SOILS AND AGRICULTURAL USE & QUALITY OF LAND OFF OXFORD ROAD BANBURY

Report 1003/2

1st February, 2019

Land Research ASSOCIATES

SOILS AND AGRICULTURAL USE & QUALITY

OF LAND OFF OXFORD ROAD, BANBURY

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Report 1003/2

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SUMMARY

A survey has been undertaken of 36 ha of agricultural land off Oxford Road, Banbury.

The land comprises four fields, under cereal stubble at the time of survey. Soils vary between shallow types over ironstone and deep heavy types with restricted subsoil drainage. Land of grade 2, sub-grade 3a and and sub-grade 3b agricultural quality exists at the site, most limited by droughtiness or soil wetness.

The 290-320 mm thick sandy clay loam topsoil across most of the land would form a high quality resource for landscaping use if the site is developed.

1.0 Introduction

1.1 This report provides information on the soils and agricultural quality and use of 36 ha of land off Oxford Road, Banbury. The report is based on a soil and agricultural desk study and a survey of the land in August 2014.

SITE ENVIRONMENT

1.2 The land investigated comprises three complete fields and the southern section of a fourth field to the north-west. The land is bordered to the west by Oxford Road and an adjoining sports ground and on other sides by adjoining agricultural land. The land is level to very gently sloping at an average elevation of approximately 115 m AOD.

AGRICULTURAL USE

1.3 The land is in arable use and at the time of survey was under cereal stubble having recently been harvested. The land is registered under an Entry Level Environmental Stewardship Agreement as part of a 366.6 ha holding.

PUBLISHED INFORMATION

1.4 1:50,000 BGS geological information shows the land is mainly underlain by Jurassic ferruginous limestone and ironstone of the Marlestone Rock Formation. A small area in the north is recorded as Jurassic mudstone of the Whitby Mudstone Formation. Drift cover is not recorded.

1.5 The reconnaissance (1:250,000) soil map of South East England[1] shows the land as Banbury Association, comprising freely to imperfectly-draining loamy soils over shattered ironstone.

1.6 A Post 1988 Agricultural Land Classification published by MAFF in the 1990s shows the land as mainly grade 2, with a small strip of sub-grade 3b land in the north.

[1] Jarvis, M.G. (*et al)* 1984. *Soils and their Use in South East England.* Soil Survey of England and Wales Bulletin No. 15

2.0 Soils

2.1 The National Planning Practice Guidance states that the planning system should protect and enhance valued soils and prevent the adverse effects of unacceptable levels of pollution. This is because soil is an essential finite resource that provides important ecosystem services, for example as a growing medium for food, timber and other crops, as a store for carbon and water, as a reservoir of biodiversity and as a buffer against pollution.

2.2 A detailed soil resource and agricultural quality survey was carried out in August 2014. It was based on observations at intersects of a 100 m grid, giving a sampling density of one observation per hectare. During the survey soils were examined by a combination of pits and augerings to a maximum depth of 1.1 m. A log of the sampling points and a map (Map 3) showing their location is in an appendix to this report.

2.3 The soils vary according to depth and drainage. The distribution of soil types is shown in Map 1 in an appendix to this report.

Fine loamy soils

2.4 The dominant soils at the site are of sandy clay loam texture, with variable depth to underlying weathered ironstone bedrock. Topsoils are approximately 29-33 cm thick, underlain by permeable stony subsoil. In the south of the site total soil depth is mainly in the region of 40-70 cm but in the north soils are often deeper, with heavier slowly permeable lower subsoil.

2.5 An example profile is described below from observation 13 (Map 3).

0-30 cm	Dark brown (10YR 3/2) sandy clay loam; slightly stony (small to medium rotting ironstone); moderately developed medium sub-angular blocky structure; friable; non-calcareous; smooth clear boundary to:
31-46 cm	Reddish brown (5YR 4/3) sandy clay loam with many distinct medium strong brown (7.5YR 5/8) mottles; moderately stony; moderately developed medium platy structure; friable; gradual uneven boundary to:
46 cm+	Fractured ironstone

2.6 The shallower soils are freely-draining (Soil Wetness Class I) while those with slowly permeable layers at depth are imperfectly-draining (Soil Wetness Class II to III). They have a high capacity to absorb excess winter rainfall.

