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AESC UK

AESC PLANT 3

SOIL MANAGEMENT PLAN

OCTOBER 2023

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SOIL MANAGEMENT PLAN

OCTOBER 2023

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1 INTRODUCTION

1.1 Background

1.1.1 Wardell Armstrong LLP (WA) has been commissioned by AESC UK to produce this Soil Management Plan (SMP) for the proposed works at land north of the A1290 at North Moor Farm, East Boldon (SR5 3FH) (hereafter referred to as 'the Site').

1.2 Site Description

1.2.1 The Site is located within the administrative area of Sunderland City Council and is accessed from the A1290 northeast of Washington, Sunderland. The entire Site is comprised of agricultural fields. Surrounding land includes agricultural fields to the North and North West of the Site. There is a Nissan Factory and business park located to the south of the Site. Nearby urban and residential areas include Washington and Hylton.

1.2.2 The site comprises approximately 42.39 hectares (ha) of land. The 2023 Agricultural Land Classification (ALC) survey recorded 23.93 ha of Subgrade 3a agricultural land, 17.31 ha of Subgrade 3b agricultural land, and 1.15 ha of non-agricultural land. The site location is shown in Plate 1 below.

Plate 1: Site Location (basemap © Bing Maps)

1.3 Summary of Works to be Undertaken

1.3.1 This Soil Management Plan is informed by the proposed works set out in the Drawing 201-P02 Proposed Site Plan. The proposed development involves the construction of the following built development:

- Factory building
- Pack &Warehouse Building
- Office Building
- Ancillary MEP Plant Rooms
- Gatehouse
- HV Substation
- Car Parking and Bicycle and Motorcycle Shelter
- HGV Spaces

1.3.2 During the construction process the main works involving soil relate to the construction of the built infrastructure listed above, and the vehicular movement around the Site.

1.4 Baseline Conditions

1.4.1 Soil type is largely informed by organic matter content and soil texture, the proportion of sand, silt and clay and organic matter content. The soil texture influences many soil properties largely driven by the total surface area of particles which is determined by texture.

1.4.2 An Agricultural Land Classification Survey of the site was conducted in July 2023 to verify existing post 1988 soil data. Representative samples of the soils from across the site were taken for analysis to confirm soil texture.

1.4.3 Soils across the Site were typically medium textured clay loam topsoils overlying heavy clay loam or clay subsoils. The survey showed that the soil across the site belong to the Foggathorpe 1 association, and a summary of the soil characteristics is provided in Table 1.

Table 1: The Soil Associations based on the Soil Survey of England and Wales (1984).	
Soil Association	**712h Foggathorpe 1**
Geology	Glaciolacustrine drift and till.
Soil Series	Foggathorpe, Hallsworth, Dunkeswick
Soil characteristics	The Foggathrope 1 soil association consists of slowly permeable seasonally waterlogged clayey and fine loamy over clayey soils, often stoneless. Pelo-stagnogley soils present. Dominated by seasonally waterlogged clayey, often stoneless soils in till and glaciolacustrine clay. Occurs on flat land where lacustrine clay overlies the till. Elevation varies from around 6 m A.O.D. at the coast to 150 m A.O.D. on higher ground. The clayey texture and surface wetness of the Foggathorpe and Hallsworth series restrict cropping to grass and barley. Much of the land is characterised by rough grazing, particularly on wetter ground where reseeding is difficult
Soil Water Regime	Foggathorpe 1 soils experience seasonal, sometimes severe, waterlogging. Without artificial drainage the soils are seasonally waterlogged for long periods in winter (Wetness Class IV). Drainage is essential if lands are to be used other than in summer.
Erodibility	Very small risk from water

1.4.4 The texture of the topsoil across the Site was typically a medium clay loam. Other topsoil textures were also recorded including sandy clay loam at one point in the north of the Site, fine sandy loam at one point in northwest of the Site, and a heavy clay loam topsoil was recorded at one point towards the south of the Site. The topsoil was typically a very dark greyish brown colour. The topsoil ranged in depth from 25 to 38 cm with an average depth of 31 cm. Topsoil displayed medium (coarse at one location) ped size, and friable to firm consistency (very firm at one location). The structure in the topsoil was consistently subangular blocky. Stones were encountered within the topsoil in three of the fourteen locations which contained 5-15% stone sized between 2 and 6cm. No mottling or ferri-manganiferous concentrations were observed in the topsoil.

1.4.5 The subsoil was recorded between 25cm and 90cm below ground level and generally consisted of clay and heavy clay loam textures (medium clay loam and sandy clay loam textures were also recorded). Ochreous mottles and ferri-manganiferous concentrations were present throughout the subsoil horizons.

1.4.6 The upper subsoil extended to an average depth of 53 cm (range between 38 and 65cm). The soil was typically a weakly developed, coarse, angular blocky clay (heavy clay loam, sandy clay loam and medium clay loam textures also encountered) of a firm to very firm ped strength with ochreous mottles and ferri-manganiferous concentrations present in the horizon. Stones were encountered within the upper subsoil in half the locations which contained 5% stones of 2-6cm and 25% stones >6cm at one location.

1.4.7 The lower subsoil was found at all locations except for two points and extended to a depth between 60 and 90cm (average depth of 77cm). The soil was typically characterised by a weak to moderately developed, medium to coarse, prismatic (angular blocky and subangular blocky structures also encountered) clay (sandy clay loam at one location) of a firm to very firm sped strength (friable where sandy clay loam was recorded). Stones were encountered within the lower subsoil in ten locations which contained between 5 and 10% of stones between 2-6cm and 5% of stones >6cm at one location.

1.4.8 A second lower subsoil horizon was recorded at five locations and extended to a depth of between 70 and 90cm (average depth of 84cm). This horizon was characterised by a weakly developed, coarse, prismatic clay of very firm ped strength. Stones were encountered within this horizon in three locations which contained between 5 and 10% of stones between 2-6cm and 5% of stones >6cm at one location.

1.5 Soil Chemical Characteristics

Table 2: Chemical Characteristics of soil at the Site

Characteristic	Units	Average	Min	Max
Topsoil (n=3)				
P	Mg/l	7.1	2.8	10.4
K	Mg/l	61.7	30	86
Mg	Mg/l	231	185	281
pH	-	6.9	6.6	7.1
OM (Loss on Ignition)	%	6.1	5.1	6.8
Subsoil (n=2)				
P	Mg/l	3.9	2.6	5.2
K	Mg/l	64	53	75
Mg	Mg/l	375	298	452
pH	-	7.7	7.6	7.7
OM (Loss on Ignition)	%	3.1	2.7	3.5

1.5.1 The laboratory results confirm the topsoil texture to be as medium clay loam in the topsoil and subsoil of survey point 1, sandy loam in the topsoil of survey point 9 and heavy clay loam in the subsoil of survey point 9, and a sandy clay loam in the topsoil of survey point 12.

1.5.2 The topsoil organic matter content was moderate in the topsoil (5.1% to 6.8 soil organic matter) and generally above target levels for arable land use under low rainfall conditions. Soil samples were slightly acidic to moderately alkaline (pH 6.6 to 7.7).

Topsoil samples were below arable and grassland target levels for potassium and phosphorous. However, magnesium levels were above target levels.

2 SOIL BALANCE AND REUSE ON SITE

2.1 Background

2.1.1 For the proposed development, soils will only be retained in-situ on site in the areas of retained vegetation. Any stripped soils should be retained on site, and where not directly reinstated to their final destination, are to be stored appropriately..

2.1.2 Stripping of topsoil and subsoil will be required in all the areas of built development (buildings, hardstanding, gravel).

2.2 Soil Volume Balance

2.2.1 A soil balance identifies if there is a surplus, deficit or soil balance within the current site plan, including the quantities of topsoil. Where possible, all soil resources (topsoil and subsoil) should be retained on site for reuse. This will often save money and time in having to source soil elsewhere or pay for disposal off site (which requires an environmental permit).

2.2.2 There is likely to be surplus soil on site due to the scale of the built development associated with the proposed works. The destination of surplus soils needs to be confirmed and specified prior to the commencement of works.

2.3 Soil Storage Locations

2.3.1 Appropriate soil storage locations should be identified prior to stripping which will ensure that soil handling and movement is kept to a minimum. Soils should be moved directly from the donor site to the receptor site or directly to a designated long term storage location.

2.3.2 Topsoils may be stored on top of topsoil or subsoil. Subsoils may only be stored on top of subsoils, which will require the stripping of topsoils in subsoil storage locations.

2.4 Soil Handling and Storage Monitoring Protocol

2.4.1 Table 3 summarises the need for record keeping and monitoring by site contractors and a Soil Scientist during the construction phase. Records should be kept for reference and auditing purposes.

Table 3: Record keeping and monitoring during the construction phase			
Item	**What to look for**	**Responsibility**	**Frequency**
Soil Stockpiles	Erosion rills, water ponding, loss of protective cover.	Contractor	Once a month and after rainfall exceeding 10 mm in 24 h.
Soil handling	Conformance with the Soil Resource Plan (SRP), record operations undertaken, weather and soil conditions, any problems and corrective actions undertaken.	Contractor	Daily when operations including or impacting soils are undertaken.
	Conformance with the SRP, check daily record.	Contractor	
Ongoing monitoring of SMP implementation	Verification of soil works on site and soil stockpiles to measures outlined in SRP.	Soil Scientist	At key stages of site works, approximately monthly.
Verification of the restoration standard	Has the soil profile been restored as much as practicable to do so?	Soil Scientist	Once, after reinstatement, re-inspected after remediation (if applicable).
Aftercare reports	Significant differences in plant performance, compaction and waterlogging between the restored and undisturbed land.	Soil Scientist	Annually until unrestricted.

2.5 Site Specific Measures

2.5.1 Where soils are excavated, they should be separated into topsoil and subsoil and should be stored separately to avoid the loss of soil resources through mixing.

2.5.2 Dependant on the depth of the excavations, there will be a volume of topsoil available for reuse. It is recommended that topsoil is not replaced to a depth greater than 300mm.

2.5.3 To minimize compaction of any heavy textured soils (clay and heavy clay loam) present on site, it is recommended that all plant used be equipped with low ground pressure tires, and traffic be limited to dedicated haul roads where possible.

2.5.4 It is recommended that construction takes place in the drier summer months, particularly with the clay textured soils present on site. If construction is to be undertaken when the ground will be moist to wet, ground preparations for machinery will be required. It is recommended that all plant used be equipped with low ground pressure tires, and traffic be limited to dedicated haul roads where possible.

3 GENERAL PRINCIPLES OF SOIL HANDLING

3.1.1 The main threats to soil resources at construction sites are trafficking of vehicles/plant and incorrect handling, which will cause damage to soil structure through compaction and smearing (both effects are sometimes referred to as deformation). These effects compromise the ability of the soil to perform its functions, such as providing adequate amounts of water, air and nutrients to plant roots. The risk of compaction and smearing increases with soil wetness. To minimise the risk of damage to soil structure, the following main rules must be observed during all soil handling tasks:

- No trafficking/driving of vehicles/plant or materials storage to occur outside designated areas.
- No trafficking/driving of vehicles/plant on reinstated soil (topsoil or subsoil).
- Only direct movement of soil from donor to receptor areas (no triple handling and/or ad hoc storage).
- No soil handling to be carried out when the soil moisture content is above the lower plastic limit (where the soil is plastic, see Table 4 and Table 5).
- Soils should only be moved under the driest practicable conditions, and this must take account of prevailing weather conditions (see rainfall "stop" criteria in Section 4.1).
- No mixing of topsoil with subsoil, or of soil with other materials.
- Soil only to be stored in designated soil storage areas.
- Plant and machinery only work when ground or soil surface conditions enable their maximum operating efficiency.
- All plant and machinery must always be maintained in a safe and efficient working condition.
- Daily records of operations undertaken, and site and soil conditions should be maintained (see Section 2.4 for the summary of monitoring and record keeping schedule).

3.1.2 Low ground pressure (LGP) models or tracked vehicles should be used where possible. This will greatly minimise the extent and/or intensity of the soil loosening required after restoration. Consequently, it will reduce the costs and potential delays due to the need for additional soil cultivation.

4 STOP CONDITIONS

4.1 Adverse Weather

4.1.1 In certain weather conditions, the handling of topsoil must be effectively managed to prevent damage. The following criteria must be applied during operation to determine if conditions are suitable for topsoil and subsoil handling:

- In drizzle and/or intermittent light rain, handling can continue for up to four hours or until the soils enter a plastic state at which point operation must cease (see Table 4, testing for soil moisture state);
- If there is heavy rain (e.g. heavy showers, slow moving depressions), handling must stop immediately;
- If there is sustained heavy rainfall of more than 10 mm in 24 hours, soil handling must be suspended and not restarted until the ground has had at least a full day to dry, or an agreed soil moisture limit met; and
- Soil shall not be handled or trafficked over/driven on immediately after heavy rainfall (or snow/hail) in a waterlogged condition, or when there are standing pools of water on the soil surface.

4.1.2 If the works are interrupted by a rainfall event, soil stripping should be suspended; and where the soil profile has already been disturbed, the works should be completed to the base level in that location.

4.1.3 Before recommencing work, soil moisture content must be tested, as described in Table 4 and Table 5, and only recommence if soil moisture is below the lower plastic limit. The weather forecast must also be checked and works only recommenced if there is no rain forecast for at least a day, regardless of soil moisture condition.

4.1.4 Additionally, soil should not be handled or trafficked over/driven on when the ground is frozen or covered by snow.

4.1.5 The above criteria should be clearly understood by all personnel.

4.2 Soil Conditions

4.2.1 Irrespective of the weather, soils should not be handled when in a plastic state (when moisture content exceeds their lower plastic limit); and as a general rule they should be dry when handled.

4.2.2 A project-wide seasonal constraint to the construction programme is not recommended as this may not be achievable in practice. The onsite soil types identified in the Agricultural Land Classification Survey and described in Section 1.3 are medium clay loam topsoils (sandy clay loam, fine sandy loam and heavy clay loam textures also recorded in the topsoil) over heavy clay loam and clay subsoils (sandy clay loam and medium clay loam textures also recorded in the subsoil). Based on the soil types discussed, soil handling is recommended to take place in drier periods of the year.

