

# M5 Junction 10 Improvements Scheme

Environmental Statement (ES)

Appendix 10.5 Agricultural Land Survey Report -

Flood Storage Area

TR010063 - APP 6.15

Regulation 5 (2) (a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

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# Infrastructure Planning Planning Act 2008

## The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

### M5 Junction 10 Improvements Scheme Development Consent Order 202[x]

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#### 6.15 Environmental Statement (ES)

#### Appendix 10.5 Agricultural Land Survey Report - Flood Storage Area

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This report provides an assessment of the agricultural land quality in the area immediately to the south east of M5 Junction 10. Within the Scheme design this area is referred to as the Flood storage area.

Whilst this report refers to this area as the Flood compensation area, the areas are the same.



# **Agricultural Land Classification:**

J10 M5 Flood Compensation Area

Prepared for:

**Atkins**

Prepared by:

**Askew Land & Soil Limited**

Date:

**25<sup>th</sup> October 2021**

Project Number:

**C831**

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### APPENDICES

Appendix 1:	Soil Profile Logs
Appendix 2:	Soil Pit Description
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*Our interpretation of the site characteristics is based on available data made during our desktop study and soil survey. This desktop study and soil survey has assessed the characteristics of the site in relation to the assessment of its Agricultural Land Classification. It should not be relied on for alternative end-uses or for other schemes. This report has been prepared solely for the benefit of Atkins.*

# 1 INTRODUCTION

## 1.1 Background

1.1.1 This report was commissioned by Atkins to determine the quality of agricultural land proposed as a flood compensation area at Junction 10 of the M5, Cheltenham, Gloucestershire, GL51 0TH('the Site'). The assessment was made in accordance with the Agricultural Land Classification(ALC) system for England and Wales (see 'Methodology' below). The approximately 20 hectare(ha) Site is located north-west of Cheltenham, Gloucestershire, as shown on **Figure 1**. The approximate centre of the Site is located at British National Grid (BNG) reference SO 90461 25156.

## 1.2 Competency

1.2.1 The work has been carried out by a Chartered Scientist (CSci), who is a Fellow (F.I. Soil Sci) of the British Society of Soil Science (BSSS). The soil surveyor meets the requirements of the BSSS Professional Competency Standard (PCS) scheme for ALC (see BSSS PCSS Document 2 '*Agricultural Land Classification of England and Wales*'<sup>1</sup>). The BSSS PCS scheme is endorsed, amongst others, by the Department for Environment, Food and Rural Affairs (Defra), Natural England, the Science Council, and the Institute of Environmental Assessment and Management (IEMA).

## 1.3 Methodology

1.3.1 This assessment is based upon the findings of a study of published information on climate, geology and soil in combination with a soil investigation carried out in accordance with the Ministry of Agriculture, Fisheries and Food (MAFF)<sup>2</sup> '*Agricultural Land Classification of England and Wales: Revised Guidelines and Criteria for Grading the Quality of Agricultural Land*', October, 1988 (henceforth referred to as the 'the ALC Guidelines').

1.3.2 The ALC system provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long-term limitations on agricultural use. The ALC system divides agricultural land into five grades (Grade 1 '*Excellent*' to Grade 5 '*Very Poor*'), with Grade 3 subdivided into Subgrade 3a '*Good*' and Subgrade 3b '*Moderate*'. Agricultural land classified as Grade 1, 2 and Subgrade 3a falls in the '*best and most versatile*' category in Paragraphs 174 and 175 of the National Planning Policy Framework (NPPF) revised on 20<sup>th</sup> July 2021. Further details of the ALC system and national planning policy implications are set out by Natural England in Technical Information Note 049<sup>3</sup>.

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<sup>1</sup> British Society of Soil Science. Professional Competency Scheme Document 2 '*Agricultural Land Classification of England and Wales*'. Available online at [soil.org.uk](http://soil.org.uk)

<sup>2</sup> The Ministry of Agriculture, Fisheries and Food (MAFF) was incorporated within the Department for Environment, Food and Rural Affairs (Defra) in June 2001

<sup>3</sup> Natural England (December, 2012). '*Agricultural Land Classification: protecting the best and most versatile agricultural land (TIN049)*'.

- 1.3.3 A detailed soil survey and ALC of the Site was carried out on the 14<sup>th</sup> October 2021. The ALC survey involved examination of the soil's physical properties at 20 auger-bore locations at a sampling density of approximately 1 auger bore per 1 ha. The soil profile was examined at each sample location to a maximum depth of approximately 1.2 m by hand with the use of a 5cm diameter Dutch (Edleman) soil auger. One soil pit, i.e., Pit 1 was excavated near to auger-bore 15 by hand with a spade in order to examine certain soil physical properties, such as stone content and the structural condition of the subsoil, more closely. The locations of the auger bores and the soil pit is shown on **Figure 1**.
- 1.3.4 The auger-bore locations were located using a hand-held Garmin E-Trec Geographic Information System (GIS) to enable the sample locations to be relocated for verification, if necessary. Where auger locations on a 100 m grid pattern fall on headland, tramlines, or within 3 m of a hedgerow or tree, they were relocated on agricultural land close by, i.e., to avoid compacted ground or land affected by tree roots, etc.
- 1.3.5 The soil profile at each sample location was described using the 'Soil Survey Field Handbook: Describing and Sampling Soil Profiles' (Ed. J.M. Hodgson, Cranfield University, 1997). Each soil profile was ascribed an Agricultural Land Classification (ALC) grade following the MAFF ALC Guidelines.
- 1.3.6 A sample of topsoil was collected at auger-bore locations 9, 11, and 15, as shown on **Figure 1**. The samples were sent to an accredited laboratory for particle size analysis, i.e., the proportions of sand, silt and clay. This is to determine the definitive texture class of the topsoil, especially with regard to distinguishing between medium clay loams (i.e., <27% clay) and heavy clay loams (27% to 35% clay).

## 1.4 Structure of the Remainder of this Report

- 1.4.1 The remainder of this report is structured as follows:
- Section 2 – Planning Policy Framework
  - Section 3 – Agricultural Land Classification;
    - Climate;
    - Site (Gradient, Micro-relief, Risk of Flooding);
    - Soil (Geology, Soil Properties);
    - Interactive Limitations (Soil Droughtiness, Soil Wetness);
    - ALC Grading at the Site.
  - Section 4 - ALC at the Site in a Wider Geographical Context;
  - Section 5 – Summary and Conclusions

## 2 PLANNING POLICY FRAMEWORK

### 2.1 Background

2.1.1 This section of the report sets out the national and local planning framework in which to assess the opportunities and constraints to development at the Site in agricultural land quality terms.

### 2.2 National Planning Policy Statement (NPPF) July 2021

2.2.1 National planning policy guidance on development involving agricultural land is set out in National Planning Policy Framework (NPPF), which was revised on the 20<sup>th</sup> July 2021. The NPPF aims to provide a simplified planning framework which sets out the Government's economic, environmental and social planning policies for England. The NPPF includes policy guidance on '*Conserving and Enhancing the Natural Environment*' (Section 15). Paragraph 174 (a and b) (page 50) are of relevance to this assessment of agricultural land quality and soil and states that:

*'174...Planning policies and decisions should contribute to and enhance the natural and local environment by:*

*a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);*

*b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;...'*

2.2.2 Paragraph 175 of the NPPF (2021) goes on to describe that:

*'175. Plan should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework<sup>53</sup> ...'*

2.2.3 Footnote number 58 states that:

*'Where significant development of agricultural land is demonstrated to be necessary, areas of poorer quality land should be preferred to those of a higher quality.'*

### 2.3 Best Practice Guidance

2.3.1 The Department for Environment, Food and Rural Affairs (Defra) has published a 'Code of Practice for the Sustainable Use of Soils on Construction Sites'<sup>4</sup>.

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<sup>4</sup> Department for Environment, Food and Rural Affairs (September, 2009) '*Code of Practice for the Sustainable Use of Soils on Construction Sites*'. Available online @ <https://www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites>. Last accessed October 2021



### 3 AGRICULTURAL LAND CLASSIFICATION

#### 3.1 Background

3.1.1 This section of the report sets out the findings of the Agricultural Land Classification (ALC). It is based on a desktop study of relevant published information on climate, topography, geology, and soil in conjunction with a soil survey.

3.1.2 As described in the ALC Guidelines, the main physical factors influencing agricultural land quality are:

- climate;
- site;
- soil; and
- interactive limitations.

