management has been carried out.

2. Soil Association Descriptions

The following pages describe the following soil map units, (soil associations), in more detail.



NEWPORT 1 551d

Deep well drained sandy and coarse loamy soils.



SALOP 711m

Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils

The soil associations are described in terms of their texture and drainage properties and potential risks may be identified. The distribution of the soils across England and Wales are provided. Further to this, properties of each association's component soil series are described in relation to each other. Lastly, schematic diagrams of each component series are provided for greater understanding and in-field verification purposes.

NEWPORT 1 (551d)

Deep well drained sandy and coarse loamy soils.

a. General Description

Deep well drained sandy and coarse loamy soils. Some sandy soils affected by groundwater. The major landuse on this association is defined as cereals, sugar beet and potatoes; dairying on short term grassland in Cheshire and Wales.

b. Distribution (England and Wales)

The NEWPORT 1 association covers 1191 km² of England and Wales which accounts for 0.79% of the landmass. The distribution of this association is shown in figure 2. Note that the yellow shading represents a buffer to highlight the location of very small areas of the association.

c. Comprising Soil Series

Multiple soil series comprise a soil association. The soil series of the NEWPORT 1 association are outlined in Table 1 below. In some cases other minor soil series are present at a particular site, and these have been grouped together under the heading 'OTHER'. We have endeavoured to present the likelihood of a minor, unnamed soil series occurring in your site in Table 1.

Schematic diagrams of the vertical soil profile of the major constituent soil series are provided in Section D to allow easier identification of the particular soil series at your site.

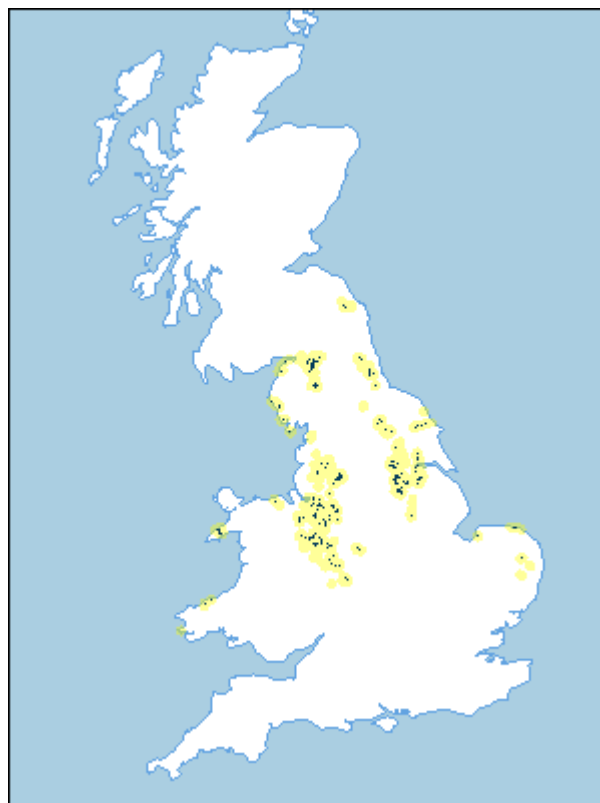


Figure 2: Association Distribution

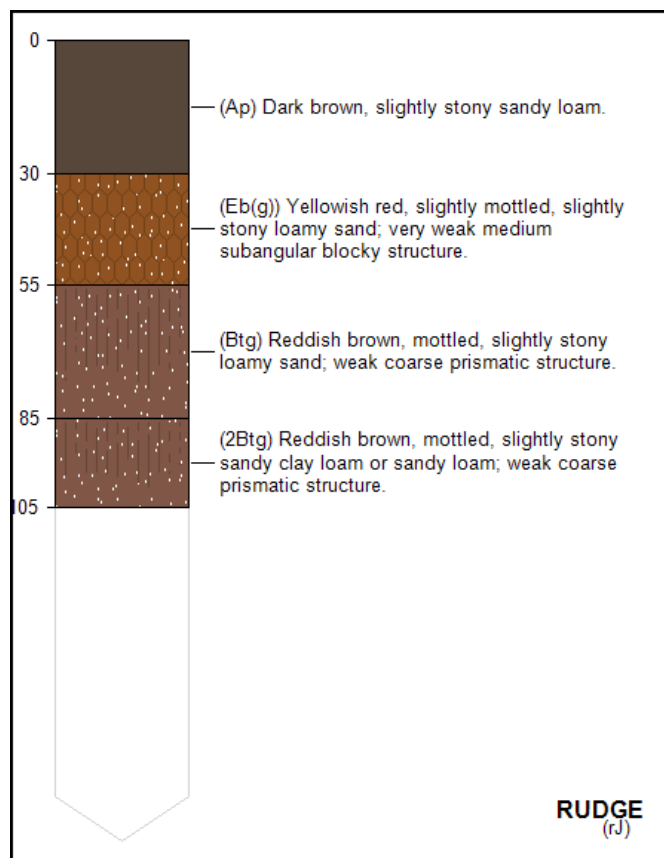
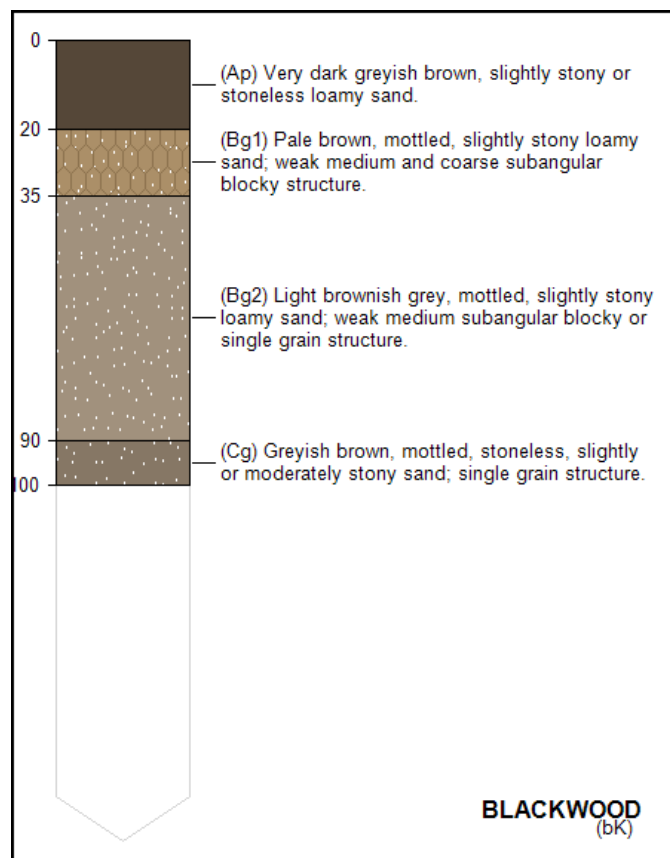
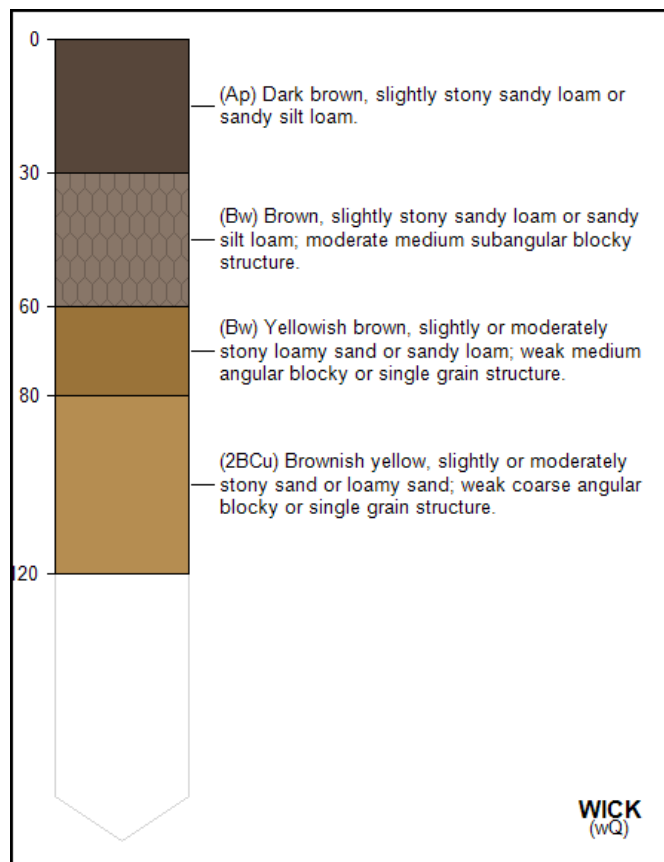
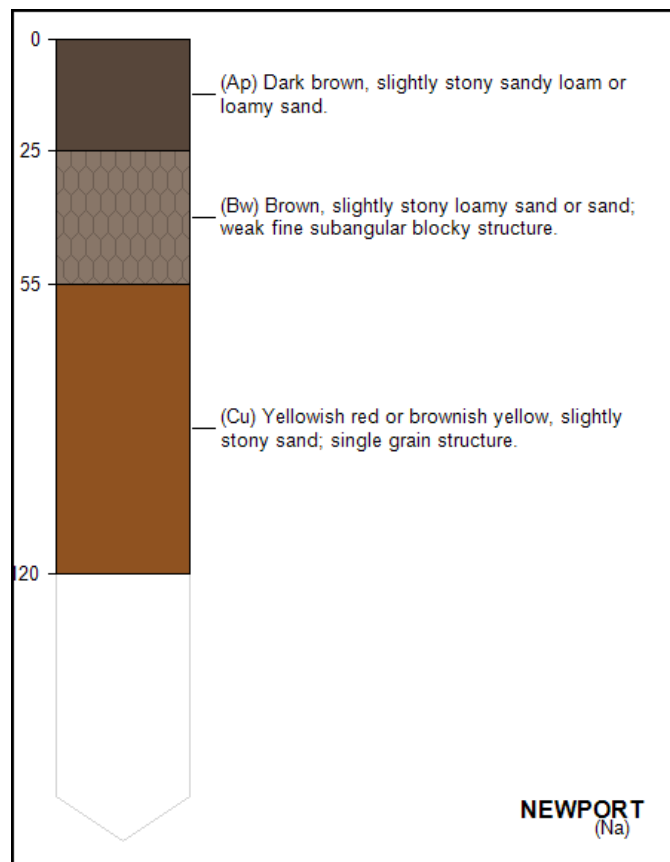
Table 1: The component soil series of the NEWPORT 1 soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

Soil Series	Description	Area %
NEWPORT (Na)	sandy drift with siliceous stones	40%
WICK (wQ)	light loamy drift with siliceous stones	20%
BLACKWOOD (bK)	sandy drift with siliceous stones	10%
RUDGE (rJ)	sandy drift with siliceous stones	10%
OTHER	other minor soils	20%

NEWPORT 1 (551d)

Deep well drained sandy and coarse loamy soils.

d. NEWPORT 1 Component Series Profiles



SALOP (711m)

Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils

a. General Description

Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils associated with fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.

