A46 Newark Bypass

TR010065/APP/6.3

6.3 Environmental Statement
Appendix 9.4 Soil Nutrient Survey Report

APFP Regulation 5(2)(a)

Planning Act 2008

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

Volume 6

April 2024

Infrastructure Planning

Planning Act 2008

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

A46 Newark Bypass

Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT

APPENDIX 9.4 SOIL NUTRIENT SURVEY REPORT

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010065
Application Document Reference	TR010065/APP/6.3
Author:	A46 Newark Bypass Project Team, National Highways

Version	Date	Status of Version
Rev 1	April 2024	DCO Application

Contents

1 Introduction

1.1.1 This Soil Nutrient Survey (SNS) Report has been prepared as part of the Environmental Statement (ES) **(TR010065/APP/6.3)** submitted for the Development Consent Order (DCO) application for the Scheme.

1.1.2 In accordance with the British Standard BS 3882[1] and Natural England TIN036[2] guidance, this report details soil properties relevant to supporting plant life in areas of potential landscaping and permanent and temporary acquisition of land.

1.1.3 This Report aims to determine the pH and the concentration of available phosphorous (P), potassium (K), magnesium (Mg), and soil organic matter (SOM) in the soil.

1.1.4 This Report has been prepared in parallel with Appendix 9.3 (Agricultural Land Classification) (ALC) Report of the ES Appendices **(TR010065/APP/6.3)**, and has also informed the Outline Soil Management Plan (SMP) for the Scheme, contained in Appendix B.3 of the First Iteration Environmental Management Plan (EMP) **(TR010065/APP/6.5)** which provides a framework to manage and monitor the soils disturbed during construction of the Scheme and also Chapter 9 (Geology and Soils) of the ES **(TR010065/APP/6.1)**.

[1] The British Standards Institution. (2015). BS3882:2015 Specification for topsoil.

[2] Natural England. (2008). Natural England Technical Information Note TIN036 Soils and agri-environment Schemes: interpretation of soil analysis.

2 Legislation and policy overview

2.1.1 The National Policy Statement for National Networks (NPSNN)[3] sets out the policy which the Scheme should comply with. It is also the basis for informing a judgement on the impacts of a Scheme, for example whether the Scheme is consistent with the provisions of the NPSNN. Compliance of the Scheme with the NPSNN is detailed within the NPSNN Accordance Tables **(TR010065/APP/7.2)**. The relevant sections are outlined below.

2.1.2 A draft NPSNN was published for consultation in March 2023. The consultation period ended in June 2023. The draft NPSNN may be subject to change following the consultation and once published in its designated form. Although this is currently in draft it has been considered in respect of the Scheme and the Draft NPSNN Accordance Tables **(TR010065/APP/7.3)** summarise compliance of the Scheme with the draft NPSNN.

- Paragraph 4.15: *"All proposals for projects that are subject to the European Union's Environmental Impact Assessment Directive and are likely to have significant effects on the environment, must be accompanied by an ES, describing the aspects of the environment likely to be significantly affected by the project. The Directive specifically requires an environmental impact assessment to identify, describe and assess effects on human beings, fauna and flora, soil, water, air, climate, the landscape, material assets and cultural heritage, and the interaction between them".*
- Paragraph 5.167: *"During any pre-application discussions with the applicant, the local planning authority should identify any concerns it has about the impacts of the application on land-use, having regard to the development plan and relevant applications, and including, where relevant, whether it agrees with any independent assessment that the land is surplus to requirements".*
- Paragraph 5.168: *"Applicants should take into account the economic and other benefits of the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification). Where significant development of agricultural land is demonstrated to be necessary, applicants should seek to use areas of poorer quality land in preference to that of a higher quality. Applicants should also identify any effects, and seek to minimise impacts, on soil quality, taking into account any mitigation measures proposed. Where possible, developments should be on previously developed (brownfield) sites provided that it is not of high environmental value. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination and how it is proposed to address this".*

[3] Department for Transport. (2014). National Policy Statement for National Networks.

- Paragraph 5.176: *"The decision-maker should take into account the economic and other benefits of the best and most versatile agricultural land. The decision-maker should give little weight to the loss of agricultural land in grades 3b, 4 and 5, except in areas (such as uplands) where particular agricultural practices may themselves contribute to the quality and character of the environment or the local economy".*
- Paragraph 5.179: *"Applicants can minimise the direct effects of a project on the existing use of the proposed site or proposed uses near the site by the application of good design principles, including the layout of the project and the protection of soils during construction".*

2.1.3 In 2009, Department for Environment Food and Rural Affairs (Defra) issued the Soil Strategy for England – Safeguarding our Soils[4]. This outlines the goal that by 2030 all of England's soils will be managed sustainably, with degradation threats tackled successfully, to improve quality and safeguard their ability to provide future generations with the vast range of soil ecosystem services. The aims of the strategy have also been incorporated into the Natural Environment White Paper ('The natural choice: securing the value of nature[5]).

2.1.4 The National Planning Policy Framework (NPPF)[6] highlights in paragraph 180 that the planning system should both contribute to and improve the natural and local environment by protecting and enhancing soils.

[4] Department for Environment, Food and Rural Affairs. (2009) Safeguarding our Soils: A Strategy for England. Defra.

[5] Department for Environment, Food and Rural Affairs. (2011) The Natural Environment White Paper, The natural choice: securing the value of nature. London: The Stationery Office.

[6] Department for Levelling Up, Housing & Communities (December 2023). National Planning Policy Framework [online] available at: National Planning Policy Framework (publishing.service.gov.uk) (last accessed March 2024).

3 Survey Methodology

3.1 Survey location

3.1.1 The SNS was undertaken in the fields displayed in the drawings contained in Appendix A to E of this report along the main Scheme alignment between the Winthorpe and Farndon roundabouts and the Kelham and Averham Floodplain Compensation Area (FCA).

3.1.2 The areas sampled have been labelled with a number prefix followed by the land title (for example, 1-NT342330 as displayed in Table 4-2) as multiple fields or wooded areas may be associated with the same land title. Within the body of the report and on maps, the fields or wooded areas\ are labelled with their prefix only.

3.2 Sampling methodology

3.2.1 Soil samples were collected from 46 fields or wooded areas between 10 to 12 January and 1 and 3 March 2023 by suitably qualified Soil Scientists for laboratory analysis of nutrient levels.

3.2.2 Sampling of topsoil was undertaken in accordance with the guidelines outlined in British Standard BS38821[1] and Natural England TIN035[7]. Samples were taken from each field/wooded area in clean polythene bags using a sampling auger to a depth of ~20 centimetres for grassland, ~25 centimetres for arable land or until subsoil was encountered. Each sample comprised 16 cores (subsamples) bulked together to give a single representative sample (~500 grams). Subsamples were collected in a W pattern across each field/wooded area.

3.3 Laboratory analysis and interpretation

3.3.1 Samples were tested by a UKAS accredited laboratory (NRM, UK) for pH, available P, K, Mg and SOM. The results were interpreted as per the following industry standards:

- Nutrient Management Guide (RB209)[8]
- Technical Information Note TIN036 | Soil and agri-environment Schemes: interpretation of soil analysis[2]
- BS 3882:20151[2]

[7] Natural England (2008). TIN035: soil sampling for habitat recreation and restoration.

