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HS2

High Speed Rail (Crewe – Manchester) Environmental Statement

Volume 5: Appendix AG-001-0MA02

Agriculture, forestry and soils

MA02: Wimboldsley to Lostock Gralam

Agriculture, forestry and soils assessment

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Department for Transport

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1 Introduction

1.1.1 This report is an appendix to the agriculture, forestry and soils assessment. It presents the following for the Wimboldsley to Lostock Gralam community area (MA02):

- agriculture and soils baseline data for agricultural land, including open spaces and natural soils within urban areas; and
- a summary of the farm holding impact assessment.

1.1.2 Additional data used for the agriculture, forestry and soils assessment are set out in Background Information and Data (BID) report Agriculture, forestry and soils baseline data (BID AG-002-0MA02)[1].

[1] High Speed Two Ltd (2022), High Speed Rail (Crewe – Manchester), *Background and Information Data, Agriculture, forestry and soils baseline data.* BID AG-002-0MA02. Available online at: https://www.gov.uk/government/collections/hs2-phase-2b-crewe-manchester-environmental-statement.

2 Soils and agricultural land classification

2.1 Background

2.1.1 An element of the assessment of the effects of the route of the Proposed Scheme upon agriculture is concerned with the consideration of the quantity and quality of the agricultural land affected. The determination of the quality of agricultural land is undertaken by the application of a secondary evaluation of the interaction of soil and other physical parameters in accordance with a prescribed methodology. That methodology is set out in guidelines[2] prepared by the Ministry of Agriculture, Fisheries and Food (MAFF) in 1988 which enables the classification of land by qualitative grade in accordance with the Agricultural Land Classification (ALC) system. This establishes the inherent productive capability of agricultural land which can be considered on a consistent basis throughout England and Wales.

2.1.2 The approach taken to the collection and collation of baseline data on soil types present, and the other physical characteristics of topography, climate and drainage in the Wimboldsley to Lostock Gralam area is described. The baseline data are described and how the MAFF evaluation methodology has been applied to provide the definitive classification of the quality of agricultural land affected by the route of the Proposed Scheme. This provides the baseline for the assessment of the effects of the project on agricultural land and soils which is detailed in Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02), Section 4 Agriculture, forestry and soils.

2.1.3 This document should be read with reference to the Agriculture, forestry and soils baseline data contained in the Background Information and Data (BID AG-002-0MA02)[1] and the Volume 5, Agriculture, forestry and soils Map Book (AG-02-302 and AG-04-304b to AG-04-309a).

2.2 Soils and agricultural land classification surveys - methodology

2.2.1 During the EIA process, soil and ALC information has been considered on two levels. The soils and agricultural land quality baseline conditions reported have been established from initial desktop studies and then with regard to subsequent site-specific surveys, where necessary and possible. The data are presented in this context with that derived from the material and interpretation of publicly available sources addressed first, followed by that

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

derived from site specific surveys whereby the initial desk-based work has been extended and/or validated.

2.2.2 At both levels the data have been evaluated in accordance with the MAFF methodology for assessing the quality of agricultural land. The review of available existing ALC information has concentrated on the extent of detailed post-1988 survey information. There were substantive changes to the ALC system in 1988 which rendered previously available information less useful.

2.2.3 The ALC system is concerned with the classification of agricultural land according to the extent to which physical or chemical characteristics impose long-term limitations on agricultural use. The main limiting factors are climate, the physical character of a site, and soil. These factors and their interactions enable land to be attributed to one of five qualitative grades, with Grade 1 being the highest quality and Grade 5 the lowest. Grade 3 land which is the most extensive grade is divided into two subgrades; 3a and 3b.

2.2.4 Of relevance to the assessment of the environmental effects of the route of the Proposed Scheme is that land falling within Grades 1 and 2 and Subgrade 3a of the ALC is determined by planning policy to comprise the best and most versatile (BMV) agricultural land.

2.2.5 The physical factors influencing the agricultural capability of land are considered within the ALC assessment methodology as follows. The main climatic factors are temperature and rainfall. Site factors are gradient, microrelief and flood risk. Relevant soil characteristics are texture, structure, depth and stoniness. These factors can act either separately or in combination to influence agricultural capability. The most important interactive limitations are soil wetness and droughtiness.

2.2.6 Soil wetness expresses the extent to which excess water imposes restrictions on crop growth and cultivations. The ALC methodology provides an approach which combines an assignment of soil to one of six categories of wetness class (WC) (I-VI with I being the most freely draining), the texture of the topsoil (sandy textures being freely draining and clays generally poorly draining), and the climatic regime expressed in terms of the number of days when the soil cannot absorb additional water (Field Capacity Days, FCD).

2.2.7 A similar approach is adopted towards the consideration of soil droughtiness. This seeks to determine the extent to which a combination of climate, soil and crop requirements provide adequate reserves of soil moisture during the growing season. The magnitude and duration of any shortfall represents a potential limitation of the land to maintain particular crops.

2.2.8 Soil droughtiness is determined in the ALC methodology with reference to an indicative drought risk based on two crops, winter wheat and maincrop potatoes. The average soils moisture balance for these crops is calculated on the basis of two parameters. Firstly, the measure of the quantity of water held in the soil profile which can be taken up by the specified crop, and secondly the moisture deficit which is the balance between rainfall and potential evaporation calculated over a critical part of a growing season. Land quality is

derived from the moisture balance, this being the difference between the two parameters, with a negative difference relating to increasingly poorer quality in the ALC system.

2.3 Soils and agricultural land classification surveys - publicly available information

2.3.1 Initially, the assessment of the impacts on soils and agricultural land quality is based on publicly available data gathered by desk based studies. This relates primarily to the identification of soil resources in the study area, the associated physical characteristics of geology, topography and climate which underpin the assessment of agricultural land quality, and the disposition of land uses. The main sources of information have included:

- National Soil Map[3];
- Soils and Their Use in Midland and Western England; regional reconnaissance mapping showing soil associations (groupings of spatially related soil types)[4];
- solid and superficial deposits from the Geology of Britain viewer[5];
- grid point meteorological data for ALC of England and Wales[6];
- Provisional ALC of England and Wales (1:250,000)[7];
- Defra Likelihood of Best and Most Versatile Agricultural Land mapping (1:250,000)[8];
- agri-environment schemes[9]; and
- aerial photography.

2.3.2 Publicly available existing detailed ALC information is generally at a mapped scale of 1:10,000 based on field surveys of soils and agricultural land quality carried out by MAFF and the Soil Survey of England and Wales (SSEW). A desk based assessment of soils and agricultural land quality was based on this publicly available data.

[3] Cranfield University (2001), *The National Soil Map of England and Wales 1:250,000 scale,* Cranfield University: National Soil Resources Institute.

[4] Soil Survey of England and Wales (1984), *Soils and Their Use in Midland and Western England*, Harpenden.

[5] British Geological Survey, *Geology of Britain Viewer.* Available online at: www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html.

[6] Meteorological Office (1989), *Grid point Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations.*

[7] Ministry of Agriculture, Fisheries and Food (1983), *Agricultural Land Classification of England and Wales (1:250,000)*.