The major land use on this association is defined as Dairying on short term and permanent grassland, some cereals in drier districts.

b. Distribution (England and Wales)

The SALOP association covers 3110 km² of England and Wales which accounts for 2.06% of the landmass. The distribution of this association is shown in figure 3. Note that the yellow shading represents a buffer to highlight the location of very small areas of the association.

c. Comprising Soil Series

Multiple soil series comprise a soil association. The soil series of the SALOP association are outlined in Table 1 below. In some cases other minor soil series are present at a particular site, and these have been grouped together under the heading 'OTHER'. We have endeavoured to present the likelihood of a minor, unnamed soil series occurring in your site in Table 2.

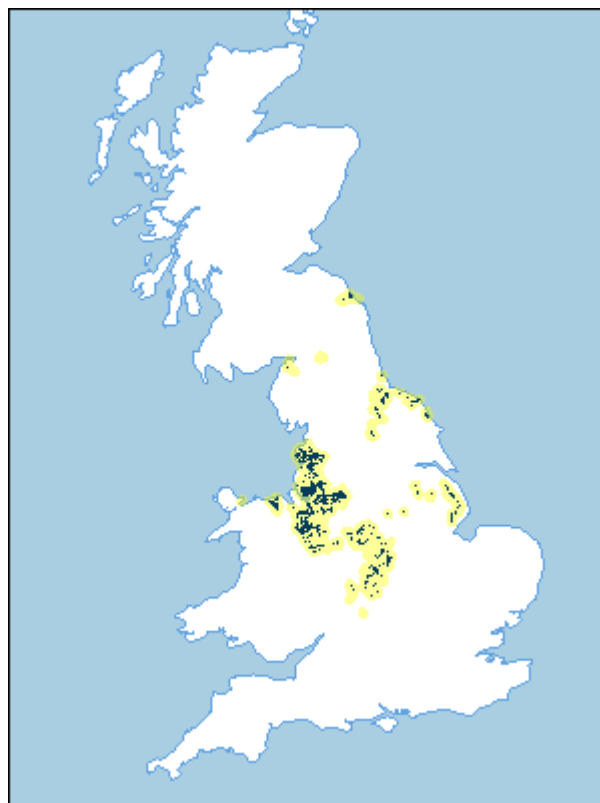


Figure 3: Association Distribution

Schematic diagrams of the vertical soil profile of the major constituent soil series are provided in Section D to allow easier identification of the particular soil series at your site.

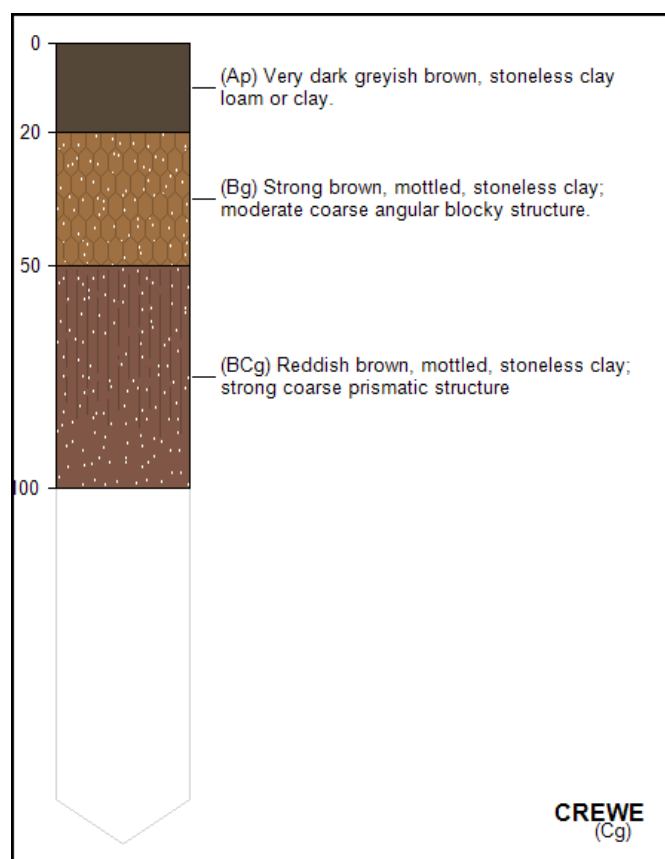
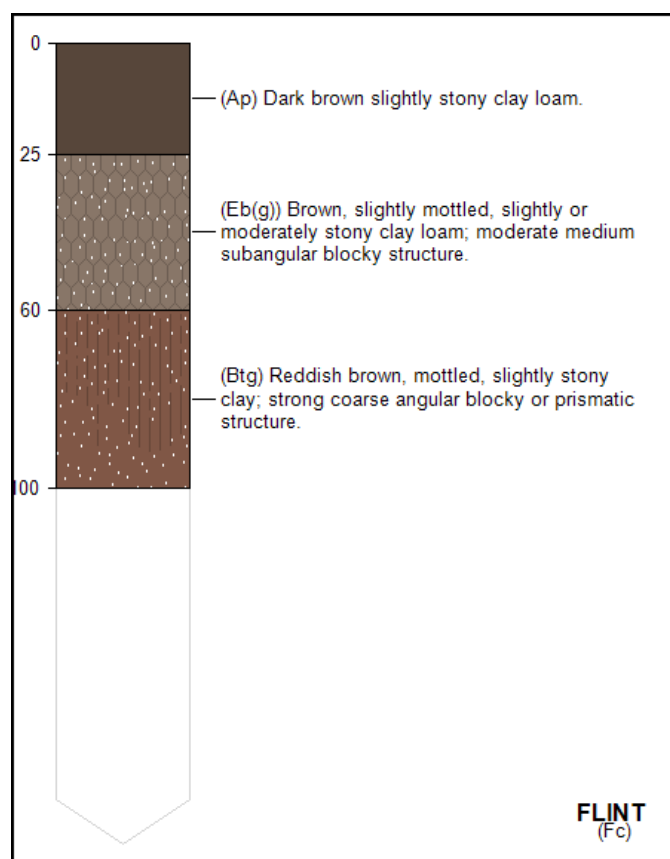
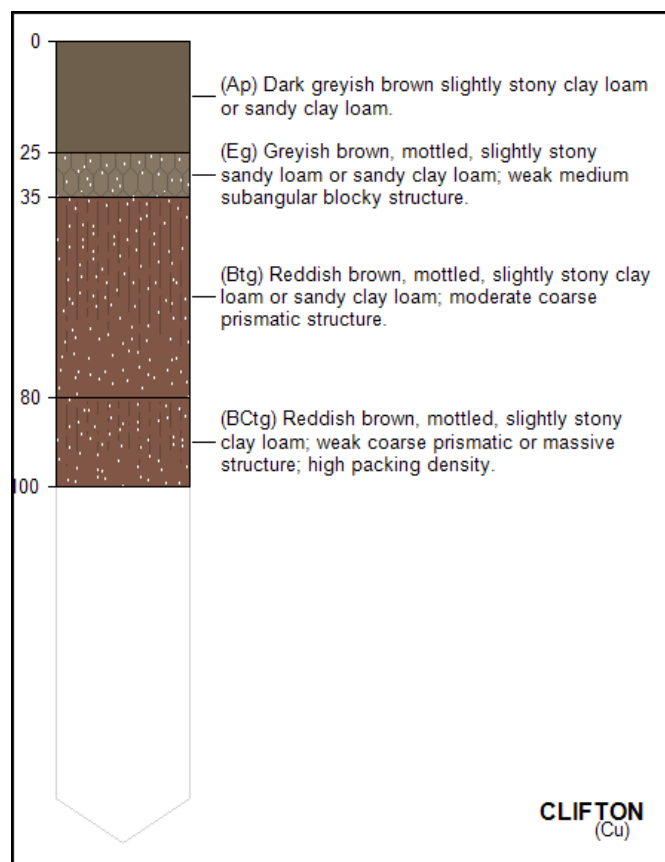
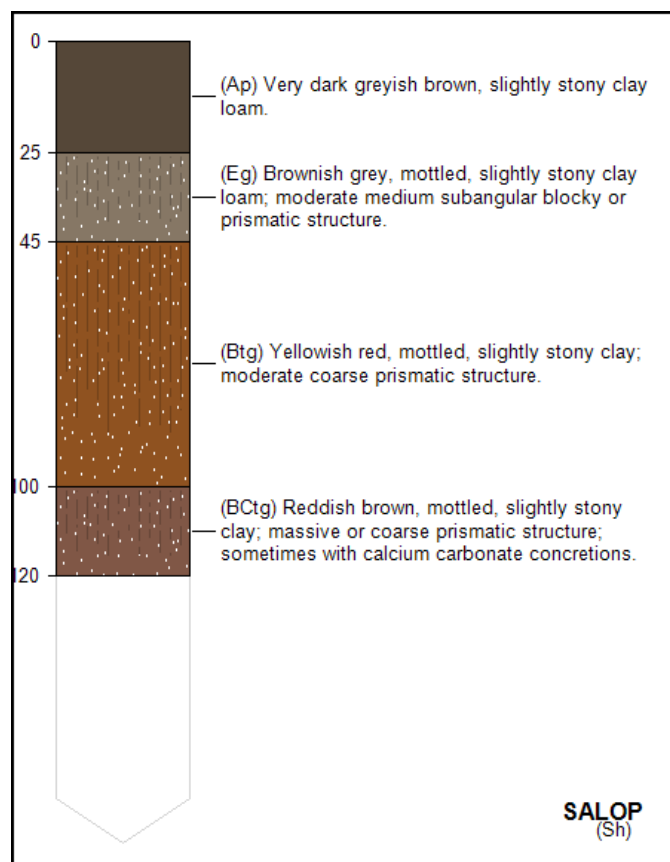
Table 2: The component soil series of the SALOP soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

Soil Series	Description	Area %
SALOP (Sh)	reddish medium loamy over clayey drift with siliceous stones	35%
CLIFTON (Cu)	reddish medium loamy drift with siliceous stones	20%
FLINT (Fc)	reddish medium loamy over clayey drift with siliceous stones	15%
CREWE (Cg)	reddish clayey stoneless drift	10%
OTHER	other minor soils	20%

SALOP (711m)

Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils

d. SALOP Component Series Profiles



3. Soil Series Properties

The following pages describe the following soil series in more detail:

BLACKWOOD (bK)	sandy drift with siliceous stones
CLIFTON (Cu)	reddish medium loamy drift with siliceous stones
CREWE (Cg)	reddish clayey stoneless drift
FLINT (Fc)	reddish medium loamy over clayey drift with siliceous stones
NEWPORT (Na)	sandy drift with siliceous stones
RUDGE (rJ)	sandy drift with siliceous stones
SALOP (Sh)	reddish medium loamy over clayey drift with siliceous stones
WICK (wQ)	light loamy drift with siliceous stones

SOIL PROPERTY DEFINITIONS

The following terms are used in the report.

