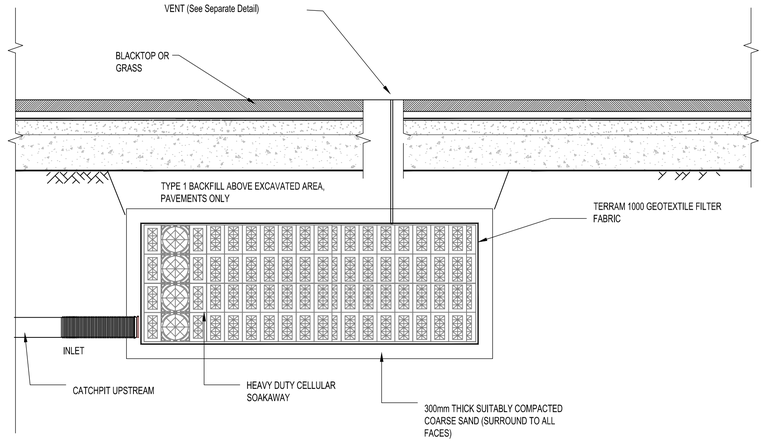
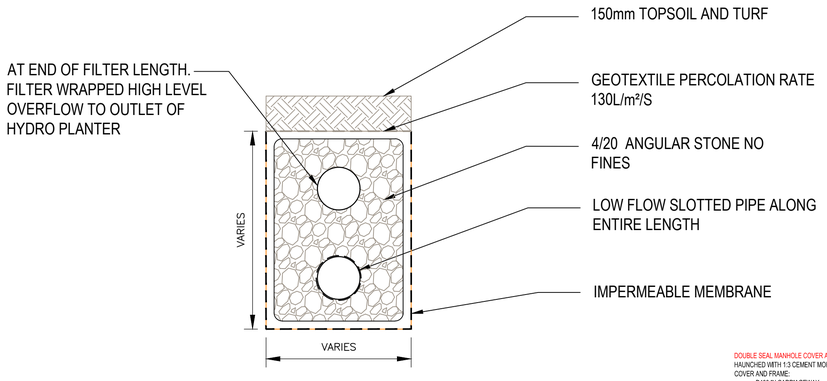


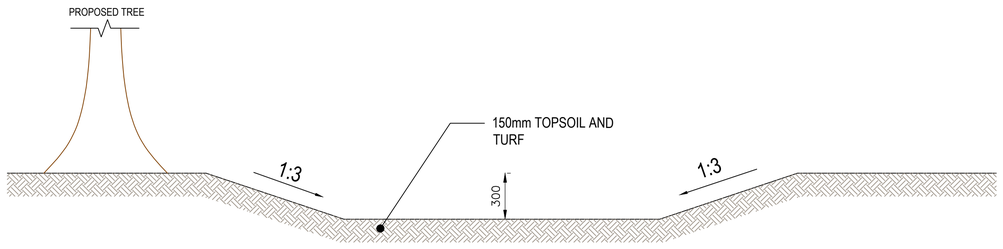
TYPICAL SECTION THROUGH FILTER TRENCH AND MH / IC
NTS



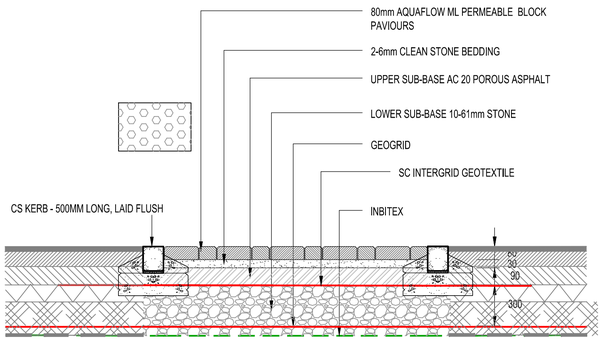
TYPICAL SECTION THROUGH STORAGE CELLS



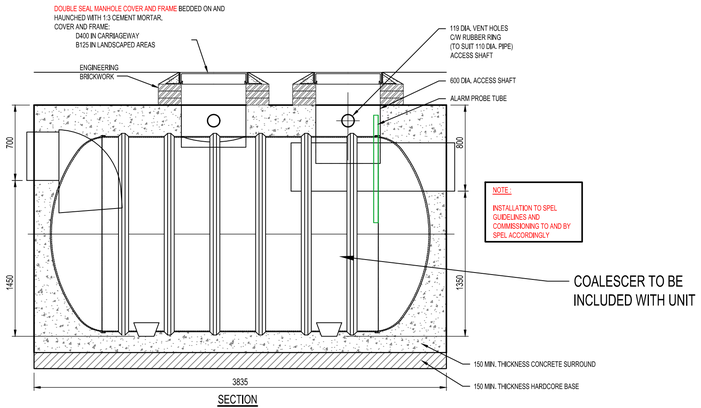
SECTION THROUGH FILTER DRAIN



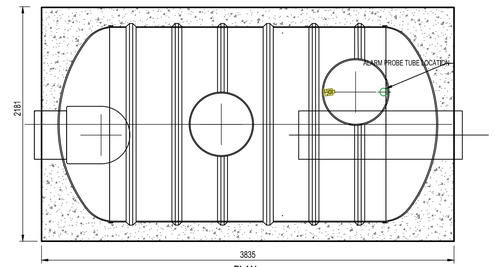
TYPICAL SECTION THROUGH RETENTION BASIN
NTS



PARKING BAYS PERMEABLE PAVING CONSTRUCTION SCALE 1:20

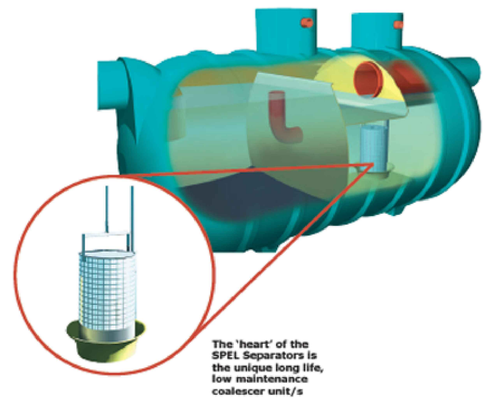


SECTION



PLAN

SPEL FSR SEPERATOR WITH TELEMETRY ALARM - FSR25C1
SCALE 1:20



NOTES

1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS DRAWINGS. ANY DISCREPANCIES FOUND BETWEEN INFORMATION SHOWN ON THIS OR ANY OTHER DRAWING SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY AND PRIOR TO WORKS COMMENCING ON SITE.

2. DO NOT SCALE FROM THIS DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

3. INVERT LEVELS OF EXISTING DRAINAGE & CONNECTIONS SHALL BE VERIFIED PRIOR TO ANY WORKS COMMENCING ON SITE. ANY DISCREPENCY SHALL BE REPORTED TO DRAINAGE ENGINEER IMMEDIATELY.

4. INVERT LEVELS GIVEN AT MANHOLES ON DRAWING ARE THAT OF THE LARGEST DIAMETER PIPE UNLESS OTHERWISE STATED.

5. ABOVE GROUND DRAINAGE DETAILS AND ROUTES ARE TO BE FINALISED BY OTHERS.

6. BEDDING DEPTHS APPLY TO FINISHED ROAD DEPTHS. CONTRACTOR TO PROVIDE ADEQUATE PROTECTION TO PIPES IF LOADED PRIOR TO FINISHING ROAD LAYERWORKS OR FIELD TOPSOIL.

7. ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH SEWERS FOR ADOPTION 7TH EDITION, BUILDING REGULATIONS NI 2012 PART N, AND OSMA DRAIN INSTALLATION SPECIFICATIONS.

8. ALL EXTERNAL DRAINAGE WORKS SHALL BE OSMA ULTRA RIB PIPEWORK, SPIGOT AND SOCKET WITH CONCRETE BED AND SURROUND IF COVER TO SOFFIT IS LESS THAN 900 IN ROADS AND 600 IN FIELDS.

9. RWP OUTLETS 100mm DIAMETER UNLESS OTHERWISE STATED ON DRAINAGE LAYOUT.

10. MINIMUM FOUL WATER DRAINAGE SHALL BE 110mm DIAMETER UNLESS OTHERWISE STATED.ALL FOUL SEWERS 150mm DIAMETER

11. ALL PIPEWORK SHALL JOIN AT SOFFIT LEVEL UNLESS OTHERWISE STATED ON DRAINAGE LAYOUT.

12. ALL CONCRETE WORK TO BE IN ACCORDANCE WITH BS 8110. CONCRETE TO MEET CLASS DS-2, ACEC CLASSIFICATION AC-1S AND ACHIEVE 100 YEAR EXPOSURE CLASS XS2. DETAILS OF CONCRETE SPECIFICATION ARE TO BE SUBMITTED AND APPROVED BY THE ENGINEER.