[8] AHDB (2022). Nutrient Management Guide (RB209), Section 1: Principles of nutrient management and fertiliser use.

3.3.2 Nutrient concentrations were classified as per TIN036 guidance[2] and BS 3882[1] as displayed in Table 3-1 and Table 3-2 respectively.

3.3.3 Based on the concentration of each nutrient detected in the sample by standard analytical methods, the soil was assigned a nutrient index. The nutrient status describes the nutrient index, and ranges from 'very low' to 'very high'.

3.3.4 As this framework uses index categories associated with whole numbers (for example, P index 0: 0-9 mg/L, index 1: 10-15 mg/L), soil nutrient values were rounded to the nearest whole number for the purposes of classification in conjunction with TIN036[2].

Table 3-1: Soil nutrient status criteria

P		K		Mg		Status
mg/L*	**Index**	**mg/L**	**Index**	**mg/L**	**Index**	
0 – 9	0	0 – 60	0	0 – 25	0	**Very low**
10 – 15	1	61 – 120	1	26 – 50	1	**Low**
16 – 25	2	121 – 180	2-	51 – 100	2	**Moderate**
		181 – 240	2+			
26 – 45	3	241 – 400	3	101 – 175	3	**High**
46 – 70	4	401 – 600	4	NA	4	**Very high**

*P extracted by Olsen's method (with sodium bicarbonate)

3.3.5 Topsoils were described following British Standard classification[1]. This uses a range of soil nutrient content measurements (as shown within Table 3-2) to classify topsoils as either multipurpose topsoil or specific purpose topsoil (including acidic, calcareous, low fertility, low fertility acidic, or low fertility calcareous).

3.3.6 Soil pH criteria were adjusted from BS 3882:20151 to match RB209[7] criteria and professional judgement.

Table 3-2: Topsoil classification criteria

Parameter	Multipurpose topsoil		Low fertility topsoil	
	Acidic	**Calcareous**	**Acidic**	**Calcareous**
Extractable P mg/L	16 – 140	16 – 140	≤ 20	≤ 20
Extractable K mg/L	121- 1,500	121- 1,500	-	-
Extractable Mg mg/L	51 – 600	51 – 600	-	-
% mass loss on ignition (organic matter)	5 – 30	5 – 20	2 – 30	2 – 20
Soil pH*	< 7 *	> 7 *	< 7 *	> 7 *

Table constructed based on BS3882:2015**Error! Bookmark not defined.** guidance

*pH criteria were adjusted from BS3882:2015**Error! Bookmark not defined.** according to professional judgement

4 Results

4.1 General

4.1.1 The results and interpretation of the laboratory analysis are recorded in Table 4-2 and mapped in Appendices A-E of this Report.

4.1.2 Raw laboratory results are contained in Appendix F of this Report.

4.2 Soil pH

4.2.1 Soil calcareousness was determined according to the methodology of the Soil Survey Field Handbook[9]. Field results were corroborated with geological information and laboratory testing of bulk samples to set a standard for soil pH across the Order Limits that fits with the reported topsoil types in accordance with BS 38821. On this basis, fields with a pH of up to 7.4 were adjudged to be non-calcareous soils.

4.2.2 The combination of methodologies to define pH mitigated the risk of possible occurrence of fragments of chalk or other alkaline rock derivatives that can 'contaminate' the bulk sample. If such contaminants are included within the small subsample analysed by the laboratory, the result will be unrepresentative of pH status of the entire field/wooded area.

4.2.3 The soils were mostly acidic with pH values ranging from 4.8 to 7.4 in 38 fields.

4.2.4 Eight fields were considered calcareous with a pH ranging from 7.5 to 7.7.

4.2.5 There was no obvious pattern to the distribution of pH across the Order Limits.

4.3 Available phosphorous

4.3.1 The level of available P ranged from 5.6 mg/L (index 0) to 92 mg/L (index 5) as displayed in Appendix B.

4.3.2 Nine fields had very low (index 0) and 6 fields had low (index 1) levels of available P. P concentration is considered the limiting factor in defining low fertility and ensuring a species-rich habitat as low P reduces competition from aggressive broad-leaved species or the dominance of grasses.

[9] Hodgson, JM (1974). Soil Survey Field Handbook. Soil Survey Technical Monograph No. 5, Silsoe.

4.3.3 The 9 fields with very low levels of available P were clustered directly west of the Cattle Market Roundabout. These included fields 15-24.

4.3.4 The 6 fields with low levels of available P comprised fields 3b, 3c, 4, 26, 27 and 43. Fields 3b, 3c, 4 are clustered between the Winthorpe and Cattle Market Roundabout roundabouts.

4.3.5 Adjoining Fields 3b, 3c and 4, Field 3a had moderate levels of available P. Field 2 had high levels of available P.

4.3.6 The fields in the north-east of the Order Limits had moderate to very high (indices 2-5) available P.

4.3.7 Fields AF2-7 in the Kelham and Averham FCA had very high available P ranging between 28.6 and 92.0 mg/L.

4.4 Available potassium

4.4.1 The level of available K ranged from 41 mg/L (index 0) to 412 (index 4) as displayed in Appendix C.

4.4.2 The fields between the Farndon roundabout and the Cattle Market Roundabout mostly had low or very low levels of available K, following a similar distribution as available P. Specifically, Fields 3b, 3c and 4 had low levels of available K whilst adjoining Field 3a had moderate levels. Field 2 had very high levels of available K. Fields 15-24 had a very low (index 0) or low (index 1) level of available K.

4.4.3 In the north-east of the Order Limits, fields had moderate (index 2) to high (index 3) levels, with the exception of Fields 60b, which had very low levels (index 0).

4.4.4 The fields in the Kelham and Averham FCA had moderate (AF3, AF4 and AF8), high (Field 67 and AF6/7) or very high (AF2) available K.

4.5 Available Magnesium

4.5.1 The level of available Mg ranged from 56 mg/L (index 2) to 536 mg/L (index 6), in other words, moderate to very high as displayed in Appendix D of this Report.

4.5.2 Fields 1-36, 38 and 43 had very high levels of available Mg (index 5 or 6).

4.5.3 If such soils need lime, it is best to use a calcium lime source, which will reduce magnesium levels gradually.

4.5.4 In the north-east of the Order Limits, Fields 37, 39, 40, 44 and 49 had high levels, while Fields 46-48 and 50 had moderate levels.

4.5.5 In the Kelham and Averham FCA, the available K of fields AF2 and AF6/7 fell into index 4 (very high) bracket, while that of Field 67, AF3-4 and AF8 fell into index 3 (high).

4.5.6 High soil Mg levels may be caused by application of magnesium limestone for liming purposes. Where soil magnesium exceeds index 5 (Fields 1-36, 38 and 43), there is a likelihood of reduced K availability and instability in soil structure.

4.6 Soil Organic matter

4.6.1 The SOM ranged from 2.6% (low) to 13.7% (high) as displayed in Appendix E of this Report.

4.6.2 Throughout the majority of the Scheme, SOM was measured as moderate (3-6%) or high (>6%).

4.6.3 Only 5 fields out of 46 had low SOM and these were concentrated in the north-east of the Order Limits, including Fields 46, 47, 50, 52 and 53.

4.6.4 The fields in the Kelham and Averham FCA had moderate – high SOM.

4.6.5 On the Order Limits, the fields with high SOM were broadly distributed to the south of the Scheme and those with moderate SOM to the north.

