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PHASE 2

GEO-ENVIRONMENTAL REPORT

job number	C4137/24/E/6329
date	26/04/24
site address	Cummins Turbo Proposed Footbridge, Saint Andrew's Road, Huddersfield, HD1 6RA.
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Appendices

Report on a Phase 2 Geo-environmental Investigation

Location:	Cummins Turbo Proposed Footbridge Saint Andrew's Road, Huddersfield, West Yorkshire, HD1 6RA
For:	Cummins Turbo Technology
Report No.	C4137/24/E/6329 Report date: April 2024

For and on behalf of **Rogers Geotechnical Services Ltd**

BEng FGS Geo-environmental Engineer	MSc FGS ACIEH Engineering Director

Report Summary[1]

Item	Comments	Section
Development	Construction of a new pedestrian footbridge.	1.
Geology	Superficial geology: Alluvium. Solid geology: Pennine Lower Coal Measures Formation.	5.
Strata Conditions	Made ground encountered to 2.2m depth, over very soft sandy clay to 3.5m below ground level. Then very loose becoming dense granular alluvial soils.	6.
Groundwater	Groundwater strikes encountered at 3.2m depth in WS02.	6.2
Foundation Design	Piled foundation solution.	10.1
Effect of Sulphates	DC-1 concrete.	10.3
Contamination	Contamination levels below SSVs for commercial development.	11.

[1] This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that the land at Cummins Turbo is to be developed by the construction of a new pedestrian footbridge. The footbridge shall be constructed from east to west over St. Andrews Road in order to allow pedestrian access from the visitors car park (east) directly into the first floor of the building on the western side of St Andrew's Road. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties and to assist in the design of safe and economical foundations for the proposed development. This investigation also takes into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C4137/24/E/6328 in March 2024. This report has been used extensively during the current intrusive investigation.

4. Fieldworks

The fieldworks were undertaken on the 20th March 2024 and included the following:

- Two windowless sample boreholes.
- Standard penetration tests within WS02.
- Two dynamic probes.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

4.1 GPS Survey

A GeoMax Zenith 16 GPS survey unit was employed during the fieldworks to record positions relevant to the investigation. During the investigation, the GPS system typically indicated 2D co-ordinate (X-axis & Y-axis) accuracies of +/-3mm, with 3D co-ordinate (X-axis, Y-axis & Z-axis) accuracy of +/-9mm. Whilst the system utilised Assisted-GPS (A-GPS) to improve initialisation time, it should be appreciated that clear view of the sky is required in order to obtain accuracy better than +/-3m. Therefore, in areas where tall obstructions are present, such as near tree canopies or buildings, it is not always possible to obtain accurate survey data.

4.2 Windowless Sample Boreholes

These boreholes were sunk using a drive-in windowless sampler. The cores were undertaken in 1m lengths and reduced in diameter from 87mm for the first 1m through 77mm and 57mm for subsequent 1m increments. The recovered cores were sealed and returned to the laboratory for logging and subsequent testing. The soils were described in general accordance with BS5930: 2015 +A1: 2020 and full descriptions are given on the windowless sample records which are presented in Appendix 2. Also included on these records are the core diameters and percentages of core recovered.

4.3 Standard Penetration Tests

Standard penetration tests (SPT) were undertaken at regular depth increments within windowless sample borehole WS02. The SPT was conducted in accordance with the procedures given in BS EN ISO 22476: Part 3: 2005 +A1: 2011, and the results are summarised on the borehole record. During this work an automatic trip hammer of 63.5kg falling through 750mm was employed to drive either a cone or split barrel sampler assembly into the ground and the recovered barrel samples were retained in air tight plastic containers.

4.4 Dynamic Probes

Dynamic penetration tests were undertaken adjacent to the windowless sample boreholes in accordance with the procedure given in BS EN ISO 22476: Part 2: 2005 +A1: 2011, using the super heavy penetrometer (DPSH). This probe consists of a 63.5kg mass falling through 750mm onto an anvil, which drives a 50mm diameter cone into the ground. The number of blows required to drive the cone through successive 100mm increments are recorded as the N_{100} values. The results of the dynamic penetration tests are tabulated and presented as bar charts of N_{100} values versus depth in Appendix 3.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site			
Strata Type	**Strata Name**[2]	**Previous Name**[3]	**Description**[3]
Superficial Geology	Alluvium	-	Soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.
Solid Geology	Pennine Lower Coal Measures Formation	-	Interbedded grey mudstone, siltstone and pale grey sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part.

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile			
Depth m below ground level to underside of layer	**Strata Type**	**Positions Encountered**	**Groundwater Strikes** m below ground level
0.35 – 0.5	TOPSOIL	All	None
+0.50 – 2.20	MADE GROUND (Granular).	All	None
3.50	Sandy CLAY. [ALLUVIUM].	WS02	3.2m (WS02)
3.90	Slightly clayey silty SAND. [ALLUVIUM].	WS02	None
+4.45	Sandy GRAVEL. [ALLUVIUM].	WS02	None

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

6.1 General Strata

In general, below the topsoil, granular made ground was revealed to between 0.5m and 0.8m, whereupon a layer of bound macadam was encountered, upon which refusal was met in WS01. Yellow discolouration under PAK marker was observed on the bound macadam within WS01. This positive test indicates the potential presence of tar. It is likely that this layer represents a road associated with historical construction. Below the bound macadam within WS02, further deposits of granular made ground was revealed to 2.2m depth. The made ground was noted to have a dense insitu condition at the near surface and included brick, mortar, clinker and concrete fragments.

Beneath the made ground, very soft sandy clay was revealed to 3.5m, over very loose slightly clayey silty fine sand to 3.9m depth. This material was found to be underlain by dense very sandy gravel to the base of the borehole. With respect to the local geology, it is considered that this material is representative of the superficial deposits of alluvium which are indicated to underlie the site.

It should be appreciated that the alluvial soils to 3.9m depth were noted to have hydrocarbon staining and odours. However, no volatiles were detected during headspace testing with a PID monitor.

[2] Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[3] Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [*online resource from www.bgs.ac.uk*]

6.2 Groundwater

It should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions. Notwithstanding this, a groundwater strike was observed at 3.2m within WS02 during the site investigation.