3.1.3 These factors are considered in turn below.

#### 3.2 Climate

3.2.1 Interpolated climate data relevant to the determination of the Agricultural Land Classification (ALC) grade of land at the Site is given in the Tables below.

<b>Table 3.1: ALC Climate Data for J10 M5 Flood Compensation Area</b>	
<b>Climate Parameter</b>	<b>Grid Ref: SO904251</b>
Average Altitude (m)	25
Average Annual Rainfall (mm)	624
Accumulated Temperature above 0°C (January – June)	1491
Moisture Deficit (mm) Wheat	114
Moisture Deficit (mm) Potatoes	108
Field Capacity Days (FCD)	138
Grade According to Climate	1

3.2.2 With reference to Figure 1 'Grade according to climate' on page 6 of the ALC Guidelines, there is no climatic limitation to the quality of agricultural land at the Site. This means that agricultural land at the Site would be determined as Grade 1, without any additional limitations.

3.2.3 Agricultural land at the Site is predicted to be at field capacity (i.e., the amount of soil moisture or water content held in soil after excess water has drained away and the rate of downward movement has materially decreased) for 138 Field Capacity Days (FCD) per year, mainly over the late autumn, winter and early spring. The combination of topsoil texture, drainage status (Wetness Class) of the profile, and number of FCD affects the degree to which agricultural land is limited by soil wetness.

### 3.3 Site

3.3.1 The approximately 20 ha Site is located to the north-west of Cheltenham, Gloucestershire. The approximate centre of the Site is located at British National Grid (BNG) reference SO 90461 25156. The location and boundaries of the Site are shown on **Figure 1**.

3.3.2 With regard to the ALC Guidelines, agricultural land quality can be limited by one or more of three main site factors as follows:

- gradient;
- micro-relief (i.e., complex change in slope angle over short distances); and
- risk of flooding.

#### I. Gradient and Micro-Relief

3.3.3 The land at the Site is broadly level at an elevation of between 25 to 26 metres (m) Above Ordnance Datum (AOD), with a localised, dome-shaped area of relatively higher ground in the south-west corner, at approximately 27 to 28 mAOD. The quality of agricultural land at the Site is not limited by gradient, as the gradient of the slope does not exceed 7° (see Table 1 of the ALC Guidelines, 1988). Likewise, the quality of agricultural land at the Site is not limited by micro-relief, i.e., complex changes in slope angle and direction over short distances.

#### II. Risk of Flooding

3.3.4 From the Government Flood Map for Planning website<sup>5</sup>, the Site is mainly located in Flood Zones 2 and 3, with a high probability of flooding. The slightly higher ground in the south-west is in Flood Zone 1, with a low risk of flooding. However, there are no records/data which show the quality of the agricultural land is limited by a risk of flooding in accordance with criteria for frequency and duration set out in Table 2 'Grade according to flood risk in summer' and/or Table 3 'Grade according to flood risk in winter' in the ALC Guidelines.

### 3.4 Soil

#### I. Geology/Soil Parent Material

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<sup>5</sup> Government Flood Map for Planning. Available online @ <https://flood-map-for-planning.service.gov.uk/confirm-location?eastings=454700&northing=272400&nationalGridReference=SP547724> Last accessed October 2021

- 3.4.1 British Geological Survey (BGS) information available online<sup>6</sup> has been utilised to identify the Bedrock underlying the Site and any Superficial (Drift) Deposits over the Bedrock. This information helps to determine the parent material<sup>7</sup> from and within which a soil has formed. The BGS information (1:50,000) indicates that Site is underlain by mudstone in the Charmouth Mudstone Formation.
- 3.4.2 The BGS information (1:50,000) indicates the bedrock across most of the Site is covered by Alluvium (Clay, Silt, Sand, And Gravel). The north-eastern part of the Site is covered by superficial deposits of sand and gravel (i.e., Cheltenham Sand and Gravel). The relatively higher ground in the south-western part of the Site is not covered by any superficial deposits.

## II. Published Information on Soil

- 3.4.3 The Soil Survey of England and Wales (SSEW) soil map of South West England (Sheet 5) at a scale of 1:250,000 and accompanying Bulletin No. 14<sup>8</sup> reports that agricultural land at the Site is mainly covered by soils in the Evesham 2 Association, with smaller regions of Badsey 2 and Fladbury 1 Association.
- 3.4.4 As described by the SSEW, the Evesham 2 Association are developed in Jurassic and Cretaceous clay shales and associated thin drifts in the clay vales of lowland England. The soils of this Evesham association are developed in Jurassic and Cretaceous clay shales and associated thin drifts in the clay vales of lowland England. The unit consists of Evesham series (typical calcareous pelosols) and Denchworth series (pelo-stagnogley soils) which together make up three-quarters of the mapped area. These soils are clayey and have slowly permeable subsoils. In contrast, Wickham (typical stagnogley soils) and Oxpasture soils occur where loamy drift covers the shales, and locally non-calcareous Holdenby soils occur in clayey drift. Occasional limestone bands in the clay shales give ancillary Haselor profiles. The river valleys crossing the broad clay vales have Fladbury, Thames, Uffington (Allen and Sturdy 1980) and Wyre soils in clayey alluvium. Evesham and Denchworth soils are slowly permeable and are generally seasonally waterlogged (Wetness Class III). On low-lying sites Denchworth and Wickham soils are waterlogged for long periods (Wetness Class IV), occasionally into the growing season.
- 3.4.5 The Badsey 2 Association comprise mainly of fine loamy soils over calcareous gravel. The soils are moderately to very porous over extremely porous gravelly subsoils and are largely well drained (Wetness Class I), in which winter rainwater is readily absorbed.

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<sup>6</sup> British Geological Survey 'Geology of Britain Viewer'. Available online @ <http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html> Last accessed October 2021

<sup>7</sup> British Geological Survey. A 'parent material' is a soil-science name for a weathered rock or deposit from and within which a soil has formed. In the UK, parent materials provide the basic foundations and building blocks of the soil, influencing their texture, structure, drainage and chemistry. Available online @ [Soil Parent Material Model - British Geological Survey \(bgs.ac.uk\)](http://www.bgs.ac.uk/soil-parent-material-model/) Last accessed October 2021

<sup>8</sup> D.C. Findlay, G.J.N. Colborne, D.W. Cope, T.R. Harrod, D.V. Hogan, and S.J. Stains (1984) 'Soils and their use in Eastern England', Soil Survey of England and Wales Bulletin No.14, Harpenden

- 3.4.6 The soils in the Fladbury 1 Association consist of deep clayey alluvial soils which are widespread on flat valley floors. The subsoils are usually slowly permeable, yet the primary source of waterlogging is groundwater which fluctuates seasonally with changes in the river level. The duration of waterlogging is often related to elevation and in winter months, a water-table is at shallow depth for long periods (Wetness Class IV) and locally they suffer prolonged waterlogging (Wetness Class V).

### III. Soil Survey

- 3.4.7 The ALC/soil survey determined three types of soil, as described below.

#### Type 1

- 3.4.8 The first, and predominant type of soil extended from the south-east to the north-west on low-lying ground covered by alluvium (see 'Geology' above). The non-calcareous soils consist of light olive brown (Munsell colour 2.5Y5/3), very slightly stony (1% hard gravel) to stoneless silty clay or clay topsoil over light olive brown (2.5Y5/4) clay upper subsoil. The similarly coloured lower-subsoil (2.5Y5/6) had common ochreous mottles (7.5YR5/8) and a weakly developed, coarse prismatic structure. The depth to the top of a slowly permeable layer (SPL), in terms of the ALC Guidelines, was approximately 70cm, and the profiles are placed in Wetness Class III accordingly. This type of soil is comparable with those described by the SEEW as being in the Fladbury 1 Association.

#### Type 2

- 3.4.9 The second type of soil occurs in the north-eastern part of the Site covered by Cheltenham Sand and Gravels. Here the topsoil is a non-calcareous to very slightly calcareous (<1% calcium carbonate), dark greyish brown (2.5Y4/2), very slightly stony (2% hard gravel), sandy clay loam or heavy clay loam. The upper subsoil is a slightly calcareous (1-5% calcium carbonate), light olive brown (2.5Y5/3), slightly stony (8% hard gravel), sandy clay loam. The lower subsoil is a light brownish grey (2.5Y6/2) sandy clay, which is moderately calcareous (5-10% calcium carbonate) to very calcareous (>10% calcium carbonate) and is very stony (70% gravel). These profiles do not have an SPL and are permeable (Wetness Class I). This type of soil fits SSEW's description of soils in the Badsey 2 Association.