Heavy clay soils

2.7 These soils comprise heavy clay loam topsoil of approximately 30 cm depth, underlain by clay or heavy clay loam subsoil which is dominantly grey-mottled and slowly permeable at less than 50 cm below the surface. On the transition

to the soils described above these soils are thinner and bedrock was encountered at a depth of 60-80 cm below the land surface.

2.8 A profile is described below from observation 6 (Map 3).

0-31 cm	Very dark greyish brown (10YR 3/2) heavy clay loam; stoneless; moderately developed coarse and medium sub-angular blocky structure; friable; smooth abrupt boundary to:
31-60 cm	Pale brown (10YR 6/3) clay with common distinct medium yellowish brown (10YR 5/6) mottles; slightly stony (platey hard ironstone); moderately developed coarse prismatic structure; very firm; very few macro-pores; wavy clear boundary to:
60 cm+	Fractured ironstone.

2.9 These soils are slowly permeable within 50 cm of the land surface (Soil Wetness class III to IV) and consequently are poorly-draining. They have a low capacity to absorb winter rainfall.

3.0 Agricultural Quality

3.1 To assist in assessing land quality, the Ministry of Agriculture, Fisheries and Food (MAFF) developed a method for classifying agricultural land by grade according to the extent to which physical or chemical characteristics impose long-term limitations on agricultural use for food production. The MAFF Agricultural Land Classification (ALC) system classifies land into five grades numbered 1 to 5, with grade 3 divided into two sub-grades (3a and 3b). The system was devised and introduced in the 1960s and revised in 1988.

3.2 The agricultural climate is an important factor in assessing the agricultural quality of land and has been calculated using the Climatological Data for Agricultural Land Classification[2]. The relevant site data for an average elevation of 115 m is given below.

- Average annual rainfall: 689 mm
- January-June accumulated temperature >0°C 1369 day°
- Field capacity period (when the soils are fully replete with water) 155 days mid Nov-mid April
- Summer moisture deficits for: wheat: 101 mm potatoes: 91 mm

3.3 The survey described in the previous section was used in conjunction with the agroclimatic data above to classify the site using the revised guidelines for agricultural land classification issued in 1988 by the Ministry of Agriculture, Fisheries and Food[3]. There are no climatic limitations to land quality in this locality.

SURVEY RESULTS

3.4 The agricultural quality of the land is determined by either droughtiness or wetness limitations. Land of grade 2 and grade 3 quality has been identified.

Grade 2

3.5 This grade is mapped where deep fine loamy soils with free to imperfect drainage occur (Soil Wetness Class I or II). These soils are limited either by slight droughtiness caused by limited subsoil depth, or by slight wetness

[2] *Climatological Data for Agricultural Land Classification*. Meteorological Office, 1989
[3] *Agricultural Land Classification for England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land*. MAFF, 1988.

restrictions to machinery access. A wide range of agricultural and horticultural crops can usually be grown and yield can be expected to be high but lower or more variable than Grade 1 land.

Sub-grade 3a

3.6 This sub-grade is mapped over areas in the south-west and south-east, where soils are shallowest and the restricted rooting depth limits crop available moisture. A range of crops can be grown regularly, but average yield is likely to be reduced.

3.7 Also included are soils on the transition to the heavy soils described in paragraphs 2.7-2.9. These soils have moderate drainage restrictions (Wetness Class III), caused by slowly permeable subsoil, which combined with the moderate clay content of the topsoil, restricts access for field operations during wet periods, particularly in spring.

Sub-grade 3b

This sub-grade is mapped in the north-west of the site, occurring where soils are slowly permeable within 50 cm of the surface (see paragraphs 2.7-2.9). This results in impedance to downward water movement, periodic surface wetness (Wetness Class III/IV) and moderate constraints to use due to the difficulty in cultivating the heavy topsoils when wet. Such land is capable of producing moderate yields of only a narrow range of crops, principally cereals and oilseeds.

Grade areas

3.8 The boundaries between the different grades of land are shown on Map 2 and the areas occupied by each are shown below.