13. ALL GULLIES ARE TO BE TRAPPED AND TO BS. 5911. GRATINGS AND FRAMES ARE TO BE TO BS EN 124. GULLY CONNECTIONS ARE TO BE 150mm DIAMETER AND SHALL BE LAID IN TYPE Z BEDDING WHERE UNDER PROPOSED CARRIAGEWAY.

14. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ALL SERVICES THAT ARE AFFECTED BY THE PROPOSED WORKS ARE LOCATED PRIOR TO WORKS COMMENCING. TRIAL HOLES ARE TO BE DUG IF NECESSARY.

15. LINEAR CHANNEL OUTFALL TO HAVE UNIVERSAL GULLY AND SILT BUCKETS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

16. ALL ACCESS CHAMBER DEEPER THAN 1.2M AND LESS THAN 1.2M IN DIAMETER ARE TO BE FITTED WITH A 300MM DIAMTER REUCING ACCESS FITTING.

FIGURE 9

Rev.	Description	Date	By	Chkd
I1	INFORMATION ISSUE	19/09/24	LF	HBG

Glanville
Survey > Plan > Engineer
Civil Engineering · Highways Engineering · Structural Engineering · Building Surveying · Transport Planning · Geomatics
Hertfordshire | Oxfordshire | Cambridgeshire | Bristol

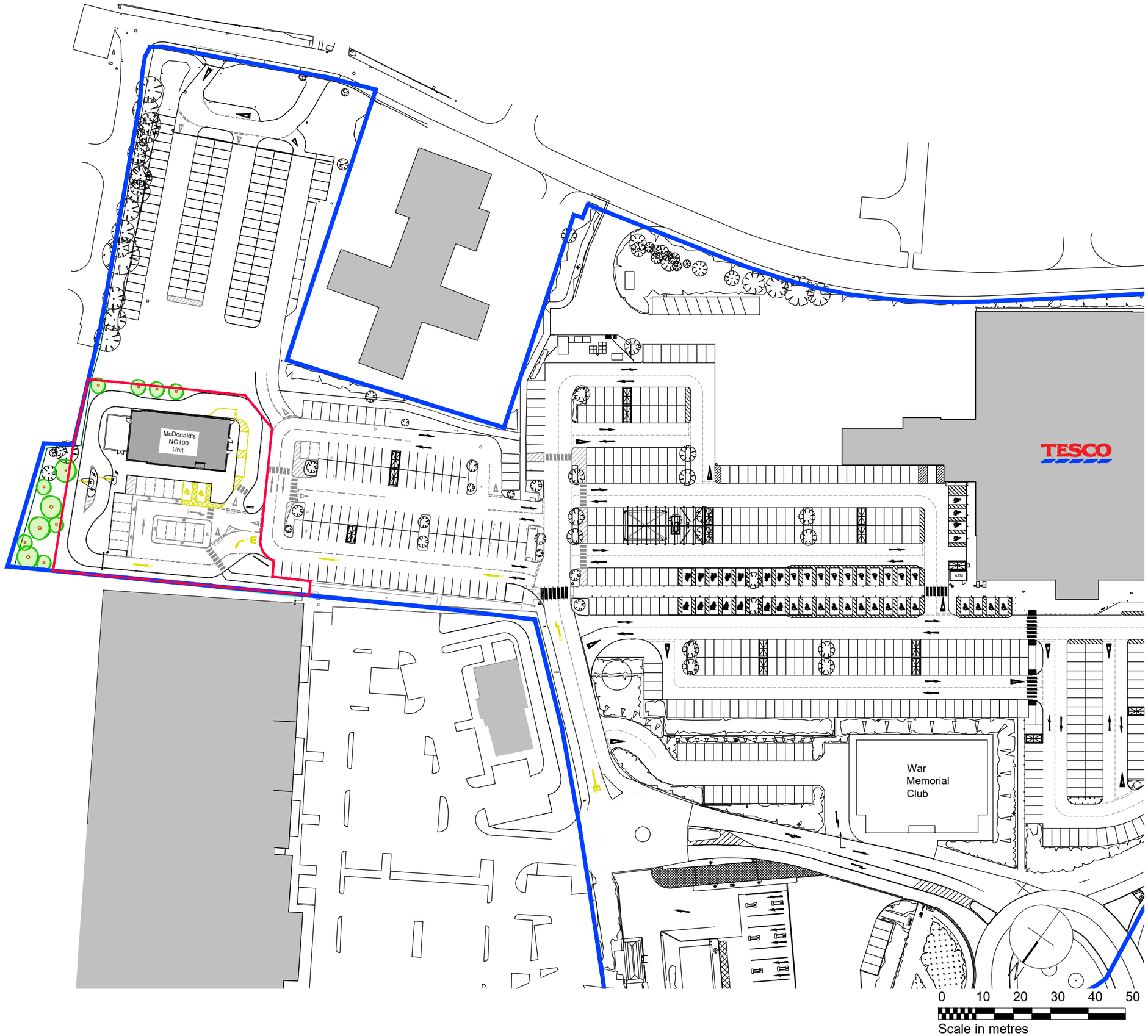
Client : McDonald's RESTAURANT

Project : McDONALD'S RESTAURANT
CRESCENT ROAD, WREXHAM
CLWYD, WALES, LL13 8HF

Title : PROPOSED DRAINAGE DETAILS

Engineer : HBG | Date : SEP '24
Director : HBG | Scale : AS SHOWN @A3
Status : INFORMATION

Drawing No. 4240121-SK12 | Rev I1



Scurr Architects
85 Southdown Road
Harpenden
Hertfordshire
AL5 1PR
T: 01582 793999
email: scurrs@scurr.co.uk
www.scurr.co.uk
architects ⊠ designers ⊠ project managers

Notes:
All drawings to be read in conjunction with all other drawings as noted on issue sheet.

Tesco Boundary (as per Existing Tesco Site Plan REF: 3433pg##)

Proposed McDonald's Demise = 0.69 Acres

REV.	DATE.	DRAWING REVISIONS.	BY.	CHECKED

GENERAL NOTES:
All works are to be undertaken in accordance with the Building Regulations and the latest British Standards.
All proprietary materials and products are to be used strictly in accordance with the manufacturer's recommendations.
All dimensions to be checked on site prior to construction.
All risks assessed to comply with the designer's responsibility under the Construction (Design Management) Regulations 2015.

PROPOSED DEVELOPMENT AT
Tesco, Crescent Road
WREXHAM LL13 8HF

STORE No :-
ST XXXX

ON BEHALF OF :-
McDonald's Restaurants Ltd

DRAWING TITLE :-
Site Feasibility Plan
NG100 Unit
Side by Side CODs

DRAWN BY	CHECKED BY	DRAWING No.
DM	-	7611-SA-8903-SK33
SCALE & SIZE	DATE	
1:1000@A3	NOV 2023	

NG100

Scurr Architects
85 Southdown Road
Harpenden
Hertfordshire
AL5 1PR
T: 01582 793999
email: scurrs@scurr.co.uk
www.scurr.co.uk
architects ⊠ designers ⊠ project managers

© Copyright McDonald's Restaurants & Scurr Architects

Appendix A

Geotechnical Data

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical



Phase III Geotechnical Assessment



Project Name: Wrexham

Location: Tesco, Crescent Rd, Wrexham

Client: Glanville Group Ltd

Project ID: JN1246

Report Date: 21 August 2024

Report Issue: 2

SUMMARY

The site is located off Crescent Road, approximately 1km to the north-east of Wrexham Town Centre in North Wales, extends to about 0.22 ha and comprises an operational car park bounded by fencing, with hedgerows and semi-mature trees. It is proposed to redevelop the site with a new single storey McDonalds, and associated soft landscaping, car park and access roads.

A Phase I desk study and Phase II preliminary investigation have been undertaken previously, under the same job number. The reader is referred to this report for more detail. These Phase III works targeted the revised build-print for the proposed development, and aimed to improve confidence in soakage assessment, the sub-grade shrinkage potential and the CBR value. Very limited additions contamination analysis was also carried out.

Geological records indicate that the site geology consists of Glaciofluvial Sheet Deposits over Salop Formation.

Five windowless sampler holes were drilled as part of these Phase III works (3.45-4.45m deep), with one gravel-filled trial pit soakaway excavated by JCB.

As before, the soils encountered comprised a construction layer of Blacktop over sub-bases, over Made Ground, to a maximum depth of 2.2m, over Sand. On the raised western verge (WLS12&13) hardstand and sub-bases were replaced by subsoils of reworked local brown sand.

Most of the geotechnical recommendations for the site have not changed and the reader is referred to the Phase II document for fuller details. The same applies to the contamination recommendations.

