



BS3882:2015 & BS8601:2013 Report PROTOS Phase 2 Infrastructure

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CONTENTS

1	INTRODUCTION.....	3
2	SURVEY METHODOLOGY	4
3	SAMPLE EXAMINATION	5
4	RESULTS OF ANALYSIS.....	7
4.1	Particle Size Analysis and Stone Content	7
4.1.1	Area B.....	7
4.1.2	Area E.....	7
4.1.3	Area C East	8
4.1.4	Area C West	8
4.2	pH, Calcium Carbonate and Electrical Conductivity Values	9
4.2.1	Area B.....	9
4.2.2	Area E.....	9
4.2.3	Area C East	9
4.2.4	Area C West	9
4.3	Organic Matter and Fertility Status	10
4.3.1	Area B.....	10
4.3.2	Area E.....	10
4.3.3	Area C East	11
4.3.4	Area C West	11
4.4	Phytotoxic Contaminants.....	12
5	CONCLUSION	13
5.1	Topsoil.....	13
5.2	Subsoil.....	13
6	RECOMMENDATIONS.....	14
6.1	Compost and Fertiliser for Planting (if needed)	14
6.1.1	Compost.....	14
6.1.2	Fertiliser	14
6.2	Stripping of topsoil	14
6.2.1	Topsoil stripping depth and storage	14
6.2.2	General guidance on topsoil stripping and storage.....	14
6.2.3	Preventing Compaction	15
7	APPENDIX 1 – LOCATION OF AUGER BORINGS AND PITS.....	16
8	APPENDIX 2 – AUGER BORING AND PIT DESCRIPTIONS	17

9 APPENDIX 3 – SOIL ANALYSIS RESULTS REPORT.....	27
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Tables

Table 1: Sample locations and analysis	4
Table 2: Soil sample numbers and sample locations	5

Figures

Figure 1: The loose tipping method for placing topsoil, including subsoil loosening	15
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1 INTRODUCTION

RSK ADAS Ltd were instructed to carry out a soil survey for at the proposed location for a new Energy from Waste Facility (EfW). The proposed development is west of Ellesmere Port and is located in approximately 20 ha of agricultural land. The site is located within a wider industrial area and adjacent facilities include a fertiliser plant, oil refinery and wind farm.

RSK are working on the landscaping of PROTOS Phase 2 Infrastructure following development for the EfW facility. ADAS was commissioned to provide comment on soils on proposed ecological areas following the implementation of Phase 1 Infrastructure.

The Brief

- Carryout an in-situ survey of the soil on three areas of the site by means of auger borings and pits.
- Take four topsoil samples for laboratory analysis to cover BS3882:2015 topsoil specification requirements with some addition analysis for potential contaminants.
- Take four subsoil samples for laboratory analysis to cover BS3882:2015 topsoil specification requirements with some addition analysis for potential contaminants. The analysis contains the necessary results to interpret for BS8601:2013 subsoil specification.
- Produce a log of the auger boring and pit information recorded.
- Produce an interpretation of the laboratory topsoil and subsoil results with reference to meeting BS3882:2015 topsoil and BS8601:2013 subsoil specifications.

2 SURVEY METHODOLOGY

Table 1: Sample locations and analysis

Location	Approx. Size	Number of Augers and Pits	Sample Refs*	Analysis Required
Area B1+2	3.7 Ha	4 Augers 1 Pit	B1, B2, B3 , B4	1 topsoil and 1 subsoil sample for analysis
Area C	10.6 Ha	10 Augers 2 Pits	C1, C2 , C3, C4 , C5, C6, C7 , C8, C9 , C10	2 topsoil and 2 subsoil samples for analysis
Area E	2 Ha	2 Augers 1 Pit	E1, E2	1 topsoil and 1 subsoil sample for analysis

*Sample locations marked in bold show the soil pits. All others were surveyed using the auger.

3 SAMPLE EXAMINATION

We have evaluated the analysis from Analytical Report 19-08355 produced by Envirolab. Table 1 shows the samples analysed.

ADAS carried out an *in situ* soil survey of the areas sampled for BS3882:2015 & BS8601:2013 laboratory soil analysis on 27-28th August 2019 by means of 3 auger borings and 1 pit in area B, 1 auger boring and 1 pit in area E and 6 auger borings and 4 pits in area C to 1,000+mm. For the *in-situ* soil survey soil texture was assessed by hand texturing and colour recorded. The location of these auger borings and pits are shown in the plan inserted as Appendix 1 and the description of the findings from the auger borings and pits in Appendix 2.

Four samples of topsoil (sampling depth 0-250mm) and four samples of subsoil (sampling depth 300-500mm) were sent to Envirolab for BS3882:2015 analysis requirements with in addition arsenic, cadmium, chromium, lead, mercury, molybdenum, selenium, water soluble sulphate, acid soluble sulphate and total sulphate. The samples sent for analysis from area B were made up of subsamples taken from soil profile investigation locations B1, B2, B3 & B4. The samples sent for analysis from area E were made up of subsamples taken from soil profile investigation locations E1 & E2. The samples sent for analysis from area C East were made up of subsamples taken from soil profile investigation locations C3, C4, C6, C9 & C10. The samples sent for analysis from area C West were made up of subsamples taken from soil profile investigation locations C1, C2, C5, C7 & C8.