DROCK (Depth to rock (cm))

Depth (cm) to rock. 999 implies no rock

DGLEY (Depth to gleying (cm))

Depth to gleyed horizon (cm). 999 implies NO gleyed horizon present.

DIMP_DP (Depth to slowly permeable layer (downward percolation) (cm))

Depth (cm) to slowly permeable layer, i.e. in which effectively there is no downward percolation of water - 999 implies NO slowly permeable layer

DIMP_UD (Depth to slowly permeable layer (upward diffusion) (cm))

Depth (cm) to slowly permeable layer - upward diffusion, i.e. in which effectively there is no upward movement of water - 999 implies NO slowly permeable layer

IAC_DP (Integrated air capacity (IAC) (mm))

Integrated air capacity (downward percolation), a measurement of the volume of air in moist soils (0.05 bar suction) integrated from the surface to either an impermeable horizon, bedrock or 1m whichever is the shallowest, used for estimating the water storage potential of a soil

SPR (Standard percentage runoff (SPR) (%))

Standard Percentage Run-off. Dimensionless variable (range 0 to 100 %) that represents the percentage of rainfall that causes the short-term increase in flow at the catchment outlet seen after the storm event

BFI (Base flow index (BFI) (0 to 1))

Baseflow index. Dimensionless variable (range 0 to 1) that expresses the fraction of the average flow volume (in a river), represented by the contribution from groundwater storage

AWC (Available water (AWC) (mm))

Available water to 1m for a specific soil type, water available between suctions 5 and 1500kPa

AP_GRASS (Available water for grass (mm))

Available water (AP) in the profile for grass (mm); water available between suctions 5 and 1500 kPa

AP_CEREAL (Available water for cereal (mm))

Available water (AP) in the profile for cereals (mm); water available between suctions 5 and 1500 kPa

AP_SB (Available water for sugar (mm))

Available water (AP) in the profile for sugar beet (mm); water available between suctions 5 and 1500 kPa

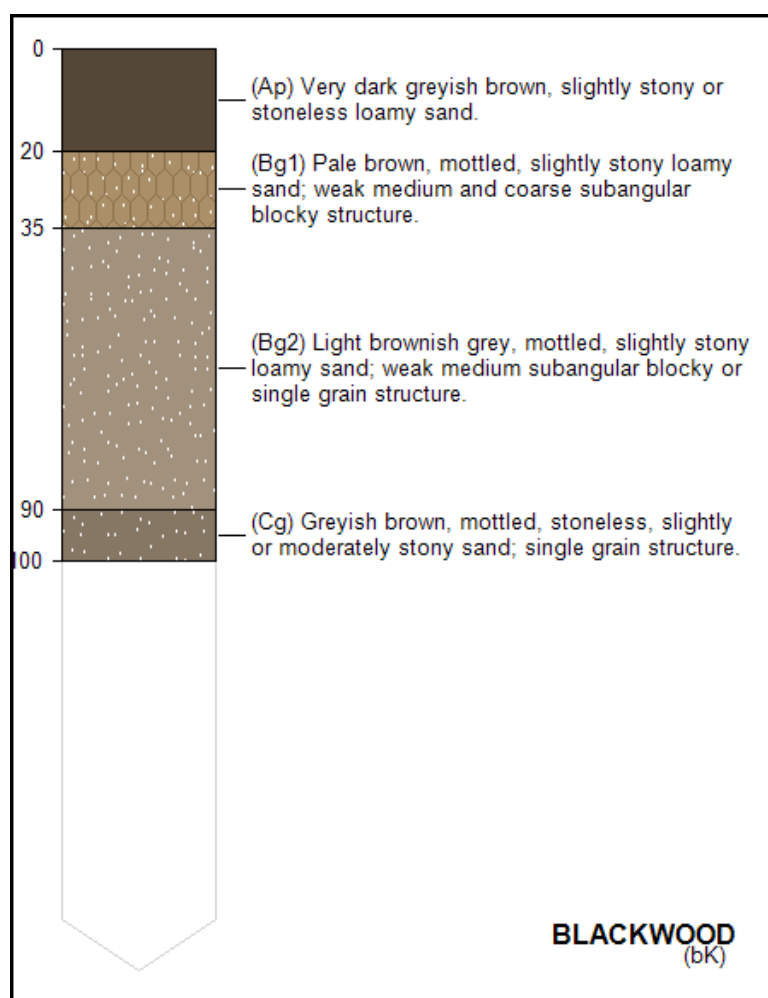
AP_POT (Available water for potatoes (mm))

Available water (AP) in the profile for potatoes (mm); water available between suctions 5 and 1500 kPa

8.21 BLACKWOOD (bK) (124)

Major soil group:	08 ground-water gley soils	Seasonally waterlogged soils affected by a shallow fluctuating groundwater-table. They are developed mainly within or over permeable material and have prominently mottled or greyish coloured horizons within 40 cm depth. Most occupy low-lying or depressional sites.
Soil group:	2 sandy gley soils	Sandy, with distinct topsoil and no clay-enriched subsoil.
Soil Subgroup:	1 typical sandy gley soils	(with non calcareous subsoil)
Soil Series:	Blackwood series	sandy drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	30
Depth to slowly permeable layer (downward percolation) (cm)	n/a*
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*
Integrated air capacity (IAC) (mm)	208
Standard percentage runoff (SPR) (%)	35
Base flow index (BFI) (0 to 1)	0.52
Available water (AWC) (mm)	130
Available water for grass (mm)	125
Available water for cereal (mm)	125
Available water for sugar (mm)	145
Available water for potatoes (mm)	105

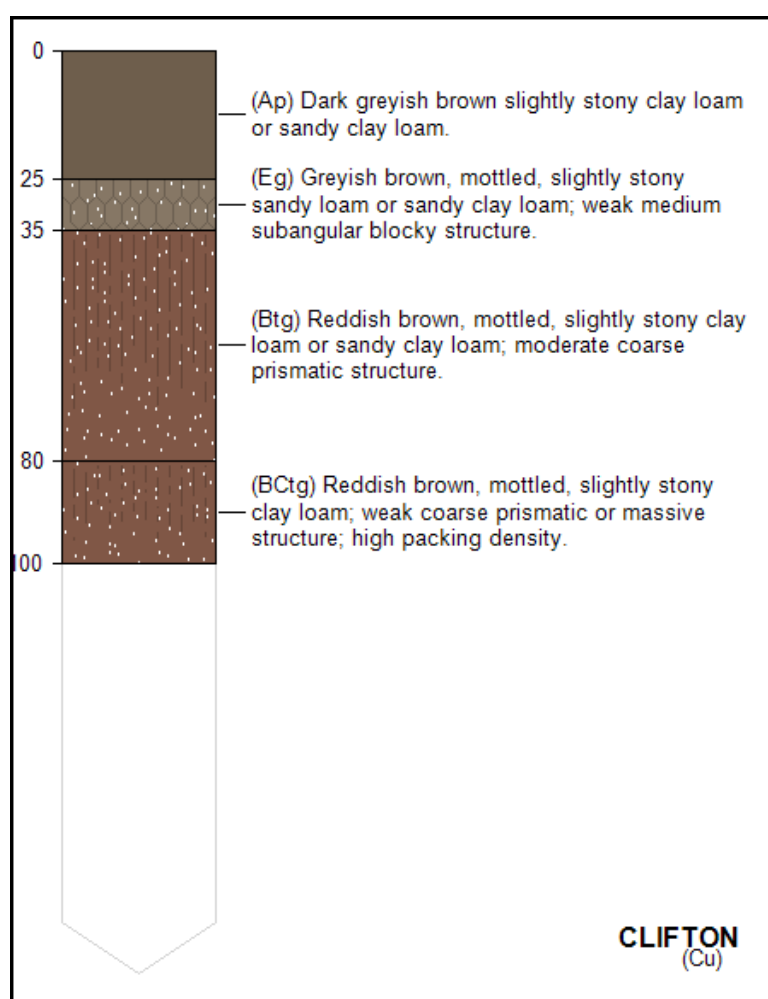


* not present within 150cm

7.11 CLIFTON (Cu) (226)

Major soil group:	07 surface-water gley soils	Seasonally waterlogged slowly permeable soils, formed above 3 m O.D. and prominently mottled above 40 cm depth. They have no relatively permeable material starting within and extending below 1 m of the surface.
Soil group:	1 stagnogley soils	With a distinct topsoil. They are found mainly in lowland Britain.
Soil Subgroup:	1 typical stagnogley soils	(with ordinary clay enriched subsoil)
Soil Series:	Clifton series	reddish medium loamy drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	25
Depth to slowly permeable layer (downward percolation) (cm)	47
Depth to slowly permeable layer (upward diffusion) (cm)	47
Integrated air capacity (IAC) (mm)	62
Standard percentage runoff (SPR) (%)	40
Base flow index (BFI) (0 to 1)	0.31
Available water (AWC) (mm)	145
Available water for grass (mm)	125
Available water for cereal (mm)	125
Available water for sugar (mm)	155
Available water for potatoes (mm)	110