The cohesive made ground subsoils are shown to be low to non-shrinkable and the initial low VCP classification reported during the Phase II investigation should still prudently be adopted.

The soakaway test worked well, with triple discharge achieved, at an inferred rate of 1.08×10^{-5} m/s.

CBR probe array inferred an existing sub-base CBR of around 50%+ and a CBR of 6%+ for the Made Ground. The Made Ground sub-grades appear to be in good condition, but are without full engineering provenance. Settlements are likely to be limited unless ground levels are to be raised significantly.

Contamination analysis was limited to confirmation that coal tars are absent from the site asphalt, and that the natural substrate soakaway discharge medium at depth in trial pit S1 was free from any significant contamination. The additional sulphate analysis confirmed DS-1, AC-1s condition as reported in our earlier investigation.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Glanville Group. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd. believes are reliable. Nevertheless, Southern Testing Laboratories Ltd. cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The recommendations contained in this report are made in respect of the particular context of the investigation as described in the report and may not be appropriate to alternative development schemes. This report should be considered in its entirety and Southern Testing Laboratories Ltd accepts no responsibility for and excludes liability in respect of any omission or alteration made by others, and any use of the report for any purpose other than that for which it was produced.

Author	Chris Nolan BSc MSc	
Check / Review	Joe Kelly BSc PhD DIC	

For and on behalf of Southern Testing Laboratories Limited

DOCUMENT HISTORY AND STATUS

Issue No.	Date	Purpose or Status	Author	Check / Review
01	03/07/2024	Phase III Investigation Report	CN	JK
02	21/08/2024	Phase III (Nat Res Wales)	CN	JK

Copyright © 2024 Southern Testing Laboratories Ltd.

TABLE OF CONTENTS

A	**INTRODUCTION**		**2**
	1	Location	2
	2	Proposed Construction	2
	3	Object	2
	4	Scope	2
B	**DESK STUDY & PHASE II SUMMARY**		**3**
C	**GROUND INVESTIGATION**		**3**
	5	Strategy and Method	3
	6	Weather Conditions	3
	7	Soils as Found	4
	8	Groundwater Observations	4
D	**DISCUSSION OF GEOTECHNICAL TEST RESULTS AND RECOMMENDATIONS**		**4**
	12	Pavement Construction	6
	13	Chemical Analysis	7

TABLE OF APPENDICES

APPENDIX A
Site Plans and Exploratory Hole Logs

APPENDIX B
Field CBR & Soakage Test Results

APPENDIX C
Photographs

APPENDIX D
Laboratory Test Methods and Results

A INTRODUCTION

1 Location

The site is located off Crescent Road, approximately 1km to the north-east of Wrexham Town Centre in North Wales. The approximate National Grid Reference of the site is SJ 341 504.

2 Proposed Construction

It is proposed to construct a new single storey McDonald's restaurant with an associated car parking area, 'drive-thru' and areas of hard and soft landscaping. The intended build-print is approximately as indicated on Figure 2 in Appendix A.

3 Object

This is a Phase III supplemental geotechnical assessment. A desk study and Preliminary Phase II Investigation was undertaken for the site in May 2019 under the same job number. The reader is referred to this for more detail, although a summary is provided in section B.

The main objective of the investigation was to undertake some further geotechnical investigation in light of the revised build-print. This included a soakage test.

4 Scope

This report presents our Phase III Site Investigation findings, exploratory hole logs, laboratory test results and our interpretation of these data. A brief summary of the desk study and Phase II findings is also presented.

As with any site there may be differences in soil conditions between exploratory hole positions.

This report is not an engineering design and the figures and calculations contained in the report should be used by the Engineer, taking note that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the Engineer's design.

The ground/site investigation has been completed with reference to BS 5930 Ref [4] and BS 10175 Ref [5].

The reader is referred to the Phase I and II report for further details.

The findings and opinions conveyed via this investigation report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited. cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Glanville Group. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report are made in respect of the particular context of the investigation as described in the report and may not be appropriate to alternative development schemes. This report should be considered in its entirety and Southern Testing Laboratories Limited accepts no responsibility for and excludes liability in respect of any omission or alteration made by others, and any use of the report for any purpose other than that for which it was produced.

Detailed information on the proposed development, such as detailed final layout, loadings and serviceability limits was not provided. Accordingly, where geotechnical design advice is provided it is on the prescriptive basis allowed for by Eurocode 7: employing conventional and conservative design rules.

B DESK STUDY & PHASE II SUMMARY

A Phase I & II investigation has been carried out for the site, ref JN1246, dated 10th May 2019, to which the reader is referred for full details.

The desk study indicated that the site remained a field until the construction of the car park by 2003. The surrounding area has undergone significant development, including a large sand extraction pit along the north eastern boundary of the site. This represents a potential gas risk.

Geological records indicate that the site geology consists of Glaciofluvial Sheet Deposits over Salop Formation.

Glaciofluvial Sheet Deposits consist of material that has been transported, sorted and deposited by meltwater from a glacier or inland ice sheet. The meltwater collected in the ice and formed high velocity glacial rivers in tunnels and cracks leading out to the ice front. These rivers carried material ranging from clay particles to boulders. During transport in the glacial river, the particles were rounded and sorted.

The Salop Formation comprises red and red-brown mudstone, and red-brown (mostly sublitharenite) sandstone containing beds of pebbly sandstone and conglomerate itself containing Carboniferous limestone and chert clasts, and thin 'Spirobis' limestone beds and caliche in the lower part of the unit.

Intrusive investigation was undertaken comprising 8 No windowless sampler boreholes to a maximum depth of 5.00m bgl. The soils encountered comprised MADE GROUND (-0.5/1.9m) overlying medium-dense fine SAND (-5m+) with loose very clayey SAND bands [*only encountered within WLS1 & WLS2]*.

Pad & beam foundations were recommended for this site, transferring loads below any Made Ground, onto the natural sands beneath. DS-1, AC-1s concrete conditions would apply.

No significant contamination was identified relative to a commercial end-use, although ingress against natural radon and basic land gas protection was required.

C GROUND INVESTIGATION

5 Strategy and Method

This Phase III investigation targeted the reconfigured build-print and a full scale soakage test in the near vicinity of intended infrastructure. The works comprised the following:-

Activity / Method	Purpose	Max Depth Range (mbgl)	Installations / Notes
WLS 9-13	Windowless sampling to confirm bearing formation level for structure.	3.45-4.45 m	WLS12 & 13 were drilled on the slightly elevated landscaped area.
S1 soakaway	BRE 365 soakaway test.	1.2-3m	Gravel filled.
DCP CBR	Sub-grade CBR measurement at trial holes.	1.0 m	

The exploratory hole locations are shown on Figure 2 in Appendix A.

6 Weather Conditions

The fieldwork was carried out 29-30th May 2024, at which time weather was warm with light showers.

7 Soils as Found

The soils encountered are described in detail on the attached exploratory hole logs (Appendix A), but in general comprised a sequence of variable construction / Made Ground, over Clay, over sand. A summary is given below.

Depth (m)	Soil Type	Description
GL - 0.4/0.8	Construction or Verge	Typically 100mm asphalt over compact grey limestone aggregate. Island is deep topsoil over aggregate. Western landscape is topsoil and reworked local sand subsoils.
– 1.1/2.2	Fill	MADE GROUND composed of compacted dark grey mottled brown, silty, sandy CLAY, with occasional brick fragments.
– 4.45+	Sand	Loose to moderately compact buff brown silty fine SANDS.

The soil sequences observed were generally commensurate with the Phase II findings and infer a thorough placement of a thin fill blanket across the whole site. The aggregate below topsoil in the island might infer car park reconfiguration at some point.

8 Groundwater Observations

No groundwater was observed in any of the additional exploratory holes, to a maximum depth of 4.45m.

D DISCUSSION OF GEOTECHNICAL TEST RESULTS AND RECOMMENDATIONS

For full assessment reference must be made to the Phase II report. Only certain aspects have been supplemented and are reviewed as follows:-

8.1 Fill

The fill was encountered in all holes as compacted dark grey very sandy gravelly clays.

Two Atterberg limit results for this material from WLS9@1.5m and WLS11@1.0m, recorded a Plasticity Index of 9% and 10%, indicating a Low Volume Change Potential. Whilst granular fraction might downgrade the plasticity condition, prudent design should still consider low VCP commensurate with the majority of field descriptions for this material as cohesive.

8.2 Natural Sands

The fill was encountered in all holes as loose to moderately compact buff brown silty fine SANDS.

Three particle size distributions were established on these materials form holes 9, 11 & 12. Results indicate a medium grained sand with 6-30% fines fraction.

Findings are commensurate with the Phase 2 investigations, and the deeper natural substrate may be considered effectively non-shrinkable, below the overlying cohesive fill.