4.2.3 If the soil is excavated and placed in stockpiles when wet (above the plastic limit), they can be easily over-compacted by the machinery handling them, or by the weight of the soil above them in the stockpile. As well as this structural damage, when soils within a stockpile are compacted, the core of the stockpile remains anaerobic throughout the storage period. This damage results in the soil being very difficult to handle and re-spread at the time of reinstatement (i.e. it will not be in a friable state and will not break down into a suitable tilth). In relation to this scenario, in order to achieve the required standard of restoration, a period of drying and appropriate additional cultivation is required (to repair soil structure and re-aerate the soil) to ensure the soil is acceptable for planting. The costs of these unplanned operations, and consequent delays to the programme of works could be substantially greater than the costs of ensuring that the soil stripping and stockpiling operations are carried out in optimum conditions and making allowances for delays due to bad weather.

4.2.4 For arable land, the period where the soil conditions will generally be the driest typically occur in the summer following the spring crop harvest, when the plant evapotranspiration will have dried the soil.

4.2.5 Once placement of soils into each stockpile has been completed, rainfall and soil moisture conditions are of lesser importance, providing they do not lead to significant environmental impacts, such as erosion and discharges of sediment laden water from the stockpiles to drainage ditches and other watercourses.

4.3 Field Testing of Soil Conditions

4.3.1 The two stage methodology outlined in the following sections, comprising a moisture state and a consistency tests, has been recognised by Natural England as an acceptable and valid approach; as it is considered to be less open to interpretation and easier to conduct than use of consistency testing (Table 5) alone.

4.3.2 At least five points per area to be worked on a given day should be sampled (a minimum of 1 point per 50 m of the length of the working area, or 2 samples per ha). The sample should be a composite of at least five subsamples from around each sample point. Samples of both topsoil and subsoil should be taken and sampled separately.

Soil moisture state

4.3.3 The samples should first be tested for soil moisture state, see methodology in Table 4

Table 4: Testing for moisture state

Test	**Handling Allowed?**
If soil sample is wet, films of water are visible on the surfaces of grains and aggregates; or If soil sample readily deforms into a cohesive 'ball' when squeezed.	Soils should not be handled.
Soil peds break up/crumble readily when squeezed in the hand. Sample does not form a cohesive ball.	Soils can be handled
If the sample is moist, there is a slight dampness when squeezed between the fingers, but it does not significantly change colour (darken) on further wetting.	No handling by dozers but may be handled by excavators if the consistency test is passed.
Sample is dry and brittle. Sample looks dry and changes colour (darkens) on wetting.	Soils can be handled if the consistency test is passed.

Consistency

4.3.4 Where required as per Table 4, samples should be further tested for consistency (see methodology in Table 5.

Table 5: Consistency testing

STEP A		
Attempt to roll sample into a ball by hand	It is impossible because the soil is too hard (dry)	Soils can be handled
	It is impossible because the soil is too loose (dry)	Soils can be handled
	It is impossible because the soil is too loose (wet)	Soils should not be handled
	It is possible to roll the sample into a ball by hand	See STEP B
STEP B		
Attempt to roll the ball into a thread of 3 mm diameter on a flat non-adhesive surface using light pressure from the flat of a hand	It is impossible as the soil crumbles or disintegrates	Soils can be handled
	It is possible to roll a 3 mm diameter thread	Soils should not be handled

4.3.5 The final decision on whether soil handling can commence will be made based upon at least 80% of samples passing the specific criteria set out in Tables 4 and 5. The above criteria should be clearly understood by all personnel.

4.4 Preparation

4.4.1 Marking and signposting of the undisturbed areas (where no construction activities or vehicle trafficking over/driving on occurs) is to take place per Contractor method statements (to be prepared by the Contractor). Any trees, hedgerows or valuable habitats which are to be retained should be marked out with barrier tape; and subsequently protected and managed.

4.4.2 Any underground services crossing the area of soil stripping are to be surveyed and their depth and position clearly marked to ensure they are not impacted by the stripping works. After stripping, to ensure the integrity of the service infrastructure is maintained, the service location may require fencing off; or if the area over the service is to be trafficked, additional protection or mitigation may be required.

4.4.3 To reduce the likelihood of anaerobic conditions developing within the topsoil stockpile, prior to the soil strip commencing, the topsoil surface should either be bare, under stubble, or have only short surface vegetation. To achieve short surface vegetation, the area should be mown or trimmed, where required. Cuttings should be disposed of off-site to a suitably licenced facility with reuse and recycling favoured over disposal (e.g. recycling via a local composting facility). Cuttings must not be added to or mixed with the stripped soil, as the presence of excessive amounts of plant material in the stockpile will be detrimental to its quality due to its putrefaction (rotting) in anaerobic conditions. Alternatively, the vegetation may be killed off by application of a suitable, Environment Agency approved, non-residual herbicide applied not less than two weeks prior to commencement of soil stripping operations at the location.

5 SOIL STRIPPING

5.1 Introduction

5.1.1 Topsoil can be stored on either topsoil (of the same type) or on subsoil. Subsoil can ONLY be stored on subsoil and therefore the topsoil must be stripped from subsoil storage areas in advance of subsoil stripping.

5.1.2 The stripping method should follow one of the appropriate methods as described in the Institute of Quarrying's (IQ's) *Good Practice Guide to Handling Soils in Mineral Workings*.

5.1.3 If soils are to be stored adjacent to the excavation area, the use of dumper trucks will not be required, and a single excavator should be able to strip soils and form the stockpiles. However, where soils are to be stored away from the excavation area, two excavators and one transport vehicle (dumper) will be required for soil stripping operations. One excavator will be required to undertake the soil stripping and the other to form the soil stockpiles. The excavator undertaking the soil stripping should be fitted with a toothed bucket. The above method, if correctly carried out, should avoid severe compaction as soil trafficking is minimised.

5.1.4 The size of the earthmoving plant to be used should be tailored to the size of the area to be stripped and the space available within the working area. The use of a long reach excavator, which will minimise the need for movement across the soil surface, and the use of tracked vehicles or vehicles with a low ground bearing pressure is recommended to further reduce soil compaction.

5.1.5 Prior to commencement of soil stripping, the width of each strip must be determined. Strip width is determined by the length of the excavator boom minus the stand-off to operate; typically, 3 to 4 m. The strip width should make full use of the reach of the excavator. This will maximise the time the excavator can remain at a fixed location, before moving further along the strip; minimising the number of locations subject to the weight of standing plant.

5.1.6 The depth of the topsoil strip is to be determined on a 'location by location' basis using the soil survey data as described in the soil resource survey. During the strip, the excavator should stand on the surface of the topsoil, digging the topsoil to the required depth and forming the stockpile or loading it into the transport vehicle (dump truck). Following topsoil removal, the subsoil can be excavated (if required). Topsoil should be recovered to the full width of the strip without contamination with the subsoil. The boundary between the topsoil and subsoil is usually very clearly visible through a change in colour (the topsoil being much darker due to greater organic matter content). However, this may not always be the case, as often the topsoil gradually transitions into subsoil, and their colours are similar. Therefore, the depth of the topsoil to be stripped must be determined by measuring the depth from the surface (excluding any vegetation) using the soil survey data as described above.

5.1.7 The key points to minimise soil compaction and maximise its readiness for reuse are:

- The operations of the vehicles (excavators and dumper trucks, if relevant) on the topsoil should be minimised.
- Plant and machinery are to only work when ground conditions enable their maximum efficiency.
- Soils should only be handled when dry (i.e. when tests set out in Table 4 and Table 5 are passed).
- Stop conditions as set out in Section 4 must be observed.
- Protect the subsoil from ponding of water by diverting water inflow away from it.
- **Do not** work when there is standing water on the topsoil or subsoil surface.

5.2 Creation of Stockpiles

5.2.1 Correct storage/stockpiling will maintain soil quality and minimise damage to soil structure and soil biota. This ensures that the soil will readily recover once re-spread, promoting timely and effective restoration. Stockpiled soil must not be vulnerable to compaction or erosion; must not cause pollution to surrounding watercourses; and must not increase flood risk to the surrounding area.

5.2.2 Potential soil erosion and water pollution can be minimised through a number of good practice measures, including, but not limited to, the avoidance of trafficking over/driving on the soil stockpiles, the seeding of stockpiles, and the use of intermittent spaces in the stockpiles.

5.2.3 Soil should not be stacked closer than 5 m from a watercourse or ditch. Gaps shall be left where necessary to allow for surface water drainage and avoid the catchment (ponding) of water behind stockpiles.

5.2.4 Generally, topsoil stockpiles should not exceed 3 m in height and subsoil stockpiles should not exceed 5 m in height. However, if the soil to be stockpiled is dry (below the plastic limit) formation of higher stockpiles may be permissible, if required, as the soil is likely to remain dry in the core of the stockpile for the entire storage period. However, the appropriateness of higher stockpiles will need to be established on a location-by-location basis.

5.2.5 Stockpiles are to be formed by 'loose-tipping' followed by 'shaping' to form a level surface on top of the pile and uniform gradients down the sides. During 'forming', the top and sides should be smoothed so that they can shed water, ensuring that the entry of the water to the stockpile is limited and that the stored soil remains dry; and helping prevent erosion and ponding. This is achieved by dragging the bottom of the excavator bucket along the stockpile surface.

5.2.6 The natural angle of repose of a soil, and hence the maximum gradient (slope) of the stockpile sides, depends upon its texture and moisture content. The maximum achievable slope angle is 40°, however, shallower angles are often more appropriate. If the stockpiles are to be seeded and maintained, a maximum slope of 25° (1 in 2) is considered appropriate. However, this should be defined in location-specific construction method statements.

5.3 Stockpile Maintenance

5.3.1 If it is expected that the soil will be stored for a period of more than six months the stockpiles should be seeded with appropriate low maintenance grass/clover mixture (to protect the soil against erosion, minimise soil nutrient loss, and maintain soil biological activity). Appropriate seeding will also help prevent colonisation of the stockpile by nuisance weeds that could spread onto adjacent land.

5.3.2 In the period where vegetative cover on the stockpiles is establishing, where required during dry weather, the stockpiles will be sprayed with water to prevent wind erosion (generation of dust) and to ensure that the seeds establish.

5.3.3 The stockpile vegetation cover is to be managed (by spraying, mowing or stripping as appropriate and as defined in location-specific construction method statements, or similar) to prevent the spread of seeds from the stockpile onto adjacent land.

5.3.4 The condition of the stockpiles is to be regularly monitored. If rainwater gathers on the stockpile surface or in areas directly adjacent to them, drainage pathways to soakaway(s) away from the stockpile should be provided.

5.4 Stockpile Records

5.4.1 The locations and footprints of each stockpile should be accurately recorded on a plan of appropriate scale. Marker posts should be provided in locations which have been surveyed and recorded.

5.4.2 The approximate volume of each stockpile should be recorded, along with details of the type of soil stored.

5.5 Drainage

5.5.1 Prior to soil stripping, where required, pre-construction drainage will be installed per specification provided by a specialist drainage contractor. This drainage is designed to prevent water entering the working area.

5.5.2 Gaps shall be left between soil stockpiles where necessary to allow for surface water drainage and avoid the catchment (ponding) of water behind stockpiles. Where required, 'grips' may be dug across the working area at predetermined locations to prevent erosion and prevent ponding against stockpiles. Appropriate measures such as stone silt traps and silt fencing should be employed as required.

5.6 General Methods to be used during Restoration.

5.6.1 Soil reinstatement shall be subject to the same constraints of weather and soil moisture conditions as soil stripping (see Table 4 and Table 5 above). All methods must adhere to the general principles set out below.

Soil decompaction

5.6.2 Due to the use of subsoil or overburden as the working surface during construction, subsoil decompaction will be required prior to the placement of the topsoil. The method using a low ground pressure bulldozer either fitted or towed with winged subsoiler tines is recommended. Three passes of the dozer at angles should be completed, there should be no heave above the allowed surface evenness. Light grading following decompaction may be needed to achieve this.

5.6.3 The final surface should be even, but not smooth. Different depths of decompaction and number of passes may need to be used if additional compacted layers are identified. For the decompaction to be effective, the moisture content of the soil must be below the lower plastic limit, so that the soil is dry enough to shatter and for fissures to be created. Decompaction is vital, especially for the clayey soils present within the site, as otherwise there is a risk of an impermeable layer being created beneath the reinstated soils which will lead to poor drainage, surface water ponding and potentially planting failure.

Excavation of soil stockpiles

5.6.4 The size of the earthmoving plant to be used should be tailored to the size of the area to be stripped. In some locations, direct excavation of the soil from the stockpiles using a long-reach back-acting/360o excavator may be possible. However, it is anticipated that the majority of soils will be transported to the reinstatement area via dump truck, and stockpile excavation is to follow the methodology described in IQ Guide, Sheet C: Excavation of Soil Storage Mounds with Excavators and Dump Trucks. In this method, the dump trucks enter the storage area travelling on the base layer (where topsoil and subsoil are stripped) and on the subsoil (where only topsoil has been stripped). If a back acting/360o excavator is used, it must stand on top of the stockpile to load the dump truck. The stockpile is dug to the base (the original subsoil) before moving progressively back along its axis.

5.6.5 Front loading machines may be used, in which case they will not need to enter the top of the stockpile.

5.6.6 The methodology above will also apply for the loading of dump trucks from stockpiles where excess soil resource is to be exported from site.

5.6.7 Any exposed edges/surfaces should be shaped at the onset of rain and at the end of each day.

Soil Reinstatement

5.6.8 Soil reinstatement is the reverse of soil stripping, with topsoil being replaced over subsoil. The specifications for reinstated soil profiles are to be determined on a location-by-location basis and set out in Contractor method statements. Soils should be placed by the loose tipping method; whereby soil is tipped from the dump truck (or a front loader) and then placed in the receptor area using digger bucket. The correct use of this method should prevent the need for soil decompaction following the soil placement. The operations need to follow a detailed plan showing the areas to be reinstated, haul routes, and how correct topsoil depths are to be achieved.

5.6.9 Care must be taken to ensure that soil horizons are replaced to the correct thickness. Up to a 20% allowance should be made for settlement (bulking factor) of loosely placed soil (before any cultivation). The area of the soil reinstatement must be protected from water inflow and ponding.

5.6.10 In some locations, direct excavation and restoration of the soil from the stockpiles using a long-reach back-acting/360o excavator may be possible. In this method, the subsoil will be replaced first, with the excavator travelling on the subsoil and gradually taking the topsoil from the stockpile and depositing it on the subsoil. The deposition of material is to be carried out by loose tipping and a toothed digger bucket is to be used to alleviate compaction of soil.