[8] Department for Environment, Food and Rural Affairs (2005), *Likelihood of Best and Most Versatile Agricultural Land (1:250,000).*

[9] Multi-Agency Geographical Information for the Countryside (MAGIC). Available online at: www.magic.gov.uk.

2.3.3 Existing detailed ALC survey data covering agricultural land within the study area is available at Northwich Business Park in Lostock Gralam[10], Long Wood in Lostock Gralam[11] and Lostock Triangle in Lostock Gralam[12].

2.3.4 In addition, consideration has been given to detailed ALC information available within 2km of the study area, including Tiverton East[13], west of Gadbrook Park[14], Northwich[15], and Davenham by-pass landfill[16].

2.3.5 Consideration has also been given to detailed ALC information available within 5km of the study area, including Leftwich Grange[17], Ways Green Farm[18] and Nixon Drive and Chester Road[19].

2.3.6 Findings of the desk-based studies based on publicly available information are described in the following section. The location and extent of different soil types and ALC grades/subgrades are influenced by topography and drainage, by geology and soil parent materials, and by climate which are now described in turn.

2.4 Soil parent materials

2.4.1 This section only considers geology as a soil parent material[20]. The soil association developed in each parent material is identified below. The soil associations are described under 'Description and distribution of soil types' below.

[10] Ministry of Agriculture, Fisheries and Food (MAFF) (1993), *Agricultural Land Classification, Northwich,* MAFF Ref ALCW02693.

[11] Ministry of Agriculture, Fisheries and Food (MAFF) (1996), *Agricultural Land Classification, Vale Royal Borough Local Plan*, MAFF Ref ALCW6995.

[12] Ministry of Agriculture, Fisheries and Food (MAFF) (1995), *Agricultural Land Classification, Vale Royal Borough Local Plan*, MAFF Ref ALCW11695.

[13] Ministry of Agriculture, Fisheries and Food (MAFF) (1996), *Agricultural Land Classification, Vale Royal Borough Local Plan,* MAFF Ref ALCW03496.

[14] Ministry of Agriculture, Fisheries and Food (MAFF) (1995), *Agricultural Land Classification, Vale Royal Borough Local Plan,* MAFF Ref ALCW17095.

[15] Ministry of Agriculture, Fisheries and Food (MAFF) (1996), *Agricultural Land Classification, Northwich Local Plan*, MAFF Ref ALCW07788.

[16] Ministry of Agriculture, Fisheries and Food (MAFF) (1995), *Agricultural Land Classification, Davenham by-pass landfill*, MAFF Ref ALCW14695.

[17] Ministry of Agriculture, Fisheries and Food (MAFF) (1989), *Agricultural Land Classification, Northwich*, MAFF Ref ALCW02689.

[18] Ministry of Agriculture, Fisheries and Food (MAFF) (1990), *Agricultural Land Classification, Winsford*, MAFF Ref ALCW00890.

[19] Ministry of Agriculture, Fisheries and Food (MAFF) (1994), *Agricultural Land Classification, Winsford*, MAFF Ref ALCW15794.

[20] British Geological Survey. A 'parent material' is a soil-science name for a weathered rock or deposit from and within which a soil has formed. In the UK, parent materials provide the basic foundations and building

2.4.2 The majority of the Wimboldsley to Lostock Gralam area is underlain by reddish glacial till and lake deposits. Where these superficial deposits overlie Sidmouth Mudstone, it gives rise to slowly permeable and seasonally waterlogged clay soils in the Crewe association. Where glacial till overlies halite stone and mudstone in the Northwich Halite Member, there are slowly permeable and seasonally waterlogged clay loam soil in the Salop association.

2.4.3 River terrace deposits comprising sand and gravel are present in isolated locations along the valley of the River Dane. Where this parent material gives rise to well drained, deep sandy loam and loamy sand soils, they are placed in the Newport 1 association. Where this parent material is seasonally waterlogged by a fluctuating ground-water table, it produces soils in the Blackwood association.

2.4.4 Where there is alluvium, variably comprising organic rich silty clay, silt, sand and gravel, along the base of the valley of the River Dane, it produces deep, stoneless, permeable, silty soils in the Teme association. These soils are at risk of flooding.

2.5 Topography and drainage

2.5.1 Topography in this study area comprises undulating slopes characterised by shallow to moderate gradients of up to seven degrees. The area is located on the Cheshire Plain, incised by river courses and streams.

2.5.2 In the southern part of the study area, near Wimboldsley, the land ranges in elevation from 45m to 50m above Ordnance Datum (AOD), over gentle to moderate slopes with gradients of less than seven degrees. Where the route of the Proposed Scheme crosses the A533 Bostock Road to the east of Bostock near Bull's Wood, there is a steep, north-east facing slope down to the floodplain and course of the River Dane, and to the Trent and Mersey Canal. The top of the slope descends from an elevation of 50m AOD to 25m AOD, over a seven to 11 degree gradient.

2.5.3 Around the eastern edge of Northwich and Rudheath, land is undulated at elevations between 29m and 33m AOD. The slopes are gentle to moderate, with gradients less than seven degrees. At Lostock Green, at 38m AOD, the land dips towards the floodplain of Wade Brook, at approximately 29m AOD. The land rises to 40m AOD to the east of Lostock Gralam, before descending to approximately 30m AOD at the confluence of Peover Eye, Smoker Brook and Wincham Brook at the far northern end of the area, at Leonard's Wood and Smoker Wood.

2.5.4 Flood risk is potentially limiting to agricultural land quality within the study area in the floodplains of the River Dane, Gad Brook, Puddinglake Brook, Wade Brook, Peover Eye and Smoker Brook. The land in these floodplains is classed as predominantly Flood Zone 3, in

blocks of the soil, influencing their texture, structure, drainage and chemistry. Available online at Soil Parent Material Model - British Geological Survey (bgs.ac.uk).

which there is a 1 in 100 or greater annual probability of flooding. Further details are provided in Section 15, Water resources and flood risk.

2.6 Agro-climate

2.6.1 The local agro-climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at three representative points within the study area shown in Table 1. There is some variation across the study area.

2.6.2 Average annual rainfall is between 767mm to 784mm, generally increasing further north. FCD range from 179 days to 185 days. Moisture deficits are between 92mm to 93mm for wheat and 81mm to 82mm for potatoes, with the lower values occurring on the higher ground.

2.6.3 Accumulated temperature is the excess of daily air temperatures above a selected threshold temperature (0ºC), summed over a specified period (January to June which is the critical growth period for most crops). The accumulated temperature within the study area is between 1,407 and 1,427 day ºC.

Table 1: Interpolated agro-climatic data

Agro-climatic parameter	SJ 6870 6250 68706 Wimboldsley	SJ 68350 70250 Whatcroft	SJ 70300 7570 Northwich
Altitude (AOD)	50	29	32
Average annual rainfall (AAR)	767	784	780
Accumulated temperature >0° C[21] (AT0)	1,407	1,427	1,421
Field capacity days (FCD)	179	185	185
Average moisture deficit, wheat	92	92	93
Average moisture deficit, potatoes	81	81	82

2.7 Description and distribution of soil types

2.7.1 The characteristics of the soils are described in the SSEW regional bulletin covering the study area and their distribution is illustrated on the National Soil Map[3]. The soils are grouped into soil associations of a range of soil types that are spatially related and are summarised in

[21] Accumulated temperature is the excess of daily air temperatures above a selected threshold temperature (0ºC), summed over a specified period (January to June which is the critical growth period for most crops).