7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out in WS02 are summarised in the following table:

Table 3: Summary of Standard Penetration Tests

Strata	Depth Range (m)	SPT 'N' (Blows/300mm)		Comments
		Granular soils	Cohesive soils	
MADE GROUND (Granular)	1.0m 2.0m	49 5	-	SPT's indicate granular made ground is present is a variably very loose to dense insitu condition. Higher result likely to have been affected by presence of brick cobbles.
ALLUVIUM	3.0m 4.0m	- 56	4 -	Results indicate cohesive alluvium to be present in a very soft insitu condition, whilst the underlying granular alluvium suggest to be present in a very dense insitu condition.

7.2 Dynamic Penetration Tests

Dynamic penetration tests were undertaken adjacent to the windowless sample borehole positions. A summary of the results is presented below:

Table 4: Summary of Dynamic Penetration Tests

Position	Blows/100mm			Refusal type (Effective/ Abrupt)[4]	Comments
	0 - 2	3 - 10	10+		
	Depth to which blow count range was observed (m)				
DP01	0.3	0.5	0.7	Abrupt	Initial low results to 0.5m followed by an abrupt refusal.
DP02	0.2 4.1	1.4 4.3	4.9	Effective	Variable but generally high near surface results with results of between 5 and 20 blows/100mm to around 1.4m depth. Followed by poor results to 4.3m below ground level. Blow counts then noted to rapidly increase until refusal.

[4] Abrupt refusal: obstruction or bedrock encountered. Effective refusal: +25 blows/100mm.

8. Laboratory Testing - Geotechnical

The following programme of laboratory testing has been undertaken on samples obtained during this investigation:

- Soluble sulphate content — BS 1377-3:2018+A1:2021: Pt3: 7.3
- pH value — BS 1377-3:2018+A1:2021: Pt3: 12

The test results are presented in Appendix 4 and are summarised below:

Table 5: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Soluble sulphate & pH	2	SO_4 pH	300 & 700 mg/l 9.6 & 9.7	

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

Table 6: Summary of Geotechnical Properties

Property	Range of values	Comments
Concrete classification	DC-1	Brownfield locations (mobile water).

9. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr^{VI}, Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN^- and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO_4^{2-}.
- Asbestos.
- Waste Acceptance Criteria (WAC)

This testing was undertaken by i2 Analytical Ltd and the results of all of the chemical testing are presented in Appendix 4 of this report.

10. Discussion of Ground Conditions - Geotechnical

It is understood that the site is to be developed by the construction of a new pedestrian footbridge over St. Andrews Road in order to allow pedestrian access from the visitors car park directly into the first floor of the building across the road. At the time of writing this report the precise layout and method of construction is not known, thus the discussion below is of a generalised nature.

Typically, it cannot be recommended that foundations be constructed directly within made ground as these deposits can be present in a weak and variable condition such that excessive total and or differential settlement could occur under moderately light surface loading. In this instance, the made ground at the near surface appears to be present in a dense insitu condition. Notwithstanding this, this relatively competent ground has only been proven at one location to date. As outlined above, made ground can be variable in condition. For instance, RGS have previously undertaken site investigation for Cummins Turbo on the western side of St Andrew's Road and found that the made ground was very loose and soft. Thus, unless further evidence is gathered. it cannot be recommended that shallow strip or spread footings be considered. As such, for provisional designs, piles should be adopted in order to transfer foundation loads through the made ground and weak superficial deposits to competent strata at depth. A piled foundation will have the advantage of limiting differential settlement of the new structure across the site.

10.1 Piled Foundations

In order to formulate a suitable design, it is recommended that the advice of specialist piling contractors be sought. However, for preliminary design and estimating purposes the following discussion is presented.

It should be appreciated that in view of the ground conditions encountered and the abrupt refusals to the dynamic probes, driven concrete piles may be subject to breakage upon encountering the rockhead. Therefore, consideration should be given to the use of driving shoes or a lead steel section to minimise the risk of pile breakages. In addition, low levels of lateral support on the piles could be expected through the fill and very soft/loose superficial soils, thus potential buckling failure of the piles should be accounted for in design.

Consideration may also be given to the use of bored cast-in-place piles using continuous flight augers (CFA). In this type of piling an auger borehole is formed and concrete placed via the hollow stem of the auger as they are withdrawn. A reinforcement cage is then placed into the fluid concrete filled hole to complete the pile. However, spoil will be produced at the surface which will need to be disposed of. Moreover, should such piles encounter an obstruction or the underlying bedrock, a condition known as 'flighting' may occur. Flighting is where loose soils immediately adjacent to the pile borehole are pulled laterally into the drill string when the augers rotate quickly with little downward penetration.

Finally, drill and cased piles (Odex, Symmetrix or similar) could be employed at this site. These methods employ down the hole hammers which have the capacity to bore through obstructions and into the underlying hard stratum to form a rock socket. Through the overburden, the drill bit is attached to casing which prevents the pile borehole collapsing. When rock is encountered the drilling can continue using open hole drilling techniques. On completion of the boring operations, concrete is then pumped into the hole and a steel reinforcing cage can be installed. The steel casing can be removed or left in place.

Irrespective of the method of pile installation a working platform must be provided, the thickness of which will be determined by the type of piling rig employed and the strength of the near surface soils. The design of the platform should be undertaken in accordance with the procedures and specification given in the BRE publication entitled *Working platforms for tracked plant*. The near surface obstruction at WS01 should also be inspected further and broken out prior to pile installation.

10.2 General Comments for Excavations

The stability of excavation faces cannot be guaranteed thus temporary support to the excavation faces may become necessary unless the foundations are constructed using trench-fill techniques. In this method the foundation trenches should be excavated, inspected and backfilled with concrete as a continuous operation. Under no circumstances should operatives be allowed to enter unsupported excavations.

Should the excavations be required to stand open, it is considered that a blinding layer of lean-mixed concrete be placed over the sub-grade. This expedient will reduce loosening or softening of the underling soil due to both physical disturbance and the ingress of surface water.

Should seepage of groundwater be encountered it is considered that it could be dealt with using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped.

10.3 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2[5], which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-2 requirements. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[6], which can be found in Part D, *Specifying concrete for general cast-in-situ use,* of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

[5] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*
[6] Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*

11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of a new pedestrian footbridge over St. Andrews Road in order to allow pedestrian access from the visitors car park directly into the first floor of the building across the road. Consequently, screening values for a commercial end use have been adopted for contamination analyses.