Table 1. Areas occupied by the different land grades

Grade/sub-grade	*Area (ha)*	*% of land*
Grade 2	18.4	51
Sub-grade 3a	9.5	26
Sub-grade 3b	7.5	21
Non-agricultural	0.6	2
Total	36.0	100

4.0 Soil resources and their use

4.1 An objective of the Defra Soil Strategy was to ensure that the construction industry and planning authorities take sufficient account of the need to protect soil resources, and ensure soils are able to fulfil as many as possible of their functions. An Environment Agency strategy *Soil a Precious Resource: Our strategy for protecting*, *managing and restoring soil* (Environment Agency, 2007) has complementary aims.

Topsoil

4.2 Two topsoil resources exist at the site: the sandy clay loams of the majority of the land and the heavy clay loams of the heavy soils in the north-west. The sandy clay loams are a high quality resource and should be reused preferentially in landscaping should the site be developed. The heavier soils are harder to handle with machinery when wet and are very susceptible to structural damage. These two resources should be stripped and stockpiled separately. Topsoils are approximately 290-330 mm thick across the site.

Subsoil

4.3 The upper subsoils are permeable across the majority of the land and would be easily damaged by trafficking during topsoil stripping and other construction activities. If compacted during they should be loosened before any topsoil is spread on them, in order to retain their ability to absorb excess winter rainfall.

Soil Handling

4.4 Areas not being built over (e.g. environmental buffers and landscape areas) should not be trafficked by construction vehicles as this will render the soils impermeable, preventing percolation of rainfall beyond the base of the topsoil, which will quickly become saturated.

4.5 Stripped topsoil should be stored in separate resource bunds no more than 3 m high, and kept grassed and free from construction traffic until required for re-use. The *Construction Code of Practice for Sustainable Use of Soils on Construction Sites* (Defra 2009) provides guidance on good practice in soil handling.

APPENDIX