Table 2. Their distribution is shown on map AG-02-302 (Volume 5, Agriculture, forestry and soils Map Book).

Table 2: Soil associations

Soil association: code shown on map AG-02-304	Soil association: name	Description	Wetness class
712f	Crewe	Slowly permeable seasonally waterlogged reddish clayey and fine loamy over clayey soils, often stoneless.	IV
711m	Salop	Slowly permeable seasonally waterlogged reddish fine loamy over clayey, fine loamy and clayey soils associated with fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.	IV
511d	Newport 1	Deep well drained sandy and coarse loamy soils. Some sandy soils affected by groundwater. Risk of wind and water erosion.	I
821b	Blackwood	Deep permeable sandy and coarse loamy soils, affected by fluctuating groundwater.	III-IV
561b	Teme	Deep stoneless permeable silty soils. Some similar soils variably affected by groundwater. Gravelly subsoil in places. Flat land. Risk of	I/II

2.7.2 The National Soil Map shows the general distribution of the following five soil associations in the study area:

- the Crewe association is found in the south and the centre of the study area;
- the Salop association occurs in the north and the south of the study area;
- the Newport 1 association occurs on river terraces in the centre of the study area;
- the Blackwood association developed on pockets of river terrace deposits to the west of Middlewich and to the east of Lostock Green; and
- the Teme association is found in a localised area in the centre of the study area.

2.7.3 Soils of the Crewe, Salop, Newport 1, Blackwood, and Teme associations are described further in the Soils Guide[22] which is available at Cranfield University's Landis website.

2.7.4 Detailed descriptions for the dominant soil series in the Crewe, Salop, Newport 1, Blackwood, and Teme associations are given in Table 3.

[22] Cranfield University (2017), *The Soils Guide*. Available online at: www.landis.org.uk.

Table 3: Dominant soil series

Soil series	
Crewe series	
0-20cm	Very dark greyish brown (10YR3/2) stoneless clay loam or clay; moderately developed fine subangular block; low packing density; moderately porous; moderately weak soil strength; moderately firm ped strength; abundant fine fibrous roots; slightly calcareous; abrupt smooth boundary.
20-50cm	Strong brown (7.5YR5/4) mottled, stoneless clay; moderate coarse angular blocky structure. Medium packing density; moderately firm soil and ped strength; abundant fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
50-100cm	Reddish brown (5YR4/4) stoneless clay with many medium greenish grey (5GY6/1) mottles; strong coarse prismatic structure. High packing density; very firm soil strength; common very fine fibrous roots; non-calcareous; common irregular soft ferri-manganiferous concentrations; many stress oriented coats; clear irregular boundary.
0-25cm	Very dark greyish brown (10YR3/3) slightly stony clay loam; moist; moderately developed medium angular blocky; low packing density; moderately weak soil strength; few very fine fibrous roots; non-calcareous; sharp smooth boundary.
Salop series	
25-45cm	Brownish grey (2.5Y5/2) slightly stony clay loam very many fine strong brown (7.5YR5/8) mottles; moist; moderate medium subangular blocky or prismatic structure; medium packing density; moderately firm ped strength; few very fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
45-100cm	Yellowish red (10YR4/1) slightly stony clay with many medium yellowish brown (10YR5/6) mottles; very moist. Moderate coarse prismatic structure, moderately developed coarse prismatic with dark greyish brown (10YR4/2) faces; medium packing density; moderately firm soil strength; few very fine fibrous roots; non-calcareous; few rounded ferri-manganiferous nodules; clear smooth boundary.
100-120cm	Reddish brown (10YR4/2) slightly stony clay with many medium reddish brown (5YR4/4) mottles; massive or coarse prismatic structure; sometimes with calcium carbonate concentrations; very moist; moderately developed medium prismatic with dark grey (10YR4/1) faces; medium packing density; moderately weak soil strength; common very fine fibrous roots; non-calcareous; common rounded soft ferruginous concentrations; abrupt wavy boundary.
Newport series	
0 -25cm	Dark brown (10YR3/2) slightly stony sandy loam or loamy sand; small stones; moist; moderately developed medium subangular blocky with very dark grey (10YR3/1) faces; high packing density; moderately firm soil strength; abundant fine fibrous roots; non-calcareous; abrupt irregular boundary.
25-55cm	Brown (7.5YR5/6) slightly stony loamy sand or sand; with many extremely fine brown (10YR5/3) mottles; very small stones; moist; weak fine subangular blocky structure with dark greyish brown (10YR4/2) faces; high packing density; moderately strong soil strength; common fine fibrous roots; non-calcareous; few ferri-manganiferous nodules; clear irregular boundary.
55-120cm	Yellowish red or brownish yellow (7.5YR5/6), slightly stony sand; single grain structure.
Blackwood series	
0 – 20cm	Very dark greyish brown (10YR3/2), loose slightly stony or stoneless loamy sand; mainly small and medium subrounded quartzite pebbles; weak fine and medium granular; abundant fine pores; common fine fibrous roots; clear abrupt boundary.

Soil series	
20 – 35cm	Pale brown (10YR6/3), slightly stony loamy sand; mainly medium and large subrounded quartzite pebbles; common very pale brown (10YR7/3), light grey (10YR 7/2) and light yellowish brown (10YR 6/4) prominent mottles; single grain to weak medium coarse subangular blocky structure; gradual wavy boundary.
35 – 90cm	Light brownish grey (10YR6/2), slightly stony loamy sand to sand; mainly medium and large subrounded quartzite pebbles; common brown (10YR5/3), pale brown (10YR6/3) and very pale brown (10YR7/3) mottles; single grain to weak medium coarse subangular blocky structure; gradual wavy boundary.
90 – 100cm	Greyish brown (10YR5/2) loamy sand to sand, stoneless; common brown (10YR5/3), pale brown (10YR6/3) and very pale brown (10YR7/3) mottles; single grain structure.
Teme series	
0-18cm	Dark brown (10YR4/3) silty clay loam; very rare stones with small water-worn tabular shales; moderate coarse and medium subangular blocky with medium and fine crumb; F2, K3, P1, C1; moist; abundant fine fibrous cereal roots; merging boundary.
18-30cm	Yellowish brown (10YR5/4) silty clay loam; stones as above; moderate very coarse to medium subangular blocky; abundant fine pores; numerous worm channels; F2, K3, P1, C1; moist; few fine roots, merging boundary.
30-70cm	Dark yellowish brown (10YR4/4) silt loam, otherwise as above.
70-90+	Dark brown to brown (10YR4/3) loamy gravel with gravel-size stone; structureless, weakly massive; slightly moist.