#### Type 3

- 3.4.10 The third type of soil occurs on the slightly higher, domed-shaped land in the south-west corner of the Site. This land is not covered by any superficial deposits and the soil are developed in the Charmouth Mudstone (see 'Geology' above). This gives rise to soils with slightly calcareous (1-5% calcium carbonate) and stoneless to very slightly stony (3% hard gravel) dark greyish brown (2.5Y5/2) clay topsoil. The upper subsoil is a moderately calcareous (5-10% calcium carbonate), stoneless light olive brown (2.5Y5/4) clay with a few, distinct, ochreous mottles (10YR5/8). The lower subsoil is a moderately calcareous (1-5% calcium carbonate), stoneless light olive brown (2.5Y5/3) clay with common, distinct, ochreous mottles (10YR5/6). Below a depth of 60cm, the olive grey (5Y4/2) clay is strongly calcareous (>10% calcium carbonate) and has many distinct, ochreous mottles (10YR5/8) and many,

distinct, grey mottles (5Y6/1). The top of a SPL was recorded at approximately 43cm and the profiles are placed in Wetness Class III.

- 3.4.11 A log of the soil profiles recorded on Site (see Figure 1) is given as **Appendix 1**. A description of one soil pit (soil Pit 1) is given as **Appendix 2**.

### Topsoil Texture

- 3.4.12 The texture of the topsoil was determined on Site by hand-texturing, as described in Natural England's Technical Information Note 037 'Soil Texture'<sup>9</sup>. To substantiate topsoil texture determined during the ALC survey by hand-texturing, three sample of topsoil were collected over the Site (i.e., auger bore locations 9, 11 and 15, **Figure 1**). The samples of topsoil were sent to an accredited laboratory for analysis of particle size distribution (PSD), based on the British Standard Institution particle size grades. The certificate of analysis is provided as **Appendix 3**. The findings of the PSD analysis are shown in Table 3.2 below:

<b>Topsoil Sample Location (See Fig. 1)</b>	<b>% sand 0.063-2.0 mm</b>	<b>% silt 0.002- 0.063 mm</b>	<b>% clay &lt;0.002 mm</b>	<b>ALC Soil Texture Class</b>
<b>AB9 (Soil Type 2)</b>	45	27	28	Heavy Clay Loam
<b>AB11 (Soil Type 1)</b>	14	48	38	Silty Clay
<b>AB15 (Soil Type 3)</b>	15	44	41	Clay

## 3.5 Interactive Limitations

- 3.5.1 From the published information above, together with the findings of the detailed soil survey, it has been determined that the quality of agricultural land at the Site is limited mainly by soil wetness during the autumn and winter, and by soil droughtiness during the growing season (spring and summer).

### I. Soil Wetness

- 3.5.2 From the ALC Guidelines, a soil wetness limitation exists where *'the soil water regime adversely affects plant growth or imposes restrictions on cultivations or grazing by livestock'*. Agricultural land quality at the Site is limited by soil wetness as per Table 3.3 below (based on Table 6 'Grade According to Soil Wetness – Mineral Soils' in the ALC Guidelines):

<sup>9</sup> Natural England's Technical Information Note 037 'Soil Texture'. Available online at <http://publications.naturalengland.org.uk/publication/32016>

<b>Table 3.3: ALC Grade According to Soil Wetness</b>		
<b>Wetness Class</b>	<b>Texture of the Top 25 cm</b>	<b>126 - 150 Field Capacity Days</b>
<b>I</b>	Sandy Loam, Sandy Silt Loam	1
	Medium Clay Loam*, Sandy Clay Loam	1
	Heavy Silty Clay Loam**, Heavy Clay Loam**	2
	Sandy Clay, Silty Clay, Clay	3a (2)
<b>II</b>	Sandy Loam, Sandy Silt Loam	1
	Medium Clay Loam*, Sandy Clay Loam	2
	Heavy Silty Clay Loam**, Heavy Clay Loam**	3a (2)
	Sandy Clay, Silty Clay, Clay	3b (3a)
<b>III</b>	Sandy Loam, Sandy Silt Loam	2
	Medium Clay Loam*, Sandy Clay Loam	3a (2)
	Heavy Silty Clay Loam**, Heavy Clay Loam**	3b (3a)
	Sandy Clay, Silty Clay, Clay	3b (3a)
<b>Key</b> * <27% clay; and ** >27% clay ( ) bracket denote a grade uplift for naturally calcareous soils with more than 1% calcium carbonate and between 18% and 50% clay		

3.5.3 In a climate area with 138 FCD, soil profiles on Site are limited by soil wetness as follows:

- (i) Type 1 soils in Wetness Class III with non-calcareous clay topsoil are limited by soil wetness to Subgrade 3b;
- (ii) Type 2 soils in Wetness Class I with non-calcareous heavy clay topsoil are limited by slight soil wetness to Grade 2. It should be noted that Type 2 soils with non-calcareous to slightly calcareous, sandy clay loam topsoil in Wetness Class I are not limited by soil wetness; and
- (iii) Type 3 soils in Wetness Class III with slightly calcareous (1-5% calcium carbonate), clay topsoil are limited by soil wetness to Subgrade 3a (NB, there is a grade uplift as the topsoil has more than 1% calcium carbonate and the has between 18% and 50% clay content).

## **II. Soil Droughtiness**

3.5.4 From the ALC Guidelines, a soil droughtiness limitation exists *'in areas with relatively low rainfall or high evapotranspiration, or where the soil holds only small reserves of moisture available to plant roots.'* The ALC grade according to soil droughtiness is shown in Table 3.4 below (based on Table 8 'Grade According to Droughtiness' in the ALC Guidelines). To be eligible for Grades 1 to 3b the moisture balances (MBs) must be equal to, or exceed, the stated minimum values for *both* wheat and potatoes. If the MB for *either* crop is less (i.e., more negative) than that shown for Subgrade 3b, the soil is Grade 4 on droughtiness):

Grade/Subgrade	Moisture Balance (MB) Limits (mm)	
	Wheat	Potatoes
1	+30	+10
2	+5	-10
3a	-20	-30
3b	-50	-55
4	<-50	<-55

3.5.5 As determined by MB calculations given in **Appendix 1**, the MB value for wheat and potatoes limits the quality of agricultural land with Type 2 soils in the north-eastern part of the Site (c.f. Badsey soils developed over Cheltenham Sand and Gravel) are limited by soil droughtiness to Subgrade 3a, i.e., a shortage of water in the soil for crops during the growing season.

### 3.6 ALC Grading at the Site

3.6.1 The area of land in each ALC grade has been measured from **Figure 2** and the area (ha) and proportion (% of Site) is given in Table 3.5.

ALC Grade	Area (Ha)	Area (%)
Grade 1 (Excellent)	0	0
Grade 2 (Very Good)	0	0
Subgrade 3a (Good)	6.8	34.7
Subgrade 3b (Moderate)	12.8	65.3
Grade 4 (Poor)	0	0
Grade 5 (Very Poor)	0	0
Other Land / Non-agricultural	0	0
<b>Total</b>	<b>19.6</b>	<b>100</b>

## 4 ALC AT THE SITE IN A WIDER GEOGRAPHICAL CONTEXT

### 4.1 Introduction

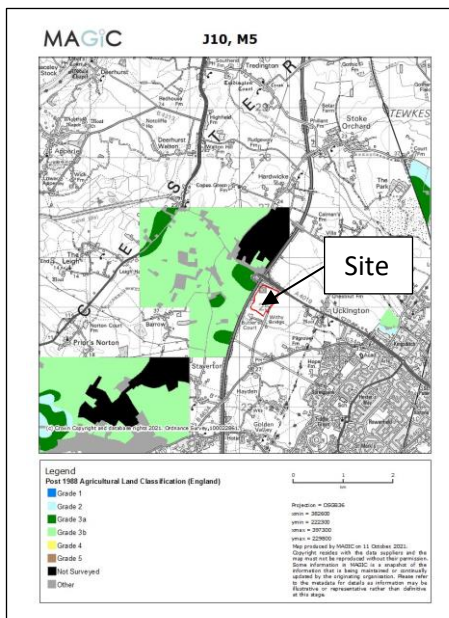
4.1.1 The aim of this section is to examine agricultural land quality at the Site in a national, regional, county and local context.

