LAND FOR A PROPOSED MARINA DEVELOPMENT AT GLEBE FARM, CLAYDON, OXFORDSHIRE

AGRICULTURAL LAND CLASSIFICATION

March 2017

LLM/008/17

LandLook (Midlands)

1 INTRODUCTION

Purpose

1.1 This report sets out below the results of a survey to determine the quality of approximately 19.5 hectares (ha) of agricultural land adjacent to the Oxford canal north of the village of Claydon ('the Site') carried out on the 31st of March 2017.

The Site

1.2 The Site is located just north of Claydon and is bounded in the north by a tributary of the River Cherwell and in the south by the Oxford Canal. Access is from the Boddington Road which forms the western boundary, whilst hedges mark the boundary in the east. It is intended to provide a marina and corresponding infrastructure together with a reservoir that will be located in the eastern part of the Site. The Site comprises a single large arable field currently given to winter cereals.

The Author

1.3 The report has been prepared on behalf of SBRice Ltd by LandLook(Midlands). LandLook(Midlands) is a specialist consultancy advising farmers, developers and environmental consulting groups on agricultural land quality. We are familiar with all types of agricultural land quality procedures.

Background Information

1.4 Provisional ALC maps covering England and Wales were published in the late 1970s and early 1980s. These Provisional ALC maps are not sufficiently accurate to allow assessment of individual fields or small individual development sites and, as advised by DEFRA, should not be used other than for general guidance at a strategic regional level. The provisional maps were created before the ALC Guidelines were revised (MAFF1988) and Grade 3 has now been sub-divided into Subgrades 3a and 3b.

Methodology

1.5 The land was subject to an agricultural land classification survey on 31st March 2017 and has been graded according to the current agricultural land classification (ALC) guidelines and criteria for England and Wales (MAFF 1988[1]).

[1] Agricultural Land Classification of England and Wales: Revised Guidelines and Criteria for Grading the Quality of Agricultural Land', October, 1988. The Ministry of Agriculture, Fisheries and Food (MAFF) was incorporated within the Department for Environment, Food and Rural Affairs (Defra) in June 2001

1.6 The soil resources were determined from 21 inspection sites using a spade and hand auger to a maximum depth of 120 cm where possible. These sites followed the Ordnance Survey grid at 100 m intervals, to avoid bias in selection. However, where the grid point was close to the Site boundary, ditch spoil or located at some anomaly such as a pond it may have been relocated slightly to avoid possible disturbance effects. Additional bores may have been included to give a better coverage at the Site. The sample auger locations and the grading of the survey are shown on **Appendix 1** and the findings at each location are summarised at **Appendix 2**.

The presence of calcium carbonate was assessed using a 10% solution of hydrochloric acid dispensed from a dropper bottle and the resultant reaction compared to Table 11 in the Soil Survey Field Handbook (Hodgson 1997)[2]. Stone content in the topsoil was assessed by eye using the charts given in Figures 5a and 5b, pages 18-19 in the same publication. In the subsoil estimate of stone content was made from ease of augering. Determination of soil texture is calculated by hand from the textural diagram given in Hodgson 1997.

1.7 Three topsoil samples for texture analysis were collected from sites considered representative (Nos. 1, 7 and 12) to confirm texture assessment in the field and to provide analytical data for accurate ALC grading. At this site texture in conjunction with climate in the way it affects moisture holding is important in assessing ALC grade. The analytical results are given in Table 1 below.