MAPS AND DETAILS OF OBSERVATIONS

Land at Oxford Road, Banbury: ALC and soil resources survey – Details of observations at each sampling point

Obs	Topsoil			Upper subsoil			Lower subsoil			Slope	Wetness	Agricultural quality	
No	Depth (cm)	Texture	Stones (%)	Depth (cm)	Texture	Mottling	Depth (cm)	Texture	Mottling	(°)	Class	Grade	Main limitation
1	0-32	HCL	<5	32-47	C	xxx	47-75 75+	SC R?	xxx	0	IV	3b	W
2	0-31	HCL	<5	31-46	C	xxx	46-80+	C	xxxx	0	IV	3b	W
3	0-32	HCL	<5	32-50	HCL	xx(x)	50-70 70-90+	HCL C	xxx xxxx	0	III	3b	W
4	0-31	SCL	<5	31-56	SCL	xx	56+	R		0	I	2/3a	D
5	0-32	HCL	<5	32-47	HCL	xxx	47-90+	C	xxx(x)	0	III	3b	W
6	0-31	HCL	<5	31-60	C	xxx	60+	R		0	IV	3b	W
7	0-33	SCL	<5	33-44	SCL	xxx	44-68 68+	SC R	xxx	0	III/IV	3a/3b	W
8	0-29	SCL	<5	29-64	C	xxx	64+	R		0	III/IV	3a/3b	W
9	0-31	SCL	<5	29-61	SCL	xx	61+	R		0	I	2/3a	D
10	0-31	SCL/HCL	<5	31-58	SCL/HCL	xx	58-71+	HCL	xxx	0	II/III	3a/3b	W
11	0-33	HCL	<5	33-49	HCL	xx	49-86 86-95+	HCL SC	xxx xxx	0	III/II	3b/3a	W
12	0-35	SCL	<5	35-90+	mstSCL	xx				0	I/II	2	D
13	0-30	SCL	<5	30-45	mstSCL	xx	45+	R		0	I	3a	D
14	0-33	SCL	<5	33-73	SCL(r)	o	73-98 98-110+	SC(r) SCL	x xx	0	I	1	
15	0-32	SCL/MCL	<5	32-47	SCL	x	47-59 59-100+	SCL C	xx xxx	0	II	2	W/D
16	0-31	MCL/SCL	<5	31-61	SCL	xx(x)	61-90+	SCL	xxx	0	II/III	2/3a	D
17	0-34	SCL	<5	34-60	SCL	xx	60+	R		0	II	2	W
18	0-32	SCL	<5	32-48	SCL	xx	48-72 72-80+	SCL/SC SC	xxx xxx	0	II/III	2/3a	W
19	0-30	HCL	<5	30-47	SCL	xx	47-90+	mstHCL	xxx	0	II/III	3a/3b	W
20	0-32	SCL	<5	32-47	SCL	xx	47-65+	SC(r)	xx	0	II/III	2	W/D
21	0-30	SCL	<5	30-65	SCL	xx	65-90	mstSC(r)	xx	0	II	2	W/D
22	0-32	SCL	<5	32-50	SCL	xx	50-71 71+	SCL R	xx	0	II	2	W/D
23	0-32	SCL	<5	32-65	SCL	x	65+	R		0	I	2	D
24	0-34	SCL	<5	34-44	SCL	x	44-66 66-100+	SCL SC	xx xxx	0	II	2	W
25	0-33	SCL/HCL	<5	33-76	SCL	x(x)	76-110+	SC	xxx	1	II	2	W/D
26	0-34	SCL	<5	34-54	SCL	x	54-72 72-110+	SCL HCL	xx xxx	0	II	2	W/D
27	0-31	SCL/HCL	<5	31-43	SCL	x	43+	R		0	I	3a	D
28	0-28	SCL	<5	28-61	SCL	x	61-82 82+	SCL R	xx	0	I	2	D
29	0-30	SCL	<5	30-41	SCL	x	41+	R		0	I	3a	D
30	0-28	SCL	<5	28-41	SCL	x	41-105 105+	SCL R	xx	0	I	2	D
31	0-32	SCL	<5	32-56	SCL	o	56+	R		0	I	3a	D
32	0-27	SCL	<5	27-70	SCL	x	70+	R		0	I	2	D