### 4.2 Pre-1988 ALC Information

4.2.1 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 appropriate for land areas greater than 80 ha. The provisional MAFF ALC map of Eastern England (1:250,000, 1984) indicates that the quality of agricultural land at the Site is Grade 3 (not differentiated into Subgrade 3a or Subgrade 3a).

### 4.3 Post-1988 ALC Information

4.3.1 The former MAFF has not carried a Post-1988 ALC survey of agricultural land covering the Site. An extract from the Post-1988 Agricultural Land Classification map online<sup>10</sup> surrounding the Site is given below.



4.3.2 As shown on the Post-1988 ALC survey above, MAFF has classified agricultural land close to the Site, to the west of the M5, as predominantly Subgrade 3b with pockets of Subgrade 3a. Therefore, the grading at the Site is consistent with MAFF Post 1988 ALC in the vicinity.

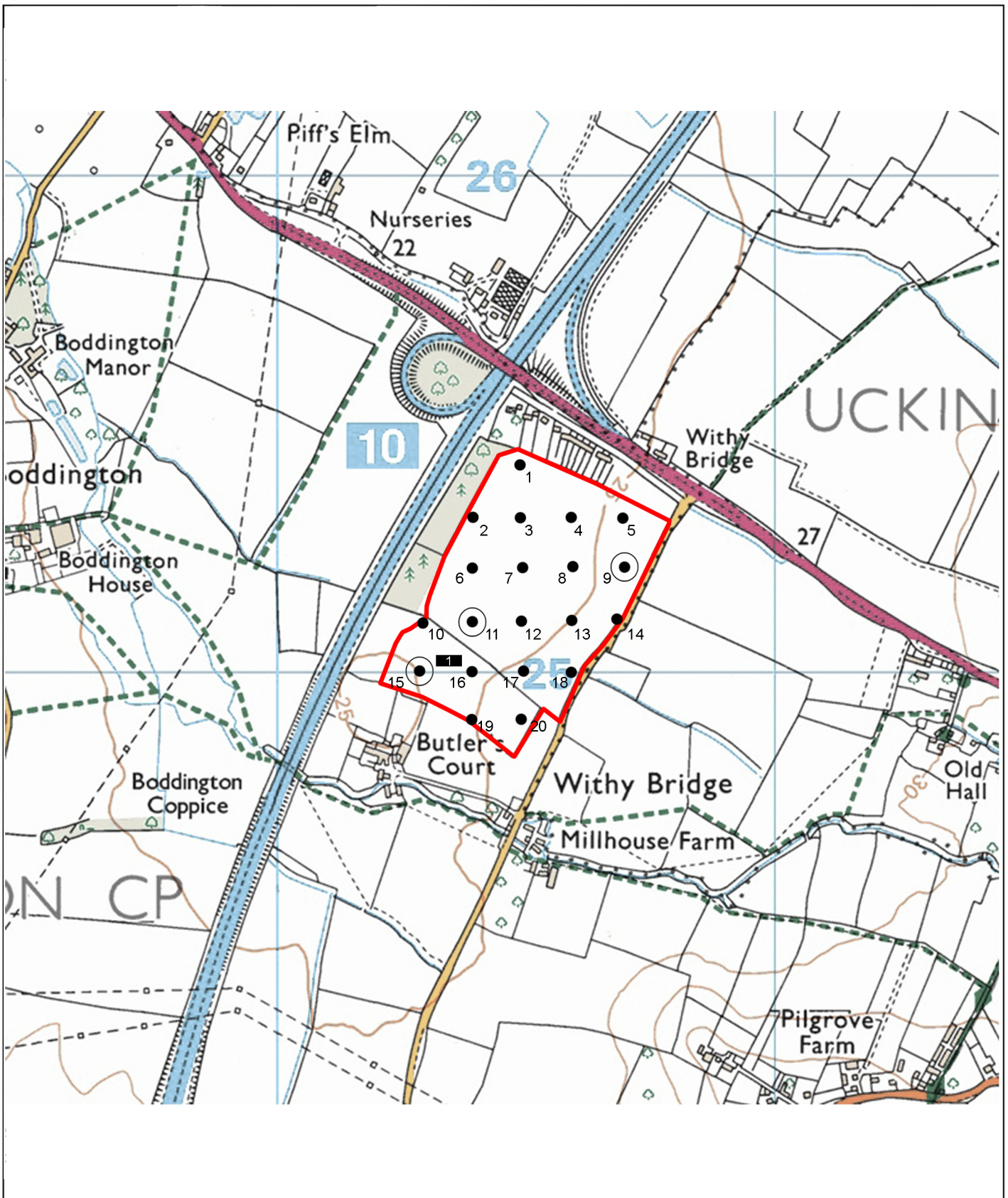
<sup>10</sup> Multi Agency Geographic Information for the Countryside. Post 1988 Agricultural Land Classification. Available online @ [www.MAGIC.gov.uk](http://www.MAGIC.gov.uk) Last accessed October 2021



## 5 SUMMARY AND CONCLUSIONS

- 5.1.1 This report was commissioned by Atkins to determine the quality of agricultural land proposed for a flood compensation area near Junction 10 of the M5 ('the Site'). The assessment was made in accordance with the Agricultural Land Classification (ALC) system for England and Wales. The approximately 20 hectare (ha) Site is located north west of Cheltenham, Gloucestershire. The approximate centre of the Site is located at British National Grid (BNG) reference SO 90461 25156.
- 5.1.2 British Geological Survey (BGS) information (1:50,000) indicates that Site is underlain by mudstone in the Charmouth Mudstone Formation. The bedrock across most of the Site is covered by Alluvium (Clay, Silt, Sand, And Gravel). The north-eastern part of the Site is covered by superficial deposits of sand and gravel (i.e., Cheltenham Sand and Gravel). Some relatively higher ground in the south-western part of the Site is not covered by any superficial deposits.
- 5.1.3 The National Soil Map (1:250,000) shows the Site is covered by soils in the Evesham 2, Badsey 2 and Fladbury 1 Association. The Eversham 2 Association comprises clayey soils that are slowly permeable (Wetness Class III), whilst the Badsey 2 Association comprises mainly of fine loamy soils over calcareous gravel which is well drained (Wetness Class I). Lastly, the Fladbury 1 Association comprise deep clayey alluvial soils that are usually slowly permeable (Wetness Class IV and V).
- 5.1.4 A detailed ALC/soil survey carried out on the 14<sup>th</sup> October 2021 determined three types of soil. The predominant Type 1 soils are consistent with SSEW's description of soils in the Fladbury 1 Association. These soils are non-calcareous clay soils developed in alluvium. They are slowly permeable and seasonally waterlogged (Wetness Class III) and are limited by soil wetness to Subgrade 3b (i.e., 12.8ha or 65.3% of the Site).
- 5.1.5 Type 2 and Type 3 soil are in Subgrade 3a, i.e., 6.8 or 34.7% of the Site. Type 2 soils are similar to those described by the SSEW as belonging to the Badsey 2 Association. These well drained (Wetness Class) sandy clay loam over calcareous, very stony/gravelly, sandy clay subsoils are limited by soil droughiness to Subgrade 3a. Type 3 soils are calcareous clayey soils developed in Charmouth Mudstone. The soil profiles are slowly permeable and seasonally waterlogged, but because the clay topsoil is slightly calcareous (1-5% calcium carbonate), they are limited by soil wetness to Subgrade 3a, i.e., there is a grade uplift from 3b to 3a due to the calcium carbonate in the topsoil.
- 5.1.6 MAFF has classified agricultural land close to the Site, to the west of the M5, as predominantly Subgrade 3b with pockets of Subgrade 3a. Therefore, the grading at the Site is consistent with MAFF Post 1988 ALC in the vicinity.