4.7 Topsoil classification

4.7.1 The classification of the fields is recorded in Table 4-2 and mapped in Appendix A of this Report.

4.7.2 Across the Order Limits, 15 fields were classed low fertility acidic, 1 field was low fertility calcareous, 27 fields were multipurpose, 2 fields were specific purpose acidic and one field was specific purpose calcareous.

4.7.3 The three areas (8, 48 and 60b) considered specific purpose had a P concentration that was too high to be classed as low fertility but K concentrations too low to meet the requirements for more fertile soils such as multipurpose topsoil. The specific purpose acidic areas were in the north-east of the Order Limits, while the specific purpose calcareous Field 8 was directly south of the Farndon Roundabout.

4.7.4 Fields 34-58 (except 48) in the north-east of the Order Limits were classed as multipurpose topsoil. The fields in the Kelham and Averham FCA (Fields AF2-AF8) were also classed as multipurpose soil.

4.7.5 Fields 3a and 4 were classed as low fertility acidic, while Field 3b was classed as low fertility calcareous.

4.7.6 Fields 2 and 6 were multipurpose topsoil.

4.7.7 Fields 15 to 27 were classed as low fertility acidic.

4.7.8 The volume of soil of each topsoil class was estimated based on the topsoil depth reported in Table 2-1 of the Outline SMP (Appendix B.3 of the First Iteration EMP **(TR010065/APP/6.5)**) and is recorded in Table 4-1.

Table 4-1: Soil volumes across Scheme

Topsoil classification	**Total soil volume, m^3**
Low fertility acidic	128,000
Low fertility calcareous	22,000
Multipurpose	186,700
Specific purpose acidic	16,500

Table 4-2: Laboratory analysis results for topsoil samples

Field	pH	P			K			Mg			Organic matter		Topsoil classification
		mg/L	Index	Status	mg/L	Index	Status	mg/L	Index	Status	%	Status	
2-NT282847	7.4	44.4	3	High	406	4	Very high	327	5	Very high	12.3	High	Multipurpose
3a-NT282847	7.2	15.8	2	Moderate	141	2-	Moderate	463	6	Very high	8.3	High	Low fertility acidic
3b-NT342330	7.7	13.8	1	Low	97	1	Low	444	6	Very high	7.8	High	Low fertility calcareous
3c-NT342330	7.4	12.4	1	Low	118	1	Low	392	6	Very high	7.5	High	Low fertility acidic
4-NT342330	7.3	10.6	1	Low	86	1	Low	448	6	Very high	7.6	High	Low fertility acidic
6-NT454379	7.0	27.6	3	High	138	2-	Moderate	304	5	Very high	6.1	High	Multipurpose
8-NT530350	7.6	17.0	2	Moderate	50	0	Very low	182	4	Very high	3.5	Moderate	Specific purpose calcareous
15-U100018	6.4	5.6	0	Very low	45	0	Very low	290	5	Very high	9.8	High	Low fertility acidic
17-NT297078	6.5	8.6	0	Very low	78	1	Low	267	5	Very high	8.6	High	Low fertility acidic
18-NT526230	6.9	8.0	0	Very low	48	0	Very low	505	6	Very high	9.4	High	Low fertility acidic
19-NT477349	6.3	6.6	0	Very low	71	1	Low	448	6	Very high	9.5	High	Low fertility acidic
20-NT526230	6.5	6.4	0	Very low	120	1	Low	453	6	Very high	10.6	High	Low fertility acidic
21-NT297245	6.5	6.4	0	Very low	41	0	Very low	371	6	Very high	10.8	High	Low fertility acidic
22-NT297245	6.4	5.6	0	Very low	51	0	Very low	370	6	Very high	10.2	High	Low fertility acidic
23-NT526231	6.6	6.8	0	Very low	87	1	Low	518	6	Very high	10.6	High	Low fertility acidic
24-NT414035	6.4	8.0	0	Very low	100	1	Low	394	6	Very high	12.4	High	Low fertility acidic
26-NT285583	6.6	10.4	1	Low	112	1	Low	536	6	Very high	13.7	High	Low fertility acidic
27-NT323459	6.8	11.0	1	Low	69	1	Low	390	6	Very high	10.0	High	Low fertility acidic
34-NT227149	7.4	19.8	2	Moderate	134	2-	Moderate	312	5	Very high	9.2	High	Multipurpose
35-NT361486	7.6	20.6	2	Moderate	195	2+	Moderate	426	6	Very high	9.2	High	Multipurpose
36-NT319513	7.0	41.6	3	High	187	2+	Moderate	326	5	Very high	6.2	High	Multipurpose
37-NT472773	6.7	42.8	3	High	178	2-	Moderate	148	3	High	3.7	Moderate	Multipurpose
38-NT450212	7.3	38.8	3	High	174	2-	Moderate	211	4	Very high	5.8	Moderate	Multipurpose
39-NT448560	7.5	46.6	4	Very high	223	2+	Moderate	103	3	High	3.3	Moderate	Multipurpose

Field	pH	P			K			Mg			Organic matter		Topsoil classification
		mg/L	Index	Status	mg/L	Index	Status	mg/L	Index	Status	%	Status	
40-U100024	7.4	52.4	4	Very high	234	2+	Moderate	171	3	High	5.4	Moderate	Multipurpose
42-NT448569	7.5	40.0	3	High	334	3	High	104	3	High	3.3	Moderate	Multipurpose
43-NT446523	6.3	10.4	1	Low	195	2+	Moderate	179	4	Very high	7.4	High	Low fertility acidic
44-NT446540	7.0	52.4	4	Very high	253	3	High	162	3	High	8.9	High	Multipurpose
46-NT448560	7.6	32.8	3	High	236	2+	Moderate	80	2	Moderate	2.8	Low	Multipurpose
47-NT448560	7.6	60.2	4	Very high	297	3	High	81	2	Moderate	2.6	Low	Multipurpose
48-NT448560	4.8	89.0	5	Very high	104	1	Low	62	2	Moderate	7.6	High	Specific purpose acidic
49-NT425291	7.0	55.6	4	Very high	220	2+	Moderate	114	3	High	3.2	Moderate	Multipurpose
50-NT448560	7.5	68.8	4	Very high	292	3	High	91	2	Moderate	2.7	Low	Multipurpose
51-NT448560	7.0	64.2	4	Very high	278	3	High	93	2	Moderate	4.0	Moderate	Multipurpose
52-NT405103	7.2	44.4	3	High	201	2+	Moderate	94	2	Moderate	2.8	Low	Multipurpose
53-NT405103	7.3	61.8	4	Very high	208	2+	Moderate	84	2	Moderate	2.7	Low	Multipurpose
54-NT425291	6.6	46.2	4	Very high	189	2+	Moderate	96	2	Moderate	4.5	Moderate	Multipurpose
55-NT425291	6.9	49.2	4	Very high	168	2-	Moderate	56	2	Moderate	4.2	Moderate	Multipurpose
58-NT460276	7.4	60.4	4	Very high	244	3	High	83	2	Moderate	3.1	Moderate	Multipurpose
60b-NT310896	6.5	45.4	3	High	44	0	Very low	59	2	Moderate	3.5	Moderate	Specific purpose acidic
67-NT428449	7.2	28.6	3	High	390	3	High	167	3	High	4.6	Moderate	Multipurpose
AF2-NT428449	6.6	64.6	4	Very high	412	4	Very high	203	4	Very high	4.7	Moderate	Multipurpose
AF3-NT291060	6.5	76.4	5	Very high	180	2-	Moderate	134	3	High	4.3	Moderate	Multipurpose
AF4-NT291060	6.6	92.0	5	Very high	217	2+	Moderate	129	3	High	3.4	Moderate	Multipurpose
AF6/7-NT291060	7.0	66.4	4	Very high	313	3	High	308	5	Very high	8.0	High	Multipurpose
AF8-NT291060	5.9	62.6	4	Very high	166	2-	Moderate	108	3	High	3.5	Moderate	Multipurpose