Table 1: Analytical results of Topsoil Texture

Determinant	Bore No. 1	Bore No. 7	Bore No. 12
Sand %	30	17	42
Silt %	34	42	29
Clay %	36	41	29
Textural Class	Clay	Clay	Heavy Clay Loam

2 AGRICULTURAL LAND QUALITY

2.1 The Agricultural Land Classification (ALC) system provides a framework for classifying land according to the extent to which physical or chemical characteristics impose long term limitations by affecting crop diversity, yield levels, consistency of yield or the cost in producing it. It divides agricultural land into five grades according to the inherent qualities and versatility

[2] Hodgson, J.M. (1997). Soil Survey Field Handbook. Soil Surv. Land Res. Centre Tech. Monogr. No5

of soils interacting with other factors such as depth to rock, slope, stoniness, flood risk and climate. Field experience during the mid-1970's led to the separation of Grade 3 into two, more meaningful subgrades, 3a and 3b. This separation together with refinement of others grades was incorporated into the current 1988 guidelines to give four Grades and two Subgrades. The ALC system assumes a reasonably good level of management and that factors such as soil wetness have been improved by ditching or drainage at reasonable cost.

2.2 Grade 1 of the ALC is described as being of excellent quality and Grade 5, at the other end of the scale, is described as being of very poor quality (**Appendix 3**). Agricultural land within Grades 1, 2 and 3a of the ALC is considered the "**best and most versatile agricultural land**"[3] (BMV). This is land which is most flexible, productive and efficient in response to inputs.

Factors Affecting Land Quality

2.3 Agricultural land quality is affected by a number of factors including climatic, topographic and soil characteristics, and the interaction between these factors.

2.4 **Climate** affects the grading of land through its influence on the potential for agricultural uses and the cost and level of production. Climate determines the energy available for photosynthesis and water supply to plant roots. Plant growth is influenced partly through the interaction of climate with soil and site properties.

2.5 The key climatic variables for this site are provided by the Met Office (1989)[4] based on a 5 km grid. The climatic figures for a point at the centre of the Site are given in Table 2, from nearby 5 km grid points using interpolating algorithms.

Table 2: Climate and altitude data

Grid reference	SP46405100
Altitude	110m AOD
Average annual rainfall	698 mm
Accumulated temperature >0°C (Jan-June)	1370 degree days
Moisture deficit, wheat	100 mm
Moisture deficit, potatoes	90 mm
Field capacity period	158 days

[3] National Planning Policy Framework Annex 2: Glossary (2012)
[4] Meteorological Office (1989). Climatological data for Agricultural Land Classification. HMSO

Climate in this area does not directly affect the grade but limits land quality by interacting with soil texture. This influences not only the workability of the soil and the flexibility for field operations under reasonably good conditions but also the potential for grazing stock.

Temperature, represented by the accumulated temperature above 0° C between January and June, indicates moderately warm conditions typical of much of eastern England and rainfall is relatively low at 698 mm being in the drier part of the country. The moisture deficit for wheat is 100 mm and for potatoes is 90 mm and may impact negatively on the water balance between natural input by rainfall and that which can be held by the soil where the soil is considered to be over rock. However drought restriction is not an important limitation.

2.6 **Geology and soils**.

The British Geological Society (BGS) website shows the area to be underlain by the Charmouth Mudstone Formation of Jurassic age. It comprises dark grey laminated shales and pale bluish grey mudstones interbedded locally with thin tabular limestone bands. Along the edge of the brook that forms the northern boundary to the Site the Charmouth Mudstone is overlain by river alluvium which consists of clay silt sand and gravel.

Detailed soil mapping by the Soil Survey of England and Wales[5] indicates that the soils at the Site are of the Denchworth Association that comprises slowly permeable clayey soils of the Denchworth Series (Wetness Class III **Appendix 4**) with slowly permeable clayey and loam over clayey subsidiary soils of the Lawford series (Wetness Class III) and Wickham series (Wetness Class III). Some clayey calcareous soils of the Evesham series (Wetness Class III) and loamy soils of the Oxpasture series (Wetness Class III) with seasonal waterlogging may also occur but were not recognised during the survey. Soils of the Denchworth and Wickham series were most common at the Site with the occasional Lawford profile.

Close to auger bore No.3 a pit had been dug to rectify a drainage defect and the horizon sequence and the matrix and mottle colours of a typical Lawford soil is shown in **Figure 1** below.