Table 2: Soil sample numbers and sample locations

Analytical Report No	Sample Number	Sample ID
19-08355	19-08355/1	B TS (topsoil – sample depth 0-250mm)
	19-08355/2	B SS (subsoil – sample depth 300-500mm)
	19-08355/3	E TS (topsoil – sample depth 0-250mm)
	19-08355/4	E SS (subsoil – sample depth 300-500mm)
	19-08355/5	C East TS (topsoil – sample depth 0-250mm)
	19-08355/6	C East SS (subsoil – sample depth 300-500mm)
	19-08355/7	C West TS (topsoil – sample depth 0-250mm)
	19-08355/8	C West SS (subsoil – sample depth 0-250mm)

The laboratory results report is inserted as Appendix 3. An interpretation of the results is given in Section 4 of this report in relation to the requirements of BS3882:2015 topsoil & BS8601:2013 subsoil requirements.

4 RESULTS OF ANALYSIS

4.1 Particle Size Analysis and Stone Content

4.1.1 Area B

Based on the soil test certificate from Envirolab the topsoil texture (0-250mm depth) was reported as clay loam (with a clay content of 18.6% this makes it a medium clay loam (at the lighter end of the medium clay loam texture category which can have a clay content spanning a range of 18-26%). The texture of this topsoil meets BS3882 requirements. The field survey work also classified the topsoil as a medium clay loam (3 locations) and medium/heavy silty clay loam (1 location). The proportions of stones in the >2mm size range was 1.0% and in the >20mm & >50mm size ranges were less than 0.1% and the topsoil contained no visible contaminants. Therefore stones and visible contaminants do not restrict its use.

Subsoil texture (300-500mm depth) was reported as silty clay loam texture (with a clay content of 23.7% this makes it a medium silty clay loam (in the upper half of the medium silty clay loam texture category which can have a clay content spanning a range of 18-26%). The texture of this subsoil meets BS8601 requirements. The field survey work, depending on location, within the 300-500mm depth, identified medium and heavy silty clay loam textures. The proportions of stones in the >2mm, >20mm & >50mm size ranges were all less than 0.1% and the topsoil contained no visible contaminants. Therefore stones and visible contaminants do not restrict its use.

4.1.2 Area E

Based on the soil test certificate from Envirolab the topsoil texture (0-250mm depth) was reported as silty clay loam (with a clay content of 25.1% this makes it a medium clay loam and at the heavier end of the medium clay loam texture category which can have a clay content spanning a range of 18-26%). The texture of this topsoil meets BS3882 requirements. The field survey work classified the topsoil as a heavy silty clay loam. The proportions of stones in the >2mm, >20mm & >50mm size ranges were all less than 0.1% and the topsoil contained no visible contaminants. Therefore stones and visible contaminants do not restrict its use.

Subsoil texture (300-500mm depth) was reported as silty clay loam texture (with a clay content of 25.7% this makes it a medium silty clay loam and at the heavier end of the medium silty clay loam texture category which can have a clay content spanning a range of 18-26%). The texture of this subsoil meets BS8601 requirements. The field survey work, depending on location, within the 300-500mm depth, identified silty clay, heavy silty clay loam and medium sandy loam textures. The proportions of stones in the >2mm, >20mm & >50mm size ranges were all less than 0.1% and the topsoil contained no visible contaminants. Therefore stones and visible contaminants do not restrict its use.

4.1.3 Area C East

Based on the soil test certificate from Envirolab the topsoil texture (0-250mm depth) was reported as sandy silt loam (a clay content of 10.2%). The texture of this topsoil meets BS3882 requirements. The field survey work classified the topsoil as a medium clay loam, medium silty clay loam and heavy silty clay loam depending on location. The proportions of stones in the >2mm, >20mm & >50mm size ranges were all less than 0.1% and the topsoil contained no visible contaminants. Therefore stones and visible contaminants do not restrict its use.

Subsoil texture (300-500mm depth) was reported as clay loam texture (with a clay content of 24.2% this makes it a medium clay loam and at the heavier end of the medium clay loam texture category which can have a clay content spanning a range of 18-26%). The texture of this subsoil meets BS8601 requirements. The field survey work, depending on location, within the 300-500mm depth, identified medium clay loam, heavy clay loam, heavy silty clay loam, silty clay and clay textures. The proportions of stones in the >2mm size range was 0.2% and in the >20mm & >50mm size ranges were less than 0.1% and the topsoil contained no visible contaminants. Therefore stones and visible contaminants do not restrict its use.

4.1.4 Area C West

Based on the soil test certificate from Envirolab the topsoil texture (0-250mm depth) was reported as sandy silt loam (a clay content of 10.0%). The texture of this topsoil meets BS3882 requirements. The field survey work classified the topsoil as a medium clay loam (medium silty clay loam at one location). The proportions of stones in the >2mm size range was 2.7% and in the >20mm & >50mm size ranges were less than 0.1% and the topsoil contained <0.1% visible contaminants. Therefore stones and visible contaminants do not restrict its use.

Subsoil texture (300-500mm depth) was reported as clay loam texture (with a clay content of 24.2% this makes it a medium clay loam and at the heavier end of the medium clay loam texture category which can have a clay content spanning a range of 18-26%). The texture of this subsoil meets BS8601 requirements. The field survey work, depending on location, within the 300-500mm depth, identified medium clay loam, heavy clay loam, medium silty clay loam, heavy silty clay loam and sandy clay loam textures. The proportions of stones in the >2mm size range was 0.3% and in the >20mm & >50mm size ranges were less than 0.1% and the subsoil contained <0.1% visible contaminants. Therefore stones and visible contaminants do not restrict its use.

Summary of soil texture

All topsoil samples passed the BS3882:2015 requirements for topsoil texture. In areas B & E the topsoil would be considered of medium texture (medium clay loam and silty clay loam). In area C the topsoil is lighter (sandy silt loam from the laboratory analysis).

