Geo-Environmental

AGRICULTURAL LAND ASSESSMENT

for the land off

DOWNEND ROAD, PORTCHESTER,

HAMPSHIRE PO16 8PX

on behalf of

MILLER HOMES

Report:	**AGRICULTURAL LAND ASSESSMENT**
Site:	**LAND OFF DOWNEND ROAD, PORTCHESTER, HAMPSHIRE PO16 8PX**
Client:	**MILLER HOMES**
Date:	**11/10/2017**
Reference:	**GE15996-ALA-OCT17**
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AMENDMENT RECORD

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1.0	02/02/2017	First issue for Client review	VB/GR
1.1	11/10/2017	Minor amendments to reflect updated Masterplan	GR

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EXECUTIVE SUMMARY

The site has been assessed in line with the guidelines in the Agricultural Land Classification[15] (ALC) system, from which the following has been identified:

Whilst the general site factors do not affect the ALC classification, several site specific factors including microrelief, drainage potential as demonstrated by in-situ testing, local variations in ground conditions, local historic and current uses of specific areas of the site are likely to reduce the ALC classification at least locally within the site, with a potential reduction to Sub-Grade 3b, or 4 for some areas. The stoniness of the exposed surface soils in particular is considered a major limiting factor and it is anticipated that this would make the soil more prone to droughtiness.

The area of the farmyard and garage complex is considered to be "Non-Agricultural".

It is considered that the loss of land at the site would not significantly harm national, regional or local agricultural interests and it would not "*result in the fragmentation of agricultural or horticultural holdings so as to seriously undermine the economic viability of the remaining holding*."

It is considered that the proposed development of the land would be consistent with local strategy to favour development within settlements, supplemented with selected releases of land on the edge of the main settlements as it is on the edge of established settlement, outside of the Green Belt, and not an Area of Outstanding Natural Beauty (AONB) or Area of Great Landscape Value (AGLV).

This Executive Summary is intended to provide a brief summary of the main findings and conclusions of the assessment. For detailed information, the reader is referred to the main report ref. GE15996/ALA/OCT17V1.1.

1.0 INTRODUCTION

1.1 General

Geo-Environmental Services Limited (Geo-Environmental) was instructed by Miller Homes to undertake an Agricultural Land Assessment of land off Downend Road, Portchester, Hampshire PO16 8PX herein referred to as 'the site'. The site's location is presented in Figure 1.

1.2 Form of Development

The proposed development is understood to comprise a "residential development, demolition of existing agricultural buildings and the construction of new buildings providing up to 350 dwellings; the creation of new vehicular access with footways and cycleways; provision of landscaped communal amenity space, including children's play space; creation of public open space comprising approximately 7.5ha; together with associated highways, landscaping, drainage and utilities".

1.3 Objectives

The scope of the report comprised a desktop study to gather and review pertinent information to assess the quality of agricultural land at the site.

The report utilises published information on climate, geology, soils and published DEFRA Provisional (pre-1988) ALC information, together with information on rural land designations, such as agri-environmental schemes, forestry and woodland schemes and other land based schemes.

The information collected from the desk study has been used to provide an interpretation of the site's setting and is assumed to be factually correct. The recommendations and opinions expressed in this report are based on the data obtained. Geo-Environmental takes no responsibility for conditions that have either not been revealed in the available records or that occur between or under points of any physical investigation. Whilst every effort has been made to interpret the conditions, such information is only indicative and liability cannot be accepted for its accuracy.

2.0 PLANNING POLICY AND GUIDELINES

2.1 Introduction

This chapter of the assessment considers the National, Regional and Local planning policies and guidelines with respect to identifying any opportunities or constraints that could impact development on the site, in the context of the agricultural land quality of the site.

2.2 Overview of Legislation

The key legislative drivers for dealing with development on agricultural land include:

- The Environment Act 1995[1];
- The Contaminated Land (England) Regulations 2000[2];

[1] HM Government, The Environment Act 1995 (Section 57)
[2] HM Government, The Contaminated Land (England) Regulations 2000 revision (2000)

- The Town and Country Planning Act 1990[3];
- The Localism Act 2011[4]
- Planning Act 2008[5]
- Countryside and Rights of Way Act 2000[6]
- Environmental Damage (Prevention and Remediation) (Amendment) Regulations 2010[7]
- Agricultural Land (Removal of Surface Soil) Act 1953[8]
- Local Democracy, Economic Development and Construction Act 2009[9]

The Environment Act establishes regulating bodies for contaminated land, abandoned mines, national parks, control of pollution, conservation of natural resources, conservation or enhancement of the environment and fisheries. The Contaminated Land Regulations lay out provisions relating to the identification and remediation of contaminated land and the circumstances in which contaminated land affects controlled waters.

The Town and Country Planning Act consolidates certain enactments relating to town and country planning. The Localism Act makes further provision for town and country planning, but also introduces the duty to co-operate, which requires local planning authorities to co-operate strategically on planning issues that cross administrative boundaries and which builds on measures in the Local Democracy, Economic Development and Construction Act. Additionally, strategic planning issues can be addressed through joint planning boards, using existing powers in the Town and Country Planning Act, whereby local planning authorities can agree to prepare joint Development Plan Documents. The Localism Act also introduces a new voluntary neighbourhood planning process which will input into the Local Plan.

The Countryside and Rights of Way Act sets out rules on countryside access, rights of way, driving vehicles off road, nature conservation and protecting wildlife and areas of outstanding natural beauty. It also enables traffic regulation orders to be made to conserve areas of natural beauty.

The Environmental Damage Regulations, forces polluters to prevent and repair damage to water systems, land quality, species and their habitats and protected sites. The polluter does not need to be prosecuted first, so remedying the damage can be prioritised.

Finally, except where planning permission has already been granted, the Agricultural Land (Removal of Surface Soil) Act makes it an offence to remove surface soil from agricultural land with the intention of selling it, if the amount is more than 5 cubic yards in three months.

2.3 National Planning Policy

Prior to March 2012, policy comprised a range of planning policy guidance documents (PPG) and planning policy statements (PPS) covering a range of environmental subjects. These were replaced by a more concise single document known as the National Planning Policy Framework (NPPF)[10].

[3] HM Government, The Town and Country Planning Act (1990)
[4] HM Government, The Localism Act (2011)
[5] HM Government, Planning Act (2008)
[6] HM Government, Countryside and Rights of Way Act (2000)
[7] HM Government, Environmental Damage (2010)
[8]HM Government, Agricultural Land Act (1953)
[9] HM Government, Local Democracy, Economic Development and Construction Act 2009
[10] Communities and Local Government, National Planning Policy Framework (NPPF), March 2012

In terms of development of agricultural land, the NPPF places a greater emphasis on sustainable development than previous policy documents, but at the expense of some detail. However, in its core planning principles it states the following:

- Local planning authorities should take into account the economic and other benefits of the best and most versatile agricultural land. Where significant development of agricultural land is demonstrated to be necessary, local planning authorities should seek to use areas of poorer quality land in preference to that of a higher quality. (NPPF, paragraph 112, p26)

In describing what it means by "best and most versatile agricultural land":

- "Best and most versatile agricultural land: Land in grades 1, 2 and 3a of the Agricultural Land Classification.;" (NPPF, Annex 2, p50)

In addition:

- "Local planning authorities should set criteria based policies against which proposals for any development on or affecting protected wildlife or geodiversity sites or landscape areas will be judged. Distinctions should be made between the hierarchy of international, national and locally designated sites, so that protection is commensurate with their status and gives appropriate weight to their importance and the contribution that they make to wider ecological networks." (NPPF, paragraph 113, p26)

Furthermore the NPPF states that:

- "Local planning authorities should: set out a strategic approach in their Local Plans, planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure;" (NPPF, paragraph 114, p26)

2.4 Regional and Local Planning Policy

The site falls under the jurisdiction of Fareham Borough Council. Regional planning documentation has been superseded by the numerous changes to the planning system at the national level, which have included:

a) Changes to the legislation (e.g. through the Localism Act and new regulations);
b) Replacement of most of the National Planning Policy Guidance Notes with a National Planning Policy Framework;
c) Revocation of the South East Plan in March 2013;
d) Introducing the ability for neighbourhood forums to prepare neighbourhood plans;
e) Removing the requirement of local planning authorities to submit the LDS to the Secretary of State.

Fareham Borough Council's Local Plan. This plan includes a core strategy, adopted on 4th August 2011. During an examination of Part 2 of the Local Plan in 2014 - 15, the Council agreed to commit to undertake an immediate review of the Local Plan to reflect new housing and employment needs for Fareham until 2036. This review is ongoing, with a likely completion and adoption timeframe set as Autumn 2018. In particular and with relation to development outside of defined urban settlements, the Core Strategy includes the following:

- **CS6:** In identifying land for development, the priority will be for the reuse of previously developed land, within the defined urban settlement boundaries including their review through the Site Allocations and Development Management DPD, taking into consideration biodiversity / potential community value, the

character, accessibility, infrastructure and services of the settlement and impacts on both the historic and natural environment. Opportunities will be taken to achieve environmental enhancement where possible.

In addition,

- **CS14**: Built development on land outside the defined settlements will be strictly controlled to protect the countryside and coastline from development which would adversely affect its landscape character, appearance and function. Acceptable forms of development will include that essential for agriculture, forestry, horticulture and required infrastructure. The conversion of existing buildings will be favoured. Replacement buildings must reduce the impact of development and be grouped with other existing buildings, where possible. In coastal locations, development should not have an adverse impact on the special character of the coast when viewed from the land or water.

Furthermore, specifically related to the environmental implications of development:

- **6.12**: Fareham has areas which are made up of high quality soil, which is an important finite resource that has helped to shape the character of the Borough's landscape. As well as being essential for agriculture, it also aids biodiversity habitats and stores a large quantity of carbon. The rising costs of buying food and the environmental impact of importing food over long distances, reinforces the need to protect land and soils for agricultural use, now and for future generations.

In addition, specifically related to implications of development to natural resources:

- **CS16**: New development will be expected to safeguard the use of natural resources by: Preventing the loss of the best and most versatile agricultural land (Grades 1, 2 or 3a of the Natural England Agricultural Land Classifications System).

Furthermore this document states that:

- **5.146**: The strategy concentrates development into the existing urban areas and strategic sites. To support this approach, development in the countryside, outside the settlement boundaries will be strictly controlled and will focus on meeting agricultural, farm diversification, countryside recreation, leisure and tourism needs i.e. needs that can only be met in this type of location. Where such development is necessary, the priority is to protect and enhance landscape character, the setting of settlements and biodiversity. A review of the settlement boundaries will be undertaken in the Site Allocations and Development Management Development Plan Document.

Figure 1 shows the site in context with other planned areas of development in the local area. The Red Line Boundary for the application site is shown on TOR drawing 2495-01/PP-002, Aug 2017 (presented as Figure 2 herein) and whilst other figures within this report might indicate an approximate site area or site boundary, the TOR plan should be referred to for the definitive boundary.

Figure 1 – Extract from Fareham Borough Council's Planning Maps[11]

2.5 Best Practice Guidelines

Natural England published "Developing farmland: regulations on land use"[12] in September 2012 and the Natural England Technical Information Note, TIN049, "Agricultural Land Classification: protecting the best and most versatile agricultural land"[13], also in September 2012.

Within TIN049, it states that the MAFF document, "Agricultural Land Classification of England and Wales"[14] published in October 1988 should be followed when deciding on the correct classification for a particular piece of agricultural land.

Finally, for identifying the classification of a piece of agricultural land, TIN049 also refers to the Natural England MAGIC website, which contains Pre-1988 and Post 1988 ALC data.[15]

3.0 SITE DETAILS AND BASELINE CONDITIONS

Based on the findings of the desk study, ref. GE15996/DSR/NOV16 and subsequent preliminary intrusive investigations as reported in GE15996-GR03-170201, the following sections summarise the anticipated geotechnical and environmental factors likely to impact the site.

[11] https://maps.fareham.gov.uk/LocalViewWeb_External/Sites/PoliciesMap2015/# Accessed 25/11/2016
[12] Natural England (2012) Developing farmland: regulations on land use, Planning applications for new buildings on agricultural land or change of use for existing farmland or buildings.
[13] Natural England (2012) Technical Information Note, TIN049, Agricultural Land Classification: protecting the best and most versatile agricultural land
[14] MAFF (1988) Agricultural Land Classification of England and Wales
[15] Natural England Website, accessed 25/11/2016 http://www.natureonthemap.naturalengland.org.uk/

3.1 Site Description

The site is located to the east of Downend Road, near Portchester, Fareham and extends to c. 28Ha. The approximate National Grid Reference of the site is 459960, 106340.

There are several buildings on site, consisting of barns, general farm buildings, old pig sties and a car workshop. Several of the farm buildings, i.e. barn type buildings in the north-western portion of the farm yard complex and former pig sties were in a state of dilapidation. Vegetation consisted of a mixture of deciduous trees, hedgerows, the remnants of an orchard, grazing and arable land. It is understood from anecdotal information that the fields forming the eastern portion of the site had been used previously for various crop types and also for pig farming.

Each of the site boundaries was vegetated with a mixture of hedgerows and deciduous trees.

The site was bounded to the south by a railway line located within a cutting; to the east by a crematorium, allotments and houses/properties; to the north by horse grazing and the M27 (located within a deep cutting); and to the west by commercial properties including a health club fronting on to Downend Road.

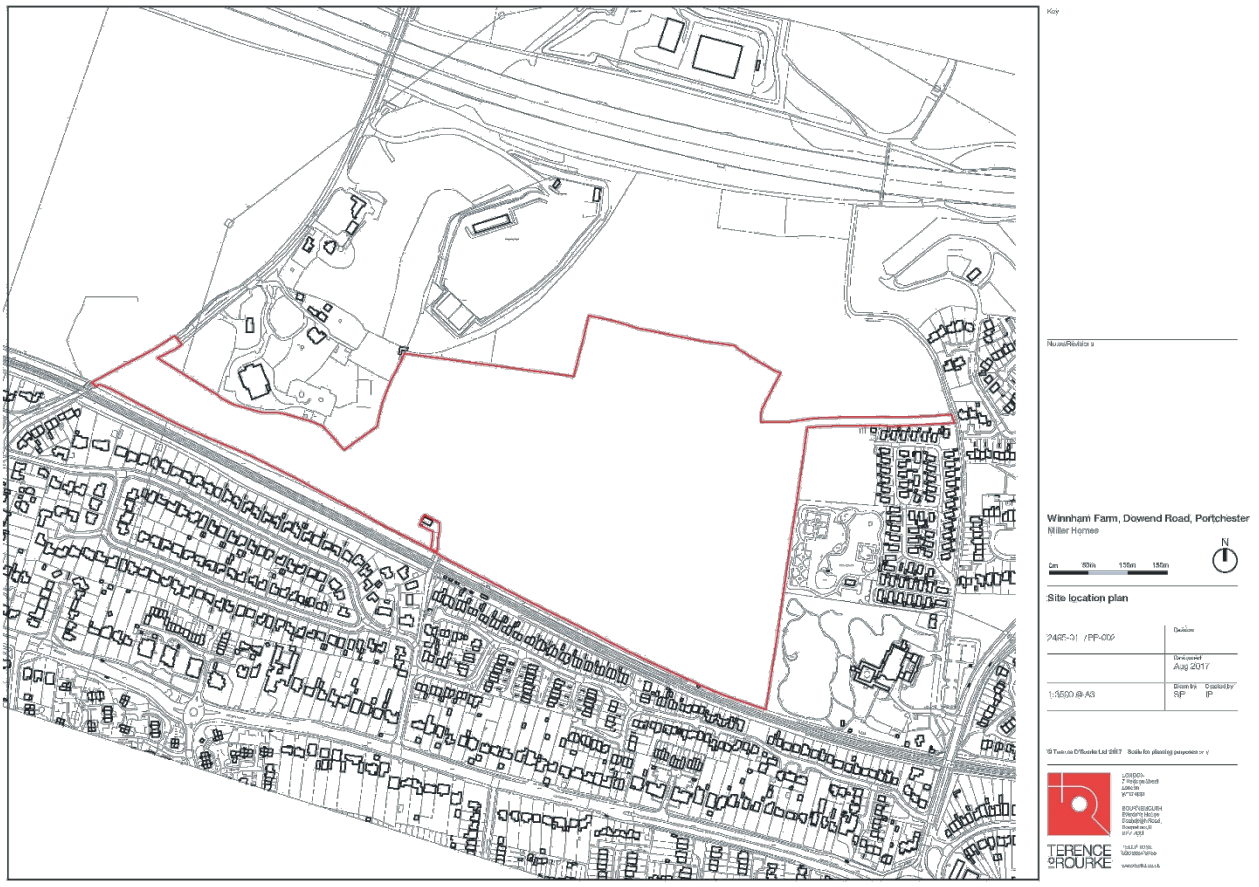


Figure 2 – Site location and Red Line Boundary (from TOR drawing 2495-01/PP-002, Aug 2017)

3.2 Site Topography

The site slopes generally down to the south, with undulations across the area. Several depressions are located in the northeast of the site and a shallow valley feature falling towards the south is located within the central portion

of the site. The M27 and Fareham and Portsmouth railway are both located off-site within east-west trending cuttings. No standing water was present on site at the time of the walkover.

Figure 3 – View of the site facing southeast

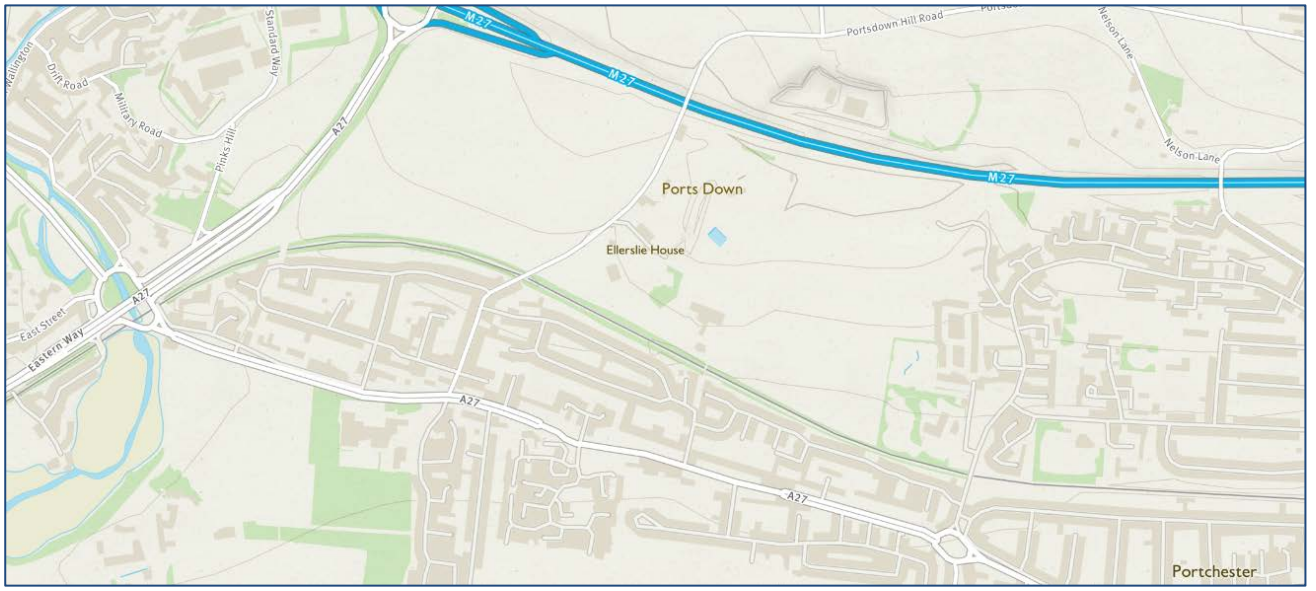


Figure 4 – Ordnance Survey Map of the Site[16]

3.3 Current Use

The site is currently a farm complex consisting of several structures, a car workshop, grazing and two arable fields.

3.4 Geology

According to published information the anticipated geological succession beneath the site was indicated to comprise a combination of Head Deposits in the south over Portsdown Chalk Formation and Spetisbury Chalk Member, Tarrant Chalk and Undifferentiated White Chalk Subgroup.

[16] Source: BGS Website, accessed 25/11/16 http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html

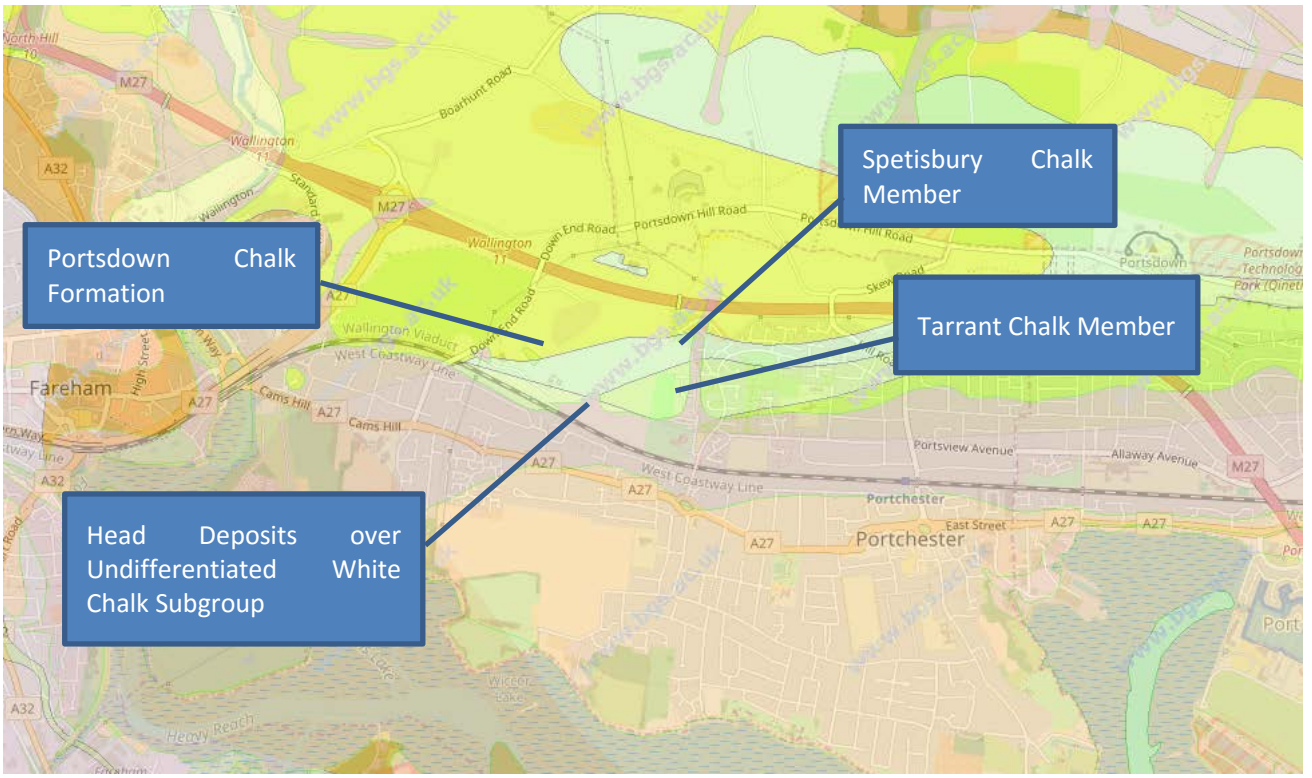


Figure 5 – Local Geology at the Site - source British Geological Survey[16]

Superficial Deposits

Head Deposits are drifts produced by solifluction, the downslope movement of debris outwash during the periglacial period and characteristically comprise poorly sorted clay, sand and gravel of local derivation.

In terms of the Agricultural Land Assessment, this has bearing as the stoniness of soil is a key limitation for the grading of the soil.

Bedrock

The **Portsdown Chalk Formation** comprises a white chalk with marl seams (particularly in the lower part) and flint bands.

The **Spetisbury Chalk Member** comprises a firm white chalk with regular large flint seams.

The **Tarrant Chalk Member** comprises a soft white chalk with relatively widely spaced but large flint seams.

The **Undifferentiated White Chalk Subgroup** is characterised as hard to very hard nodular chalks and hardgrounds (which resist scratching by finger-nail) with interbedded soft to medium hard chalks (some grainy) and marls. The softer chalks become more abundant towards the top. Nodular chalks are typically lumpy and iron-stained (usually marking sponges). Regular seams of nodular flint occur throughout.

In terms of the Agricultural Land Assessment, the presence of chalk rock and flint, coupled with soil texture and structure are limiting factors on the grading of the soil.

Available data on the soil scape at the site would expect the top 1.2m of soil to be 'freely draining', and in the main lime rich and loamy[17].

Figure 6 – Soilscapes Map[17]

The majority of the site is covered in Soilscape 5 – Coombe 1, the description of this soil type from this source is that it is: "*Well drained calcareous fine silty soils deep in valley bottoms, shallow to chalk on valley sides in places. Slight risk of water erosion. The major landuse on this association is defined as winter cereals, cereal and grassland rotations with dairying; some horticultural crops.*"

The drainage on the site from this source is described as "freely draining". Due to the presence of the weathered Chalk overlain by potentially clay rich Head Deposits this could be an optimistic characterisation as both clay rich Head Deposits and weathered/structureless Chalk could impede rainfall infiltration.

In addition to the natural strata as described above, it is likely that a mantle of Made Ground soils could be present in some areas of the site, e.g. those where development has taken place. Made Ground is an anthropogenic soil in which the material has been placed without engineering control and/or manufactured by man in some way. Great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter entrained within Made Ground soils.

The Desk Study Report (GE15996/DSR/NOV16) identified several depressions within the surface topography and tentatively identified these as potential dolines and solution features. A geophysical survey undertaken as part of a third party archaeological assessment also identified these features and indicated that the shallow valley feature could be a palaeovalley, albeit with an area of potentially worked ground and associated tailings located towards the northern end of the valley feature. This potentially worked ground was also identified on historic mapping as a disused chalk pit (1870 and 1898 1:10560 maps).

In addition to the desk study referred to above, an initial intrusive investigation was undertaken to clarify specific aspects of the desk study and to inform the emerging drainage strategy. The results of this investigation were presented in a letter report ref. GE15996-GR03-170201.

[17]Source: Landis Website, accessed 28/11/2016 http://www.landis.org.uk/soilscapes/

The intrusive investigation encountered the anticipated geological conditions beneath variable thicknesses of Made Ground or Topsoil. A general summary of the ground conditions encountered on site are presented in Table 1 below, with exploratory hole logs, location plan and soil classification test results presented in Appendix A.

Top (m bgl)	Base (m bgl)	Description
0	0.25 – 0.50	TOPSOIL: Dark brown silty gravelly cobbly CLAY
0	0.50	MADE GROUND: Concrete; brown silty clayey gravel with charcoal fragments [WS4 only]
0.25 – 0.50	0.85 – 3.0+	HEAD DEPOSITS: Firm reddish brown gravelly cobbly CLAY; orange red and brown clayey slightly gravelly SILT; medium to high strength orange-brown silty CLAY. [TP4 from 2.2m bgl Orange-brown very slightly clayey flint GRAVEL].
0.40 – 1.60	3.0+	CHALK: Light brown, white and off-white structureless CHALK composed of a silt and sand matrix with gravel to cobble size weak medium density clasts and some gravel to cobble sized flint. CIRIA Grade Dc, locally Grade Dm/Dc

Table 1 Summary of encountered ground conditions

The Head Deposits encountered were of varying composition but generally included some clay content. It is considered likely that the presence of clay, or clay-rich soils could impede rainwater infiltration and thus the classification of shallow soils as 'freely draining' (as described above) could be an overestimate of the drainage potential of these soils.

The presence of Made Ground soils could have a bearing on the grading of the land, albeit that at this stage Made Ground was only identified in the area of the farmyard and garage complex. In addition, exploratory hole WS3 was located in the north-western portion of the farmyard and in an area where fragments of potentially asbestos containing materials, e.g. corrugated sheeting and the like, were observed at the ground surface. Whilst asbestos was not identified from visual inspection of the soils recovered from this position, a sample of the near surface soil (logged as Topsoil) was submitted for asbestos identification as part of the analytical suite. Here again, this could have bearing on the classification of soils in an agricultural context.

In-situ permeability testing was undertaken within some of the exploratory holes from which infiltration rates in the Head Deposits and weathered Chalk were estimated to be in the general range 10^{-5}m/s to 10^{-6}m/s. These values would not generally be considered indicative of 'freely draining' strata. The tests in TP4 indicated better drainage but this targeted a gravel layer within the Head Deposits and thus was not indicative of the general composition of the more clayey Head Deposits encountered at shallow depth elsewhere on the site.

The initial intrusive investigation also considered soil composition and likely Topsoil classification in the context of BS3882:2015. With regards to nutrient content, the results mostly closely conformed to calcareous or low fertility calcareous Topsoil but some rebalancing of nutrients could be required if strict compliance with BS3882:2015 was required. The soils' grading was assessed to be a 'sandy silt loam'. However, this was based on the grading ratios of sand; silt and clay fractions. Soils exposed at the ground surface were observed to have an appreciable stone content (flint gravel and cobble).

3.5 Flood Risk and Groundwater Protection

The site is not in a flood risk area, being outside both Flood Zone 2 and 3 across the entirety of the site, as shown in Figure 7 below. Furthermore the entire extent of the site is considered to be at very low risk of surface water flooding.

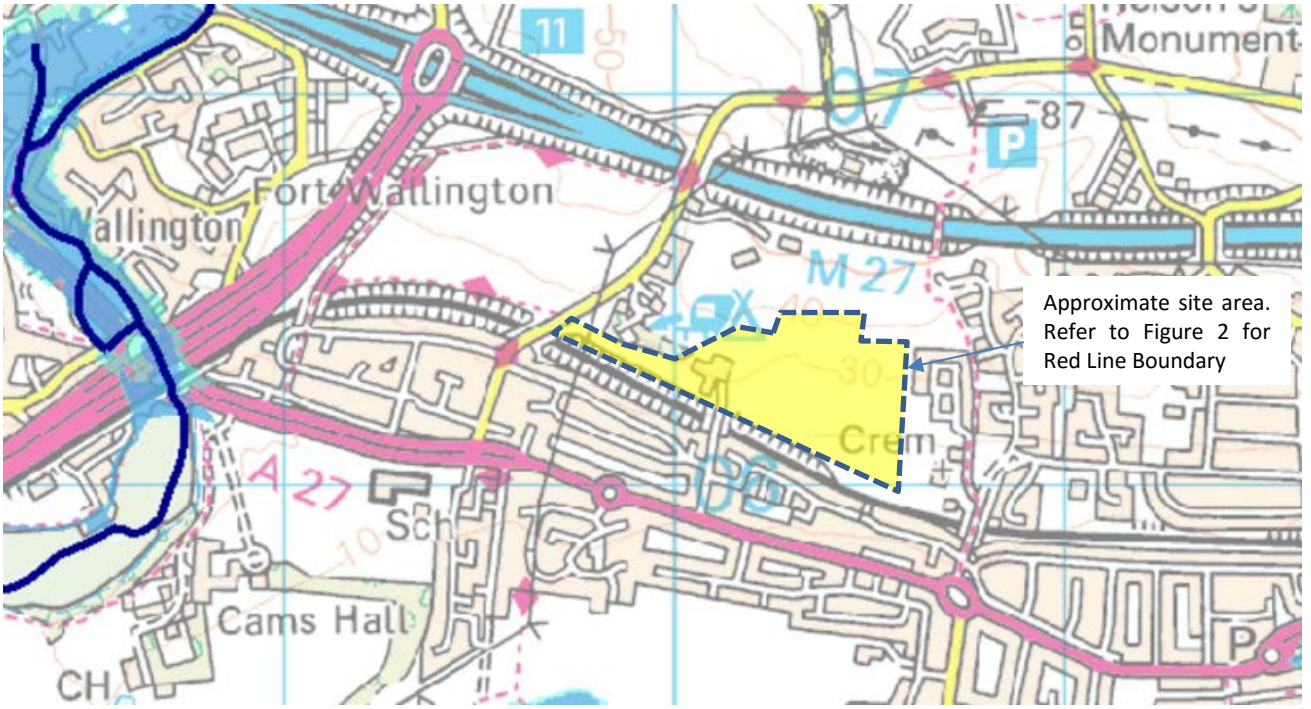


Figure 7 – Flooding from rivers and seas map for the area surrounding the site[18]

With reference to the information presented in report GE15996-GR03-170201, the results indicated relatively poor soakage potential within the Head Deposits and weathered Chalk in general, with better soakage potential associated with a gravel seam in the Head Deposits around TP4. However, tentative identification of solution features/dolines and anecdotal information of an infilled crown hole along the site's southern boundary could influence drainage in the vicinity of TP4.

3.6 Climate

The data available shows that the local climate within the Portchester area is temperate and would be of no issue relating to the land use specified. Figure 8 shows the annual averages for temperature and precipitation between the years 2000 and 2012.

[18] Source Environment Agency, What's in my backyard access 28/11/16
http://maps.environment-agency.gov.uk/wiyby/wiybyController

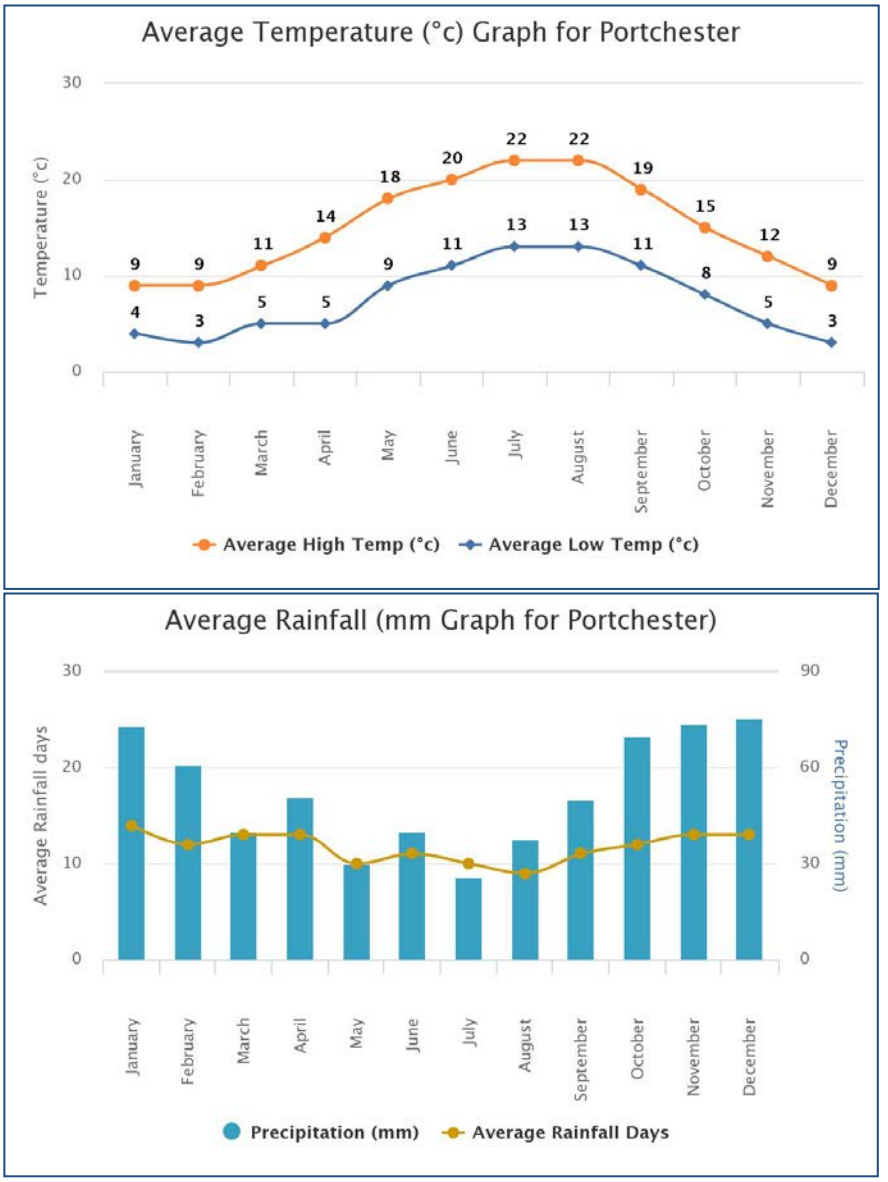


Figure 8 – Temperature and average precipitation profiles for the area between 2000 and 2012[19]

3.7 Habitat Potential

A search of available data revealed that there were no priority habitats on the site; no grassland, heathland or woodland considered as priority habitat. Areas of priority deciduous woodland are recorded to the immediate southeast and west of the site and areas of priority traditional orchards are recorded to the west of the site.