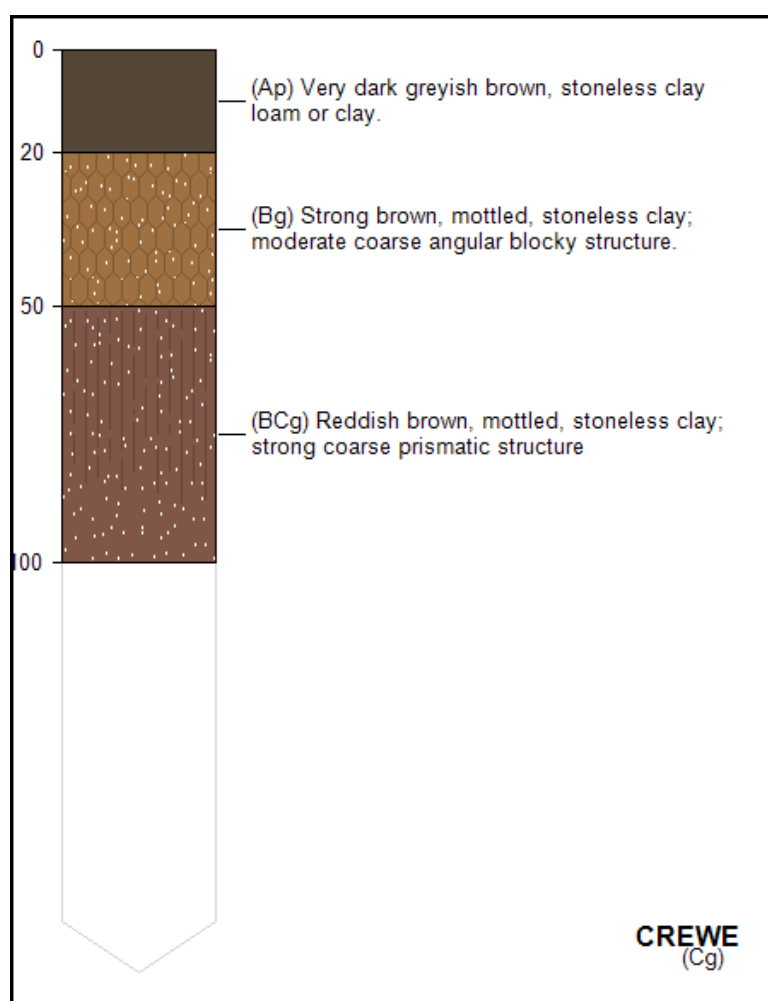


* not present within 150cm

7.12 CREWE (Cg) (244)

Major soil group:	07 surface-water gley soils	Seasonally waterlogged slowly permeable soils, formed above 3 m O.D. and prominently mottled above 40 cm depth. They have no relatively permeable material starting within and extending below 1 m of the surface.
Soil group:	1 stagnogley soils	With a distinct topsoil. They are found mainly in lowland Britain.
Soil Subgroup:	2 pelo-stagnogley soils	(clayey)
Soil Series:	Crewe series	reddish clayey stoneless drift

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	25
Depth to slowly permeable layer (downward percolation) (cm)	29
Depth to slowly permeable layer (upward diffusion) (cm)	29
Integrated air capacity (IAC) (mm)	69
Standard percentage runoff (SPR) (%)	40
Base flow index (BFI) (0 to 1)	0.31
Available water (AWC) (mm)	145
Available water for grass (mm)	125
Available water for cereal (mm)	120
Available water for sugar (mm)	150
Available water for potatoes (mm)	115

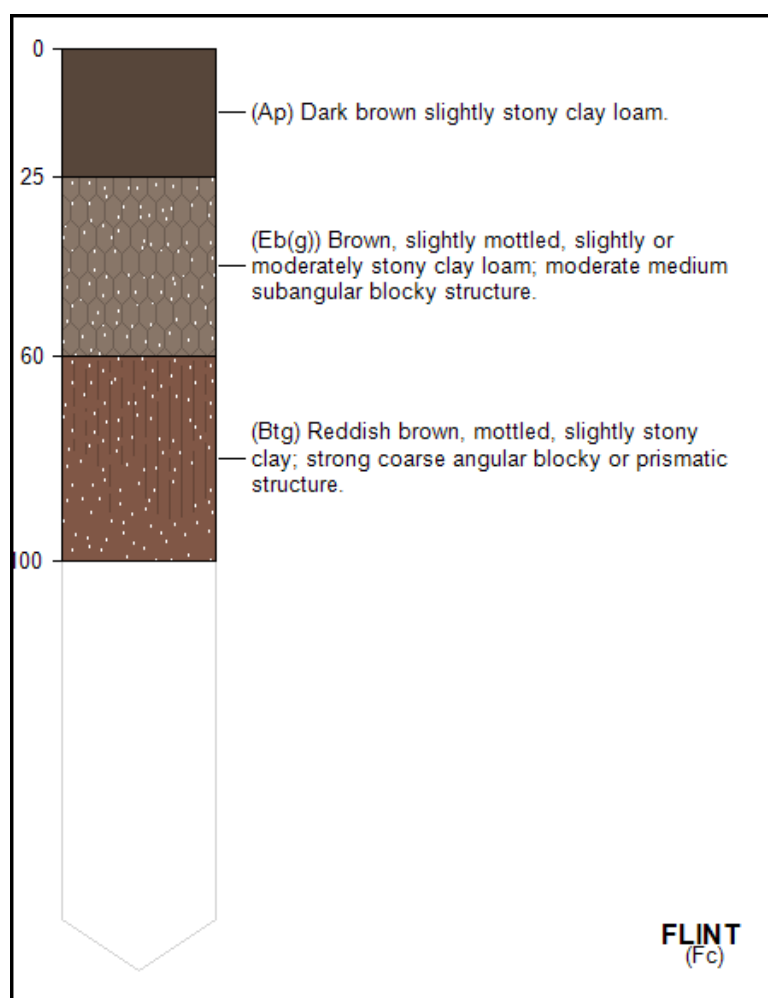


* not present within 150cm

5.72 FLINT (Fc) (514)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.O.D. Most are in agricultural use.
Soil group:	7 argillic brown earths	Loamy or clayey with an ordinary clay-enriched subsoil.
Soil Subgroup:	2 stagnogleyic argillic brown earths	(faintly mottled with slowly permeable subsoil)
Soil Series:	Flint series	reddish medium loamy over clayey drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	60
Depth to slowly permeable layer (downward percolation) (cm)	39
Depth to slowly permeable layer (upward diffusion) (cm)	39
Integrated air capacity (IAC) (mm)	86
Standard percentage runoff (SPR) (%)	47
Base flow index (BFI) (0 to 1)	0.52
Available water (AWC) (mm)	135
Available water for grass (mm)	120
Available water for cereal (mm)	125
Available water for sugar (mm)	150
Available water for potatoes (mm)	105

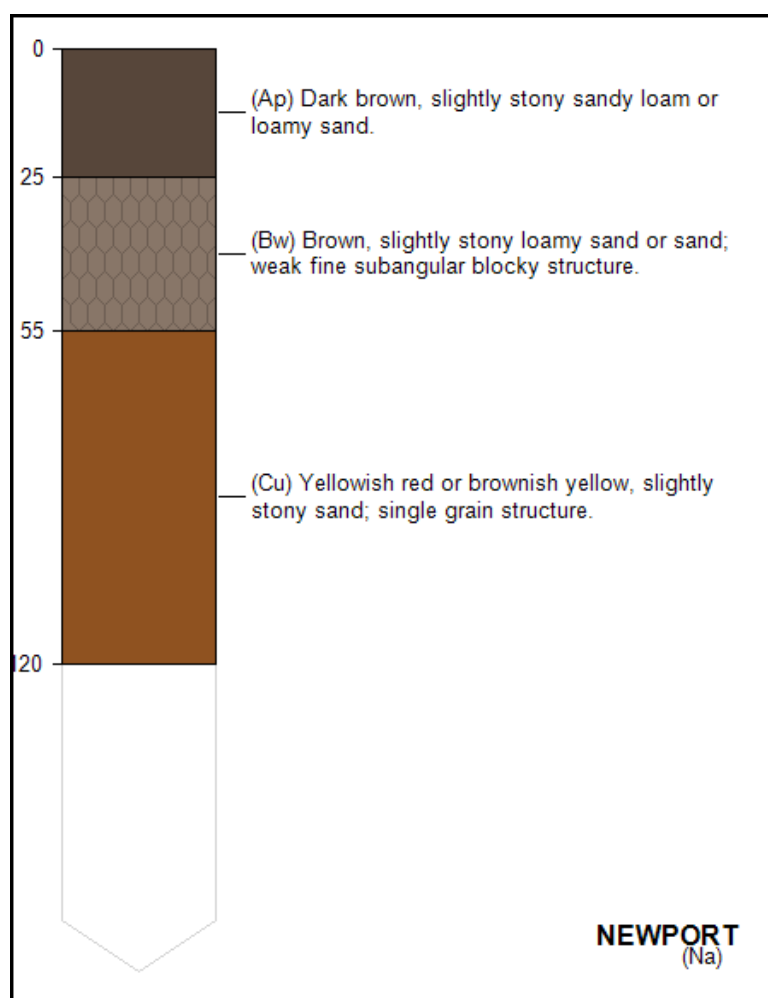


* not present within 150cm

5.51 NEWPORT (Na) (1310)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.O.D. Most are in agricultural use.
Soil group:	5 brown sands	Non-calcareous sandy or sandy gravelly.
Soil Subgroup:	1 typical brown sands	(unmottled with no clay-enriched subsoil)
Soil Series:	Newport series	sandy drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	n/a*
Depth to slowly permeable layer (downward percolation) (cm)	n/a*
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*
Integrated air capacity (IAC) (mm)	256
Standard percentage runoff (SPR) (%)	12
Base flow index (BFI) (0 to 1)	0.88
Available water (AWC) (mm)	95
Available water for grass (mm)	85
Available water for cereal (mm)	95
Available water for sugar (mm)	110
Available water for potatoes (mm)	70