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 2.5% and 5.5%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website[7] and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 4. These results indicate the following:

Table 7: Summary of Contaminated Areas

Location	Depth (m)	Contaminants found to be exceeding SSVs (Commercial)
WS01	0.4	PAH [Benzo(a)anthracene, chrysene, bezn(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene].
WS02	0.5 – 0.9	PAH [Benzo(a)anthracene, chrysene, bezn(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene].
WS02	3.70	None.

Concentrations of cadmium, chromium(VI), selenium, cyanide (free), phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C12; aromatic C7 to C12) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded in at least one position, but these fell below the associated Atrisk Soil Screening Values. In addition, no asbestos was detected within the soils samples tested.

It should be appreciated that the soil screening values for PAHs and TPHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion[8]. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs and TPHs at this site.

[7] http://www.atrisksoil.co.uk/pages/general/subscribers.asp
[8] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 1% SOM, Commercial land use, 23.06.17.

The results of the contaminants found to exceed these screening values are tabulated as follows:

Table 8: Summary of Areas Contaminated by PAHs & TPHs

Location	Depth (m)	Contaminants found to be exceeding SSVs (Commercial)
WS01	0.4	None
WS02	0.5 – 0.9	None
WS02	3.70	None

On the basis of the above information, the results of the investigation indicate that the development area is not significantly contaminated with respect to the proposed end use. Moreover, whilst the soils at depth have a hydrocarbon odour, contamination testing and PID monitoring suggests that these soils are not significantly contaminated.

Notwithstanding this, it should be appreciated that given the history of the wider Cummins Turbo Technologies site, the possibility of contamination should still be considered in relation to construction operatives as these receptors are likely to be subject to greater exposure than end users. Moreover, the PAK marker spray has indicated that the bound macadam layer identified at shallow depth is likely to comprise tar.

11.1.2 Waste Acceptance Criteria (WAC)

One sample has been tested for Waste Acceptance Criteria and the results are presented in Appendix 4. In general, the determinands fell within the parameters required for inert waste, with the exception of total organic carbon, mineral oils and arsenic, which fell within the limits for stable non-reactive hazardous waste in a non-hazardous landfill.

It should be appreciated that it may be possible to modify the material such that it could be disposed of to an inert landfill. However, it is recommended that the advice of the landfill operators is sought.

For further guidance, please refer to the following documents which are available on the *www.gov.uk* website:

- Environment Agency – LIT 5234 *Waste Acceptance at Landfills - Guidance on waste acceptance procedures and criteria* – November 2010.
- Environment Agency – LIT 5902 *Treatment of waste for landfill* – June 2014.

11.2 Site Specific Risk Assessment

11.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the ‘suitable for use’ approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency[9] advice on the assessment of risks arising from the presence of contamination

[9] R&D Publication CLR 8, ‘Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research’.

in soils and using the source-pathway-receptor approach.[10] This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed, DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'[11]

11.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 9. Sources of contamination include the following:

On-site – none.

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

N/A -	A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.
Low -	A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.
Moderate -	The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary
High -	The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 9.

[10] The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.
[11] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 9: Conceptual Site Model and Site-Specific Risk Assessment [Contamination: none]				
Conceptual Site Model			**Site Specific Risk Assessment**	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Notes**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – whilst no contamination found to be present exceeding commercial SSVs, contact with soil is likely for site operatives during works.	Moderate	Precautionary measures will be required during the construction phase to protect site operatives. However, as the site is anticipated to be secured during the development phase, contamination is not anticipated to affect neighbours.
	End User	No – end users will not come in contact with the soil.	N/A	
	Neighbours	Yes – some contamination has been identified (albeit below commercial SSVs).	Low	
Inhalation of Dust/Vapours	Operative	Yes – dust may be derived from contaminated soils, which may present a risk to site operatives. In addition, hydrocarbon odours have been noted within the soils.	Moderate	Precautionary measures will be required during the construction phase to protect the site operatives and neighbours. Remediation will be required to either remove the contamination or break pathways.
	End User	No – new footbridge is elevated; thus, vapours will vent directly to atmosphere.	N/A	
	Neighbours	Yes – neighbouring properties present and possible inhalation of dust during the works.	Moderate	
Ingestion of fruit/vegetables and/or waters	Operative	No – no edible plants or contained water sources in the area of the proposed new works.	N/A	No further action required.
	End User	No – no soft landscaping proposed as part of the new development.	N/A	
	Neighbours	No – no nearby residential dwellings present.	N/A	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	No – new footbridge is elevated; thus gases will vent directly to atmosphere.	N/A	
	End User		N/A	

	Neighbours	Yes – whilst potential made ground could be present, due to historical development activities, ground gas is likely to represent a wider issue within the local area. Moreover, considering the development comprises a footbridge, it is considered that the landfill gas setting will not be affected.	Low	
Spillage/loss/run off direct to receiving water	Controlled Waters	Yes – known controlled waters within 250m. However, the contamination falls below SSVs.	Low	
Migration via permeable unsaturated strata	Controlled Waters	Yes – a Secondary A aquifer is present beneath the site. However, the contamination falls below SSVs.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site. However, the contamination falls below SSVs.	Low	
Direct contact with contaminated soils Uptake via root system	Plants	No – no soft landscaping areas present as part of the proposed development.	N/A	No further action required.
Direct contact with contaminated soils Direct contact with contaminated groundwater	Building Materials	Yes – TPH and minor PAH contamination revealed at the site may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1.	Moderate (plastic services) Low (buried concrete)	Please see section 11.3.3 for information on good building practice.
Exposure to Radon	Operative End User	No – not in a radon affected area.	N/A	The property is in a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). BR211 states that no radon protective measures are necessary.
UXO Risk	Operative End User	Yes – the Zetica[12] online maps indicate that the site is at low risk from UXO.	Low	Unlikely to be affected by UXO.

[12] Pre-desk study assessment [*online resource from www.zeticauxo.com*].

11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

11.3.1 Remediation Objectives

Based on the site-specific risk assessment the object of the remediation is likely to be as follows.

- To protect the site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust and vapours.
- To protect neighbours from the inhalation and ingestion dust during the construction process.
- To protect plastic services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwaters.