By laboratory analysis all subsoil samples passed the BS8601:2013 requirements for subsoil texture containing from the laboratory analysis 21.4-25.7% clay (medium silty clay loam in areas B & E and medium clay loam in area C). The field soil survey work identified some heavier (higher clay content) subsoil textures namely heavy clay loam, heavy silty clay loam, clay and silty clay as well as some lighter textures namely sandy clay loam and sandy loam.

The topsoil should be reasonably easy to handle during stripping and placement because of its medium (areas B & E) and lighter (area C) texture. The subsoil will be more difficult to handle because of its more variable texture as identified by the field survey work.

4.2 pH, Calcium Carbonate and Electrical Conductivity Values

4.2.1 Area B

The topsoil had a pH of 7.49 and calcium carbonate content of 4.3%. Although the calcium carbonate content is above the 1% required for specific calcareous purpose topsoil the pH is just below that required (pH 7.5). From the aspect of pH and calcium carbonate the topsoil falls in the multipurpose category (pH requirement 5.5-9.0). The calcium sulphate extract value for electrical conductivity was 2,310 $\mu\text{S}/\text{cm}$ and compliant with BS3882 requirements i.e. did not exceed 3300 $\mu\text{S}/\text{cm}$.

The subsoil had a pH of 7.99 and a calcium carbonate content of less than 0.8. With these results the subsoil falls in the BS8601 multipurpose subsoil category. The subsoil conductivity of 2,230 $\mu\text{S}/\text{cm}$ recorded is low and not an issue.

4.2.2 Area E

The topsoil had a pH of 7.24 and calcium carbonate content of less than 0.8%. With these results this topsoil falls within the BS3882 multipurpose category. The calcium sulphate extract value for electrical conductivity was 2,230 $\mu\text{S}/\text{cm}$ and compliant with BS3882 requirements i.e. did not exceed 3300 $\mu\text{S}/\text{cm}$.

The subsoil had a pH of 7.96 and a calcium carbonate content of less than 0.8. With these results the subsoil falls in the BS8601 multipurpose subsoil category. The subsoil conductivity of 2,230 $\mu\text{S}/\text{cm}$ recorded is low and not an issue.

4.2.3 Area C East

The topsoil had a pH of 7.76 and calcium carbonate content of less than 0.8%. With these results this topsoil falls within the BS3882 multipurpose category. The calcium sulphate extract value for electrical conductivity was 2,130 $\mu\text{S}/\text{cm}$ and compliant with BS3882 requirements i.e. did not exceed 3300 $\mu\text{S}/\text{cm}$.

The subsoil had a pH of 7.76 and a calcium carbonate content of less than 0.8. With these results the subsoil falls in the BS8601 multipurpose subsoil category. The subsoil conductivity of 2,060 $\mu\text{S}/\text{cm}$ recorded is low and not an issue.

4.2.4 Area C West

The topsoil had a pH of 7.71 and calcium carbonate content of 4.6%. As the calcium carbonate content is above the 1% and the pH is within the range 7.5-9.0 the results meet the requirements for a BS3882 calcareous topsoil. The calcium sulphate extract value for electrical conductivity was 2,710 $\mu\text{S}/\text{cm}$ and compliant with BS3882 requirements i.e. did not exceed 3300 $\mu\text{S}/\text{cm}$.

The subsoil had a pH of 7.95 and a calcium carbonate content of less than 0.8. With these results the subsoil falls in the BS8601 multipurpose subsoil category. The subsoil conductivity of 2,270µS/cm recorded is low and not an issue.

Summary of pH, Calcium Carbonate and Electrical Conductivity

The areas B, E & C East topsoil samples passed the BS3882 Multipurpose Topsoil requirement for pH and the area C West sample passed the Calcareous Topsoil requirements for pH and calcium carbonate. The topsoils were slightly alkaline. All the topsoil samples passed the BS3882 soil electrical conductivity requirement.

All the areas passed the BS8601 Multipurpose Subsoil requirement for pH. The subsoil samples were slightly alkaline. All the subsoil samples passed the BS8601 soil electrical conductivity requirement.

4.3 Organic Matter and Fertility Status

4.3.1 Area B

The topsoil contained 9.2% organic matter (based on loss on ignition) and a total nitrogen content of 0.088% resulting in a carbon:nitrogen (C:N) ratio of 61.5. The organic matter content meets BS3882 requirements, the total nitrogen only meets low fertility requirements but the C:N ratio, at 61.5, is high and does not meet the BS3882 requirement for any purpose. These results would suggest that the land has been extensively managed with little or no input of organic manures or nitrogenous fertilisers.

The topsoil had a high extractable phosphorus level (58mg/l, Index 4), low extractable potassium level (76mg/l, Index 1) and high extractable magnesium level (192mg/l, Index 4). From the aspect of BS3882 the extractable phosphorus is too high for low fertility use and the potassium level too low except for low fertility use.

At 3.8% the subsoil organic matter content is too high to meet BS8601 subsoil requirements (maximum 2%).

4.3.2 Area E

The topsoil contained 7.0% organic matter (based on loss on ignition) and a total nitrogen content of 0.051% resulting in a carbon:nitrogen (C:N) ratio of 80.7. The organic matter content meets BS3882 requirements, the total nitrogen only meets low fertility requirements but the C:N ratio, at 80.7, is very high and does not meet the BS3882 requirement for any purpose. These results would suggest that the land has been extensively managed with little or no input of organic manures or nitrogenous fertilisers.