[19]World Weather Online Accessed 28/11/16
https://pt.worldweatheronline.com/portchester-weather-averages/hampshire/gb.aspx

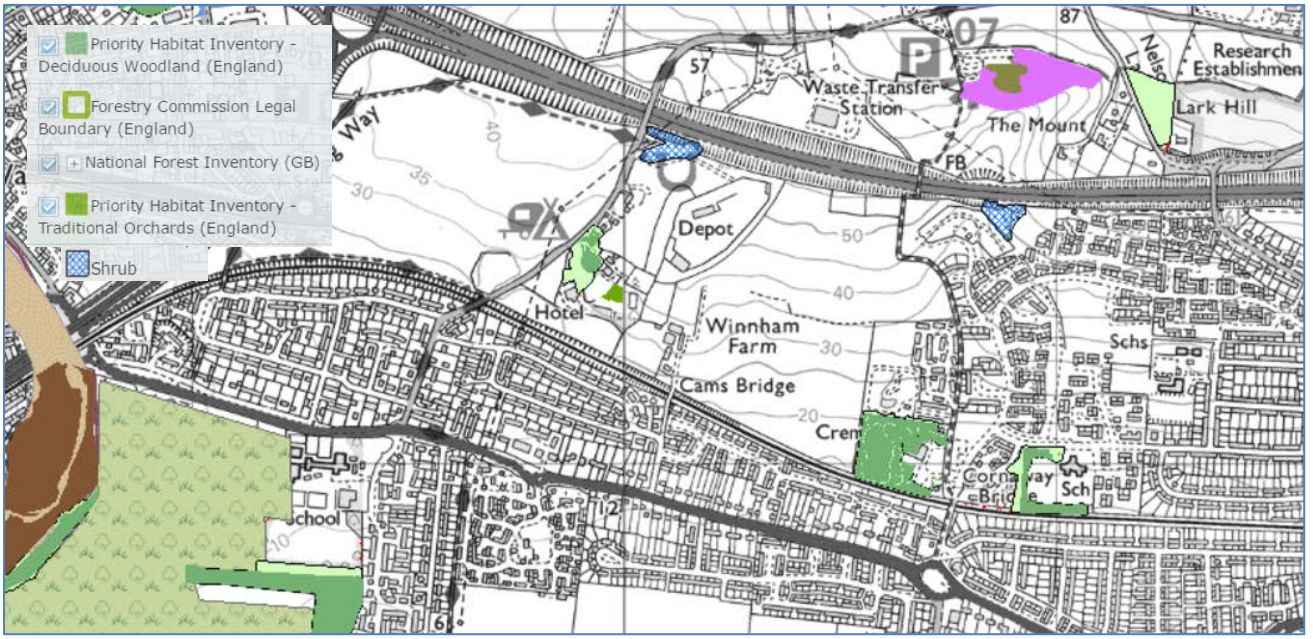


Figure 9 – Habitat Opportunity for the areas of the site that would be developed[20]

3.8 Agricultural Land Classification (ALC)

The ALC system classifies land into five grades, with Grade 3 subdivided into Subgrades 3a and 3b. The best and most versatile land is defined as Grades 1, 2 and 3a by policy guidance (see Annex 2 of NPPF). This is the land which is most flexible, productive and efficient in response to inputs and which can best deliver future crops for food and non-food uses such as biomass, fibres and pharmaceuticals. Current estimates are that Grades 1 and 2 together form about 21% of all farmland in England; Subgrade 3a also covers about 21%.

The ALC system is used by Natural England and others to give advice to planning authorities, developers and the public if development is proposed on agricultural land or other greenfield sites that could potentially grow crops. The Town and Country Planning (Development Management Procedure) (England) Order 2010 (as amended) refers to the best and most versatile land policy in requiring statutory consultations with Natural England.

Pre-1988 Classification

During the 1960's and 1970's MAFF produced a series of maps to show the provisional ALC grade of agricultural land over the whole of England and Wales at a scale of 1:250,000. These provisional ALC maps are suitable for strategic land use planning only, i.e. they are appropriate for land areas greater than 80Ha [NOTE: The site extends to approximately 28Ha]. These maps were produced before the current land grading system was adopted and cannot be relied upon to provide a definitive ALC grading for the site, neither do they differentiate between the different sub-grades 3a and 3b.

According to the data available from these maps the agricultural land on the site is classified as "Grade 2 and 3" – Very good, or Good to Moderate quality (see Figure 10). It should be noted that the majority of agricultural land

[20] Defra accessed 28/11/16
http://magic.defra.gov.uk/MagicMap.aspx

surrounding the site is also classed as Grade 2 and 3. However it should be noted that this map is only indicative of ALC grade.

Figure 10 – Pre-1988 ALC information[21]

Post 1988 Classification

The Post-1988 Classification is the latest, most up to date ALC data, utilising the new data from individual sites surveyed in more detail by MAFF (including subdivisions of Grade 3 Land) between 1989 and 1999. Individual sites were mapped at varying scales and level of detail from 1:5,000 to 1:50,000 (typically 1:10,000). According to survey, the site has been designated as Grade 3a and 3b – good to moderate quality agricultural land, by Natural England.

[21]Source: London & South East Region 1:250 000 Series Agricultural Land Classification

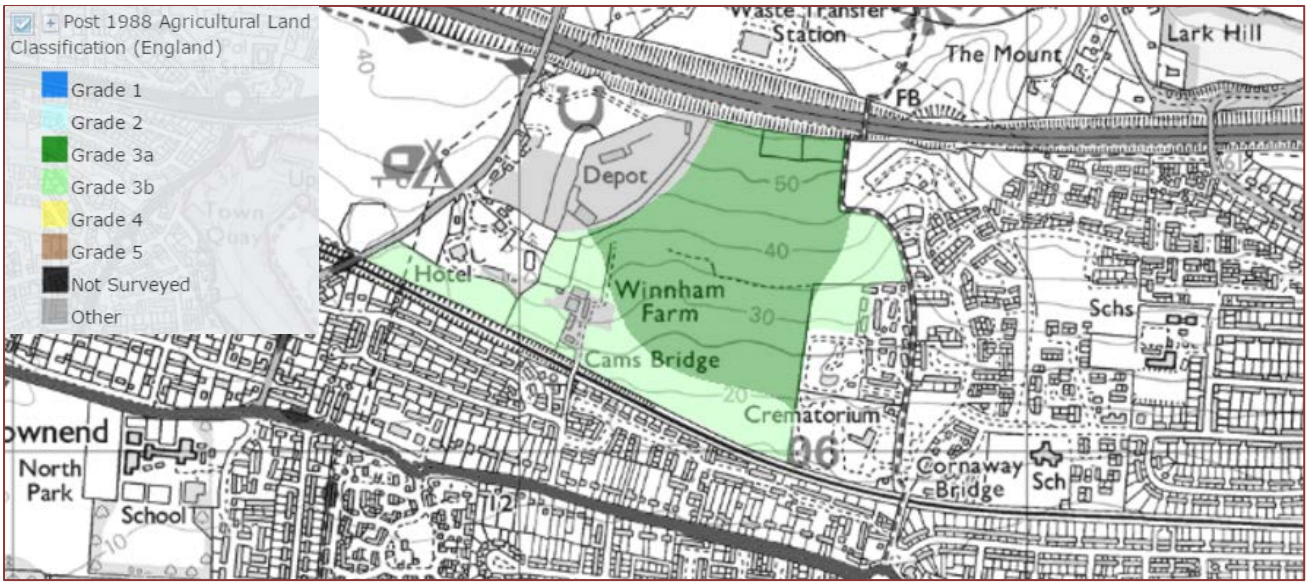


Figure 11 – Post-1988 ALC information[20]

3.9 Agri-Environmental Scheme Data

An analysis of available data revealed that the site area was not covered by any Agri-environment, Forestry and Woodland or Other Land Based Schemes, see Figure 12. However, a former chalk pit located to the west of the northern portion of the site is an area under conservation and enhancement agreement (see Figure 13). In addition to this, the site is not located in or in close proximity to the green belt.

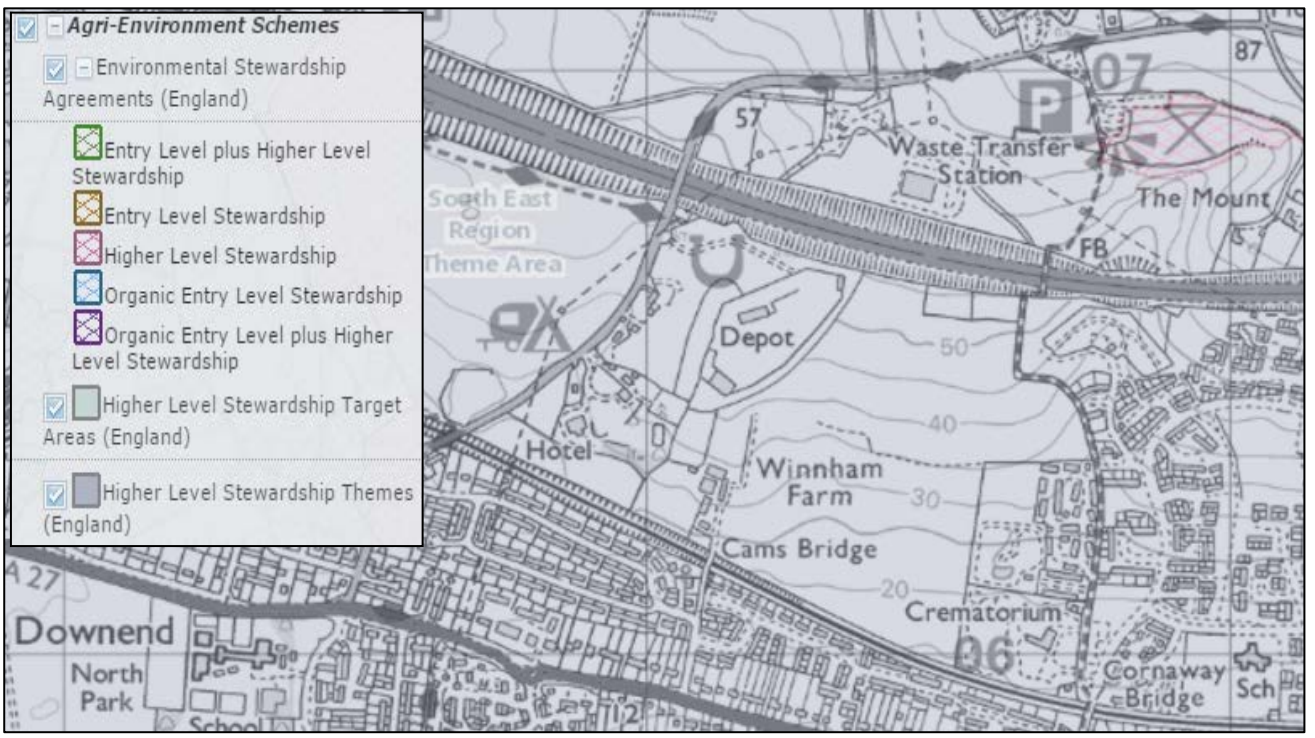


Figure 12 – Agri-Environmental Schemes in the area[20]

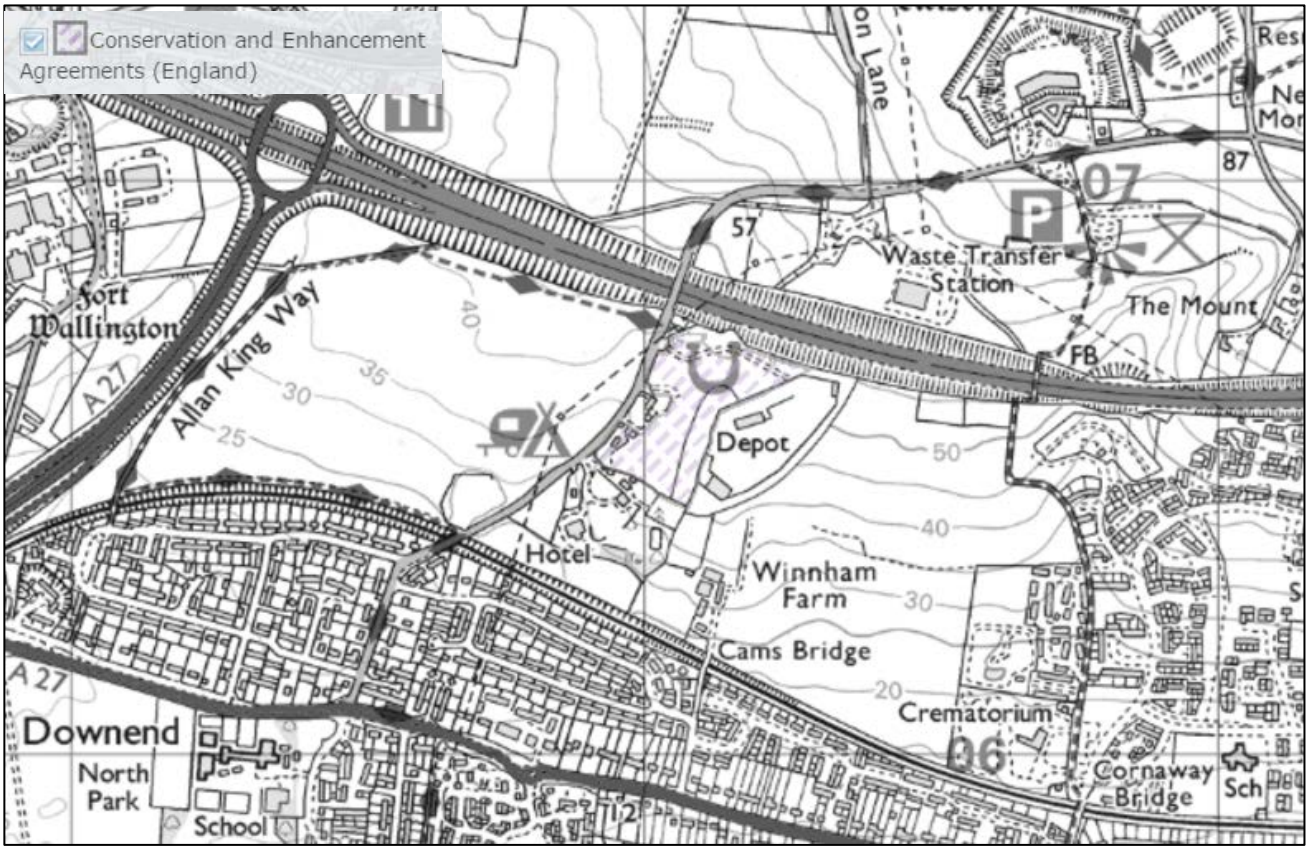


Figure 13 – Other Land Based Schemes in the area[20]

3.10 NSRI Soils Site Report

A Soils Site Report was commissioned from NSRI as part of the assessment. A copy of the report, ref. 106000804, is presented in Appendix B and a summary of key findings is presented in Table 2 below. The NSRI report covers the 1kmx1km grid square within which the site is located. Four principal zones were identified within this grid square, a north-eastern quadrant (which appeared to encompass the northern portion of the site), a central zone (which appears to cover the majority of the site), a southern area (primarily to the south of the railway line) and a small area in the north-western corner pf the grid square which fell outside of the site and so has not been included in the summary in Table 2.

Assessment Element	Comment
Soil association	North-eastern quadrant – Upton 1: Shallow well draining silty soils over chalk. Central zone – Coombe 1: well drained calcareous fine silty soils deep in valley bottoms. Southern area – Hamble 2: deep stoneless well drained silty soils and similar soils affected by groundwater over gravel.
Hydrology of soil type	Free draining
Ground movement potential	Very low to low
Flood vulnerability	Minor risk (presumed run-off rather than groundwater)
Risk of corrosion of ferrous iron	Non-aggressive

Assessment Element	Comment
Pesticide leaching risk	North-eastern quadrant – High Central and southern areas - Intermediate
Pesticide run-off risk	North-eastern and central – moderate South – very low
Hydrogeological rock type	North-eastern quadrant – chalk Central area – chalky drift Southern area – cover loam
Groundwater protection policy	North-eastern quadrant – high leaching potential Central area – intermediate leaching potential Southern area – intermediate leaching potential
Soil parent material	North-eastern quadrant – chalk Central area – chalky drift Southern area – Aeolian silty drift
Expected crop and land use	North-eastern quadrant – permanent grassland, rough grazing, woodland, cereals Central area – winter cereals, cereal, grassland rotation with dairy Southern area – winter cereals, grassland rotation, stock grazing
Natural soil fertility	North-eastern quadrant – lime rich Central area – lime rich Southern area – low
Simple soil texture	Loamy
Typical habitat	North-eastern quadrant – herb rich downland, limestone pasture Central area – herb rich chalk and limestone pasture Southern area – neutral and acid pasture

Table 2 Summary of NSRI Soils Site Report findings

4.0 ANALYSIS OF CONDITIONS

4.1 Methodology

As previously discussed in Section 2.5, best practice dictates that the MAFF document, "Agricultural Land Classification of England and Wales"[15] published in October 1988 should be followed when deciding on the correct classification for a particular piece of agricultural land.

As described in the Agricultural Land Classification[15], the main physical factors influencing agricultural land quality are:

- Climate;
- Site; and
- Soil.

4.2 Climatic Factors

According to Figure 1 of the Agricultural Land Classification[15] the Medium Accumulated Temperature (AT0) of 1521 - 1554 day degree Celsius and Annual Accumulated Rainfall (AAR) 791 - 830 mm/year indicates that there are no climate limitation to agricultural land quality at the site. On this measure the overall climatic grade for the site equates to grade 1.

4.3 Site Factors

The Agricultural Land Classification[15] states that the site related limiting factors for land quality are:

- Gradient – the gradient should be less than 7°;
- Microrelief – complex change in slope angle over short distances;
- Flood Risk – is the site susceptible to flooding?

The site slopes generally to the south with a fall in ground level from c. 55m AOD down to 15m AOD, which equates to a general gradient of c. 4-5°. The site is not in a flood risk area. As such these parameters would not limit the site.

However, as noted previously, there are several undulations and changes in slope profile within and across the site such that locally the slope profile is in excess of 7° and not necessarily in the general slope direction. As such, these 'microrelief' factors are considered, as part of the site specific assessment, potentially to impact the classification of the site.

4.4 Soil Factors

The Soilscape classification indicated that 'freely draining' soils were anticipated to be present. Testing of Topsoil recovered from the site indicated the soil (<2mm particle size range) to comprise a sandy silt loam which may be prone to 'droughtiness'. Intrusive investigation indicated the underlying natural subsoils and superficial deposits to include clay fraction and bedrock to comprise structureless weathered Chalk. These strata are considered unlikely to be 'freely draining' as supported by in-situ permeability testing, excluding from TP4 where more gravelly soils were present at depth.

These would are considered to be limiting factors on the site, limiting the quality of the land to Subgrade 3a and 3b in the south.

Further to this, a visual inspection of the site revealed stoniness of exposed surface soils and in places appeared to be very stony in relation to Table 5 of the ALC guidelines. This may limit the quality of the land to Subgrade 3b or 4 in the North and East of the site especially. We would anticipate that this high stone content would also make the soil prone to droughtiness.

4.5 Conclusion

The site extends to approximately 28Ha and this is lower than the 80Ha limit applied under the pre-1988 ALC system.

The climatic factors on the site are not considered to limit land-quality to less than Grade 1.

The general site factors do not limit land-quality to less than Sub-Grade 3a and 3b. However, microrelief factors could impact, i.e. reduce the ALC in several areas of the site, including where Sub-Grade 3a has been assigned from local/regional assessment. This could reduce Sub-Grade to 3a to 3b, or 3b to 4 at least locally within the site.

The desk study and third party surveys have identified that the site includes a former chalk pit, which although localised in extent, could influence the character of the ground in proximity to the former pit. The pit is no longer evident but appears to have been lost beneath one of the fields, i.e. presumably backfilled with tailings/spoil, overburden and ploughed soils. This could reduce the Sub-Grade 3a classification to 3b, or possibly 4 at least locally within the site, i.e. in the immediate vicinity of the former chalk pit.

Made Ground was identified within the farmyard/garage complex located within the site and asbestos was identified within a sample of Topsoil recovered from the north-western portion of the farmyard complex. The farmyard complex also includes several buildings in a state of disrepair. Thus, it is considered that the soils in the vicinity of the farmyard and garage complex would not be classified as agricultural soils.

The fields along the south-western portion of the site, i.e. extending from the garage complex to Downend Road are used currently as grazing pasture for a small number of horses. Investigation in this area indicated the presence of clay rich Topsoil land subsoil over structureless Chalk. These soils were considered to have limited agricultural value, i.e. possibly reducing from the classified Sub-Grade 3b to Grade 4 (Poor) due to the clay content.

The site is currently subject to various uses including arable fields on the eastern portion of the site, a farmyard and garage complex and horse grazing in the west. Anecdotal information indicates that the farm has been associated with arable crops as well as pig farming and thus not subject to a consistent farming use.

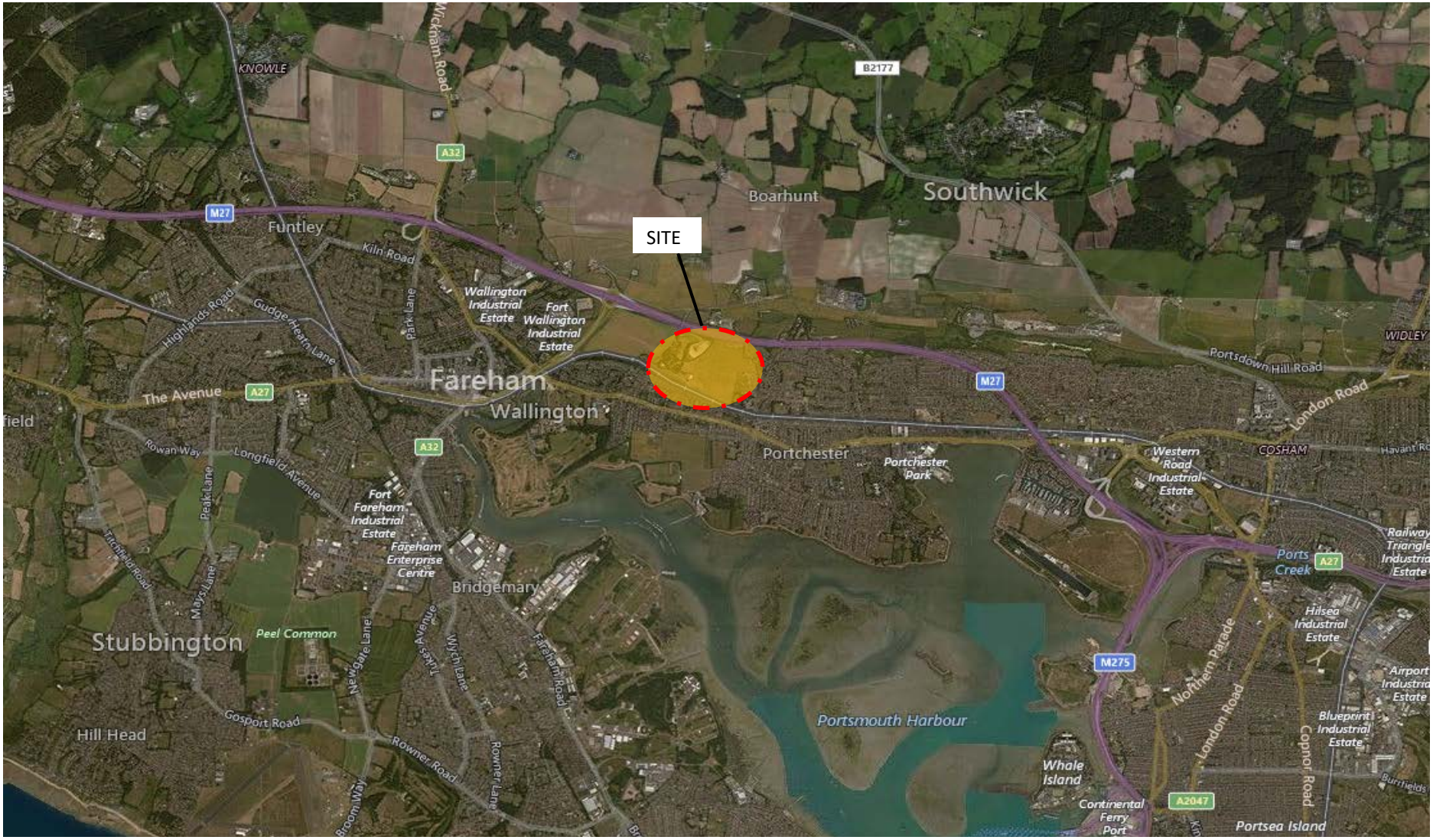
The site is bounded to the north by the M27 which is located in a deep cutting, with a mixture of residential land and a crematorium to the east, to the south by a railway cutting with residential areas beyond and to the west by former chalk pits, commercial/leisure uses and residential land, with open land further to the west. Thus the site is considered to be located in an urban fringe area and thus the proposed development could be consistent with local strategy to "*to favour development within settlements.*"

The proposed development would result in the loss of farmed land, i.e. the two fields forming the eastern portion of the site. However, whilst the ALC system classifies this land as Sub-Grade 3a or 3b, site specific factors including the stoniness of the exposed soils, subsoil composition (i.e. clayey soils), microrelief and past land use are considered likely to result in a downgrading of specific areas of these fields thereby potentially reducing the impact of the loss of these fields. The stoniness of the site as a factor on its own may limit the quality of the land to Subgrade 3b or 4 in the North and East of the site especially and this stone content would most likely make the soil prone to droughtiness which would be a further limiting factor. In addition to this, it is presumed that these two fields in isolation would not comprise a sustainable arable farm.

Geo-Environmental

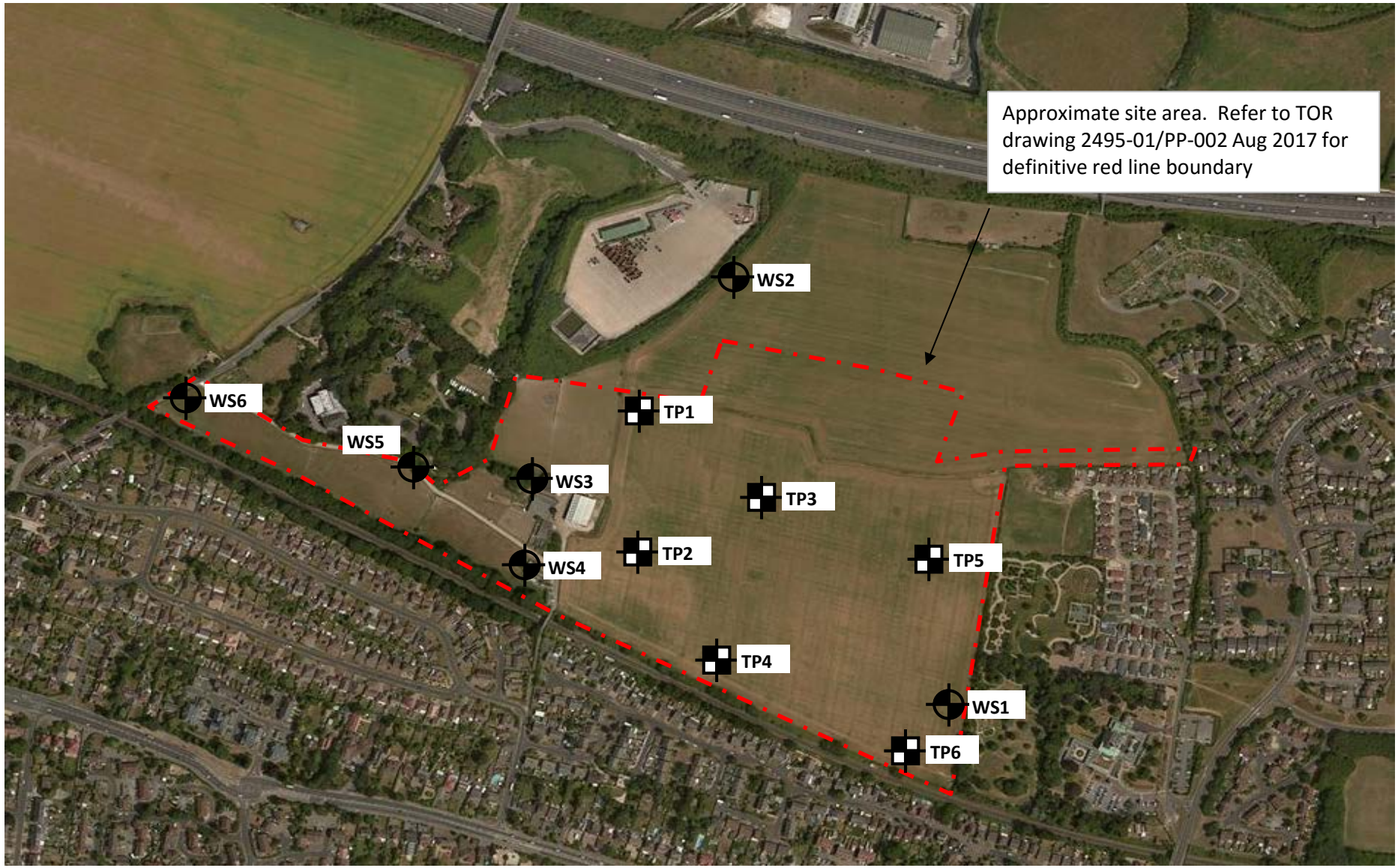
APPENDIX A

Exploratory Hole Logs, Plans and Soil Classification Test Results



Refer to TOR drawing 2495-01/PP-002 Aug 2017 for definitive red line boundary

Project:	Land off Downend Road, Portchester PO16 8PX			**Title**	Site Location Plan
Client:	Miller Homes			**Geo-Environmental Services Ltd** **Unit 7 Danworth Farm, Cuckfield Road** **Hurstpierpoint, West Sussex BN6 9GL** **+44(0)1273 832972 www.gesl.net**	Geo-Environmental
Ref No:	GE15996	**Revision:**	1.1		
Drawn:	VB/GR	**Date:**	11/10/2017		
Figure:	1	**Scale:**	Not To Scale		



Project:	Land off Downend Road, Portchester PO16 8PX			**Title**	Exploratory Hole Location Plan
Client:	Miller Homes			**Geo-Environmental Services Ltd**	
Ref No:	GE15996	**Revision:**	1.1	**Unit 7 Danworth Farm, Cuckfield Road**	
Drawn:	GR	**Date:**	11/10/2017	**Hurstpierpoint, West Sussex BN6 9GL**	
Figure:	2	**Scale:**	Not To Scale	**+44(0)1273 832972 www.gesl.net**	Geo-Environmental

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Trial Pit Log

TrialPit No: TP1
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460199.43 - 106388.88 Level:	Date 13/12/2016
Location:	Downend Road, Portchester	Dimensions (m): 2.36 × 0.60 Depth 3.00		Scale 1:25
Client:	Miller Homes			Logged VB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.26 0.26	D ES		0.40			Dark brown clayey gravelly cobbly SILT. Gravel and cobbles consist of subangular flint.
				0.75			Light brown and off-white structureless CHALK composed of a silt and sand matrix with gravel and cobble size weak low to medium density clasts and some gravel sized flint. CIRIA Grade Dc.
	1.55 1.55	D ES					White and off-white structureless CHALK composed of a silt and sand matrix with gravel to cobble size weak medium density clasts and some gravel and cobble sized flint. CIRIA Grade Dc.
				3.00			End of Pit at 3.00m

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Water Strikes

Depth Strike	Rose to (mbgl)

Remarks None encountered

Stability

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Trial Pit Log

TrialPit No: TP2
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460189.58 - 106221.54 Level:	Date 13/12/2016
Location:	Downend Road, Portchester	Dimensions (m): Depth 3.00	2.50 × 0.60	Scale 1:25
Client:	Miller Homes			Logged VB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.25 0.25	D ES		0.30			Dark brown clayey gravelly cobbly SILT. Gravel and cobbles consist of subangular flint.
	0.68 0.68	D ES		0.80			Orange gravelly cobbly CLAY. Gravel and cobbles of subangular flint.
	1.46 1.46	D ES		3.00			Firm orange-brown and reddish brown clayey slightly gravelly SILT. Gravel is fine to medium subangular flint. End of Pit at 3.00m

Water Strikes

Depth Strike	Rose to (mbgl)

Remarks: None encountered

Stability

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Trial Pit Log

TrialPit No: TP3
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460301.58 - 106281.29 Level:	Date 13/12/2016
Location:	Downend Road, Portchester	Dimensions (m): 2.37 × 0.60 Depth 3.00		Scale 1:25
Client:	Miller Homes			Logged VB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Dark brown clayey gravelly cobbly SILT. Gravel and cobbles consist of subangular flint.
	0.25 0.25	D ES		0.25			Orange-brown gravelly cobbly CLAY. Gravel and cobble is subangular flint.
	0.67 0.67	D ES					
				0.85			Light brown and off-white structureless CHALK composed of a silt and sand matrix with gravel size weak low to medium density clasts and some gravel and cobble sized flint. CIRIA Grade Dc.
	1.06 1.06	D ES					
				1.60			White and off-white structureless CHALK composed of a silt and sand matrix with gravel to cobble size weak medium density clasts and some gravel to cobble sized flint. CIRIA Grade Dc.
	2.80 2.80	D ES					
				3.00			End of Pit at 3.00m

1 2 3 4 5

Water Strikes

Depth Strike	Rose to (mbgl)

Remarks None encountered

Stability

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Trial Pit Log

TrialPit No: TP4
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460255.03 - 106126.47 Level:
Location:	Downend Road, Portchester	Dimensions (m): 2.40 × 0.60 Depth 3.00	Date 13/12/2016 Scale 1:25
Client:	Miller Homes		Logged VB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.33 0.33	D ES		0.35			Greyish brown gravelly clayey SILT. Gravel is subangular flint.
	0.67	D					Firm orange-brown gravelly cobbly CLAY. Gravel and cobble is subangular flint.
	1.20 1.20	D ES		1.10			Firm to stiff orange-brown silty CLAY.
	2.40 2.40	D ES		2.20			Orange-brown very slightly clayey GRAVEL. Gravel is fine to medium subanglar to sub-rounded flint.
				3.00			End of Pit at 3.00m

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Water Strikes	
Depth Strike	Rose to (mbgl)

Remarks None encountered

Stability

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Trial Pit Log

TrialPit No: TP5
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460478.59 - 106180.29 Level:
Location:	Downend Road, Portchester	Dimensions (m): 2.20 × 0.60 Depth 3.10	Date 13/12/2016 Scale 1:25
Client:	Miller Homes		Logged VB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.25 0.25	D ES					Dark brown clayey gravelly cobbly SILT. Gravel and cobbles consist of subangular flint.
				0.50			Firm orange-brown gravelly cobbly CLAY. Gravel and cobble of subangular flint.
	1.00 1.00	D ES					
				1.70			Firm to stiff orange-brown silty CLAY with occasional black flecks/mottling
				1.90			Firm light greyish brown silty sandy gravelly CLAY. Gravel is subangular flint.
	2.80 2.80	D ES					
				3.10			End of Pit at 3.10m

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Water Strikes
Depth Strike | Rose to (mbgl)

Remarks None encountered

Stability

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Trial Pit Log

TrialPit No: TP6
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460503.05 - 105999.77 Level:
Location:	Downend Road, Portchester	Dimensions (m): 2.30 × 0.60 Depth 3.00	Date 13/12/2016 Scale 1:25
Client:	Miller Homes		Logged VB

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.25 0.25	D ES		0.30			Dark brown clayey gravelly cobbly SILT. Gravel and cobbles consist of subangular flint.
	1.00 1.00	D ES		1.60			Firm reddish brown graavelly cobbly CLAY. Gravel and cobble consist of subangular flint, which become sparse from 1.25m.
	2.00 2.00	D ES		3.00			Light brown to light orange-brown and off-white structureless CHALK composed of a silt and sand matrix with gravel size weak low to medium density clasts and some gravel sized flint. CIRIA Grade Dc. End of Pit at 3.00m

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Water Strikes

Depth Strike	Rose to (mbgl)

Remarks None encountered

Stability

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS1** Sheet 1 of 1
Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460533E - 106045N	Hole Type WLS
Location:	Downend Road, Portchester		Level:	Scale 1:25
Client:	Miller Homes		Dates: 14/12/2016	Logged By VB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.15 0.15	D ES					Greyish brown slightly SILT with some subangular flint gravel
					0.30			
								Firm reddish brown silty slightly gravelly CLAY. Gravel is subangular flint.
					0.65			
								Slightly reddish brown silty clayey fine to coarse flint GRAVEL with occasional cobble sized flint
		1.50 1.50	D ES					
					2.05			Firm orange brown CLAY
		2.50 2.50	D ES					
					3.00			End of Borehole at 3.00m

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

No water encountered

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS2** Sheet 1 of 1
Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460291E - 106526N	Hole Type WLS
Location:	Downend Road, Portchester		Level:	Scale 1:25
Client:	Miller Homes		Dates: 14/12/2016	Logged By VB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 0.20	D ES					Greyish brown slightly SILT with some subangular flint gravel
		0.50 0.50	D ES		0.35			Firm reddish brown and off-white sandy gravelly CLAY. Gravel is subangular flint and chalk.
					0.75			Recovered as off-white CHALK compopsed of a silt size matrix with sand and gravel sized weak low density clasts. Possible CIRIA Grade Dc.
		2.00 2.00	D ES					
					3.00			End of Borehole at 3.00m