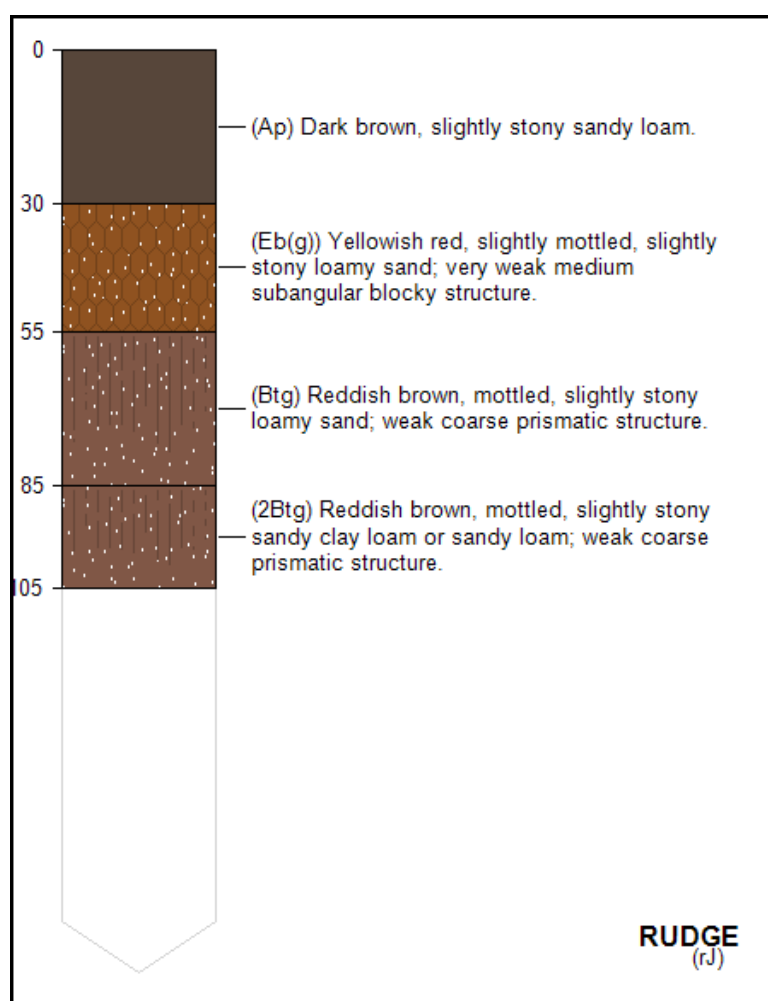


* not present within 150cm

5.53 RUDGE (rJ) (1743)

Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.O.D. Most are in agricultural use.
Soil group:	5 brown sands	Non-calcareous sandy or sandy gravelly.
Soil Subgroup:	3 stagnogleyic brown sands	(faintly mottled with slowly permeable subsoil)
Soil Series:	Rudge series	sandy drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	70
Depth to slowly permeable layer (downward percolation) (cm)	80
Depth to slowly permeable layer (upward diffusion) (cm)	80
Integrated air capacity (IAC) (mm)	176
Standard percentage runoff (SPR) (%)	47
Base flow index (BFI) (0 to 1)	0.52
Available water (AWC) (mm)	120
Available water for grass (mm)	110
Available water for cereal (mm)	115
Available water for sugar (mm)	135
Available water for potatoes (mm)	95

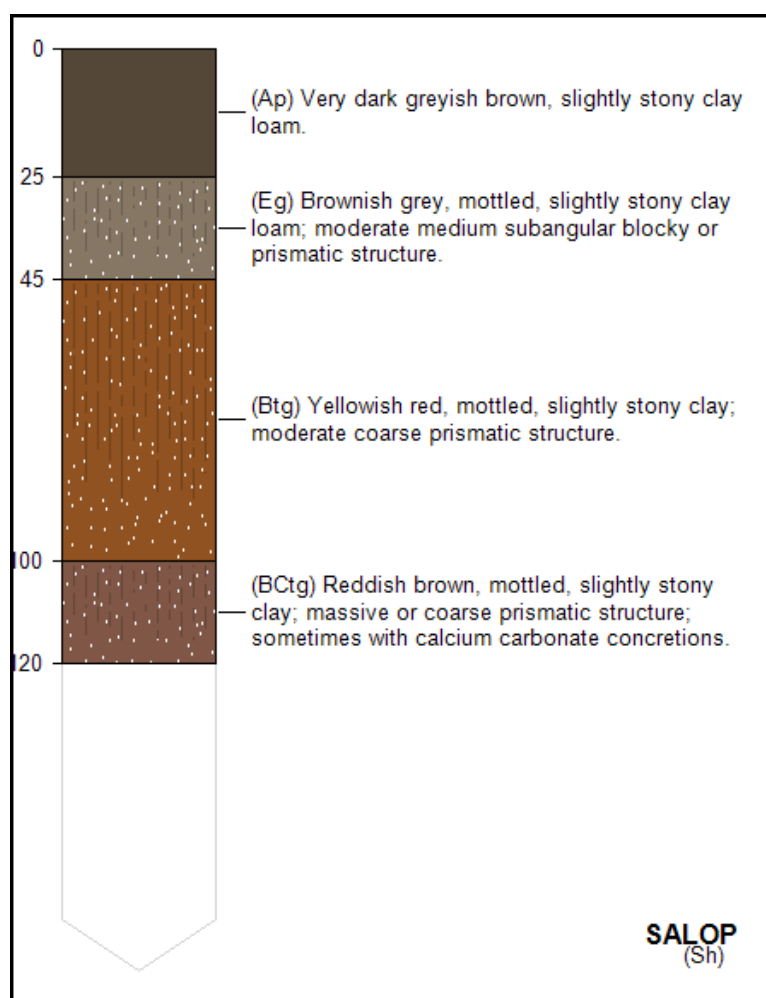


* not present within 150cm

7.11 SALOP (Sh) (1802)

Major soil group:	07 surface-water gley soils	Seasonally waterlogged slowly permeable soils, formed above 3 m O.D. and prominently mottled above 40 cm depth. They have no relatively permeable material starting within and extending below 1 m of the surface.
Soil group:	1 stagnogley soils	With a distinct topsoil. They are found mainly in lowland Britain.
Soil Subgroup:	1 typical stagnogley soils	(with ordinary clay enriched subsoil)
Soil Series:	Salop series	reddish medium loamy over clayey drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	25
Depth to slowly permeable layer (downward percolation) (cm)	41
Depth to slowly permeable layer (upward diffusion) (cm)	41
Integrated air capacity (IAC) (mm)	51
Standard percentage runoff (SPR) (%)	40
Base flow index (BFI) (0 to 1)	0.31
Available water (AWC) (mm)	140
Available water for grass (mm)	120
Available water for cereal (mm)	120
Available water for sugar (mm)	150
Available water for potatoes (mm)	100

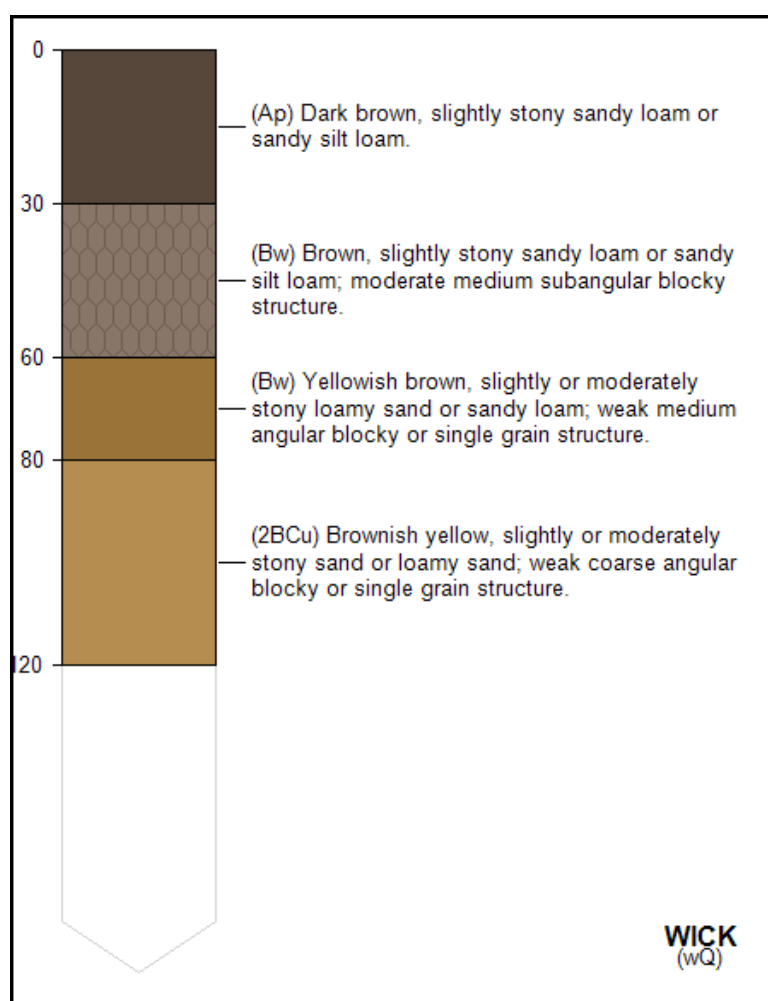


* not present within 150cm

5.41 WICK (wQ) (2225)

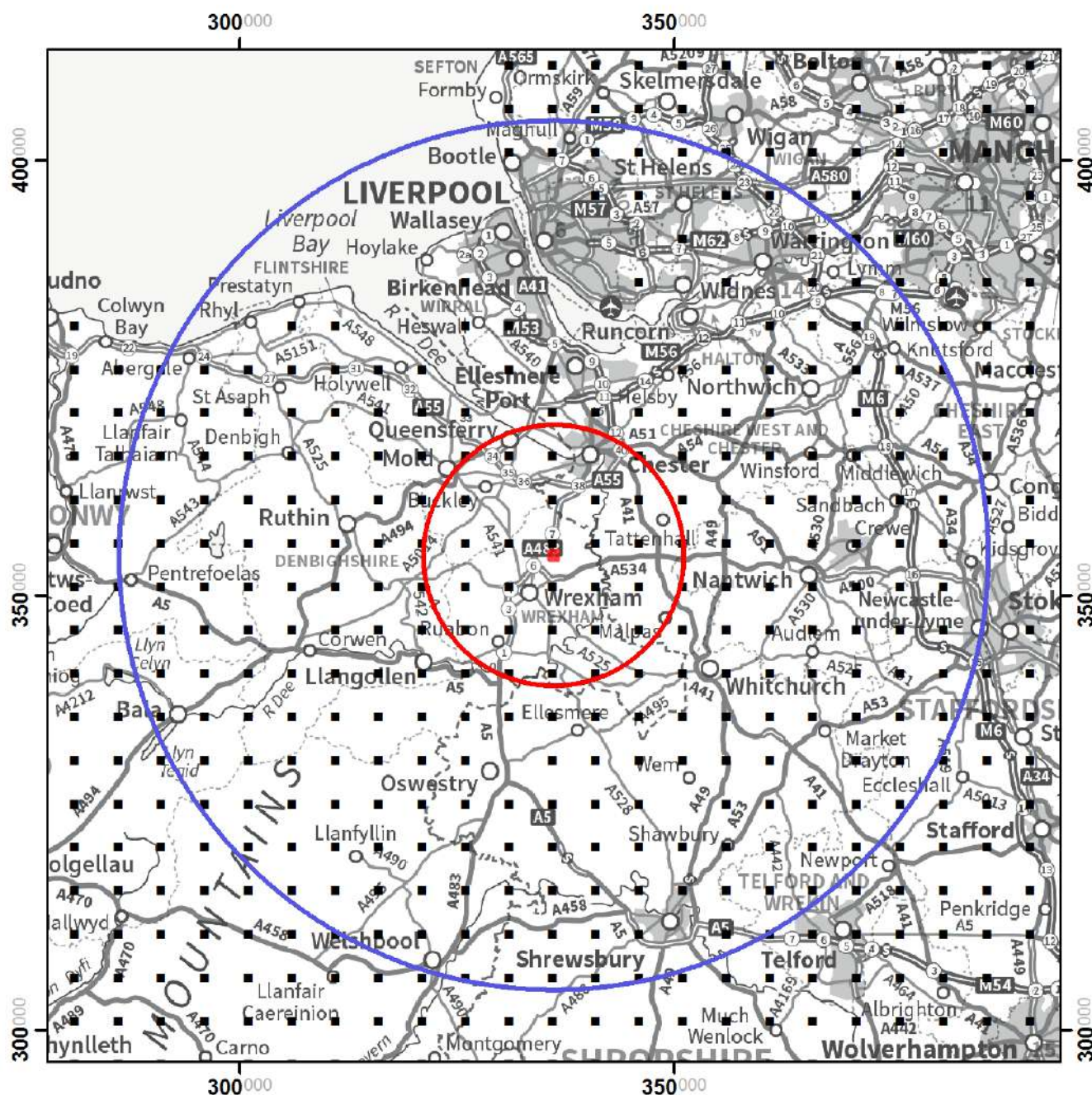
Major soil group:	05 brown soils	With dominantly brownish or reddish subsoils and no prominent mottling or greyish colours (gleying) above 40 cm depth. They are developed mainly on permeable materials at elevations below about 300 m.O.D. Most are in agricultural use.
Soil group:	4 brown earths	Non-alluvial, with non-calcareous loamy or clayey subsoils without significant clay enrichment.
Soil Subgroup:	1 typical brown earths	(unmottled)
Soil Series:	Wick series	light loamy drift with siliceous stones