The topsoil had a moderate extractable phosphorus level (20mg/l, Index 2), low extractable potassium level (75mg/l, Index 1) and high extractable magnesium level (142mg/l, Index 3). From the aspect of BS3882 the extractable phosphorus meets BS3882 requirements but the potassium level is too low except for low fertility use.

At 3.7% the subsoil organic matter content is too high to meet BS8601 subsoil requirements (maximum 2%).

4.3.3 Area C East

The topsoil contained 9.2% organic matter (based on loss on ignition) and a total nitrogen content of 0.407% resulting in a carbon:nitrogen (C:N) ratio of 14. The organic matter and total nitrogen contents and C:N ratio meet BS3882 requirements. These results would suggest that the land has been managed with organic manure and nitrogenous fertiliser application.

The topsoil had a high extractable phosphorus level (86mg/l, Index 5), moderately high extractable potassium level (246mg/l, Index 3) and high extractable magnesium level (99mg/l, Index 2). These results meet BS3882 requirements except for low fertility situations for which the extractable phosphorus level is too high (level below 20mg/l required).

These results would suggest that the land has been managed intensively with organic manure and fertiliser applications.

At 7.1% the subsoil organic matter content is too high to meet BS8601 subsoil requirements (maximum 2%).

4.3.4 Area C West

The topsoil contained 11.3% organic matter (based on loss on ignition) and a total nitrogen content of 0.378% resulting in a carbon:nitrogen (C:N) ratio of 17.6. The organic matter and total nitrogen contents and C:N ratio meet BS3882 requirements.

The topsoil had a high extractable phosphorus level (54mg/l, Index 4), moderately high extractable potassium level (237mg/l, Index 2+) and high extractable magnesium level (274mg/l, Index 2+). These results meet BS3882 requirements except for low fertility situations for which the extractable phosphorus level is too high (level below 20mg/l required).

These results would suggest that the land has been managed intensively with organic manure and fertiliser applications.

At 3.5% the subsoil organic matter content is too high to meet BS8601 subsoil requirements (maximum 2%).

Summary of organic matter and nutrient status

The topsoils from areas C East & C West meet BS3882 Multipurpose topsoil nutrient requirements. They have good organic matter contents and from their total nitrogen and C:N ratios look fairly fertile from a nitrogen aspect. They also have high extractable phosphorus and moderately high extractable potassium levels. Amendment with additional organic matter, e.g. from organic manures, and application of phosphate and potash will not be necessary.

In a strict interpretation the topsoils from areas B & E does not meet any BS3882 nutrient requirements. The C:N ratios are high due to the organic matter levels being reasonably good and total nitrogen levels low (from a BS3882 aspect C:N ratios too high even for low fertility for which it states a C:N ratio <35). If a low fertility topsoil is required then the soil from area E would probably best meet this need as in addition to the likely low nitrogen supply due to the high C:N ratio the extractable phosphorus level is moderate compared to high in area B topsoil.

4.4 Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined only copper, nickel, zinc are covered by BS3882:2015 and none was found at levels that exceeded the maximum permissible levels specified (for soil pH >7.0 zinc <300mg/kg, copper <200mg/kg and nickel <110mg/kg). Analysis was also carried out for arsenic, cadmium, chromium, lead, mercury, molybdenum, selenium, water soluble sulphate, acid soluble sulphate and total sulphate. No levels of concern were identified. See Appendix 3 for results report.

5 CONCLUSION

5.1 Topsoil

The topsoils from areas B & E differ in physical and chemical fertility characteristics compared to topsoils from areas C East & C West. The BS3882:2015 analysis showed areas B & E topsoil to have clay loam/silty clay loam texture compared to a lighter sandy silt loam texture for areas C East & C West. The difference appeared not as great from the *in-situ* hand texturing but still different with heavy silty clay loam recorded for areas B & E at 3 out of 6 observation compared to 1 out of 9 observation points for areas C East & C West (where not heavy silty clay loam the texture was medium clay loam or medium silty clay loam).

All the samples had moderately good to good organic matter levels but areas B & E had very low total nitrogen contents leading to high C:N ratios and pointing to a history of extensive management on these areas with little organic manure and fertiliser application. Areas C East & C West would appear to have been more intensively managed (area C East) was arable land.

Areas B & E had low extractable potassium levels compared to moderately high levels in Areas C East & C West. All areas had moderate or high extractable phosphorus levels. The topsoils were slightly alkaline with pH (BS3882:2015 method) ranging from 7.24 to 7.71.

Areas B & E topsoils do not meet any BS3882:2015 topsoil specification requirement but could perhaps be considered if there is a requirement for a low fertility topsoil. For use in situations where a higher fertility topsoil is required area B & E topsoils would require more fertiliser, particularly nitrogen and potash fertiliser, (or perhaps organic manure) application than areas C East & C West topsoils.

Samples taken from area C meet the specifications of BS3882. The area C East topsoil sample passed the BS3882 Multipurpose Topsoil requirement. The area C West sample passed the Calcareous Topsoil requirements.

There are no issues from stone or visible contaminant content in the topsoils. The topsoils are either stonesless or have only a low stone content (one sample). No visible contaminants were recorded in the topsoil.

5.2 Subsoil

The subsoils meet the BS8601:2013 specification requirements for texture but overall fail because their organic matter content is too high (range 3.5-7.1%) against a specification maximum requirement of 2%.

There are no issues from stone or visible contaminant content in the subsoils. The subsoils are either stonesless or have only a low stone content (one sample). Except in one sample no visible contaminants were recorded in the subsoil.