5 Discussion

5.1 Soil nutrients

5.1.1 In relation to soil P, where the key objective for a site is the establishment of botanical diversity, such as for certain landscaping requirements, it is beneficial for the site to have a low soil P status (indexes 0 or 1). For areas of species-rich, semi-natural grasslands, P is most often the critical nutrient in influencing sward diversity and should be Index 0 or 1 for these habitats to flourish. Conversely, where the goal is to maintain or heighten crop yields, P may be increased through fertilisers or animal manure. Fields 3b, 3c and 15-27 would be considered good for botanical diversity.

5.1.2 The range in K concentration is likely to be influenced by the land management and interactions with other nutrients, in particular Mg. K levels appear to be inversely correlated with Mg levels across the Order Limits. Where soil magnesium exceeds index 5 (Fields 1-36, 38, 43 and AF6/7), there is a likelihood of reduced K availability and instability in soil structure[7].

5.1.3 K concentrations were found to be broadly low throughout the south-west and the north-east areas where Mg had index 5 or 6. K concentrations were moderate-high on Fields 34-58 where Mg had index 3 or 4. Where soil magnesium exceeds index 5 (Fields 2, 3a-36, 38, 43 and AF6/7), there is a likelihood of reduced K availability and instability in soil structure7.

5.1.4 In comparison with P, where species-rich establishment may be required, K is less important when considering establishment suitability. Where arable soils are required, moderate K status (index 2 and above) is required.

5.1.5 Additional Mg input is not recommended on any of these soils and if a higher pH is required, calcium lime should be preferentially used to a Mg lime source.

5.2 Topsoil classification

5.2.1 The low fertility topsoils found in 16 fields are suitable for species-rich habitats, such as biodiverse grasslands. P concentration is considered the limiting factor in defining low fertility and ensuring a species-rich habitat, as low P reduces competition from aggressive broad-leaved species or the dominance of grasses.

5.2.2 Where the main objective of the land is to reach botanical diversity, a low soil P status and (less critically) high N status is preferable.

5.2.3 Calcareous and acidic grasslands can establish within a large range of pH, although it is typical for calcareous species-rich grassland to occur at pH >6.8 and acidic species-rich grassland to occur at pH <5.

5.2.4 There are 27 fields with nutrient levels corresponding to multipurpose topsoil, which is suitable for general use, including shrubs and trees. Multipurpose soil has a broad range of pH and nutrient levels and can be used for a range of applications. Within multipurpose soils, those with more specific pH values can meet the requirements of plants suited to a particular pH.

5.2.5 Woodland establishment requires the level of nutrients found in multipurpose soil[10]. Forest/woodland habitats can be developed on a variety of soil types, depending on the tree species that will be planted.

5.2.6 There are 3 fields which cannot currently be classified as per the British Standard[1] due to atypical balances of the key nutrients and have been termed ‘specific purpose acidic’ in the vicinity of the Winthorpe Roundabout and ‘specific purpose calcareous’ south of the Farndon Roundabout. These soils may need conditioning if used for landscaping purposes in order to balance the nutrient levels appropriately.

[10] ADAS and Earthcare Technical Ltd., 2015 Guidance on suitable organic material applications for land restoration and improvement.

6 Conclusion

6.1.1 Across the Order Limits, there are 16 fields with low fertility topsoil, 27 fields with multipurpose topsoil and 3 fields with atypical nutrient profiles.

6.1.2 Topsoils have a pH ranging from 5.7 to 7.9 and an atypical field of 4.8. Topsoils in 38 fields are considered acidic (pH<7.5) and those of 18 fields are considered calcareous (pH>7.5). The field with pH 4.8 should be limed.

6.1.3 The 16 fields of low fertility topsoil are well-suited to species-rich habitats such as biodiverse grassland.

6.1.4 The 27 fields of multipurpose topsoil are well-suited to the majority of needs, including shrubs and trees.

6.1.5 There are 2 non-classified fields near the Winthorpe Roundabout and 1 south of the Farndon Roundabout that may need conditioning if used for landscaping purposes in order to balance the nutrient levels appropriately. The P levels in these fields are too high to be suitable for low fertility habitats.

6.1.6 During stockpiling, low fertility soils should be stored separately if practicable. This would be facilitated by the fact that the low fertility soils are located proximally to each other (Fields 3a-27).

6.1.7 Appropriate soil handling will be achieved by following a SMP (which would build on the Outline SMP contained in Appendix B.3 of the First Iteration EMP **(TR010065/APP/6.5)**) in accordance with Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites[11].

6.1.8 To enable landscape or ecological habitat establishment, soil volumes of different soil nutrient classes will need to be included in the SMP. Volumes of the different soil classes have been calculated and reported in Table 4-1.

[11] Defra (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

7 References

[1] The British Standards Institution. (2015). BS3882:2015 Specification for topsoil.

[2] Natural England. (2008). Natural England Technical Information Note TIN036 Soils and agri-environment Schemes: interpretation of soil analysis.

[3] Department for Transport. (2014). National Policy Statement for National Networks.

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[7] Natural England (2008). TIN035: soil sampling for habitat recreation and restoration.

[8] AHDB (2022). Nutrient Management Guide (RB209), Section 1: Principles of nutrient management and fertiliser use.

[9] Hodgson, JM (1974). Soil Survey Field Handbook. Soil Survey Technical Monograph No. 5, Silsoe.