Obs	Topsoil			Upper subsoil			Lower subsoil			Slope	Wetness	Agricultural quality	
No	**Depth (cm)**	**Texture**	**Stones (%)**	**Depth (cm)**	**Texture**	**Mottling**	**Depth (cm)**	**Texture**	**Mottling**	**(°)**	**Class**	**Grade**	**Main limitation**
33	0-31	MCL/SCL	<5	31-91	SCL	x	91-110+	SCL	xx	0	I	1	
34	0-30	SCL	<5	30-59	SCL	x	59-73 73-110+	SCL SC	xx xxx	0	II	2	W
35	0-30	SCL	<5	30+	R					0	I	3b	D

Key to table

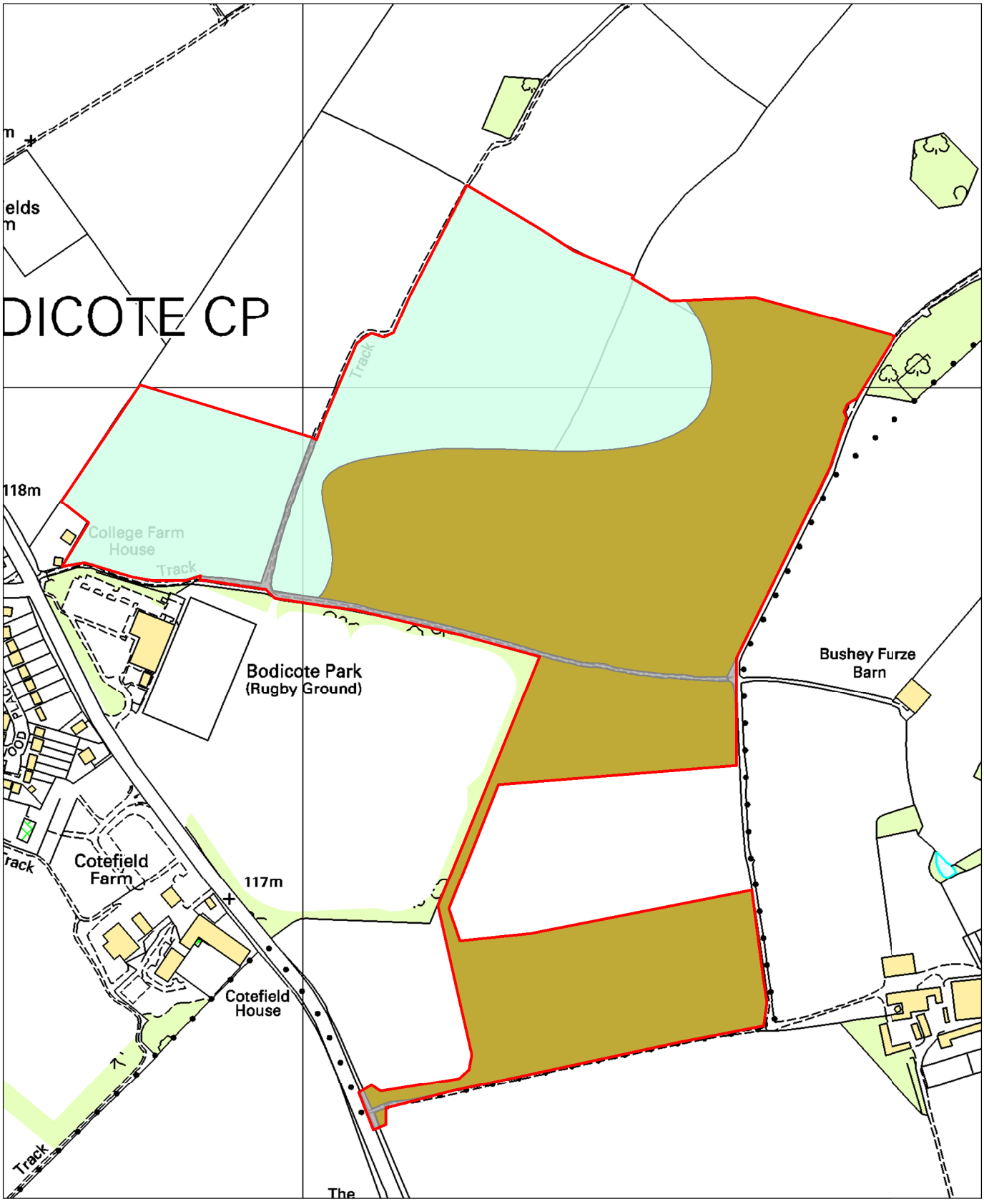
Mottle intensity:
- o unmottled
- x few to common rusty root mottles (topsoils) or a few ochreous mottles (subsoils)
- xx common to many ochreous mottles and/or dull structure faces
- xxx common to many greyish or pale mottles (gleyed horizon)
- xxxx dominantly grey, often with some ochreous mottles (gleyed horizon)

a depth underlined (e.g. 50) indicates the top of a slowly permeable layer
(a wavy underline indicates the top of a layer borderline to slowly permeable)

Texture:
- C - clay
- ZC - silty clay
- SC - sandy clay
- CL - clay loam (H-heavy, M-medium)
- ZCL - silty clay loam (H-heavy, M-medium)
- SCL - sandy clay loam
- SZL - sandy silt loam (F-fine, M-medium, C-coarse)
- SL - sandy loam (F-fine, M-medium, C-coarse)
- LS - loamy sand (F-fine, M-medium, C-coarse)
- S - sand (F-fine, M-medium, C-coarse)
- P - peat (H-humified, SF-semi-fibrous, F-fibrous)
- LP - loamy peat; PL - peaty loam
- R - consolidated bedrock

Limitations:
- W - wetness/workability
- D - droughtiness
- De - depth
- St – stoniness
- Sl – slope
- F - flooding
- T – topography/microrelief

Texture suffixes & prefixes:
- ca – calcareous: x-extremely, v-very, sl-slightly
- (ca) – marginally calcareous
- r – reddish; (v)st – (very) stony;