## Figures



Study Area



Auger location



Topsoil Sample



Soil Pit



Client

Atkins

Project No C831

Dwg. No 01

Scale NTS

Date 25/10/2021

Drawn By ELA

Figure 1

Sample Locations

Project Name

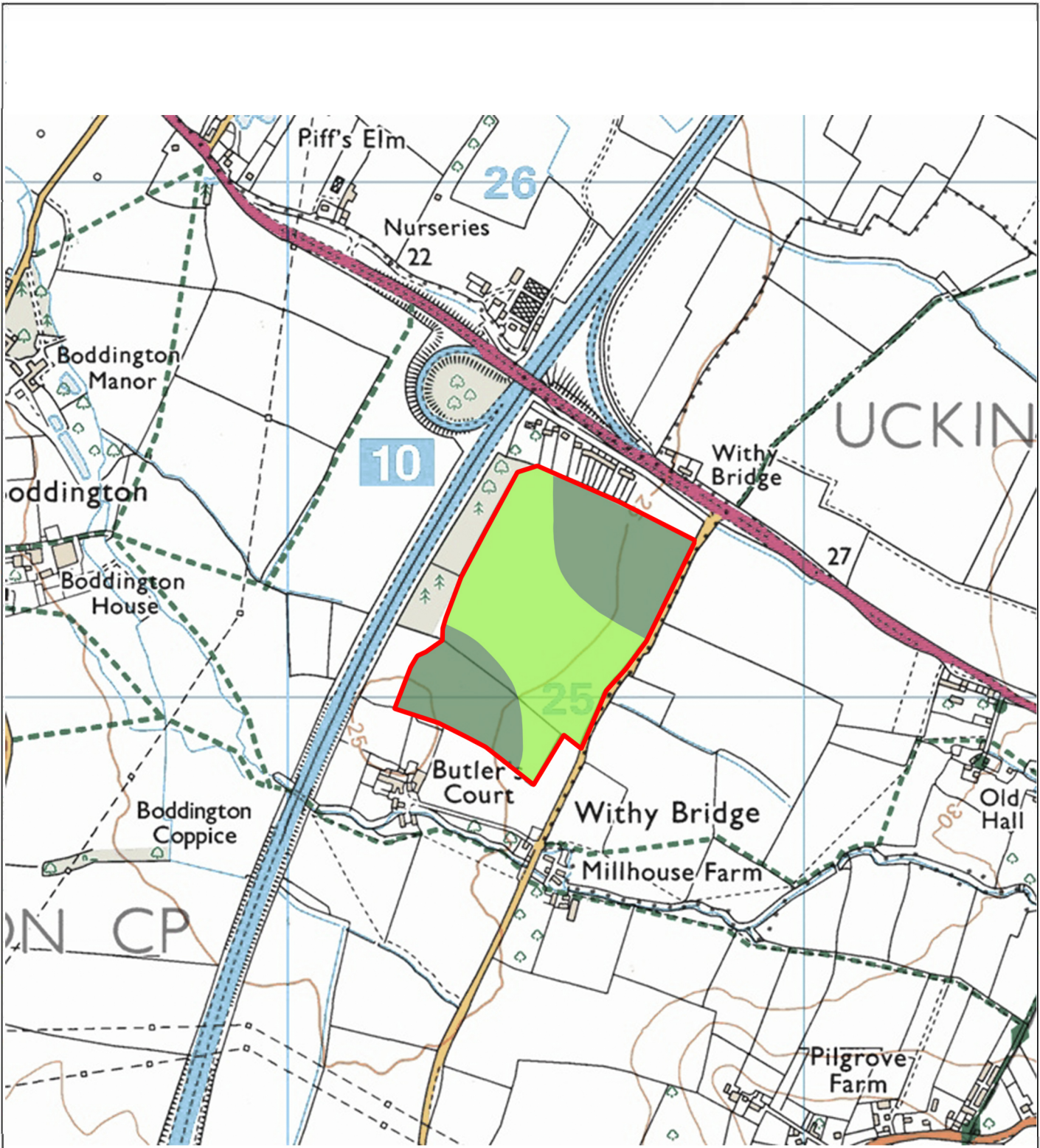
J10 M5 Flood Compensation Area

**R W Askew** BSc(Hons) MSc SoilSci MSc CSCi

The Old Stables, Upexe, Exeter, EX5 5ND

Tel: 07753 227 224

Email: [rw.askew@btinternet.com](mailto:rw.askew@btinternet.com)



ALC Grade

- Grade 1
- Grade 2
- Subgrade 3a
- Subgrade 3b
- Grade 4
- Grade 5
- Non-agricultural

Study Area



Client

Atkins

Project No C831  
 Dwg. No 01  
 Scale NTS  
 Date 25/10/2021  
 Drawn By ELA

Figure 2:

Agricultural Land Classification

Project Name

J10 M5 Flood Compensation Area

**R W Askew** BSc(Hons) MSc CSCi  
 The Old Stables, Upexe, Exeter, EX5 5ND  
 Tel: 07753 227 224  
 Email: rw.askew@btinternet.com

# Appendix 1: Soil Profile Logs

Project Number	Project Name	Parcel
C831	J10, M5	C831

Date of Survey	Survey Type	Surveyor(s)	Company
14/10/2021	Detailed ALC	RWA	Askew Land and Soil

Weather	Relief	Land use and vegetation
Dry, Sunny	Level	

Grid Reference	Postcode	Altitude	Area
SO904251	GL510TH	25	20

MAFF prov	MAFF detailed	Flooding
Grade 3	None	Flood Zone 1/2/3

AAR	ATO	MDw	MDp	FCD	Climate grade
624	1491	114	108	138	1

Bedrock	Superficial deposits
Charmouth Mudstone	None/Alluvium/Cheltenham Sand and Gravel

Soil association(s) 1:250,000	Detailed soil information
Evesham 2/Badsey 2/Fladbury 1	None

Revision Number	Date Revised
2	25/10/2021







**Mottle form**

FF - Few Faint  
 FD - Few Distinct  
 FP - Few Prominent  
 CF - Common Faint  
 CD - Common Distinct  
 CP - Common Prominent  
 MF - Many Faint  
 MD - Many Distinct  
 MP - Many Prominent  
 VF - Very many Faint  
 VD - Very many Distinct  
 VP - Very many Prominent

**Texture**

C - Clay  
 CHK - Chalk  
 CS - Coarse Sand  
 CSL - Coarse sandy loam  
 CSZL - Coarse sandy silt loam  
 FP - Fibrous and semifibrous peats  
 FS - Fine Sand  
 FSL - Fine sandy loam  
 FSZL - Fine sandy silt loam  
 HCL - Clay loam (heavy)  
 HP - Humified peats  
 HZCL - Silty clay loam (heavy)  
 IMP - Impenetrable to roots  
 LCS - Loamy Coarse Sand  
 LFS - Loamy fine sand  
 LMS - Loamy medium sand  
 LP - Loamy peats  
 MCL - Clay loam (medium)  
 MS - Medium Sand  
 MSL - Medium sandy loam  
 MSZL - Medium sandy silt loam  
 MZ - Marine Light Silts  
 MZCL - Silty clay loam (medium)  
 OC - Organic clays  
 OL - Organic loams  
 OS - Organic sands  
 PL - Peaty loams  
 PS - Peaty sands  
 SC - Sandy clay  
 SCL - Sandy clay loam  
 SP - Sandy peats  
 ZC - Silty clay  
 ZL - Silt loam

**Stone Type**

CH - Chalk or chalk stones  
 FSST - Soft fine grained sandstones  
 GH - Gravel with non-porous (hard) stones  
 GS - Gravel with porous stones (mainly soft stone types listed above)  
 HR - All hard rocks or stones (i.e. those which cannot be scratched with a finger nail)  
 MSST - Soft, medium or coarse grained sandstones  
 SI - Soft 'weathered' igneous or metamorphic rocks or stones  
 SLST - Soft oolitic or dolomitic limestones  
 ZR - Soft, argillaceous or silty rocks or stones

**Ped. Shape**

SG - Single grain  
 GRA - Granular  
 SAB - Subangular Blocky  
 AB - Angular Blocky  
 PRIS - Prismatic  
 PLAT - Platy  
 MASS - Massive  
 NA - N/A

**Subsoil Structure Condition**

Not Applicable  
 Good  
 Moderate  
 Poor

**Soil or Ped. Strength**

Loose  
 Very friable  
 Friable  
 Firm  
 Very firm  
 Extremely firm  
 Extremely hard  
 N/A

**Calcareousness**

NON - Non-calcareous (<0.5% CaCO<sub>3</sub>)  
 VSC - Very slightly calcareous (0.5 - 1% CaCO<sub>3</sub>)  
 SC - Slightly calcareous (1 - 5% CaCO<sub>3</sub>)  
 MC - Moderately calcareous (5 - 10% CaCO<sub>3</sub>)  
 VC - Very calcareous (>10% CaCO<sub>3</sub>)

**Ped. Size**

VF - Very Fine  
 F - Fine  
 M - Medium  
 C - Coarse  
 VC - Very Coarse  
 NA - N/A