Where the BGS indicates superficial deposits of alluvium the scale of the soil map is not sufficient to show soils developed on this material, however, during this Site survey soil profiles were recognised that contained layers indicative of drift material which in this Site is likely to be river alluvium. In places it is not thick over mudstone and no series name was identified.

[5] Hodge *et al*. (1984) Soils and Their Use in Eastern England. Bull. Soil Surv. No 13

Topsoils are in the region of 25 cm thick with upper subsoils, below this, a further 25 cm thick on average. These depths will release several thousand cubic meters of topsoil and upper subsoil available to be used in either restoration and landscaping on Site or elsewhere. Below the upper subsoil the material is mostly a silty clay or clay with some deeper pockets of loamy material to 70cm depth locally.

2.7 **Limitations.**

The interaction of **texture and wetness** is the limiting factor on the Site and affects soil workability by restricting the time available for field work and grazing of stock. Grey and rusty mottles in most of the soil profiles indicate that these soils are wet for long periods in winter and spring. The soils at the Site have relatively slowly permeable subsoils that restrict downward water movement and workability and grazing of the soil will be limited for several days after heavy rain. Where the water level in the adjacent Cherwell tributary is high there is a potential risk of flooding though the duration and frequency is not known.

Other limitations.

There were no limitations to agricultural land quality associated with slope, stoniness, drought or soil depth. Flooding may be a restriction to grade but will only be significant if the frequency is 'occasional' or 'frequent' and the duration is 'medium' or 'short' (MAFF 1988, Table 3).

Agricultural Land Classification

2.8 The survey shows that the Site is composed mostly of Subgrade 3b with some Subgrade 3a.

The proportion of land in each grade is given in Table 3 below.

Table 3: ALC Grades as a Proportion of Agricultural Land

ALC Grade	Area (ha)	Area (%)
1	0	0
2	0	0
3a	2.37ha	12.90%
3b	15.99ha	87.10%
4	0	0
5	0	0
Total	18.36ha	100%

2.9 The location of the sample points and the ALC Grade are shown at **Appendix 1** and the summary of auger bore data in **Appendix 2**.

3 ASSESSMENT AND CONCLUSION

Agricultural Land Quality

3.1 The proposals involve the non-agricultural use of approximately 18.4 ha of agricultural land for a marina and irrigation reservoir with corresponding infrastructure. A detailed ALC survey has shown that the Site is mainly moderate quality agricultural land, Subgrade 3b with a relatively small amount of good quality agricultural land, Subgrade 3a.