Client: HALLAM LAND MANAGEMENT

Project: Banbury

Map title: Map 1 Soil Types

KEY

- Fine loamy soils
- Heavy clay soils
- Survey area

1003/1

Scale: 1:6,000 at A4

Date: 01/02/2019

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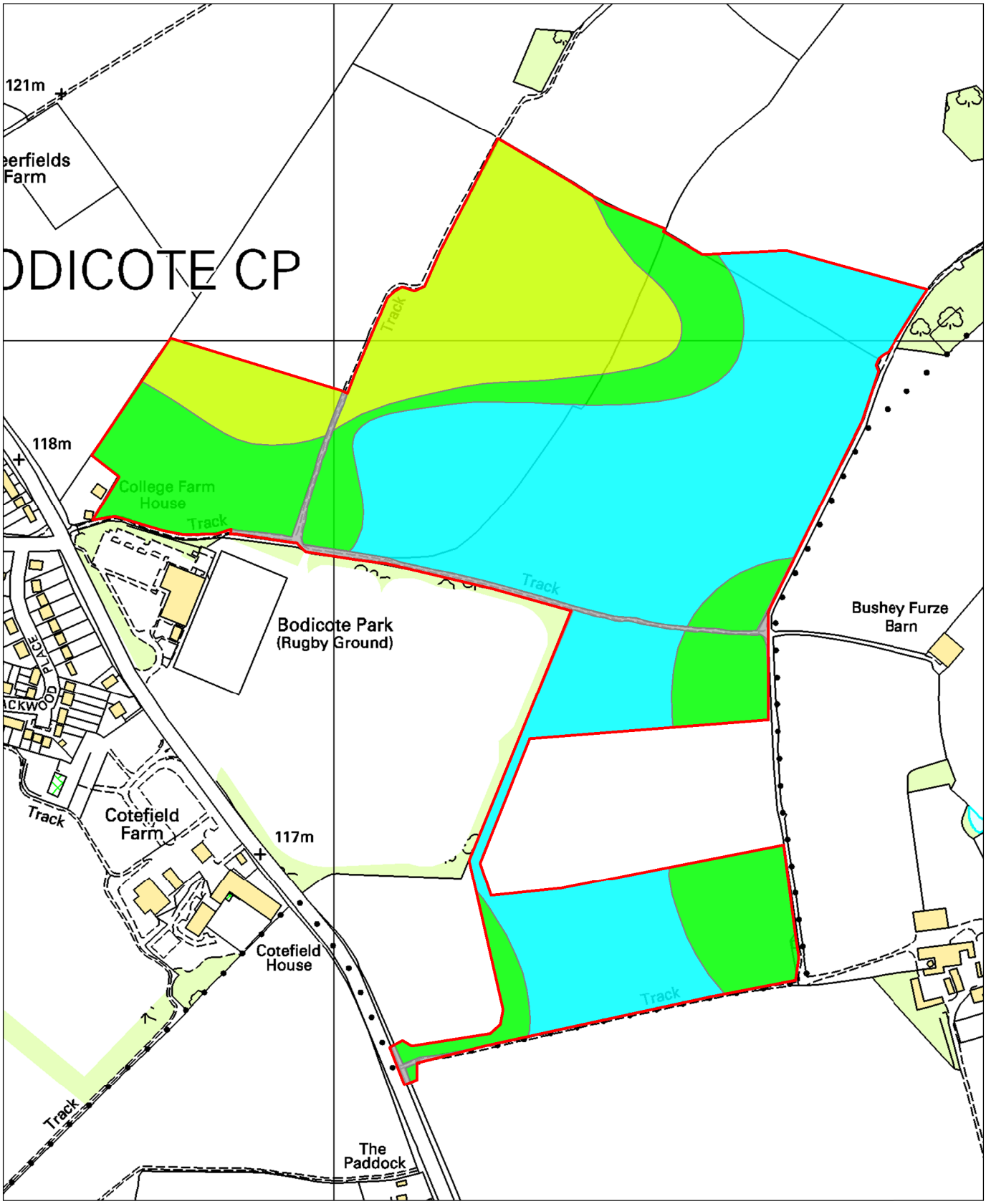