5.6.11 Soil replacement is generally to follow the methodology set out in IQ Guide, Sheet D: Soil Replacement with Excavators and Dump Trucks. In this method, the soil is replaced in strips above the base layer to recreate the original soil profile or profile as specified by the site specific design to achieve the agreed planting plan. The topsoil is replaced on the previously decompacted subsoil. The replacement is carried out in strips in a similar manner to the stripping operations. First, the initial strip width and axis is to be demarcated. The width of the strip is determined by excavator boom length less the stand-off to operate; typically, 5 to 8 m. A wide bladed bucket should be used to spread the soil (use of a toothed bucked must be avoided in this case).

5.6.12 The dump truck should reverse to the edge of the current strip and tip the lowest layer, without the wheels riding onto the strip. The dump truck must not drive away until all the soil is deposited within the strip without spillage over the basal layer. To achieve this, assistance from the excavator to 'dig away' some of the tipped soil may be required. The tipped soil should be spread to the full thickness required, by the excavator utilising the digging, pushing and pulling action of the bucket. Each load must be spread before another is tipped. Repeat the process along the strip until it is completely covered with the required depth of the soil layer. Should the spread soil comprise large blocks (>0.3 m), they should be broken down by 'slicing' them with the excavator bucket.

6 REFERENCES

- Sheet A: Good Practice Guide for Handling Soils: Soil Stripping with Excavators and Dump Trucks (Institute of Quarrying, 2021).
- Sheet B: A Good Practice Guide for Handling Soils: Building Soil Storage Mounds with Excavators and Dump Trucks (Institute of Quarrying, 2021).
- Sheet C: A Good Practice Guide for Handling Soils: Excavation of Soil Storage Mounds with Excavators and Dump Trucks (Institute of Quarrying, 2021).
- Sheet D: A Good Practice Guide for Handling Soils: Soil Replacement with Excavators and Dump Trucks (Institute of Quarrying, 2021).
- Soil Survey of England and Wales (1984) Soils and their Use in Northern England, with accompanying 1: 250,000 map, Sheet 1.

APPENDIX 1: Agricultural Land Classification Report

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ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING AND MINERAL PROCESSING
MINERAL ESTATES
WASTE RESOURCE MANAGEMENT

AESC UK

AESC Plant 3

Agricultural Land Classification Report

October 2023

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AESC Plant 3

Agricultural Land Classification Report

October 2023

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ENERGY AND CLIMATE CHANGE
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1 INTRODUCTION

1.1 Background

1.1.1 Wardell Armstrong LLP (WA) has been commissioned by AESC UK to undertake an Agricultural Land Classification (ALC) survey on a c. 42.39 hectares (ha) parcel of land west of International Advanced Manufacturing Park (IAMP), East Boldon, SR5 3FH (hereafter referred to as 'the Site', NT15821/ALC). The purpose of the survey was to conduct a verification of the existing post 1988 ALC survey data already present for the Site in support of a Planning Application.

1.2 Site Description

1.2.1 The Site is located within the administrative area of Sunderland City Council and is accessed from the A1290 northeast of Washington, Sunderland. The entire Site is comprised of agricultural fields.

1.2.2 Surrounding land includes agricultural fields to the North and North West of the Site. There is a Nissan Factory and business park located to the south of the Site. Nearby urban and residential areas include Washington and Hylton.

1.2.3 At the time of the survey in July 2023, the weather was overcast and wet. Photograph 1 below shows the conditions on site at the time of the survey.

Photograph 1: Overview of the site during the survey in July 2023

1.3 Definitions

1.3.1 The ALC system was devised by the Ministry of Agriculture, Fisheries and Food (MAFF) (1988)[1] and is the standard method for determining the quality of agricultural land in England and Wales according to its versatility, productivity and workability, based upon inter-related parameters including climate, relief, soil characteristics and drainage; i.e. ALC assesses land quality based upon the type and level of agricultural production the land can potentially support.

1.3.2 The ALC places land into one of five grades: Grade 1 (excellent); Grade 2 (very good); Grade 3 (good to moderate) which is divided into Subgrades 3a (good) and 3b (moderate); Grade 4 (poor); and Grade 5 (very poor).

1.3.3 Best and most versatile (BMV) agricultural land is defined as land of excellent to good agricultural quality (ALC Grades 1, 2 and Subgrade 3a) and is afforded a degree of protection in the National Planning Policy Framework (NPPF), 2023[2].

1.3.4 Soil series are the lowest category in the soil classification system and are precisely defined based upon particle-size distribution, parent material (substrate) type, colour, and mineralogical characteristics. Soil Associations are groupings of related soil series.

[1] MAFF (1988). The Agricultural Land Classification (ALC) of England and Wales: Revised Guidelines and Criteria for Grading the Quality of Agricultural Land. Available at: http://publications.naturalengland.org.uk/publication/6257050620264448 (Accessed August 2023).

[2] Department for Levelling Up & Communities (December 2023). National Planning Policy Framework (NPPF). Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2.

2 METHODOLOGY

2.1 Desk Study

2.1.1 Information about the soils and agricultural land present on the Site was obtained from the following published sources:

- MAFF (1993). 1:250,000 'Provisional Agricultural Land Classification'[3].
- Met Office (1989) Climatological Data for Agricultural Land Classification (ALC): Grid point datasets of climatic variables at 5 km intervals for England and Wales[4].
- Soil Survey of England and Wales (1984) Soils and their Use in Northern England, with accompanying 1: 250,000 map, Sheet 1.
- Multi-Agency Geographical Information for the Countryside (MAGIC)[5].
- Google Maps including Streetview[6].
- Cranfield University (2015). Research to develop the evidence base on soil erosion and water use in agriculture[7].
- Natural England (2017) Likelihood of Best and Most Versatile (BMV) Agricultural Land – Strategic scale map Northeast region[8].
- Munsell (2010) Colour Charts[9].

2.2 Site Survey

2.2.1 A soil survey was undertaken on the 19th and 20th July 2023, by an experienced soil surveyor using a combination of augured soil cores and soil profile pits.

2.2.2 Auger cores were taken using a 70 mm diameter hand-held Edelman auger, capable of sampling to a maximum depth of 120 cm. The soil profile pits were excavated, using a spade to a maximum depth of 120 cm, sufficient to evaluate the *in-situ* structure of the soil profile.

[3] Provisional Agricultural Land Classification Maps and Data. Available at: https://data.gov.uk/dataset/952421ec-da63-4569-817d-4d6399df40a1/provisional-agricultural-land-classification-alc (Accessed August 2023).
[4] Met Office (1989) Climatological Data for Agricultural Land Classification (ALC): Grid point datasets of climatic variables at 5 km intervals for England and Wales. Available at: https://data.gov.uk/dataset/8a334958-ff65-4f5c-9674-5a85e61ee269/climatological-data-for-agricultural-land-classification (Accessed August 2023).
[5] HM Government. Multi-Agency Geographical Information for the Countryside (MAGIC). Available at: www.magic.gov.uk
[6] Google Maps (©2021). Available at: https://www.google.co.uk/maps/ (Accessed August 2023).
[7] Knox *et al*. (2015). 'Research to develop the evidence base on soil erosion and water use in agriculture: Final Technical Report. pp147' Available at https://www.theccc.org.uk/wp-content/uploads/2015/06/Cranfield-University-for-the-ASC.pdf (Accessed August 2023).
[8] Natural England (2017) Likelihood of Best and Most Versatile (BMV) Agricultural Land - Strategic scale North East Region (ALC013) Available at: http://publications.naturalengland.org.uk/category/5208993007403008 Accessed April 2023.
[9] Munsell Colour (2010). Munsell Soil Colour Charts. Not available online.

2.2.3 A total of 14 points (12 cores and 2 pits) were inspected (NT15821/ALC). The purpose of the survey was to verify the existing post 1988 ALC survey for a larger area that encompasses the Site undertaken as part of the City of Sunderland UDP in 1996. The results of the Soil Survey and ALC calculations are included in Appendix 1 and the City of Sunderland Agricultural Land Classification Report is provided in Appendix 2.

2.2.4 To confirm the soil texture across the Site, five samples were sent for analysis of particle size distribution and other determinants (organic matter, pH, phosphorus, potassium, and magnesium). The samples were analysed by NRM Laboratories, which is accredited by UKAS to the internationally recognised standard for competence; ISO/IEC 17025. The laboratory results are included in Appendix 3.

3 DESK STUDY

3.1 Soils

3.1.1 The scale of the Soil Survey of England and Wales (1984) mapping is such that it is not accurate to the field level and does not pick up small-scale local variations in soil type. However, it does provide a general indication of soil types within the Site and wider area.

3.1.2 The Soil Survey of England and Wales (1984) indicates the Site is within Foggathorpe 1 (712h) association. A summary of the characteristics of this soil association is provided in Table 1.

Table 1: The Soil Associations based on the Soil Survey of England and Wales (1984)

Soil Association	712h Foggathorpe 1
Geology	Glaciolacustrine drift and till.
Soil Series	Foggathorpe, Hallsworth, Dunkeswick
Soil characteristics	The Foggathrope 1 soil association consists of slowly permeable seasonally waterlogged clayey and fine loamy over clayey soils, often stoneless. Pelo-stagnogley soils present. Dominated by seasonally waterlogged clayey, often stoneless soils in till and glaciolacustrine clay. Occurs on flat land where lacustrine clay overlies the till. Elevation varies from around 6 m A.O.D. at the coast to 150 m A.O.D. on higher ground. The clayey texture and surface wetness of the Foggathorpe and Hallsworth series restrict cropping to grass and barley. Much of the land is characterised by rough grazing, particularly on wetter ground where reseeding is difficult
Soil Water Regime	Foggathorpe 1 soils experience seasonal, sometimes severe, waterlogging. Without artificial drainage the soils are seasonally waterlogged for long periods in winter (Wetness Class IV). Drainage is essential if lands are to be used other than in summer.
Erodibility	Very small risk from water

3.2 Agricultural Land Classification

3.2.1 The Provisional 1:250,000 ALC mapping indicates that agricultural land within the Site is ALC Grade 3 (good to moderate quality). However, as with the soils data, the scale of the mapping is not accurate at the field level, and this is reflected by the inability to pick up variations in ALC grade for areas less than approximately 80 ha. However, it does provide an indication of the predominant ALC grading in the wider area.

3.2.2 Detailed post-1988 ALC survey data is available for the Site and was carried out in September 1996 as part of the City of Sunderland UDP (Land North of A1290) by ADAS Leeds Statutory Group. The ALC survey conducted found that the Site is comprised predominantly of Subgrade 3b (moderate quality) agricultural land with a small area of Subgrade 3a (good quality) agricultural land in the northwest section of the Site. As part of the 1996 survey land directly north of the Site was also surveyed and was comprised of a mixture of Grade 2, Subgrade 3a, and Subgrade 3b. Soil wetness was the main factor limiting the Site to Subgrade 3a and Subgrade 3b.

3.2.3 The Natural England BMV Likelihood mapping shows the Site to be mostly in an area of low (<= 20 % area BMV) likelihood BMV, with a small section of high likelihood of BMV land (>60 % area BMV) at the northwest section of the Site's which correlates with the location of Subgrade 3a land recorded in the post-1988 ALC Survey carried out in 1996.

3.3 Aerial Imagery and Ordnance Survey Mapping

3.3.1 The Ordnance Survey mapping indicates that the Site has no visible limitations, with elevation ranging from 36 m to 40 m above sea level. The ordnance survey map indicates that there is a small stream located along the north of the site boundary. There are areas of trees and scrub separating the fields.

4 SITE SURVEY

4.1 Soils

4.1.1 The primary soil profiles observed across the Site were found to be consistent with the mapped soil association, the Foggathorpe 1 (712h). A photograph showing a typical soil profile taken as part of this survey is displayed below.

Photograph 2: Soil Profile observed at the Site (scale in decimetres, survey point 14)

4.1.2 Topsoil across the Site was typically characterised by a stoneless (slightly stony at points 3, 6, and 13), very dark greyish brown, medium clay loam (sandy clay loam at survey point 12; sandy loam at survey point 9, heavy clay loam at point 14), extending to an average depth of 31 cm (range from 25 to 38 cm). The topsoil was typically of a moderately developed (weak at point 4), medium (coarse at point 4), sub-angular blocky structure of friable to firm (very firm at point 14) ped strength. No mottling or ferri-manganiferous concentrations were observed in the topsoil.

4.1.3 Upper subsoil across the Site was typically characterised by a very slightly stony (stoneless at survey points 2, 3 ,4, 7, 10 ,12; moderately stoney at point 9), brown (greyish brown at point 8, yellowish brown at point 9, dark yellowish brown at points 11 and 12, brownish yellow at point 14) clay (heavy clay loam at points 6, 9 and 11, medium clay loam at point 1, sandy clay loam at point 10) extending to an average depth of 53 cm (range from 38 to 65 cm). The upper subsoil was typically of weak development (moderate development at survey point 2, 5, 10, and 11), coarse (medium at survey points 5, 10 and 11), angular blocky structure (sub-angular blocky at survey point 2, 5, 10, and 14), with a firm to very firm ped strength (friable at point 10). Common ochreous (brown and grey mottles also found) mottles were found (no mottles at survey point 11). Ferri-manganiferous concentrations were common the upper subsoil.

4.1.4 A lower subsoil was found in all locations except for points 12 and 13. Lower subsoil across the site was typically characterised by a very slightly stony (slightly stony at point 1) brown clay (sandy clay loam at survey point 7) extending to an average depth of 77 cm (range from 60 to 90 cm) with common ochreous mottles and common ferri-manganiferous concentrations. The lower subsoil was typically characterised by a weakly developed (moderate at points 2, 3, 4, 7 and 9), coarse (medium ped size at points 2, 7, 8, 9, and 10), prismatic structure (angular blocky at survey point 3, 4, and 14; subangular blocky at point 7), of firm to very firm ped strength (friable at survey point 7, extremely firm at point 1).

4.1.5 A second lower subsoil horizon was recorded at points 3, 4, 7, 10 and 14. This horizon was typically characterised by a very slightly stony (slight stony at point 3, stoneless at point 10), very dark greyish brown clay extending to an average depth of 84cm (range between 70 cm and 90 cm) with few ochreous mottles and common ferri-manganiferous concentrations. The second lower subsoil horizon was typically characterised by a weakly developed, coarse, prismatic structure of very firm ped strength.