11.3.2 Development Requirements

It is understood that the development is to comprise the construction of a new footbridge over St. Andrews Road in order to allow pedestrian access from the visitors car park into the first floor of the building across the road. In view of the above a site-specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered.

11.3.3 Outline Strategy

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore, the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working with potentially contaminated soils and the potential hazards associated with materials containing tar.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be encouraged to use them.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.

- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.
- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-2.

11.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3882 (2015)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG[13] documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

[13] *YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V4 .1* Appendix 1a, June 2021

Table 10: Validation Sampling and Testing		
Fill Type	**Frequency**	**Minimum Determinands**
Virgin Quarried Material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)
Crushed Hardcore, Stone, Brick	Minimum 1 per 500m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).
Greenfield/ Manufactured Soils	Minimum 3 Dependent on source and receptor, between 1 per 50m³ and 1 per 250m³	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).
Brownfield/ Screened Soils	Minimum 6 Dependent on source and receptor, between 1 per 50m³ and 1 per 100m³	Standard metals/ metalloids (as above), PAH (16 USEPA speciation), TPH (CWG banded), asbestos, pH and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

Table 11: Fill Screening Values			
Contaminant	**Screening Value (Commercial) (mg/kg)**		**Reference**
	1% SOM	**6% SOM**	
As	635	635	Atrisk^{SOIL} SSVs
Cd	410	410	Atrisk^{SOIL} SSVs
Cr(VI)	19.7	19.7	Atrisk^{SOIL} SSVs
Cu	106000	106000	Atrisk^{SOIL} SSVs
Hg	350	350	Atrisk^{SOIL} SSVs
Ni	1770	1770	Atrisk^{SOIL} SSVs
Pb	2310	2310	Atrisk^{SOIL} SSVs
V	7490	7490	Atrisk^{SOIL} SSVs
Zn	1100000	1100000	Atrisk^{SOIL} SSVs

Please see summary sheet within Appendix 5 for full screening values including PAHs & TPHs.

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate

sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

12. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Discussions with piling contractors regarding their method for installing piles.
- Discussions with ground work contractors in relation to the suitability of imported materials.
- Detailed design of the sub-structure.

Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

13. References

- British Geological Survey (NERC) (2024), BGS, Keyworth.
  - Geology of Britain Viewer: (*http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)*
  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing,* B.S.I., London.
- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-3: *Geotechnical investigation and testing – Field testing, Part 3: Standard penetration test,* B.S.I., London.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations,* B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice,* British Standards Institute.
- British Standards Institution (2015 +A1:2019) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* B.S.I., London.
- British Standards Institution (2013), BS 8576 Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.
- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.

- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: Concrete in aggressive ground, BRE Press, Garston.
    - Part C: *Assessing the aggressive chemical environment.*
    - Part D: *Specifying concrete for general cast-in-situ use.*

- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.

- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.

- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.

- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings,* CIRIA Report C665.

Appendix 5

Fill Screening Values

Appendix 1

Site Plan

Notes:

Investigation positions approximated from site operative's notes.

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:

Cummins Turbo Technologies

Job Number:

C3215/22/E/4877

Project Details:

Cummins Turbo Technologies
Walkway Project

Scale:	Not to scale - reference only

Appendix 2

Borehole Records

Borehole Log

Borehole No. **WS01**

Sheet 1 of 1

Project Name:	Cummins Turbo Proposed Footbridge	Project No. C4137/24/E/6329	Co-ords:	415074.90E - 416967.54N	Hole Type WLS
Location:	St Andrews Road, Huddersfield		Level:	62.36m aOD	Scale 1:50
Client:	Farrar Bamforth Associates Ltd		Dates:	20/03/2024	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.40	D	87	100		0.35 0.50	62.00 61.86		TOPSOIL (Dark brown silty SAND with frequent rootlets). MADE GROUND (Dark brown silty very gravelly SAND. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of brick, mortar, sandstone and asphalt fragments). *0.4m - 0.5m: Hydrocarbon odour noted.* *0.5m: possible old asphalt surfacing.* End of Borehole at 0.50m

Remarks

No groundwater strike.

Abrupt refusal at 0.5m

Borehole Log

Environmental Geotechnical Specialists

Borehole No. **WS02**

Sheet 1 of 1

Project Name:	Cummins Turbo Proposed Footbridge	Project No. C4137/24/E/6329	Co-ords:	415076.59E - 416975.07N	Hole Type WLS
Location:	St Andrews Road, Huddersfield		Level:	62.36m aOD	Scale 1:50
Client:	Farrar Bamforth Associates Ltd		Dates:	20/03/2024	Logged By IMY

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Dia. (mm)	TCR (%)	Results	Depth (m)	Level (m)	Legend	Stratum Description
							0.00	62.36		TOPSOIL (Dark brown silty SAND with frequent rootlets).
		0.50 - 0.90	D	87	80		0.50	61.86		MADE GROUND (Medium dense to dense brown, locally dark brown very gravelly silty SAND. Sand is fine. Gravel is sub-angular to sub-rounded, fine to medium of brick, mortar, sandstone, asphalt and concrete fragments).
		1.00	SPT			N=49 (39,19/10,11,12,16)	1.00	61.36		
				77	100		1.20	61.16		*0.8m - 0.85m: Layer of tarmac - yellow discolouration under PAK marker spray.*
		2.00	SPT			N=5 (1,2/2,1,1,1)				MADE GROUND (Dense light brown sandy sub-angular to sub-rounded, fine to medium GRAVEL of sandstone).
				57	95		2.20	60.16		MADE GROUND (Medium dense becoming loose dark brown silty very gravelly fine SAND with medium cobble content. Cobbles are sub-angular of brick. Gravel is sub-angular to sub-rounded, fine to medium of brick, mortar, clinker and rare coal fragments).
	▼	3.00	SPT			N=4 (1,0/1,1,1,1)				
		3.20		57	100		3.50	58.86		Very soft brown becoming greyish brown sandy CLAY with frequent black stained patches. Hydrocarbon odour present. [ALLUVIUM].
		3.70	D							*3.1m: PID monitor reading - 0ppm.*
		4.00	SPT			N=56 (3,4/13,16,12,15)	3.90	58.46		Very loose black slightly clayey silty fine SAND. Hydrocarbon staining and odour present. [ALLUVIUM].
							4.45	57.91		Light brown very sandy, sub-angular to well rounded, fine to medium GRAVEL of sandstone. [ALLUVIUM].
										3.9m: PID monitor reading - 0ppm.
										End of Borehole at 4.45m

Remarks

Abrupt refusal at 4.45.