Client: HALLAM LAND MANAGEMENT

Project: Banbury

Map title: Map 2
Land Quality

KEY

- Grade 2
- Sub-grade 3a
- Sub-grade 3b
- Non-agricultural
- Survey area

1003/2

Scale: 1:5,000 at A4

Date: 01/02/2019

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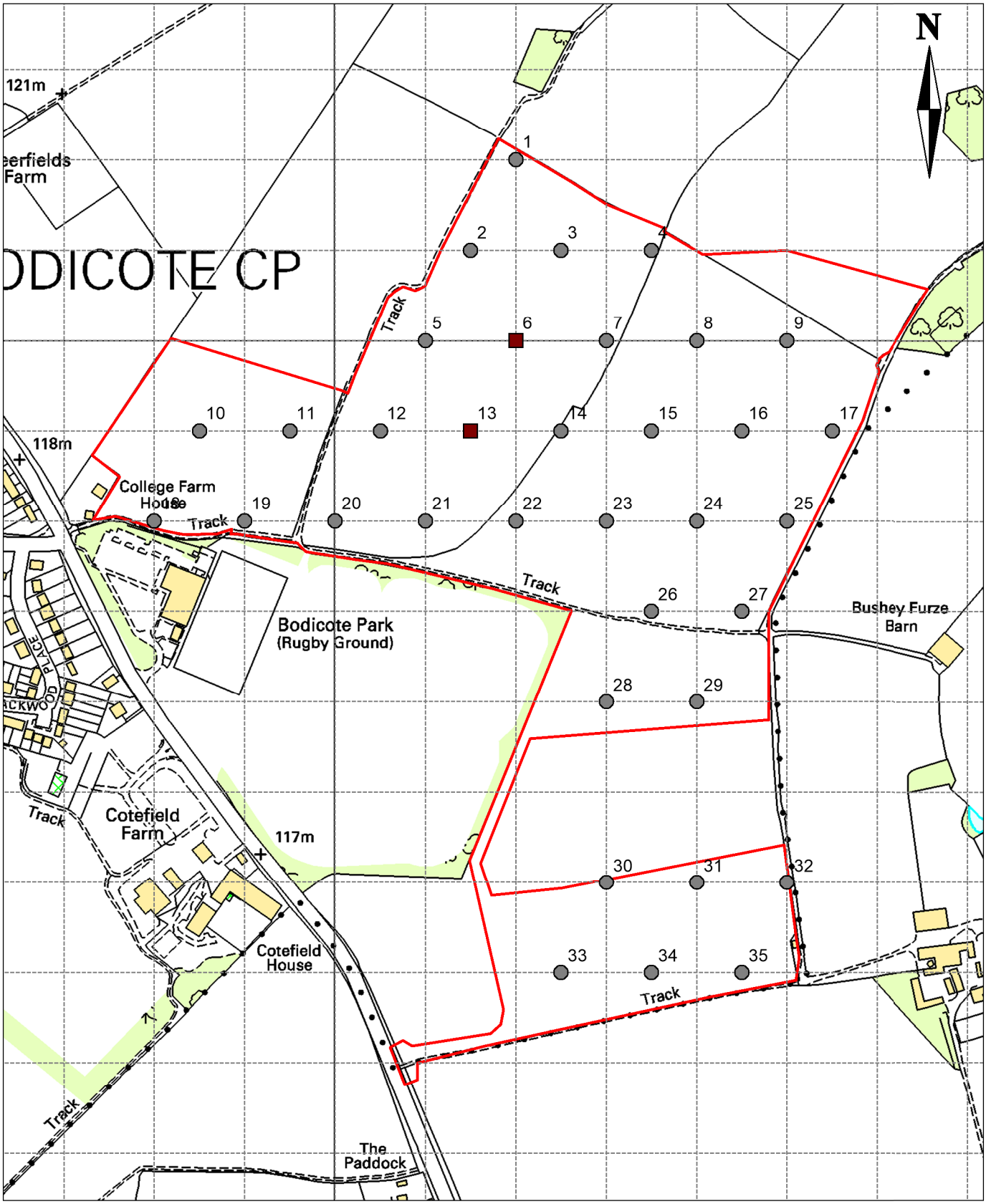

Client: HALLAM LAND MANAGEMENT

Project: Banbury

Map title: Map 3
Survey Observations

KEY

- Survey observation
- Soil/land grade description point
- Survey area

1003/3

Scale: 1:5,000 at A4

Date: 01/02/2019

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