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

No water encountered

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS3** Sheet 1 of 1
Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460094E - 106309N	Hole Type WLS
Location:	Downend Road, Portchester		Level:	Scale 1:25
Client:	Miller Homes		Dates: 14/12/2016	Logged By VB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30 0.30	D ES		0.40			Greyish brown slightly SILT with some subangular flint gravel
		0.75 0.75	D ES		1.50			Firm brown silty gravelly CLAY. Gravel is subangular flint.
		2.00 2.00	D ES		3.00			Recovered as off-white CHALK compopsed of a silt size matrix with sand and gravel sized weak low density clasts. Possible CIRIA Grade Dc. End of Borehole at 3.00m

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

No water encountered

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS4** Sheet 1 of 1
Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 460089E - 106209N	Hole Type WLS
Location:	Downend Road, Portchester		Level:	Scale 1:25
Client:	Miller Homes		Dates: 14/12/2016	Logged By VB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 0.20	D ES		0.10			Worn, broken conctrete hardstanding.
								Brown and black mottled silty clayey flint gravel with some fine gravel sized charcoal fragments
					0.50			Reddish brown silty clayey fine to coarse flint GRAVEL.
		1.00 1.00	D ES		1.00			Firm reddish brown gravelly CLAY. Gravel is fine to coarse size subangular flint.
					2.00			Firm reddish brown silty CLAY
		2.50 2.50	D ES		3.00			End of Borehole at 3.00m

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

No water encountered

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	**Borehole Log**	Borehole No. **WS5** Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 459978E - 106320N	Hole Type WLS
Location:	Downend Road, Portchester		Level:	Scale 1:25
Client:	Miller Homes		Dates: 14/12/2016	Logged By VB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20 0.20	D ES					Dark brown and locally black mottled clayey gravelly SILT. Gravel is fine to coarse subangular flint.
					0.40			Firm reddish brown silty slightly gravelly CLAY. Gravel is subangular flint.
		0.75 0.75	D ES					
					1.00			Pale brown staining GRAVEL. Weathered, unstructured chalk.
					1.25			Recovered as off-white CHALK composed of a silt size matrix with sand and gravel sized weak low density clasts. Possible CIRIA Grade Dm/ Dc.
		2.75 2.75	D ES					
					3.00			End of Borehole at 3.00m

1 2 3 4 5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks

No water encountered

AGS

Geo-Environmental

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Borehole Log

Borehole No.
WS6
Sheet 1 of 1

Project Name:	Downend Road, Portchester	Project No. GE15996	Co-ords: 459732E - 106397N	Hole Type WLS
Location:	Downend Road, Portchester		Level:	Scale 1:25
Client:	Miller Homes		Dates: 14/12/2016	Logged By VB

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10 0.10	D ES		0.20			Dark brown silty CLAY.
					0.50			Firm reddish brown silty slightly gravelly CLAY. Gravel is subangular flint.
								Recovered as off-white CHALK composed of a silt size matrix with sand and gravel sized weak low density clasts. Possible CIRIA Grade Dc.
		2.50 2.50	D ES		3.00			End of Borehole at 3.00m

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Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to

Remarks
No water encountered

AGS

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
22132	Downend Road, Portchester	Samples received	20/12/2016
		Schedule received	15/12/2016
Project No.	Client	Project started	21/12/2016
GE15996	GESL	Testing Started	10/01/2017

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
TP4	5	1.20		D	Orange brown slightly gravelly sandy CLAY (gravel is fm and sub-angular to angular)	21	89	41	19	22	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

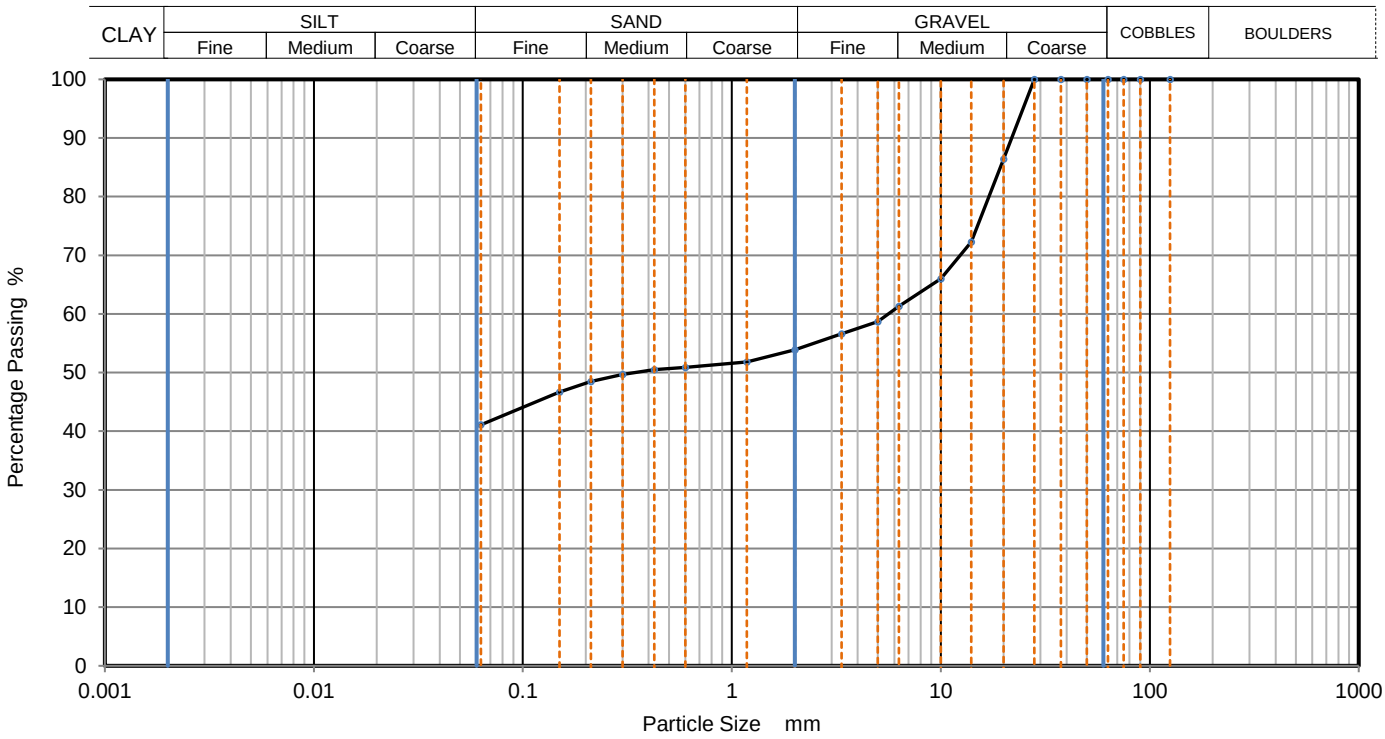
Checked and Approved

Initials **J.P**

Date: 11/01/2017

PARTICLE SIZE DISTRIBUTION

				Job Ref	22132
				Borehole/Pit No.	TP2
Site Name	Downend Road, Portchester			Sample No.	4
Project No.	GE15996	Client	GESL	Depth	0.68 m
Soil Description	Greyish brown and brown slightly sandy gravelly CLAY (gravel is fmc and sub-angular to angular)			Sample Type	D
				Samples received	20/12/2016
				Schedules received	15/12/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	21/12/2016
				Date tested	10/01/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	86		
14	72		
10	66		
6.3	61		
5	59		
3.35	57		
2	54		
1.18	52		
0.6	51		
0.425	51		
0.3	50		
0.212	49		
0.15	47		
0.063	41		

Dry Mass of sample, g	678

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	46.1
Sand	12.9
Fines <0.063mm	41.1

Grading Analysis		
D100	mm	
D60	mm	5.6
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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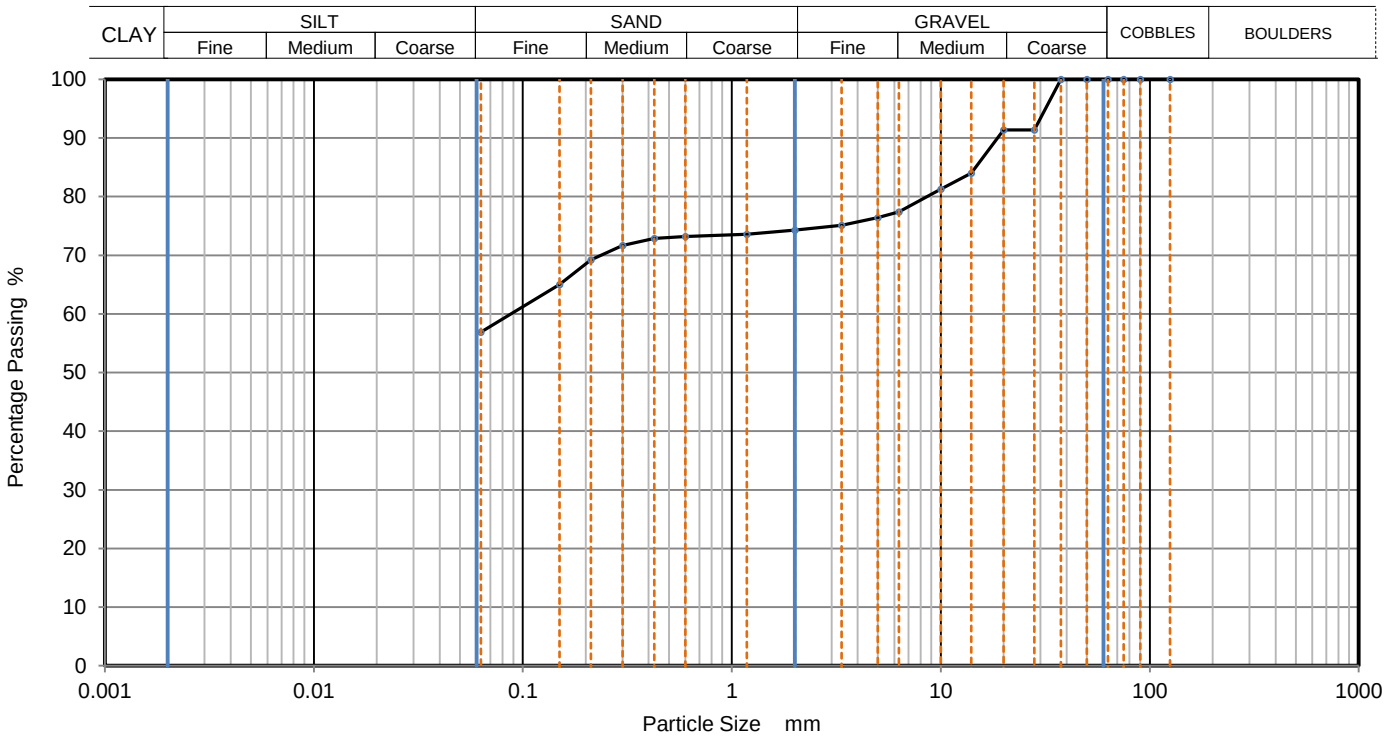
Tel: 01923 711288

Checked and Approved
Initials: **J.P**
Date: 11/01/2017

PARTICLE SIZE DISTRIBUTION

				Job Ref	22132
				Borehole/Pit No.	TP5
Site Name	Downend Road, Portchester			Sample No.	4
Project No.	GE15996	Client	GESL	Depth	1.00 m
Soil Description	Brown slightly sandy slightly gravelly CLAY (gravel is fmc and sub-rounded to angular)			Sample Type	D
				Samples received	20/12/2016
				Schedules received	15/12/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	21/12/2016
				Date tested	10/01/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	91		
20	91		
14	84		
10	81		
6.3	77		
5	76		
3.35	75		
2	74		
1.18	74		
0.6	73		
0.425	73		
0.3	72		
0.212	69		
0.15	65		
0.063	57		

Dry Mass of sample, g	332

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	25.7
Sand	17.4
Fines <0.063mm	56.9

Grading Analysis		
D100	mm	
D60	mm	0.088
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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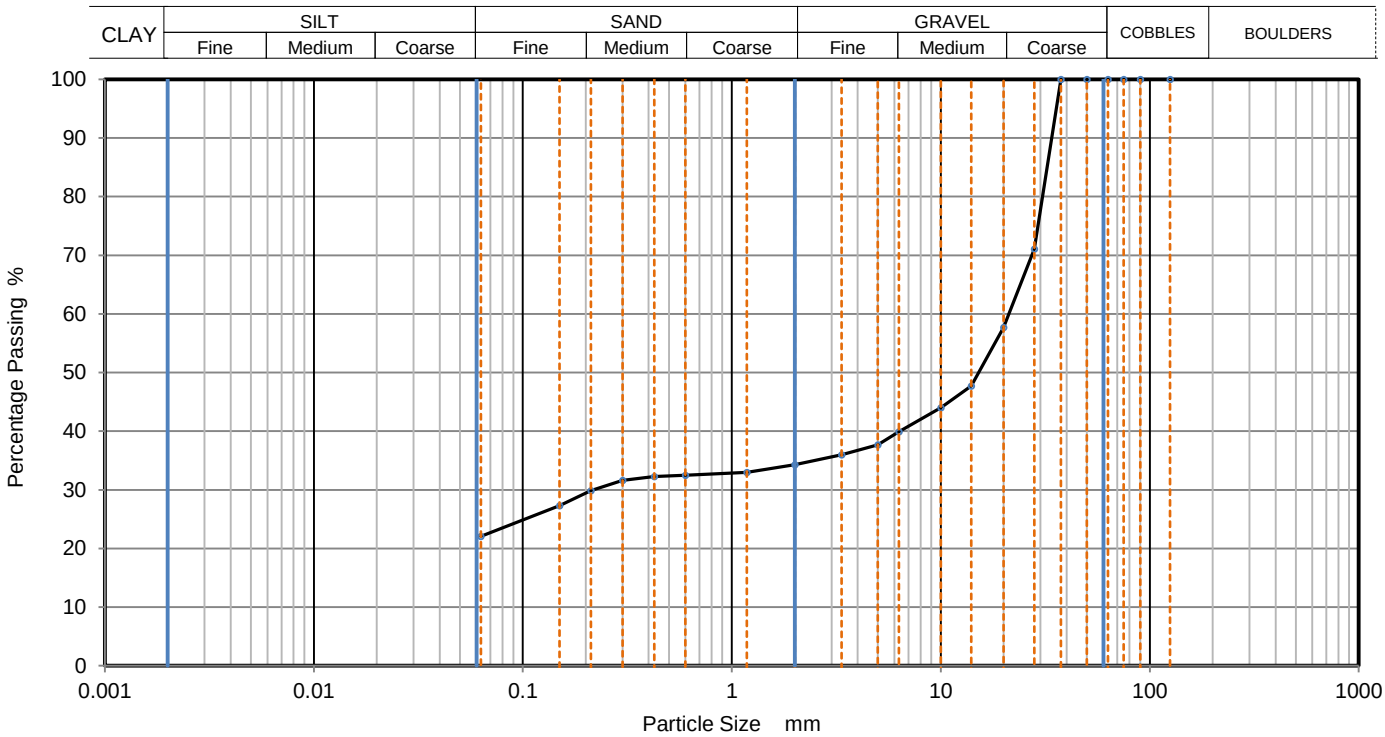
Date: 11/01/2017

PARTICLE SIZE DISTRIBUTION

				Job Ref	22132
				Borehole/Pit No.	TP6
Site Name	Downend Road, Portchester			Sample No.	4
Project No.	GE15996	Client	GESL	Depth	1.00 m
Soil Description	Brown sandy very clayey GRAVEL (gravel is fmc and sub-rounded to angular)			Sample Type	D
				Samples received	20/12/2016
				Schedules received	15/12/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	21/12/2016
				Date tested	10/01/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	71		
20	58		
14	48		
10	44		
6.3	40		
5	38		
3.35	36		
2	34		
1.18	33		
0.6	33		
0.425	32		
0.3	32		
0.212	30		
0.15	27		
0.063	22		

Dry Mass of sample, g	869

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	65.7
Sand	12.1
Fines <0.063mm	22.1

Grading Analysis		
D100	mm	
D60	mm	21.2
D30	mm	0.217
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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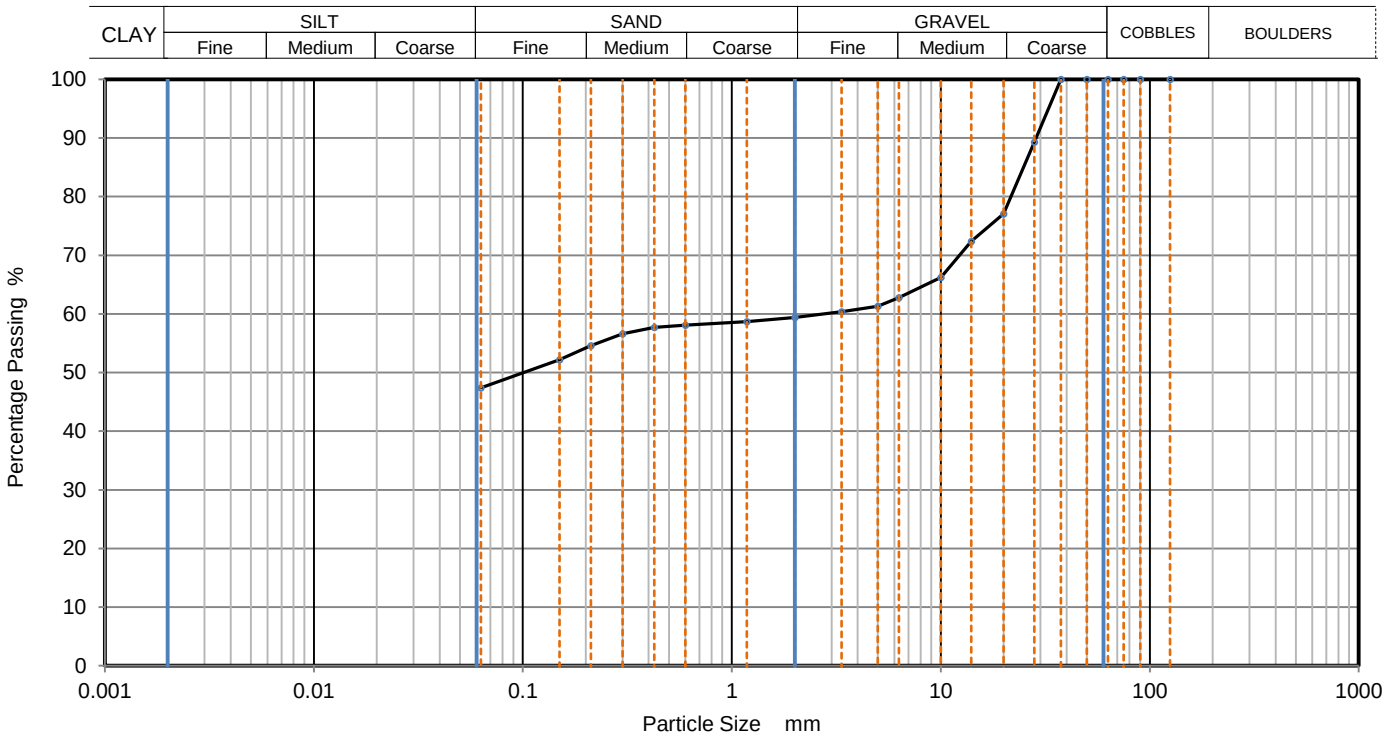
Initials: **J.P**

Date: 11/01/2017

PARTICLE SIZE DISTRIBUTION

				Job Ref	22132
				Borehole/Pit No.	WS1
Site Name	Downend Road, Portchester			Sample No.	4
Project No.	GE15996	Client	GESL	Depth	1.50 m
Soil Description	Brown slightly sandy gravelly CLAY (gravel is fmc and sub-angular to angular)			Sample Type	D
				Samples received	20/12/2016
				Schedules received	15/12/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	21/12/2016
				Date tested	10/01/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	89		
20	77		
14	72		
10	66		
6.3	63		
5	61		
3.35	60		
2	59		
1.18	59		
0.6	58		
0.425	58		
0.3	57		
0.212	55		
0.15	52		
0.063	47		

Dry Mass of sample, g	419

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	40.6
Sand	12.0
Fines <0.063mm	47.4

Grading Analysis		
D100	mm	
D60	mm	2.77
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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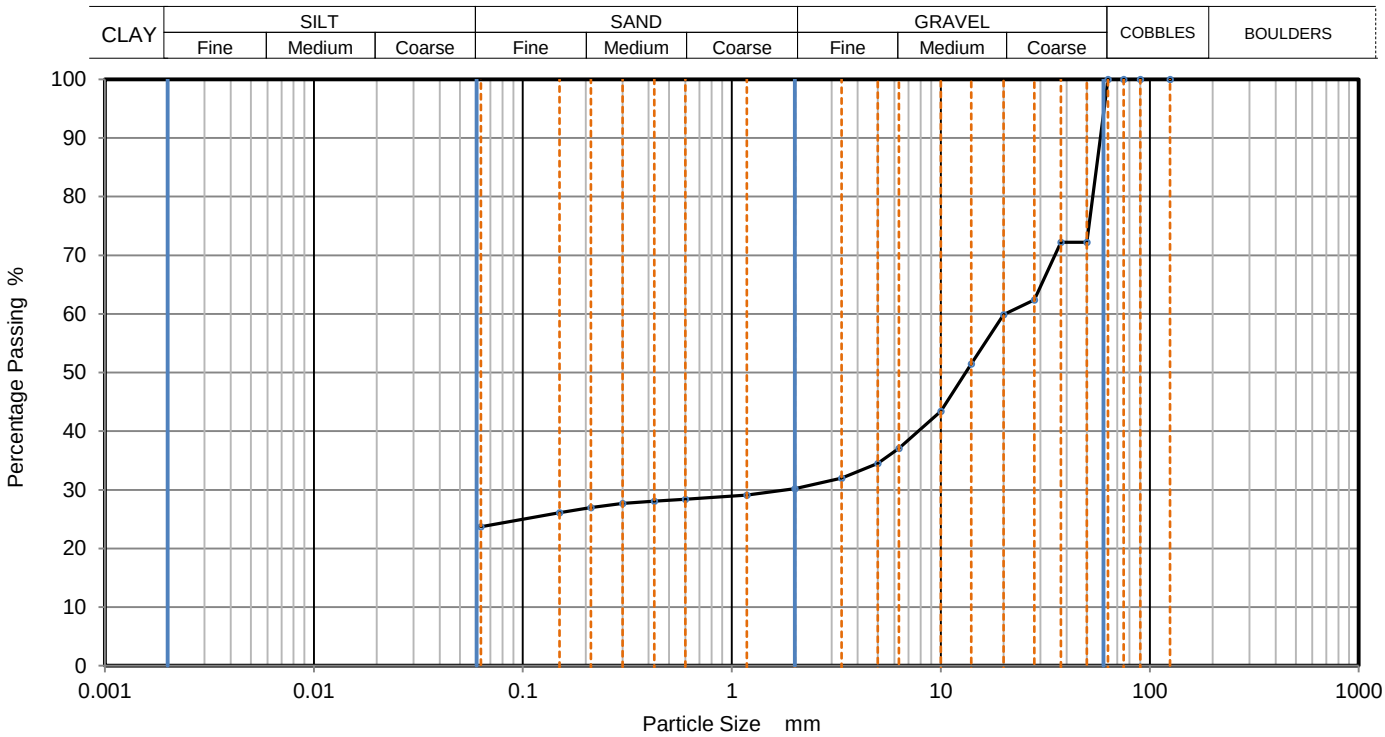
Initials: **J.P**
Date: 11/01/2017

PARTICLE SIZE DISTRIBUTION

				Job Ref	22132
				Borehole/Pit No.	WS4
Site Name	Downend Road, Portchester			Sample No.	4
Project No.	GE15996	Client	GESL	Depth	1.00 m
Soil Description	Brown slightly sandy very clayey GRAVEL (gravel is fmc and angular to rounded)			Sample Type	D
				Samples received	20/12/2016
				Schedules received	15/12/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	21/12/2016
				Date tested	10/01/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	72		
37.5	72		
28	62		
20	60		
14	52		
10	43		
6.3	37		
5	35		
3.35	32		
2	30		
1.18	29		
0.6	28		
0.425	28		
0.3	28		
0.212	27		
0.15	26		
0.063	24		

Dry Mass of sample, g	674

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	69.8
Sand	6.5
Fines <0.063mm	23.7

Grading Analysis		
D100	mm	
D60	mm	20.2
D30	mm	1.83
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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Checked and Approved
Initials: **J.P**
Date: 11/01/2017

Geo-Environmental

APPENDIX B

NSRI Soils Site Report (106000804)

National Soil Resources Institute

Cranfield UNIVERSITY

Soils Site Report

Full Soil Report

106000804

National Grid Reference: SU6035006312

Easting: 460350

Northing: 106312

Site Area: 1km x 1km

Prepared by
authorised user:

Customer Services
Landmark Information Group

24 November 2016

Citations

Citations to this report should be made as follows:

National Soil Resources Institute (2016) Full Soils Site Report for location 460350E, 106312N, 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 Soils Site Report identifies and describes the properties and capacities of the soil at your specified location as recorded in the 1:250,000 scale 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 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 Soils Site 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.

For more information visit www.landis.org.uk/reports

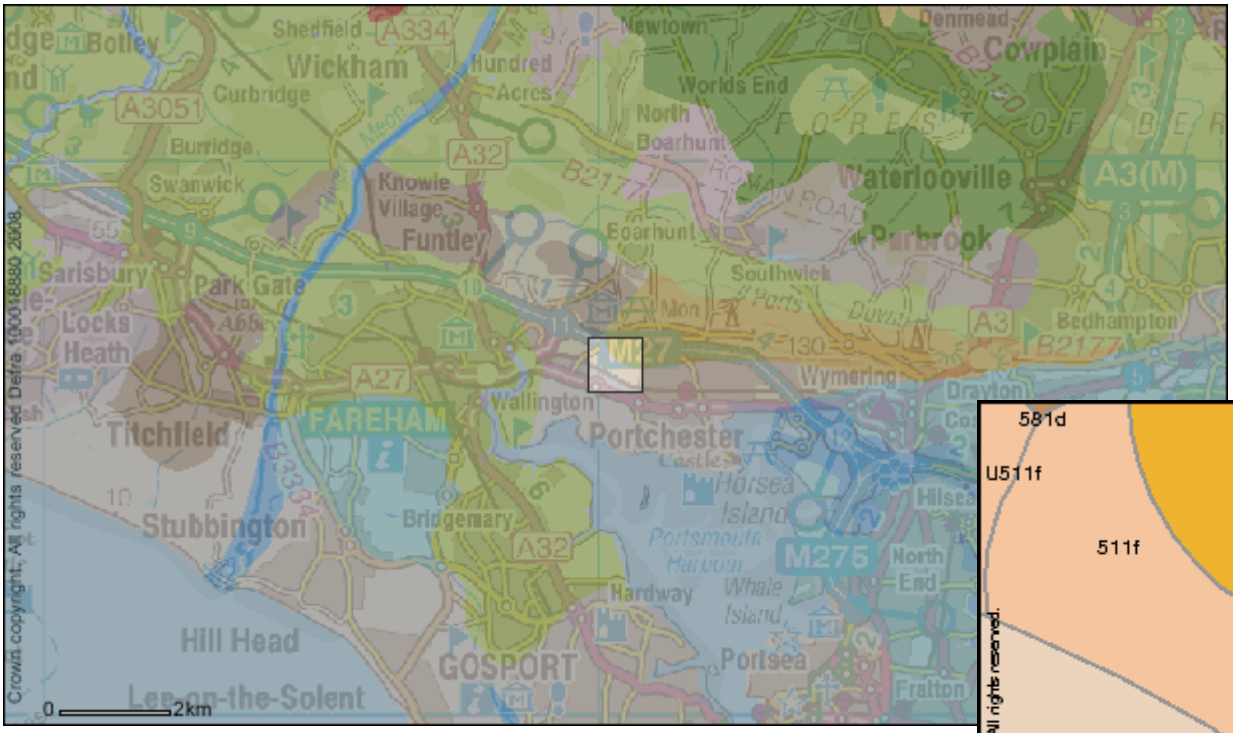
Table of Contents

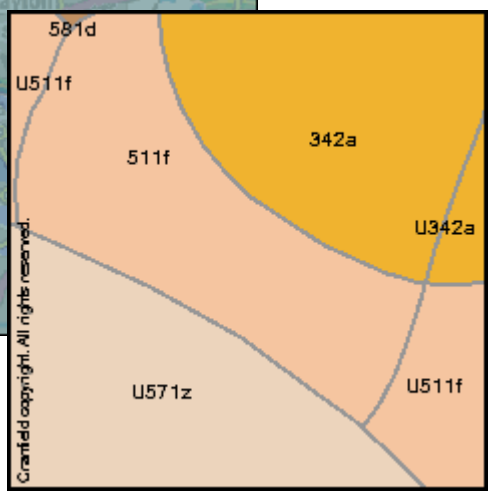
1. SOIL THEMATIC MAPS

This section contains a series of maps of the area surrounding your selected location, based on the 1:250,000 scale National Soil Map, presenting a number of thematic maps 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 though 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 forthcoming legislation such as the proposed Soil Framework Directive (SFD) (COM(2006) 232) will seek to identify measures aimed towards soil protection and 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.

1a. SOILS - SPATIAL DISTRIBUTION





SOIL ASSOCIATION MAP UNIT KEY

UPTON 1 342a
Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

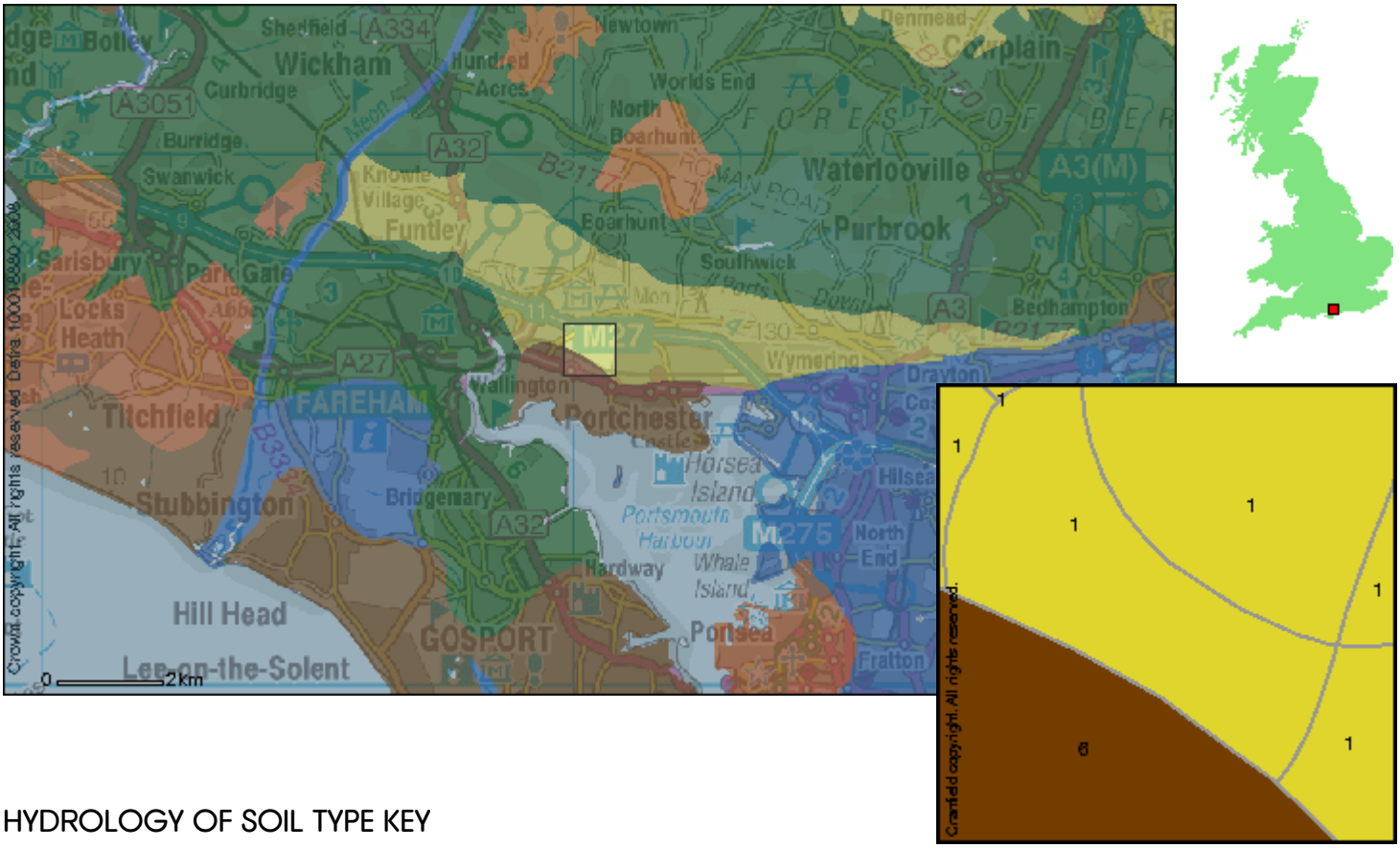
COOMBE 1 511f
Well drained calcareous fine silty soils deep in valley bottoms,

HAMBLE 2 571z
Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally.

CARSTENS 581d
Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

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)



HYDROLOGY OF SOIL TYPE KEY

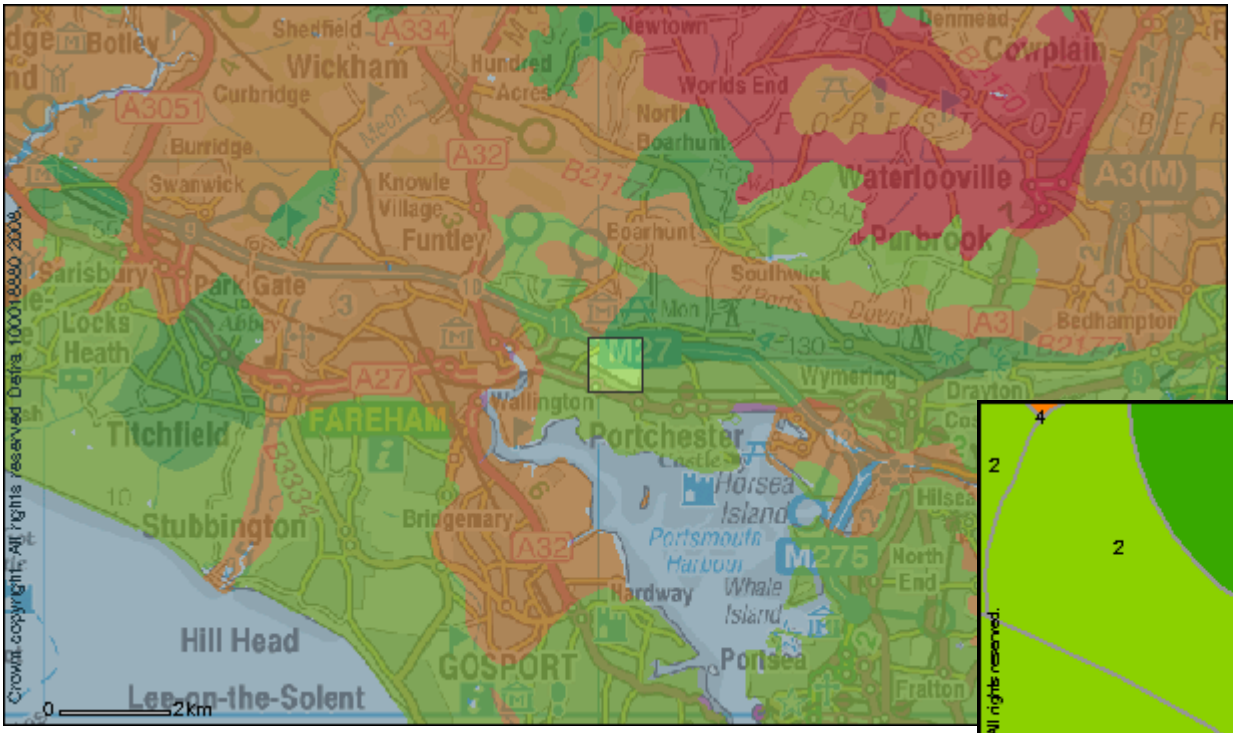
1 - *Free draining permeable soils on chalk and chalky substrates with relatively high permeability and moderate storage capacity*

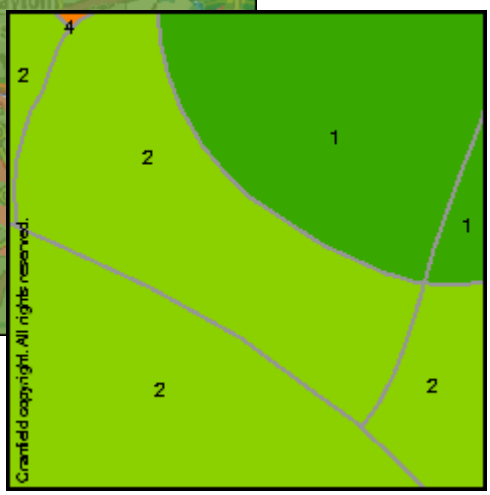
6 - *Free draining permeable soils in unconsolidated loams or clays with low permeability and storage capacity*

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





GROUND MOVEMENT POTENTIAL KEY

- 1 - *Very low*
- 2 - *Low*
- 3 - *Moderate*
- 4 - *High*
- 5 - *Very high*

* 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 <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.