Property	Value
Depth to rock (cm)	n/a*
Depth to gleying (cm)	n/a*
Depth to slowly permeable layer (downward percolation) (cm)	n/a*
Depth to slowly permeable layer (upward diffusion) (cm)	n/a*
Integrated air capacity (IAC) (mm)	206
Standard percentage runoff (SPR) (%)	12
Base flow index (BFI) (0 to 1)	0.88
Available water (AWC) (mm)	140
Available water for grass (mm)	130
Available water for cereal (mm)	140
Available water for sugar (mm)	165
Available water for potatoes (mm)	100



* not present within 150cm

4. Topsoil Element Background Levels



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Topsoil Element Background Levels Key

- Report area
- 15 km radius - local area
- 50 km radius - regional area
- NSI sample points

TOPSOIL ELEMENT BACKGROUND LEVELS DESCRIPTION

The National Soil Inventory (NSI) covers England and Wales on a 5 km grid and provides detailed information for each intersect of the grid. Collectively NSI data are statistically representative of England and Wales soils. The original sampling was undertaken around 1980 and there were partial resamplings in the mid-1990s. The most up-to-date data is presented here.

Analysis of the NSI samples provides detailed measurements of over 20 elements from the soils, in addition to pH. This data is summarised over three areas to provide you with an understanding of how your site, and your data for it, sits within the local, regional and national context.

Where available, the soil element levels are compared with the Soil Guideline Values and where a soil sample we have analysed has been found in excess of the SGV guidelines for "residential with plant uptake" land, this is displayed in red in the tables which follow.

SGV levels are provided for the following elements: lead, selenium, nickel, mercury, chromium, cadmium and arsenic.

In the following pages, a number of analyses of the topsoil are provided. The majority of analyses have been performed on the full compliment of sample points, however, in some areas, for some elements, only a few samples were analysed as part of subsequent programmes. In order to present the full suite of possible datasets, and accurately convey the validity of the data, the number of actual measured samples is stated for each analysis. Care should be taken where the number of samples is disproportionately low.

a. Analysis Within a 15km Radius (25 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST.DEV
pH (PH)	25	5.6	3.7	7.2	0.9
Carbon (CARBON)	25	3.8	1.5	12.6	2.3
Aluminium (AL_ACID)	25	21802.0	7099.0	40755.0	8241.5
Arsenic (AS_ACID)	12	2.4	1.2	4.0	0.9
Barium (BA_ACID)	25	246.4	57.0	1488.0	277.3
Calcium (CA_ACID)	25	2559.5	107.0	7257.0	1819.5
Cadmium (CD_ACID)	25	0.4	0.0	1.1	0.3
Cadmium (Extractable) (CD_EDTA)	25	0.3	0.1	0.5	0.1
Cobalt (CO_ACID)	25	7.7	1.0	14.5	3.6
Cobalt (Extractable) (CO_EDTA)	25	0.7	0.1	1.4	0.4
Chromium (CR_ACID)	25	32.6	6.0	78.7	15.4
Copper (CU_ACID)	25	16.3	6.3	27.8	5.5
Copper (Extractable) (CU_EDTA)	25	5.8	1.4	10.5	2.3
Fluoride (F_ACID)	10	41.6	16.6	75.3	19.9
Iron (FE_ACID)	25	21727.6	3249.0	37138.0	8777.8
Mercury (HG_ACID)	11	0.1	0.0	0.4	0.2
Potassium (K_ACID)	25	4369.0	1100.0	8304.0	1898.5
Potassium (Extractable) (K_NITRATE)	25	176.3	39.0	1450.0	275.2
Magnesium (MG_ACID)	25	4018.7	915.0	9242.0	2386.0
Magnesium (Extractable) (MG_NITRATE)	25	171.4	19.0	525.0	136.0
Manganese (MN_ACID)	25	506.6	24.0	1067.0	286.2
Manganese (Extractable) (MN_EDTA)	25	105.4	2.0	308.0	71.1
Molybdenum (MO_ACID)	14	0.7	0.0	2.3	0.7
Sodium (NA_ACID)	25	268.3	95.0	433.0	97.9
Nickel (NI_ACID)	25	19.7	3.0	58.3	11.5
Nickel (Extractable) (NI_EDTA)	25	1.3	0.3	3.3	0.7
Phosphorus (P_ACID)	25	712.9	202.0	1841.0	354.5
Phosphorus (Extractable) (P_OLSEN)	25	32.8	8.0	98.0	26.2
Lead (PB_ACID)	25	68.0	26.0	208.0	37.2
Lead (Extractable) (PB_EDTA)	25	28.6	10.8	80.0	16.4
Selenium (SE_ACID)	12	0.3	0.0	0.7	0.2
Strontium (SR_ACID)	25	18.8	1.0	43.0	10.9
Vanadium (V_ACID)	14	27.2	6.3	65.0	17.8
Zinc (ZN_ACID)	25	77.5	28.0	138.0	31.4
Zinc (Extractable) (ZN_EDTA)	25	8.9	2.9	31.8	6.8

for units, see Analyses Denitions (p53)

b. Analysis Within a 50km Radius (260 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST.DEV
pH (PH)	258	5.6	3.3	7.8	0.9
Carbon (CARBON)	260	6.3	0.7	54.5	9.6
Aluminium (AL_ACID)	260	24355.3	1654.0	52685.0	11203.2
Arsenic (AS_ACID)	124	3.2	0.0	16.2	2.4
Barium (BA_ACID)	260	192.6	23.0	1488.0	149.2
Calcium (CA_ACID)	260	2961.9	80.0	55475.0	4411.8
Cadmium (CD_ACID)	260	0.7	0.0	11.3	1.0
Cadmium (Extractable) (CD_EDTA)	259	0.4	0.0	25.0	1.6
Cobalt (CO_ACID)	260	8.9	0.0	56.4	6.0
Cobalt (Extractable) (CO_EDTA)	259	0.7	0.0	7.0	0.7
Chromium (CR_ACID)	260	35.8	0.0	167.7	20.7
Copper (CU_ACID)	260	21.4	1.3	203.3	19.2
Copper (Extractable) (CU_EDTA)	259	7.0	1.1	68.7	7.2
Fluoride (F_ACID)	148	44.4	0.0	401.9	51.4
Iron (FE_ACID)	260	24815.9	1500.0	57787.0	12691.4
Mercury (HG_ACID)	104	0.1	0.0	2.4	0.2
Potassium (K_ACID)	260	4682.5	497.0	10294.0	2130.2
Potassium (Extractable) (K_NITRATE)	258	148.3	17.0	1450.0	142.3
Magnesium (MG_ACID)	260	4463.9	197.0	12237.0	2504.1
Magnesium (Extractable) (MG_NITRATE)	258	138.1	11.0	595.0	102.2
Manganese (MN_ACID)	260	623.3	18.0	2644.0	479.8
Manganese (Extractable) (MN_EDTA)	259	114.3	2.0	733.0	95.1
Molybdenum (MO_ACID)	205	1.2	0.0	20.0	2.0
Sodium (NA_ACID)	260	309.3	32.0	1722.0	214.0
Nickel (NI_ACID)	260	21.6	1.3	71.7	12.2
Nickel (Extractable) (NI_EDTA)	259	1.1	0.2	10.8	0.9
Phosphorus (P_ACID)	260	772.2	87.0	2541.0	342.0
Phosphorus (Extractable) (P_OLSEN)	257	30.9	4.0	106.0	23.3
Lead (PB_ACID)	260	105.7	13.0	3264.0	296.9
Lead (Extractable) (PB_EDTA)	259	43.0	5.2	1322.9	138.0
Selenium (SE_ACID)	124	0.5	0.0	2.0	0.4
Strontium (SR_ACID)	260	18.4	0.0	143.0	14.8
Vanadium (V_ACID)	206	33.1	0.0	140.0	19.9
Zinc (ZN_ACID)	260	107.1	23.0	2125.0	171.6
Zinc (Extractable) (ZN_EDTA)	259	11.2	0.8	349.1	25.4

for units, see Analyses Denitions (p53)