4.2 Site Conditions

4.2.1 There was evidence of mixing in the soil profile at survey points 13 and 14 and these were classed as disturbed.

4.3 Laboratory Results

4.3.1 Samples were taken from the topsoil and subsoil at survey points 1, 9 and 12. These were analysed for pH, macro nutrient availability, soil organic matter and soil texture.

4.3.2 The laboratory results confirm the topsoil texture to be as medium clay loam in the topsoil and subsoil of survey point 1, sandy loam in the topsoil of survey point 9 and heavy clay loam in the subsoil of survey point 9, and a sandy clay loam in the topsoil of survey point 12.

4.3.3 The topsoil organic matter content was moderate in the topsoil (5.1% to 6.8 soil organic matter) and generally above target levels for arable land use under low rainfall conditions. Soil samples were slightly acidic to moderately alkaline (pH 6.6 to 7.7). Topsoil samples were below arable and grassland target levels for potassium and phosphorous. However, magnesium levels were above target levels.

4.4 Agricultural Land Classification

4.4.1 Agroclimatic data were taken from the nearest meteorological stations and interpolated to obtain site specific values (Table 2). This was then used to establish whether the agricultural land quality of the Site is limited by climate and, in conjunction with soil profile characteristics, wetness and droughtiness.

Table 2: Interpolated Agroclimatic Data for the Site	
Average annual rainfall (mm)	633
Accumulated Temperature (^{0}C)	1319
Field Capacity Duration (FCD) (days)	156
Moisture Deficit Wheat (mm)	96.9
Moisture Deficit Potatoes (mm)	84.4

Direct Limitations

4.4.2 Climate (a combination of average annual rainfall and accumulated temperature) posed no limit to the ALC grading for the Site.

4.4.3 Topsoil depth limited one survey point to an ALC grade of 3a (survey point 13) due to the shallow soil depth of 35 cm recorded due to hitting a large impassable rock at this depth. However, given the soil depth observed across the remainder of the Site, this is not considered a limiting factor.

4.4.4 Topsoil stoniness limited one survey point to an ALC grade of 3a (survey point 3) and limited another survey point to grade 2 (survey point 13).

4.4.5 No other direct limitations including gradient, summer and winter flood risk and topsoil texture limited the ALC grade at the Site.

Interactive ALC Limitations

4.4.6 Wetness was the main limitation at the Site resulting in the ALC grades of Subgrade 3a (points 2, 4, 5, 6, 7, 10, 11, 12) and Subgrade 3b (points 1, 3, 8, 14).

4.4.7 Most points showed signs of a slowly permeable layer within 54 cm and no gleying, or a slowly permeable layer occurring within 70 cm and gleying within 45 cm leading to soils of Wetness Class III. Where Wetness Class III soils were combined with a medium clay loam topsoil texture (sandy clay loam topsoil texture at point 12), the survey points were limited to Subgrade 3a due to wetness. Survey point 14 was of Wetness Class III and had a heavy clay loam topsoil which limited this location to Subgrade 3b due to Wetness.

4.4.8 Soils of Wetness Class IV were recorded where a slowly permeable layer and gleying were recorded within 30 cm of the soil profile (points 1, 3, 8). These survey points recorded as Wetness Class IV combined with a medium clay loam texture were limited by Wetness to ALC Subgrade 3b.

4.4.9 Survey point 13 was a disturbed soil and was recorded as Wetness Class II due to no slowly permeable layer or gleying being recorded within the profile due to the shallow soil depth which combined with a medium clay loam topsoil limited the Site to ALC Grade 2. Survey point 9 was also limited by wetness to ALC Grade 2 due to the combination of a fine sandy loam topsoil and a Wetness Class III soil.

4.4.10 Survey points 11 and 13 were limited to Grade 2 by wetness due to medium clay loam textured topsoils and Wetness Class II soil and point 9 was limited to Grade 2 by wetness due to a fine sandy loam topsoil and Wetness Class III soil.

4.4.11 Soil wetness can adversely affect plant growth and can inhibit the development of a good root system, it also reduces the workability of soils for a longer period during wetter seasons.

4.4.12 Droughtiness limited the majority of points to an ALC grade of 2 by droughtiness due to poor to moderate structural subsoil condition limiting the amount of easily and total available water for crop growth. Droughtiness limited survey points 1, 3, 6, 9 and 12 to Subgrade 3a. Droughtiness limited survey point 13 to Subgrade 3b due to shallow soil depth.

4.5 Overall Agricultural Land Classification

4.5.1 Grade boundaries were drawn based on field observations and the calculations from the individual points to make mapping units (groups of ALC gradings) representative of field conditions. The ALC map comprises Subgrade 3a and Subgrade 3b agricultural land and a small area of non-agricultural land.

4.5.2 A description of each grade is provided below. A summary of the ALC gradings for the survey boundary are shown in Table 3. The Site falls within ALC Subgrade 3a (23.93 ha, 56.5% of the Site) towards the north and ALC Subgrade 3b (17.31 ha, 40.8% of the Site) in the south with smaller areas of Subgrade 3b in the north and northeast of the Site and a small area of non-agricultural land (1.15 ha, 2.7%) (Drawing NT15821/ALC).

Subgrade 3a

4.5.3 Subgrade 3a was recorded at nine locations (survey points 2, 4, 5, 6, 7, 9, 10, 11 and 12). Soils of Wetness Class III were recorded where a slowly permeable layer was found within 54 cm of the soil profile and no gleying, or a slowly permeable layer occurred within 70 cm and gleying within 45 cm. Soil of Wetness Class III combined with a medium clay loam textured topsoil (or sandy clay loam topsoil at point 12) and 156 FCD limited the majority of the Site to Subgrade 3a due to wetness.

4.5.4 A combination of Wetness and Droughtiness limited two points to Subgrade 3a (points 6 and 12) due to a poorly structured subsoil.

4.5.5 Droughtiness was the main limitation of one point to Subgrade 3a (point 9) where a fine sandy loam topsoil was recorded.

Subgrade 3b

4.5.6 Soils of Wetness Class IV with medium clay loam textured topsoils combined with 156 FCD lead to a wetness limitation limiting areas of the Site (survey points 1, 3, 8) to Subgrade 3b. At one location (survey point 14) a heavy clay textured topsoil combined with Wetness Class III limited this area to Subgrade 3b due to Wetness.

One location (survey point 13) was limited to Subgrade 3b by soil droughtiness primarily due to shallow soil depth.

Non-agricultural

4.5.7 The non-agricultural land consisted of farm buildings and access tracks.

Table 3: Summary of ALC within the Survey Area

ALC or other land category	**Area (ha)**	**Percentage %**
Subgrade 3a (good)	23.93	56.5
Subgrade 3b (moderate)	17.31	40.8
Non-agricultural	1.15	2.7
Total	42.39	100

4.6 Comparison to Previous ALC Survey

4.6.1 The majority of the Site was recorded as Subgrade 3b in the 1996 ALC survey due to poorly drained soils (WCIV) which were reported as being medium clay loam or heavy clay loam topsoils overlying gleyed and slowly permeable heavy clay loam or clay subsoils at between 25cm and 35cm. The report states that soil wetness and topsoil workability limited these sections of the site to Subgrade 3b. There was a small section of Subgrade 3a land recorded in the north west corner of the Site in the 1996 ALC Survey.

4.6.2 The 2023 survey found that the Site consisted of a larger proportion of Subgrade 3a than the original survey. In the 2023 survey, the majority of soils on the Site were of Wetness Class III as most points showed signs of a slowly permeable layer within 54 cm and no gleying, or a slowly permeable layer occurring within 70 cm and gleying within 45 cm. The 2023 ALC survey found that the soil across the Site generally consisted of medium clay loam topsoils overlying heavy clay loam or clay subsoils with soil wetness being the main limitation. The laboratory analysis used in the 2023 survey confirmed the presence of a medium clay loam topsoil and upper subsoil at one location (survey point 1), a sandy loam topsoil overlying a heavy clay loam upper subsoil at another location (survey point 9) in the northeast of the Site, and a sandy clay loam topsoil at a third location (survey point 12).

4.6.3 The description for Subgrade 3a areas in the 1996 report of medium clay loam topsoils and soils of Wetness Class III is consistent with the soils recorded as Subgrade 3a in the 2023 survey. However, the majority of upper subsoils at the Site where Subgrade 3a was recorded were of a heavy clay loam or clay texture with the exception of survey point 10 where a sandy clay loam upper subsoil was recorded.

4.6.4 Three survey points of Wetness Class IV were recorded in the 2023 survey (survey point 1, 3, and 8) with medium clay loam topsoils and these points were consistent with the description of Subgrade 3b agricultural land in the 1996 report. One point in the 2023 survey (point 14) was limited to Subgrade 3b due to droughtiness as a result of a shallow soil due to hitting an impassable rock at 35 cm. One point in the 2023 survey (point 14) was limited to Subgrade 3b due to a heavy clay loam topsoil and Wetness Class III soil.

4.6.5 The variation between the 1996 survey to the 2023 survey is due to recorded depth of the slowly permeable layer and gleying and thus Wetness Class. Additionally, the laboratory results confirmed the presence of a fine sandy loam topsoil at one point and droughtiness limited this point to Subgrade 3a.

5 POLICY AND GUIDANCE

5.1 National Planning Policy

5.1.1 Under Section 15 of the NPPF[2] (2023): Conserving and enhancing the natural environment, Paragraph 180 states that 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;*

e) *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans*; and

f) *remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate*.

5.1.2 The footnote to Paragraph 181 also 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*'.

5.1.3 The Planning Practice Guidance (PPG) which accompanies the NPPF is split into a number of guidance notes. Guidance on soils and agricultural land is found in the Planning Practice Guidance for the Natural Environment 2019 (PPGNE)[10] under the heading *Agricultural Land, Soil and Brownfield Land of Environmental Value*. This advises that the ALC be used to assess the quality of farmland to enable informed choices to be made about its future use within the planning system; and explains that the ALC places agricultural land into five Grades with Grade 3 subdivided into 3a and 3b. The BMV land is defined as Grades 1, 2 and 3a. The PPGNE states that *'Planning*

[10] Planning Practice Guidance for the Natural Environment 2019 (PPGNE) Available at: https://www.gov.uk/guidance/natural-environment (Accessed August 2023).

policies and decisions should take account of the economic and other benefits of the best and most versatile agricultural land'.

5.1.4 The PPGNE goes on to state that 'In the circumstances set out in Schedule 4 paragraph (y) of the Development Management Procedure Order 2015[11], Natural England is a statutory consultee: '*a local planning authority must consult Natural England before granting planning permission for large-scale non-agricultural development on best and most versatile land that is not in accord with the development plan'* and refers to Natural England guidance to assessing development proposals on agricultural land, 2018.

5.1.5 Therefore, knowledge of the ALC grading of the Site, is necessary to be able to determine whether the requirements of planning policy are being met.

5.1.6 The PPGNE also recognises soil as an essential natural capital asset 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. It also recommends Defra's Code of Practice for the Sustainable Use of Soils on Construction Sites[12] as a useful tool when setting planning conditions for development sites, as it provides advice on the use and protection of soil in construction projects, including the movement and management of soil resources.

5.2 Local Planning Policy

5.2.1 The Sunderland City Council's Core Strategy and Development Plan (2015 -2033)[13] was adopted in January 2020 and reflects the NPPF in Policy NE12 (Agricultural Land) which states that "development which would result in the loss of best and most versatile agricultural land should be considered in the context of the agricultural land's contribution in terms of economic and other benefits".

5.2.2 Soils are considered under the term "geodiversity" as stated in Paragraph 10.8. Policy NE2 (Biodiversity and Geodiversity) states that "where appropriate

[11] HM Government (2015). Statutory Instrument 2015 No. 595, The Town and Country Planning (Development Management Procedure) (England) Order 2015. Available at https://www.legislation.gov.uk/uksi/2015/595/contents/made (Accessed August 2023).

[12] DEFRA (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69308/pb13298-code-of-practice-090910.pdf (Accessed August 2023).

[13] Sunderland City Council (2021) Core Strategy and Development Plan (2015-2033). Available at: https://www.sunderland.gov.uk/media/22171/Core-Strategy-and-Development-Plan-2015-2033/pdf/CSDP_2015-2033.pdf?m=637159725864470000 (Accessed August 2023).

development must demonstrate how it will avoid (through locating on an alternative site with less harmful impact) or minimise adverse impacts on biodiversity and geodiversity in accordance with the mitigation hierarchy".

5.3 Guidance

5.3.1 Natural England Technical Information Note 49 (TIN049)[14], promotes the use of ALC for assessing the quality of agricultural land, to ensure informed choices are made about its future use within the planning system. It advocates the use of soil survey to inform environmental assessment. TIN049 states that where development is proposed on agricultural or other potential crop producing land, if that proposed development is not for agricultural purposes and is not in accordance with the provisions of a development plan, and involves the direct or cumulative loss of more than 20 ha of BMV agricultural land, Natural England must be consulted in accordance with the Schedule 4, paragraph (y) of the Statutory Instrument 2015 No. 595[15].

5.3.2 Natural England's Guide to assessing development proposals on agricultural land 2018 (NE; 2018)[16] sets out the government policies and legislation which developers and local planning authorities (LPA) should refer to when considering development proposals that affect agricultural land and guidance on when Natural England should be consulted on development proposals. It also provides a detailed explanation of the ALC, information on published ALC resources and explains circumstances in which new detailed surveys may be required. It also explains how ALC data should be used in the assessment of planning decisions. Importantly, the guidance states that the LPA should ensure that development proposals include plans to protect soils; that where insufficient data are available, new surveys should be undertaken to better inform the planning decision; and that these surveys should be carried out by soil scientists or experienced soil specialists. The guidance also summarises the required survey methodology (also presented in TIN049).

[14] Natural England (2012). Technical Information Note 049, 'Agricultural Land Classification: protecting the Best and Most Versatile agricultural land'. Available at http://publications.naturalengland.org.uk/publication/35012 (Accessed August 2023).

[15] Statutory Instrument 2015 No. 595, The Town and Country Planning (Development Management Procedure) (England) Order 2015, Schedule 4, Part (y).

[16] Natural England (2018). Guide to assessing development proposals on agricultural land . Accessed April 2023. Available at: https://www.gov.uk/government/publications/agricultural-land-assess-proposals-for-development/guide-to-assessing-development-proposals-on-agricultural-land (Accessed August 2023).