9 Soakaways

Soakage testing was carried out in S1. This tests indicated good infiltration as summarised in the table below.

9.1 Soakage Test Results

The BRE paper DG365, Ref [6] describes a method for site testing to determine soil infiltration rates at the proposed site of a soakaway. The in-situ test method is described in Appendix B.

The DG365 Ref [6], states that each pit should be allowed to drain three times to near empty, with filling on the same or consecutive days. This was rendered possible by gravel filling the pit to prevent side collapse on inundation. 40% air void was assumed in the calculation.

The infiltration rate from each trial hole is summarised in the table below. The soakage rate in this report in expressed as ℓ/m²/minute, which is a convenient rate to use. The BRE use a unit of m/sec, which is the value in l/m²/minute divided by 60,000.

Test ID	Test Depth (mbgl)	Design Infiltration Rate	
		ℓ/m²/minute	m/sec
S1	3.0m	0.952	$1.59x10^{-5}$
		0.808	$1.35x10^{-5}$
		0.649	$1.08x10^{-5}$

Note: The Design Infiltration Rate is the lowest of the three tests

9.2 General Guidance on Design of Soakaways

Any soakaway scheme may require the approval of Natural Resources Wales, Building Control and, where applicable, the adopting Highways Authority.

Soakaways are used to store the immediate surface water run-off from hard surfaced areas, such as roof or carparks, and allow for efficient infiltration into the adjacent soil. They should be designed to discharge their stored water sufficiently quickly to provide the necessary capacity to receive run-off from a subsequent storm. The time taken for discharge depends upon the soakaway shape and size, and the surrounding soil's infiltration characteristics.

Groundwater levels can vary considerably from season to season and year to year, often rising in wet or winter weather, and falling in periods of drought. As such, a high groundwater table may affect the storage capacity of soakaways. In addition, it should be noted that an unsaturated zone may be required between the base of soakaways and the groundwater table, by Natural Resources Wales. Longer term monitoring may be required to establish actual groundwater levels as part of the planning approval process.

The design of soakaways can be square, circular (conventional) or trench excavations, and they may be rubble filled, perforated precast concrete ring units, plastic cells or any similar structure that collects rainwater and run-off and allow discharge directly into the ground. Depending on the geological conditions, and depth at which suitable infiltration is achieved, soakaways can also be deep bored.

Long-term maintenance and inspection must be considered during the design and construction process. Maintenance of silt traps, gully pots and interceptors will improve the long-term performance of soakaways. The use of wet well chambers within the soakaway system can further assist in pollutant trapping and extending the operating life of soakaways.

Generally, roof and surface run-off should not significantly impact on groundwater quality and subject to appropriate approvals from Natural Resources Wales could be discharged directly to soakaways. However, although again subject to approvals from Natural Resources Wales, paved surface run-off for larger trafficked areas should generally be passed through a suitable form of oil interception device prior to discharge to the soakaway.

Care must be taken to ensure that the discharge of large volumes of surface run-off into the soil does not disrupt the existing sub-surface drainage patterns. Similarly, in areas of sloping topography, consideration should be given to the siting of soakaways to avoid potential discharge and or flooding of down slope areas.

10 Sulphates and Acidity

Chemical analysis of selected soils has been undertaken to establish the aggressive chemical environment for concrete in accordance with the BRE Special Digest 1, Ref [7].

5 No. additional samples were analysed for BRE SD1 suite B.

Oxidisable sulphides are calculated as being < 0.3% in all of samples.

Therefore pyrite is not considered to be potentially present and water extract of SO^4 is used to determine the site characteristic. Each water extract of SO4 is <500 mg/l.

In accordance with SD1, Table C, the Design Sulphate Class is **DS-1.**

Groundwater should be assumed to be mobile and the recorded pH values are in the range 5.2-7.9 (slightly acid to neutral). The corresponding ACEC class is therefore **AC-1s.**

Conditions are therefore similar to findings of the Phase II investigation.

11 Foundation Bearing Formation

The depth to bearing formation is schematically represented as Figure 3. Foundation design recommendations are discussed fully in the Phase II document, to which the reader is referred.

12 Pavement Construction

DCP CBR probes were undertaken at 5 trial hole locations. Driven from surface, a continual CBR with depth is attained down to 1m or refusal. The full results are appended and the lowest value attained for each of the horizons is tabulated below:-

Location	WLS13	WLS12	WLS11	WLS9	S1
Sub-base			67	155	373
Subgrade	9.3	6.1	20		22

The existing sub-base construction appears to be robust with 200-340mm of compacted quarrystone displaying good CBR values and inclusive of geo-grid and geotextile evidence in trial holes.

Based on the available data, it is anticipated that the sub-grade formation to proposed pavement areas will otherwise comprise of silty sandy clayey gravel and gravelly clay Made Ground.

The results of in-situ DCP CBR testing generally indicated sub-grade CBR values in the range of 6.1-22%. However, it should be noted that CBR readings can vary significantly depending on a number of factors, including the moisture content of the soil and this can in turn vary depending on the weather and other site conditions leading up to and during testing.

The results of Atterberg Limits tests on the cohesive fill materials indicate plasticity indices in the range of 9-10%. On the basis of guidance in the DMRB Ref [6], a CBR value of about 2.5% is estimated for a thin pavement construction for poor construction conditions with a low water table.

As discussed, full provenance is not available as to the engineered placement of the fill sub-grades at the site, and irrespective of the preliminary CBR data obtained, a design CBR of <2% would normally be prudently advised for hardstand design. Deep fill sub-grades underlie the site and hardstand construction should consider geo-grid reinforced design, with allowances for potential long term maintenance issues. Raising of levels should be avoided if settlements are to be mitigated.

Taking these factors into consideration, a preliminary design CBR value of 2% can be assumed for pavement foundation design purposes. However, given that the soils are likely to be disturbed by heavy plant during demolition and construction, it would be suggested that the CBR value is reassessed as construction progresses. Further sampling and laboratory testing may be necessary to satisfy Local Highway Authority design guidance, in terms of frequency and types of testing, if roads are to be submitted for adoption. Given the made ground status of the soils and the potential for marked variations in settlement characteristics from place to place, a geo-grid reinforced or lime/cement stabilised pavement construction should be considered.

The specialist contractor would be best placed to advise on the relative merits of the various systems available and on the suitability of the soils for the various treatments.

The most important element of any road construction is drainage and attention must be given not only to the drainage of the subsoil but to the various layers of construction. To this end, the formation should be shaped to a camber or crossfall to allow water movement out of the sub-base. Silty soils soften extremely quickly if allowed to become wet, or if they are excavated below the water table, and this softening can give rise to a very substantial increase in costs.

Sub-base and coarse capping materials tend to segregate during placing operations, particularly when end-tipped. On soft clay sub-grades this can lead to punching and softening of the formation. The use of an appropriate geo-textile or geo-fabric, laid in accordance with manufacturer's recommendations / guidance, should help to minimise this.

The formation should be proof-rolled in a manner appropriate to the sub-grade soils, and any soft spots found should be excavated and replaced with compacted granular material. The surface of the formation should then be appropriately compacted, prior to laying the capping layer and/or sub-base.

Construction traffic should be kept off formations and it is often advisable to leave a protective layer of soil above formation level until the last moment, before reducing to formation level and placing the capping and/or sub-base.

The formation should be considered potentially frost-susceptible.

13 Chemical Analysis

Along with the sulphate analysis reviewed in section 10 above, some additional contamination testing was undertaken.

The first test was a general suite undertaken on a sample of the natural sand subgrade in the location of the intended soakaway infrastructure. No elevated concentrations for a range of heavy metals, speciated PAHs and petroleum hydrocarbons were recorded above what might be considered natural background levels. This concurs with the visual and olfactory evidence. Provided the discharge media is the natural sands below the shallow fills, and there is no evidence of any impact, the contamination risk will be low.

The second analysis was precautionary screening of the site asphalt recovered from WLS9 & 10 for coal tars. None were recorded, and the data may be provided to receiving tips (along with all others from the Phase II investigation) for waste stream assessment.

REFERENCES

[1] BSI Standards, “BS 5930 Code of practice for ground investigations,” 2015.

[2] BSI Standards, “BS10175 Investigation of potentially contaminated sites – Code of practice,” 2013.

[3] Building Research Establishment (BRE), “DG365 Soakaway Design,” 2016.

[4] Building Research Establishment (BRE), “SD1 Concrete in aggressive ground,” 2005.

[5] Highways England, “Pavement Design CD 225 Design for new pavement foundations (Rev 1) (formerly IAN 73/06 revision 1 (2009), HD 25/94).”.