c. National Analysis (5686 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST.DEV
pH (PH)	5630	6.0	3.1	9.2	1.3
Carbon (CARBON)	5672	6.1	0.1	61.5	8.9
Aluminium (AL_ACID)	5677	26775.3	491.0	79355.0	12772.2
Arsenic (AS_ACID)	2729	4.6	0.0	110.0	5.7
Barium (BA_ACID)	5677	150.0	7.0	3840.0	159.5
Calcium (CA_ACID)	5677	13768.7	0.0	339630.0	37785.0
Cadmium (CD_ACID)	5677	0.7	0.0	40.9	1.0
Cadmium (Extractable) (CD_EDTA)	5655	0.5	0.0	85.0	3.0
Cobalt (CO_ACID)	5677	10.6	0.0	567.0	13.7
Cobalt (Extractable) (CO_EDTA)	5655	1.1	0.0	26.5	1.2
Chromium (CR_ACID)	5677	38.9	0.0	2339.8	43.7
Copper (CU_ACID)	5677	22.6	0.0	1507.7	36.8
Copper (Extractable) (CU_EDTA)	5655	6.4	0.3	431.4	11.1
Fluoride (F_ACID)	3320	58.5	0.0	6307.9	186.2
Iron (FE_ACID)	5677	28147.8	395.0	264405.0	16510.5
Mercury (HG_ACID)	2159	0.1	0.0	2.4	0.2
Potassium (K_ACID)	5677	4727.7	60.0	23905.0	2700.2
Potassium (Extractable) (K_NITRATE)	5609	182.0	6.0	2776.0	151.6
Magnesium (MG_ACID)	5677	3648.1	0.0	62690.0	3284.1
Magnesium (Extractable) (MG_NITRATE)	5609	146.0	1.0	1601.0	147.5
Manganese (MN_ACID)	5677	777.0	3.0	42603.0	1068.8
Manganese (Extractable) (MN_EDTA)	5654	159.4	0.0	3108.0	188.6
Molybdenum (MO_ACID)	4417	0.9	0.0	56.3	2.0
Sodium (NA_ACID)	5677	323.3	17.0	25152.0	572.3
Nickel (NI_ACID)	5677	25.4	0.0	1350.2	29.2
Nickel (Extractable) (NI_EDTA)	5655	1.6	0.1	73.2	2.0
Phosphorus (P_ACID)	5677	792.1	41.0	6273.0	433.9
Phosphorus (Extractable) (P_OLSEN)	5604	27.4	0.0	534.0	25.5
Lead (PB_ACID)	5677	73.3	0.0	17365.0	280.6
Lead (Extractable) (PB_EDTA)	5655	27.8	1.2	6056.5	119.7
Selenium (SE_ACID)	2729	0.6	0.0	22.8	0.8
Strontium (SR_ACID)	5677	42.3	0.0	1445.0	67.8
Vanadium (V_ACID)	4428	41.0	0.0	854.4	33.9
Zinc (ZN_ACID)	5677	90.2	0.0	3648.0	104.4
Zinc (Extractable) (ZN_EDTA)	5655	9.6	0.5	712.0	24.6

for units, see Analyses Denitions (p53)

SOIL GUIDELINE VALUES (SGV)

Defra and the Environment Agency have produced soil guideline values (SGVs) as an aid to preliminary assessment of potential risk to human health from land that may be contaminated. SGVs represent 'intervention values', which, if exceeded, act as indicators of potential unacceptable risk to humans, so that more detailed risk assessment is needed.

The SGVs were derived using the Contaminated Land Exposure Assessment (CLEA) model for four land uses:

1. residential (with plant uptake / vegetable growing)
2. residential (without vegetable growing)
3. allotments
4. commercial / industrial

SGVs are only designed to indicate whether further site-specific investigation is needed. Where a soil guideline value is exceeded, it does not mean that there is necessarily a chronic or acute risk to human health.

The values presented in this report represent those from a number of sample points (given in the "Samples" column in each table) providing local, regional and national background levels. Figures which appear in red indicate that a bulked sample from 20m surrounding a sample point, has at a past date, exceeded the SGV for the 'residential with plant uptake' land use.

It is always advisable to perform site specific investigations.

More details on all the SGVs can be found on the Environment Agency Website.

All units are mg/kg which is equivalent to parts per million (ppm)

SUBSTANCE	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	ALLOTMENTS	COMMERCIAL /INDUSTRIAL
LEAD	450	450	450	750
SELENIUM	35	260	35	8000
NICKEL	50	75	50	5000
MERCURY	8	15	8	450
CHROMIUM	130	200	130	5000
CADMIUM (pH 6)	1	30	1	1400
CADMIUM (pH 7)	2	30	2	1400
CADMIUM (pH 8)	8	30	8	1400
ARSENIC	20	20	20	500

ANALYSES DEFINITIONS

PH (pH)

pH of soil measure after shaking 10ml of soil for 15 minutes with 25ml of water

CARBON (Carbon)

Organic Carbon (% by wt) measured either by loss-on-ignition for soils estimated to contain more than about 20% organic carbon or by dichromate digestion.

AL_ACID (Aluminium)

Total Aluminium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

AS_ACID (Arsenic)

Total Arsenic concentration (mg/kg) determined by Hydride Atomic Absorption Spectrometry (AAS), extracted into hydrochloric acid after digestion with nitric acid and ashing with magnesium nitrate

BA_ACID (Barium)

Total Barium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

CA_ACID (Calcium)

Total Calcium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

CD_ACID (Cadmium)

Total Cadmium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

CD_EDTA (Cadmium Extractable)

Extractable Cadmium concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

CO_ACID (Cobalt)

Total Cobalt concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

CO_EDTA (Cobalt Extractable)

Extractable Cobalt concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

CR_ACID (Chromium)

Total Chromium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

CU_ACID (Copper)

Total Copper concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

CU_EDTA (Copper Extractable)

Extractable Copper concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

ANALYSES DEFINITIONS continued

F_ACID (Flouride)

Flouride extracted with 1mol / l sulphuric acid and determined by Ion Selective Electrode (ISE)

FE_ACID (Iron)

Total Iron concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

HG_ACID (Mercury)

Total Mercury concentration (mg/kg) determined by Hydride Atomic Absorption Spectrometry (AAS), digested in a nitric/sulphuric acid mixture

K_ACID (Potassium)

Total Potassium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

K_NITRATE (Potassium Extractable)

Extractable Potassium concentration (mg/l) determined by shaking 10ml of air dry soil with 50ml of 1.0M ammonium nitrate for 30mins, filtering and then measuring the concentration by flame photometry

MG_ACID (Magnesium)

Total Magnesium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

MG_NITRATE (Magnesium Extractable)

Extractable Magnesium concentration (mg/l) determined by shaking 10ml of air dry soil with 50ml of 1.0M ammonium nitrate for 30mins, filtering and then measuring the concentration by flame photometry

MN_ACID (Manganese)

Total Manganese concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

MN_EDTA (Manganese Extractable)

Extractable Manganese concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

MO_ACID (Molybdenum)

Total Molybdenum concentration (mg/kg) determined by Atomic Adsorption Spectrometry (AAS) in an aqua regia digest

MO_EDTA (Molybdenum Extractable)

Extractable Molybdenum concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

NA_ACID (Sodium)

Total Sodium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

NI_ACID (Nickel)

Total Nickel concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

ANALYSES DEFINITIONS continued

NI_EDTA (Nickel Extractable)

Extractable Nickel concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

P_ACID (Phosphorus)

Total Phosphorus concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

P_OLSON (Phosphorous Extractable)

Extractable Phosphorus concentration (mg/l) determined by shaking 5ml of air dry soil with 100ml of 0.5M sodium bicarbonate for 30mins at 20 deg.C, filtering and then measuring the absorbance at 880 nm colorimetrically with acid ammonium molybdate solution

PB_ACID (Lead)

Total Lead concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

PB_EDTA (Lead Extractable)

Extractable Lead concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

SE_ACID (Selenium)

Total Selenium concentration (mg/kg) determined by Hydride Atomic Absorption Spectrometry (AAS), extracted into hydrochloric acid after digestion with nitric acid and ashing with magnesium nitrate

SR_ACID (Strontium)

Total Strontium concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

V_ACID (Vanadium)

Total Vanadium concentration (mg/kg) determined by Atomic Adsorption Spectrometry (AAS) in an aqua regia digest

ZN_ACID (Zinc)

Total Zinc concentration (mg/kg) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) in an aqua regia digest

ZN_EDTA (Zinc Extractable)

Extractable Zinc concentration (mg/l) determined by Inductively Coupled Plasma Emission Spectrometry (ICP) after shaking 10ml of soil with 50ml of 0.05M EDTA at pH 7.0 for 1h at 20 deg. C and then filtering

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To view a glossary visit: www.landis.org.uk/sitereporter/glossary.pdf

For a list of further reading visit: www.landis.org.uk/sitereporter/FURTHER_READING.pdf

GIS Datasets:

The GIS data used in the creation of this report is available to lease for use in projects. To learn more about, or acquire the GIS datasets used in the creation of this report, please contact the National Soil Resources Institute:

nsridata@cranfield.ac.uk

+44 (0) 1234 75 2992

National Soil resources Institute

Cranfield University

Bedfordshire

MK43 0AL

United Kingdom

www.landis.org.uk

Appendix 2 – Exploratory Hole Logs

Soil Profile Logs

Soil Profile Logs																							
Project Number	Project Name	Location	Date	Surveyor(s)	Company																		
MCA2055	Land off Hillock Lane	Gresford, Wexham	20/11/2019	JA	BWB Consulting Ltd																		
Site Properties																							
Land use/crop	% Cover	Previous land use/crop	Slope *	Slope Shape	Aspect	Surface Condition	Av Rut depth (cm)	Visible evidence of run off, erosion and/or deposition	Topsoil Moisture State	Parent Material													
Grassland for cattle	100% Grass	NA	<7	NA	NA					Superficial Deposits	Bedrock	Bedrock											
Pit	Wetness Class	Grade	Limitation(s)	Notes																			
HP01	1																						
Grid Ref.		Weather and Conditions																					
Easting	Northing	Temp(°C)	Sky	Wind	Precipitation																		
336036	354482	4	Overcast	Strong Winds	Dry																		
Horizon	Depth		Matrix			Gleying			Mottling			Stone Content		Calc	Mn C	Dev.	Ped/Soil Structure			Horizon Boundary		Biopores	SPL
	Top (mbgl)	Bottom (mbgl)	Texture	Colour	Munsell	Gley	Colour	Munsell	Form	Colour	Munsell	%	Type				Size	Structure	Strength	Distinct	Form		
1	0	0.28	Sandy clay loam	Very dark brown	10YR 2/2	No Gleying			No Mottling			5%	Sandstone, quartzite, coal	NA			Very fine to medium	Angular blocky		Clear	Wavy		No
2	0.28	0.6	Loamy sand	Strong brown	7.5YR 4/6	No Gleying			No Mottling			3%	Sandstone, quartzite, flint	NA			fine and medium	Granular					No
Pit	Wetness Class	Grade	Limitation(s)	Notes																			
A01	1																						
Grid Ref.		Weather and Conditions																					
Easting	Northing	Temp(°C)	Sky	Wind	Precipitation																		
336076	354573	4	Overcast	Strong Winds	Dry																		
Horizon	Depth		Matrix			Gleying			Mottling			Stone Content		Calc	Mn C	Dev.	Ped/Soil Structure			Horizon Boundary		Biopores	SPL
	Top (mbgl)	Bottom (mbgl)	Texture	Colour	Munsell	Gley	Colour	Munsell	Form	Colour	Munsell	%	Type				Size	Structure	Strength	Distinct	Form		
1	0	0.32	Sandy clay loam	Very dark brown	10YR 2/2	No Gleying			No Mottling			5%	Sandstone, quartzite, coal	NA			Very fine to medium	Angular blocky		NA	NA		No
2	0.32	0.7	Sandy clay loam	Dark brown	7.5YR 3/4	No Gleying			No Mottling			3%	Sandstone, quartzite, siltstone	NAN			fine and medium	Granular					No
Pit	Wetness Class	Grade	Limitation(s)	Notes																			
A02	1																						
Grid Ref.		Weather and Conditions																					
Easting	Northing	Temp(°C)	Sky	Wind	Precipitation																		
335943	354563	4	Overcast	Strong Winds	Dry																		
Horizon	Depth		Matrix			Gleying			Mottling			Stone Content		Calc	Mn C	Dev.	Ped/Soil Structure			Horizon Boundary		Biopores	SPL
	Top (mbgl)	Bottom (mbgl)	Texture	Colour	Munsell	Gley	Colour	Munsell	Form	Colour	Munsell	%	Type				Size	Structure	Strength	Distinct	Form		
1	0	0.35	Sandy clay loam	Very dark brown	10YR 2/2	No Gleying			No Mottling			5%	Sandstone, quartzite	NA			Very fine to medium	Angular blocky		NA	NA		No
2	0.35	0.7	Loamy sand	Dark brown	7.5YR 3/4	No Gleying			No Mottling			3%	Sandstone, quartzite, siltstone	NA			fine and medium	Granular					No
Pit	Wetness Class	Grade	Limitation(s)	Notes																			
A03	1																						
Grid Ref.		Weather and Conditions																					
Easting	Northing	Temp(°C)	Sky	Wind	Precipitation																		
335903	354479	4	Overcast	Strong Winds	Dry																		
Horizon	Depth		Matrix			Gleying			Mottling			Stone Content		Calc	Mn C	Dev.	Ped/Soil Structure			Horizon Boundary		Biopores	SPL
	Top (mbgl)	Bottom (mbgl)	Texture	Colour	Munsell	Gley	Colour	Munsell	Form	Colour	Munsell	%	Type				Size	Structure	Strength	Distinct	Form		
1	0	0.3	Sandy clay loam	Very dark greysih brown	10YR 3/2	No Gleying			No Mottling			5%	Sandstone, quartzite, siltstone	NA			Very fine to medium	Angular blocky		NA	NA		No
2	0.3	0.75	Sandy clay loam	Dark yellowish brown	10YR 4/6	No Gleying			No Mottling			3%	Sandstone, siltstone	NA			fine and medium	Granular					No

Appendix 3 – Laboratory Report



TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Environmental Science

4041

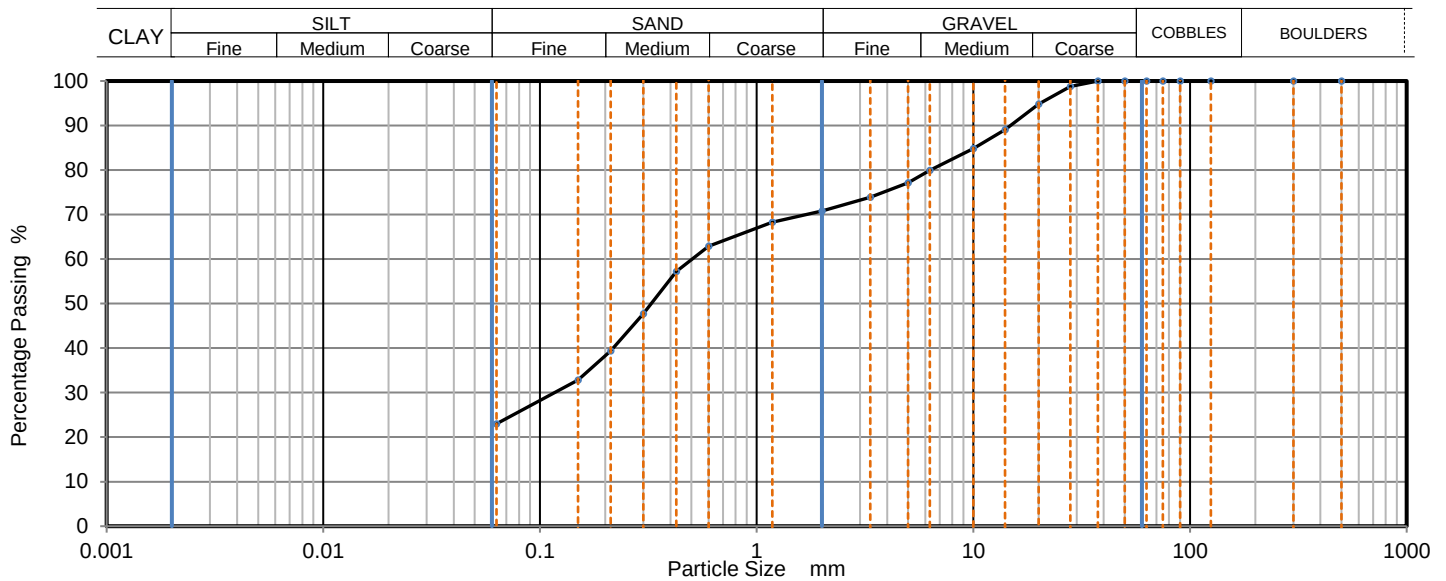
Client: BWB Consulting Limited
Client Address: 5th Floor, Waterfront House,
Nottingham, NG2 3DQ
Contact: Jade Allen
Site Name: Land off Hillock Lane, Gresford, Wrexham
Site Address: Not Given

Client Reference: MCA2055
Job Number: 19-73346
Date Sampled: 20/11/2019
Date Received: 21/11/2019
Date Tested: 26/11/2019
Sampled By: Not Given

Test Results:

Laboratory Reference: 1369832
Hole No.: HP01
Sample Reference: 1
Sample Description: Dark brown gravelly clayey SAND

Depth Top [m]: 0.00
Depth Base [m]: 0.28
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	99		
20	95		
14	89		
10	85		
6.3	80		
5	77		
3.35	74		
2	71		
1.18	68		
0.6	63		
0.425	57		
0.3	48		
0.212	39		
0.15	33		
0.063	23		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	29.20
Sand	47.50
Fines <0.063mm	23.40

Grading Analysis	
D100	mm 37.5
D60	mm 0.503
D30	mm 0.116
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/12/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 100.13

*Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation.
This report may not be reproduced other than in full without the prior written approval of the issuing laboratory.
The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*

Any assessment of compliance with specifications based on the analytical results in a report take in to account no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.



TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Environmental Science

4041

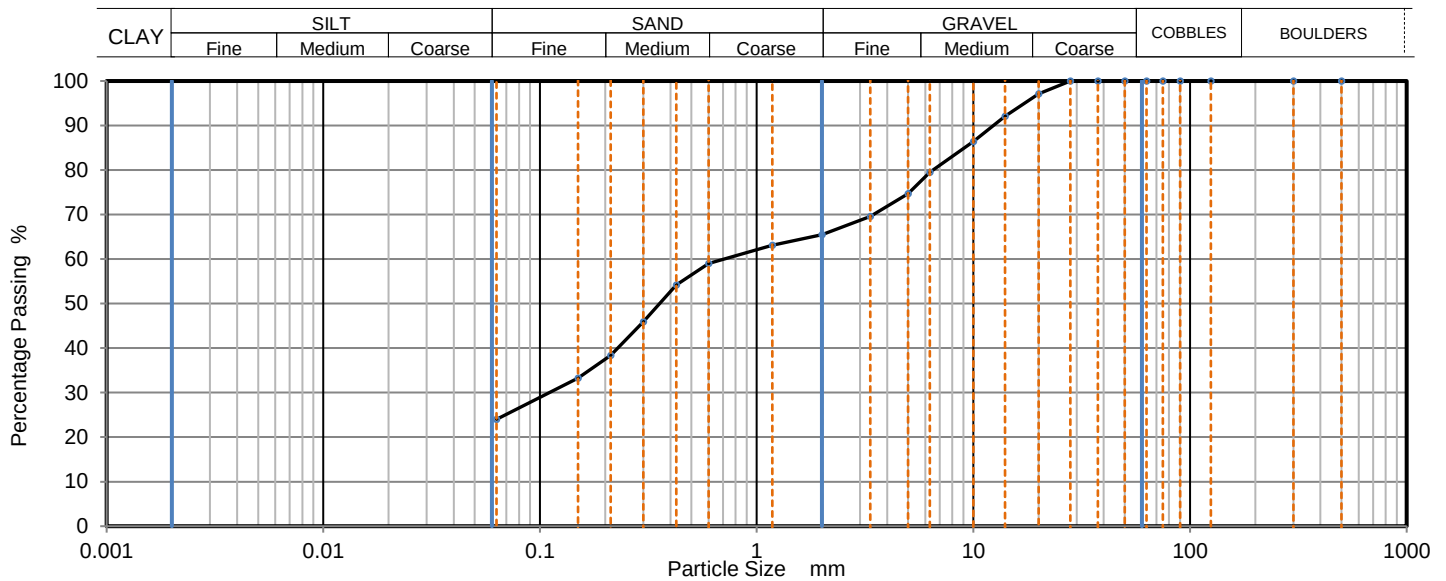
Client: BWB Consulting Limited
Client Address: 5th Floor, Waterfront House,
Nottingham, NG2 3DQ
Contact: Jade Allen
Site Name: Land off Hillock Lane, Gresford, Wrexham
Site Address: Not Given

Client Reference: MCA2055
Job Number: 19-73346
Date Sampled: 20/11/2019
Date Received: 21/11/2019
Date Tested: 26/11/2019
Sampled By: Not Given

Test Results:

Laboratory Reference: 1369833
Hole No.: HP01
Sample Reference: 2
Sample Description: Brown gravelly clayey SAND

Depth Top [m]: 0.28
Depth Base [m]: 0.60
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	97		
14	92		
10	86		
6.3	80		
5	75		
3.35	70		
2	66		
1.18	63		
0.6	59		
0.425	54		
0.3	46		
0.212	38		
0.15	33		
0.063	25		

Sample Proportions	% dry mass
Very coarse	0.00
Gravel	34.50
Sand	41.00
Fines <0.063mm	24.50

Grading Analysis	
D100	mm 28
D60	mm 0.71
D30	mm 0.108
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 05/12/2019

Signed: Darren Berrill
Geotechnical General Manager
for and on behalf of i2 Analytical Ltd GF 100.13

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