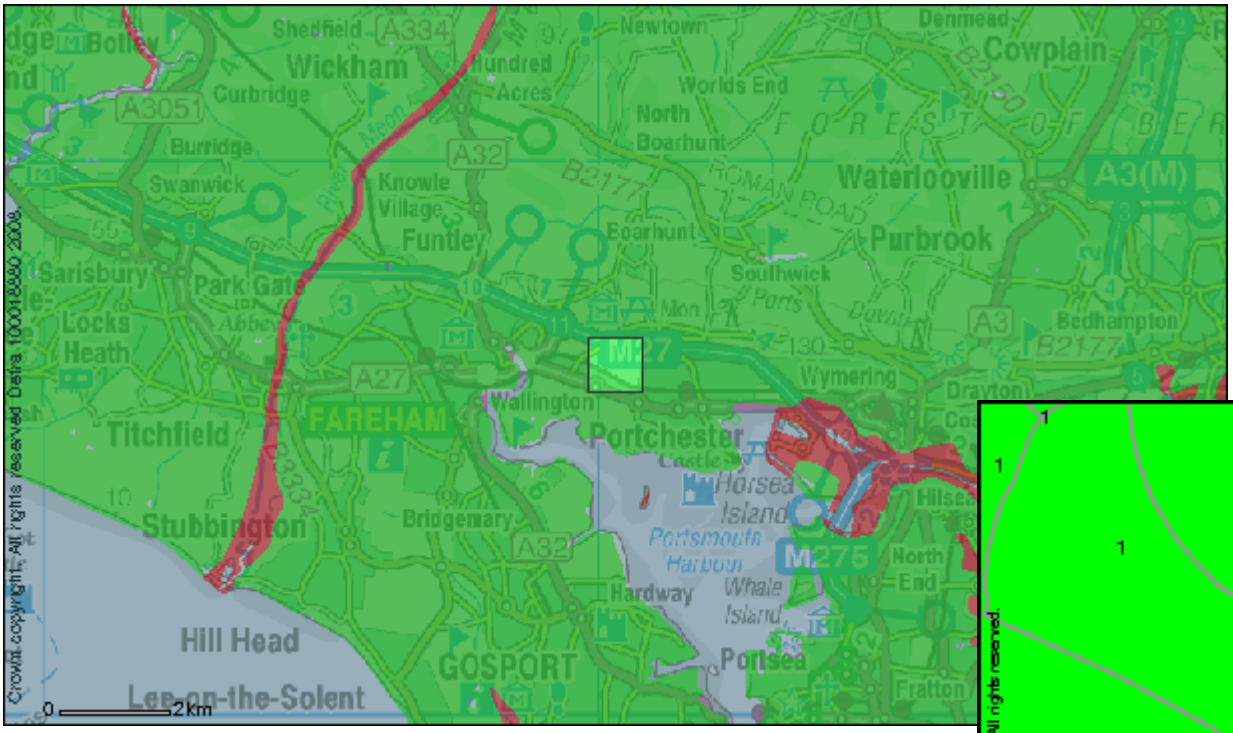
In a natural undisturbed condition, the moisture content of deep subsoil clay does not change greatly through the year and consequently there are no changes in volume leading to shrinkage and swelling. However, when clays are exposed at or near the ground surface and especially when vegetation is rooting 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

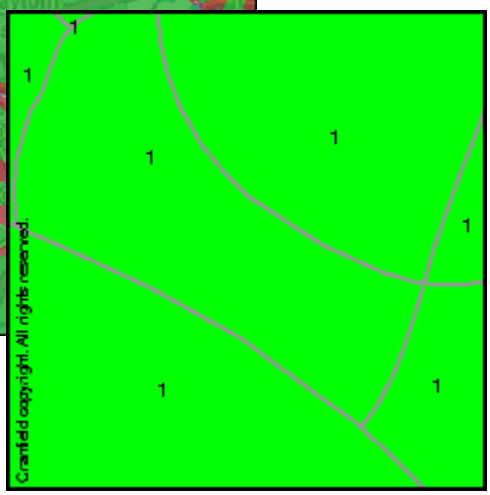
also takes place from soil and plant structures, and the combination of evaporation from surfaces and transpiration by plants and trees is termed *evapotranspiration*. Thus, the layer of soil material down to 2m depth into which plants will root is critical when assessing the vulnerability of land to 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





FLOOD VULNERABILITY CLASS KEY

0 - *Major risk*

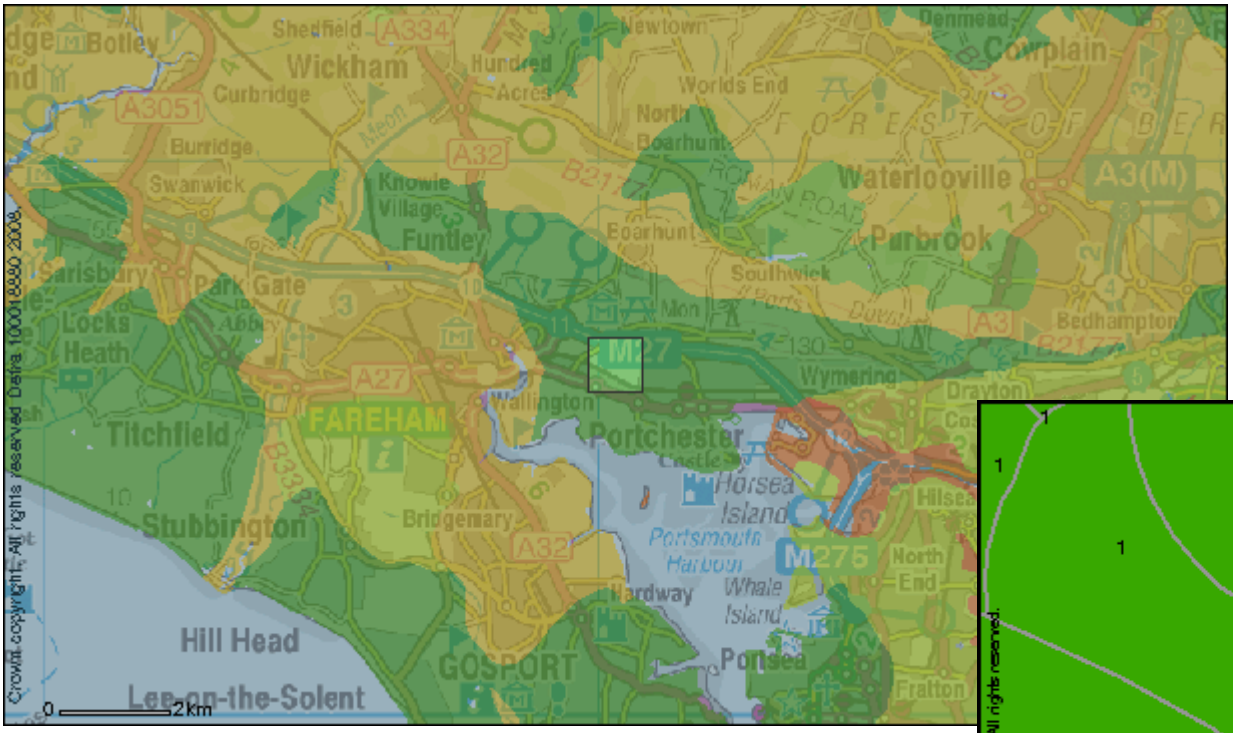
1 - *Minor risk*

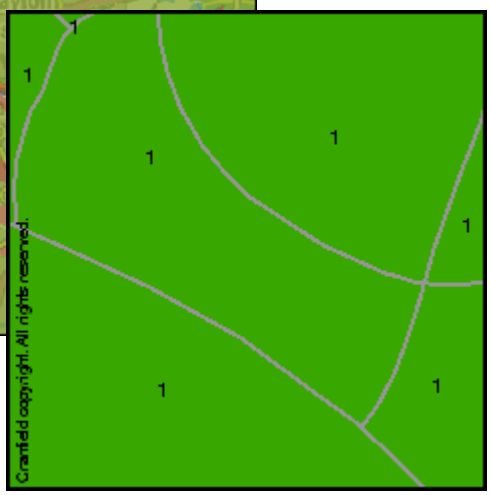
FLOOD VULNERABILITY DESCRIPTION

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





RISK OF CORROSION TO FERROUS IRON KEY

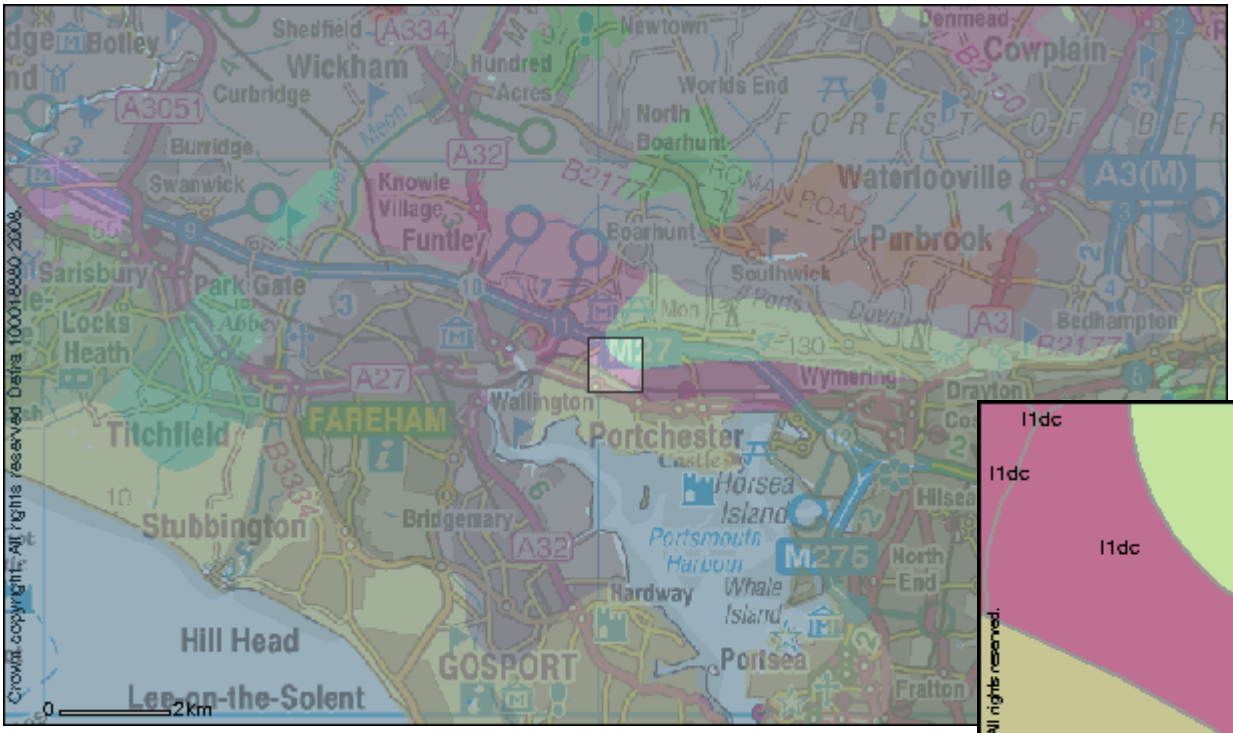
- 1 - *Non-aggressive*
- 2 - *Slightly Aggressive*
- 3 - *Moderately Aggressive*
- 4 - *Highly Aggressive*
- 5 - *Very highly Aggressive*
- 6 - *Impermeable Rock*

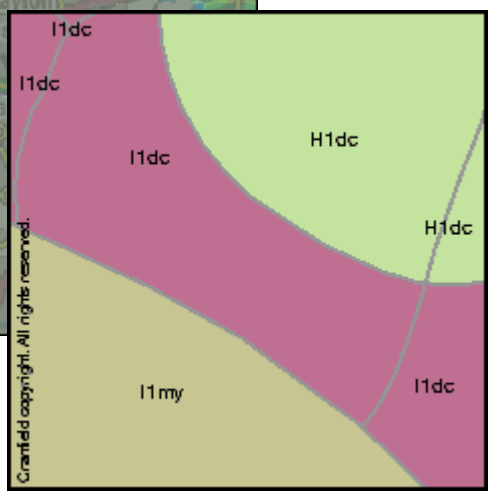
* If a class is starred, it is assumed that there are moderate amounts of sulphate in the soil. If there is abundant sulphate present, the soil may be one class more aggressive. Conversely, if there is very little sulphate, the soil may be one class less aggressive to buried ferrous iron.

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





PESTICIDE LEACHING CLASS KEY

- H1dc - *Shallow soil over chalk with deep groundwater (2000cm)*
- l1dc - *Deep loamy soil over chalk with deep groundwater*
- l1my - *Deep loamy soil; groundwater at moderate depth*

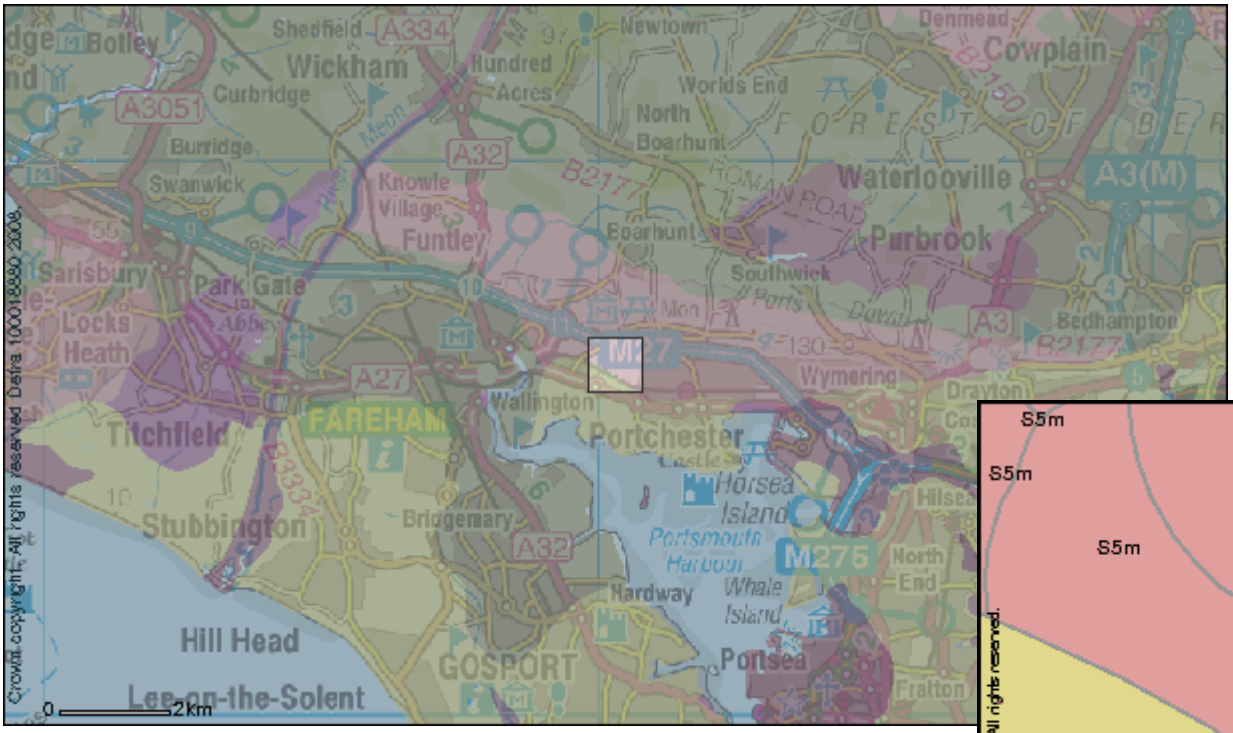
PESTICIDE LEACHING CLASS DESCRIPTION

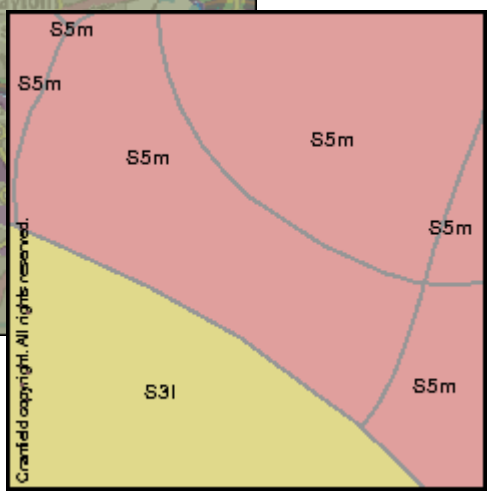
The natural permeability and water regime of soils are influential in determining the fate and behaviour of pesticides applied to the crop and soil surface (Hollis et al, 1995). A system of vulnerability assessment was devised as part of the national system for Policy and Practice for the Protection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





PESTICIDE RUNOFF RISK KEY

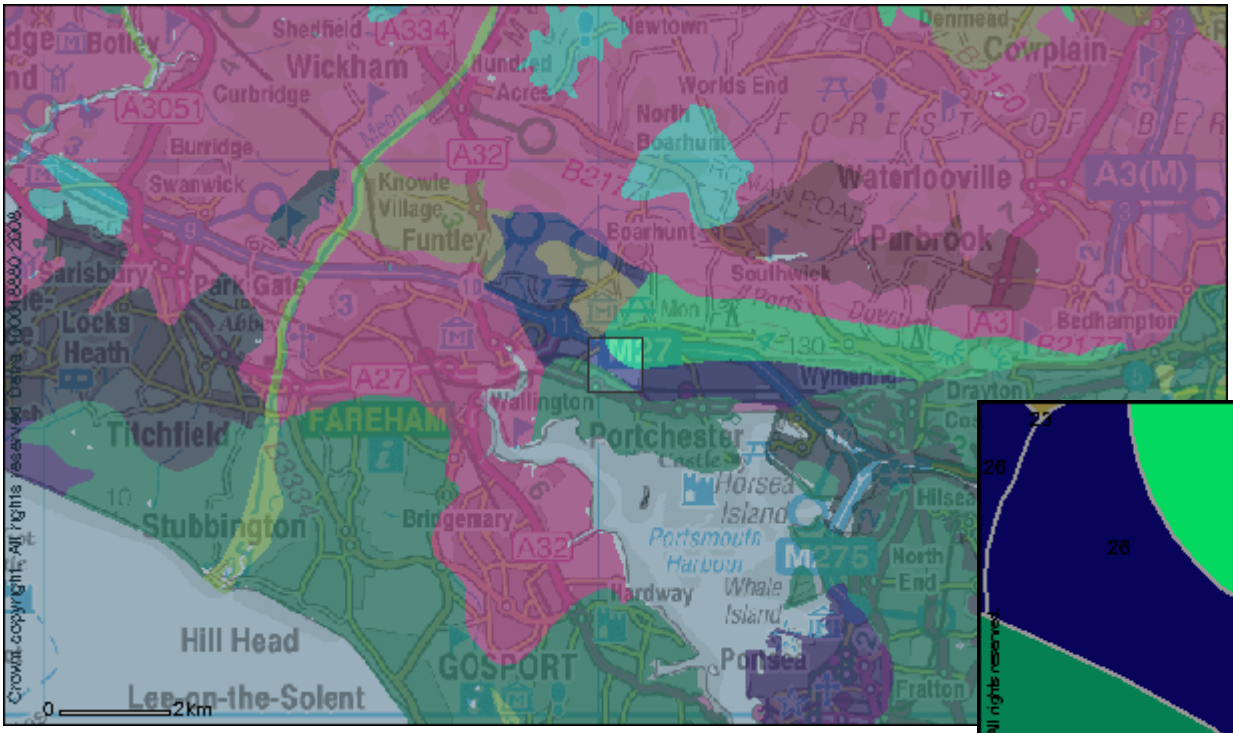
S3l - *Soils with moderate run-off potential and low adsorption potential*

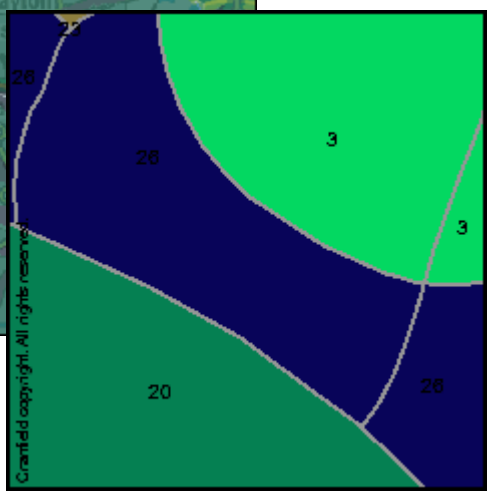
S5m - *Soils with very low run-off potential and moderate adsorption potential*

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). At as 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. The mineral soil classes are further subdivided according to the potential for pesticide adsorption.

1h. HYDROGEOLOGICAL ROCK TYPE





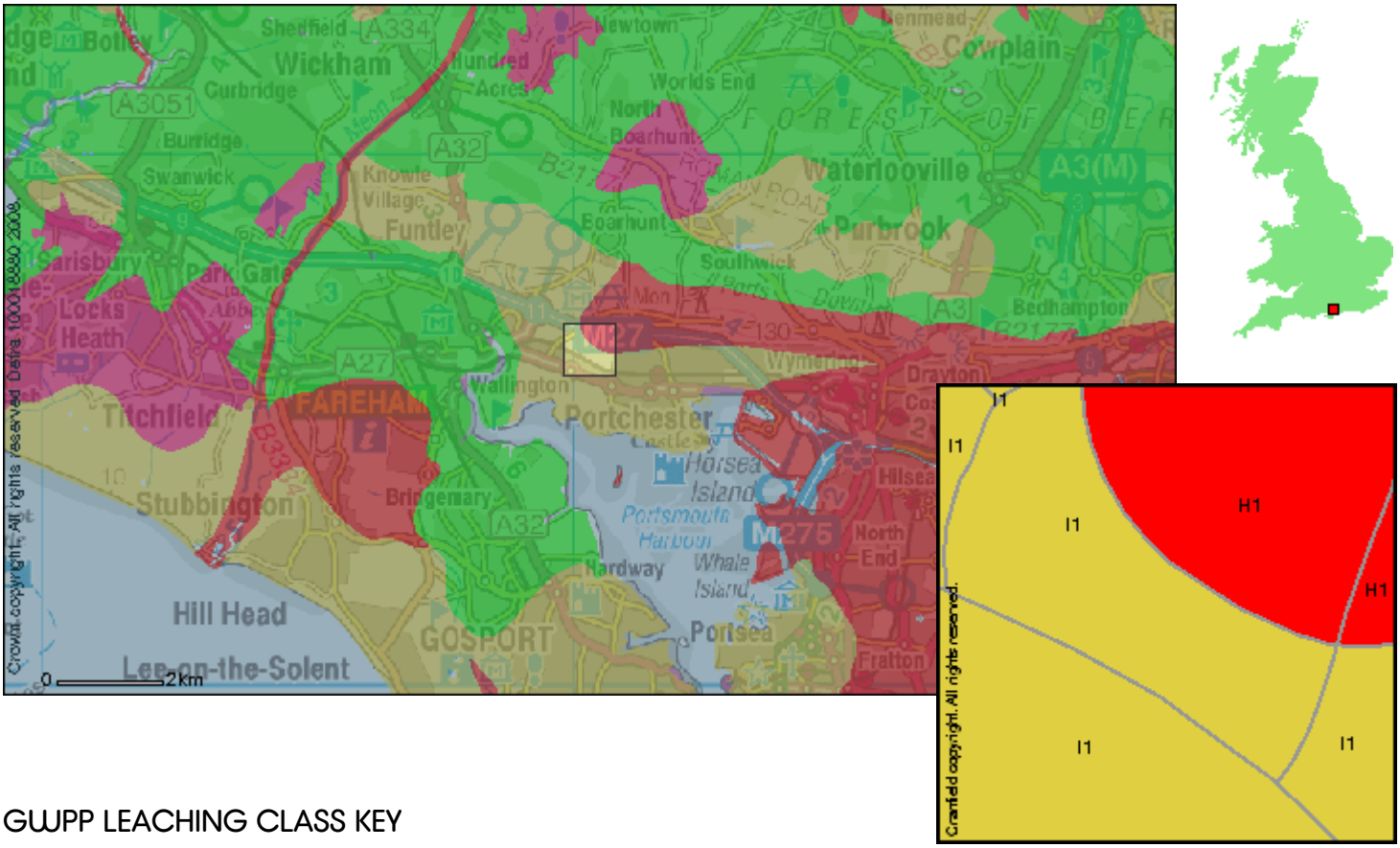
HYDROGEOLOGICAL ROCK TYPE KEY

- 20 - *coverloam*
- 23 - *clay with flints and plateau drift*
- 26 - *chalky drift*
- 3 - *chalk*

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).

1i. GROUND WATER PROTECTION POLICY (GWPP) LEACHING



GWPP LEACHING CLASS KEY

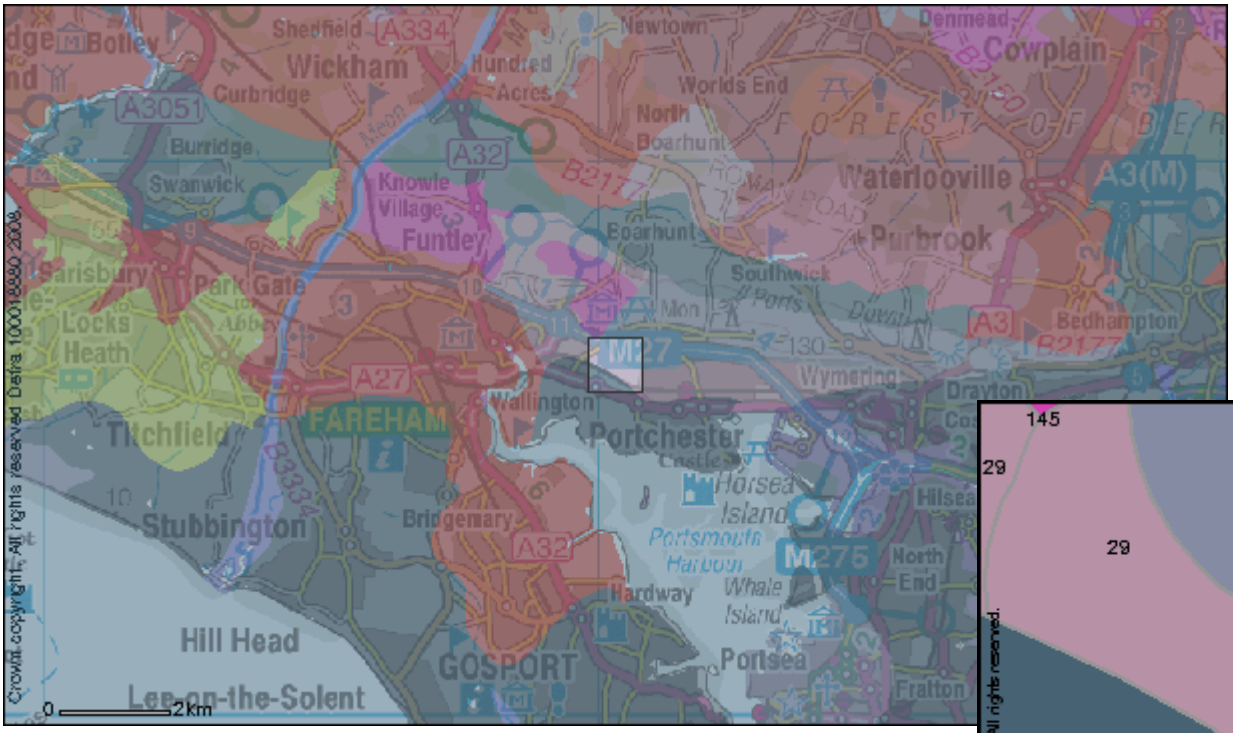
H1 - *Soils of high leaching potential, which readily transmit liquid discharges because they are either shallow, or susceptible to rapid bypass flow directly to rock, gravel or groundwater*

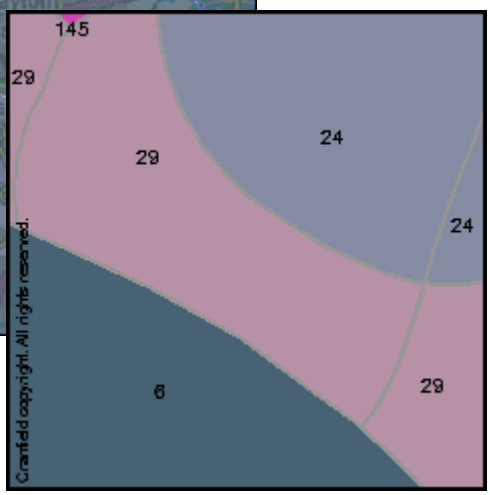
I1 - *Soils of intermediate leaching potential which have a moderate ability to attenuate a wide range of diffuse source pollutants but in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soil layer*

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.

1j. SOIL PARENT MATERIAL





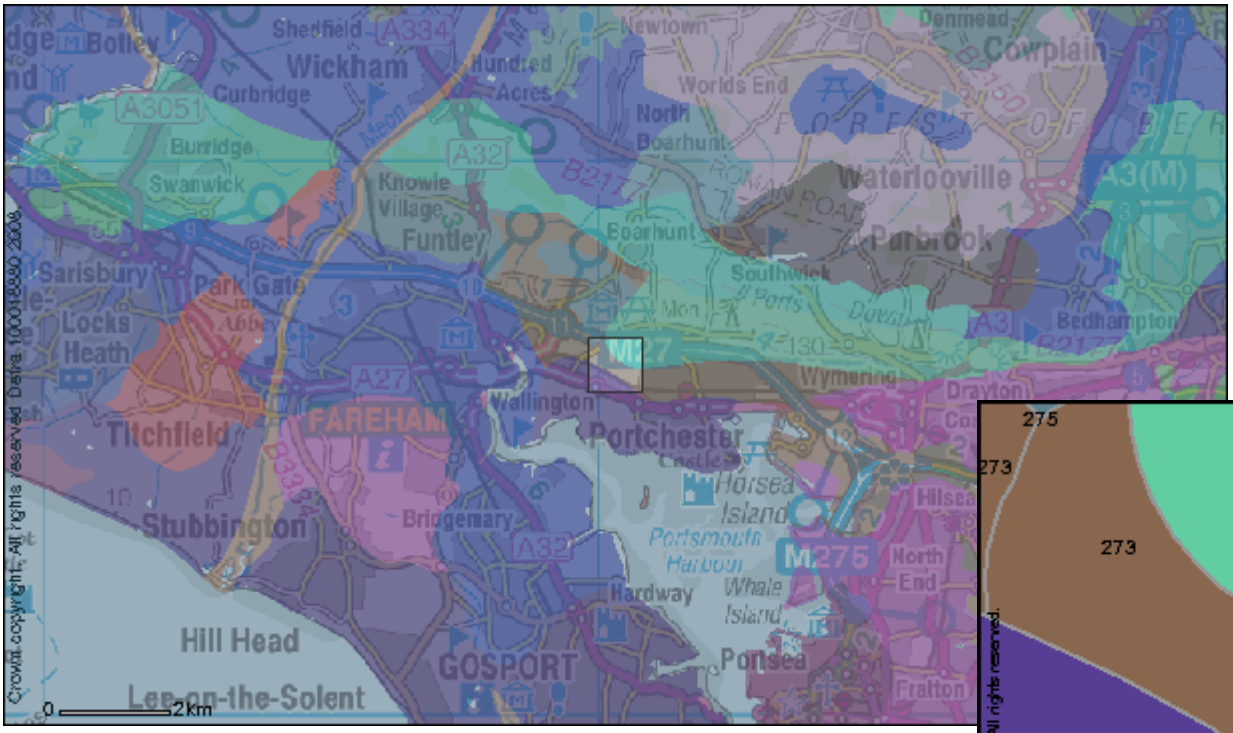
SOIL PARENT MATERIAL KEY

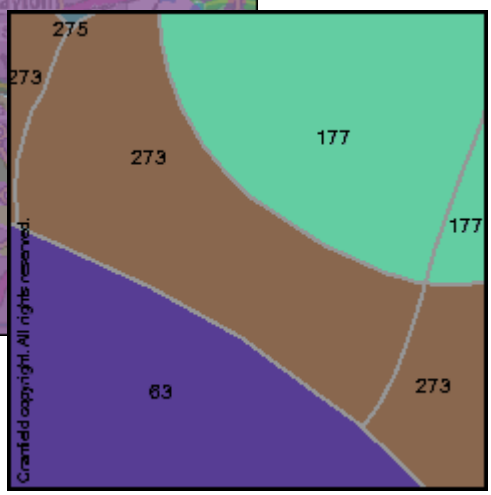
- 145 - *Plateau drift and clay-with-flints*
- 24 - *Chalk*
- 29 - *Chalky drift and chalk*
- 6 - *Aeolian silty drift*

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.

1k. EXPECTED CROPS AND LAND USE





EXPECTED CROPS AND LAND USE KEY

177 - *Permanent grassland rough grazing and woodland on scarps; cereals and short term grassland on gentle slopes; recr*

273 - *Winter cereals, cereal and grassland rotations with dairying; some horticultural crops.*

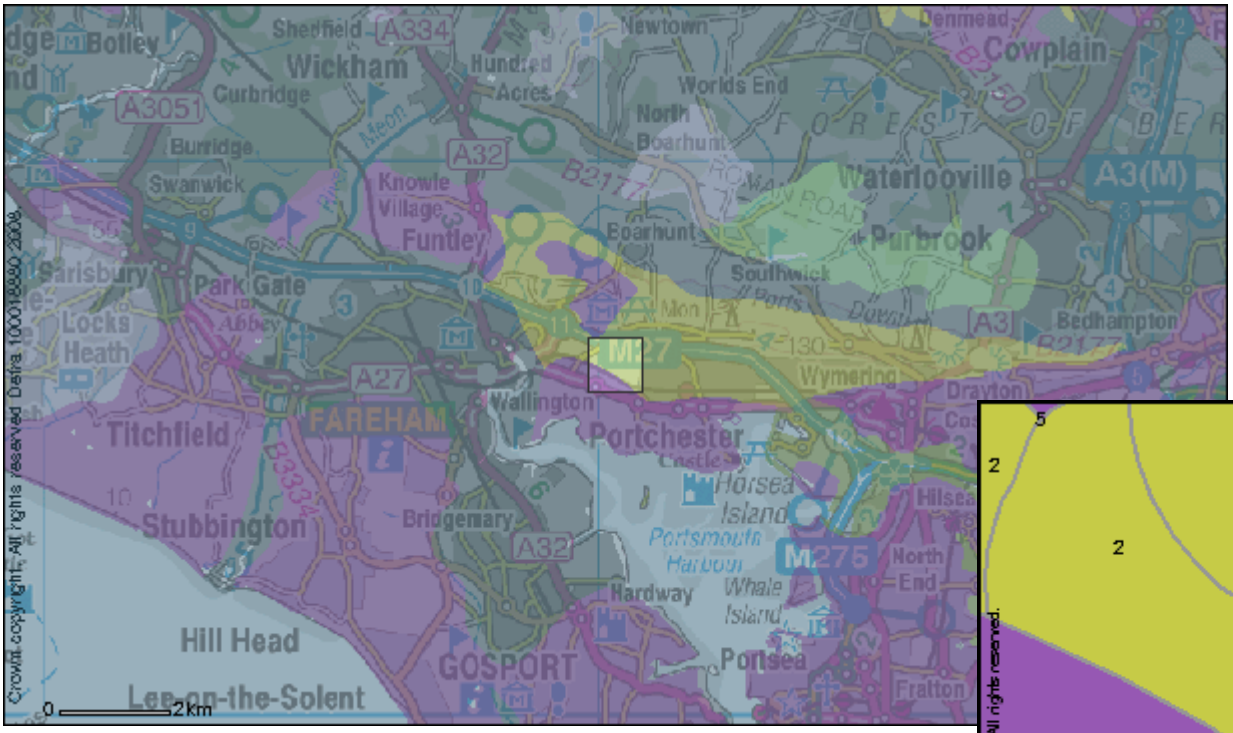
275 - *Winter cereals, often in rotation with grass; stock rearing; some deciduous and coniferous woodland.*

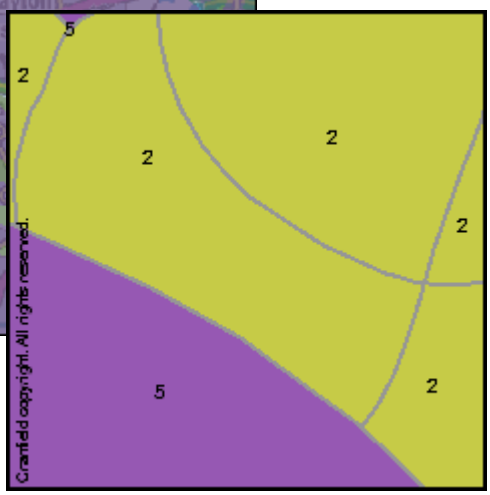
63 - *Cereals, potatoes, field vegetables and some short term grassland; local glasshouse and horticultural crops.*

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.