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical

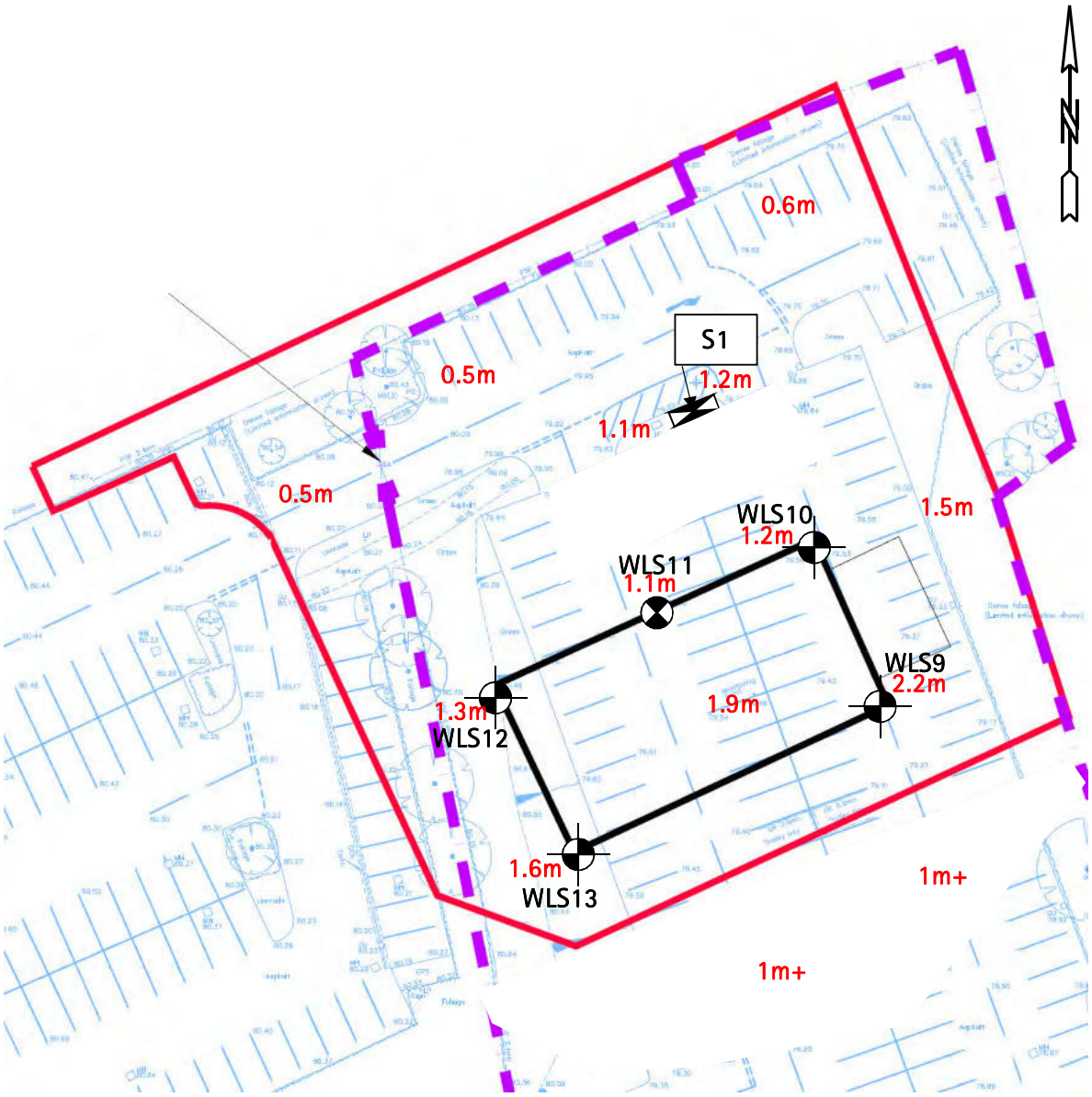


APPENDIX A

Site Plans and Exploratory Hole Logs



A



NB: Positions of Boreholes and/or Trial Pits are only indicative

Site:	Tesco Wrexham	STL: JN1246	Fig No: 1
Date:	29th May 2024	Made Ground Depths	

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

ST Consult

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical

Key to Exploratory Hole Logs, Plans and Sections

Backfill Symbols		Pipe Symbols		Principal Soil Types		Principal Rock Types		Drilling Records	
Arisings		Plain Pipe		Topsoil		Mudstone		Water Strike	
Concrete		Slotted Pipe		Made Ground		Claystone		Depth Water Rose	
Blacktop		Piezometer		Clay		Siltstone		Total Core Recovery (%) [TCR]	
Bentonite		Piezometer Tip		Silt		Sandstone		Solid Core Recovery (%) [SCR]	
Gravel Filter		Filter Tip		Sand		Limestone		Rock Quality Index (%) RQD]	
Sand Filter		Extensometer		Gravel		Chalk		Fracture Index (fractures / m) [FI]	
		Inclinometers		Peat					

All soil and rock descriptions are in general accordance with BS5930 2015, BS EN ISO 14688-1:2002+A1:2013 and BS EN ISO 14689-1:2003. Chalk descriptions are also based on CIRIA C574 and "Logging the Chalk – R.N. Mortimer 2015". The Geology Code is only provided where a positive identification of the sample strata has been made.

Location / Method Identifiers	
BH	Borehole (undefined)
CP	Cable Percussive
RC	Rotary Core
RO	Rotary Open Hole
ODC	Rotary Odex/Symmetrix drilling cased
CP+RC	Cable Percussive to Rotary Core
SNC	Sonic
CFA	Continuous Flight Auger
FA	Flight Auger
VC	Vibro Core
WLS+RC	Windowless (Dynamic) Sampler to Rotary Core
WLS	Windowless Sampler
WS	Window Sampler
HA	Hand Auger
C	Road / Pavement Core
IP	Inspection Pit (Hand Excavation)
TP	Trial Pit (Machine Excavated)
OP	Observation Pit (Supported Excavation Hand or Machine)

In-situ Test Location / Method	
DP	Dynamic Probe
CPT	Cone Penetration Test
CBR	In-situ CBR Test
DCP	CBR using Dynamic Cone Penetrometer
CBRT	CBR using TRL Probe
PB	Plate Bearing Test
SPT (S)	Standard Penetration Test (Split Barrel Sampler)
SPT (C)	Standard Penetration Test (Solid Cone)
N	SPT Result
-/-	Blows/Penetration (mm) after seating drive
-*/-	Total Blows / Penetration (mm)
( )	Extrapolated Value
PPT	Perth Penetration (In-House Method - Equivalent N Value)
HP / UCS	Strength from Hand Penetrometer (kN/m^2)
IVN	Strength from Hand Vane ((kN/m^2) P = peak, R = residual
PID	Photo Ionisation Detector (ppm)
MEXE	Mexi-Cone CBR (%)

Samples / Test Type	
B	Bulk Sample
BLK	Block Sample
C	Core Sample
CBRS	CBR Mould Sample
D	Small Disturbed Sample
ES	Environmental Sample (Soil)
EW	Environmental Sample (Water)
GS	Environmental Sample (Gas)

Samples / Test Type	
SPTLS	Standard Penetration Test Split Barrel Sample
TW	Thin Wall Push In Sample (e.g. Shelby Sampler)
U	Undisturbed Open Drive Sample (blows to take)
UT	Thin Wall Undisturbed Open Drive Sample (blows to take)
W	Water Sample (Geotechnical)
SP	Sample from Stockpile
P	Piston Sample
AMAL	Amalgamated Sample

Southern Testing ST Consult

Start - End Date:	Project ID:	Hole Type:	S1
29/05/2024	JN1246	WS	Sheet 1 of 1

Client:	Glanvilles	Co-ordinates:	Level (m AOD)	Logger:

Project Name:	Tescos Wrexham	Location:	Crescent Rd, Wrexham

Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type/FI	Results	Window Run				
		0.30	ES				(0.55)		MADE GROUND:- Brown silty clayey sand topsoil. Some cobbles sandstone and concrete.
						0.55	(0.20)		MADE GROUND:- Moderately compact grey MOT limestone aggregate. Terram at base.
						0.75	(0.45)		MADE GROUND:- Moderately compact dark grey silty sandy gravelly clay including brick, tile, wire and glass fragments.
						1.20	(1.80)		Medium dense brown silty fine SAND.
		1.80	ES SPT	N=9 (2,2/2,2,2,3)					
						3.00			End of Borehole at 3.00m

Remarks:

1.6m long gravel filled soak

Status:		Log Print Date and Time:	10/06/2024 11:32	Log Approved By:	

Southern Testing ST Consult	Start - End Date:	Project ID:	Hole Type:	WLS9
	29/05/2024	JN1246	WS	Sheet 1 of 1

Client:	Glanvilles	Co-ordinates:	Level (m AOD)	Logger:

Project Name:	Tescos Wrexham	Location:	Crescent Rd, Wrexham

Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type/FI	Results	Window Run					
		0.06	ES			0.11	(0.11)		ASPHALT	
							(0.34)		MADE GROUND:- Moderately compact grey limestone MOT aggregate. Geogrid at base.	
						0.45			MADE GROUD:- moderately compact dark grey silty sand and clay with abundant gravel including sandstone. brick and clinker.	
		1.00	SPT	N=19 (3,5/4,5,6,4)						1
							(1.75)			
		1.50	ES							
		2.00	SPT	N=14 (4,5/4,3,3,4)						2
						2.20			Medium dense buff brown silty fine to medium SAND. From 3m becoming moister SILT & SAND.	
		3.00	SPT	N=20 (3,2/3,5,6,6)						3
							(2.25)			
		4.00	SPT	N=15 (2,4/4,4,3,4)						4
		4.45	D			4.45			End of Borehole at 4.45m	
										5

Remarks:

Status:		Log Print Date and Time:	10/06/2024 11:32	Log Approved By:	

Southern Testing ST Consult

Start - End Date:	Project ID:	Hole Type:	WLS10
29/05/2024	JN1246	WS	Sheet 1 of 1

Client:	Glanvilles	Co-ordinates:	Level (m AOD)	Logger:

Project Name:	Tescos Wrexham	Location:	Crescent Rd, Wrexham

Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type/FI	Results	Window Run				
		0.05	ES			0.10	(0.10)		ASPHALT.
							(0.30)		MADE GROUND:- Moderately compact to compact grey limestone MOT aggregate. Terram & geogrid at base.
						0.40			MADE GROUND:- Moderately compact dark grey silty sandy clay with gravel including brick and shale.
		1.00	ES SPT	N=22 (4,4/3,5,8,6)			(0.80)		
						1.20			Medium dense brown silty fine SAND. Initially dark brown.
		2.00	SPT	N=15 (2,4/4,4,5,2)			(2.25)		
		3.00	SPT	N=7 (2,2/1,1,2,3)					
		3.45	D			3.45			End of Borehole at 3.45m

1 2 3 4 5

Remarks:

Status:		Log Print Date and Time:	10/06/2024 11:32	Log Approved By:	

Southern Testing ST Consult

Start - End Date:	Project ID:	Hole Type:	WLS11
29/05/2024	JN1246	WS	Sheet 1 of 1

Client:	Glanvilles	Co-ordinates:	Level (m AOD)	Logger:

Project Name:	Tescos Wrexham	Location:	Crescent Rd, Wrexham

Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type/FI	Results	Window Run					
						0.08	(0.08)		ASPHALT	
									MADE GROUND:- Moderately compact grey limestone MOT aggregate. Geogrid at base.	
						0.40	(0.32)			
									MADE GROUND:- Moderately compact dark grey silty sandy topsoil material including brick clinker and sandstone.	
		1.00	ES SPT	N=14 (3,5/5,3,3,3)		1.10	(0.70)			1
									Medium dense brown silty fine SAND with occasional rootlets.	
		2.00	SPT	N=9 (3,2/2,1,3,3)		1.90	(0.80)		Medium dense buff fine to medium SAND.	2
		2.50	D							
		3.00	SPT	N=7 (2,2/2,1,2,2)			(1.55)			3
						3.45			End of Borehole at 3.45m	4
										5

Remarks:

Status:		Log Print Date and Time:	10/06/2024 11:32	Log Approved By:	

Southern Testing ST Consult	Start - End Date:	Project ID:	Hole Type:	WLS12
	29/05/2024	JN1246	WS	Sheet 1 of 1

Client:	Glanvilles	Co-ordinates:	Level (m AOD)	Logger:

Project Name:	Tescos Wrexham	Location:	Crescent Rd, Wrexham

Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type/FI	Results	Window Run					
		0.10	ES			0.20	(0.20)		Topsoil & Turf	
									MADE GROUND:- Loose to moderately compact reworked brown silty fine sand.	
						0.80	(0.60)			
		1.00	SPT	N=22 (3,5/5,6,5,6)					MADE GROUND:- Moderately compact dark grey silty sandy clay including brick sandstone and clinker.	1
						1.30	(0.50)			
		1.50	D						Medium dense brown silty fine SAND.	
						1.90	(0.60)			
		2.00	SPT	N=8 (2,1/2,1,2,3)					Medium dense buff fine to medium SAND.	2
							(1.55)			
		3.00	SPT	N=10 (2,1/2,2,2,4)						3
		3.45	D			3.45			End of Borehole at 3.45m	
										4
										5

Remarks:

Status:		Log Print Date and Time:	10/06/2024 11:32	Log Approved By:	

Southern Testing ST Consult	Start - End Date:	Project ID:	Hole Type:	WLS13
	29/05/2024	JN1246	WS	Sheet 1 of 1

Client:	Glanvilles	Co-ordinates:	Level (m AOD)	Logger:

Project Name:	Tescos Wrexham	Location:	Crescent Rd, Wrexham

Well	Water Strikes	Samples and Insitu Testing			Progress	Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type/FI	Results	Window Run				
						0.20	(0.20)		Topsoil & Turf.
						0.65	(0.45)		MADE GROUND:- Reworked natural brown sand.
		1.00	ES SPT	N=26 (2,4/4,6,7,9)		1.60	(0.95)		MADE GROUND:- Moderately compact grey silty sandy gravelly clay topsoil material. Including sandstone, clinker and brick fragments.
						1.90	(0.30)		Medium dense brown silty fine SAND.
		2.00	SPT	N=9 (1,2/2,2,2,3)					Medium dense buff fine to medium SAND.
		3.00	ES SPT	N=8 (1,1/2,1,2,3)		3.45	(1.55)		End of Borehole at 3.45m

Remarks:

Status:		Log Print Date and Time:	10/06/2024 11:32	Log Approved By:	

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical



APPENDIX B

Field CBR & Soakage Test Results



B

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

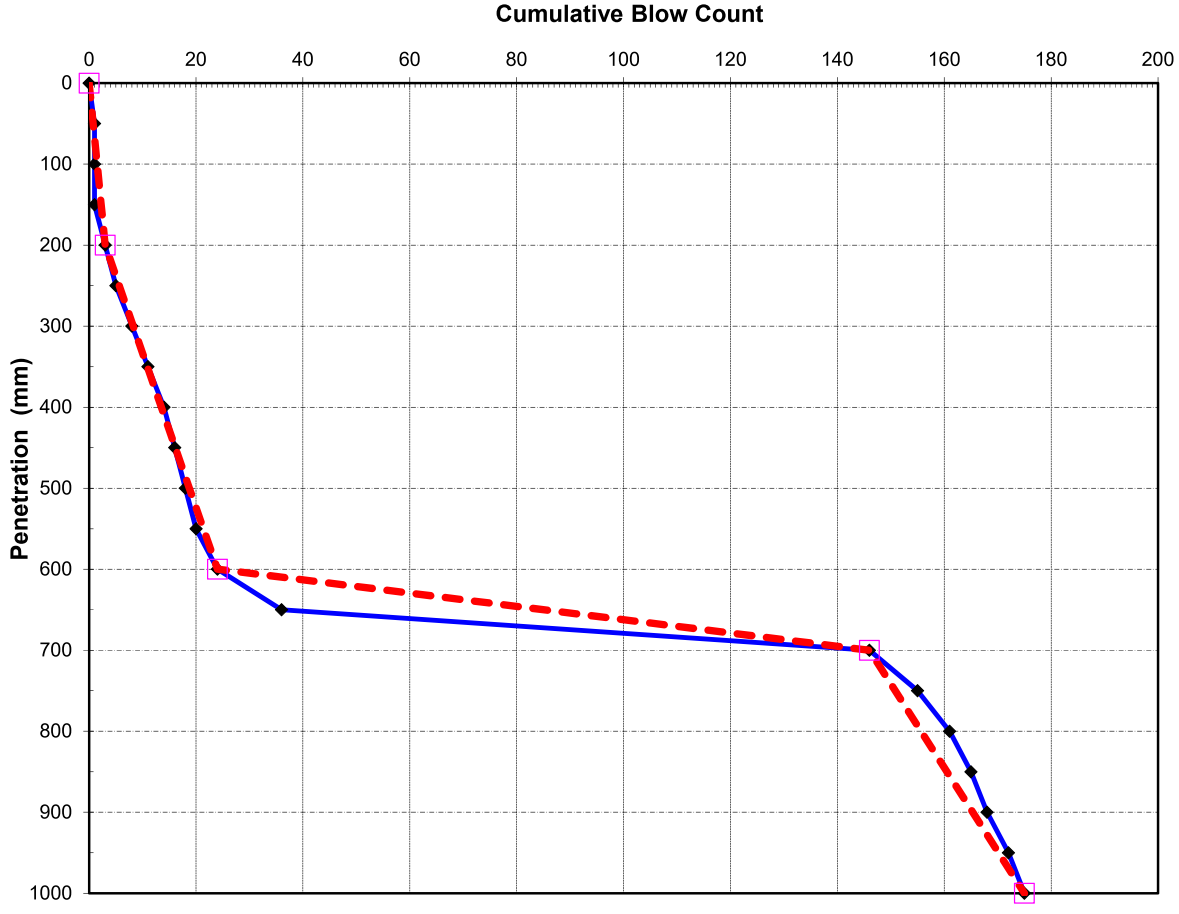
ST Consult

Dynamic Cone Penetrometer (DCP) Test Results

Test No: S1

Chainage:		Tested By:	ES
Start Layer:	Turf	Checked By:	CN
Soil Condition:		Test Date:	29-May-24
Notes:			