6 CONCLUSION

6.1.1 The soils within the Site are generally dominated by medium clay loam (fine sandy loam, sandy clay loam, and heavy clay loam textures also recorded) topsoils falling under Wetness Class III. The subsoil was typically of a clay texture (heavy clay loam, medium clay loam and sandy clay loam textures also recorded). The presence of a slowly permeable layer and characteristics of gleying were common across the site.

6.1.2 The main limitation at the site was soil wetness, primarily due to medium clay loam topsoil and the 156 field capacity days. This will reduce the workability of the soil for an extended period of the year.

6.1.3 The Provisional ALC mapping identifies the agricultural land within the Site as Grade 3 (good to moderate quality); with Natural England's BMV Likelihood mapping designating a predicted low likelihood (<= 20 % area BMV) of BMV land, with a small section of high likelihood of BMV land (>60 % area BMV) at the northwest section of the Site. Post 1988 data, indicates that the site was mostly Subgrade 3b (moderate quality) with a small section of Subgrade 3a land in the northwest of the Site.

6.1.4 The ALC survey showed that the Site falls within Subgrade 3a (23.93 ha, 56.5% of the Site) towards the north of the site and Subgrade 3b (17.31 ha, 40.8% of the Site) in the south of the Site with smaller areas of Subgrade 3b in the north and northeast of the Site. A small area of non-agricultural land was recorded within the Site (1.15 ha, 2.7% of the Site).

APPENDICES

APPENDIX 1: Soil Profile Descriptions and Agricultural Land Classification

APPENDIX 1 Soil Survey Record and ALC

Legend for non-self-explanatory terms:

Horizons - number of different horizons identified within the profile
Type - type of sample, auger core or soil profile pit dug using a spade
Depth - depth to the bottom of the (horizon number) horizon in cm
Texture - C - clay, ZC - silty clay, SC - sandy clay, CL - clay loam, SCL - sandy clay loam, ZCL - silty clay loam, SL - sandy loam, LS - loamy sand, S - sand;
CL and ZCL textures are subdivided into medium (M) and heavy (H) classes according to clay content, as follows: M medium (less than 27 % clay), H heavy (27-35 % clay); F, M and C refer to fine, medium and coarse, respectively, and are subdivisions of S, LS, SL, and SZL textures; O - organic, P - peat or peaty, HP - humified (highly decomposed peat), FP - fibrous peat, SFP - semi-fibrous peat; MZ - marine light silts
Matrix (main) colour - dominant colour of the soil; **Hue** - Munsell colour hue; **Value** - Munsell colour value; **Chroma** - Munsell colour chroma
Mottling - spots and blotches of different colour than the dominant matrix colour
Ped faces - surfaces of the primary soil fragments into which the soil naturally breaks up upon excavating
FeMn - ferri-manganifeours concertions
Biopores - 'yes' if >0.5 % biopores greater than 0.5 mm diameter present (by area)
Stones > 2 cm up to % - maximum percentage of 2 - 6 cm diameter stones
Stones > 6 cm up to % - maximum percentage of > 6 cm diameter stones
Type - H - All hard rocks or stones (those which cannot be scratched with a finger nail); SS - Soft, medium or coarse grained sandstones; SIM - Soft 'weathered' igneous or metamorphic rocks or stones; SL - Soft oolitic or dolomitic limestones; SFS - Soft fine-grained sandstones; SAZ - Soft, argillaceous or silty rocks or stones; CH - Chalk or chalk stones; GRH - Gravel[1] with non-porous (hard) stones; GRS - Gravel[1] with porous stones (mainly soft stone types listed);1 - Gravel with at least 70% rounded stones by volume
Structure type - SG - single grain; GR - granular; SAB - subangular blocky; AB - angular blocky; PR - prismatic; PL - platy; MAS - massive
Dev - Development, how well the structure is developed; W - weak; M - moderate; S - strong
Consistence - Soil consistence (strength); L - loose; VFR - very friable; FR - friable; FIR - firm; VFIR - very firm; EXFIR - extremely firm; EXHD - extremely hard
Gley - depth to gleying
SPL - depth to slowly permeable layer
Wetness Class - classification of the soil according to the depth and duration of waterlogging in the soil profile, the higher the class, the longer and at the shallower depth the soil is wet

Overall ALC - this part of the table combines results of the classification for each of the limitations

Soil profile descriptions / **Soil profile descriptions continued**

Survey point	Type	Gradient	Soil disturbed or restored	Horizon	Depth	Texture	Matrix (main) colour			Peat-specific properties					Mottling				Ped faces				FeMn up to %	Biopores	Stones and rocks			Structure			Consistence	Calcareous	Gleying	SPL	Notes
							Hue	Value	Chroma	Von Post	Water content (B)	Fine fibre content (F)	Coarse fibre content (R)	Wood remains (W)	Abundance up to %	Hue	Value	Chroma	Colour different to matrix	Hue	Value	Chroma			> 2 cm up to %	> 6 cm up to %	Type	Type	Development	Ped size					
1	**Pit**	0	NO	1	25	MCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FIR	NO	NO	NO	Red sand in H3
				2	45	MCL	7.5YR	4	2	n/a	n/a	n/a	n/a	n/a	5	7.5YR	4	6	NO	n/a	n/a	n/a	2	NO	5	0	H	AB	W	C	VFIR	NO	YES	YES	
				3	70	C	10YR	5	3	n/a	n/a	n/a	n/a	n/a	20	10YR	5	6	NO	n/a	n/a	n/a	20	NO	5	5	H	PR	W	C	EXFIR	NO	YES	YES	
				4																															
				5																															
2	**Core**	0	NO	1	30	MCL	7.5YR	3	1	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FIR	NO	NO	NO	-
				2	60	C	7.5YR	4	2	n/a	n/a	n/a	n/a	n/a	20	7.5YR	4	6	NO	n/a	n/a	n/a	2	NO	0	0	n/a	SAB	M	C	VFIR	NO	YES	NO	
				3	90	C	7.5YR	4	1	n/a	n/a	n/a	n/a	n/a	5	10YR	4	4	NO	n/a	n/a	n/a	20	NO	5	0	H	PR	M	M	FIR	NO	NO	YES	
				4																															
				5																															
3	**Core**	0	NO	1	25	MCL	10YR	4	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	15	0	H	SAB	M	M	FIR	NO	NO	NO	-
				2	38	C	10YR	5	3	n/a	n/a	n/a	n/a	n/a	5	10YR	5	6	NO	n/a	n/a	n/a	2	NO	0	0	n/a	AB	W	C	VFIR	NO	YES	YES	
				3	60	C	10YR	4	1	n/a	n/a	n/a	n/a	n/a	5	10YR	6	8	NO	n/a	n/a	n/a	2	NO	5	0	H	AB	M	C	FIR	NO	YES	YES	
				4	70	C	7.5YR	5	1	n/a	n/a	n/a	n/a	n/a	5	10YR	6	6	NO	n/a	n/a	n/a	20	NO	10	0	H	PR	W	C	VFIR	NO	YES	YES	
				5																															
4	**Core**	0	NO	1	28	MCL	7.5YR	4	1	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	W	C	FIR	NO	NO	NO	-
				2	50	C	10YR	4	3	n/a	n/a	n/a	n/a	n/a	5	10YR	5	4	NO	n/a	n/a	n/a	2	NO	0	0	n/a	AB	W	C	VFIR	NO	NO	YES	
				3	75	C	10YR	4	3	n/a	n/a	n/a	n/a	n/a	5	10YR	6	6	NO	n/a	n/a	n/a	2	NO	5	0	H	AB	M	C	VFIR	NO	NO	YES	
				4	90	C	7.5YR	3	2	n/a	n/a	n/a	n/a	n/a	5	10YR	5	1	NO	n/a	n/a	n/a	2	NO	0	5	H	PR	W	C	VFIR	NO	NO	YES	
				5																															
5	**Core**	0	NO	1	36	MCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FIR	NO	NO	NO	-
				2	58	C	7.5YR	4	2	n/a	n/a	n/a	n/a	n/a	20	10YR	5	8	NO	n/a	n/a	n/a	2	NO	5	0	H	SAB	M	M	VFIR	NO	YES	NO	
				3	90	C	7.5YR	4	1	n/a	n/a	n/a	n/a	n/a	5	10YR	5	8	NO	n/a	n/a	n/a	2	NO	0	0	n/a	PR	W	C	VFIR	NO	YES	YES	
				4																															
				5																															
6	**Core**	0	NO	1	30	MCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	5	0	H	SAB	M	M	FR	NO	NO	NO	Red stones in H4, orange sand in H3 and H4
				2	65	HCL	10YR	4	3	n/a	n/a	n/a	n/a	n/a	20	10YR	6	1	NO	n/a	n/a	n/a	2	NO	5	0	H	AB	W	C	FIR	NO	NO	YES	
				3	80	C	10YR	3	6	n/a	n/a	n/a	n/a	n/a	20	10YR	5	1	NO	n/a	n/a	n/a	2	NO	5	0	H	PR	W	C	FIR	NO	NO	YES	
				4																															
				5																															
7	**Core**	0	NO	1	30	MCL	7.5YR	3	1	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FIR	NO	NO	NO	-
				2	40	C	10YR	5	3	n/a	n/a	n/a	n/a	n/a	5	10YR	6	6	NO	n/a	n/a	n/a	0	NO	0	0	n/a	AB	W	C	FIR	NO	YES	NO	
				3	70	SCL	10YR	4	4	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	NO	5	0	H	SAB	M	M	FR	NO	NO	NO	
				4	90	C	10YR	3	2	n/a	n/a	n/a	n/a	n/a	5	10YR	3	6	NO	n/a	n/a	n/a	2	NO	5	0	H	PR	W	C	VFIR	NO	NO	YES	
				5																															
8	**Core**	0	NO	1	30	MCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FR	NO	NO	NO	White sand at H3
				2	65	C	10YR	5	2	n/a	n/a	n/a	n/a	n/a	5	10YR	6	8	NO	n/a	n/a	n/a	20	NO	5	0	H	AB	W	C	VFIR	NO	YES	YES	
				3	90	C	10YR	5	4	n/a	n/a	n/a	n/a	n/a	5	7.5YR	5	8	NO	n/a	n/a	n/a	2	NO	5	0	H	PR	W	M	VFIR	NO	NO	YES	
				4																															
				5																															
9	**Pit**	0	NO	1	30	FSL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FR	NO	NO	NO	Large rocks at H2
				2	60	HCL	10YR	5	8	n/a	n/a	n/a	n/a	n/a	40	10YR	5	2	NO	n/a	n/a	n/a	2	NO	5	25	H	AB	W	C	VFIR	NO	NO	YES	
				3	70	C	7.5YR	4	3	n/a	n/a	n/a	n/a	n/a	5	10YR	4	6	NO	n/a	n/a	n/a	2	NO	5	0	H	PR	W	M	FIR	NO	NO	YES	
				4																															
				5																															
10	**Core**	0	NO	1	30	MCL	7.5YR	4	1	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FR	NO	NO	NO	-
				2	45	SCL	7.5YR	5	4	n/a	n/a	n/a	n/a	n/a	5	10YR	5	2	NO	n/a	n/a	n/a	0	NO	0	0	n/a	SAB	M	M	FR	YES	NO	NO	
				3	65	C	7.5YR	5	2	n/a	n/a	n/a	n/a	n/a	5	10YR	5	8	NO	n/a	n/a	n/a	2	NO	5	0	H	PR	W	M	VFIR	NO	YES	YES	
				4	80	C	10YR	4	1	n/a	n/a	n/a	n/a	n/a	5	10YR	4	6	NO	n/a	n/a	n/a	0	NO	0	0	n/a	PR	W	C	VFIR	NO	YES	YES	
				5																															
11	**Core**	0	NO	1	38	MCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FR	NO	NO	NO	H2 Some sand
				2	54	HCL	10YR	4	6	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	2	NO	5	0	H	AB	M	M	FIR	NO	NO	NO	
				3	90	C	10YR	3	3	n/a	n/a	n/a	n/a	n/a	5	10YR	5	8	NO	n/a	n/a	n/a	2	NO	0	0	n/a	PR	W	C	VFIR	NO	NO	YES	
				4																															
				5																															
12	**Core**	0	NO	1	32	SCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	FR	NO	NO	NO	Hit large rock at 60cm
				2	60	C	10YR	4	4	n/a	n/a	n/a	n/a	n/a	20	10YR	5	8	NO	n/a	n/a	n/a	2	NO	0	0	n/a	AB	W	C	FIR	NO	NO	YES	
				3																															
				4																															
				5																															
13	**Core**	0	YES	1	35	MCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	10	0	H	SAB	M	M	FR	NO	NO	NO	Looks like coal fragment, large stone blocked auger going any further, reddish sand also observed
				2																															
				3																															
				4																															
				5																															
14	**Core**	0	YES	1	30	HCL	10YR	3	2	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	0	YES	0	0	n/a	SAB	M	M	VFIR	NO	NO	NO	H3 and H4 showed signs of red sand and coal
				2	50	C	10YR	6	6	n/a	n/a	n/a	n/a	n/a	20	10YR	5	1	NO	n/a	n/a	n/a	0	NO	5	0	H	SAB	W	C	VFIR	NO	NO	NO	
				3	65	C	7.5YR	3	1	n/a	n/a	n/a	n/a	n/a	5	10YR	5	6	NO	n/a	n/a	n/a	20	NO	10	0	H	AB	W	C	VFIR	NO	NO	YES	
				4	90	C	10YR	2	1	n/a	n/a	n/a	n/a	n/a	0	0	0	0	NO	n/a	n/a	n/a	20	NO	5	0	H	PR	W	C	VFIR	NO	NO	YES	
				5																															

ALC for areas represented by individual survey points													
Survey point	**Wetness class**	**Climate**	**Gradient**	**Summer flood risk**	**Winter flood risk**	**Topsoil texture**	**Soil Depth**	**Topsoil stoniness**	**Wetness**	**Droughti-ness**	**Other (see "Limited by" column)**	**ALC Grade**	**Limited by**
1	4	1	1	1	1	1	1	1	3b	3a	1	**3b**	Wetness
2	3	1	1	1	1	1	1	1	3a	2	1	**3a**	Wetness
3	4	1	1	1	1	1	1	3a	3b	3a	1	**3b**	Wetness
4	3	1	1	1	1	1	1	1	3a	2	1	**3a**	Wetness
5	3	1	1	1	1	1	1	1	3a	2	1	**3a**	Wetness
6	3	1	1	1	1	1	1	1	3a	3a	1	**3a**	Wetness Droughti-ness
7	3	1	1	1	1	1	1	1	3a	2	1	**3a**	Wetness
8	4	1	1	1	1	1	1	1	3b	2	1	**3b**	Wetness
9	3	1	1	1	1	1	1	1	2	3a	1	**3a**	Droughti-ness
10	3	1	1	1	1	1	1	1	3a	2	1	**3a**	Wetness
11	3	1	1	1	1	1	1	1	3a	2	1	**3a**	Wetness
12	3	1	1	1	1	1	1	1	3a	3a	1	**3a**	Wetness Droughti-ness
13	2	1	1	1	1	1	3a	2	2	3b	1	**3b**	Droughti-ness
14	3	1	1	1	1	1	1	1	3b	2	1	**3b**	Wetness

Droughtiness Calculations

Abbreviations:

TAv – Total amount of soil water available to plants, considered to be the volumetric soil water content between 0.05 and 15 bar suction or, in case of sands and loamy sands, 0.10 and 15 bar suction. These suctions approximate to the conditions of field capacity and wilting point (when the plants can extract no more moisture from the soil).