11. NATURAL SOIL FERTILITY





NATURAL SOIL FERTILITY KEY

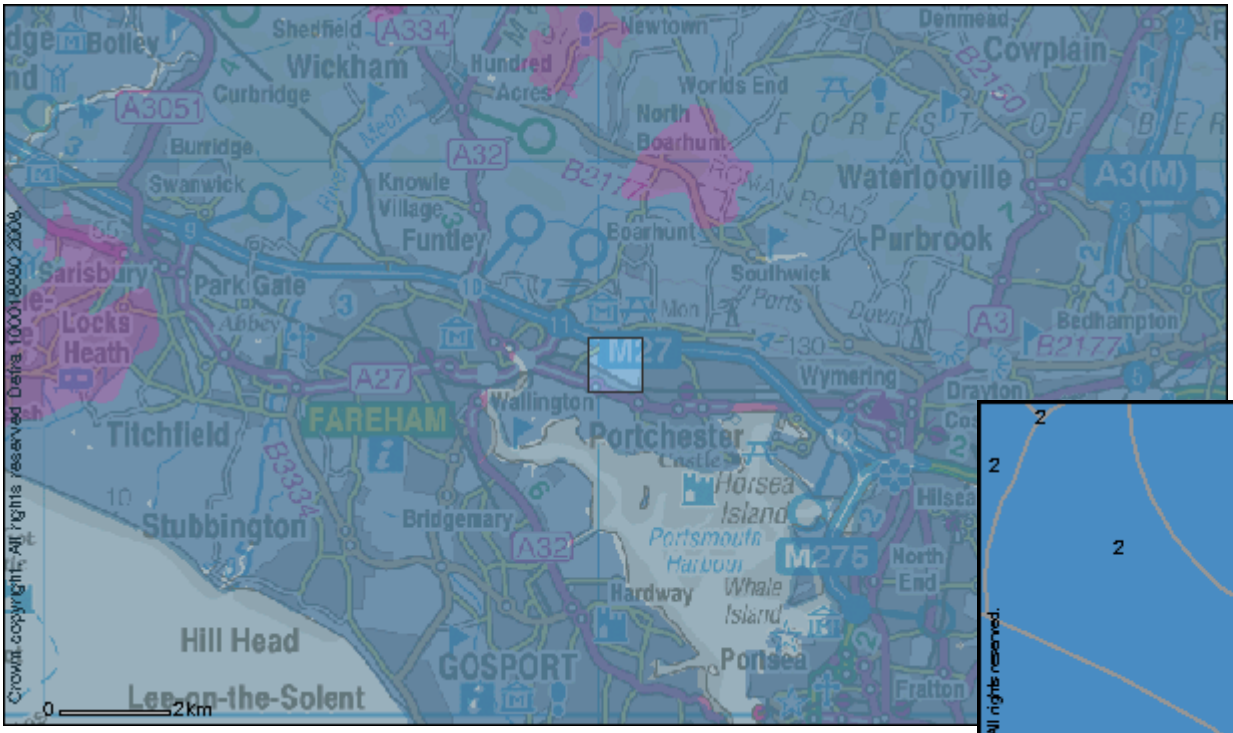
2 - *Lime-rich*

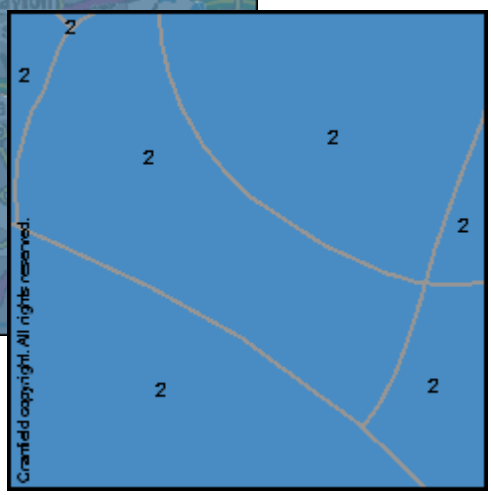
5 - *Low*

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.

1m. SIMPLE TOPSOIL TEXTURE





SIMPLE TOPSOIL TEXTURE KEY

1 - *Clayey*

2 - *Loamy*

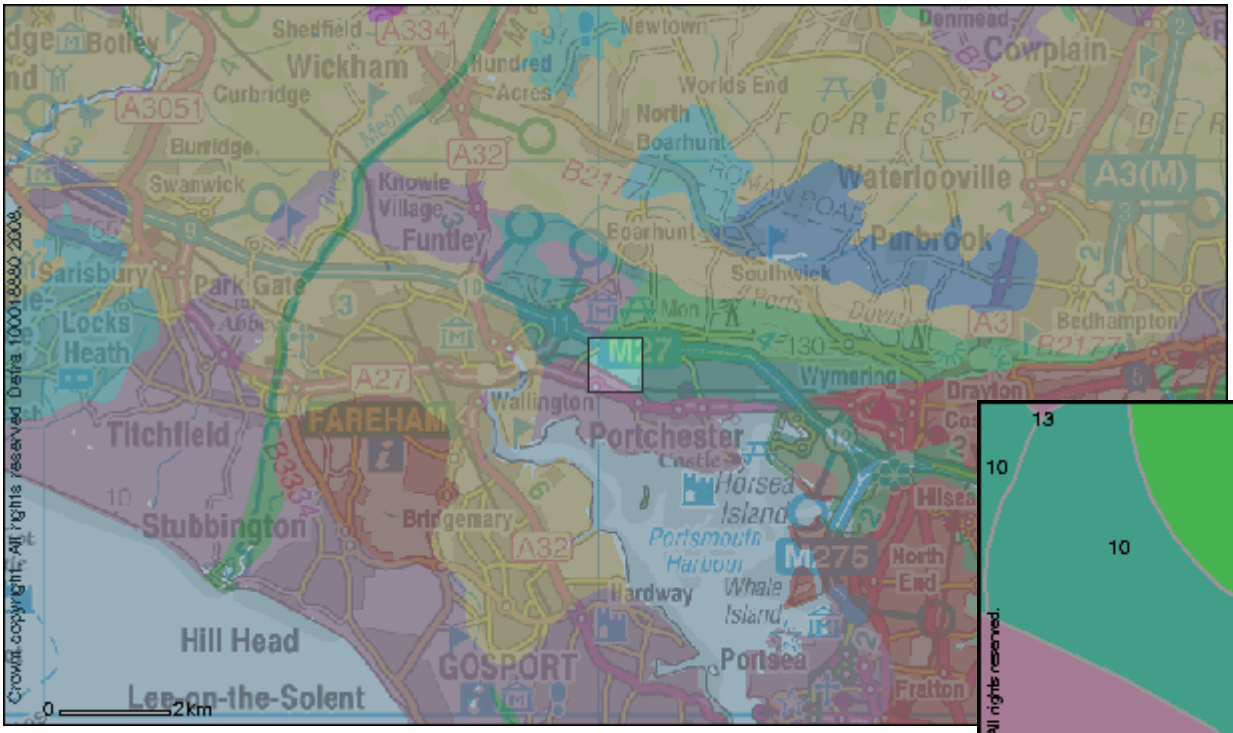
3 - *Peaty*

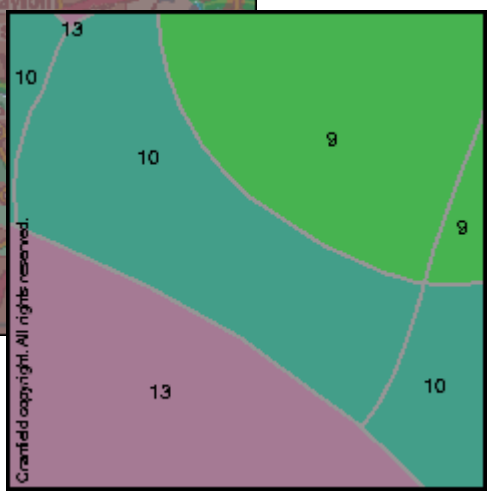
4 - *Sandy*

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.

1n. TYPICAL HABITATS





TYPICAL HABITATS KEY

10 - *Herb-rich chalk and limestone pastures; lime-rich deciduous woodlands*

13 - *Neutral and acid pastures and deciduous woodlands; acid communities such as bracken and gorse in the uplands*

9 - *Herb-rich Downland and limestone pastures; limestone pavements in the uplands; Beech hangers and other lime-rich wo*

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 or any urban development, 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.

UPTON 1 342a
Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

COOMBE 1 511f
Well drained calcareous fine silty soils deep in valley bottoms,

HAMBLE 2 571z
Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally.

CARSTENS 581d
Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

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.

UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

a. General Description

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land. Deeper fine silty calcareous soils in coombes and dry valleys.

The major landuse on this association is defined as permanent grassland rough grazing and woodland on scarps; cereals and short term grassland on gentle slopes; recreation.

b. Distribution (England & Wales)

The UPTON 1 association covers 798km² of England and Wales which accounts for 0.53% of the landmass. The distribution of this association is shown in Figure 1. 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 UPTON 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 endevoured to present the likelihood of a minor, unnamed soil series occuring 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.

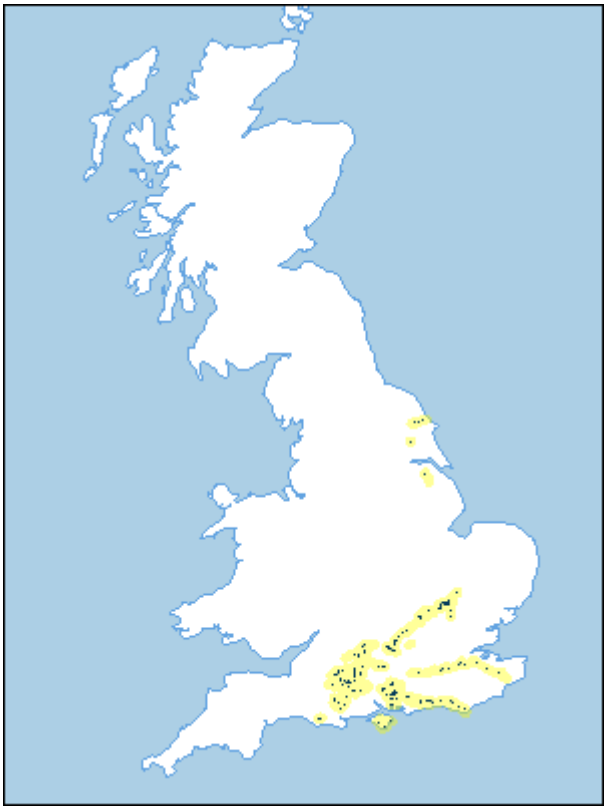


Figure 1. Association Distribution

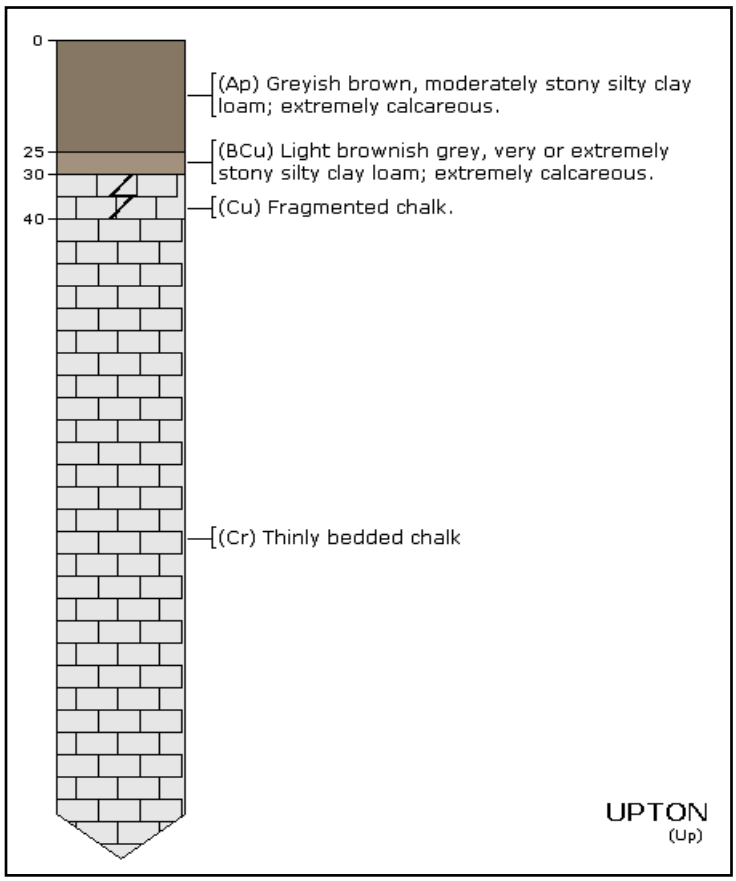
Soil Series	Description	Area %
UPTON (Up)	loamy lithoskeletal chalk	45%
ANDOVER (Ac)	silty lithoskeletal chalk	15%
ICKNIELD (Ia)	loamy lithoskeletal chalk	15%
PANHOLES (pH)	medium silty material over lithoskeletal chalk	10%
COOMBE (Ct)	medium silty chalky drift	5%
OTHER	other minor soils	10%

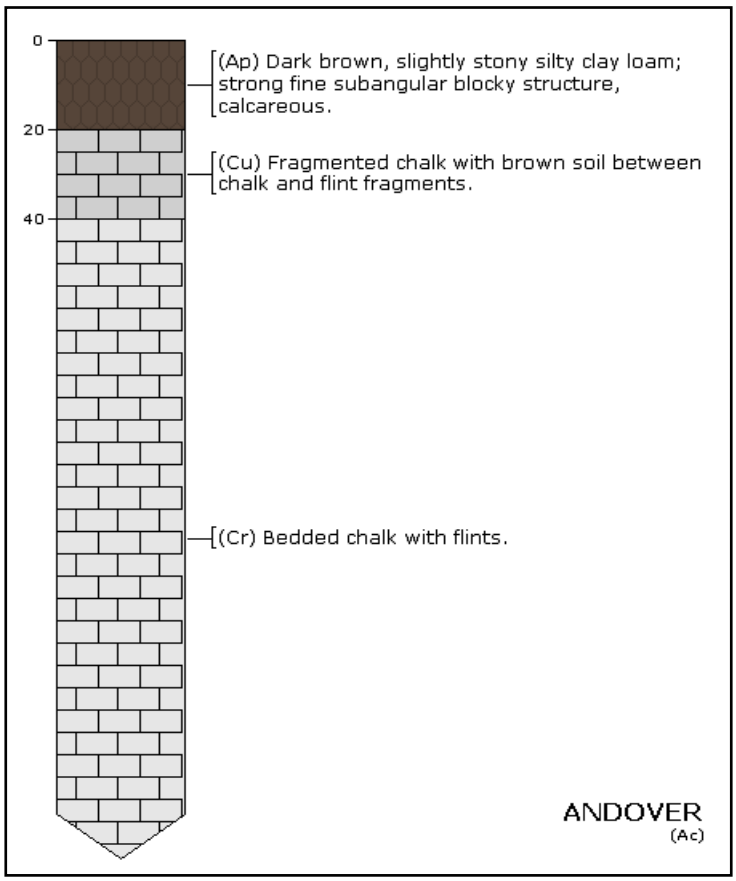
Table 1. The component soil series of the UPTON 1 soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

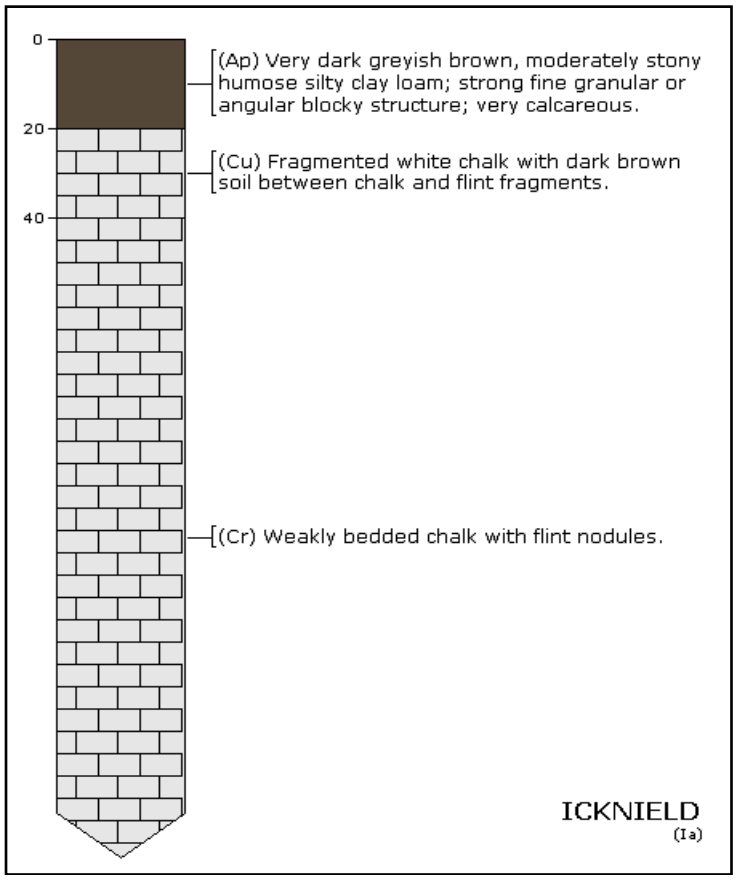
UPTON 1 (342a)

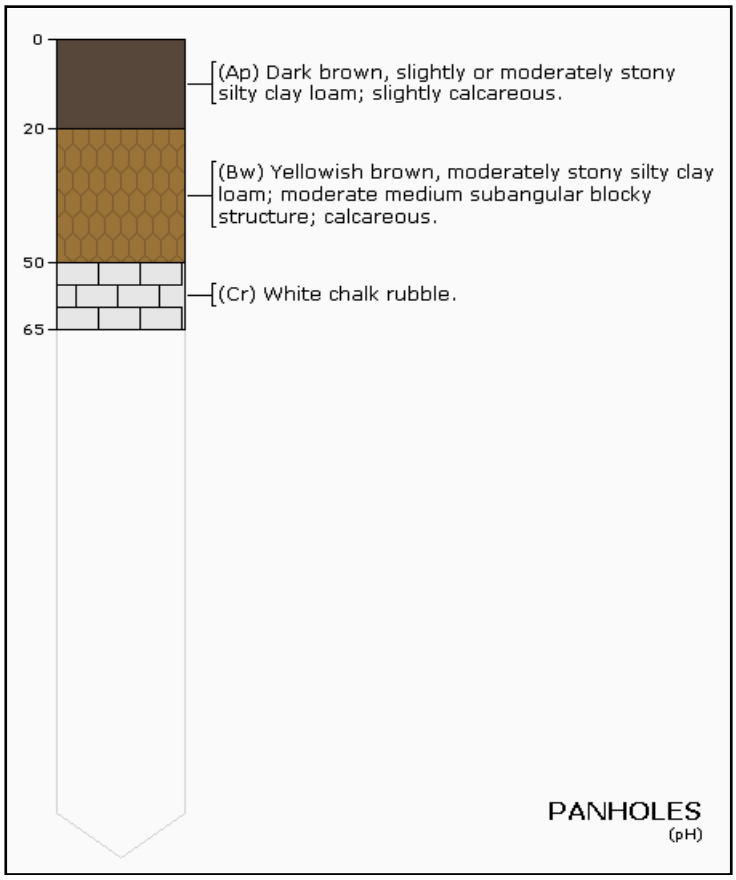
Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

d. UPTON 1 Component Series Profiles





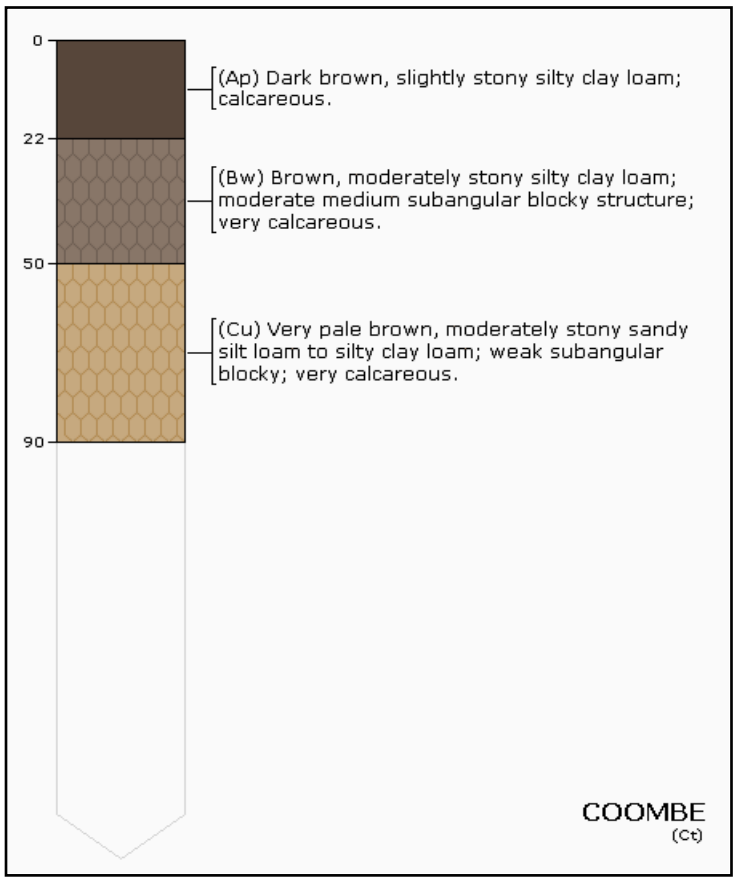




UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

d. UPTON 1 Component Series Profiles continued



UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

e. Soil Properties

This section provides graphical summaries of selected attribute data available for the component series in this association. The blue bars of the graphs presented in this section describe the range of property values for all soils across England and Wales. Superimposed on these graphs are the values for the component soil series in this association. This has been done to provide the reader with an understanding of where each property for each series sits within the national context.

Soil Series	Description	Area %
UPTON (Up)	loamy lithoskeletal chalk	45%
ANDOVER (Ac)	silty lithoskeletal chalk	15%
ICKNIELD (Ia)	loamy lithoskeletal chalk	15%
PANHOLES (pH)	medium silty material over lithoskeletal chalk	10%
COOMBE (Ct)	medium silty chalky drift	5%
OTHER	other minor soils	10%

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

e(i). Soil Depth Information and Depths to Important Layers

Depth to rock A mean depth to bedrock or very stony rubble which has been assigned to each soil series based on observed and recorded soil profiles.

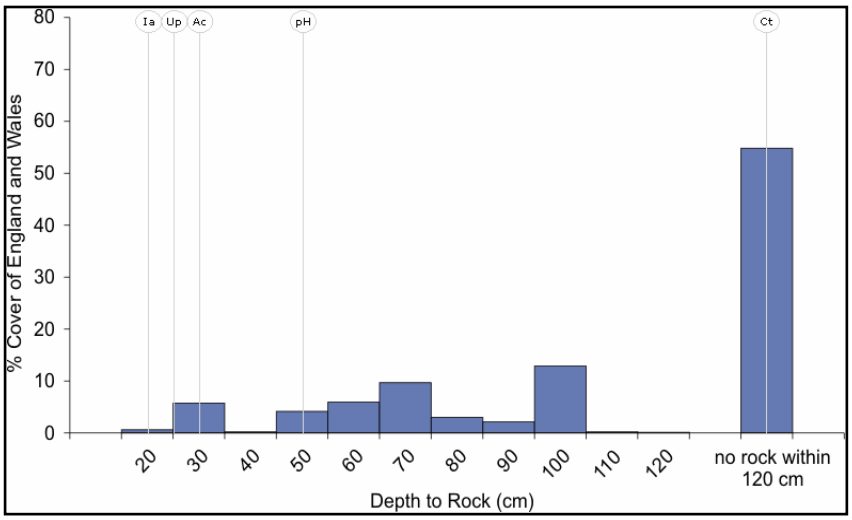


Figure 2. Depth of soil to Rock

Depth to gleying, the presence of grey and ochreous mottles within the soil, is caused by intermittent waterlogging. A mean depth to gleying has been assigned to each soil series based on observed and recorded soil profiles. The definition of a gleyed layer is designed to equate with saturation for at least 30 days in each year or the presence of artificial drainage.

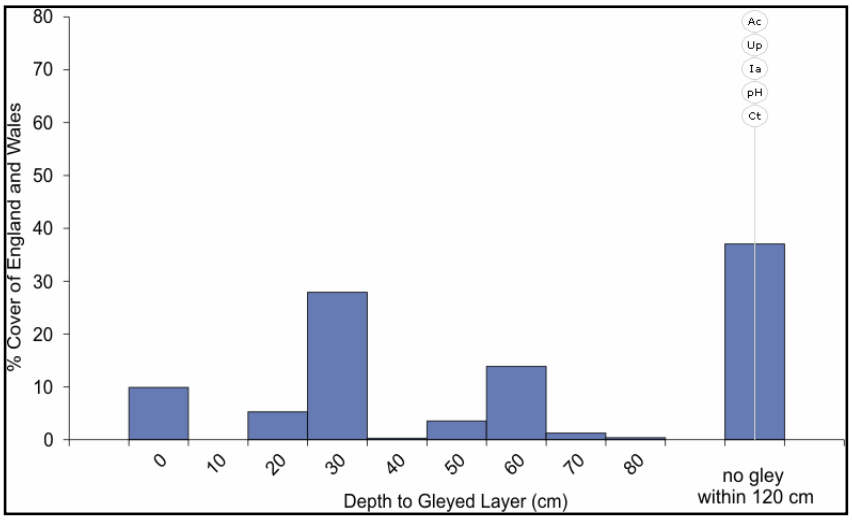


Figure 3. Depth of Soil to Gleying

UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

e(i). Soil Depth Information and Depths to Important Layers continued

Depth to slowly permeable layer (downward percolation) A mean depth to a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede downward percolation of excess soil water. This causes periodic saturation in the overlying soil, reduced storage capacity and therefore increased hydrological response to rainfall events.

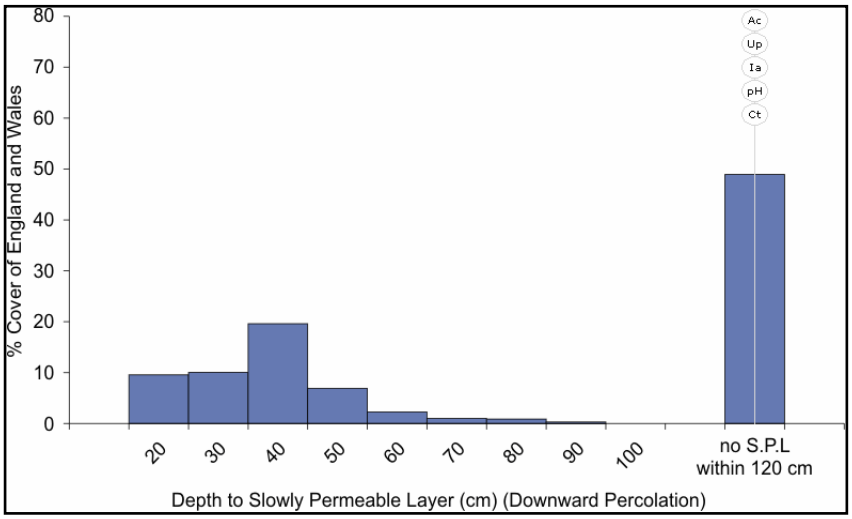


Figure 4. Depth to slowly permeable layer (downward percolation)

Depth to Slowly Permeable Layer (upward diffusion) A mean depth to the bottom of a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede upward diffusion of water and gasses.

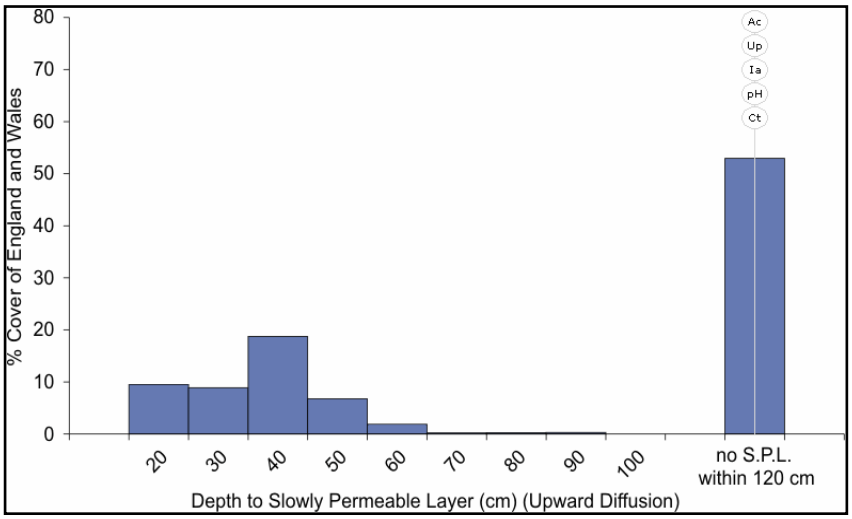


Figure 5. Depth to Slowly Permeable Layer (upward diffusion)

UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

e(ii). Soil Hydrological Information

Integrated air capacity (IAC) is the total coarse pore space (>60 μm diameter) to 1 m depth. This size of pore would normally be air-filled when the soil is fully moist but not waterlogged. A large IAC means that the soil is well aerated. This will encourage root development and, provided near surface soil structure is well developed, will allow rainfall to percolate into the ground thus mitigating against localised flooding.

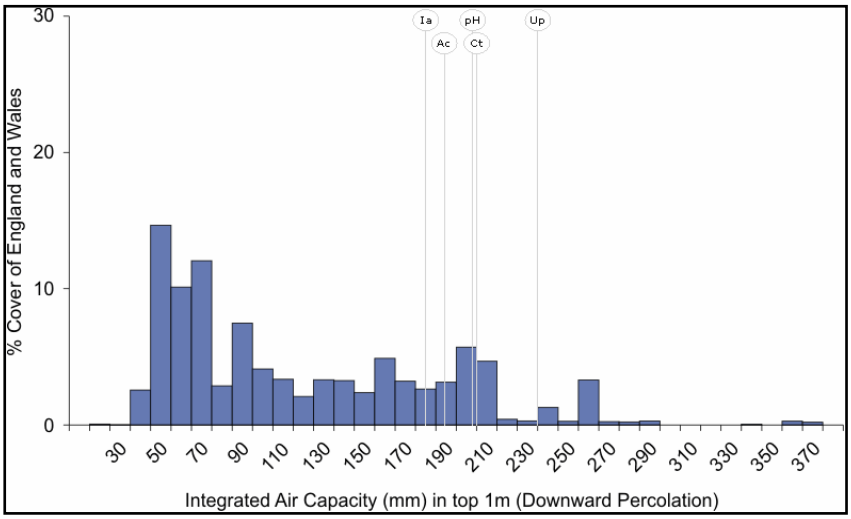


Figure 6. Integrated Air Capacity

Standard Percentage Runoff (SPR) is the percentage of rainfall that causes the short-term increase in flow seen at a catchment outlet following a storm event. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

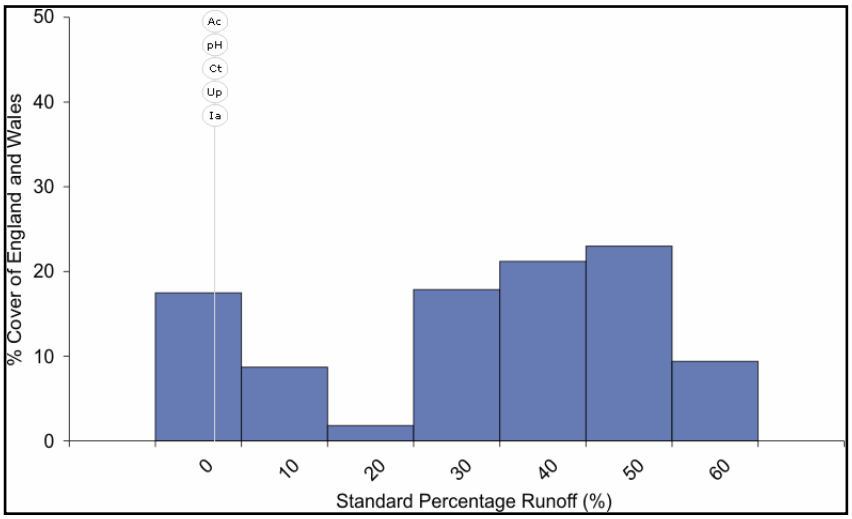


Figure 7. Standard Percentage Runoff

Base flow index is calculated from daily river flow data and expresses the volume of base flow of a river as a fraction of the total flow volume. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

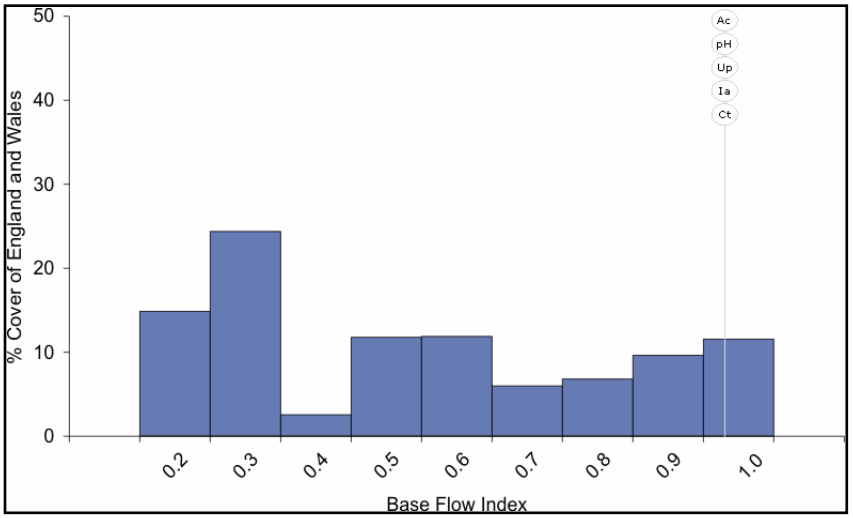


Figure 8. Base Flow Index

UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

e(iii). Available Water Content

Available water content for plants varies depending on a number of factors, including the rooting depth of the plants. Described below are differing available water contents for cereals, sugar beet, grass and potato crops, as well as a generic available water value to 1 m depth.

Available water (by crop) Available water content to 1 m for the specified soil series between suctions of 5 and 1500kPa.

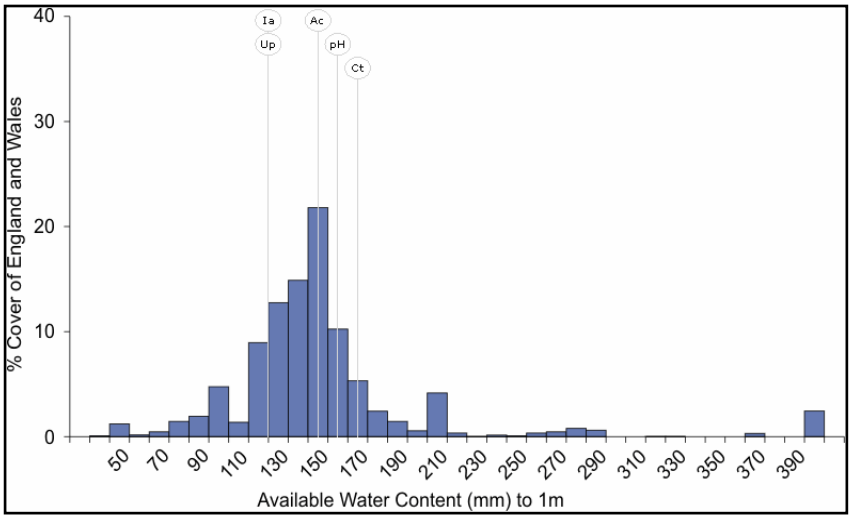


Figure 9. Available Water (by crop)

Available water for grass represents the water that is available to a permanent grass sward that is able to root to 100cm depth.