Groundwater strike at 3.2m.

AGS

Appendix 3

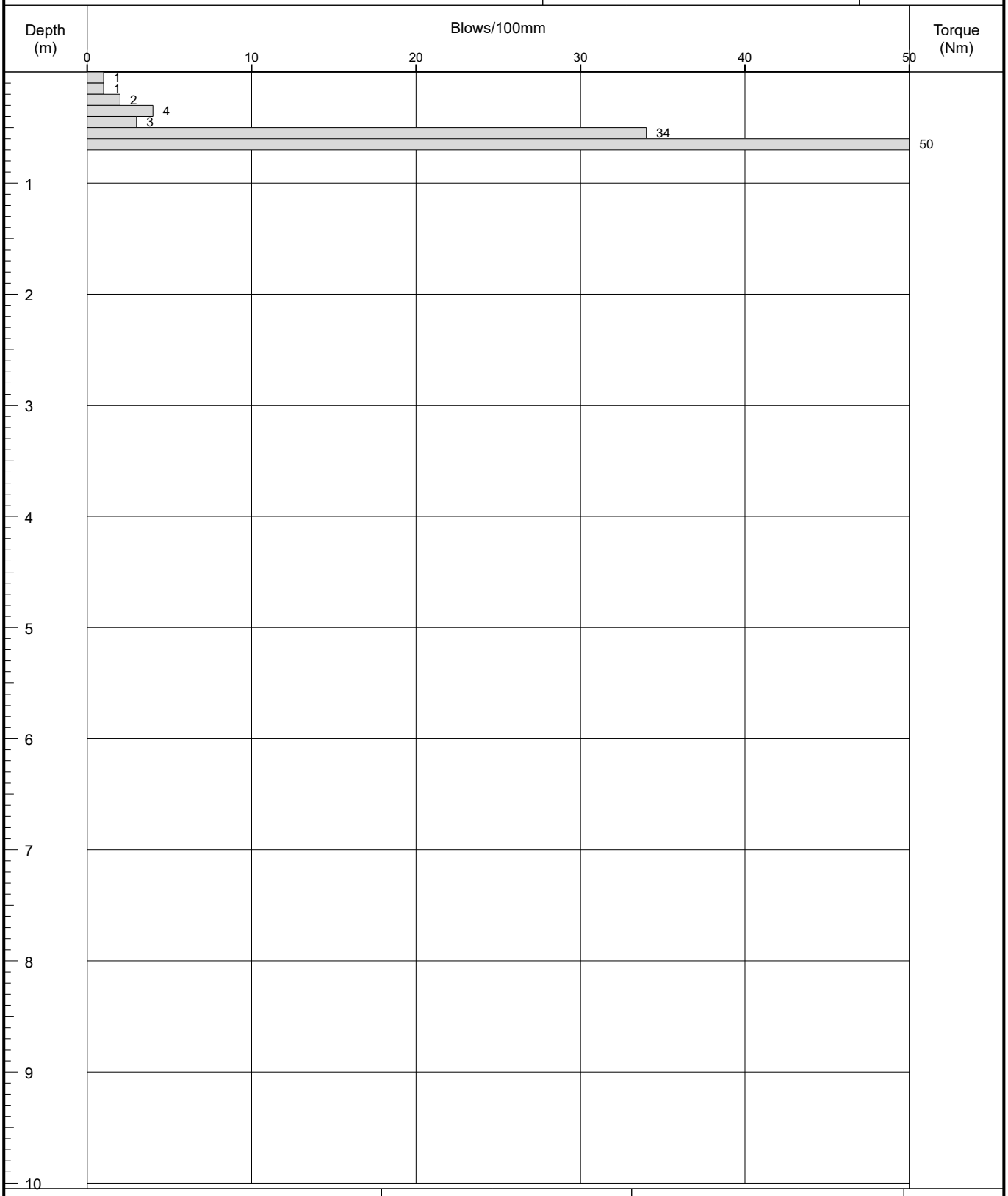
Dynamic Probing Records

Probe Log

Probe No. **DP01**

Sheet 1 of 1

Project Name: Cummins Turbo Proposed Footbridge	Project No. C4137/24/E/6329	Co-ords:	Hole Type DCP
Location: St Andrews Road, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 20/03/2024	Logged By BM



Remarks:
Abrupt refusal at 0.7m.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	0.7m
Probe Type	DPSH-B		