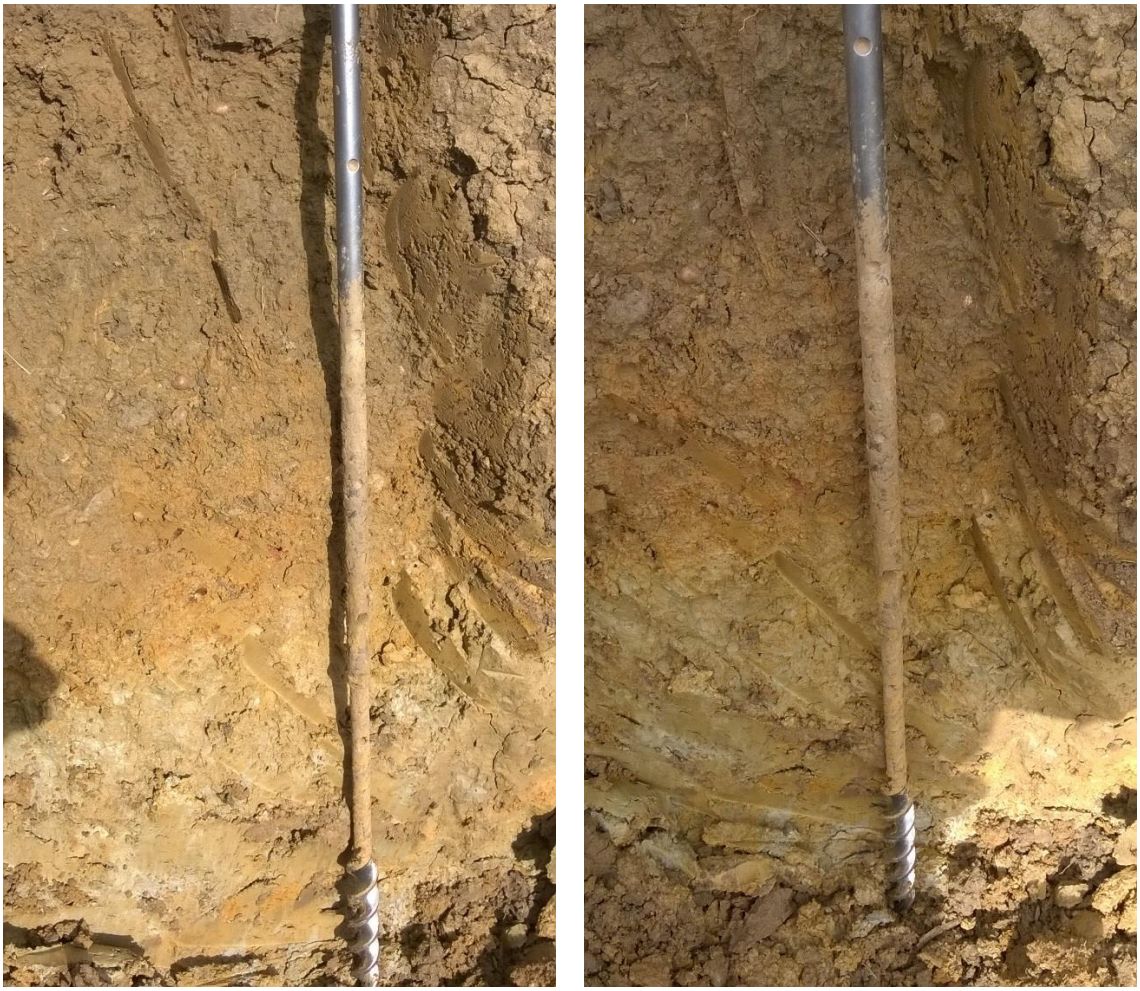

Figure 1 Matrix and mottle colours of a Lawford profile close to auger bore Nº. 3

Appendix 1 Auger Bore Locations and Land Grade

Appendix 2 Summary of Auger Bore Data

Descriptive terms given here are standard terms given in the Soil Survey Field Handbook (1997) with standard colour terms taken from the Munsell Color Book