2.8 Soil and land use interactions

2.8.1 As described earlier, the assessment of the quality of agricultural land is derived from the consideration of the extent to which long-term limitations are placed on agricultural productive capability by the key physical factors, either individually or interactively. The publicly available information and general familiarisation with the study area established the following limitations and interactions.

Agricultural land quality

2.8.2 The principal physical factors influencing agricultural production and land quality in this study area are climate, site and soil and the interactions between them. Soil wetness and workability and gradient of slope are particularly relevant limitations in this area.

Agro-climatic limitations

2.8.3 The local agro-climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at three points within the study area, as set out in Table 1. Average annual rainfall is from 767mm to 784mm, increasing with altitude. FCDs range from 179 days to 185 days. Moisture deficits are 92mm to 93mm for wheat and 81mm to 82mm for potatoes, with the lower values occurring on the higher ground.

2.8.4 Climate itself does not place any limitation upon the land in this study area but the interactions of climate with soil characteristics are important in determining the wetness limitations of the soil.

Site limitations

2.8.5 The assessment of site limitations is primarily concerned with the way in which topography influences the use of agricultural machinery and hence the cropping potential of land. In addition, gradient influences the risk of soil erosion on cultivated land, particularly where the soil is weakly structured. Gradient and microrelief are limiting to agricultural land quality across the study area.

2.8.6 Flood risk is likely to be limiting to agricultural land quality alongside the River Dane, Gad Brook, Puddinglake Brook, Wade Brook, Peover Eye and Smoker Brook. However, site-specific data on duration and frequency of flooding required to grade agricultural land according to Table 2 'Grade according to flood risk in summer' and Table 3 'Grade according to flood risk in winter' in the MAFF ALC Guidelines (1988) is not available. The land in these floodplains is classed as predominantly Flood Zone 3, in which there is a 1 in 100 or greater annual probability of flooding.

Soil limitations

2.8.7 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. Together they influence the functions of soil and affect the water availability for crops, drainage, workability and trafficability. The main soil characteristics within the study area are:

- slowly permeable and seasonally waterlogged clay loams over clay soils in drift;
- mainly heavy clay and clayey textures, developed in glacial till, affected by high AAR and number of FCDs (see Agro-climatic limitations);
- light loamy and sandy textures in river terrace or glaciofluvial drifts; and
- deep stoneless permeable silty soils in river floodplain variably affected by groundwater.

2.8.8 Soil depth and chemical limitations are not encountered in this study area.

Interactive limitations

2.8.9 The physical limitations which result from interactions between climate, the site and soil are soil wetness, droughtiness and erosion. Each soil can be allocated a WC based on soil structure, evidence of waterlogging and the number of FCDs; the topsoil texture then determines its ALC Grade in accordance with the MAFF ALC guidelines. The conclusions reached on the quality of agricultural land in the study area from the initial desk based consideration are as follows.

2.8.10 Where soils in the Salop association are slowly permeable and seasonally waterlogged (WC III to IV) clay loams over clay soils in reddish drift, agricultural land quality is limited mainly by soil wetness to mainly Subgrade 3a or Subgrade 3b, with Grade 4 where the topsoil is heavy clay loam over clay subsoil which is waterlogged for long periods over the winter C IV).

2.8.11 Soils in the Crewe series have topsoil which ranges between heavy clay loam and clay, overlying slowly permeable clay subsoil which is waterlogged for long periods over the winter (WC IV). Where soils in the Crewe series are located in the 176-225 FCD category in Table 6 of the ALC Guidelines (1988), the quality of agricultural land with heavy clay loam or clay topsoil over slowly permeable and seasonally waterlogged clay subsoil (WC IV) is limited by soil wetness to Grade 4.

2.8.12 Deep, well-drained (WC I) light loamy and sandy soils in the Newport series are most affected by soil droughtiness. The severity of limitation is determined by factors such as topsoil and subsoil textures, stone content. As crop moisture deficits are moderate to moderately large, droughtiness limitations range from slight (Grade 2) to moderate (Subgrade 3a) but may be enough to limit soils to Subgrade 3b.

2.8.13 The quality of agricultural land with soils in the Blackwood series is limited by soil wetness to Subgrade 3a where the subsoil is seasonally waterlogged (WC III) or Subgrade 3b where the subsoil is waterlogged for long periods over the winter (WC IV). Where the agricultural land is drained (WC I and WC II), soil in the Blackwood series is limited by soil droughtiness to Grade 2 or Subgrade 3a.

2.8.14 Silty loam and silty clay loams soils in the Teme association are developed in alluvium in the Dane valley. Most of the soils in this association are well drained (WC I) or only slightly seasonally waterlogged (WC II), but there is a risk of flooding in the winter. The quality of agricultural land on the soils can range from Grade 2 to Subgrade 3a, with Subgrade 3b where soil wetness is more severe, or where the land floods in the winter.

2.9 Soils and agricultural land classification surveys - detailed soil/ALC field surveys

2.9.1 The collection of site-specific information on soil resources and physical conditions has enabled a refinement and extension of published information on agricultural land quality. The analysis of the additional baseline information (topography and soils) identifies individual soil types and definitive agricultural land quality in accordance with the methodology prescribed by MAFF.

2.9.2 Site specific soils data have been collected through the observation of individual soil profiles at density of one observation per hectare across the study area; this being the degree of detail required for a definitive agricultural land classification. The characteristics of soil profiles were recorded to a maximum depth of 120cm where possible, or to any impenetrable layer, in relation to the following attributes:

- soil texture;
- significant stoniness;
- colour (including local gley and mottle colours);
- consistency;
- structural condition;
- free carbonate; and
- depth.

2.9.3 Soil WC was inferred from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling and/or poorly permeable subsoil layers at least 15cm thick. Soil available water capacity, relevant to the assessment of drought risk, was estimated from texture, structure, organic matter content, stone content and profile depth.

2.9.4 Soil data associated with post-1988 detailed ALC surveys are available from Natural England. A full archive of the soil data collected from field surveys undertaken on behalf of HS2 Ltd is presented as a series of soil survey proformas in a separate background information document (BID AG-002-0MA02)[1].

2.9.5 There are no detailed soil survey maps published by SSEW covering any part of the Wimboldsley to Lostock Gralam community area. The detailed soil surveys carried out as part of this assessment cover approximately 50% of the agricultural land in the study area.

2.9.6 The detailed soil data confirm the presence in the study area of the soil series relating to the soil associations shown on the National Soil Map. Representative soil profiles from the Blackwood, Salop, Crannymoor, Turbary Moor and Conway are described in Table 4.