6 RECOMMENDATIONS

6.1 Compost and Fertiliser for Planting (if needed)

6.1.1 Compost

The analysis results showed moderately good to good organic matter levels ranging from 7.0% (area E) to 11.3% (area C West). A plan sent indicated 'ecology area' for areas B, E & C and a hay meadow mix area. For establishment of a diverse flora ecological benefit extra 'fertility' from application of compost or another organic manure is not likely to be beneficial.

6.1.2 Fertiliser

As with compost the need for fertiliser will depend on the planting proposed. The topsoil samples showed moderate and high extractable phosphorus levels. Phosphate fertiliser would not be required. The topsoil samples for areas B & E showed low extractable potassium levels so potash fertiliser could be required where these soils are used. The main requirement would be for nitrogen fertiliser particularly for areas where B & E soils are used as these had a high C:N ratio.

6.2 Stripping of topsoil

6.2.1 Topsoil stripping depth and storage

We would recommend that the topsoil is stripped to the following depths on the four areas:-

Area B: 250mm

Area E: 250mm

Area C East: 310mm

Area C West: 250mm

If the topsoils are to be stored after stripping the soils from the four areas should be stored separately. This particularly requires soils from areas B & E to be kept separate from soils from areas C East & C West. C East & C West soils, based on laboratory analysis, have a lighter texture and have a higher fertility.

6.2.2 General guidance on topsoil stripping and storage

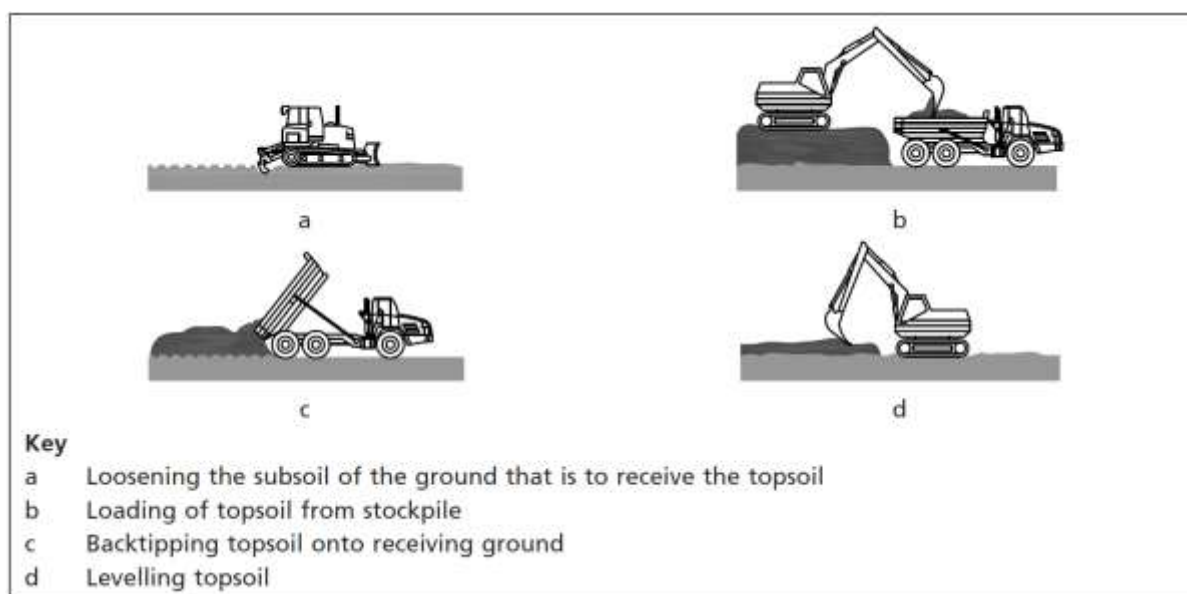
- It is advised that immediately prior to soil stripping any vegetation growth higher than 100mm should be cut and removed from the site.
- Topsoil stripping should be carried out when the soils are as dry as reasonably practicable, normally when they are below the plastic limit and not normally within 24 hrs of significant rainfall (i.e. <10 mm in 24 hrs). The soil can be tested on site by attempting to form a worm of soil 3mm in diameter by rolling it out on a flat non-porous surface. If the soil 'worm' will not form or is cracked the soil is sufficiently dry to handle.
- If the stripped topsoil is to be stored storage should be 'like on like' i.e. topsoil should be stored on an area from which topsoil has not been stripped. This helps avoid contamination of the topsoil with subsoil during subsequent handling.

- Ideally storage mound will be no greater than 2 metres high (3 metres if limited space).

6.2.3 Preventing Compaction

It is particularly important that the topsoil is not over-compacted during spreading. Over-compaction prevents plant root growth and function, and reduces water attenuation and the ability of excess water to drain away. It is one of the most common reasons for plant failures in landscape schemes, and it increases the risk of erosion and runoff. Placement of soil by tracked hydraulic excavators working in strips from ground not yet loosened (the “loose-tipping” method) is a way to avoid this. This method is illustrated below.

Figure 1: The loose tipping method for placing topsoil, including subsoil loosening



If over-compaction of subsoils occurs they should be loosened using ripping equipment before receiving topsoil; ripping should only be done when the subsoil is sufficiently dry that it shatters. In small confined areas, such as in gardens and narrow landscaping strips, the use of a small tracked excavator with a “tine attachment”, or hand cultivation, should be used.

Care should be taken to avoid overworking soils, especially with inappropriate machinery, as this can damage soil structure and increases the risk of erosion and runoff.

All stones and other objects larger than 75 mm brought to the subsoil surface by ripping should be removed from the prepared surface.

More information on managing soils during construction can be found in the DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction.