Perth Cone CBR Penetration *vs* Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From *(mm)*	To *(mm)*	Depth *(mm)*	Blow Count	No. of Blows	DCP *mm/blow*	CBR *%*	Soil Type	Remarks
1	0	200	200	3	3	66.7	2.0		
2	200	600	400	24	21	19.0	9.9		
3	600	700	100	146	122	0.8	373		
4	700	1000	300	175	29	10.3	22		

Client:	**Glanville**		**Job No:**	JN1246	
Site:	**Wrexham**		**Date:**	29/05/2024	**Fig.**

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

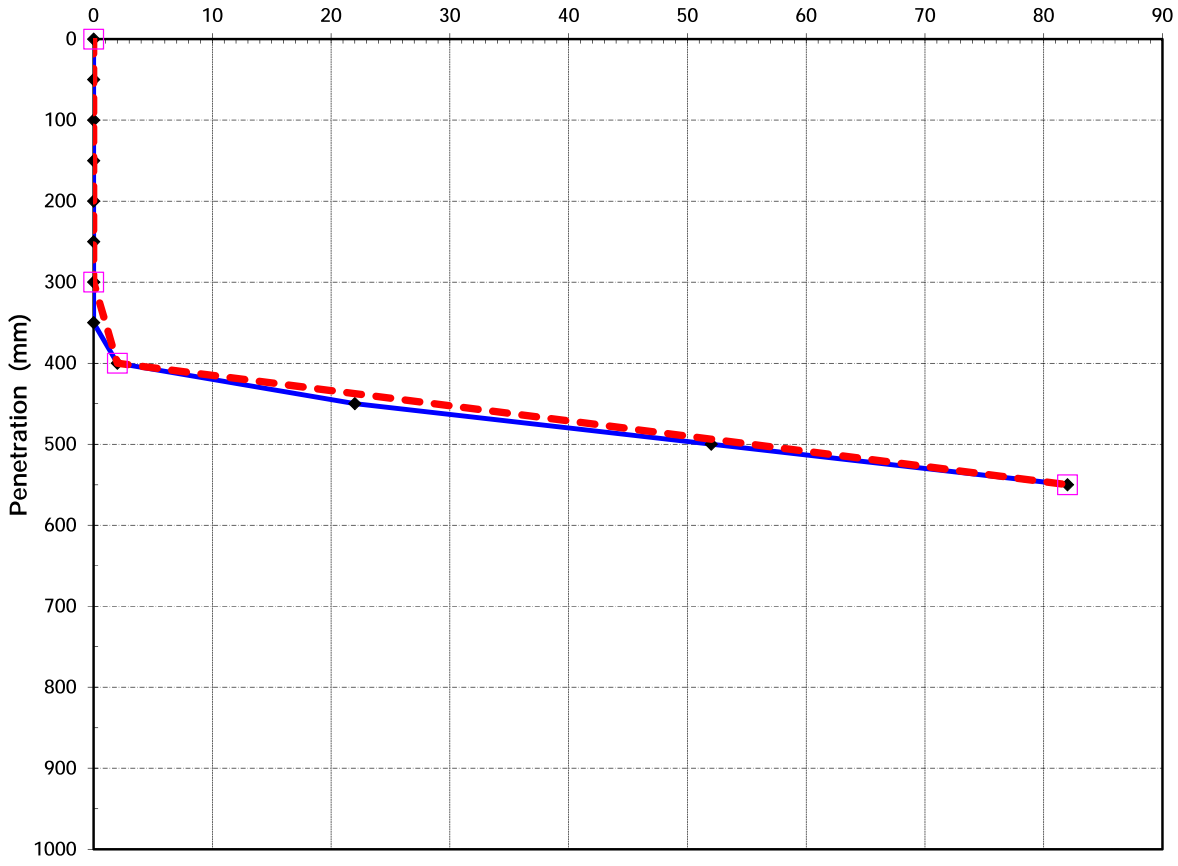
Dynamic Cone Penetrometer (DCP) Test Results

Test No: WLS9

Chainage:
Start Layer: Subbase
Soil Condition:
Notes:

Tested By: ES
Checked By: CN
Test Date: 29-May-24

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	0	300	300	0	0	0.0	0.0		
2	300	400	100	2	2	50.0	2.9		
3	400	550	150	82	80	1.9	155		

Client:	Glanville	Job No:	JN1246	
Site:	Wrexham	Date:	29/05/2024	Fig.

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

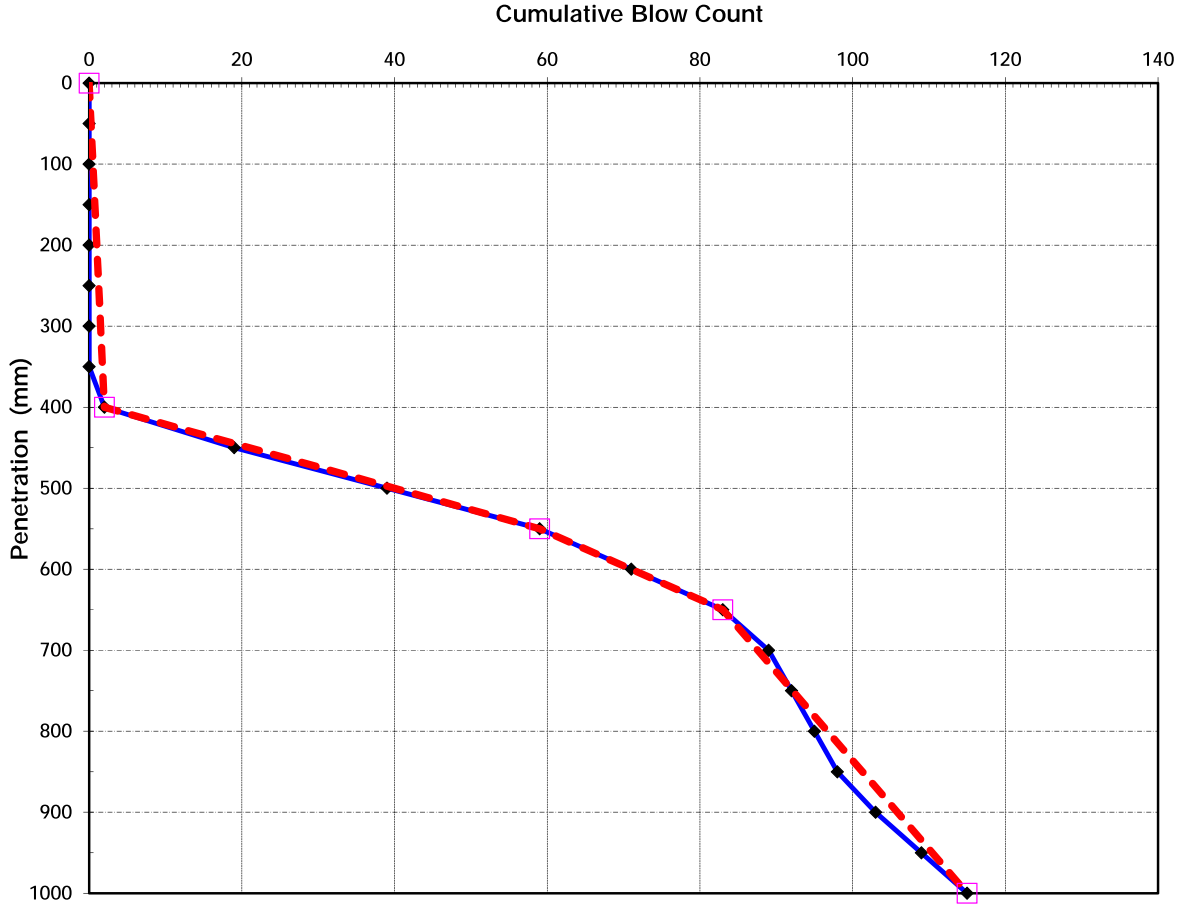
ST Consult

Dynamic Cone Penetrometer (DCP) Test Results

Test No: WLS11

Chainage:		Tested By:	ES
Start Layer:	Subbase	Checked By:	CN
Soil Condition:		Test Date:	29-May-24
Notes:			

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	0	400	400	2	2	200.0	0.5		
2	400	550	150	59	57	2.6	109		
3	550	650	100	83	24	4.2	67		
4	650	1000	350	115	32	10.9	20		

Client:	Glanville		Job No:	JN1246	
Site:	Wrexham		Date:	29/05/2024	Fig.