Table 4: Dominant soil series within study area taken from site survey data

Soil series	
Crewe series (368600, 371400)	
0 -30cm	Very dark greyish brown (10YR3/3) stoneless heavy clay loam; subangular blocky structure; low packing density; moderately porous; abundant fine fibrous roots; non-calcareous; abrupt smooth boundary.
30-65cm	Strong brown (7.5YR5/3) stoneless clay with many prominent ochreous mottles (7.5YR5/8); moderate coarse angular blocky structure. Medium packing density; moderately firm soil and ped strength; abundant fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
65-120cm	Reddish brown (5YR4/4) stoneless clay with common distinct grey (10YR5/1)) mottles; strong coarse prismatic structure. High packing density; very firm soil strength; common very fine fibrous roots; non-calcareous.
Salop series (370400, 375800)	
0-45cm	Greyish brown (2.5Y5/2) medium sandy loam; moist; moderately developed medium angular blocky; low packing density; moderately weak soil strength; few very fine fibrous roots; non-calcareous; sharp smooth boundary.
45-60cm	Dark reddish brown (5YR3/3) sandy clay loam very; moist; moderate medium subangular blocky or prismatic structure; medium packing density; moderately firm ped strength; few very fine fibrous

Soil series	
	roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary.
60-80cm	Brown (7.5YR5/2) slightly stony clay with many medium yellowish brown (10YR5/6) mottles; very moist. Moderate coarse prismatic structure, moderately developed coarse prismatic with dark greyish brown (10YR4/2) faces; medium packing density; moderately firm soil strength; few very fine fibrous roots; non-calcareous; few rounded ferri-manganiferous nodules; clear smooth boundary.
80-90cm	Reddish brown (5YR4/4) slightly stony clay; massive or coarse prismatic structure; non-calcareous; very moist; medium packing density; moderately weak soil strength; common very fine fibrous roots; non-calcareous; common rounded soft ferruginous concentrations; abrupt wavy boundary.
90-120cm	Reddish brown (5YR4/4) slightly stony clay; prismatic structure; non-calcareous; very moist; medium packing density; common very fine fibrous roots; non-calcareous; common rounded soft ferruginous concentrations; abrupt wavy boundary.
Newport series (368350, 367450)	
0-30cm	Strong brown (7.5YR 7/3) medium sand; small stones; moist; moderately developed medium subangular blocky structure; high packing density; moderately firm soil strength; abundant fine fibrous roots; slightly calcareous; abrupt irregular boundary.
30-70cm	Yellowish red or brownish yellow (7.5YR5/6), fine sand; slightly calcareous; single grain structure.
70-120cm	Yellowish red or brownish yellow (7.5YR5/6), fine sand; single grain structure.
Blackwood series (371700, 386600)	
0 – 40cm	Black (10YR2/1), medium sandy loam; mainly small and medium subrounded quartzite pebbles; weak fine and medium granular; abundant fine pores; common fine fibrous roots; clear abrupt boundary.
40 – 60cm	Very dark brown (10YR2/2), sandy loam; mainly medium and large subrounded quartzite pebbles; single grain to weak medium coarse subangular blocky structure; gradual wavy boundary.
60 – 70cm	Very dark brown (10YR2/2), loamy medium sand; mainly medium and large subrounded quartzite pebbles; single grain to weak medium coarse subangular blocky structure; gradual wavy boundary.
70 – 75cm	Brown (7.5YR5/2) medium sand, stoneless; common mottles; single grain structure.
Teme series (368400, 368600)	
0-25cm	Brown (7.5YR4/2) medium clay loam; very rare stones with small water-worn tabular shales; moderate coarse and medium subangular blocky; moist; abundant fine fibrous cereal roots; merging boundary.
25-90cm	Brown (7.5YR5/4) heavy clay loam; stones as above; moderate very coarse to medium subangular blocky; abundant fine pores; numerous worm channels; F2, K3, P1, C1; moist; few fine roots, merging boundary.
90-120cm	Brown (7.5YR4/4) sandy clay loam; gravel with gravel-size stone; structureless, weakly massive; slightly moist.

2.9.7 Where there is no available published information and it has not been possible to undertake a detailed survey of agricultural land affected by the route of the Proposed Scheme, professional judgement has been used to extrapolate from known data to provide a comprehensive ALC coverage.

2.9.8 The assessment of the quality of agricultural land in the study area based on publicly available data and additional detailed survey data have been reviewed, and the final conclusions on the distribution of agricultural land in the various grades of the ALC in the study area are shown on Maps AG-04-304b to AG-04-309a (Volume 5, Agriculture, forestry and soils Map Book).

2.9.9 The distribution of agricultural land in the different grades is shown in Table 5.

Table 5: Distribution of grades of agricultural land in the study area

Grade	Area (ha)	% of study area	% of Agricultural land area
1	0.0	0	0
2	34.0	4.6	5.3
3a	209.1	28.1	32.8
BMV subtotal	**243.1**	**32.7**	**38.1**
3b	208.3	28.0	32.6
4	187.2	25.2	29.3
5	0.0	0	0
Non agricultural	104.5	14.1	---
Total area	**743.1**	**100**	**100**

3 Assessment of effects on holdings

3.1.1 The effects on land holdings have been assessed according to the methodology set out in the in the Environmental Impact Assessment Scope and Methodology Report (SMR), (see Volume 5, Appendix CT-001-00001).

3.1.2 The land holdings assessed in this section are also presented in Volume 2, Community Area report: Wimboldsley to Lostock Gralam (MA02), Section 4 Agriculture, forestry and soils and shown on the Volume 5, Agriculture, forestry and soils Map Book (AG-01-304b to AG-01-309a).

3.1.3 A summary of the assessment is provided in Table 6. The nature of the impacts considered includes:

- temporary and permanent land required from the holding;
- the temporary and permanent severance of land;
- the permanent loss of key farm infrastructure; and
- disruption (particularly noise and dust) on land uses and the holding's operations.

3.1.4 These impacts occur primarily during the construction phase of the Proposed Scheme.

Table 6: Summary of assessment of impacts and effects on holdings

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
MA02/1 Wimboldsley Hall Farm and Wimboldsley Grange Farm Owner-occupied Additional land taken on annual licence and contract agreements. 291ha owned land with dairy herd of 570 cows. All heifers reared as dairy herd replacements or for sale. High sensitivity to change	Land required: High 129.5ha; 45% of holding required for construction of the Walley's Green embankment, Crewe north rolling stock depot, Borrow Pits A and B and Borrow Pit A satellite compound, utility diversions and soil stores. Severance: Medium To the west of the WCML agricultural land will be severed as the utility diversion works are undertaken but access will remain available, subject to liaison, as set out in the CoCP. Disruption: Low Potential for dust arising from construction to affect housed livestock. Overall temporary assessment: Major adverse due to the proportion of land required	Land required: High 80.1ha; 28% required for the Walley's Green embankment, the Crewe north rolling stock depot, balancing ponds, landscape mitigation planting and habitat creation. Severance: Medium The land to be acquired for the borrow pits will be restored for agricultural production; access to the land will be possible via the Wimboldsley Grange access diversion and the public highway. Infrastructure: Negligible Although the bridge over the WCML that serves Wimboldsley Grange will be demolished, this asset is owned by Network Rail. An alternative means of access for the farm has been provided.