Summary of Soil Auger Bore Data

Inspection Site Data

Site No.	Depth (cm)	Soil Colour *		Texture	Stones (%)	Wetness Class**	Limitation	ALC Grade
		Matrix	Mottles					
1	0-22 22-60 60-80 80-120	2.5Y3/2 2.5Y5/4 2.5Y5/6 5Y5/4	 2.5YR6/2 2.5YR5/2 5Y5/1	C C ZC ZC		III	Texture & Wetness	**3b**
2	0-25 25-50 50-65 Stopped by stones	2.5Y3/3 2.5Y4/4 2.5Y4/4	 2.5Y4/2 2.5Y5/2	C C ZC		III	Texture & Wetness	**3b**
3	0-23 23-36 36-48 48-65 65-120	2.5Y3/3 2.5Y5/4 2.5Y5/4 2.5Y4/4 5Y5/4	 2.5Y5/2 2.5Y5/2 2.5Y5/2 5Y5/1	HZCL HCL HCL ZC ZC		III	Texture & Wetness	**3b**
4	0-24 24-38 38-55 55-120	2.5Y3/3 2.5Y4/4 2.5Y4/4 2.5Y5/6	 10YR5/8 2.5Y4/2 10YR5/8	HZCL HZCL HZCL HCL		III	Texture & Wetness	**3b**
5	0-25 25-65 65-78 78-120	2.5Y3/3 2.5Y4/4 2.5Y4/4 5Y5/4	 2.5Y5/2 2.5Y5/2 5Y5/1	ZC C SCL ZC	2	III	Texture & Wetness	**3b**
6	0-25 25-45 45-55 55-70 70-120	2.5Y3/3 2.5Y4/4 2.5Y4/4 2.5Y5/4 5Y5/4	 10YR5/8 2.5YR6/2 2.5YR5/2 5Y5/1	ZC/C ZC ZC ZC ZC	2	III	Texture & Wetness	**3b**
7	0-18 18-38 38-70 70-120	2.5Y3/2 2.5Y4/4 2.5Y4/4 5Y5/4	 2.5Y5/2 N60 5Y5/1	C C ZC ZC	2	III	Texture & Wetness	**3b**
8	0-25 25-50 50-120	2.5Y3/3 2.5Y4/4 2.5Y5/4	 2.5Y5/2	C ZC ZC	7 10 5	II	Texture & Wetness	**3b**
9	0-28 28-50 50-65 65-90	2.5Y3/3 2.5Y4/4 10YR3/1 10YR4/3	 2.5Y4/2 10YR5/8 5YR3/3	HZCL HZCL C C	2	III	Texture & Wetness	**3b**

	90-120	10YR3/1	10YR5/8	C				
10	0-25 25-30 30-65 65-85 85-120	2.5Y3/3 2.5Y3/4 2.5Y4/4 2.5Y5/4 5Y5/4	 10YR5/8 2.5Y5/2 N50 5Y5/1	MZCL MZCL HZCL ZC ZC	2	III	Texture & Wetness	**3a**
11	0-25 25-39 39-50 50-80 80-120	2.5Y3/2 2.5Y4/4 2.5Y4/4 2.5Y4/4 5Y5/4	 10YR5/8 2.5Y5/2 2.5Y5/2 5Y6/1	HCL HCL HCL ZC ZC		III	Texture & Wetness	**3b**
12	0-23 23-55 55-80 80-120	2.5Y3/3 2.5Y4/3 2.5Y5/4 5Y5/4	 5Y3/3 N50 5Y6/1	HCL HCL ZC ZC		III	Texture & Wetness	**3b**
13	0-28 28-45 45-80 80-120	2.5Y3/2 2.5Y4/4 2.5Y4/4 5Y5/1	 2.5Y5/2 N50 5Y5/1	HZCL HZCL ZC ZC	3	III	Texture & Wetness	**3b**
14	0-22 22-45 45-65 65-120	2.5Y3/3 10YR4/6 2.5Y4/4 2.5Y5/4	 10YR5/8 10YR5/8 2.5Y6/2	MZCL HCL ZC ZC	3 2	II/III	Texture & Wetness	**3a**
15	0-23 23-60 Stopped by stones	10YR3/3 2.5Y5/4	 2.5Y4/2	MCL HCL	3 8	III	Texture & Wetness	**3a**
16	0-28 28-65 65-78 78-85 Stopped by Lmst	2.5Y3/3 10YR5/4 2.5Y5/4 10YR5/6	 10YR5/2 2.5Y5/2 10YR5/8	HCL HCL ZC ZC calc	3	III	Texture & Wetness	**3b**
17	0-25 25-45 45-75 Stopped by Lmst	2.5Y3/3 2.5Y4/3 2.5Y4/4	 10YR5/8 2.5Y4/2	HZCL HZCL HZCL	3 2	II	Texture & Wetness	**3a**
18	0-22 22-45 45-55 55-120	2.5Y3/3 2.5Y4/4 2.5Y4/4 5Y5/4	 10YR5/8 5Y6/1	HZCL HZCL HZCL ZC sl calc		III	Texture & Wetness	**3b**
19	0-28 28-45 45-70 70-85 85-120	2.5Y3/3 10YR5/6 2.5Y5/4 2.5Y5/4 5Y5/4	 10YR5/8 2.5Y5/2 2.5Y5/2 5Y6/1	HZCL HCL ZC ZC sl calc ZC sl calc	3	III	Texture & Wetness	**3b**
20	0-25 25-78 78-120	2.5Y3/3 2.5Y4/4 5Y4/4	 2.5Y6/2 5Y5/1	HZCL ZC ZC		III	Texture & Wetness	**3b**
21	0-25 25-35 35-55 55-75 75-100 100-120	2.5Y3/3 2.5Y4/4 2.5Y4/4 5Y4/4 10YR4/4 5Y6/1	 2.5Y5/6 2.5Y6/2 5Y6/1 10YR5/8 5Y5/6	MZCL HZCL ZC ZC SC sl calc ZC calc	2	III	Texture & Wetness	**3b**