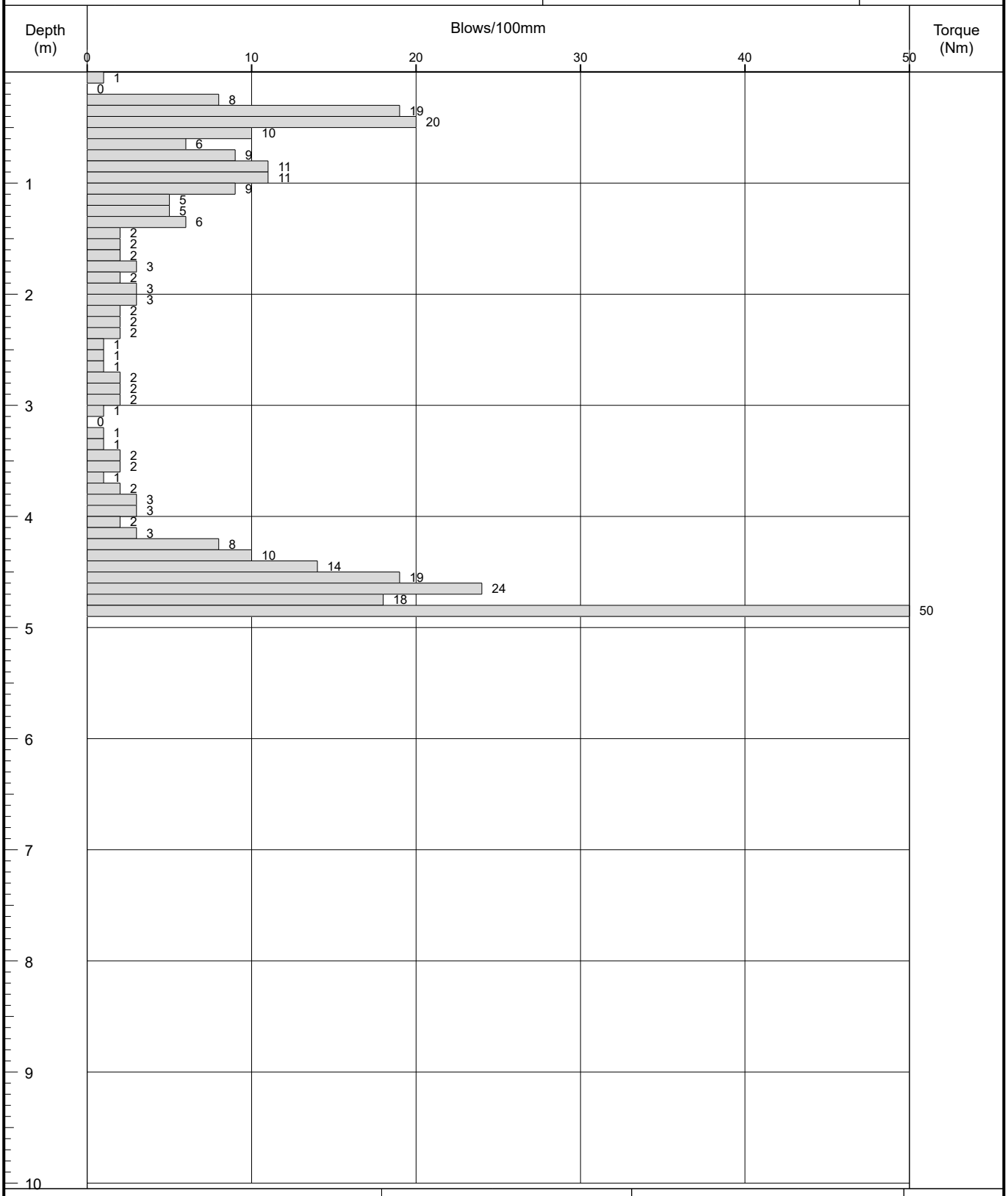
Probe Log

Environmental Geotechnical Specialists

Probe No. **DP02**

Sheet 1 of 1

Project Name: Cummins Turbo Proposed Footbridge	Project No. C4137/24/E/6329	Co-ords:	Hole Type DCP
Location: St Andrews Road, Huddersfield		Level:	Scale 1:50
Client: Farrar Bamforth Associates Ltd		Dates: 20/03/2024	Logged By BM



Remarks:
Abrupt refusal at 4.9m.

Fall Height	750mm	Cone Base Diameter	50.5mm
Hammer Wt	63.5kg	Final Depth	4.9m
Probe Type	DPSH-B		

AGS

Appendix 4

Laboratory Testing

Rogers Geotechnical Services Ltd
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e: harry.letch@rogersgeotech.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
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Watford,
Herts,
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t: 01923 225404
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e: reception@i2analytical.com

Analytical Report Number : 24-011112

Project / Site name:	Cummins Turbo	**Samples received on:**	26/03/2024
Your job number:	C4137 24 E	**Samples instructed on/ Analysis started on:**	26/03/2024
Your order number:	PO-2928	**Analysis completed by:**	03/04/2024
Report Issue Number:	1	**Report issued on:**	03/04/2024
Samples Analysed:	3 soil samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-011112
Project / Site name: Cummins Turbo
Your Order No: PO-2928

Lab Sample Number				155753	155754	155755
Sample Reference				WS01	WS02	WS02
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.50-0.90	3.70
Date Sampled				22/03/2024	22/03/2024	22/03/2024
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Stone Content	%	0.1	NONE	< 0.1	26.6	< 0.1
Moisture Content	%	0.01	NONE	11	9.5	23
Total mass of sample received	kg	0.1	NONE	1	2	0.2
Asbestos						
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	EC	EC	-
General Inorganics						
pH (L099)	pH Units	N/A	MCERTS	9.7	9.6	-
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	-
Total Sulphate as SO_4	%	0.005	MCERTS	0.198	0.293	-
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	300	730	-
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	152	366	-
Organic Matter (automated)	%	0.1	MCERTS	2.5	5.5	-
Total Phenols						
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-
Speciated PAHs						
Naphthalene	mg/kg	0.05	MCERTS	1.1	2.9	-
Acenaphthylene	mg/kg	0.05	MCERTS	0.15	0.08	-
Acenaphthene	mg/kg	0.05	MCERTS	0.82	1.7	-
Fluorene	mg/kg	0.05	MCERTS	0.64	1.4	-
Phenanthrene	mg/kg	0.05	MCERTS	6.6	11	-
Anthracene	mg/kg	0.05	MCERTS	1.7	2.9	-
Fluoranthene	mg/kg	0.05	MCERTS	10	13	-
Pyrene	mg/kg	0.05	MCERTS	8.8	12	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.7	6	-
Chrysene	mg/kg	0.05	MCERTS	4.9	6.4	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	5	7.9	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.8	2.6	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.9	6.9	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.6	3.4	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.69	0.81	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.9	3.7	-
Total PAH						
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	58.1	83.3	-

Analytical Report Number: 24-011112
Project / Site name: Cummins Turbo
Your Order No: PO-2928

Lab Sample Number				155753	155754	155755
Sample Reference				WS01	WS02	WS02
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.50-0.90	3.70
Date Sampled				22/03/2024	22/03/2024	22/03/2024
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	66	36	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	450	330	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	230	110	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	33	38	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	29	46	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	100	-
Petroleum Hydrocarbons						
TPHCWG - Aliphatic >C5 - C6 HS_1D_AL	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >C6 - C8 HS_1D_AL	mg/kg	0.02	NONE	< 0.020	< 0.020	< 0.020
TPHCWG - Aliphatic >C8 - C10 HS_1D_AL	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050
TPHCWG - Aliphatic >C10 - C12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >C12 - C16 EH_CU_1D_AL	mg/kg	2	MCERTS	3.5	6.1	< 2.0
TPHCWG - Aliphatic >C16 - C21 EH_CU_1D_AL	mg/kg	8	MCERTS	19	61	< 8.0
TPHCWG - Aliphatic >C21 - C35 EH_CU_1D_AL	mg/kg	8	MCERTS	120	1300	< 8.0
TPHCWG - Aliphatic >C5 - C35 EH_CU+HS_1D_AL	mg/kg	10	NONE	150	1300	< 10
TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.01	NONE	< 0.010	< 0.010	0.012
TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.01	NONE	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.05	NONE	< 0.050	< 0.050	< 0.050
TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	14	11	< 2.0
TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	93	49	< 10
TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	1200	170	< 10
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR	mg/kg	10	NONE	1300	230	< 10
VOCs						
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	13
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-011112
Project / Site name: Cummins Turbo