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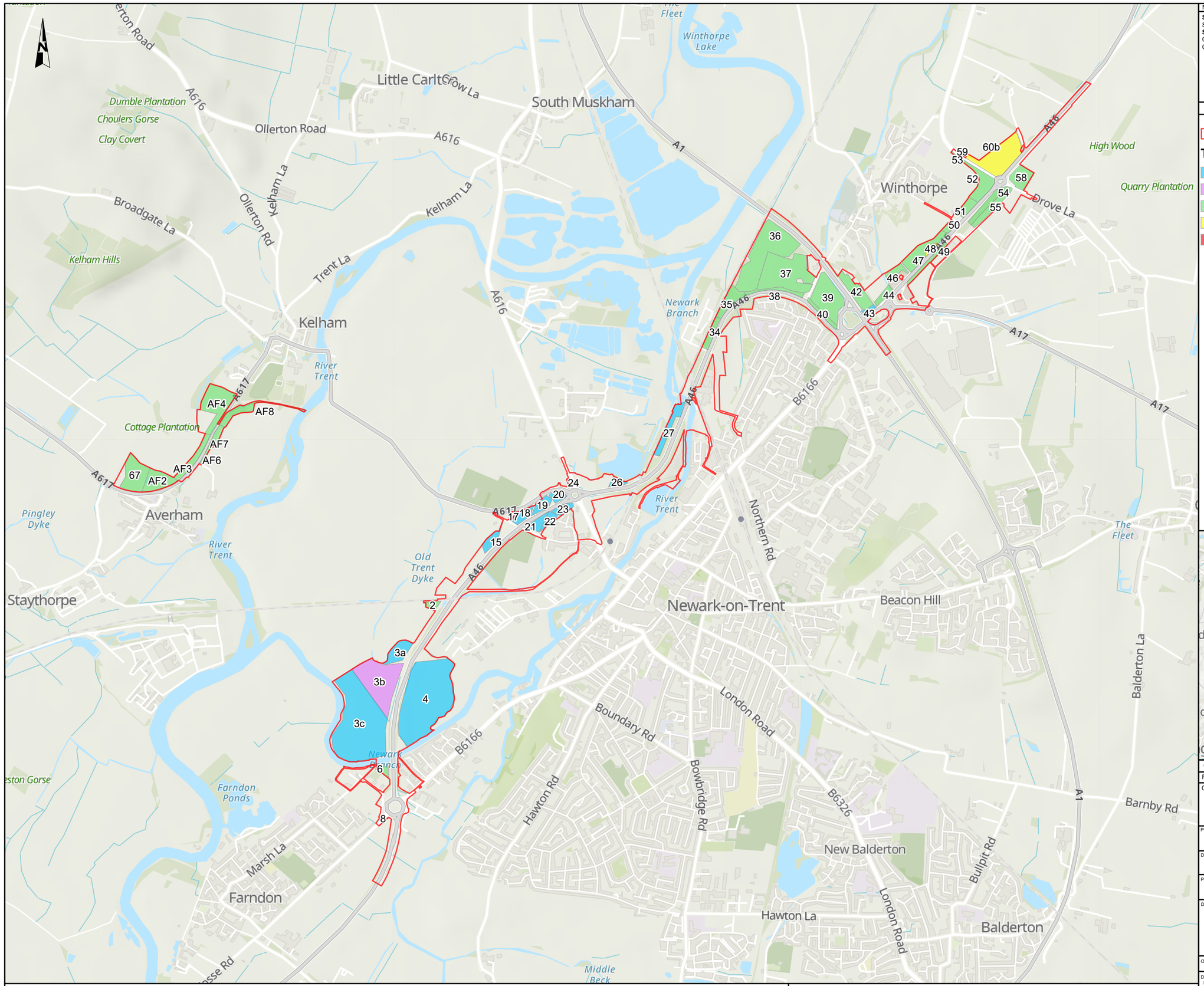
[11] Defra (2009). Construction Code of Practice for the Sustainable Use of Soils on Construction Sites.

Appendix A: Topsoil Classification



NOTES

Source
Soil data collected by Mott MacDonald, 2023.
Service Layer Credits
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Contains data from OS Zoomstack

KEY TO SYMBOLS

- Order Limits

Topsoil classification

- Low fertility acidic
- Low fertility calcareous
- Multipurpose
- Specific purpose acidic
- Specific purpose calcareous

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	08/12/23	DCO APPLICATION	BH	NR	HF

CLIENT: national highways

PURPOSE OF ISSUE: DCO APPLICATION

DEVELOPMENT CONSENT ORDER NUMBER: TR010065

PROJECT TITLE: A46 NEWARK BYPASS

DRAWING TITLE: Appendix A
Soil Survey - Topsoil Classification

ORIGINAL SIZE: A3

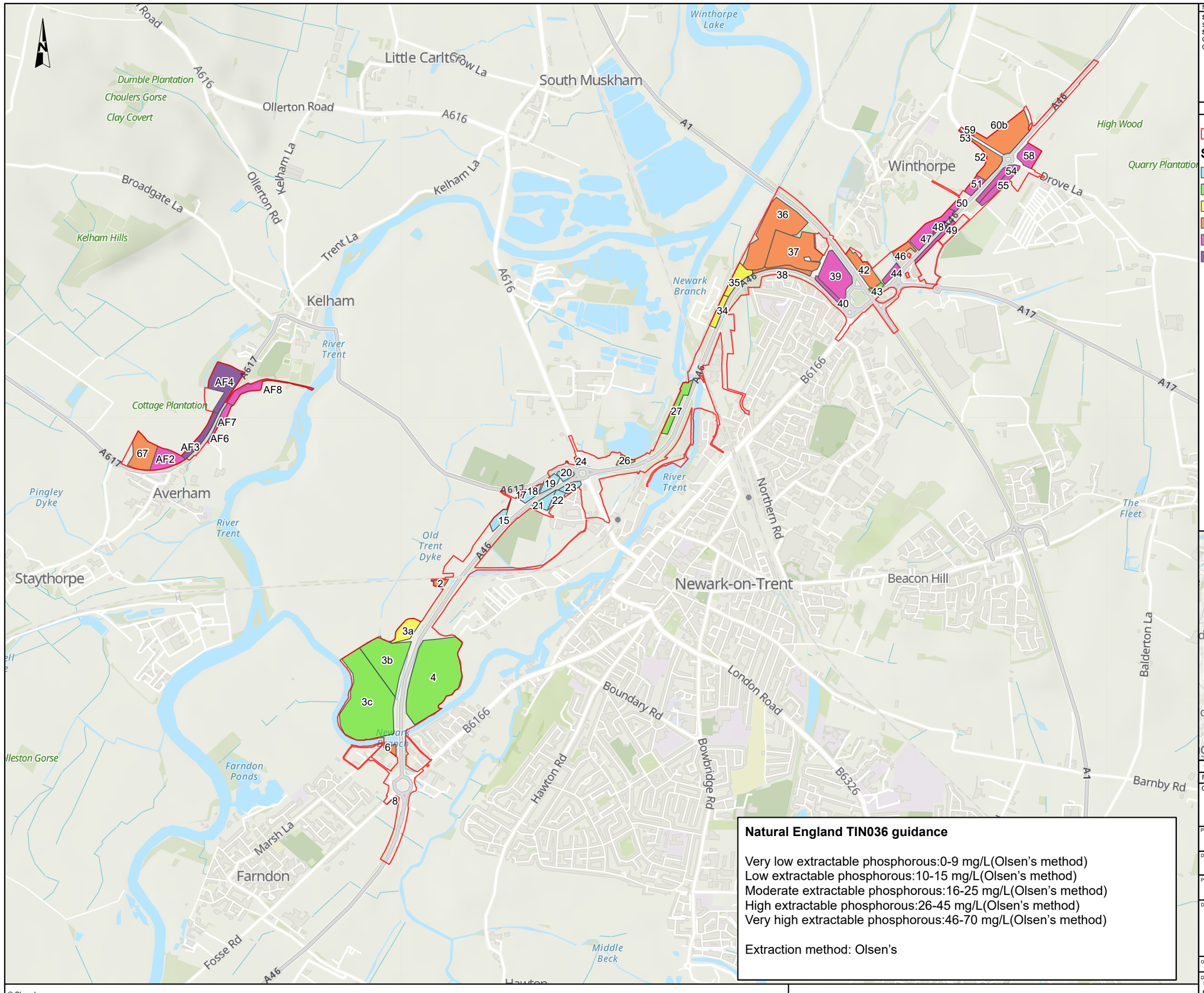
SCALE: 1:25,000

DRAWING NUMBER: HE PIN HE551478 | ORIGINATOR SKAG | VOLUME EGT | LOCATION CONWI_CONW | TYPE DR | ROLE LE | NUMBER 00013

PROJECT REF NO.: HE551478

REVISION: C01

Appendix B: Soil Phosphorous Level



NOTES

Source
Soil data collected by Mott MacDonald, 2023.
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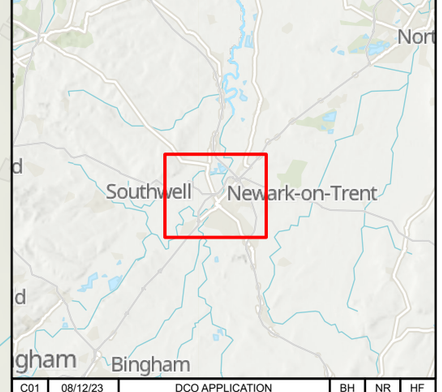
KEY TO SYMBOLS