**Degree of Ped. Development**

W - Weak  
 M - Moderate  
 S - Strong  
 NA - Not applicable

**Wetness Class**

WC I  
 WC II  
 WC III  
 WC IV  
 WC V  
 WC VI

**ALC Grades**

1  
 2  
 3a  
 3b  
 4  
 5  
 Non-Ag

**Gley**

None  
 Gley  
 N/A

## **Appendix 2: Soil Pit Description**

<b>Soil Survey</b>				Surveyor	RA
Easting (X)	390300	Northing (Y)	225000	Alt (m)	26
Land Use		Reference	15 (N/A)	Slope °	≤7
Bedrock	Charmouth Mudstone Formation	Superficial	None	Aspect	N/A
				Grid Reference	SO 90300 25000
				Date	14/10/2021

Layer	Topsoil	2	3	4	5	6	7
Lower Depth (cm)	22	43	70	120			
Texture	C - Clay	C - Clay	C - Clay	C - Clay			
Matrix Colour	2.5Y5/2	2.5Y5/4	2.5Y5/3	2.5Y5/6			
Gley (Y/N)	No	No	Yes	Yes			
Ochreous Mottles	Form		FD - Few Distinct	CD - Common Di	MD - Many Distinct		
	Munsell Colour		10YR5/8	10YR5/6	10YR5/6		
Grey Mottles	Form						
	Munsell Colour						
Manganese (Y/N)	No	Yes	Yes	Yes			
% Stones (type 1)	0	0	0	0			
Stones > 2cm							
Stones > 6cm							
Stone Type							
% Stones (type 2)							
Stones > 2cm							
Stones > 6cm							
Stone Type							
CaCO3	SC - Slightly calca	MC - Moderately calcareous	MC - Moderately	MC - Moderately calcareous (5 - 10% CaCO3)			
Shape of Peds.	SAB - Subangular	AB - Angular Blocky	AB - Angular Blo	AB - Angular Blocky			
Size of Peds.	M - Medium	M - Medium	C - Coarse	C - Coarse			
Subsoil Structure	Not Applicable	Moderate	Poor	Poor			
Soil or Ped. Strength	Firm	Firm	Firm	Firm			
Degree of Ped. Development	M - Moderate	M - Moderate	W - Weak	W - Weak			
Slowly Permeable Layer (Y/N)	No	No	Yes	Yes			

MDw	MDp	FCD
114	108	138

Wetness	Class (WC)	WC III
	Grade (WE)	3a

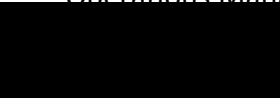
Notes	Topsoil is slightly calcareous. Therefore, CaCO3 uplift from 3b to 3a (wetness).
-------	--

## **Appendix 3: Topsoil Texture Analysis**



**TEST REPORT**  
ISSUED BY SOIL PROPERTY TESTING LTD  
DATE ISSUED: 21/10/2021



<b>Contract</b>	<b>Junction 10 M5</b>	
<b>Serial No.</b>	<b>39565_1</b>	
<b>Client:</b> Askew Land and Soil Ltd  The Old Stables Upexe Exeter EX5 5ND	<b><i>Soil Property Testing Ltd</i></b>  <b>15, 16, 18 Halcyon Court, St Margaret's Way, Stukeley Meadows, Huntingdon, Cambridgeshire, PE29 6DG</b>  <b>Tel: 01480 455579</b> <b>Email: <a href="mailto:enquiries@soilpropertytesting.com">enquiries@soilpropertytesting.com</a></b> <b>Website: <a href="http://www.soilpropertytesting.com">www.soilpropertytesting.com</a></b>	
<b>Samples Submitted By:</b> Askew Land and Soil Ltd  <b>Samples Labelled:</b> Junction 10 M5	<b>Approved Signatories:</b>  <input checked="" type="checkbox"/> <b>J.C. Garner B.Eng (Hons) FGS</b> Technical Director & Quality Manager  <input type="checkbox"/> <b>W. Johnstone</b> Materials Lab Manager  <input type="checkbox"/> <b>D. Sabnis</b> Operations Manager 	
<b>Date Received:</b> 15/10/2021	<b>Samples Tested Between:</b> 15/10/2021 and 21/10/2021	
<b>Remarks:</b> For the attention of Robert Askew Your Reference No: C831		
<b>Notes:</b>	<ol style="list-style-type: none"><li>1 All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary.</li><li>2 Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.</li><li>3 Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory.</li><li>4 This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory.</li><li>5 The results within this report only relate to the items tested or sampled.</li></ol>	



# TEST REPORT

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<b>Contract</b>		<b>Junction 10 M5</b>																				
<b>Serial No.</b>		<b>39565_1</b>					<b>Target Date</b>		<b>29/10/2021</b>													
<b>Scheduled By</b>		<b>Askew Land and Soil Ltd</b>																				
<b>Schedule Remarks</b>																						
Bore Hole No.	Type	Sample Ref.	Top Depth	Particle Size Distribution (BS1377)										Sample Remarks								
				1	2	3	4	5	6	7	8	9	10		11	12						
AB11	-	-	0.00	1																		
AB15	-	-	0.00	1																		
AB9	-	-	0.00	1																		
<b>Totals</b>				<b>3</b>																		<b>End of Schedule</b>



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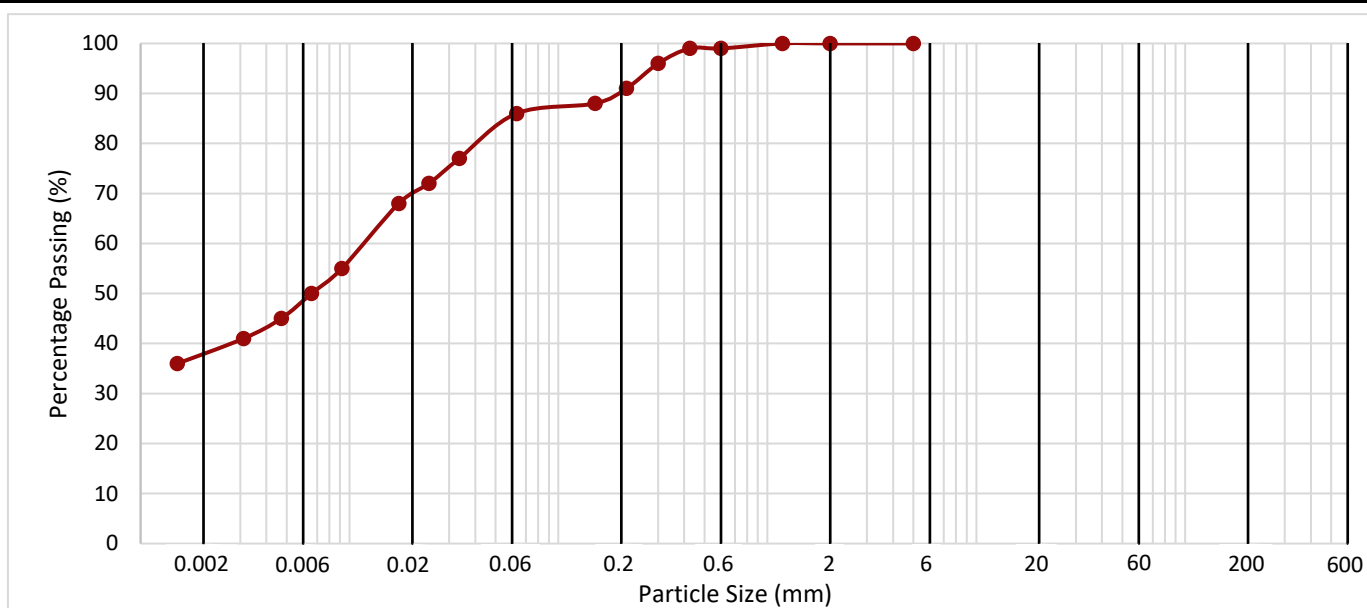
0998

<b>Contract</b>	<b>Junction 10 M5</b>
<b>Serial No.</b>	<b>39565_1</b>

## DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Pit No.	Depth (m)	Sample		Description	Remarks
		Type	Reference		
AB11	0.00 - 0.25	-	-	Brown slightly sandy silty CLAY with occasional recently active roots	

Method of Test: **Hydrometer + Pre-sieve**      Method of Pretreatment: **Not required**