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
		Overall permanent assessment: Major adverse due to the proportion of land required
MA02/2 Lea Hall Farm Owner-occupied and forms part of a wider 453ha holding including 190ha rented on a Farm Business Tenancy (FBT). Part of the land managed under the requirements of the Mid-tier Countryside Stewardship Scheme. Managed with 1,150 dairy cows across two dairy sites with Lea Hall used for rearing dairy replacement heifers (all indoors). Land at Byley used for forage production. Medium sensitivity to change as the affected land is off lying from the main holdings and no dairy cow grazing is affected.	Land required: Medium 78.6ha; 17% of holding required for the construction of the Walley's Green embankment, Crewe north rolling stock depot, Crewe rolling stock depot satellite compound, Borrow Pit B and Borrow Pit B satellite compound, Clive Green Lane realignment, utility diversions and soil stores. Severance: Medium To the east of the WCML agricultural land will be severed during utility diversion works are undertaken but access will remain available, subject to liaison, as set out in the CoCP. Disruption: Low Potential for dust arising from construction may require temporary re-housing of livestock. Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Low 37.7ha; 8% of holding required for the Walley's Green embankment, Crewe north rolling stock depot, Clive Green Lane realignment, balancing ponds, landscape mitigation planting and habitat creation. Severance: Medium Land severed will be accessed from the public highway. Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to severance
MA02/3 Norcroft Farm* 52ha grassland holding Medium sensitivity to change	Land required: Negligible 1.2ha; 2% of holding required for the construction of the Clive Green Lane realignment and highway balancing pond. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 0.6ha; 1% of holding required for the Clive Green Lane realignment and highway balancing pond. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/4 Stanthorne Park Mews* 12ha equestrian training and livery holding. Low sensitivity to change as undertaken as a new business venture on land rented from HS2 Ltd in full knowledge of the Proposed Scheme.	Land required: High 7.8ha; 65% of holding required for the construction of the Clive Green south embankment No.3, road and rail access to the Crewe north rolling stock depot, Clive Green Lane realignment and utility diversions. Severance: Medium Holding severed with access to severed land available via the public highway. Disruption: Low	Land required: High 7.2ha; 60% of holding required for the Clive Green south embankment No.3, the road and rail access to the Crewe north rolling stock depot, the Clive Green Lane realignment and landscape mitigation planting. Severance: Medium Land severed will be accessed from the public highway. Infrastructure: Negligible

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Riding and exercising horses close to construction activities may need to be limited. Overall temporary assessment: Moderate adverse due to the proportion of land required	Overall permanent assessment: Moderate adverse due to the proportion of land required
MA02/5 Park Farm Mainly owner-occupied, some agricultural land rented from Cheshire West Council; some land contract farmed. 58ha dairy holding Diversified activities include canal moorings let annually and farm buildings let. High sensitivity to change	Land required: High 18.6ha; 32% of holding required for the construction of the Clive Green south embankment, rail access to the Crewe north rolling stock depot, Shropshire Union Canal south satellite compound, utility diversions and soil stores. Severance: Negligible All agricultural land severed is required for the construction of the mitigated scheme. Disruption: Negligible Overall temporary assessment: Major adverse due to the proportion of land required	Land required: High 16.0ha; 28% of holding required for the Clive Green south embankment, rail access to the Crewe north rolling stock depot and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Major adverse due to proportion of land required
MA02/6 Yew Tree Farm (including land at Stanthorne Hall Farm) Mainly owner-occupied; Stanthorne Hall Farm rented on an annual licence; land at Moulton rented on Agricultural Holdings Act (AHA) tenancy. Part of the land managed under the requirements of the Mid-tier Countryside Stewardship Scheme. 154ha dairy holding High sensitivity to change	Land required: High 54.7ha; 35% of holding required for the construction of the Stanthorne south embankment, rail access to the Crewe north rolling stock depot, Shropshire Union Canal viaducts north satellite compound, Stanthorne south embankment, A54 Middlewich Road realignment and A54 Middlewich Road satellite compound, Borrow Pit C and Borrow Pit C satellite compound, balancing ponds, utility diversions and soil stores. Severance: Low Although the farm will be severed an agricultural access under the Proposed Scheme will be possible using the Yew Tree Farm accommodation access realignment. Disruption: Low Potential for dust arising from construction. Overall temporary assessment: Major adverse due to the proportion of land required	Land required: High 33.6ha; 22% of holding required for the Stanthorne south embankment, the rail access to the Crewe north rolling stock depot, the A54 Middlewich Road realignment, landscape mitigation planting and habitat creation. Severance: Low Although the farm will be severed an agricultural access under the line will be possible using the Yew Tree Farm accommodation access realignment. Infrastructure: High Demolition of the residential property. Overall permanent assessment: Major adverse due to the proportion of land required and property demolition

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
MA02/7 Mill Farm 44ha owner-occupied dairy holding High sensitivity to change	Land required: Negligible 0.2ha; <1% of holding required for the construction of a water culvert. Severance: Negligible Disruption: Negligible Overall temporary assessment: Minor adverse	Land required: Negligible No land permanently required. Severance: Negligible Disruption: Negligible Overall permanent assessment: Negligible
MA02/8 Bostock House Farm 26ha beef cattle holding held on an FBT from Bostock Estate; a farm shop is also being established. Low sensitivity to change as established as a new tenancy in full knowledge of the Proposed Scheme.	Land required: Medium 3.6ha; 14% of holding required for the construction of the A533 Bostock Road diversion, A533 Bostock Road satellite compound, utility diversions and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Minor adverse	Land required: Negligible 1.0ha; 4% of holding required for the A533 Bostock Road diversion. Severance: Negligible Disruption: Negligible Overall permanent assessment: Negligible
MA02/9 Greenheyes Farm 40ha dairy holding with 45 dairy cows held on an AHA tenancy from Bostock Estate. Part of the land managed under the requirements of the Mid-tier Countryside Stewardship Scheme. Diversified activities include events management in agricultural buildings. High sensitivity to change	Land required: High 13.3ha; 33% of holding required for the construction of the Stanthorne north embankment, rail access to the Crewe north rolling stock depot, A54 Middlewich Road realignment, utility diversions and soil stores. Severance: Medium Land severed to the west of the Proposed Scheme accessible from the public highway. Disruption: Low There is the potential for dust arising from construction to affect housed livestock. Overall temporary assessment: Major adverse due to the proportion of land required	Land required: Low 3.9ha; 10% of holding required for the Stanthorne north embankment, rail access to the Crewe north rolling stock depot, A54 Middlewich Road realignment, HS2 access to balancing ponds and landscape mitigation planting. Severance: Medium Land severed to the west accessed via public highway. Infrastructure: High Demolition of residential property and farm buildings. Overall permanent assessment: Major adverse due to property demolition
MA02/10 Bank Farm 85ha grassland holding held on an AHA tenancy from Bostock Estate used for rearing dairy heifers; DIY livery also provided. Medium sensitivity to change	Land required: High 22.3ha; 26% of holding required for the construction of the Stanthorne north embankment, rail access to the Crewe north rolling stock depot, River Dane viaduct, River Dane viaduct south satellite compound, A54 Middlewich Road realignment, Bank Farm accommodation access, utility diversions and soil stores. Severance: Low	Land required: Medium 12.0ha; 14% of holding required for the Stanthorne north embankment, rail access to the Crewe north rolling stock depot, River Dane viaduct, A54 Middlewich Road realignment, Bank Farm accommodation access, landscape mitigation planting and habitat creation. Severance: Low Although the farm will be severed, access will be possible using the