Order Limits

Soil P index

- 0 (Very low)
- 1 (Low)
- 2 (Moderate)
- 3 (High)
- 4 (Very high)
- 5 (Very high)



Natural England TIN036 guidance

Very low extractable phosphorous:0-9 mg/L(Olsen's method)
Low extractable phosphorous:10-15 mg/L(Olsen's method)
Moderate extractable phosphorous:16-25 mg/L(Olsen's method)
High extractable phosphorous:26-45 mg/L(Olsen's method)
Very high extractable phosphorous:46-70 mg/L(Olsen's method)

Extraction method: Olsen's

0 500 1,000 Metres

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	08/12/23	DCO APPLICATION	BH	NR	HF

CLIENT: national highways

PURPOSE OF ISSUE: DCO APPLICATION

DEVELOPMENT CONSENT ORDER NUMBER: TR010065

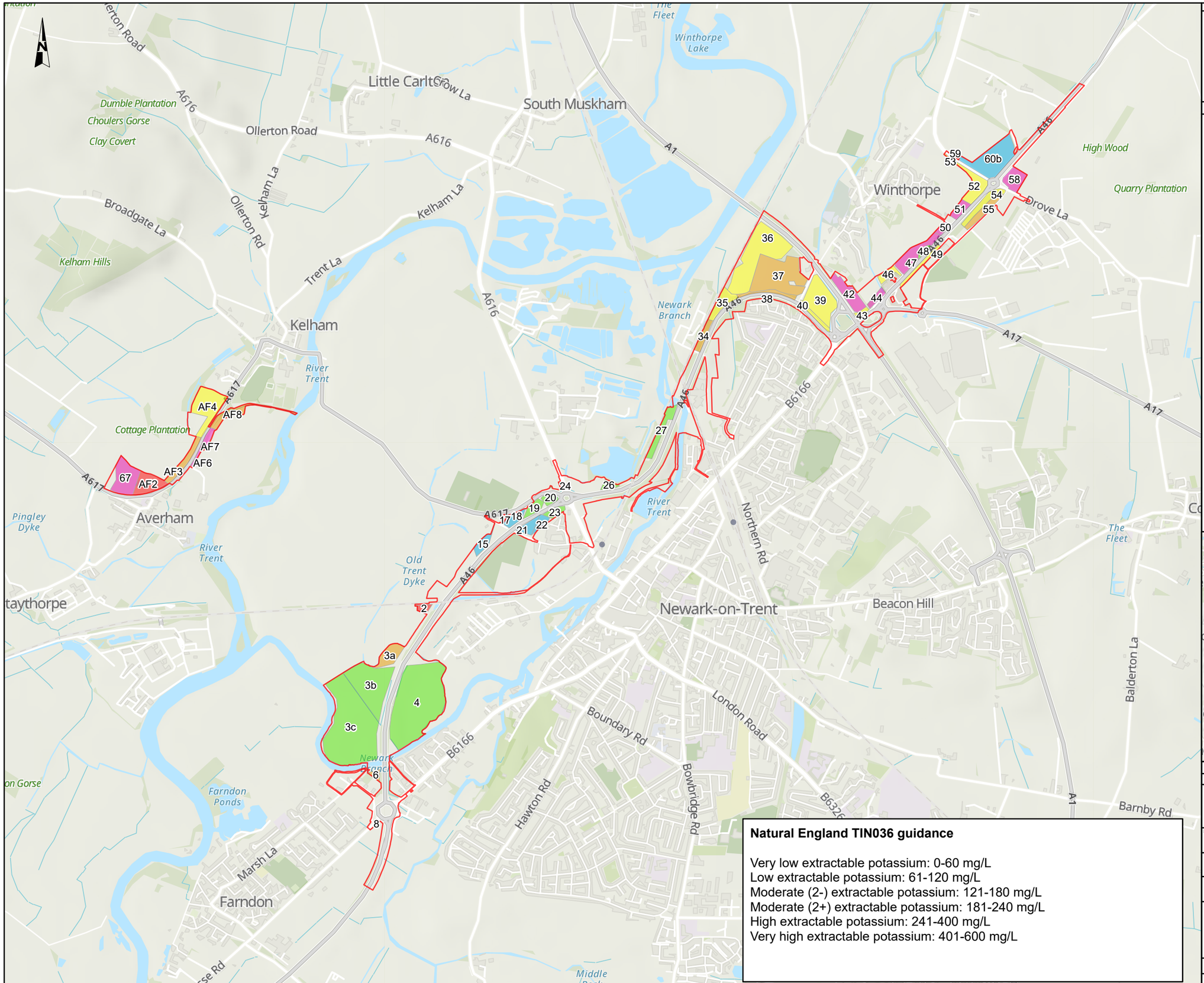
PROJECT TITLE: A46 NEWARK BYPASS

DRAWING TITLE: Appendix B
Soil Phosphorous (P) Index

ORIGINAL SIZE: A3 SCALE: 1:25,000

DRAWING NUMBER HE PIN	ORIGINATOR	VOLUME	PROJECT REF NO.
HE551478	SKAG	EGT	HE551478
LOCATION: CONWI_CONW	TYPE: DR	ROLE: LE	NUMBER: 00012 — REVISION: C01

Appendix C: Soil Potassium Level



NOTES

Source
Soil data collected by Mott MacDonald, 2023.
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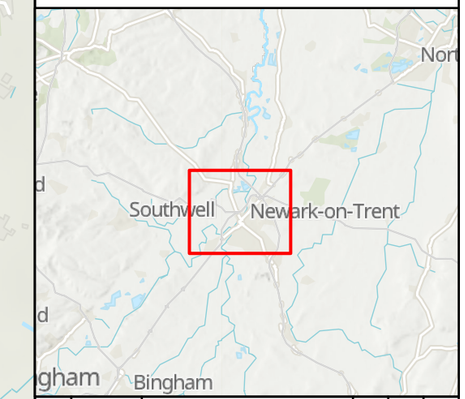
KEY TO SYMBOLS

Order Limits

Soil K Index

- 0 (Very low)
- 1 (Low)
- 2+ (Moderate)
- 2- (Moderate)
- 3 (High)
- 4 (Very high)



Natural England TIN036 guidance

Very low extractable potassium: 0-60 mg/L
Low extractable potassium: 61-120 mg/L
Moderate (2-) extractable potassium: 121-180 mg/L
Moderate (2+) extractable potassium: 181-240 mg/L
High extractable potassium: 241-400 mg/L
Very high extractable potassium: 401-600 mg/L