8 APPENDIX 2 – AUGER BORING AND PIT DESCRIPTIONS

Area B

West



East



Profile Number	Grid reference / horizon depth (mm)	
B1 (Auger boring)	346288,376817	Land use: Rough grassland
	0-240	Very dark greyish brown medium silty clay loam. Common ochreous mottles from 14cm depth. Stoneless
	240-550	Grey heavy silty clay loam. Common ochreous mottles. Stoneless
	550-1000+	Grey silty clay. Many ochreous mottles. Stoneless
B2 (Auger boring)	346332,376755	Land use: Rough grassland
	0-270	Very dark greyish brown medium/heavy silty clay loam. Few very small stones
	270-1000+	Grey silty clay. Many ochreous mottles. Stoneless
B3 (Pit)	346492,376860	Land use: Grass ley
	0-260	Very dark greyish brown medium clay loam. Stoneless
	260-480	Greyish brown medium silty clay loam (slightly sandy). Stoneless
	480-750	Grey sandy clay loam. Soft and wet
	750-1000+	Grey heavy clay loam (slightly sandy). Common ochreous mottles. Stoneless

B3 (Pit) Photo:



B4 (Auger boring)	346553,376833	Land use: Grass ley
	0-150	Very dark greyish brown medium clay loam. Stoneless
	150-250	Dark grey medium silty clay loam. Common ochreous mottles. Stoneless
	250-470	Dark grey heavy silty clay loam. Common ochreous mottles. Stoneless
	470-1000+	Grey medium sandy loam (close to sandy clay loam). Common ochreous mottles. Stoneless
Area E: 		
E1 (Auger boring)	346923,376656	Land use: Grass ley
	0-250	Very dark greyish brown heavy silty clay loam. Stoneless
	250-610	Dark grey silty clay. Many ochreous mottles. Stoneless
	610-1000+	Greyish brown medium sandy loam (sandier with depth). Common ochreous mottles. Stoneless. Waterlogged.
E2 (Pit)	347006,376622	Land use: Grass ley
	0-250	Very dark greyish brown heavy silty clay loam. Few ochreous root mottles. Few small stones.

	250-320	Dark grey heavy silty clay loam. Many ochreous mottles. Stoneless.
	320-880	Grey medium sandy loam. Common ochreous mottles. Stoneless. Soft and waterlogged.
	880-1000+	Grey sandy clay loam. Common ochreous mottles. Stoneless.

E2 (Pit) Photo:



Area C

West



East



C1 (Auger boring)	346514,377296	Land use: Grass ley
	0-170	Dark grey medium clay loam. Stoneless. Buried white powdery material.
	170-390	Very dark greyish brown medium clay loam. Stoneless. Buried white powdery material.
	390-900	Grey sandy clay loam. Many ochreous mottles. Stoneless.
	900-1000+	Grey medium sandy loam. Common ochreous mottles. Stoneless. Soft and waterlogged.
C2 (Pit)	346625,377339	Land use: Arable
	0-240	Very dark greyish brown medium clay loam. Stoneless.
	240-380	Dark grey medium/heavy clay loam. Stoneless.
	380-750	Grey heavy silty clay loam. Many ochreous mottles. Stoneless.
	750-1000+	Grey silty clay. Many ochreous mottles. Stoneless.

C2 (Pit) Photo:



C3 (Auger boring)	346732,377355	Land use: Arable
	0-350	Dark grey medium silty clay loam. Stoneless.
	350-640	Dark grey/grey heavy silty clay loam. Stoneless.
	640-1000+	Grey silty clay. Many ochreous mottles. Stoneless.
C4 (Pit)	346837,377396	Land use: Arable
	0-290	Very dark greyish brown medium clay loam. Stoneless.
	290-400	Dark grey medium clay loam. Stoneless.
	400-540	Grey/greyish brown heavy silty clay loam. Common ochreous mottles. Stoneless. Gleyed ped faces.
	540-1000+	Grey silty clay/clay. Many ochreous mottles. Stoneless.
Comments:		Many fine roots 0-40cm. Few fine roots >40cm. Very dark upper subsoil.

C4 (Pit) Photo:



C5 (Auger boring)	346678,377312	Land use: Arable
	0-300	Very dark greyish brown medium silty clay loam. Stoneless.
	300-500	Dark grey heavy silty clay loam. Stoneless.
	500-920	Grey silty clay. Many ochreous mottles. Stoneless.
	920-1000+	Grey silty clay. Common ochreous mottles. Stoneless.
C6 (Auger boring)	346812,377325	Land use: Arable
	0-360	Very dark grey medium silty clay loam. Stoneless.
	360-650	Dark grey heavy silty clay loam. Common (faint) ochreous mottles. Stoneless.
	650-1000+	Grey/dark grey silty clay/clay. Common ochreous mottles. Stoneless.
C7 (Pit)	346573,377227	Land use: Grass ley
	0-230	Very dark grey medium clay loam. Stoneless. Buried white powdery material.
	230-340	Dark grey medium clay loam. Common ochreous mottles. Stoneless. Buried white powdery material.
	340-1000+	Grey heavy silty clay loam. Many ochreous mottles. Stoneless.

C7 (Pit) Photo:



C8 (Auger boring)	346666,377216	Land use: Arable
	0-290	Very dark greyish brown medium silty clay loam. Stoneless.
	290-500	Dark greyish brown medium/heavy silty clay loam. Stoneless.
	500-1000+	Grey clay/silty clay. Many ochreous mottles. Stoneless.
C9 (Pit)	346752,377275	Land use: Arable
	0-320	Very dark grey heavy silty clay loam. Stoneless.
	320-680	Grey silty clay/clay. Common ochreous mottles. Stoneless.
	680-1000+	Grey silty clay. Many ochreous mottles. Stoneless.