EAv – Easily available water, held in the soil between 0.05 and 2.0 bar suction, used for calculating cereal available water below 50 cm depth where root systems are less well developed, and the plant's ability to extract water is diminished.

Values of TAv and EAv are estimated for each horizon based on soil texture and structural condition according to the ALC guidelines (MAFF, 1988).

AP – crop adjusted available water capacity, a measure of the quantity of water held in the soil profile which can be taken up by a specific crop.

MD – the moisture deficit term used in the ALC droughtiness assessment is a crop-related meteorological variable which represents the balance between rainfall and potential evapotranspiration calculated over a critical portion of the growing season.

MB – moisture balance: MB=AP-MD, MB for wheat and potatoes determines limitation by droughtiness

Data inputs										Droughtiness calculations																					
						Av. water (soil)		Av. water (stones)		AP wheat											AP potatoes										Limited to ALC grade
Survey Point	Horizon	Horizon thickness	Texture	Stones %	Structural condition	TAv %	EAv %	TAv %	EAv %	TAv/EAv	Start depth	End depth	Horiz. thickn.	TAv/EAv soil	% non stone	TAv/EAv stones	Stones %	AP wheat		AP(wheat) -MD(wheat)	Start depth	End depth	Horiz. thickn.	TAv top/sub soil	non-stone %	TAv stones	Stone %	AP potatoes		AP(potato) -MD(potato)	
1	1	25	MCL	0	GOOD	18				TAv	0	25	25	18	100	0	0	450	87	-10	0	25	25	18	100	0	0	450	97	13	3a
										EAv	0	25	0	0	100	0	0	0													
	2	20	MCL	5	POOR	12	7	1.0	0.5	TAv	25	45	20	12	95	1	5	229			25	45	20	12	95	1	5	229			
										EAv	25	45	0	7	95	1	5	0													
	3	25	C	10	POOR	13	7	1.0	0.5	TAv	45	70	5	13	90	1	10	59			45	70	25	13	90	1	10	295			
										EAv	45	70	20	7	90	1	10	127													
	4									TAv	70	70	0	0	100	0	0	0			70	70	0	0	100	0	0	0			
										EAv	70	70	0	0	100	0	0	0													
	5									TAv	70	70	0	0	100	0	0	0			70	70	0	0	100	0	0	0			
										EAv	70	70	0	0	100	0	0	0													
2	1	30	MCL	0	GOOD	18				TAv	0	30	30	18	100	0	0	540	117	20	0	30	30	18	100	0	0	540	117	33	2
										EAv	0	30	0	0	100	0	0	0													
	2	30	C	0	MODERATE	16	8			TAv	30	60	20	16	100	0	0	320			30	60	30	16	100	0	0	480			
										EAv	30	60	10	8	100	0	0	80													
	3	30	C	5	MODERATE	16	8	1.0	0.5	TAv	60	90	0	16	95	1	5	0			60	90	10	16	95	1	5	153			
										EAv	60	90	30	8	95	1	5	229													
	4									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
3	1	25	MCL	15	GOOD	18		1.0	0.5	TAv	0	25	25	18	85	1	15	386	88	-9	0	25	25	18	85	1	15	386	101	17	3a
										EAv	0	25	0	0	85	1	15	0													
	2	13	C	0	POOR	13	7			TAv	25	38	13	13	100	0	0	169			25	38	13	13	100	0	0	169			
										EAv	25	38	0	7	100	0	0	0													
	3	22	C	5	MODERATE	16	8	1.0	0.5	TAv	38	60	12	16	95	1	5	183			38	60	22	16	95	1	5	336			
										EAv	38	60	10	8	95	1	5	76													
	4	10	C	10	POOR	13	7	1.0	0.5	TAv	60	70	0	13	90	1	10	0			60	70	10	13	90	1	10	118			
										EAv	60	70	10	7	90	1	10	64													
	5									TAv	70	70	0	0	100	0	0	0			70	70	0	0	100	0	0	0			
										EAv	70	70	0	0	100	0	0	0													
4	1	28	MCL	0	GOOD	18				TAv	0	28	28	18	100	0	0	504	108	11	0	28	28	18	100	0	0	504	110	25	2
										EAv	0	28	0	0	100	0	0	0													
	2	22	C	0	POOR	13	7			TAv	28	50	22	13	100	0	0	286			28	50	22	13	100	0	0	286			
										EAv	28	50	0	7	100	0	0	0													
	3	25	C	5	MODERATE	16	8	1.0	0.5	TAv	50	75	0	16	95	1	5	0			50	75	20	16	95	1	5	305			
										EAv	50	75	25	8	95	1	5	191													
	4	15	C	5	POOR	13	7	1.0	0.5	TAv	75	90	0	13	95	1	5	0			75	90	0	13	95	1	5	0			
										EAv	75	90	15	7	95	1	5	100													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
5	1	36	MCL	0	GOOD	18				TAv	0	36	36	18	100	0	0	648	127	30	0	36	36	18	100	0	0	648	124	40	2
										EAv	0	36	0	0	100	0	0	0													
	2	22	C	5	GOOD	21	15	1.0	0.5	TAv	36	58	14	21	95	1	5	280			36	58	22	21	95	1	5	440			
										EAv	36	58	8	15	95	1	5	114													
	3	32	C	0	POOR	13	7			TAv	58	90	0	13	100	0	0	0			58	90	12	13	100	0	0	156			
										EAv	58	90	32	7	100	0	0	224													
	4									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													

Data inputs										Droughtiness calculations																					
						Av. water (soil)		Av. water (stones)		AP wheat											AP potatoes										Limited to ALC grade
Survey Point	Horizon	Horizon thickness	Texture	Stones %	Structural condition	TAv %	EAv %	TAv %	EAv %	TAv/EAv	Start depth	End depth	Horiz. thickn.	TAv/EAv soil	% non stone	TAv/EAv stones	Stones %	AP wheat		AP(wheat) -MD(wheat)	Start depth	End depth	Horiz. thickn.	TAv top/sub soil	non-stone %	TAv stones	Stone %	AP potatoes		AP(potato) -MD(potato)	
6	1	30	MCL	5	GOOD	18		1.0	0.5	TAv	0	30	30	18	95	1	5	515	94	-2	0	30	30	18	95	1	5	515	98	13	3a
										EAv	0	30	0	0	95	1	5	0													
	2	35	HCL	5	POOR	12	7	1.0	0.5	TAv	30	65	20	12	95	1	5	229			30	65	35	12	95	1	5	401			
										EAv	30	65	15	7	95	1	5	100													
	3	15	C	5	POOR	13	7	1.0	0.5	TAv	65	80	0	13	95	1	5	0			65	80	5	13	95	1	5	62			
										EAv	65	80	15	7	95	1	5	100													
	4									TAv	80	80	0	0	100	0	0	0			80	80	0	0	100	0	0	0			
										EAv	80	80	0	0	100	0	0	0													
	5									TAv	80	80	0	0	100	0	0	0			80	80	0	0	100	0	0	0			
										EAv	80	80	0	0	100	0	0	0													
7	1	30	MCL	0	GOOD	18				TAv	0	30	30	18	100	0	0	540	125	28	0	30	30	18	100	0	0	540	121	37	2
										EAv	0	30	0	0	100	0	0	0													
	2	10	C	0	POOR	13	7			TAv	30	40	10	13	100	0	0	130			30	40	10	13	100	0	0	130			
										EAv	30	40	0	7	100	0	0	0													
	3	30	SCL	5	GOOD	19	14	1.0	0.5	TAv	40	70	10	19	95	1	5	181			40	70	30	19	95	1	5	543			
										EAv	40	70	20	14	95	1	5	267													
	4	20	C	5	POOR	13	7	1.0	0.5	TAv	70	90	0	13	95	1	5	0			70	90	0	13	95	1	5	0			
										EAv	70	90	20	7	95	1	5	134													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
8	1	30	MCL	0	GOOD	18				TAv	0	30	30	18	100	0	0	540	106	9	0	30	30	18	100	0	0	540	104	19	2
										EAv	0	30	0	0	100	0	0	0													
	2	35	C	5	POOR	13	7	1.0	0.5	TAv	30	65	20	13	95	1	5	248			30	65	35	13	95	1	5	434			
										EAv	30	65	15	7	95	1	5	100													
	3	25	C	5	POOR	13	7	1.0	0.5	TAv	65	90	0	13	95	1	5	0			65	90	5	13	95	1	5	62			
										EAv	65	90	25	7	95	1	5	167													
	4									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
9	1	30	FSL	0	GOOD	18				TAv	0	30	30	18	100	0	0	540	83	-14	0	30	30	18	100	0	0	540	93	8	3a
										EAv	0	30	0	0	100	0	0	0													
	2	30	HCL	30	POOR	12	7	1.0	0.5	TAv	30	60	20	12	70	1	30	174			30	60	30	12	70	1	30	261			
										EAv	30	60	10	7	70	1	30	51													
	3	10	C	5	POOR	13	7	1.0	0.5	TAv	60	70	0	13	95	1	5	0			60	70	10	13	95	1	5	124			
										EAv	60	70	10	7	95	1	5	67													
	4									TAv	70	70	0	0	100	0	0	0			70	70	0	0	100	0	0	0			
										EAv	70	70	0	0	100	0	0	0													
	5									TAv	70	70	0	0	100	0	0	0			70	70	0	0	100	0	0	0			
										EAv	70	70	0	0	100	0	0	0													
10	1	30	MCL	0	GOOD	18				TAv	0	30	30	18	100	0	0	540	109	12	0	30	30	18	100	0	0	540	114	30	2
										EAv	0	30	0	0	100	0	0	0													
	2	15	SCL	0	GOOD	19	14			TAv	30	45	15	19	100	0	0	285			30	45	15	19	100	0	0	285			
										EAv	30	45	0	14	100	0	0	0													
	3	20	C	5	POOR	13	7	1.0	0.5	TAv	45	65	5	13	95	1	5	62			45	65	20	13	95	1	5	248			
										EAv	45	65	15	7	95	1	5	100													
	4	15	C	0	POOR	13	7			TAv	65	80	0	13	100	0	0	0			65	80	5	13	100	0	0	65			
										EAv	65	80	15	7	100	0	0	105													
	5									TAv	80	80	0	0	100	0	0	0			80	80	0	0	100	0	0	0			
										EAv	80	80	0	0	100	0	0	0													

Data inputs										Droughtiness calculations																					
						Av. water (soil)		Av. water (stones)		AP wheat											AP potatoes										Limited to ALC grade
Survey Point	Horizon	Horizon thickness	Texture	Stones %	Structural condition	TAv %	EAv %	TAv %	EAv %	TAv/EAv	Start depth	End depth	Horiz. thickn.	TAv/EAv soil	% non stone	TAv/EAv stones	Stones %	AP wheat		AP(wheat) -MD(wheat)	Start depth	End depth	Horiz. thickn.	TAv top/sub soil	non-stone %	TAv stones	Stone %	AP potatoes		AP(potato) -MD(potato)	
11	1	38	MCL	0	GOOD	18				TAv	0	38	38	18	100	0	0	684	116	19	0	38	38	18	100	0	0	684	114	29	2
										EAv	0	38	0	0	100	0	0	0													
	2	16	HCL	5	MODERATE	16	10	1.0	0.5	TAv	38	54	12	16	95	1	5	183			38	54	16	16	95	1	5	244			
										EAv	38	54	4	10	95	1	5	38													
	3	36	C	0	POOR	13	7			TAv	54	90	0	13	100	0	0	0			54	90	16	13	100	0	0	208			
										EAv	54	90	36	7	100	0	0	252													
	4									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													
12	1	32	SCL	0	GOOD	17				TAv	0	32	32	17	100	0	0	544	85	-12	0	32	32	17	100	0	0	544	91	7	3a
										EAv	0	32	0	0	100	0	0	0													
	2	28	C	0	POOR	13	7			TAv	32	60	18	13	100	0	0	234			32	60	28	13	100	0	0	364			
										EAv	32	60	10	7	100	0	0	70													
	3									TAv	60	60	0	0	100	0	0	0			60	60	0	0	100	0	0	0			
										EAv	60	60	0	0	100	0	0	0													
	4									TAv	60	60	0	0	100	0	0	0			60	60	10	0	100	0	0	0			
										EAv	60	60	0	0	100	0	0	0													
	5									TAv	60	60	0	0	100	0	0	0			60	60	0	0	100	0	0	0			
										EAv	60	60	0	0	100	0	0	0													
13	1	35	MCL	10	GOOD	18		1.0	0.5	TAv	0	35	35	18	90	1	10	571	57	-40	0	35	35	18	90	1	10	571	57	-27	3b
										EAv	0	35	0	0	90	1	10	0													
	2									TAv	35	35	0	0	100	0	0	0			35	35	0	0	100	0	0	0			
										EAv	35	35	0	0	100	0	0	0													
	3									TAv	35	35	0	0	100	0	0	0			35	35	0	0	100	0	0	0			
										EAv	35	35	0	0	100	0	0	0													
	4									TAv	35	35	0	0	100	0	0	0			35	35	35	0	100	0	0	0			
										EAv	35	35	0	0	100	0	0	0													
	5									TAv	35	35	0	0	100	0	0	0			35	35	0	0	100	0	0	0			
										EAv	35	35	0	0	100	0	0	0													
14	1	30	HCL	0	GOOD	18				TAv	0	30	30	18	100	0	0	540	111	14	0	30	30	18	100	0	0	540	108	24	2
										EAv	0	30	0	0	100	0	0	0													
	2	20	C	5	MODERATE	16	8	1.0	0.5	TAv	30	50	20	16	95	1	5	305			30	50	20	16	95	1	5	305			
										EAv	30	50	0	8	95	1	5	0													
	3	15	C	10	POOR	13	7	1.0	0.5	TAv	50	65	0	13	90	1	10	0			50	65	15	13	90	1	10	177			
										EAv	50	65	15	7	90	1	10	95													
	4	25	C	5	POOR	13	7	1.0	0.5	TAv	65	90	0	13	95	1	5	0			65	90	5	13	95	1	5	62			
										EAv	65	90	25	7	95	1	5	167													
	5									TAv	90	90	0	0	100	0	0	0			90	90	0	0	100	0	0	0			
										EAv	90	90	0	0	100	0	0	0													