0 500 1,000 Metres

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	08/12/23	DCO APPLICATION	BH	NR	HF

CLIENT: national highways

PURPOSE OF ISSUE: DCO APPLICATION

DEVELOPMENT CONSENT ORDER NUMBER: TR010065

PROJECT TITLE: A46 NEWARK BYPASS

DRAWING TITLE: Appendix C
Soil Potassium (K) Index

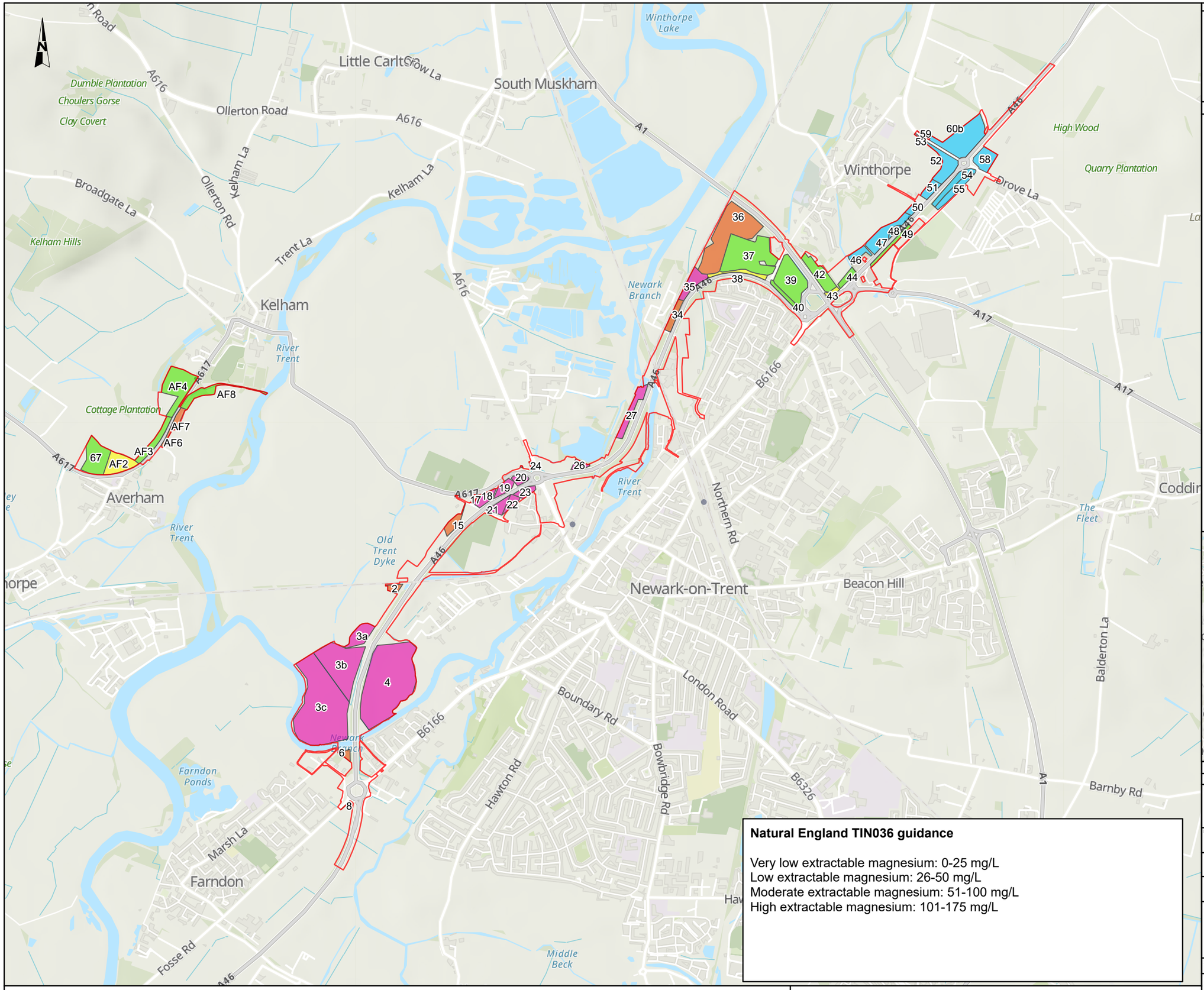
ORIGINAL SIZE: A3 SCALE: 1:25,000

DRAWING NUMBER HE PIN: HE551478 | ORIGINATOR: SKAG | VOLUME: EGT
LOCATION: CONWI_CONW | TYPE: DR | ROLE: LE | NUMBER: 00010

PROJECT REF NO.: HE551478

REVISION: C01

Appendix D: Soil Magnesium Level



NOTES

Source
Soil data collected by Mott MacDonald, 2023.
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KEY TO SYMBOLS

Order Limits

Soil Mg index

- 2 (Moderate)
- 3 (High)
- 4 (Very high)
- 5 (Very high)
- 6 (Very high)

Natural England TIN036 guidance

Very low extractable magnesium: 0-25 mg/L
Low extractable magnesium: 26-50 mg/L
Moderate extractable magnesium: 51-100 mg/L
High extractable magnesium: 101-175 mg/L

0 500 1,000 Metres

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	08/12/23	DCO APPLICATION	BH	NR	HF