C9 (Pit) Photo:



C10 (Auger boring)	346874,377289	Land use: Arable
	0-340	Very dark grey medium clay loam. Stoneless.
	340-650	Dark brown/dark grey heavy clay loam. Few (faint) ochreous mottles. Stoneless.
	650-1000+	Dark grey/dark greyish brown silty clay. Common (faint) ochreous mottles. Stoneless.

9 APPENDIX 3 – SOIL ANALYSIS RESULTS REPORT



Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/08355
Issue Number: 1 **Date:** 16 September, 2019

Client: RSK ADAS Ltd (Wolverhampton)
Titan 1
Coxwell Avenue
Wolverhampton Science Park
Stafford Road
Wolverhampton
WV10 9RT

Project Manager: Simon McMillan
Project Name: Ince
Project Ref: 1010348
Order No: P69101SM0309
Date Samples Received: 05/09/19
Date Instructions Received: 05/09/19
Date Analysis Completed: 16/09/19

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Richard Wong
Client Manager



Page 1 of 7

Envirolab Job Number: 19/08355

Client Project Name: Ince

Client Project Ref: 1010348

Lab Sample ID	19/08355/1	19/08355/2	19/08355/3	19/08355/4	19/08355/5	19/08355/6	19/08355/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	B TS	B SS	E TS	E SS	C East TS	C East SS	C West TS			
Depth to Top	0.00	0.30	0.00	0.30	0.00	0.30	0.00			
Depth To Bottom	0.25	0.50	0.25	0.50	0.25	0.50	0.25			
Date Sampled	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	4ABE	5A	5AE	5AE	5AE	5A	4AE			
% Stones >10mm _A	<0.1	0.8	<0.1	<0.1	5.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH ₀ ^{MS}	8.18	8.50	7.83	8.54	8.28	8.32	8.05	pH	0.01	A-T-031a
pH BRE ₀ ^{MS}	8.18	8.50	7.83	8.54	8.28	8.32	8.05	pH	0.01	A-T-031a
Sulphate BRE (water sol 2:1) ₀ ^{MS}	31	62	11	31	<10	39	57	mg/l	10	A-T-028a
Sulphate BRE (acid sol) ₀ ^{MS}	0.09	0.07	0.07	<0.02	0.12	0.06	0.13	% w/w	0.02	A-T-028a
Sulphur BRE (total) ₀	0.06	0.03	0.04	0.01	0.09	0.04	0.10	% w/w	0.01	A-T-024a
Arsenic ₀ ^{MS}	6	6	10	5	7	7	8	mg/kg	1	A-T-024a
Cadmium ₀ ^{MS}	1.0	1.2	1.5	1.0	1.3	1.5	1.5	mg/kg	0.5	A-T-024a
Copper ₀ ^{MS}	38	13	30	8	58	27	68	mg/kg	1	A-T-024a
Chromium ₀ ^{MS}	26	32	34	28	36	43	40	mg/kg	1	A-T-024a
Lead ₀ ^{MS}	38	30	49	14	60	42	75	mg/kg	1	A-T-024a
Mercury ₀	<0.17	<0.17	0.33	<0.17	0.21	<0.17	0.20	mg/kg	0.17	A-T-024a
Nickel ₀ ^{MS}	22	30	31	26	27	33	29	mg/kg	1	A-T-024a
Selenium ₀ ^{MS}	<1	<1	1	<1	<1	<1	1	mg/kg	1	A-T-024a
Zinc ₀ ^{MS}	115	63	104	49	146	107	188	mg/kg	5	A-T-024a

Envirolab Job Number: 19/08355

Client Project Name: Ince

Client Project Ref: 1010348

Lab Sample ID	19/08355/1	19/08355/2	19/08355/3	19/08355/4	19/08355/5	19/08355/6	19/08355/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	B TS	B SS	E TS	E SS	C East TS	C East SS	C West TS			
Depth to Top	0.00	0.30	0.00	0.30	0.00	0.30	0.00			
Depth To Bottom	0.25	0.50	0.25	0.50	0.25	0.50	0.25			
Date Sampled	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Matrix Code	4ABE	5A	5AE	5AE	5AE	5A	4AE			
Topsoil quality BS3882:2015 (without classification)										
% Clay _A	18.6	23.7	25.1	25.7	10.2	24.2	10.0	% w/w	0.1	Suboon Yara
% Silt _A	60.6	59.0	62.4	63.3	52.7	55.8	49.0	% w/w	0.1	Suboon Yara
% Sand _A	20.8	17.4	12.5	11.0	37.2	20.0	41.0	% w/w	0.1	Suboon Yara
Textural class	Clay Loam	Silty Clay Loam	Silty Clay Loam	Silty Clay Loam	Sandy Silt Loam	Clay Loam	Sandy Silt Loam			Calc
% Coarse Fragment Content >2mm _A	1.0	<0.1	<0.1	<0.1	<0.1	0.2	2.7	% w/w	0.1	A-T-044
% Coarse Fragment Content >20mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
% Coarse Fragment Content >50mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
Carbonate as CaCO _{3D}	4.3	<0.8	<0.8	<0.8	<0.8	<0.8	4.6	% w/w	0.83	CO3s
pH _D	7.49	7.99	7.24	7.96	7.76	7.76	7.71	pH	0.01	A-T-021s
Electrical conductivity _D	2310	2230	2230	2230	2130	2060	2710	µs/cm	10	A-T-027s
Nitrogen, Total % _A	0.088	0.172	0.051	0.080	0.407	0.135	0.378	%	0.01	Suboon Yara
Loss on ignition (440°C) _D	9.2	3.8	7.0	3.7	9.2	7.1	11.3	% w/w	0.6	A-T-030s
Extractable phosphorus _D	58	30	20	6	86	70	54	mg/l	5	A-T-EXTMETs
Extractable potassium _D	76	88	75	89	246	293	237	mg/l	10	A-T-EXTMETs
Extractable magnesium _D	192	260	142	212	99	160	274	mg/l	10	A-T-EXTMETs
Carbon:Nitrogen Ratio	61.5	13.0	80.7	27.2	14.0	30.9	17.6	:1	0.1	Calc-no stones
Zinc (HNO ₃ extractable) _D	119	63	113	64	171	138	256	mg/kg	5	A-T-024s
Copper (HNO ₃ extractable) _D	13	9	13	11	9	11	12	mg/kg	1	A-T-024s
Nickel (HNO ₃ extractable) _D	30	26	32	28	25	30	31	mg/kg	1	A-T-024s
% Visible Contaminants >2mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
% Visible Contaminants Plastics _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	% w/w	0.1	A-T-044
Sharps, number (in 1kg of sample) _A	0	0	0	0	0	0	0	N/A	0	A-T-044
Acceptable textural classification?	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Calc