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Although the farm will be severed access will be possible using the Bank Farm accommodation access. Disruption: Low There is the potential for dust arising from construction to affect housed livestock. Overall temporary assessment: Major/moderate adverse due to the proportion of land required	proposed Bank Farm accommodation access. Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to the proportion of land required
MA02/11 Croxton Hall Farm Owner-occupied 105ha beef cattle holding (suckler herd) Medium sensitivity to change	Land required: Negligible 2.9ha; 3% of holding required for construction traffic access to the River Dane viaduct. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 1.5ha; 1% of holding required for habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/12 Bostock Hall Farm 103ha beef cattle arable and grassland holding held on an AHA tenancy from Bostock Estate. Sheep grazing offered in the winter. Part of the land managed under the requirements of the Higher Level Stewardship scheme for environmental management. Diversified activities include livery stables and solar PV panels. Medium sensitivity to change	Land required: Medium 10.5ha; >10% of holding required for the construction of the River Dane viaduct and soil stores. Severance: Low Although the farm will be severed, access will be possible under the River Dane viaduct. Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Negligible 3.9ha; 4% of holding required for the River Dane viaduct and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/13 Dairy Farm, Whatcroft with Park Farm, Wimboldsley, Occlestone Green Farm, Wimboldsley and Yew Tree Farm, Whatcroft. Dairy Farm, Whatcroft rented on a FBT; Yew Tree Farm held on an AHA; remaining holdings are owner-occupied 331ha dairy enterprise with 800 cows High sensitivity to change	Land required: Medium 41.9ha; 13% of holding required for the construction of the Dane Valley embankment, River Dane viaduct north satellite compound, Puddinglane Brook viaduct and Puddinglane Brook viaduct satellite compound, agricultural accommodation access diversion, utility diversions and soil stores. Severance: Low Although the farm will be severed access will be possible using the Dairy Farm accommodation access diversion. Disruption: Low	Land required: Low 25.0ha; 8% of holding required for the Dane Valley embankment, the Puddinglane Brook viaduct, the agricultural accommodation access diversion, landscape mitigation and habitat creation. Severance: Low Although the farm will be severed access will be possible using the Dairy Farm accommodation access diversion. Infrastructure: Negligible Overall permanent assessment: Moderate adverse due to the

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	There is the potential for dust arising from construction to affect housed livestock. Overall temporary assessment: Major/Moderate adverse due to the proportion of land required	proportion of land required and severance
MA02/14 Shanks Farm, Byley 144ha mainly owned holding managed with arable crops, beef cattle, pigs and vegetables. Diversified activities include a large farm shop supplied with homegrown and bought-in produce, and provision of managed dog walking area. Medium sensitivity to change.	Land required: Low 8.6ha; 6% required for Borrow Pit D. Severance: Negligible Disturbance: Low Dust may have an adverse effect on growing crops, including those grown for human consumption (vegetables and salad crops). Overall temporary assessment: Minor adverse	Land required: Negligible 4.8ha; 3% required for habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/15 Allumbrook Farm 120ha dairy holding. 74ha owned and 46ha rented annually. Part of the land managed under the requirements of the Entry Level Stewardship Scheme. The land affected at Byley is assessed as medium sensitivity to change as the land is off lying from the main holding and no dairy cow grazing is affected.	Land required: Low 10.2ha; 8% required for Borrow Pit D. Severance: Negligible Disturbance: Negligible Overall temporary assessment: Minor adverse	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/16 Pear Tree Farm, Cranage 75ha beef cattle and sheep holding. Mostly owner occupied with 10ha rented on an FBT. Managed with. Medium sensitivity to change.	Land required: Medium 10.8ha; 14% required for Borrow Pit D. Severance: Negligible Disturbance: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Negligible 0.2ha; <1% required permanently. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/17 Wash Lane Farm* 28ha arable and grassland holding. Medium sensitivity to change.	Land required: High 7.1ha; 25% required for Borrow Pit D. Severance: Negligible Disturbance: Negligible Overall temporary assessment: Major/moderate adverse due to the proportion of land required.	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
MA02/18 Stublach Farm* 126ha arable and grassland holding. Medium sensitivity to change.	Land required: Low 6.6ha; >5% required for Borrow Pit D. Severance: Negligible Disturbance: Negligible Overall temporary assessment: Minor adverse	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/19 Brook Farm 50ha dairy holding with 70 dairy cows, held on an AHA tenancy from Bostock Estate. High sensitivity to change	Land required: High 10.7ha; 21% of holding required for the construction of the Whatcroft embankment south, Brook Farm accommodation access diversion, balancing ponds and associated accesses, and soil stores. Severance: Low Although the farm will be severed, access under the line will be possible using the Brook Farm accommodation access diversion. Disruption: Low There is the potential for dust arising from construction to affect housed livestock. Overall temporary assessment: Major adverse due to the proportion of land required	Land required: Medium 7.3ha; 15% of holding required for the Whatcroft embankment south, Brook Farm accommodation access diversion, balancing ponds, landscape mitigation and habitat creation. Severance: Low Access to severed land will be possible using the Brook Farm accommodation access diversion. Infrastructure: Negligible Overall permanent assessment: Major/moderate adverse due to the proportion of land required
MA02/20 Fir Tree Farm 22ha beef cattle and arable holding. Mainly owner-occupied with 6ha rented from Bostock Estate on an AHA tenancy. Medium sensitivity to change	Land required: High 12.6ha; 57% of holding required for the construction of the Gad Brook viaduct and utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: High 5.9ha; 27% of holding required for the Gad Brook viaduct, landscape mitigation and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Major/moderate adverse due to the proportion of land required
MA02/21 Higgins Lane Farm Owner-occupied 22ha arable beef cattle holding Medium sensitivity to change	Land required: High 13.6ha; 62% of holding required for the construction of the Whatcroft embankment north, Gad Brook viaduct south satellite compound, utility diversions and soil stores. Severance: Medium Land severed to the east of the Proposed Scheme accessible from the public highway. Disruption: Negligible	Land required: High 8.3ha; 38% of holding required for the Whatcroft embankment north, the Davenham Road express feeder auto-transformer station, landscape mitigation and habitat creation. Severance: Medium Land severed to the east of the Proposed Scheme accessible from the public highway. Infrastructure: High