CLIENT: national highways

PURPOSE OF ISSUE: DCO APPLICATION

DEVELOPMENT CONSENT ORDER NUMBER: TR010065

PROJECT TITLE: A46 NEWARK BYPASS

DRAWING TITLE: Appendix D
Soil Magnesium (Mg) Index

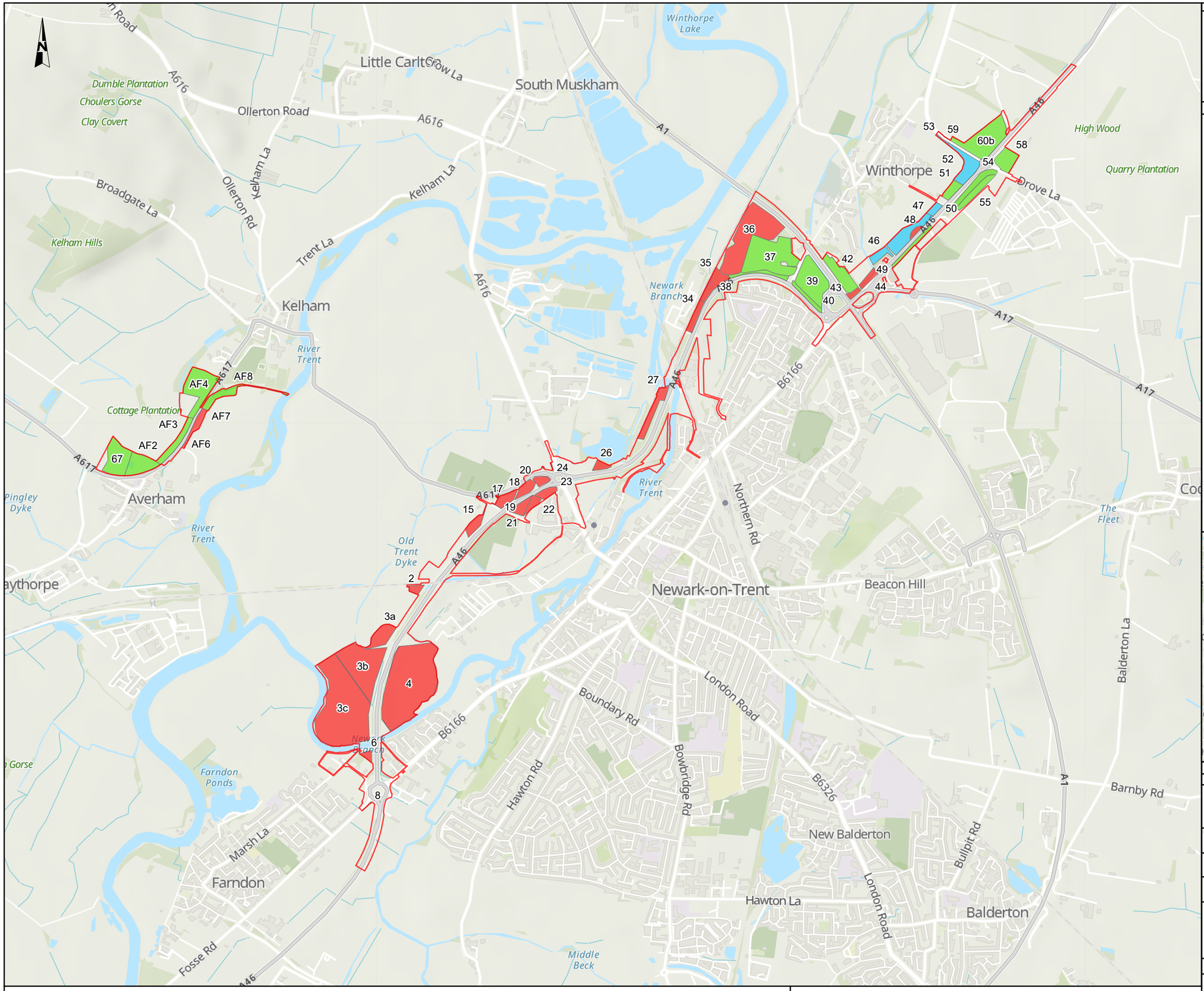
ORIGINAL SIZE: A3 SCALE: 1:25,000

DRAWING NUMBER: HE PIN HE551478 | ORIGINATOR SKAG | VOLUME EGT | LOCATION CONWI_CONW | TYPE DR | ROLE LE | NUMBER 00011

PROJECT REF NO.: HE551478

REVISION: C01

Appendix E: Soil Organic Matter



NOTES

Source
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KEY TO SYMBOLS

Order Limits

Soil organic matter

- >6% (High)
- 3-6% (Moderate)
- <3% (Low)

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	08/12/23	DCO APPLICATION	BH	NR	HF

CLIENT: national highways

PURPOSE OF ISSUE: DCO APPLICATION

DEVELOPMENT CONSENT ORDER NUMBER: TR010065

PROJECT TITLE: A46 NEWARK BYPASS

DRAWING TITLE: Appendix E
Soil Organic Matter

ORIGINAL SIZE: A3 | SCALE: 1:25,000

DRAWING NUMBER HE PIN	ORIGINATOR	VOLUME	PROJECT REF NO.
HE551478	SKAG	EGT	HE551478
CONWI_CONW LOCATION	DR | TYPE	LE | ROLE	00009 | NUMBER

REVISION: C01

0 500 1,000 Metres

Appendix F: Laboratory Results

ANALYTICAL REPORT

Report Number	**53270-23**	**W680**	[redacted]
Date Received	**20-JAN-2023**	**MOTT MACDONALD**	
Date Reported	**27-JAN-2023**	**10 TEMPLE BACK**	
Project	**SOIL**	**BRISTOL**	
Reference	**MOTT MACDONALD**	**BS1 6FL**	
Order Number			

Laboratory Reference		**SOIL604653**
Sample Reference		**A46 TS BH102**
Determinand	**Unit**	**SOIL**
Sand 2.00-0.063mm	% w/w	52
Silt 0.063-0.002mm	% w/w	30
Clay <0.002mm	% w/w	18
Textural Class **		SCL/SL

Notes

Analysis Notes

The sample submitted was of adequate size to complete all analysis requested.
The results as reported relate only to the item(s) submitted for testing.
The results are presented on a dry matter basis unless otherwise stipulated.

Document Control

** Please see the attached document for the definition of textural classes.

Reported by [redacted]

Natural Resource Management, a trading division of Cawood Scientific Ltd.
Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS
Tel: [redacted]
Fax:
email: enquiries@nrm.uk.com

ANALYTICAL REPORT

Report Number	**62648-23**	**W680** [redacted]	**Client A46 NEWARK BYPASS**
Date Received	**10-MAR-2023**	**MOTT MACDONALD**	
Date Reported	**24-MAR-2023**	**10 TEMPLE BACK**	
Project	**100103345**	**BRISTOL**	
Reference	**A46 NEWARK BYPASS**	**BS1 6FL**	
Order Number	**100103345**		

Laboratory Reference		**SOIL617096**	**SOIL617097**	**SOIL617098**	**SOIL617099**	**SOIL617100**	**SOIL617101**				
Sample Reference		**BH89 TS**	**BH100 TS**	**BH113 USS**	**BH117 USS**	**BH126 TS**	**BH128 LSS**				
Determinand	**Unit**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**	**SOIL**				
Sand 2.00-0.063mm	% w/w	69	27	58	21	81	88				
Silt 0.063-0.002mm	% w/w	16	14	21	26	11	4				
Clay <0.002mm	% w/w	15	59	21	53	8	8				
Textural Class **		SL	C	SCL	C	LS	LS				

Notes

Analysis Notes

The sample submitted was of adequate size to complete all analysis requested.
The results as reported relate only to the item(s) submitted for testing.
The results are presented on a dry matter basis unless otherwise stipulated.

Document Control

** Please see the attached document for the definition of textural classes.

Reported by [redacted]

Natural Resource Management, a trading division of Cawood Scientific Ltd.
Coopers Bridge, Braziers Lane, Bracknell, Berkshire, RG42 6NS
Tel [redacted]
Fax [redacted]
email: enquiries@nrm.uk.com

ADAS (UK) Textural Class Abbreviations

The texture classes are denoted by the following abbreviations:

Class	Code
Sand	S
Loamy sand	LS
Sandy loam	SL
Sandy Silt loam	SZL
Silt loam	ZL
Sandy clay loam	SCL
Clay loam	CL
Silt clay loam	ZCL
Clay	C
Silty clay	ZC
Sandy clay	SC

For the *sand, loamy sand, sandy loam* and *sandy silt loam* classes the predominant size of sand fraction may be indicated by the use of prefixes, thus:

- vf Very Fine (more than 2/3's of sand less than 0.106 mm)
- f Fine (more than 2/3's of sand less than 0.212 mm)
- c Coarse (more than 1/3 of sand greater than 0.6 mm)
- m Medium (less than 2/3's fine sand and less than 1/3 coarse sand).

The subdivisions of *clay loam* and *silty clay loam classes* according to clay content are indicated as follows:

- M medium (less than 27% clay)
- H heavy (27-35% clay)

Organic soils i.e. those with an organic matter greater than 10% will be preceded with a letter O.

Peaty soils i.e. those with an organic matter greater than 20% will be preceded with a letter P.