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
155753	WS01	None Supplied	0.4	Brown clay and sand with gravel
155754	WS02	None Supplied	0.50-0.90	Brown sand with gravel and stones
155755	WS02	None Supplied	3.7	Black sandy clay

Analytical Report Number : 24-011112
Project / Site name: Cummins Turbo

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated EPA-16 PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088	D/W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Analytical Report Number : 24-011112
Project / Site name: Cummins Turbo

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 24-011475

Project / Site name:	Cummins Turbo	**Samples received on:**	26/03/2024
Your job number:	C4137 24 E	**Samples instructed on/ Analysis started on:**	26/03/2024
Your order number:	PO-2928	**Analysis completed by:**	04/04/2024
Report Issue Number:	1	**Report issued on:**	05/04/2024
Samples Analysed:	10:1 WAC sample		

Signed: _____

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

i2 Analytical
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Waste Acceptance Criteria Analytical Results

Report No:	**24-011475**						
					Client:	**ROGERGEO**	
Location	**Cummins Turbo**						
Lab Reference (Sample Number)	157599				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	22/03/2024				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS02						
Depth (m)	0.50-0.90						
Solid Waste Analysis							
TOC (%)**	3.2				3%	5%	6%
Loss on Ignition (%) **	-				--	--	10%
BTEX (µg/kg) **	< 5.0				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	1800				500	--	--
Total PAH (WAC-17) (mg/kg)	81.3				100	--	--
pH (units)**	-				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0539			0.539	0.5	2	25
Barium *	0.0238			0.238	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0022			0.022	0.5	10	70
Copper *	0.013			0.13	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.00251			0.0251	0.5	10	30
Nickel *	0.00059			0.0059	0.4	10	40
Lead *	0.0011			0.011	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0026			0.026	4	50	200
Chloride *	1.0			10	800	15000	25000
Fluoride*	0.41			4.1	10	150	500
Sulphate *	13			130	1000	20000	50000
TDS*	54			540	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	6.22			62.2	500	800	1000
Leach Test Information							
Stone Content (%)	26.6						
Sample Mass (kg)	2.0						
Dry Matter (%)	91						
Moisture (%)	9.5						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 24-011475
Project / Site name: Cummins Turbo

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
157599	WS02	None Supplied	0.50-0.90	Brown sand with gravel and stones

Analytical Report Number : 24-011475
Project / Site name: Cummins Turbo

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031B	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination	L033B	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR Analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	NONE
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sample Preparation		In-house method	L043B	W	NONE
Speciated EPA-16 PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088	D/W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	ISO 17025

Analytical Report Number : 24-011475
Project / Site name: Cummins Turbo

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025
WAC Leachate 10:1		In-house method	L043B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
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AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C4137/24/E/6329
Job Name	Cummins Turbo Footbridge
Date	11/04/24
Client	Cummins Turbo Technologies

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2's detectable limit for this compound.
B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.
C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.
D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.

KEY
- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Determinand	Units	Ref	LOD	Commercial 1%		Sample Location	WS01	WS02	WS02
				Atrisk 2015 (No Free Product	Atrisk 2017	Depth Top	0.40	0.50-0.90	3.70
						Depth Base			
Cadmium	mg/kg	C	0.2		410		< 0.2	< 0.2	
Chromium (Hexavalent)	mg/kg	B/C	1.8	49.1	19.7		< 1.8	< 1.8	
Copper	mg/kg	A+	1.0		106000		450.0	330.0	
Mercury	mg/kg	A/D	0.3		350		0.3	< 0.3	
Nickel	mg/kg	A+	1.0		1770		33.0	38.0	
Lead	mg/kg	C	1.0		2310		230.0	110.0	
Zinc	mg/kg	A+	1.0		1100000		110.0	100.0	
Vanadium	mg/kg	A+	1.0		7490		29.0	46.0	
Arsenic	mg/kg	C	1.0		635		66.0	36.0	
Selenium	mg/kg	A	1.0		13000		< 1.0	< 1.0	
Cyanide (Free)	mg/kg	A	1.0		373		< 1.0	< 1.0	
Total Phenols	mg/kg	A	1.0		685		< 1.0	< 1.0	
Naphthalene	mg/kg	A+	0.05	90.1	75		1.10	2.90	
Acenaphthylene	mg/kg		0.05				0.15	0.08	
Acenaphthene	mg/kg	A+	0.05	83600	156.8		0.82	1.7	
Fluorene	mg/kg	A+	0.05		66500		0.64	1.4	
Phenanthrene	mg/kg		0.05				6.6	11.0	
Anthracene	mg/kg	A+	0.05		535000		1.7	2.9	
Fluoranthene	mg/kg	A+	0.05		72200		10.0	13.0	
Pyrene	mg/kg	A+	0.05		54100		8.8	12.0	
Benzo[a]anthracene	mg/kg	A	0.05	131	1.71		4.7	6.0	
Chrysene	mg/kg	A	0.05	14000	0.44		4.9	6.4	
Benzo[b]fluoranthene	mg/kg	A	0.05	142	1.22		5.0	7.9	
Benzo[k]fluoranthene	mg/kg	A	0.05	1430	0.686		2.8	2.6	
Benzo[a]pyrene	mg/kg	B/C	0.05	76.3	26.1		4.9	6.9	
Indeno(1,2,3-c,d)Pyrene	mg/kg	A*	0.05	142	0.0614		2.6	3.4	
Dibenz(a,h)Anthracene	mg/kg	A	0.05	14.3	0.00393		0.69	0.81	
Benzo[g,h,i]perylene	mg/kg	A	0.05	1440	0.0187		2.9	3.7	
Total Of 16 PAH's	mg/kg		0.8				58.1	83.3	
Aliphatic TPH >C5-C6	mg/kg	A+	0.02	4490	327		< 0.020	< 0.020	< 0.020
Aliphatic TPH >C6-C8	mg/kg	A+	0.02	10400	157		< 0.020	< 0.020	< 0.020
Aliphatic TPH >C8-C10	mg/kg	A+	0.05	1370	82.4		< 0.050	< 0.050	< 0.050
Aliphatic TPH >C10-C12	mg/kg	A+	1.0	7900	49.9		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	mg/kg	A+	2.0	34000	20.9		3.50	6.10	< 2.0
Aliphatic TPH >C16-C21	mg/kg	A+	8.0		3620000		19.0	61.0	< 8.0
Aliphatic TPH >C21-C35	mg/kg	A+	8.0		3620000		120.0	1300.0	< 8.0
Aliphatic TPH >C35-C44	mg/kg		10.0						
Total Aliphatic Hydrocarbons	mg/kg		10.0				150.0	1300.0	< 10
Aromatic TPH >C5-C7	mg/kg	A+	0.01		12.5		< 0.010	< 0.010	0.012
Aromatic TPH >C7-C8	mg/kg	A+	0.01	27900	834		< 0.010	< 0.010	< 0.010