Data inputs										Droughtiness calculations																					
						Av. water (soil)		Av. water (stones)		AP wheat											AP potatoes										
Survey Point	Horizon	Horizon thickness	Texture	Stones %	Structural condition	TAv %	EAv %	TAv %	EAv %	TAv/EAv	Start depth	End depth	Horiz. thickn.	TAv/EAv soil	% non stone	TAv/EAv stones	Stones %	AP wheat		AP(wheat) -MD(wheat)	Start depth	End depth	Horiz. thickn.	TAv top/sub soil	non-stone %	TAv stones	Stone %	AP potatoes		AP(potato) -MD(potato)	Limited to ALC grade
										EAv	90	90	0	0	100	0	0	0													

APPENDIX 2: City of Sunderland UDP (Land north of A1290) Agricultural Land Classification 1996

CITY OF SUNDERLAND UDP
(Land north of A1290)

Agricultural Land Classification
September 1996

Resource Planning Team
Leeds Statutory Group
ADAS Leeds

ADAS Reference: 79/96
MAFF Reference: EL 30/31
LUPU Commission: N2831

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AGRICULTURAL LAND CLASSIFICATION REPORT

CITY OF SUNDERLAND UDP
(LAND NORTH OF A1290), TYNE AND WEAR

Introduction

1. This report presents the findings of a detailed Agricultural Land Classification (ALC) survey of 161.4 ha of land between the A1290 and the River Don in Sunderland. The survey was carried out during September 1996.

2. The survey was commissioned by the Ministry of Agriculture, Fisheries and Food (MAFF) Land Use Planning Unit, Northallerton in connection with the Sunderland UDP. This survey supersedes any previous ALC surveys on this land

3. The work was conducted by members of the Resource Planning Team in the Leeds Statutory Group in ADAS. The land has been graded in accordance with the published MAFF ALC guidelines and criteria (MAFF, 1988). A description of the ALC grades and subgrades is given in Appendix I.

4. At the time of survey the land on the site was generally under cereal stubble, recently sown winter cereals and oilseed rape, or permanent grass. A number of fields had been recently ploughed in preparation for sowing.

Summary

5. The findings of the survey are shown on the enclosed ALC map. The map has been drawn at a scale of 1:10,000. It is accurate at this scale but any enlargement would be misleading.

6. The area and proportions of the ALC grades and subgrades on the surveyed land are summarised in Table 1.

Table 1: Area of grades and other land

Grade/Other land	Area (hectares)	% Total site area	% Surveyed Area
Grade 2	20.1	12.5	12.7
Subgrade 3a	11.5	7.1	7.3
Subgrade 3b	127.0	78.7	80.0
Other land	2.8	1.7	-
Total surveyed area	158.6	-	100
Total site area	161.4	100	-

7. The fieldwork was conducted at an average density of one boring per hectare. A total of one hundred and fifty seven borings and three soil pits were described.

8. Grade 2, very good quality agricultural land, occurs in the north-west of the site. The soils here are well or moderately well drained and consist of light to medium-textured topsoils and subsoils, although gleyed and slowly permeable heavy-textured horizons occur below 60 cm depth in many places. The ALC grade of this land is limited by very slight soil wetness or, where the subsoils are at least moderately stony, very slight soil droughtiness.

Subgrade 3a, good quality agricultural land, also occurs in the north-west. These soils are imperfectly drained, typically consisting of medium-textured topsoils overlying light to medium-textured upper subsoils and, at between 45 cm and 65 cm depth, gleyed and slowly permeable heavy-textured lower subsoils. The grade-limiting factor in this case is soil wetness.

Subgrade 3b, moderate quality agricultural land, covers most of the site. The soils consist of medium-textured topsoils overlying gleyed and slowly permeable heavy-textured subsoils at around 30 cm depth. The profiles are poorly drained and soil wetness is the factor which restricts the land to this subgrade.

Other land on the site consists of buildings and woodland.

Factors Influencing ALC Grade

Climate

9. Climate affects the grading of land through the assessment of an overall climatic limitation and also through interactions with soil characteristics.

10. The key climatic variables used for grading this site are given in Table 2 and were obtained from the published 5km grid datasets using the standard interpolation procedures (Met. Office, 1989).

Table 2: Climatic and altitude data

Factor	Units	Values
Grid reference	N/A	NZ 330591
Altitude	m, AOD	40
Accumulated Temperature	day°C (Jan-June)	1317
Average Annual Rainfall	mm	633
Field Capacity Days	days	156
Moisture Deficit, Wheat	mm	97
Moisture Deficit, Potatoes	mm	84

11. The climatic criteria are considered first when classifying land as climate can be overriding in the sense that severe limitations will restrict land to low grades irrespective of favourable site or soil conditions.

12. The main parameters used in the assessment of an overall climatic limitation are average annual rainfall (AAR), as a measure of overall wetness, and accumulated temperature (AT0, January to June), as a measure of the relative warmth of a locality.

13. The combination of rainfall and temperature at this site means that there is no climatic limitation to ALC grade.

Site

14. The centre and south of the site are level but in the north the topography is more undulating, with slopes of 1-2°. As all slopes on the site are less than 7° there is no limitation on ALC grade. Equally, neither micro-relief nor flood risk limit the ALC grade at any point on the site.

Geology and soils

15. This site is underlain by Upper and Middle Coal Measures over which lie deep deposits of laminated flow till (Pelaw Clay) and, in a few areas, alluvium (BGS Sheet 21, Sunderland). Although the Pelaw Clay generally consists of silty clay, lenses of sandy material occur in parts of the north of the site.

16. The soils on the site have been mapped by the Soil Survey of England and Wales (Sheet 1, Northern England) as belonging to the Foggathorpe 1 association. However, some of the lighter-textured soils in the north of the site appear to correspond to the Arrow association.

Agricultural Land Classification

17. The details of the classification of the site are shown on the attached ALC map and the area statistics of each grade are given in Table 1, page 1.

Grade 2

18. Grade 2, very good quality agricultural land, occurs in the north-west of the site. The soils in this area are well or moderately well drained, falling in Wetness Classes I and II (see Appendix II) and typically consist of medium sandy loam or medium clay loam topsoils overlying medium sandy loam, medium clay loam or sandy clay loam subsoils. In many cases gleyed and slowly permeable horizons of heavy clay loam or clay begin at between 60 cm and 80 cm depth. The ALC grade of this land is limited by very slight soil wetness or, where the upper subsoils are moderately stony, very slight soil droughtiness.

Subgrade 3a

19. Subgrade 3a, good quality agricultural land, also occurs in the north-west. Generally the soils are imperfectly drained, falling in Wetness Class III, and consist of medium clay loam or sandy clay loam topsoils overlying medium sandy loam, medium clay loam or sandy clay loam upper subsoils (which are generally gleyed) and heavy clay loam, clay or silty clay lower subsoils (which are both gleyed and slowly permeable). The lower subsoils begin at between

45 cm and 65 cm depth and soil wetness is the factor which restricts this area of land to Subgrade 3a.

Subgrade 3b

20. Most of the site has been mapped as Subgrade 3b, moderate quality agricultural land. The soils are poorly drained (Wetness Class IV) and typically consist of medium clay loam or heavy clay loam topsoils overlying gleyed and slowly permeable heavy clay loam or clay subsoils at between 25 cm and 35 cm depth. The combination of soil wetness and topsoil workability is the factor which restricts this land to Subgrade 3b.

Other land

21. Land in this category occurs in five small areas across the site and consists of buildings at West Moor Farm, North Moor and Hylton Bridge, and two blocks of deciduous woodland.

File Ref: RPT 20,066
Resource Planning Team
Leeds Statutory Group
ADAS Leeds

SOURCES OF REFERENCE

British Geological Survey (1978) *Sheet No. 21, Sunderland (Solid and Drift), 1:50,000.* BGS: London.

Ministry of Agriculture, Fisheries and Food (1988) *Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land.* MAFF: London.

Met. Office (1989) *Climatological Data for Agricultural Land Classification.* Met. Office: Bracknell.

Soil Survey of England and Wales (1983) *Sheet 1, Soils of Northern England.* SSEW: Harpenden.

Soil Survey of England and Wales (1984) *Soils and their Use in Northern England* SSEW: Harpenden

APPENDIX I

DESCRIPTIONS OF THE GRADES AND SUBGRADES

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 or horticultural crops can usually be grown but on some land of this 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 land.

Grade 3: Good to Moderate Quality Land

Land with moderate limitations which affect the choice of crops, the timing and type of cultivation, harvesting or the level of yield. When 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 the level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5: Very Poor Quality Agricultural Land

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

APPENDIX II

SOIL WETNESS CLASSIFICATION

Definitions of Soil Wetness Classes

Soil wetness is classified according to the depth and duration of waterlogging in the soil profile. Six soil wetness classes are identified and are defined in the table below.

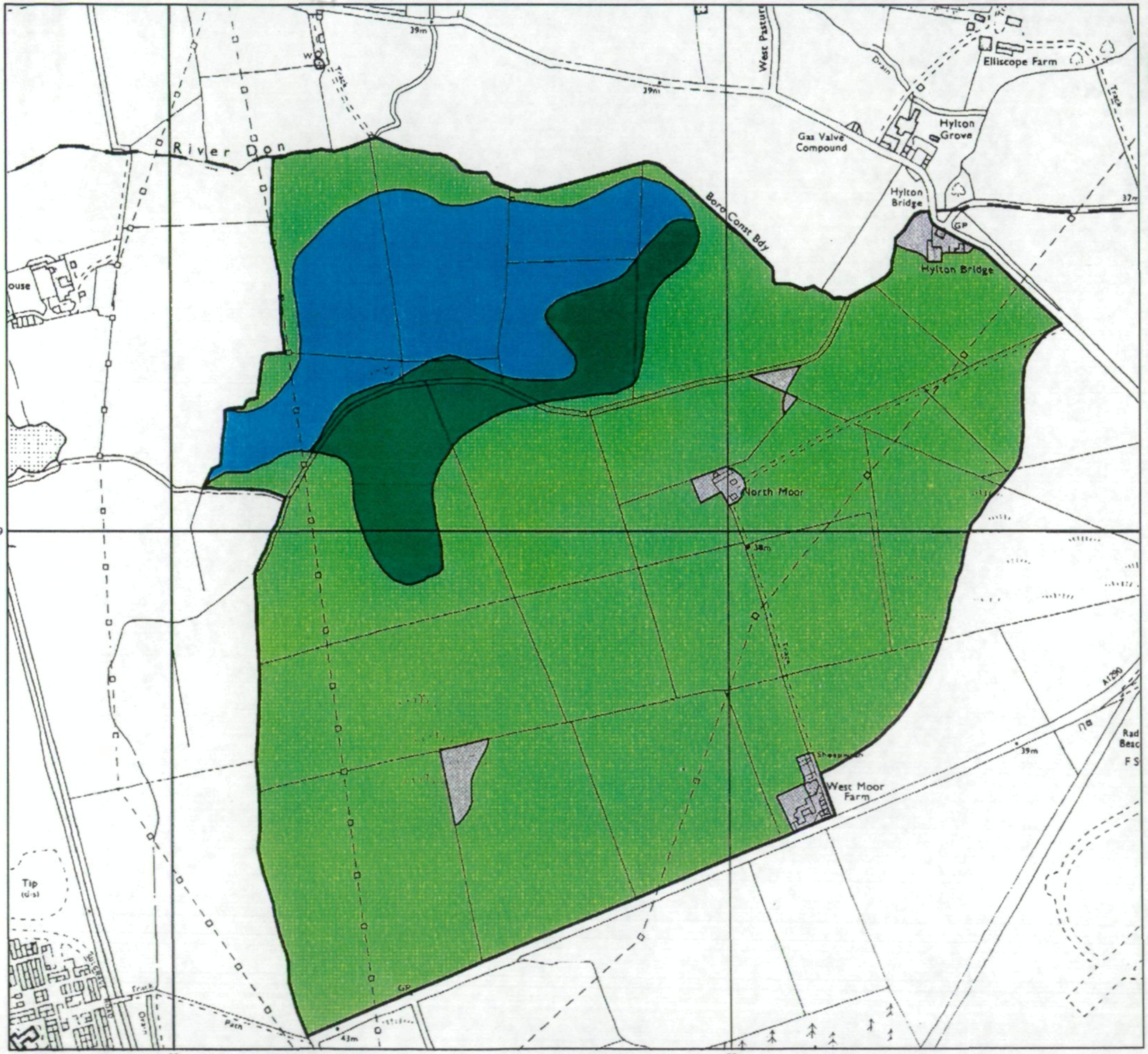
Wetness Class	Duration of waterlogging[1]
I	The soil profile is not wet within 70 cm depth for more than 30 days in most years.[2]
II	The soil profile is wet within 70 cm depth for 31-90 days in most years **or**, if there is no slowly permeable layer within 80 cm depth, it is wet within 70 cm for more than 90 days, but only wet within 40 cm depth for 30 days in most years.
III	The soil profile is wet within 70 cm depth for 91-180 days in most years **or**, if there is no slowly permeable layer present within 80 cm depth, it is wet within 70 cm for more than 180 days, but only wet within 40 cm depth for between 31-90 days in most years.
IV	The soil profile is wet within 70 cm depth for more than 180 days but not wet within 40 cm depth for more than 210 days in most years **or**, if there is no slowly permeable layer present within 80 cm depth, it is wet within 40 cm depth for 91-210 days in most years.
V	The soil profile is wet within 40 cm depth for 211-335 days in most years.
VI	The soil profile is wet within 40 cm depth for more than 335 days in most years.