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Demolition of residential and agricultural buildings. Overall permanent assessment: Major/moderate adverse due to the proportion of land required and property demolition
MA02/22 Hulse Heath Farm 200ha holding. Part owner-occupied (11ha); main holding held on AHA tenancy (53ha); remainder on annual licence. 300-cow dairy unit, with arable and potatoes. Part of the land managed under the requirements of the Mid-tier Countryside Stewardship Scheme. Medium sensitivity to change as land is off lying from main holding and no dairy cow grazing affected.	Land required: Negligible 6.4ha; 3% of holding required for the construction of the Gad Brook viaduct, A536 Chester Road realignment and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 2.5ha; 1% of holding required for the Gad Brook viaduct, A536 Chester Road realignment and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/23 Land at King Street* 17ha arable holding Medium sensitivity to change	Land required: High 7.7ha; 45% of holding required for the construction of the Gad Brook viaduct, Rudheath embankment satellite compound, B5082 Penny's Lane diversion, utility diversions and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: Negligible 0.8ha; 5% of holding required for the Gad Brook viaduct, B5082 Penny's Lane diversion, highway balancing pond and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/24 High House Farm 78ha beef cattle and arable holding. Land held on an FBT since 1966.Diversified activities include agricultural contracting. Medium sensitivity to change	Land required: High 27.2ha; 35% of holding required for the construction of the Rudheath embankment, Rudheath embankment transfer node, Rudheath embankment satellite compound, B5082 Penny's Lane diversion, Gad Brook viaduct north satellite compound, utility diversions and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: Low 7.8ha; 10% of holding required for the Rudheath embankment, B5082 Penny's Lane diversion, landscape mitigation and habitat creation. Severance: Medium Access to severed land will be from the public highway. Infrastructure: High Demolition of residential and agricultural buildings. Overall permanent assessment: Major/moderate adverse due to property demolition

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
MA02/25 Port Ford Farm 89ha dairy and arable holding. 71ha Owner occupied and 18ha tenanted on an FBT. Medium sensitivity to change as land is off lying from main holding and no dairy cow grazing affected.	Land required: Medium 11.2ha; 13% of holding required for the Gad Brook viaduct south satellite compound, Gad Brook viaduct north satellite, utility diversions and soil stores. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Negligible 0.9ha; 1% of holding required for habitat creation. Severance: Negligible Infrastructure: Negligible Overall temporary assessment: Negligible
MA02/26 Melvin Holme Farm 88ha arable holding. 28ha rented from Inovyn on an FBT agreement and farmed in conjunction with a further 60ha held on an AHA tenancy; 40ha contract farmed. Part of the land managed under the requirements of the Mid-tier Countryside Stewardship Scheme. Medium sensitivity to change	Land required: High 20.1ha; 23% of holding required for the construction of the Rudheath embankment, A566 Chester Road realignment, Penny's Lane satellite compound, utility diversions and soil stores. Severance: Medium Severance during the extensive utility diversions may require alternative access to land. Disruption: Medium Disruption during installation of utility diversions may preclude arable cropping over part of the land for a temporary period. Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: Low 4.5ha; >5% of holding required for the Rudheath embankment and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Minor adverse
MA02/27 Birchall Farm 121ha dairy holding rented from Inovyn on various AHA and FBT agreements. Medium sensitivity to change as land is off lying from main holding and no dairy cow grazing affected.	Land required: Low 6.5ha; >5% of holding required for the construction of the Rudheath embankment, utility diversions and soil stores. Severance: Medium Disruption during installation of utility diversions may preclude cropping over part of the land for a temporary period. Disruption: Negligible Overall temporary assessment: Moderate adverse due to severance	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/28 Springbank Farm* 45ha grassland holding with farm shop.	Land required: High 17.2ha; 38% of holding required for the construction of the Rudheath embankment, A556 Chester Road	Land required: High 10.5ha; 23% of holding required for the Rudheath embankment, A556 Chester Road realignment,

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
Medium sensitivity to change	realignment, utility diversions and soil stores. Severance: Medium Disruption during installation of utility diversions may preclude cropping over part of the land for a temporary period. Disruption: Low Construction impact (noise and dust) may have an effect on farm shop users and a possible reduction in sales. Overall temporary assessment: Major/moderate adverse due to the proportion of land required	landscape mitigation planting and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Major/moderate adverse due to the proportion of land required
MA02/29 Langford Farm* 77ha sheep holding Medium sensitivity to change	Land required: Negligible 3.1ha; 4% of holding required for utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/30 Land at Hangman's Lane* 7ha grassland holding Medium sensitivity to change	Land required: Medium 0.8ha; 12% of holding required for utility diversions. Severance: Negligible Disruption: Negligible Overall temporary assessment: Moderate adverse due to the proportion of land required	Land required: Negligible No land permanently required. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/31 Park Farm, Lostock Gralam 93ha arable and equestrian (livery) holding. 71ha rented from Inovyn on an AHA tenancy with the balance rented locally NPL. Medium sensitivity to change	Land required: High 29.3ha; 32% of holding required for the construction of the Rudheath embankment, utility diversions and soil stores. Severance: Medium Severance during the extensive utility diversions may require alternative access to land. Disruption: Low Disruption during installation of utility diversions may preclude cropping over part of the land for a temporary period. Riding and exercising horses close to construction activities may also need to be limited.	Land required: Negligible 0.4ha; <1% of holding required for landscape mitigation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Overall temporary assessment: Major/moderate adverse due to the proportion of land required	
MA02/32 Fieldhouse Farm 150ha Arable and beef cattle, with vegetables grown for Farmers' Market. Holding with land rented from NPL and Inovyn on various AHA tenancy and FBT agreements; 1.6ha owned. Medium sensitivity to change	Land required: High 76.4ha; 51% of holding required for the construction of the Rudheath embankment, Lostock Gralam south embankment, Lostock Gralam north embankment, A556 Chester Road realignment, Birches Lane diversion, Lostock Gralam viaduct satellite compound, Smoker Brook viaduct south satellite compound and transfer node, utility diversions and soil stores. Severance: Medium Severance during the extensive utility diversions may require alternative access to land. Access to land presently severed by the A556 provided by existing underpass, however this may be compromised during construction. Disruption: Low Potential for dust arising from construction to affect housed livestock and also soiling (construction dust) of vegetables. Overall temporary assessment: Major/moderate adverse due to the proportion of land required	Land required: High 33.1ha; 22% of holding required for the Rudheath embankment, Lostock Gralam south embankment, Lostock Gralam north embankment, A556 Chester Road Realignment, Birches Lane diversion, landscape mitigation and habitat creation. Severance: Low Land is presently severed by the A556. A replacement underpass will be provided. Infrastructure: Negligible Overall permanent assessment: Major/moderate adverse due to the proportion of land required
MA02/33 Tabley Hill Dairy Farm 198ha dairy holding rented from the Crown Estate. Medium sensitivity to change as land is off lying from main holding and no dairy cow grazing affected.	Land required: Negligible 7.8ha; 4% of holding required for the construction of the Smoker Brook viaduct. Severance: Negligible Disruption: Negligible Overall temporary assessment: Negligible	Land required: Negligible 7.5ha; 4% of holding required for the Smoker Brook viaduct and habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Negligible
MA02/34 Hilltop Holding Owner-occupied 2.6ha grassland holding used for haylage production. Diversified activities include agricultural contracting. Low sensitivity to change	Land required: High 0.6ha; 22% of holding required for the construction of the Smoker Brook viaduct. Severance: Negligible Disruption: Negligible	Land required: Medium 0.3ha; 13% of holding required for habitat creation. Severance: Negligible Infrastructure: Negligible Overall permanent assessment: Minor adverse due to the proportion of land required

Holding reference, name, description and sensitivity to change	Temporary impacts and effects	Permanent impacts and effects
	Overall temporary assessment: Moderate adverse due to the proportion of land required	

** It has not been possible to arrange farm impact assessment interviews with these holdings. Publicly available sources have been used to obtain the information presented.*

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