Rogers Geotechnical Services: Soil Screening Values Comparison Sheet

Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet

Job Number	C4137/24/E/6329
Job Name	Cummins Turbo Footbridge
Date	11/04/24
Client	Cummins Turbo Technologies

A = WS Atkins PLC, Atrisk Soil Screening Values.
A+ = Values updated June 2017.
A* = Atrisk's SSV is lower than i2's detectable limit for this compound.
B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.
C = Category 4 Screening Levels (C4SLs) based on 6% soil organic matter.
D = Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 102 should be used.

KEY
- Exceeds SSV
- Exceeds 2017, Below 2015
- Below limit of detection (LOD)

Determinand	Units	Ref	LOD	Commercial 1%		Sample Location	WS01	WS02	WS02
						Depth Top	0.40	0.50-0.90	3.70
						Depth Base			
Aromatic TPH >C8-C10	mg/kg	A+	0.05	2210	613		< 0.050	< 0.050	< 0.050
Aromatic TPH >C10-C12	mg/kg	A+	1.0	12300	369		< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	mg/kg	A+	2.0	41300	155		14.0	11.0	< 2.0
Aromatic TPH >C16-C21	mg/kg	A+	10.0		28400		93.0	49.0	< 10
Aromatic TPH >C21-C35	mg/kg	A+	10.0		28400		1200.0	170.0	< 10
Aromatic TPH >C35-C44	mg/kg		10.0						
Total Aromatic Hydrocarbons	mg/kg		10.0				1300.0	230.0	< 10
Total Petroleum Hydrocarbons	mg/kg		10.0						
pH			N/A				**9.70**	**9.60**	
Sulphate (2:1 Water Soluble) as SO4	mg/l		0.00125				300.0	730.0	
ACM Type			N/A						
Asbestos Identification	%						None	None	
ACM Detection Stage			N/A						
Moisture	%		0.01				11.00	9.50	23.00
Soil Colour			N/A						
Other Material			N/A						
Soil Texture			N/A						
Sulphate (Total)	%		0.005				0.20	0.29	
Organic Matter	%		0.1				**2.50**	**5.50**	

Appendix 5

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Commercial Landuse

Tox Data Report No.	Compound	Commercial (mg/kg)				Reference
	Metals	1% SOM		6% SOM		
3	Cadmium	410		410		C
4	Chromium VI	19.7	49.1	19.7	49.1	B/C
	Copper	106000		106000		A+
7	Mercury	350.00		405.00		A/D
8	Nickel	1770		1770		A+
	Lead	2310		2310		C
	Zinc	1100000		1100000		A+
	Vanadium	7490		7490		A+
	Semi and Non Metals					
1	Arsenic	635		635		C
10	Selenium	13000		13000		A
	Free Cyanide	373		373		A
9	Phenols (total)	685		3170		A
	Poly Aromatic Hydrocarbons	Free product	No free produc	Free product	No free product	
20	Naphthalene	75	90.1	432	1050	A+
	Acenaphthene	156.8	83600	106000		A+
	Fluorene	66500		72000		A+
	Anthracene	535000		544000		A+
	Fluoranthene	72200		72600		A+
	Pyrene	54100		54400		A+
	Benzo(a)anthracene	1.71	131	10.3	142	A
2	Chrysene	0.44	14000	2.64	14300	A
2	Benzo(b)fluoranthene	1.22	142	7.29	144	A
2	Benzo(k)fluoranthene	0.686	1430	4.12	1440	A
2	Benzo(a)pyrene	26.1	76.3	26.2	76.3	B/C
2	Dibenz(a,h)anthracene	0.00393	14.3	0.0236	14.4	A*
2	Indeno(1,2,3-cd)pyrene	0.0614	142	0.368	144	A*
2	Benzo(g,h,i)perylene	0.0187	1440	0.112	1450	A*
	Petroleum Hydrocarbons					
	Aliphatic C5-C6	327	4490	1100	29400	A+
	Aliphatic C6-C8	157	10400	769	98200	A+
	Aliphatic C8-C10	82.4	1370	476	14800	A+
	Aliphatic C10-C12	49.9	7900	297	69500	A+
	Aliphatic C12-C16	20.9	34000	126	139000	A+
	Aliphatic C16-C21	3620000		3620000		A+
	Aliphatic C21-C35	3620000		3620000		A+
	Aromatic C5-C7 (Benzene)	12.5		98		A+
	Aromatic C7-C8 (Toluene)	834	27900	4360	183000	A+
	Aromatic C8-C10	613	2210	3600	20800	A+
	Aromatic C10-C12	369	12300	2190	53800	A+
	Aromatic C12-C16	155	41300	65400		A+
	Aromatic C16-C21	28400		28400		A+
	Aromatic C21-C35	28400		28400		A+
	Others					
Asbestos						

A = WS ATKINS PLC, ATRISK SOIL SCREENING VALUES BASED ON 1% SOIL ORGANIC MATTER

A+ = Values updated June 2017.

A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.

B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.

C = Category 4 Screening Levels (C4SLs) based on 1% soil organic matter.

D - Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 7.95 should be used.