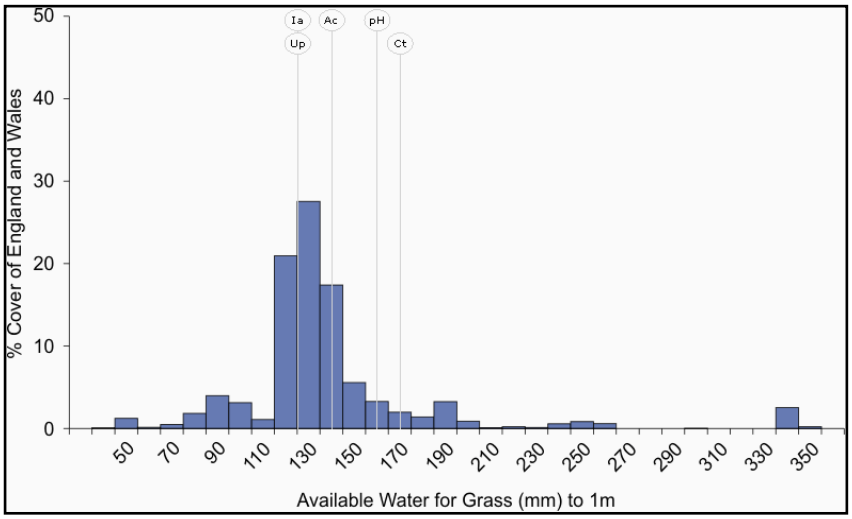


Figure 10. Available Water for Grass

UPTON 1 (342a)

Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land.

e(iii). Available Water Content continued

Available water for cereal represents the water that is available to a cereal crop that is able to root to 120cm depth.

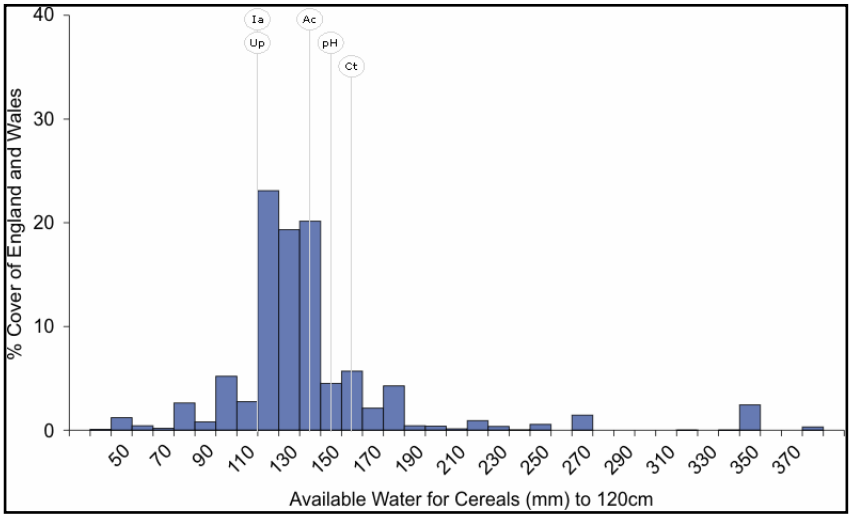


Figure 11. Available Water for Cereal

Available water for Sugar Beet represents the water that is available to a sugar beet crop that is able to root to 140cm depth.

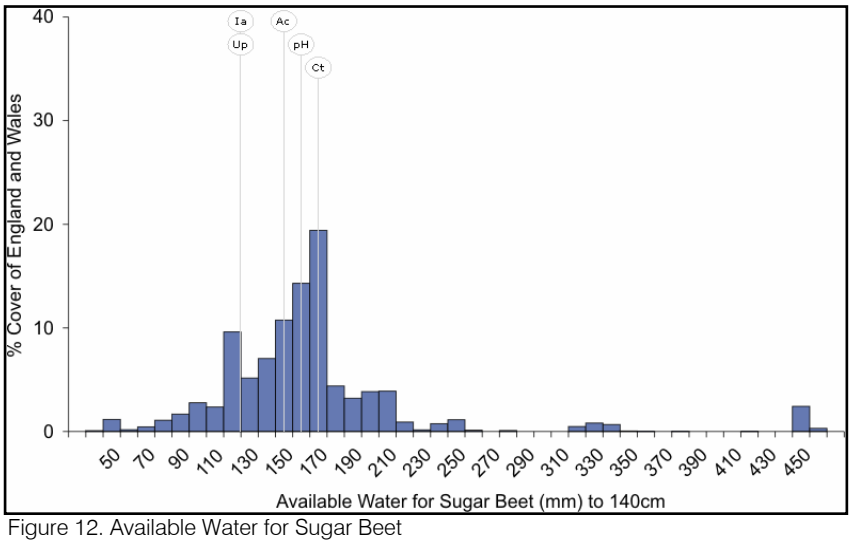


Figure 12. Available Water for Sugar Beet

Available water for Potatoes represents the water that is available to a potato crop that is able to root to 70cm depth.

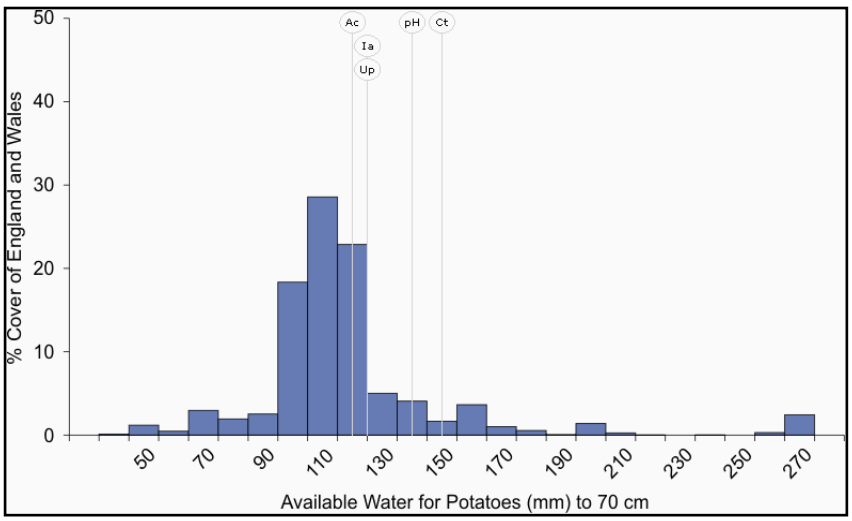


Figure 13. Available Water for Potatoes

COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

a. General Description

Well drained calcareous fine silty soils deep in valley bottoms, shallow to chalk on valley sides in places. Slight risk of water erosion
The major landuse on this association is defined as winter cereals, cereal and grassland rotations with dairying; some horticultural crops.

b. Distribution (England & Wales)

The COOMBE 1 association covers 778km² of England and Wales which accounts for 0.51% of the landmass. The distribution of this association is shown in Figure 14. 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 COOMBE 1 association are outlined in Table 2 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 endevoured to present the likelihood of a minor, unnamed soil series occuring in your site in Table 2.

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.

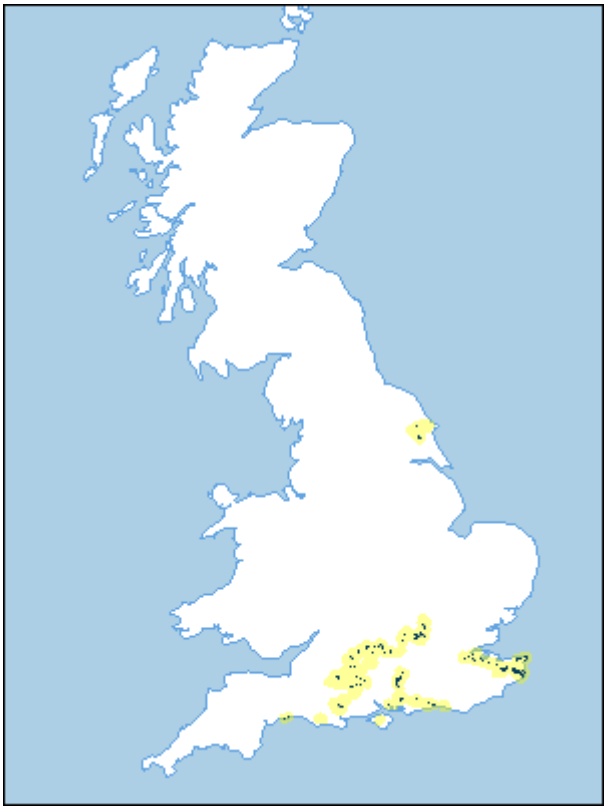


Figure 14. Association Distribution

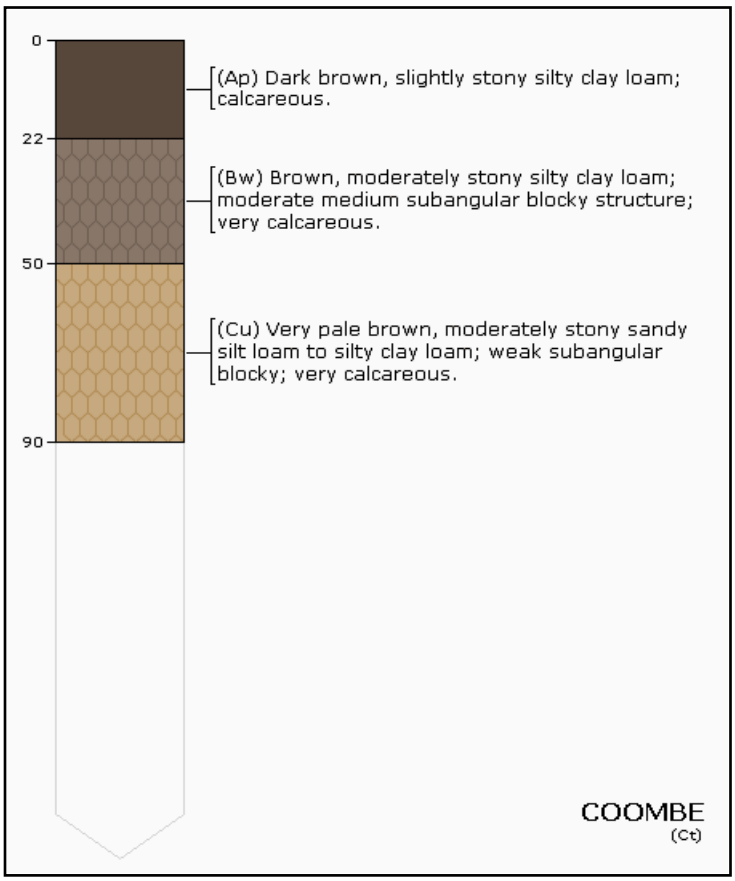
Soil Series	Description	Area %
COOMBE (Ct)	medium silty chalky drift	40%
PANHOLES (pH)	medium silty material over lithoskeletal chalk	20%
ANDOVER (Ac)	silty lithoskeletal chalk	10%
CHARITY (Cr)	medium silty drift with siliceous stones	10%
MILLINGTON (MQ)	medium silty calcareous colluvium	10%
OTHER	other minor soils	10%

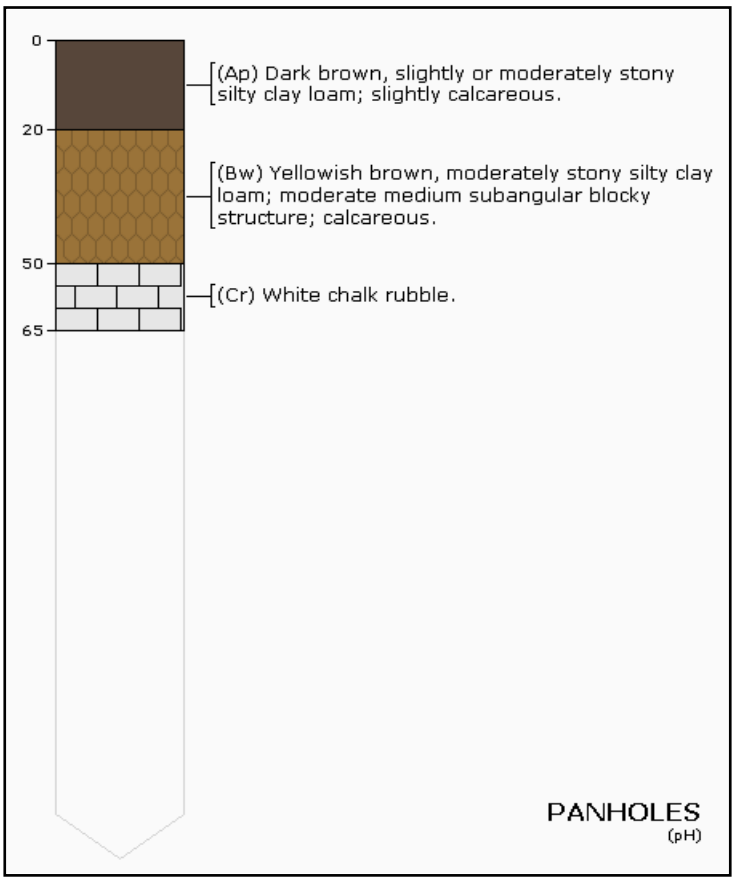
Table 2. The component soil series of the COOMBE 1 soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

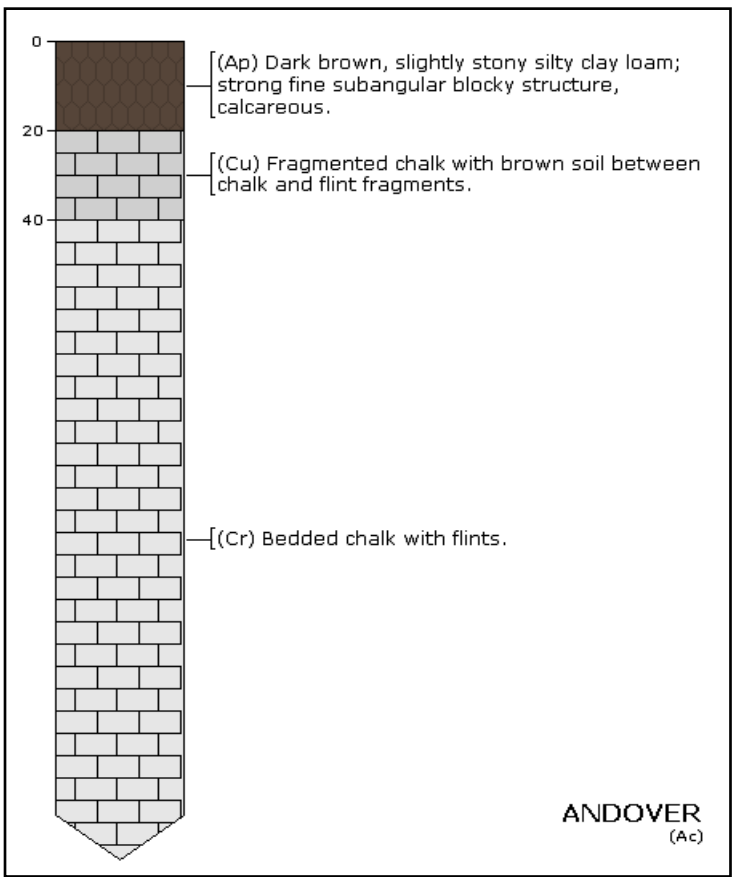
COOMBE 1 (511f)

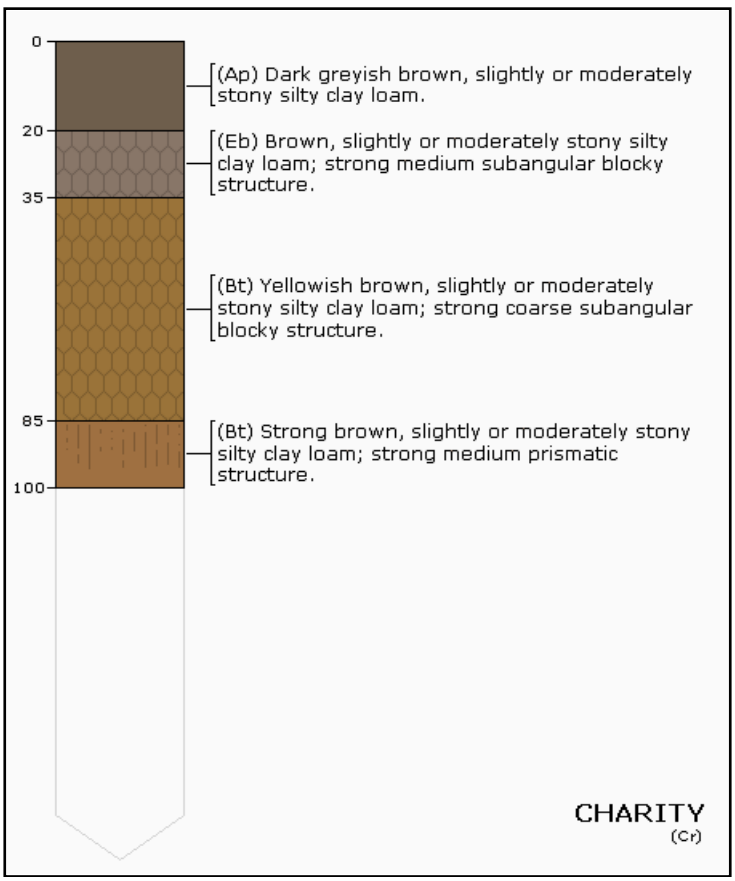
Well drained calcareous fine silty soils deep in valley bottoms,

d. COOMBE 1 Component Series Profiles





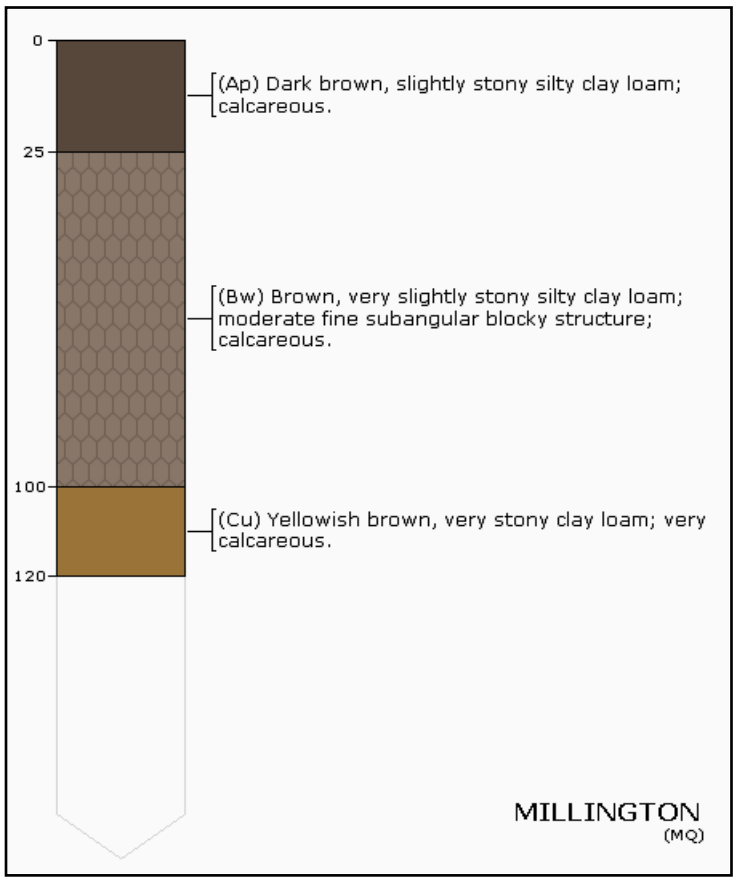




COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

d. COOMBE 1 Component Series Profiles continued



COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

e. Soil Properties

This section provides graphical summaries of selected attribute data available for the component series in this association. The blue bars of the graphs presented in this section describe the range of property values for all soils across England and Wales. Superimposed on these graphs are the values for the component soil series in this association. This has been done to provide the reader with an understanding of where each property for each series sits within the national context.

Soil Series	Description	Area %
COOMBE (Ct)	medium silty chalky drift	40%
PANHOLES (pH)	medium silty material over lithoskeletal chalk	20%
ANDOVER (Ac)	silty lithoskeletal chalk	10%
CHARITY (Cr)	medium silty drift with siliceous stones	10%
MILLINGTON (MQ)	medium silty calcareous colluvium	10%
OTHER	other minor soils	10%

Table 2. The component soil series of the COOMBE 1 soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

e(i). Soil Depth Information and Depths to Important Layers

Depth to rock A mean depth to bedrock or very stony rubble which has been assigned to each soil series based on observed and recorded soil profiles.

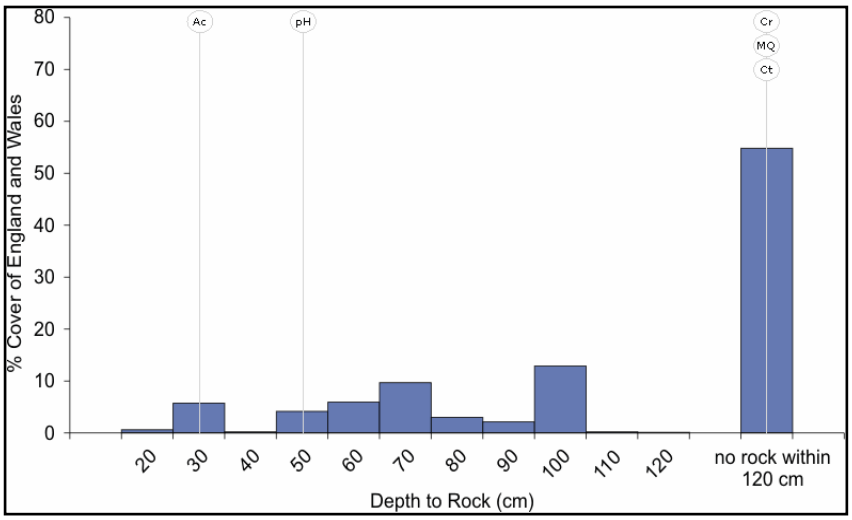


Figure 15. Depth of soil to Rock

Depth to gleying, the presence of grey and ochreous mottles within the soil, is caused by intermittent waterlogging. A mean depth to gleying has been assigned to each soil series based on observed and recorded soil profiles. The definition of a gleyed layer is designed to equate with saturation for at least 30 days in each year or the presence of artificial drainage.

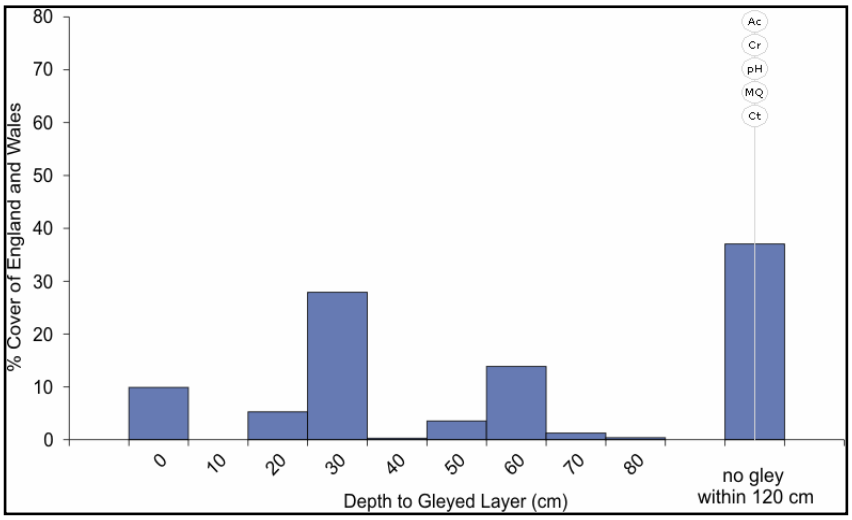


Figure 16. Depth of Soil to Gleying

COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

e(i). Soil Depth Information and Depths to Important Layers continued

Depth to slowly permeable layer (downward percolation) A mean depth to a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede downward percolation of excess soil water. This causes periodic saturation in the overlying soil, reduced storage capacity and therefore increased hydrological response to rainfall events.

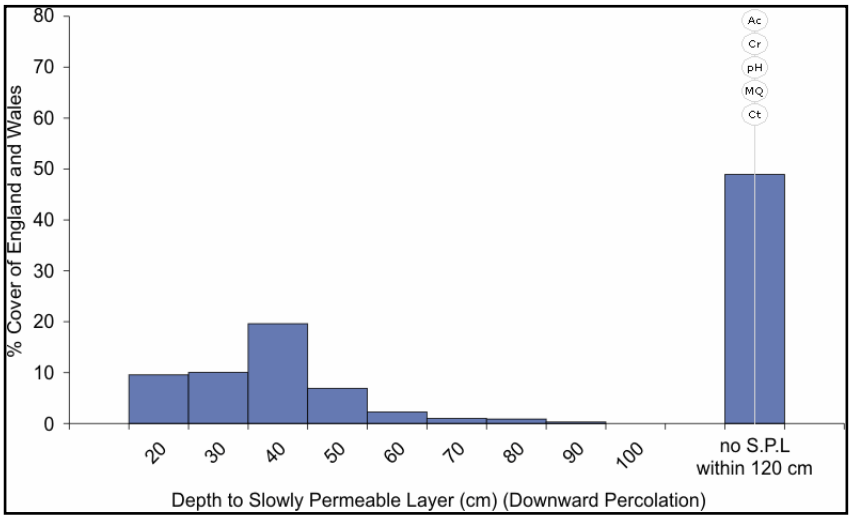


Figure 17. Depth to slowly permeable layer (downward percolation)

Depth to Slowly Permeable Layer (upward diffusion) A mean depth to the bottom of a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede upward diffusion of water and gasses.

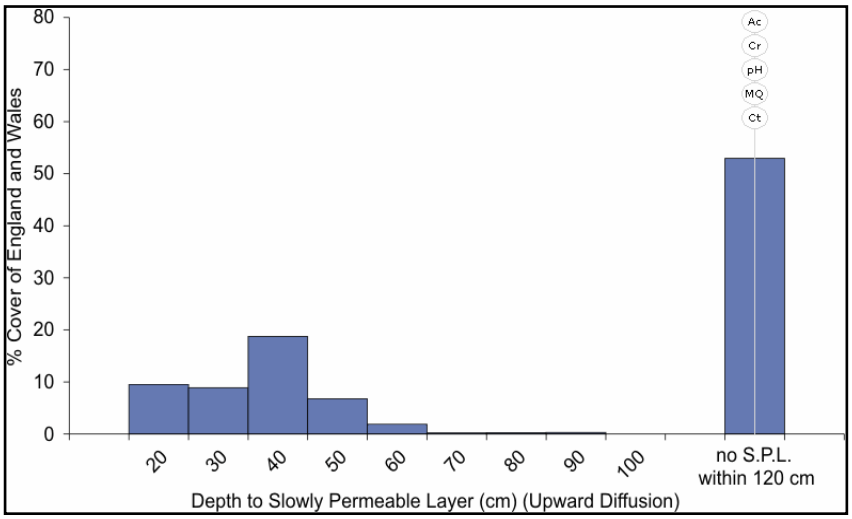


Figure 18. Depth to Slowly Permeable Layer (upward diffusion)

COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

e(ii). Soil Hydrological Information

Integrated air capacity (IAC) is the total coarse pore space (>60 μm diameter) to 1 m depth. This size of pore would normally be air-filled when the soil is fully moist but not waterlogged. A large IAC means that the soil is well aerated. This will encourage root development and, provided near surface soil structure is well developed, will allow rainfall to percolate into the ground thus mitigating against localised flooding.

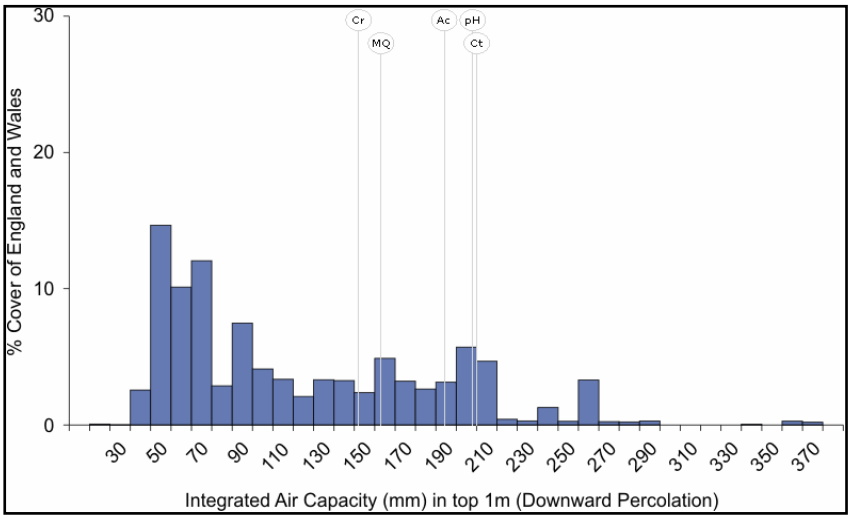


Figure 19. Integrated Air Capacity

Standard Percentage Runoff (SPR) is the percentage of rainfall that causes the short-term increase in flow seen at a catchment outlet following a storm event. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

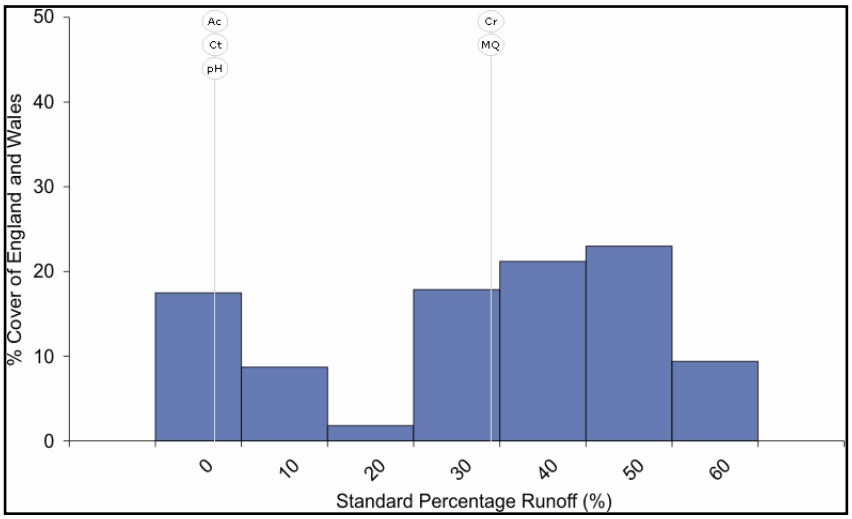


Figure 20. Standard Percentage Runoff

Base flow index is calculated from daily river flow data and expresses the volume of base flow of a river as a fraction of the total flow volume. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

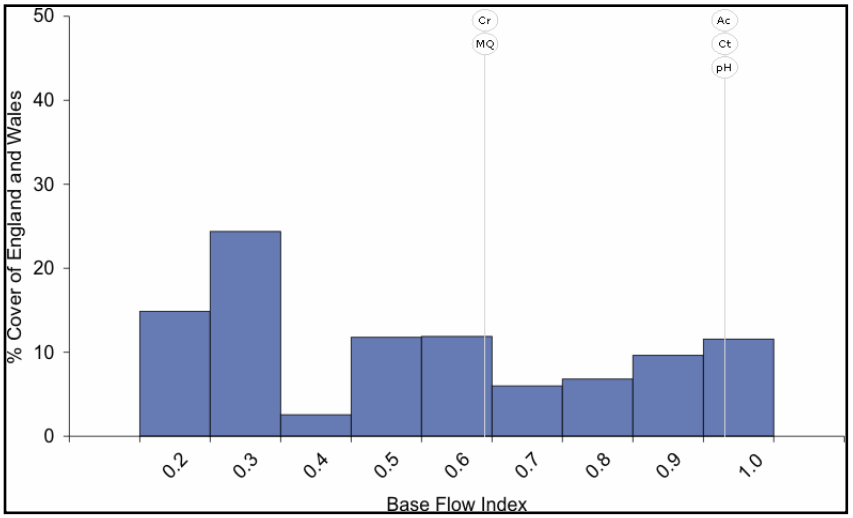


Figure 21. Base Flow Index

COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

e(iii). Available Water Content

Available water content for plants varies depending on a number of factors, including the rooting depth of the plants. Described below are differing available water contents for cereals, sugar beet, grass and potato crops, as well as a generic available water value to 1 m depth.

Available water (by crop) Available water content to 1 m for the specified soil series between suctions of 5 and 1500kPa.

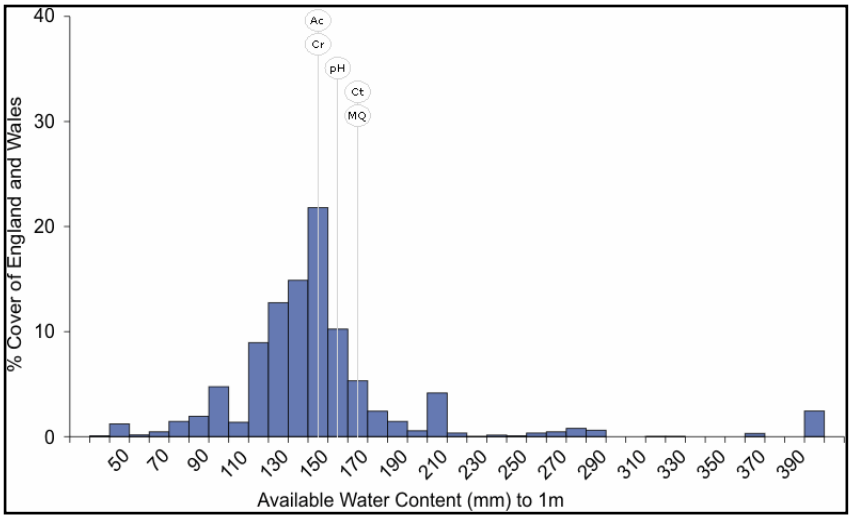


Figure 22. Available Water (by crop)

Available water for grass represents the water that is available to a permanent grass sward that is able to root to 100cm depth.

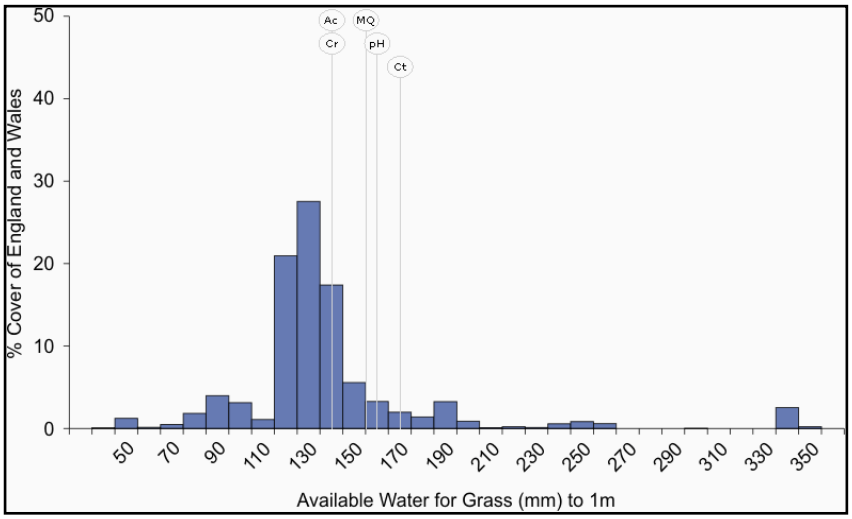


Figure 23. Available Water for Grass

COOMBE 1 (511f)

Well drained calcareous fine silty soils deep in valley bottoms,

e(iii). Available Water Content continued

Available water for cereal represents the water that is available to a cereal crop that is able to root to 120cm depth.

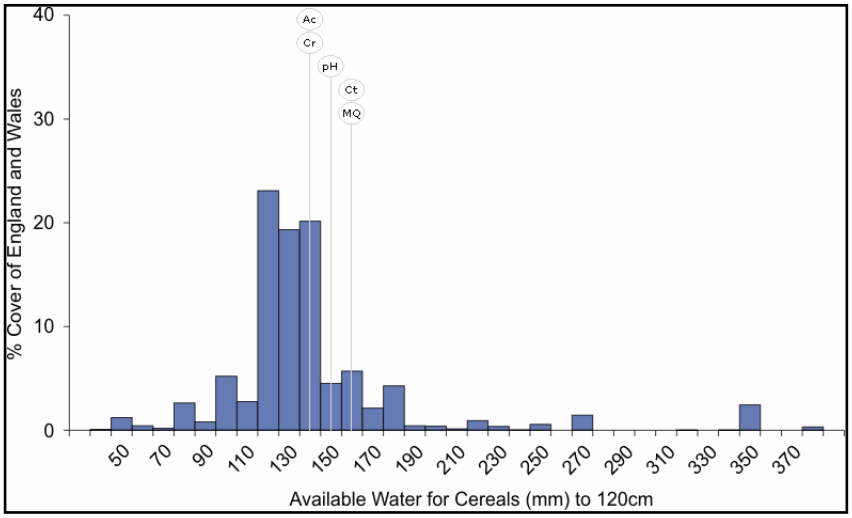


Figure 24. Available Water for Cereal

Available water for Sugar Beet represents the water that is available to a sugar beet crop that is able to root to 140cm depth.