Texture definitions

C Clay, **ZC** Silty Clay, **HCL** Heavy Clay Loam, **HZCL** Heavy Silty Clay Loam, **MCL** Medium Clay Loam, **MZCL** Medium Silty Clay Loam and **SC** Sandy Clay.

Where the texture is slightly calcareous it is given the suffix '**sl calc'** and where calcareous '**calc**'.

Where subsoils cannot be augered an estimate of expected stone % is given.

*** Soil Colour** Code for Munsell Color, Munsell Color Company Inc., Baltimore, Maryland 21218, U.S.A.
**** Wetness Class** see definitions in Appendix 4 below.

Appendix 3 Definitions of Agricultural Land Classification Grades

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Grade 1 – excellent quality agricultural land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2 – very good quality agricultural land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.

Grade 3 – good to moderate quality agricultural land

Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a – good quality agricultural land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b – moderate quality agricultural land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

Grade 4 – poor quality agricultural land

Land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops, the yields of which are variable. The grade includes very droughty arable land.

Grade 5 – very poor quality agricultural land

Land with very severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

These gradings are based on certain assumptions, which include an appropriate underdrainage system and satisfactory outfalls.

Descriptions of other land categories used on ALC maps

Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

Non-agricultural

'Soft' uses where most of the land could be returned relatively easily to agriculture, including: golf courses, private parkland, public open spaces, sports fields, allotments and soft surfaced areas on airports/airfields. Also active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

Woodland

Includes commercial and non-commercial woodland. A distinction may be made as necessary between farm and non-farm woodland.

Agricultural buildings

Includes the normal range of agricultural buildings and hard tracks as well as other relatively permanent structures such as glasshouses. Temporary structures (e.g. polythene tunnels erected for lambing) may be ignored.

Open water

Includes lakes, ponds and rivers as map scale permits.

Land not surveyed

Agricultural land which has not been surveyed.

Where the land use includes more than one of the above land cover types, e.g. buildings in large grounds, and where the map scale permits, the cover types may be shown separately. Otherwise, the most extensive cover type will usually be shown.

Appendix 4 Definitions of Wetness Class

Wetness Class	Descriptive term	Duration of waterlogging+
I	Well drained	The soil profile is not wet within 70 cm depth for more than 30 days in most years.
II	Slight seasonal waterlogging	The soil profile is wet within 70 cm depth for 31-90 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 90 days, but not wet within 40 cm depth for more than 30 days in most years.
III	Seasonally waterlogged	The soil profile is wet within 70 cm depth for 91-180 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31 and 90 days in most years.
IV	Waterlogged for long periods in winter	The soil profile is wet within 70 cm depth for more than 180 days but not within 40 cm depth for more than 210 days in most years or, if there is no slowly permeable layer within 80 cm depth, it is wet within 40 cm depth for 90-210 days in most years.
V	Severely waterlogged	The soil profile is wet within 40 cm depth for 211-335 days in most years.
VI	Permanently waterlogged	The soil profile is wet within 40 cm depth for more than 335 days in most years.

+ The number of days specified is not necessarily a continuous period;