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

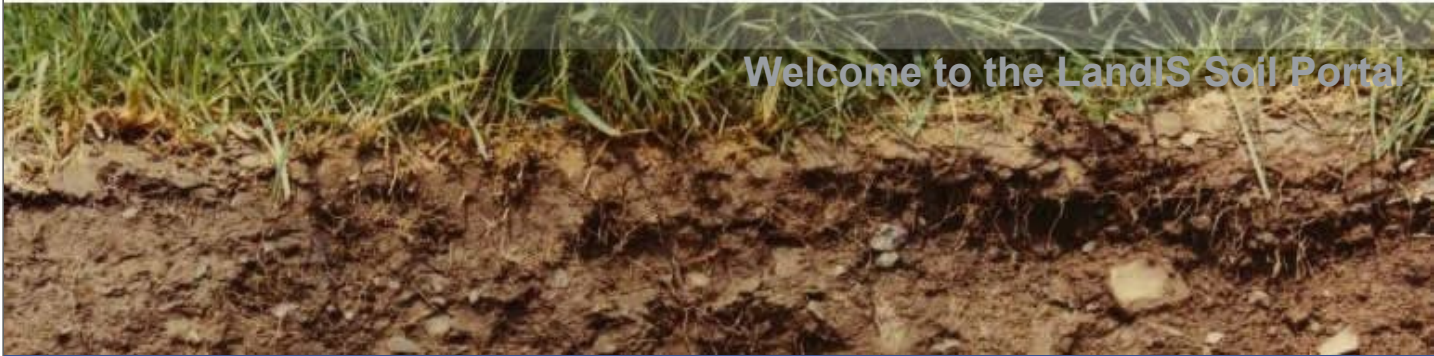
Hydrometer	Particle Size (mm)	Passing (%)	Silt by Dry Mass (%)
	0.0335	77	<b>48</b>
	0.0240	72	
	0.0172	68	
	0.0092	55	Clay by Dry Mass (%)
	0.0066	50	
	0.0047	45	
	0.0031	41	
0.0015	36	<b>38</b>	

Sieve Size (mm)	Passing (%)	Sand By Dry Mass (%)
2.00	100	<b>14</b>
1.18	100	
0.600	99	
0.425	99	
0.300	96	
0.212	91	
0.150	88	
0.063	86	

Sieve Size (mm)	Passing (%)	2mm+ By Dry Mass (%)
300		<b>0</b>
125		
90		
63		
50		
37.5		
28		
20		
14		
10		
6.3		
5	100	

Fines By Dry Mass (%)	
<0.063mm	<b>86</b>

Method of Preparation: BS1377: Part 1: 2016: 8.3 & 8.4.5  
 Method of test: BS1377: Part 2: 1990: 9.2,9.5  
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter  
 Comments:



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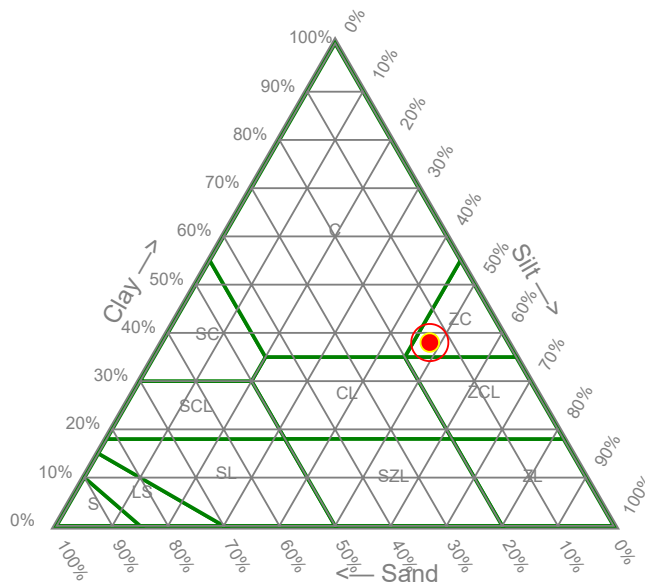
Soil Texture Triangle

Particle size class estimator

Here is a tool that allows you to estimate the particle size class of a soil sample from the proportions of sand, silt and clay. The estimator is based on the texture class intervals of the Soil Survey of England and Wales - note that other international standards also exist, such as the USDA and FAO triangles.

Enter soil sample proportions:

Clay (%)	X	Sand (%)	X	Silt (%)	X	Calculate
	38		14		48	Calculate



Top

Soil sample is a Silty Clay

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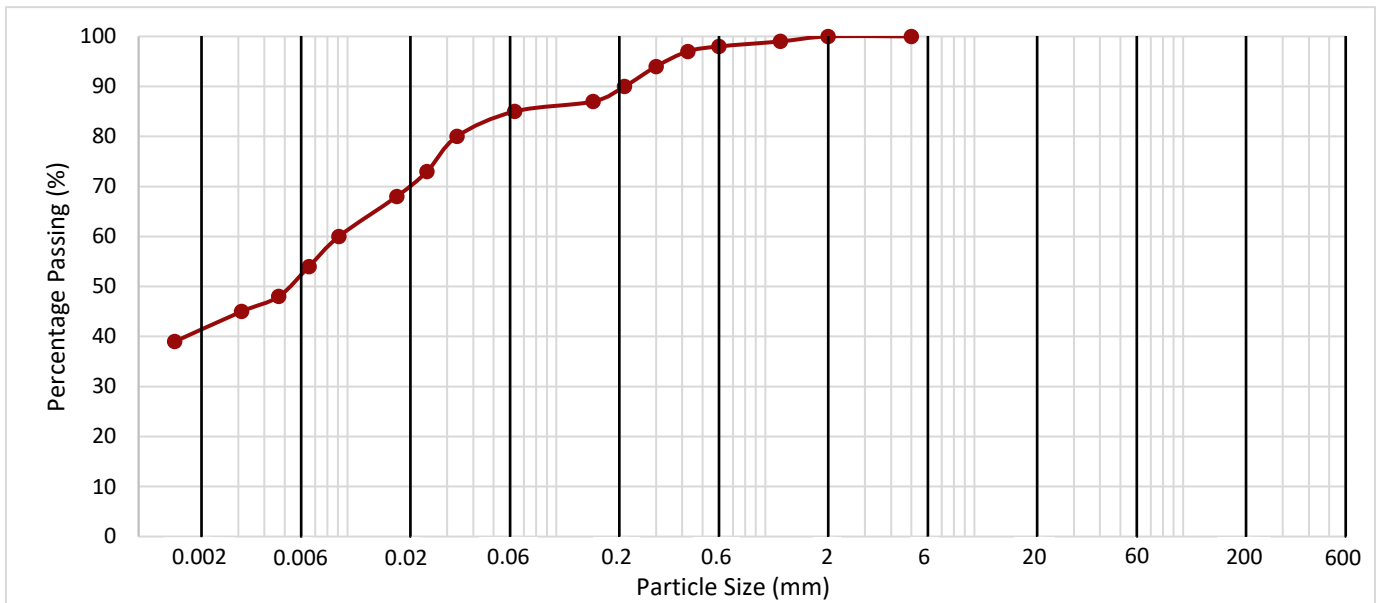
0998

<b>Contract</b>	<b>Junction 10 M5</b>
<b>Serial No.</b>	<b>39565_1</b>

## DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Pit No.	Depth (m)	Sample		Description	Remarks
		Type	Reference		
AB15	0.00 - 0.25	-	-	Olive brown slightly sandy silty CLAY with occasional recently active roots and rare fine chert gravel	Material greater than 2mm removed before test

Method of Test: **Hydrometer + Pre-sieve**      Method of Pretreatment: **Not required**



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Hydrometer	Particle Size (mm)	Passing (%)	Silt by Dry Mass (%)
	0.0334	80	<b>44</b>
	0.0240	73	
	0.0172	68	
	0.0091	60	Clay by Dry Mass (%)
	0.0065	54	
	0.0047	48	
	0.0031	45	
	0.0015	39	<b>41</b>

Sieve Size (mm)	Passing (%)	Sand By Dry Mass (%)
2.00	100	<b>15</b>
1.18	99	
0.600	98	
0.425	97	
0.300	94	
0.212	90	
0.150	87	
0.063	85	

Sieve Size (mm)	Passing (%)	2mm+ By Dry Mass (%)
300		<b>0</b>
125		
90		
63		
50		
37.5		
28		
20		
14		
10		
6.3		
5	100	

Fines By Dry Mass (%)	
<0.063mm	<b>85</b>

Method of Preparation: BS1377: Part 1: 2016: 8.3 & 8.4.5  
 Method of test: BS1377: Part 2: 1990: 9.2,9.5  
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter  
 Comments:



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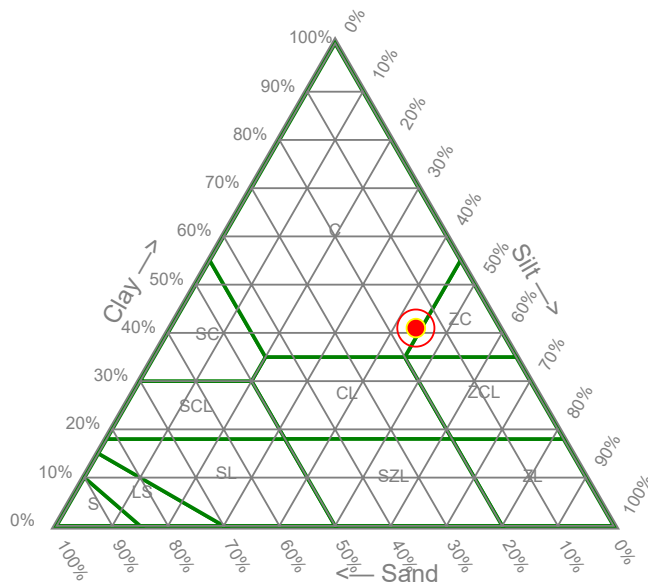
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Enter soil sample proportions:

Clay (%)	X	Sand (%)	X	Silt (%)	X	Calculate
	41		15		44	Calculate



Top

Soil sample is a Clay

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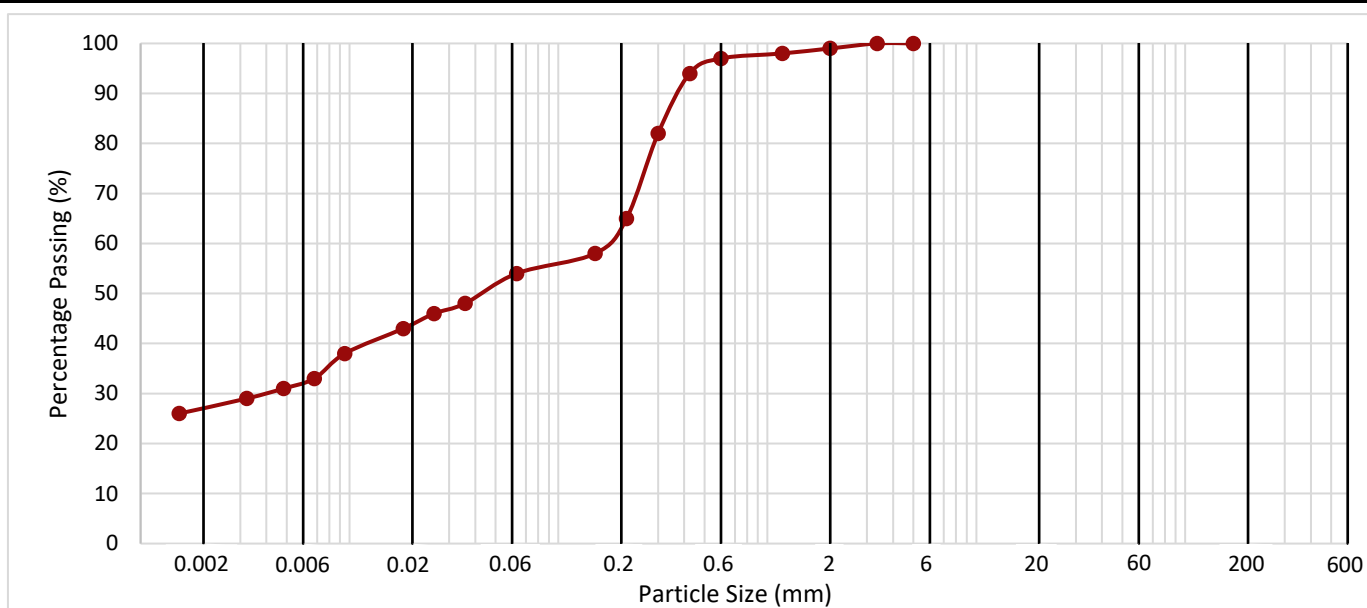
0998

<b>Contract</b>	<b>Junction 10 M5</b>
<b>Serial No.</b>	<b>39565_1</b>

## DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Pit No.	Depth (m)	Sample		Description	Remarks
		Type	Reference		
AB9	0.00 - 0.25	-	-	Brown sandy silty CLAY with occasional recently active roots and rare fine chert gravel	Material greater than 2mm removed before test

Method of Test: **Hydrometer + Pre-sieve**      Method of Pretreatment: **Not required**



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Hydrometer	Particle Size (mm)	Passing (%)	Silt by Dry Mass (%)
	0.0357	48	<b>27</b>
	0.0254	46	
	0.0181	43	
	0.0095	38	Clay by Dry Mass (%)
	0.0068	33	
	0.0048	31	
	0.0032	29	
0.0015	26	<b>27</b>	

Sieve Size (mm)	Passing (%)	Sand By Dry Mass (%)
2.00	99	<b>45</b>
1.18	98	
0.600	97	
0.425	94	
0.300	82	
0.212	65	
0.150	58	
0.063	54	

Sieve Size (mm)	Passing (%)	2mm+ By Dry Mass (%)
300		<b>1</b>
125		
90		
63		
50		
37.5		
28		
20		
14		
10		
6.3		
5	100	

Fines By Dry Mass (%)	
<0.063mm	<b>54</b>

Method of Preparation: BS1377: Part 1: 2016: 8.3 & 8.4.5  
 Method of test: BS1377: Part 2: 1990: 9.2,9.5  
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter  
 Comments:



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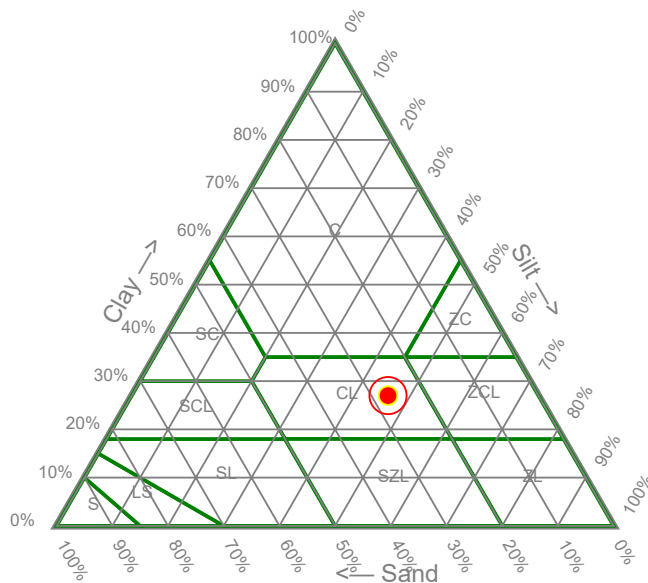
#### Soil Texture Triangle

##### Particle size class estimator

Here is a tool that allows you to estimate the particle size class of a soil sample from the proportions of sand, silt and clay. The estimator is based on the texture class intervals of the Soil Survey of England and Wales - note that other international standards also exist, such as the [USDA](#) and [FAO](#) triangles.

##### Enter soil sample proportions:

Clay (%)	X	Sand (%)	X	Silt (%)	X	Calculate	Calculate
	27		27		46		



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#### Soil sample is a Clay Loam

### INFOBAR

#### Soils Site Reporter

Download full [site-specific soil reports](#) for your neighbourhood, development site, farm, wildlife sanctuary, etc.

#### Soilscapes Viewer

Our free online simplified [interactive soil map](#) for England and Wales.

#### Soils Guide

An [Online Guide](#) to the Soils of England and Wales.

#### Case Studies

See examples of how LandIS is [being used](#).

#### FAQ

Answers to [frequently asked questions](#).

#### News

- » [Soilscapes Mobile App v1.2.1 launched: January 18 2018](#)
- » [Easy access to Soils data: January 8 2018](#)
- » [University wins fifth Queen's Anniversary Prize: December 1 2017](#)
- » [Design, Development and Impact of the soil educational website Soil-Net.com: October 24 2017](#)
- » [Developments in land information systems: examples demonstrating land resource management capabilities and options: October 23 2017](#)
- » [New Soil Site Reports: May 4 2017](#)
- » [Feeding the nine billion: February 2017](#)
- » [Soil Site Reporter - Upgrade: January 18 2017](#)
- » [Radio 4 Interview on Farming Today: January 17 2017](#)

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