Envirolab Job Number: 19/08355

Client Project Name: Ince

Client Project Ref: 1010348

Lab Sample ID	19/08355/8									
Client Sample No										
Client Sample ID	C West SS									
Depth to Top	0.30									
Depth To Bottom	0.50									
Date Sampled	28-Aug-19									
Sample Type	Soil									
Sample Matrix Code	4A									
								Units	Limit of Detection	Method ref
% Stones >10mm _A	<0.1							% w/w	0.1	A.T-044
pH ₀ ^{MS}	8.23							pH	0.01	A.T-011a
pH BRE ₀ ^{MS}	8.23							pH	0.01	A.T-011a
Sulphate BRE (water sol 2:1) ₀ ^{MS}	137							mg/l	10	A.T-026a
Sulphate BRE (acid sol) ₀ ^{MS}	0.08							% w/w	0.02	A.T-026a
Sulphur BRE (total) ₀	0.05							% w/w	0.01	A.T-024a
Arsenic ₀ ^{MS}	8							mg/kg	1	A.T-024a
Cadmium ₀ ^{MS}	1.4							mg/kg	0.5	A.T-024a
Copper ₀ ^{MS}	20							mg/kg	1	A.T-024a
Chromium ₀ ^{MS}	30							mg/kg	1	A.T-024a
Lead ₀ ^{MS}	33							mg/kg	1	A.T-024a
Mercury ₀	<0.17							mg/kg	0.17	A.T-024a
Nickel ₀ ^{MS}	30							mg/kg	1	A.T-024a
Selenium ₀ ^{MS}	1							mg/kg	1	A.T-024a
Zinc ₀ ^{MS}	83							mg/kg	5	A.T-024a

Envirolab Job Number: 19/08355

Client Project Name: Ince

Client Project Ref: 1010348

Lab Sample ID	19/08355/8									
Client Sample No										
Client Sample ID	C West SS									
Depth to Top	0.30									
Depth To Bottom	0.50									
Date Sampled	28-Aug-19									
Sample Type	Soil									
Sample Matrix Code	4A									
Topsoil quality BS3882:2015 (without classification)										
% Clay _A	21.4							% w/w	0.1	Subcon Yara
% Silt _A	55.5							% w/w	0.1	Subcon Yara
% Sand _A	23.1							% w/w	0.1	Subcon Yara
Textural class	Clay Loam									Calc
% Coarse Fragment Content >2mm _A	0.3							% w/w	0.1	A-T-044
% Coarse Fragment Content >20mm _A	<0.1							% w/w	0.1	A-T-044
% Coarse Fragment Content >50mm _A	<0.1							% w/w	0.1	A-T-044
Carbonate as CaCO _{3D}	<0.8							% w/w	0.83	CO _{3s}
pH _D	7.95							pH	0.01	A-T-031s
Electrical conductivity _D	2270							µs/cm	10	A-T-037s
Nitrogen, Total % _A	0.167							%	0.01	Subcon Yara
Loss on ignition (440°C) _D	3.5							% w/w	0.6	A-T-030s
Extractable phosphorus _D	45							mg/l	5	A-T-EXTMET9
Extractable potassium _D	177							mg/l	10	A-T-EXTMET9
Extractable magnesium _D	219							mg/l	10	A-T-EXTMET9
Carbon:Nitrogen Ratio	12.3							:1	0.1	Calc-no stones
Zinc (HNO ₃ extractable) _D	77							mg/kg	5	A-T-024s
Copper (HNO ₃ extractable) _D	10							mg/kg	1	A-T-024s
Nickel (HNO ₃ extractable) _D	28							mg/kg	1	A-T-024s
% Visible Contaminants >2mm _A	<0.1							% w/w	0.1	A-T-044
% Visible Contaminants Plastics _A	<0.1							% w/w	0.1	A-T-044
Sharps, number (in 1kg of sample) _A	0							N/A	0	A-T-044
Acceptable textural classification?	Yes									Calc

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envirolab.co.uk

Client: RSK ADAS Ltd (Wolverhampton), Titan 1, Coxwell Avenue,
Wolverhampton Science Park, Stafford Road, Wolverhampton, WV10 9RT

Project: Ince
Clients Project No: 1010348

Project No: 19/08355
Date Received: 05/09/2019 (am)
Cool Box Temperatures (°C): 14.1

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