Assessment of Wetness Class

Soils have been allocated to wetness classes by the interpretation of soil profile characteristics and climatic factors using the methodology described in *Agricultural Land Classification of England and Wales: Revised guidelines and criteria for grading the quality of agricultural land* (MAFF, 1988).

[1] The number of days is not necessarily a continuous period.

[2] 'In most years' is defined as more than 10 out of 20 years.



MAFF Ministry of Agriculture Fisheries and Food

Agricultural Land Classification

CITY OF SUNDERLAND UDP (LAND NORTH OF A1290)

Legend

	Quality	Area (ha)
Grade 1	Excellent*	NIL
Grade 2	Very Good	20.1
Grade 3a	Good	11.5
Grade 3b	Moderate	127.0
Grade 4	Poor*	NIL
Grade 5	Very Poor*	NIL
	Agricultural land not surveyed*	NIL
	Other land	2.8
	Boundary of survey area	
	Total agricultural land area	158.6
	Total survey area	161.4

* Not present within survey area

Scale - 1:10,000

0 100 200 300 400 500 600 Metres

Further details contained in MAFF (1988) Agricultural Land Classification of England and Wales - Revised guidelines and criteria for grading the quality of agricultural land. Maff (publications), London SE99 7TP.

The information is accurate at base map scale but any enlargement would be misleading.

Surveyed and drawn by the Resource Planning Team, ADAS Statutory Unit, Leeds.

Source map(s): NZ35NW

Reference no: 79 /96

APPENDIX 3: Laboratory Results

ANALYSIS REPORT

nrm part of Cawood

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CITY QUADRANT
11 WATERLOO SQUARE
NEWCASTLE UPON TYNE
NE1 4DP
Tel. : 0191 232 0943

H448

Please quote the above code for all enquiries

Client : NT15821LDEM 02 JOB

Distributor : NT56028

Local Rep : FRANCESCA OAKLEY

Telephone :

Sample Matrix : Agricultural Soil

Laboratory Reference
Card Number 70702/23

Date Received	24-Jul-23
Date Reported	28-Jul-23

SOIL ANALYSIS REPORT

Laboratory Sample Reference	Field Details			Index			mg/l (Available)		
	No.	Name or O.S. Reference with Cropping Details	Soil pH	P	K	Mg	P	K	Mg
375308/23	1	**SPITS** *No cropping details given*	**6.9**	**1**	**1**	**4**	**10.4**	**86**	**227**
375309/23	2	**SPISS** *No cropping details given*	**7.6**	**0**	**1**	**5**	**5.2**	**75**	**298**
375310/23	3	**SP9TS** *No cropping details given*	**7.1**	**0**	**0**	**5**	**2.8**	**30**	**281**
375311/23	4	**SP9SS** *No cropping details given*	**7.7**	**0**	**0**	**6**	**2.6**	**53**	**452**
375312/23	5	**SP12TS** *No cropping details given*	**6.6**	**0**	**1**	**4**	**8.2**	**69**	**185**

If general fertiliser and lime recommendations have been requested, these are given on the following sheets.
The analytical methods used are as described in DEFRA Reference Book 427
The index values are determined from the AHDB Fertiliser Recommendations RB209 9th Edition.

Released by Sandy Cameron On behalf of NRM Date 28/07/23

ANALYSIS REPORT

nrm part of Cawood

DATE **28th July 2023**

SAMPLES FROM **NT15821LDEM 02 JOB**

Report Reference: 70702/23

WARDELL ARMSTRONG LLP
CITY QUADRANT
11 WATERLOO SQUARE
NEWCASTLE UPON TYNE
NE1 4DP

Tel: 0191 232 0943

Lab Ref.	Field Details		Soil Organic Matter [LOI%] Result
	No.	**Field Name or Reference**	
375308	1	SPITS	6.8
375309	2	SPISS	3.5
375310	3	SP9TS	6.3
375311	4	SP9SS	2.7
375312	5	SP12TS	5.1

Your Organic Matter Results Interpretation

Land use	Rainfall	Soil type	Very Low	Low	Target	High
Arable	Low <650mm	Light	<=1.0	1.1-2.1	2.2-3.2	>=3.3
		Medium	<=1.7	1.8-3.3	3.4-5.0	>=5.1
		Heavy	<=2.2	2.3-4.4	4.5-6.5	>=6.6
	Moderate 650-800mm	Light	<=1.0	1.1-3.0	3.1-4.5	>=4.6
		Medium	<=1.9	2.0-4.0	4.1-6.0	>=6.1
		Heavy	<= 2.7	2.8-5.2	5.3-7.6	>=7.7
	High 800-1100mm	Light	<=1.3	1.4-3.7	3.8-6.1	>=6.2
		Medium	<=2.5	2.6-5.0	5.1-7.5	>=7.6
		Heavy	<=3.6	3.7-6.2	6.3-8.8	>=8.9
Grassland (Lowland)	All	Light	<=2.1	2.2-4.9	5.0-7.9	8.0-14.9
		Medium	<=3.4	3.5-6.4	6.5-9.3	9.3-19.9
		Heavy	<=4.6	4.7-7.6	7.7-10.5	10.6-19.9

ANALYSIS REPORT

DATE	**28th July 2023**
SAMPLES FROM	**NT15821LDEM 02 JOB**

Report Reference: 70702/23

WARDELL ARMSTRONG LLP
CITY QUADRANT
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Explanatory Note: Cropping

High	Above average and associated with crop residues returns and regular OM inputs, including ley-arable rotations. Organic and conservation agricultural systems would appear in this group.	On target --- **Continue Rotational Monitoring**
Typical	Typical levels and is associated with crop residue returns and regular OM inputs, such as cover crops, compost or FYM.	
Low	Lower than average associated with intensive cropping & few organic matter inputs. Plan to add OM inputs and retain crop residues in the field. **Be aware: changes in SOM as a result of a change in practice can take a long time.**	Lower than average --- **Review**
Very Low	Very low associated with very intensive cropping and very few organic matter returns. Plan to regularly add OM inputs and retain crop residues in the field. **Be aware: changes in SOM as a result of a change in practice can take a long time.**	Very Low --- **Investigate**

Explanatory Note: Grassland Fields [Lowland]

High	Above average for the climate and soil type. Well drained, near neutral pH, well managed returns through grazing and inputs. Be aware that high levels could suggest an accumulation of undecomposed SOM near the soil surface due to a deteriorating pH and drainage, for example due to compaction.	On target --- **Continue Rotational Monitoring**
Typical	Typical for the climate and soil type. Associated with well drained near neutral pH, well managed returns through grazing and inputs.	
Low	Lower than average for the climate and soil type, intensively managed or recently reseeded and/or low OM inputs. If the soil is compacted and regularly poached by livestock, then OM soil incorporation by biological activity will have been reduced.	Lower than average --- **Review**
Very Low	Very low for climate/soil type. Intensively managed or recently reseeded and/or very low OM inputs. If the soil is compact and regularly poached by livestock, then OM incorporation by biological activity will have been reduced. Add more OM inputs to build SOM levels.	Very Low --- **Investigate**

Traffic light system: These advisory categories only apply to mineral soils. The benchmarks **are not appropriate for peats/ organic soils, i.e. soils with >20% organic matter to 40cm depth.**

In grassland situations only: SOM results >=15% on light & >=20% on med/heavy soil types suggest accumulation at the soil surface often indicating poor biological activity due to soil acidity or wetness on mineral soils.

Cropping & grassland: There is no defined **critical SOM value to aim for,** feeding the soil with organic inputs is more important than reaching an absolute target value.

Please note: A different set of benchmarks would also be required for upland grass and semi-natural systems.

OM = Organic Matter, **SOM** = Soil Organic Matter

Reference: ADHB-BBRO Soil Biology & Soil Health Partnership protocol and benchmarking document July 2022. Rainfall categories for the SOM benchmarks in AHDB report:91140002 final report 02.pdf (windows.net) see pages 7-11, based on work originally in Defra project SP0310

MICRO NUTRIENT REPORT

DATE **28th July 2023**

SAMPLES FROM **NT15821LDEM 02 JOB**

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Tel: 0191 232 0943

Reference: **70702/375308/23** Field Name: **SPITS**	**Result**	**(*)**
Sand (2.00 - 0.063mm) %	47	
Silt (0.063 - 0.002mm) %	28	
Clay (< 0.002mm) %	25	
Textural Classification	Clay Loam	1

Reference: **70702/375309/23** Field Name: **SPISS**	**Result**	**(*)**
Sand (2.00 - 0.063mm) %	39	
Silt (0.063 - 0.002mm) %	35	
Clay (< 0.002mm) %	26	
Textural Classification	Clay Loam	1

Reference: **70702/375310/23** Field Name: **SP9TS**	**Result**	**(*)**
Sand (2.00 - 0.063mm) %	65	
Silt (0.063 - 0.002mm) %	20	
Clay (< 0.002mm) %	15	
Textural Classification	Sandy Loam	1

Reference: **70702/375311/23** Field Name: **SP9SS**	**Result**	**(*)**
Sand (2.00 - 0.063mm) %	24	
Silt (0.063 - 0.002mm) %	43	
Clay (< 0.002mm) %	33	
Textural Classification	Clay Loam	1

Reference: **70702/375312/23** Field Name: **SP12TS**	**Result**	**(*)**
Sand (2.00 - 0.063mm) %	54	
Silt (0.063 - 0.002mm) %	24	
Clay (< 0.002mm) %	22	
Textural Classification	Sandy Clay Loam	1

Notes (*)

(1) In calcareous soils the sand, silt and clay sized fractions are likely to contain particles of carbonate which may result in the incorrect classification of soil type.

ANALYSIS REPORT

DATE	28th July 2023
SAMPLES FROM	NT15821LDEM 02 JOB
SAMPLED BY	FRANCESCA OAKLEY NT56028
Report reference	70702/23

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Fax:

Fertiliser Recommendations

The phosphate and potash recommendations shown below, are those required to replace the offtake and maintain target soil indices. The larger recommended applications for soils below target index will allow the soil to build up to this target index over a number of years. Not applying fertiliser to soils which are above target index will allow the soil to run down over a number of years to the target index.
The recommendation should be increased or decreased where yields are substantially more or less than that specified. The amount to apply can be calculated using the expected yield and values for the offtake of phosphate and potash per tonne of yield given in the RB209 9th edition.
All recommendations are given for the mid-point of each Index.
Where a soil analysis value (as given by the laboratory) is close to the range of an adjacent Index, the recommendation may be reduced or increased slightly taking account of the recommendation given for the adjacent Index. Small adjustments of less than 10 kg/ha are generally not justified.
Efficient use of P and K is most likely to be achieved on soils that are well structured and enable good rooting.
For visual evaluation of soil structure (VESS), a score on 1 or 2 would be considered adequate.
Don’t forget to deduct nutrients applied as organic manures.
For Nitrogen recommendations please refer to the RB209 9th edition or seek advice from an FACTS qualified adviser.
Target Indices:
Arable, Forage, Grassland and Potato Crops: P Index 2, K Index 2-
(In rotations where most crops are Autumn-sown, soils are in good condition and P is applied annually, high index 1 can be an adequate target.)
Vegetables and Bulbs: P Index 3, K Index 2+
(If vegetables are only grown occasionally as part of an arable rotation, it would be most economic to target index 2 for arable and forage crops.)
Fruit Vines and Hops: P Index 2, K Index 2, Mg Index 2
(Note: Cider apples respond to K Index 3, Mg Index 3)
A lime recommendation is usually for a 20cm depth of cultivated soil or a 15cm depth of grassland soil. Where soil is acid below 20 cm and soils are ploughed for arable crops, a proportionately larger quantity of lime should be applied. However, if more than 10 t/ha is needed, half should be deeply cultivated into the soil and ploughed down, with the remainder applied to the surface and worked in.
For established grassland or other situations where there is no, or only minimal soil cultivation, no more than 7.5 t/ha of lime should be applied in one application.
In these situations, applications of lime change the pH below the surface very slowly. Consequently, the underlying soil should not be allowed to become too acidic because this will affect the root growth and thus limit nutrient and water uptake, which will adversely affect yield.

Field Name / Ref / Soil Type	*Last Crop / Next Crop*		*P2O5*	*K2O*	*MgO*		*Lime (Arable)*	*(Grass)*
SPITS	**Not Given / Not Given**	*Units/Acre*				*T/Ac*	**0**	**0**
375308 / Medium		*Kg/Ha*				*Te/Ha*	**0**	**0**
SPISS	**Not Given / Not Given**	*Units/Acre*				*T/Ac*	**0**	**0**
375309 / Medium		*Kg/Ha*				*Te/Ha*	**0**	**0**
SP9TS	**Not Given / Not Given**	*Units/Acre*				*T/Ac*	**0**	**0**
375310 / Medium		*Kg/Ha*				*Te/Ha*	**0**	**0**
SP9SS	**Not Given / Not Given**	*Units/Acre*				*T/Ac*	**0**	**0**
375311 / Medium		*Kg/Ha*				*Te/Ha*	**0**	**0**
SP12TS	**Not Given / Not Given**	*Units/Acre*				*T/Ac*	**0**	**0**
375312 / Medium		*Kg/Ha*				*Te/Ha*	**0**	**0**

Fertiliser recommendations are based on **AHDB RB209 (Ninth Edition).** If a nutrient is deficient and no recommendation is given, either no recommendation is given in RB209 or we have insufficient data to give a recommendation. Apply Lime to the nearest half Ton / Tonne.
NRM is a UKAS accredited laboratory to ISO/IEC 17025

DRAWINGS

KEY

Site Boundary
Auger Core
Profile Pit
Agricultural Land Classification
Subgrade 3a
Subgrade 3b
Non-Agricultural

Agricultural Land Classification	Area (ha)
Subgrade 3a	23.93 ha
Subgrade 3b	17.31 ha
Non-Agricultural	1.15 ha

Notes:

Boundaries are indicative. Aerial imagery shown for context purposes only.

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT
AESC UK

PROJECT
AESC PLANT 3

DRAWING TITLE
AGRICULTURAL LAND CLASSIFICATION

DRG No. NT15821/ALC		REV A
DRG SIZE A3	SCALE 1:5,000	DATE 26/10/2023
DRAWN BY GER	CHECKED BY FO	APPROVED BY BC

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