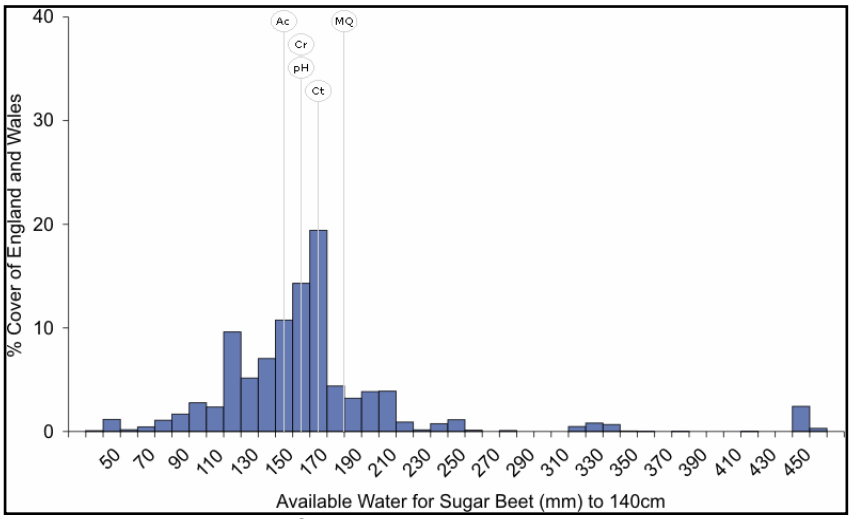


Figure 25. Available Water for Sugar Beet

Available water for Potatoes represents the water that is available to a potato crop that is able to root to 70cm depth.

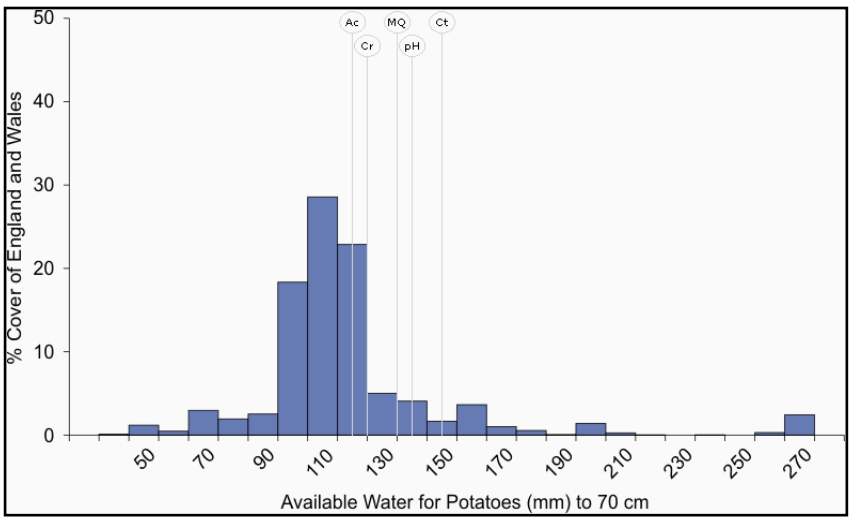


Figure 26. Available Water for Potatoes

HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

a. General Description

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally. Usually flat land.
The major landuse on this association is defined as cereals, potatoes, field vegetables and some short term grassland; local glasshouse and horticultural crops.

b. Distribution (England & Wales)

The HAMBLE 2 association covers 466km² of England and Wales which accounts for 0.31% of the landmass. The distribution of this association is shown in Figure 27. 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 HAMBLE 2 association are outlined in Table 3 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 endevoured to present the likelihood of a minor, unnamed soil series occuring in your site in Table 3.

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.

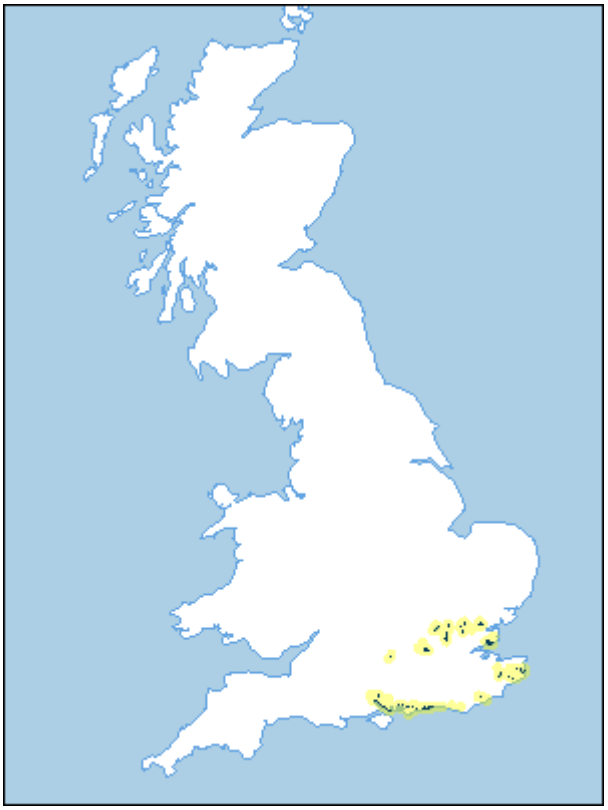


Figure 27. Association Distribution

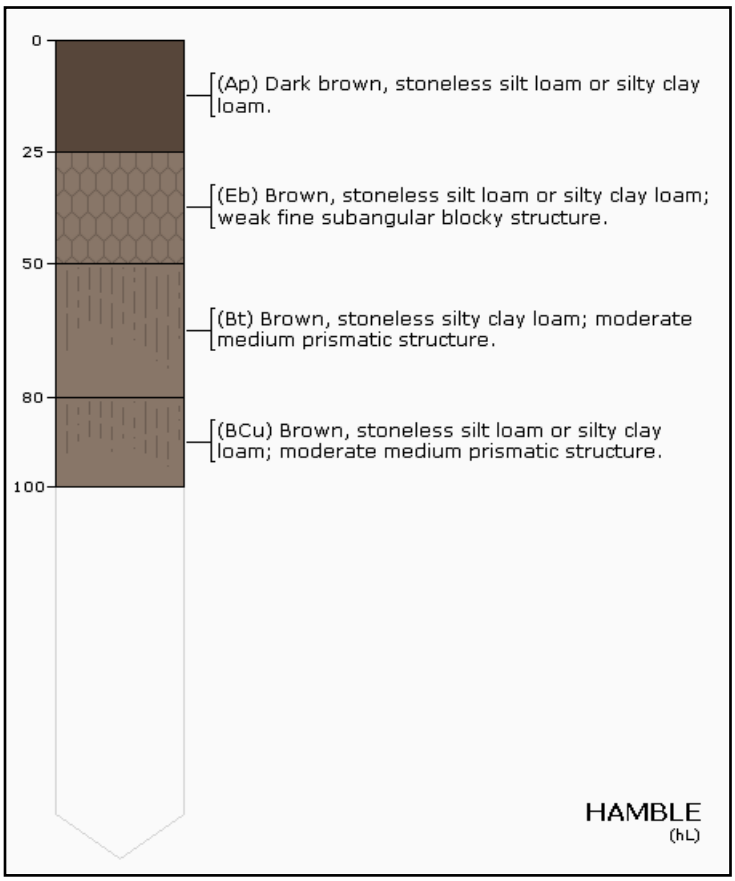
Soil Series	Description	Area %
HAMBLE (hL)	silty stoneless drift	40%
HOOK (hK)	silty stoneless drift	35%
OTHER	other minor soils	25%

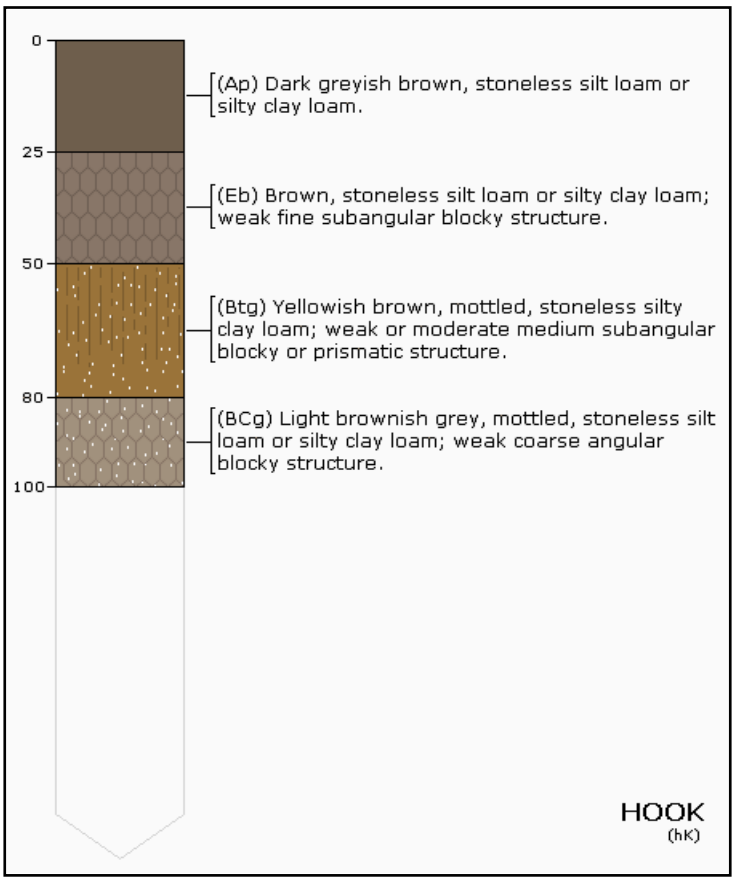
Table 3. The component soil series of the HAMBLE 2 soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

d. HAMBLE 2 Component Series Profiles





HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

e. Soil Properties

This section provides graphical summaries of selected attribute data available for the component series in this association. The blue bars of the graphs presented in this section describe the range of property values for all soils across England and Wales. Superimposed on these graphs are the values for the component soil series in this association. This has been done to provide the reader with an understanding of where each property for each series sits within the national context.

Soil Series	Description	Area %
HAMBLE (hL)	silty stoneless drift	40%
HOOK (hK)	silty stoneless drift	35%
OTHER	other minor soils	25%

Table 3. The component soil series of the HAMBLE 2 soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

e(i). Soil Depth Information and Depths to Important Layers

Depth to rock A mean depth to bedrock or very stony rubble which has been assigned to each soil series based on observed and recorded soil profiles.

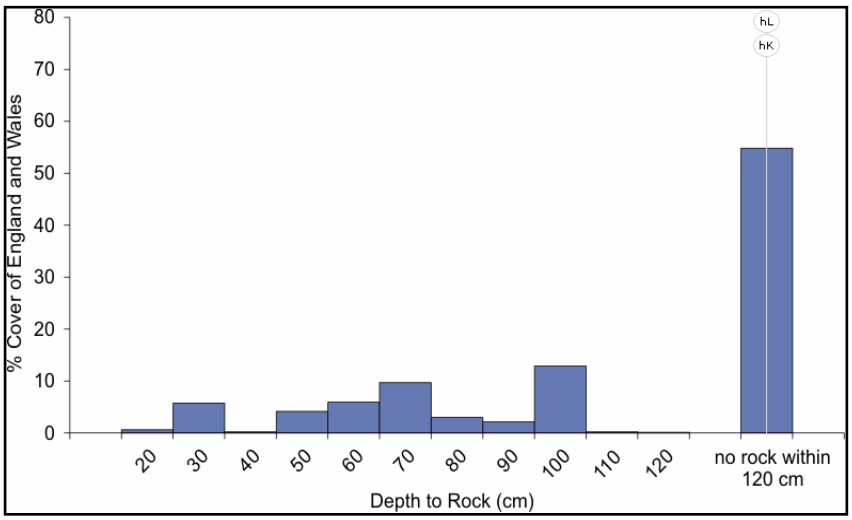


Figure 28. Depth of soil to Rock

Depth to gleying, the presence of grey and ochreous mottles within the soil, is caused by intermittent waterlogging. A mean depth to gleying has been assigned to each soil series based on observed and recorded soil profiles. The definition of a gleyed layer is designed to equate with saturation for at least 30 days in each year or the presence of artificial drainage.

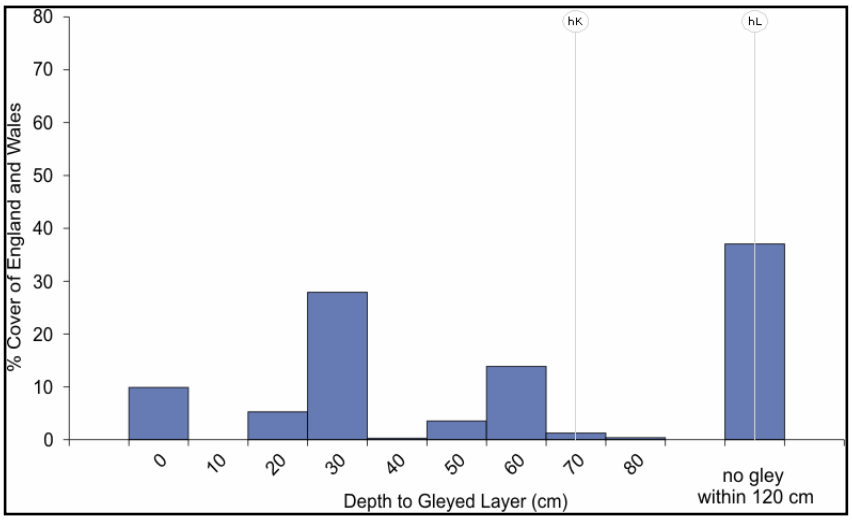


Figure 29. Depth of Soil to Gleying

HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

e(i). Soil Depth Information and Depths to Important Layers continued

Depth to slowly permeable layer (downward percolation) A mean depth to a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede downward percolation of excess soil water. This causes periodic saturation in the overlying soil, reduced storage capacity and therefore increased hydrological response to rainfall events.

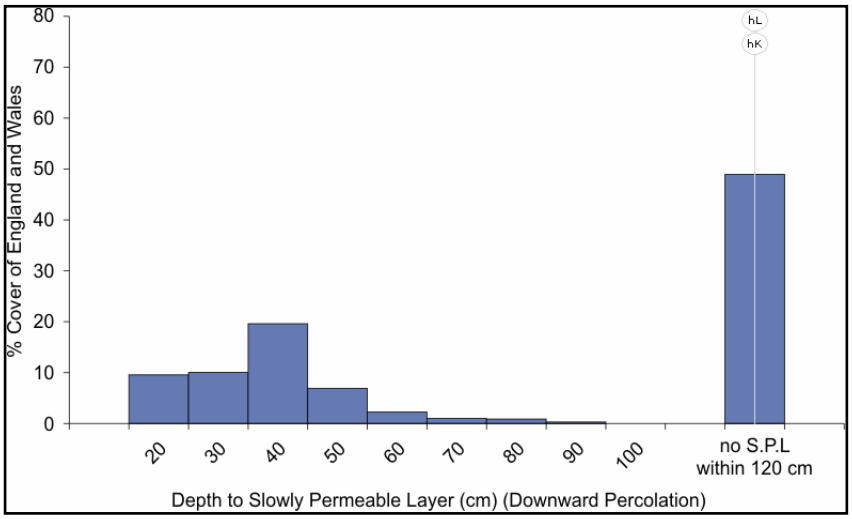


Figure 30. Depth to slowly permeable layer (downward percolation)

Depth to Slowly Permeable Layer (upward diffusion) A mean depth to the bottom of a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede upward diffusion of water and gasses.

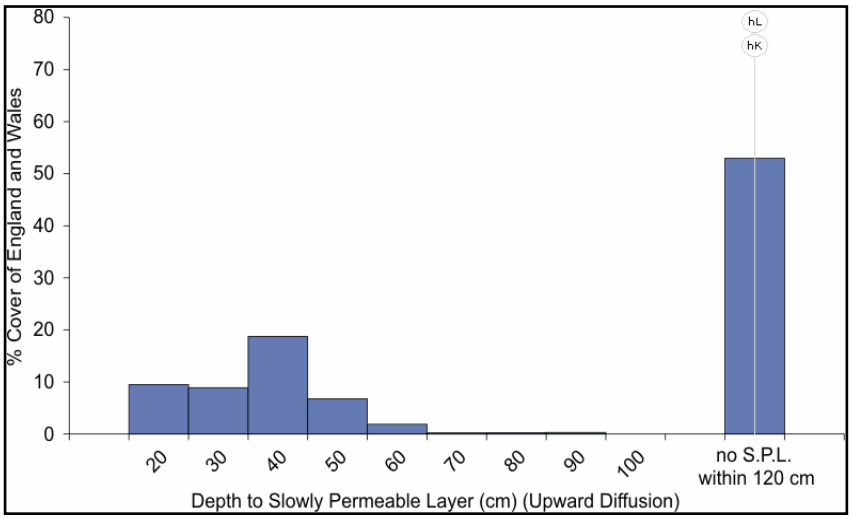


Figure 31. Depth to Slowly Permeable Layer (upward diffusion)

HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

e(ii). Soil Hydrological Information

Integrated air capacity (IAC) is the total coarse pore space (>60 μm diameter) to 1 m depth. This size of pore would normally be air-filled when the soil is fully moist but not waterlogged. A large IAC means that the soil is well aerated. This will encourage root development and, provided near surface soil structure is well developed, will allow rainfall to percolate into the ground thus mitigating against localised flooding.

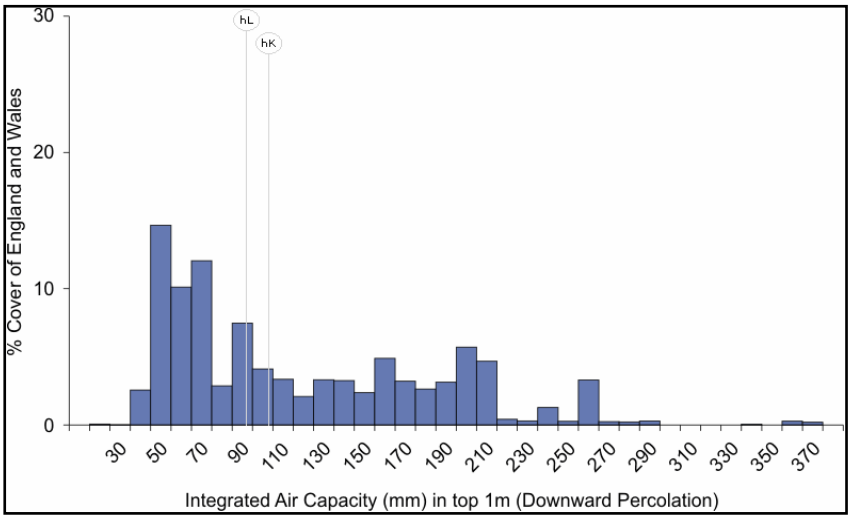


Figure 32. Integrated Air Capacity

Standard Percentage Runoff (SPR) is the percentage of rainfall that causes the short-term increase in flow seen at a catchment outlet following a storm event. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

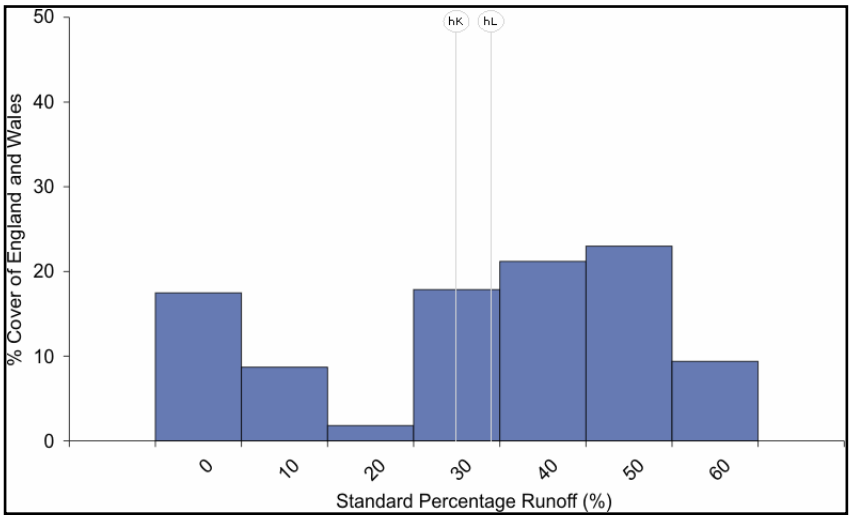


Figure 33. Standard Percentage Runoff

Base flow index is calculated from daily river flow data and expresses the volume of base flow of a river as a fraction of the total flow volume. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

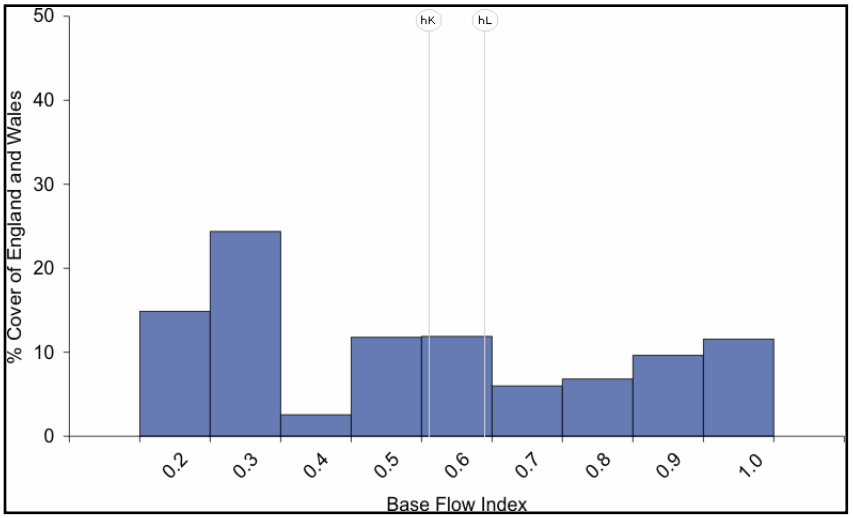


Figure 34. Base Flow Index

HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

e(iii). Available Water Content

Available water content for plants varies depending on a number of factors, including the rooting depth of the plants. Described below are differing available water contents for cereals, sugar beet, grass and potato crops, as well as a generic available water value to 1 m depth.

Available water (by crop) Available water content to 1 m for the specified soil series between suctions of 5 and 1500kPa.

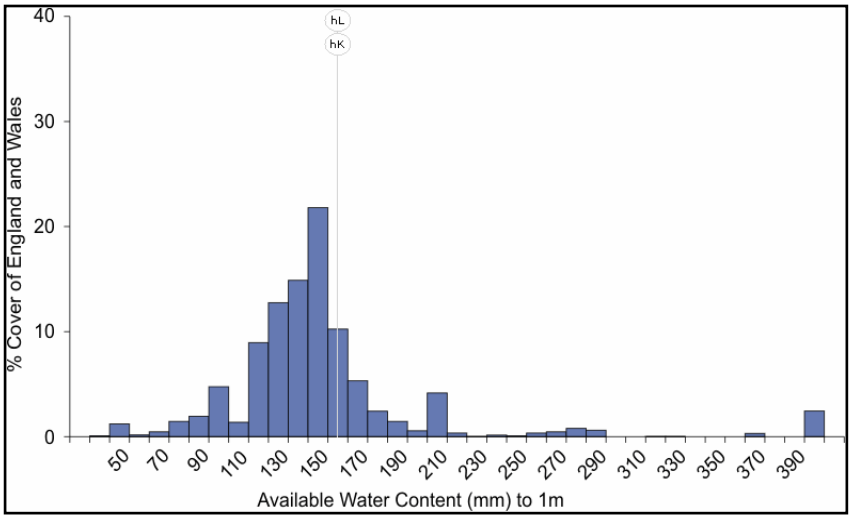


Figure 35. Available Water (by crop)

Available water for grass represents the water that is available to a permanent grass sward that is able to root to 100cm depth.

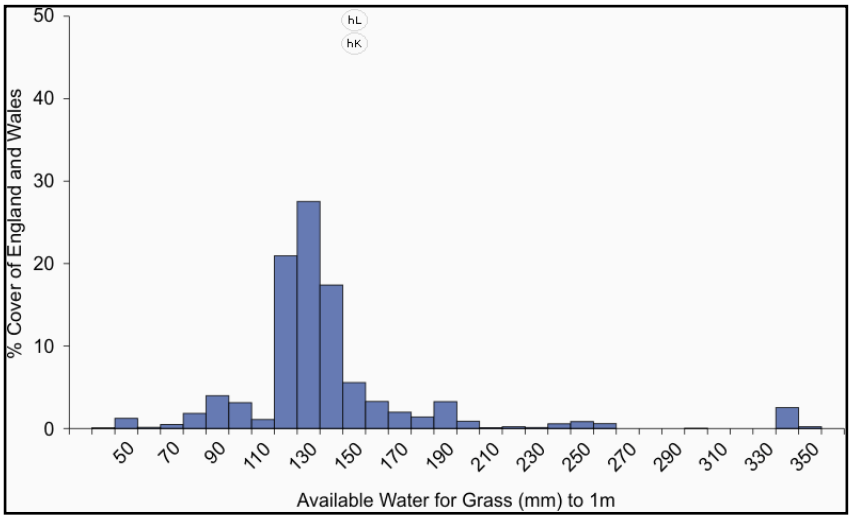


Figure 36. Available Water for Grass

HAMBLE 2 (571z)

Deep stoneless well drained silty soils and similar soils affected by groundwater, over gravel locally .

e(iii). Available Water Content continued

Available water for cereal represents the water that is available to a cereal crop that is able to root to 120cm depth.

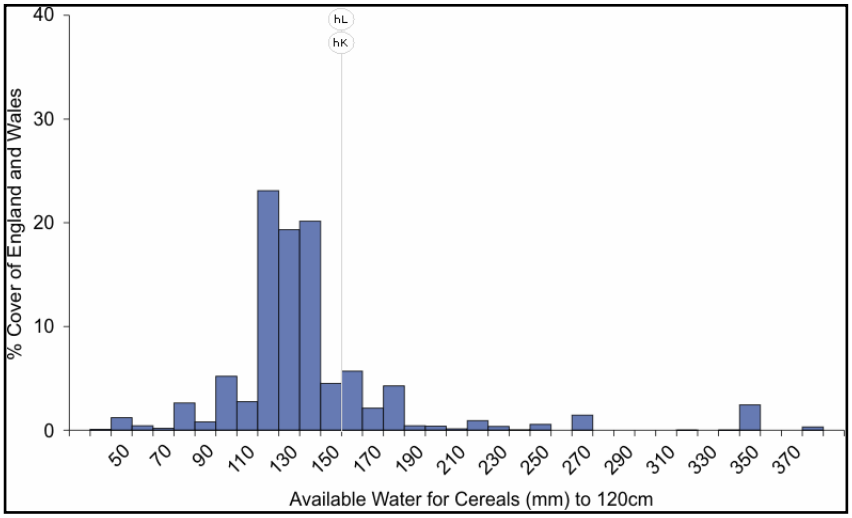


Figure 37. Available Water for Cereal

Available water for Sugar Beet represents the water that is available to a sugar beet crop that is able to root to 140cm depth.

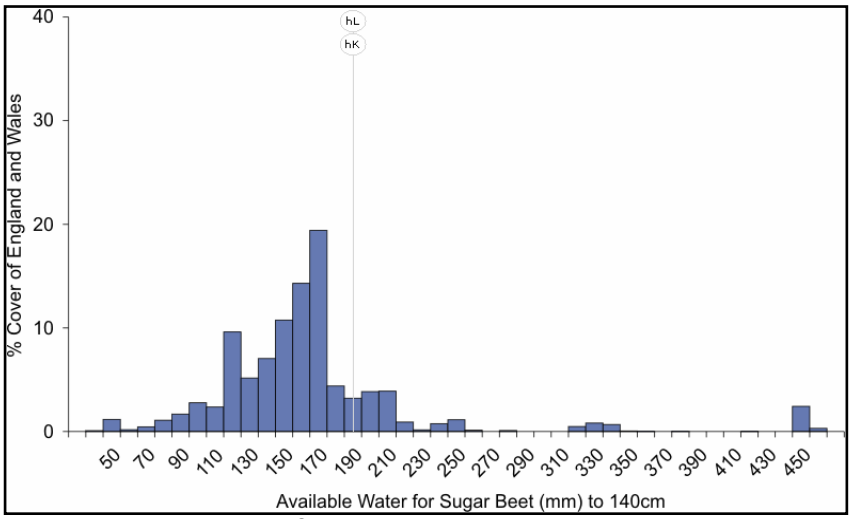


Figure 38. Available Water for Sugar Beet

Available water for Potatoes represents the water that is available to a potato crop that is able to root to 70cm depth.

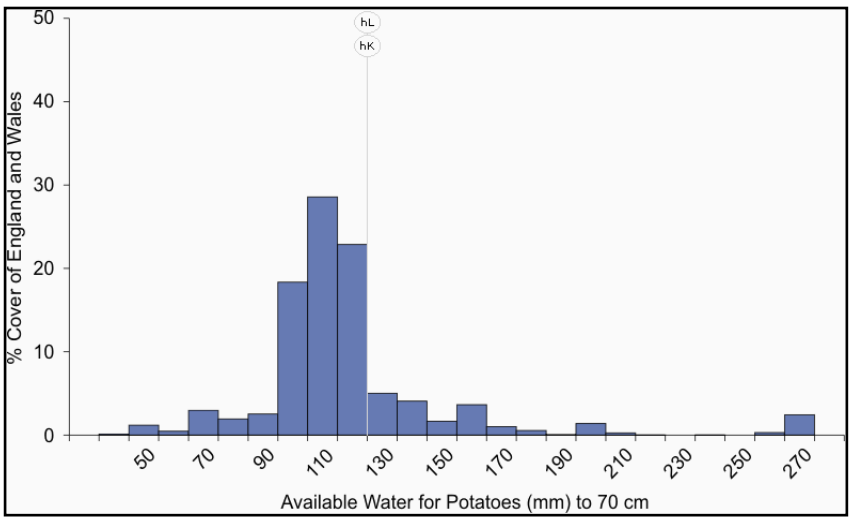


Figure 39. Available Water for Potatoes

CARSTENS (581d)

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty .

a. General Description

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

The major landuse on this association is defined as winter cereals, often in rotation with grass; stock rearing; some deciduous and coniferous woodland.

b. Distribution (England & Wales)

The CARSTENS association covers 1066km² of England and Wales which accounts for 0.7% of the landmass. The distribution of this association is shown in Figure 40. 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 CARSTENS association are outlined in Table 4 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 endevoured to present the likelihood of a minor, unnamed soil series occuring in your site in Table 4.

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.

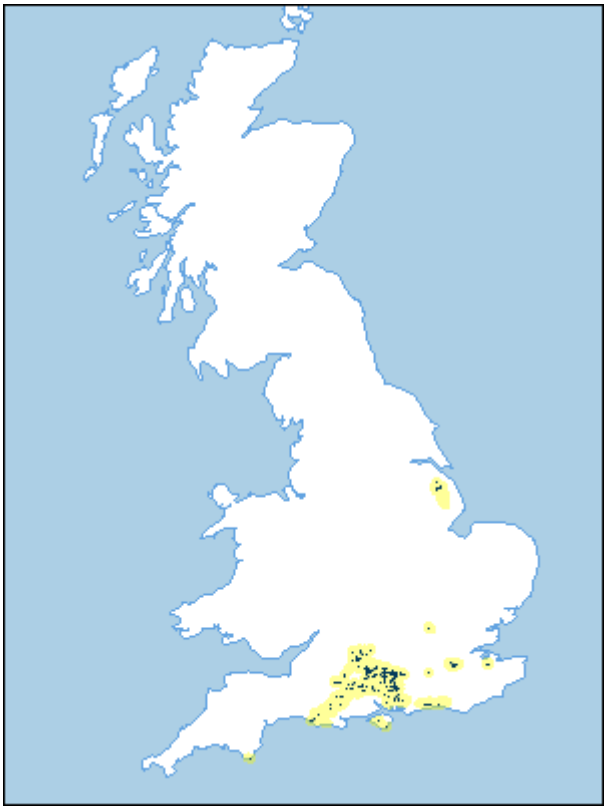


Figure 40. Association Distribution

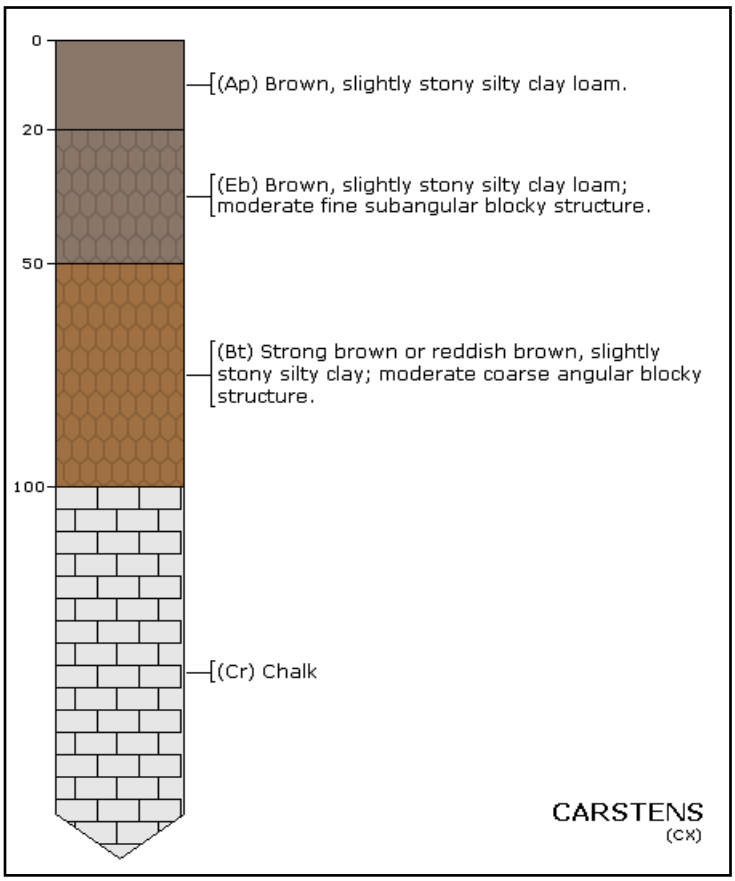
Soil Series	Description	Area %
CARSTENS (CX)	medium silty over clayey drift with siliceous stones	60%
CHARITY (Cr)	medium silty drift with siliceous stones	10%
GIVENDALE (gV)	clayey drift with siliceous stones	10%
WINCHESTER (We)	clayey material over lithoskeletal chalk	10%
OTHER	other minor soils	10%

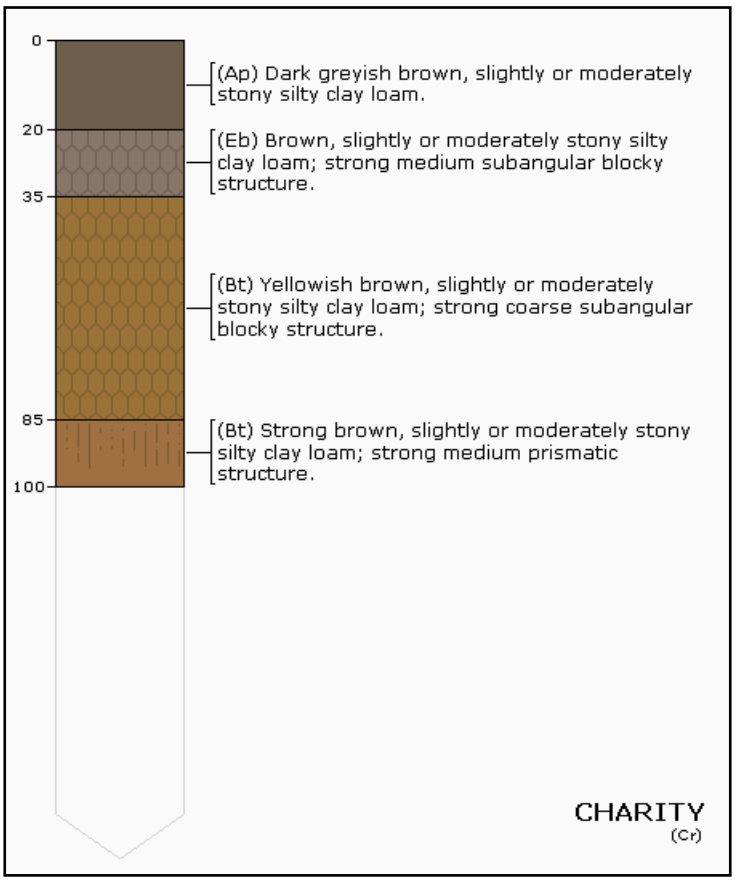
Table 4. The component soil series of the CARSTENS soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

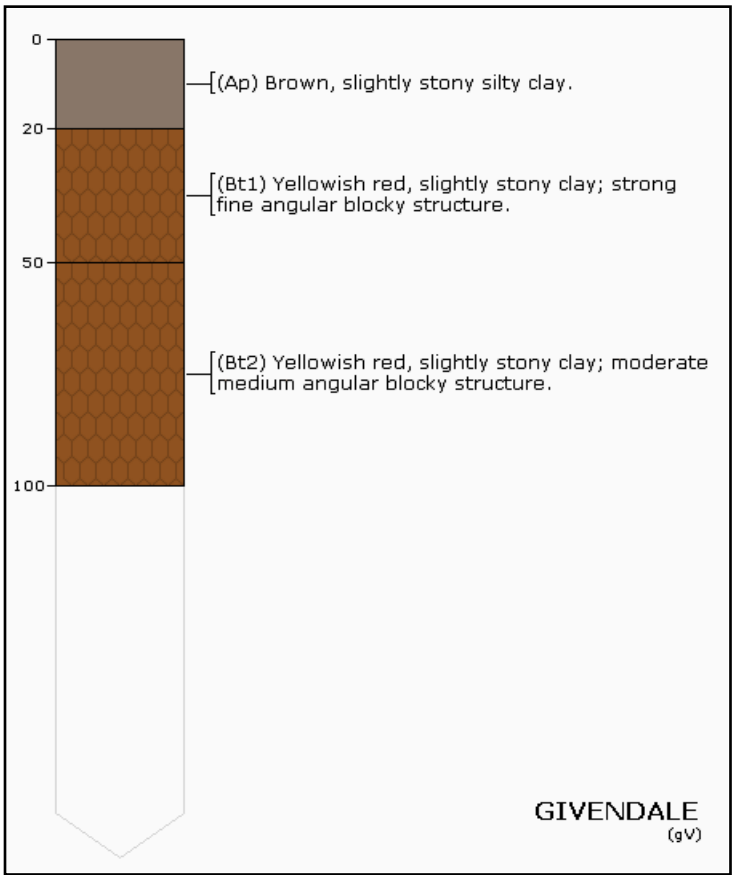
CARSTENS (581d)

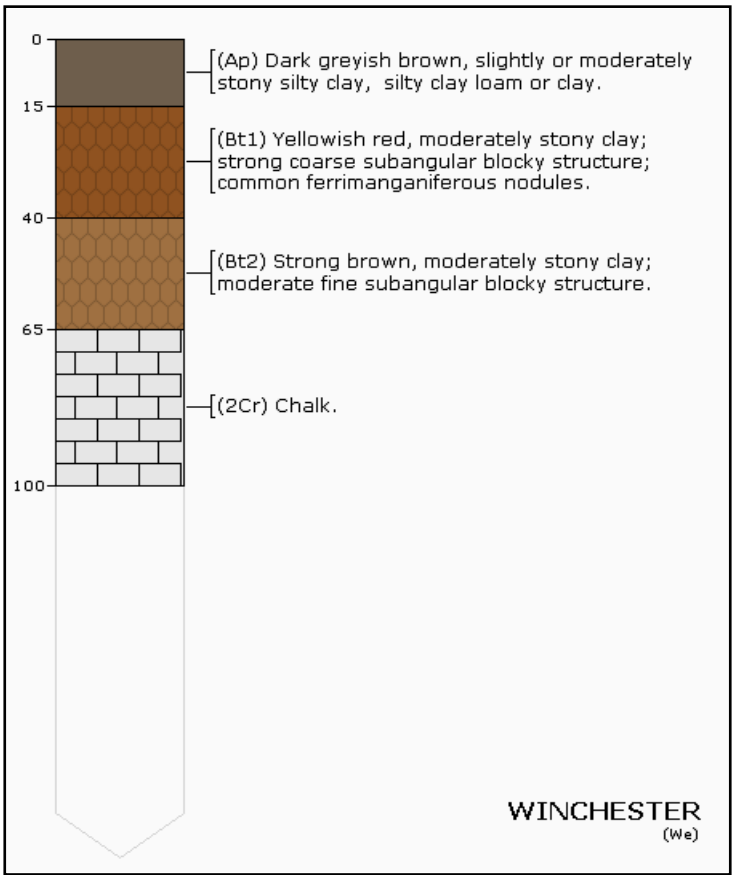
Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

d. CARSTENS Component Series Profiles









CARSTENS (581d)

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

e. Soil Properties

This section provides graphical summaries of selected attribute data available for the component series in this association. The blue bars of the graphs presented in this section describe the range of property values for all soils across England and Wales. Superimposed on these graphs are the values for the component soil series in this association. This has been done to provide the reader with an understanding of where each property for each series sits within the national context.

Soil Series	Description	Area %
CARSTENS (CX)	medium silty over clayey drift with siliceous stones	60%
CHARITY (Cr)	medium silty drift with siliceous stones	10%
GIVENDALE (gV)	clayey drift with siliceous stones	10%
WINCHESTER (We)	clayey material over lithoskeletal chalk	10%
OTHER	other minor soils	10%

Table 4. The component soil series of the CARSTENS soil association. Because absolute proportions of the comprising series in this association vary from location to location, the national proportions are provided.

e(i). Soil Depth Information and Depths to Important Layers

Depth to rock A mean depth to bedrock or very stony rubble which has been assigned to each soil series based on observed and recorded soil profiles.

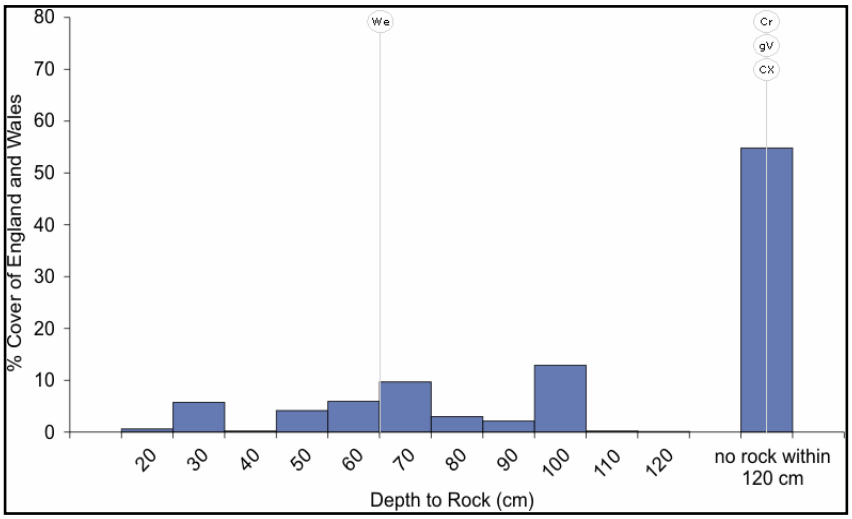


Figure 41. Depth of soil to Rock

Depth to gleying, the presence of grey and ochreous mottles within the soil, is caused by intermittent waterlogging. A mean depth to gleying has been assigned to each soil series based on observed and recorded soil profiles. The definition of a gleyed layer is designed to equate with saturation for at least 30 days in each year or the presence of artificial drainage.

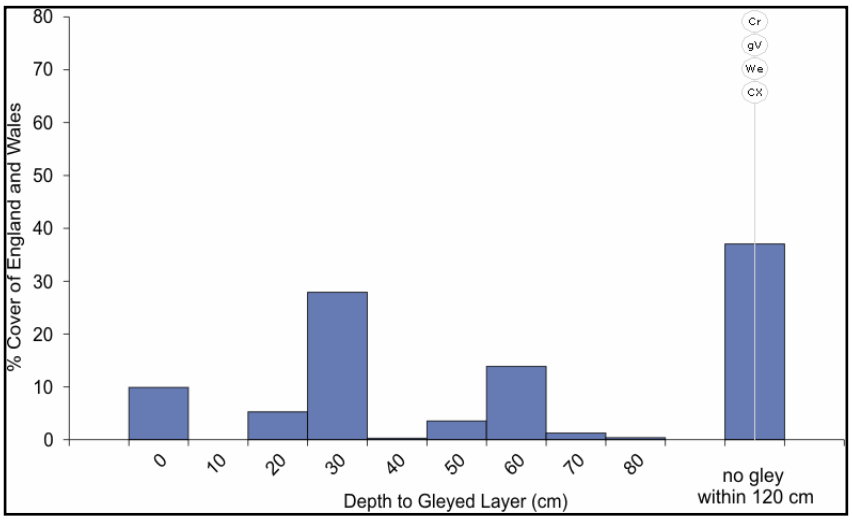


Figure 42. Depth of Soil to Gleying

CARSTENS (581d)

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

e(i). Soil Depth Information and Depths to Important Layers continued

Depth to slowly permeable layer (downward percolation) A mean depth to a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede downward percolation of excess soil water. This causes periodic saturation in the overlying soil, reduced storage capacity and therefore increased hydrological response to rainfall events.

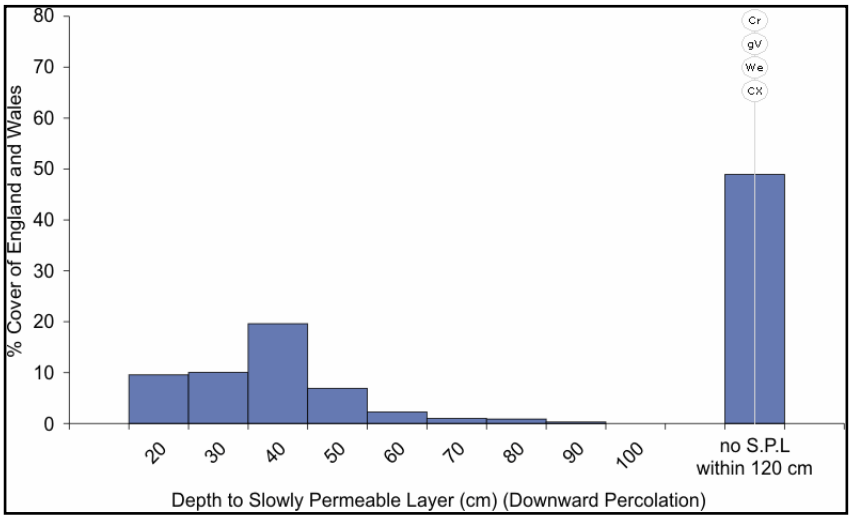


Figure 43. Depth to slowly permeable layer (downward percolation)

Depth to Slowly Permeable Layer (upward diffusion) A mean depth to the bottom of a layer with lateral hydraulic conductivity of <10 cm per day has been assigned to each soil series based on observed and recorded soil profiles. Such layers can be defined in terms of their particular soil textural and structural conditions and impede upward diffusion of water and gasses.

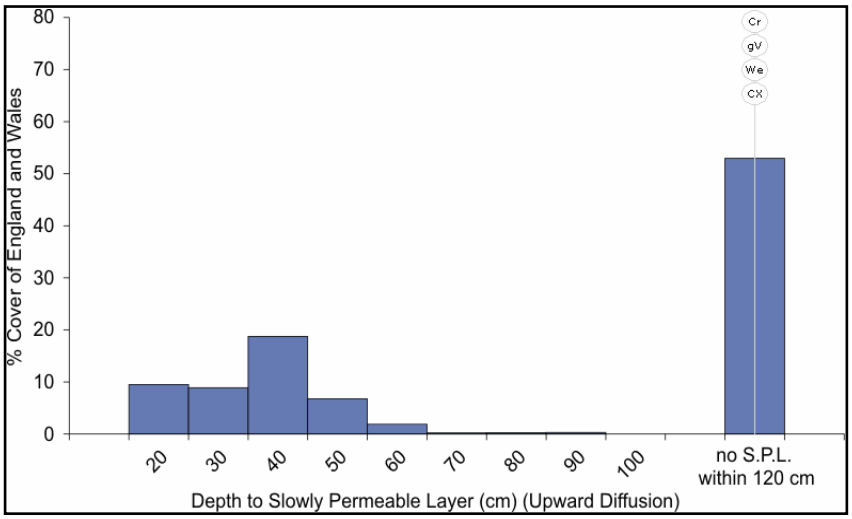


Figure 44. Depth to Slowly Permeable Layer (upward diffusion)

CARSTENS (581d)

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

e(ii). Soil Hydrological Information

Integrated air capacity (IAC) is the total coarse pore space (>60 μm diameter) to 1 m depth. This size of pore would normally be air-filled when the soil is fully moist but not waterlogged. A large IAC means that the soil is well aerated. This will encourage root development and, provided near surface soil structure is well developed, will allow rainfall to percolate into the ground thus mitigating against localised flooding.

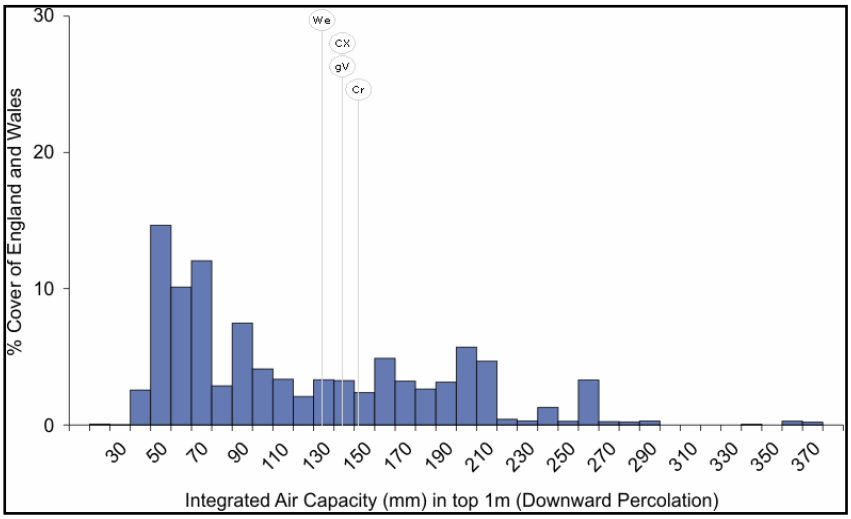


Figure 45. Integrated Air Capacity

Standard Percentage Runoff (SPR) is the percentage of rainfall that causes the short-term increase in flow seen at a catchment outlet following a storm event. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

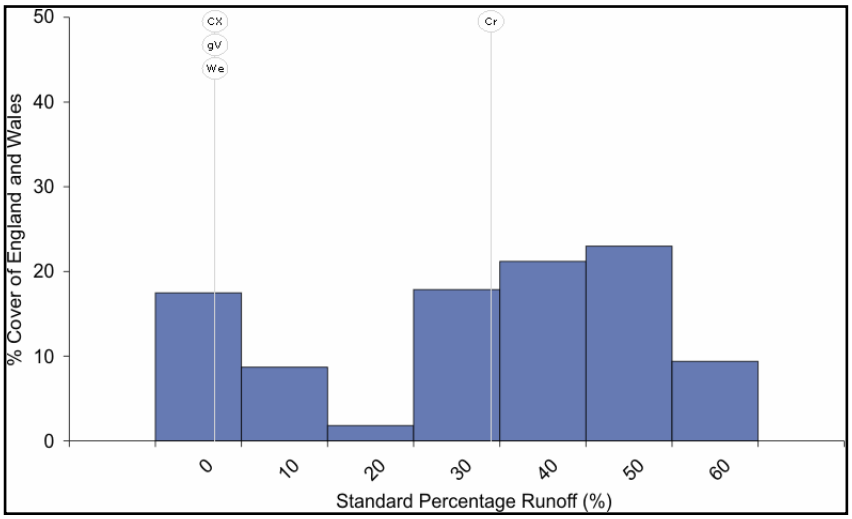


Figure 46. Standard Percentage Runoff

Base flow index is calculated from daily river flow data and expresses the volume of base flow of a river as a fraction of the total flow volume. The values associated with individual soil series have been calculated from an analysis of the relationships between flow data and the soils present within the catchment for several hundred gauged catchments.

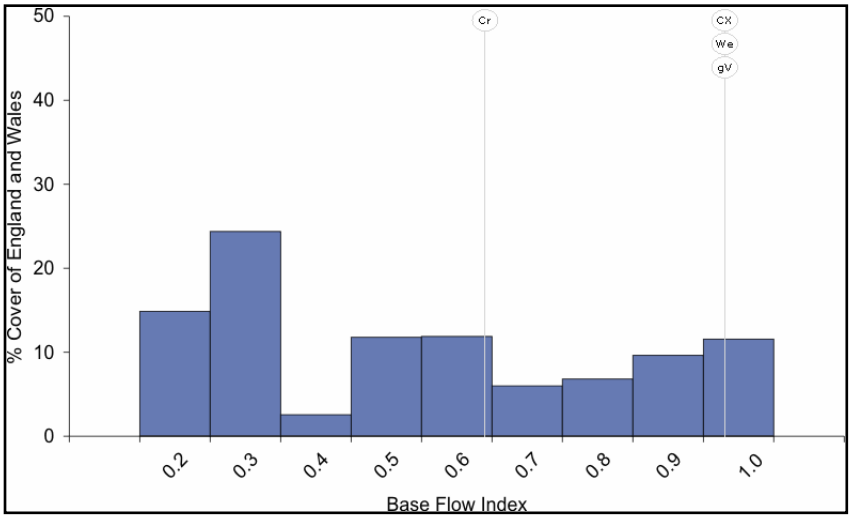


Figure 47. Base Flow Index

CARSTENS (581d)

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

e(iii). Available Water Content

Available water content for plants varies depending on a number of factors, including the rooting depth of the plants. Described below are differing available water contents for cereals, sugar beet, grass and potato crops, as well as a generic available water value to 1 m depth.

Available water (by crop) Available water content to 1 m for the specified soil series between suctions of 5 and 1500kPa.

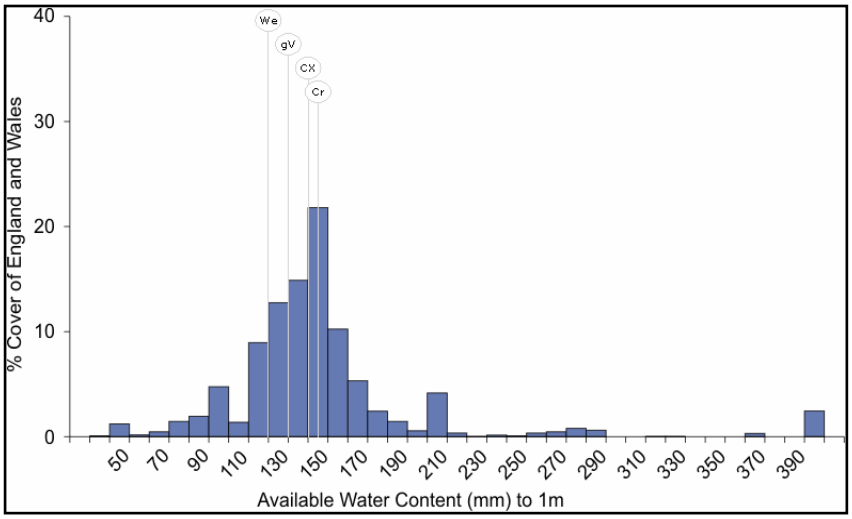


Figure 48. Available Water (by crop)

Available water for grass represents the water that is available to a permanent grass sward that is able to root to 100cm depth.

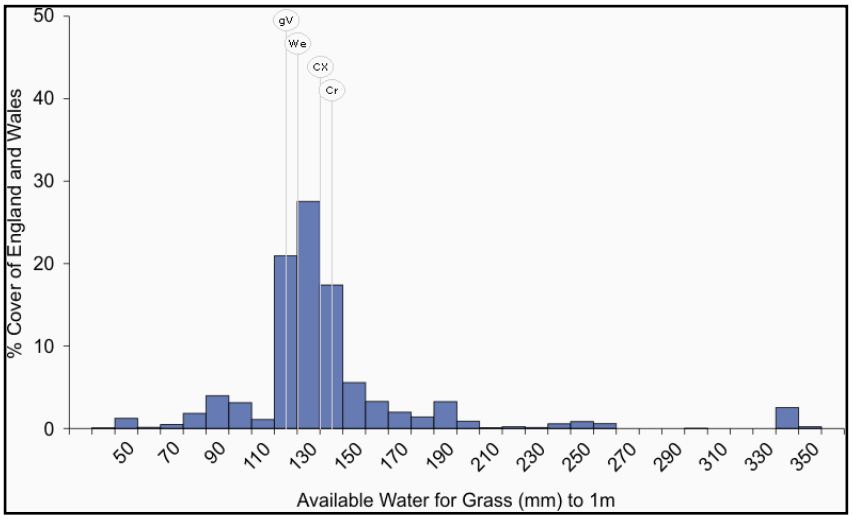


Figure 49. Available Water for Grass

CARSTENS (581d)

Well drained fine silty over clayey, clayey and fine silty soils, often very flinty.

e(iii). Available Water Content continued

Available water for cereal represents the water that is available to a cereal crop that is able to root to 120cm depth.

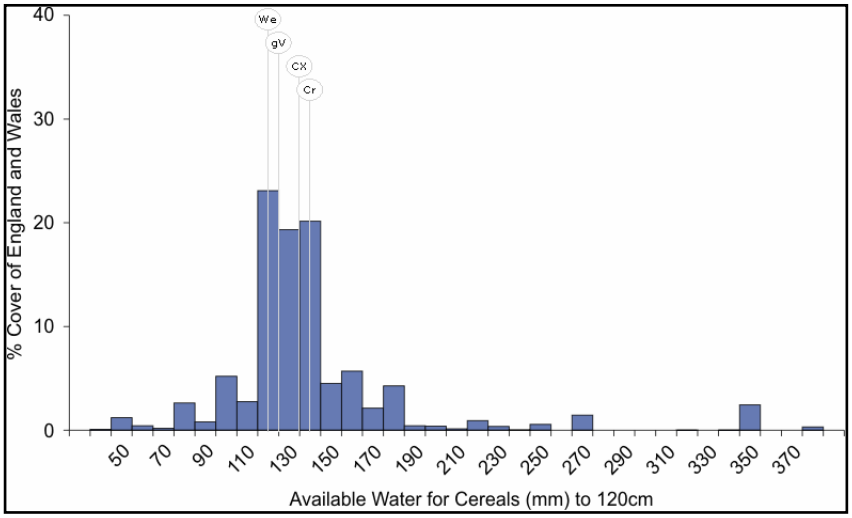


Figure 50. Available Water for Cereal

Available water for Sugar Beet represents the water that is available to a sugar beet crop that is able to root to 140cm depth.

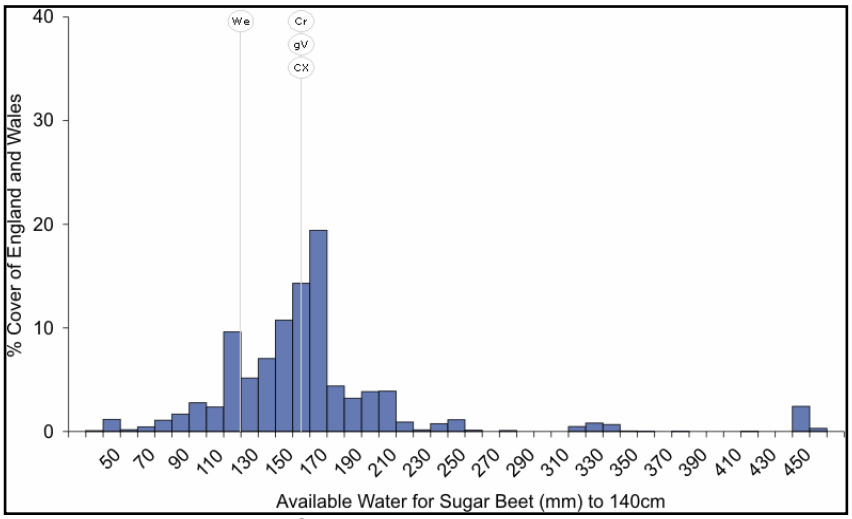


Figure 51. Available Water for Sugar Beet

Available water for Potatoes represents the water that is available to a potato crop that is able to root to 70cm depth.

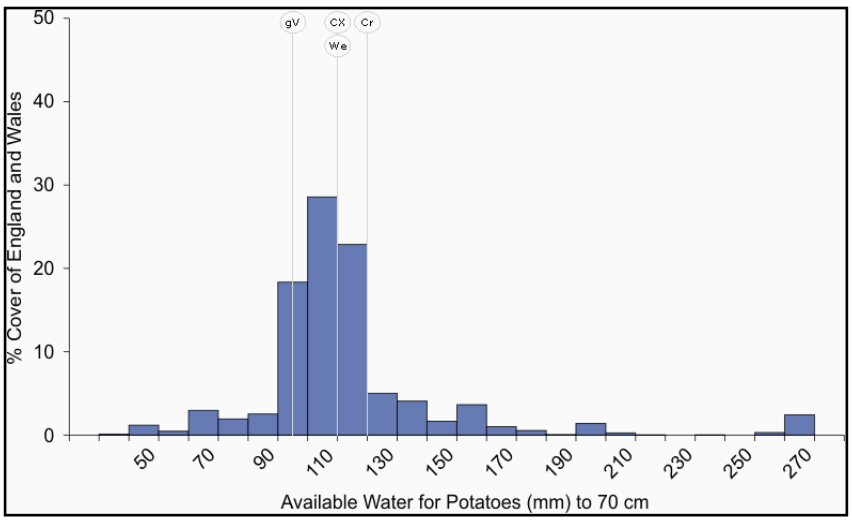
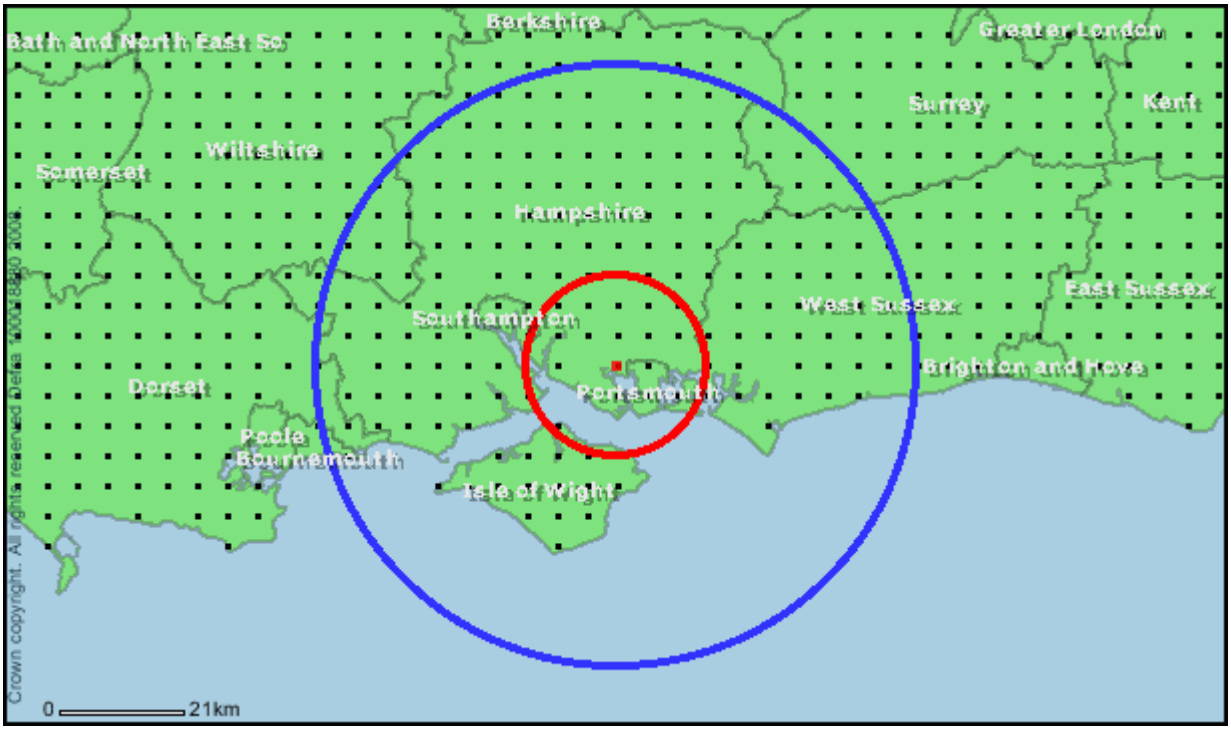


Figure 52. Available Water for Potatoes

3. TOPSOIL ELEMENT BACKGROUND LEVELS



TOPSOIL ELEMENT BACKGROUND LEVELS KEY

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

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.

3a. Analyses Within a 15 km Radius (18 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST. DEV
pH (PH)	17	6.2	4.0	7.8	1.3
Carbon (CARBON)	18	3.4	1.0	6.9	1.5
Aluminium (AL_ACID)	18	20,197.2	8,970.0	37,812.0	7,891.0
Arsenic (AS_ACID)	6	2.2	1.2	4.0	1.0
Barium (BA_ACID)	18	81.1	30.0	160.0	38.6
Calcium (CA_ACID)	18	53,741.9	283.0	264,175.0	97,647.0
Cadmium (CD_ACID)	18	0.8	0.0	2.6	0.8
Cadmium (Extractable) (CD_EDTA)	18	0.4	0.1	1.5	0.3
Cobalt (CO_ACID)	18	7.7	2.6	17.7	3.4
Cobalt (Extractable) (CO_EDTA)	18	1.0	0.1	3.5	0.9
Chromium (CR_ACID)	18	30.3	2.0	51.7	12.0
Copper (CU_ACID)	18	18.8	4.7	62.0	16.5
Copper (Extractable) (CU_EDTA)	18	5.7	0.7	25.3	7.2
Flouride (F_ACID)	7	56.6	0.0	120.5	52.6
Iron (FE_ACID)	18	18,636.4	7,852.0	28,113.0	6,407.5
Mercury (HG_ACID)	5	0.0	0.0	0.0	0.0
Potassium (K_ACID)	18	3,279.2	1,264.0	5,903.0	1,198.7
Potassium (Extractable) (K_NITRATE)	17	210.8	71.0	713.0	158.1
Magnesium (MG_ACID)	18	2,368.5	833.0	3,803.0	807.8
Magnesium (Extractable) (MG_NITRATE)	17	153.8	30.0	1,019.0	233.9
Manganese (MN_ACID)	18	593.4	93.0	2,398.0	565.0
Manganese (Extractable) (MN_EDTA)	18	134.4	8.0	893.0	210.5
Molybdenum (MO_ACID)	14	0.4	0.0	1.2	0.3
Sodium (NA_ACID)	18	524.9	93.0	5,724.0	1,299.0
Nickel (NI_ACID)	18	16.2	4.8	33.7	8.7
Nickel (Extractable) (NI_EDTA)	18	1.3	0.3	2.8	0.9
Phosphorus (P_ACID)	18	863.9	190.0	2,554.0	693.3
Phosphorus (Extractable) (P_OLSEN)	17	32.6	3.0	105.0	34.7
Lead (PB_ACID)	18	88.8	12.0	402.0	107.9
Lead (Extractable) (PB_EDTA)	18	36.9	2.6	264.2	63.3
Selenium (SE_ACID)	6	0.4	0.0	0.7	0.2
Strontium (SR_ACID)	18	94.9	2.0	445.0	137.1
Vanadium (V_ACID)	14	28.1	0.0	79.7	20.8
Zinc (ZN_ACID)	18	77.7	27.0	195.0	51.9
Zinc (Extractable) (ZN_EDTA)	18	11.5	1.9	61.8	15.2

for units, see Analyses Definitions (p58)

3b. Analyses Within a 50 km Radius (199 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST. DEV
pH (PH)	197	6.4	3.6	8.5	1.4
Carbon (CARBON)	198	4.5	0.4	26.1	4.0
Aluminium (AL_ACID)	198	20,968.5	491.0	53,770.0	11,554.2
Arsenic (AS_ACID)	111	3.0	0.0	20.8	2.5
Barium (BA_ACID)	198	87.6	11.0	507.0	55.1
Calcium (CA_ACID)	198	43,452.5	132.0	288,025.0	76,672.0
Cadmium (CD_ACID)	198	0.8	0.0	3.2	0.7
Cadmium (Extractable) (CD_EDTA)	197	0.3	0.0	1.8	0.3
Cobalt (CO_ACID)	198	9.6	0.2	48.3	7.7
Cobalt (Extractable) (CO_EDTA)	197	1.2	0.0	9.3	1.6
Chromium (CR_ACID)	198	30.2	0.6	81.5	15.1
Copper (CU_ACID)	198	13.2	1.2	62.0	9.1
Copper (Extractable) (CU_EDTA)	197	3.3	0.3	25.3	3.4
Flouride (F_ACID)	149	45.8	0.0	509.0	53.1
Iron (FE_ACID)	198	20,769.6	430.0	83,675.0	12,488.0
Mercury (HG_ACID)	63	0.1	0.0	1.8	0.2
Potassium (K_ACID)	198	3,124.6	60.0	11,726.0	1,757.6
Potassium (Extractable) (K_NITRATE)	195	174.8	22.0	766.0	121.8
Magnesium (MG_ACID)	198	2,266.1	41.0	7,035.0	1,304.2
Magnesium (Extractable) (MG_NITRATE)	195	111.7	12.0	1,241.0	146.6
Manganese (MN_ACID)	198	855.6	3.0	4,392.0	769.8
Manganese (Extractable) (MN_EDTA)	197	163.5	1.0	1,534.0	221.4
Molybdenum (MO_ACID)	188	0.5	0.0	5.8	0.8
Sodium (NA_ACID)	198	271.8	31.0	5,724.0	594.4
Nickel (NI_ACID)	198	18.3	0.0	69.6	13.2
Nickel (Extractable) (NI_EDTA)	197	1.1	0.1	7.4	1.1
Phosphorus (P_ACID)	198	745.8	44.0	2,554.0	490.1
Phosphorus (Extractable) (P_OLSEN)	195	27.6	1.0	160.0	24.2
Lead (PB_ACID)	198	40.9	3.0	402.0	44.3
Lead (Extractable) (PB_EDTA)	197	16.2	1.4	274.4	29.8
Selenium (SE_ACID)	111	0.4	0.0	5.1	0.6
Strontium (SR_ACID)	198	82.2	2.0	485.0	114.8
Vanadium (V_ACID)	187	33.8	0.0	150.1	22.8
Zinc (ZN_ACID)	198	65.4	6.0	195.0	36.9
Zinc (Extractable) (ZN_EDTA)	197	6.5	1.1	61.8	6.8

for units, see Analyses Definitions (p58)

3c. National Analyses (5686 Sample Points)

ANALYSES	SAMPLES	MEAN	MIN	MAX	ST. DEV
pH (PH)	5,630	6.0	3.1	9.2	1.3
Carbon (CARBON)	5,672	6.1	0.1	61.5	8.9
Aluminium (AL_ACID)	5,677	26,775.3	491.0	79,355.0	12,772.2
Arsenic (AS_ACID)	2,729	4.6	0.0	110.0	5.7
Barium (BA_ACID)	5,677	150.0	7.0	3,840.0	159.5
Calcium (CA_ACID)	5,677	13,768.7	0.0	339,630.0	37,785.0
Cadmium (CD_ACID)	5,677	0.7	0.0	40.9	1.0
Cadmium (Extractable) (CD_EDTA)	5,655	0.5	0.0	85.0	3.0
Cobalt (CO_ACID)	5,677	10.6	0.0	567.0	13.7
Cobalt (Extractable) (CO_EDTA)	5,655	1.1	0.0	26.5	1.2
Chromium (CR_ACID)	5,677	38.9	0.0	2,339.8	43.7
Copper (CU_ACID)	5,677	22.6	0.0	1,507.7	36.8
Copper (Extractable) (CU_EDTA)	5,655	6.4	0.3	431.4	11.1
Flouride (F_ACID)	3,320	58.5	0.0	6,307.9	186.2
Iron (FE_ACID)	5,677	28,147.8	395.0	264,405.0	16,510.5
Mercury (HG_ACID)	2,159	0.1	0.0	2.4	0.2
Potassium (K_ACID)	5,677	4,727.7	60.0	23,905.0	2,700.2
Potassium (Extractable) (K_NITRATE)	5,609	182.0	6.0	2,776.0	151.6
Magnesium (MG_ACID)	5,677	3,648.1	0.0	62,690.0	3,284.1
Magnesium (Extractable) (MG_NITRATE)	5,609	146.0	1.0	1,601.0	147.5
Manganese (MN_ACID)	5,677	777.0	3.0	42,603.0	1,068.8
Manganese (Extractable) (MN_EDTA)	5,654	159.4	0.0	3,108.0	188.6
Molybdenum (MO_ACID)	4,417	0.9	0.0	56.3	2.0
Sodium (NA_ACID)	5,677	323.3	17.0	25,152.0	572.3
Nickel (NI_ACID)	5,677	25.4	0.0	1,350.2	29.2
Nickel (Extractable) (NI_EDTA)	5,655	1.6	0.1	73.2	2.0
Phosphorus (P_ACID)	5,677	792.1	41.0	6,273.0	433.9
Phosphorus (Extractable) (P_OLSEN)	5,604	27.4	0.0	534.0	25.5
Lead (PB_ACID)	5,677	73.3	0.0	17,365.0	280.6
Lead (Extractable) (PB_EDTA)	5,655	27.8	1.2	6,056.5	119.7
Selenium (SE_ACID)	2,729	0.6	0.0	22.8	0.8
Strontium (SR_ACID)	5,677	42.3	0.0	1,445.0	67.8
Vanadium (V_ACID)	4,428	41.0	0.0	854.4	33.9
Zinc (ZN_ACID)	5,677	90.2	0.0	3,648.0	104.4
Zinc (Extractable) (ZN_EDTA)	5,655	9.6	0.5	712.0	24.6

for units, see Analyses Definitions (p58)

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	480
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

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

ANALYSES DEFINITIONS continued

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 Spectrometyr (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

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 Spectrometyr (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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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:

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