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

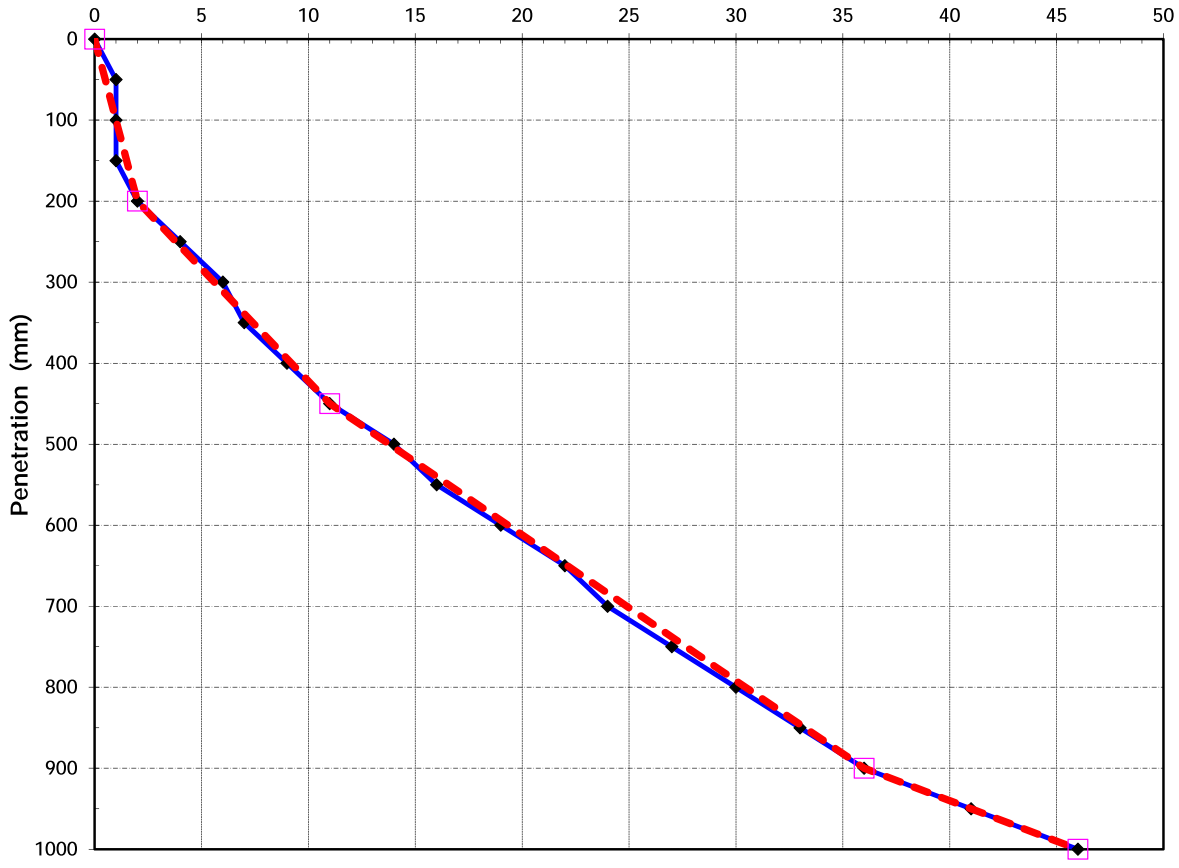
ST Consult

Dynamic Cone Penetrometer (DCP) Test Results

Test No: WLS12

Chainage:		Tested By:	ES
Start Layer:	Turf	Checked By:	CN
Soil Condition:		Test Date:	29-May-24
Notes:			

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	0	200	200	2	2	100.0	1.2		
2	200	450	250	11	9	27.8	6.1		
3	450	900	450	36	25	18.0	11		
4	900	1000	100	46	10	10.0	22		

Client:	Glanville	Job No:	JN1246	
Site:	Wrexham	Date:	29/05/2024	Fig.

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

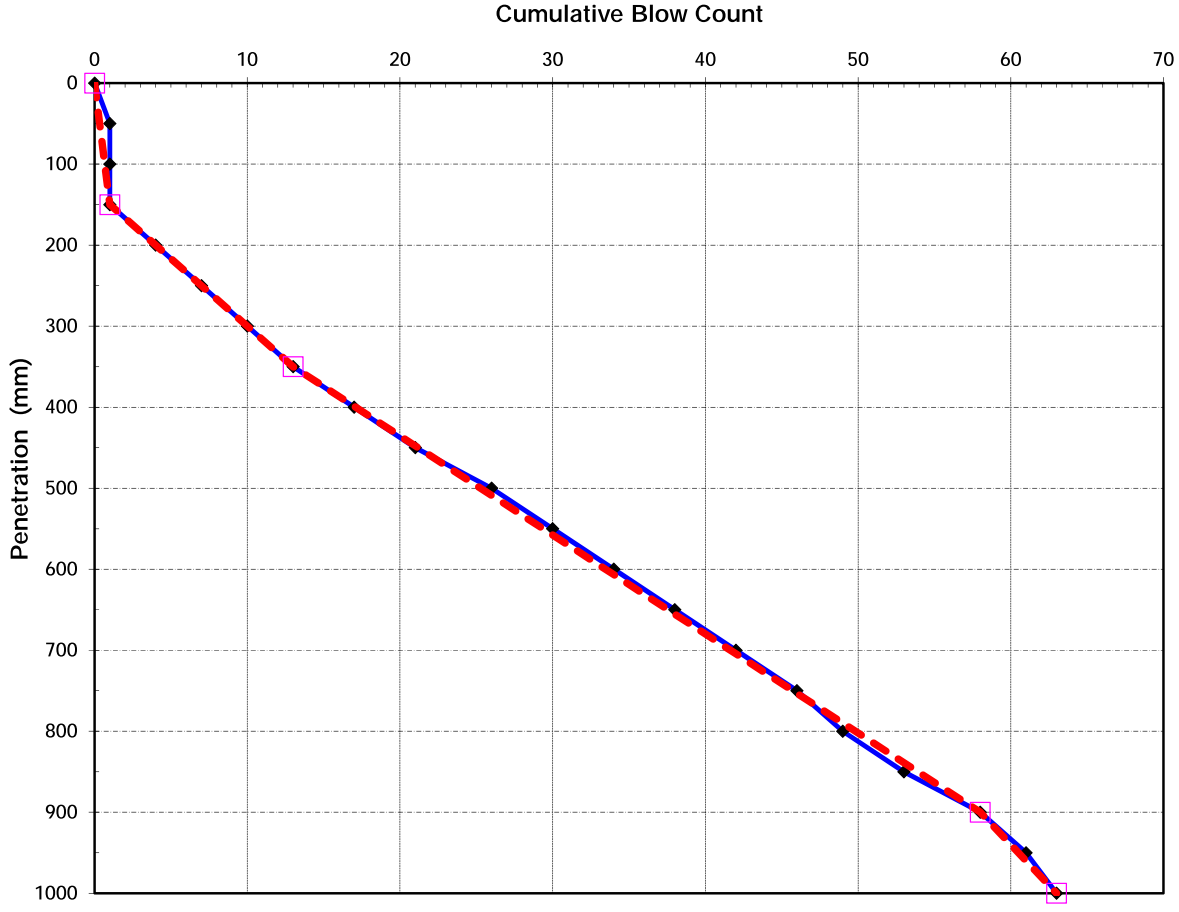
ST Consult

Dynamic Cone Penetrometer (DCP) Test Results

Test No: WLS13

Chainage:		Tested By:	ES
Start Layer:	Turf	Checked By:	CN
Soil Condition:		Test Date:	29-May-24
Notes:			

Perth Cone CBR Penetration vs Cumulative Blow Count



Evaluated CBR Values from DCP Test Results

Layer No	From (mm)	To (mm)	Depth (mm)	Blow Count	No. of Blows	DCP mm/blow	CBR %	Soil Type	Remarks
1	0	150	150	1	1	150.0	0.7		
2	150	350	200	13	12	16.7	12		
3	350	900	550	58	45	12.2	17		
4	900	1000	100	63	5	20.0	9.3		

Client:	Glanville	Job No:	JN1246	
Site:	Wrexham	Date:	29/05/2024	Fig.

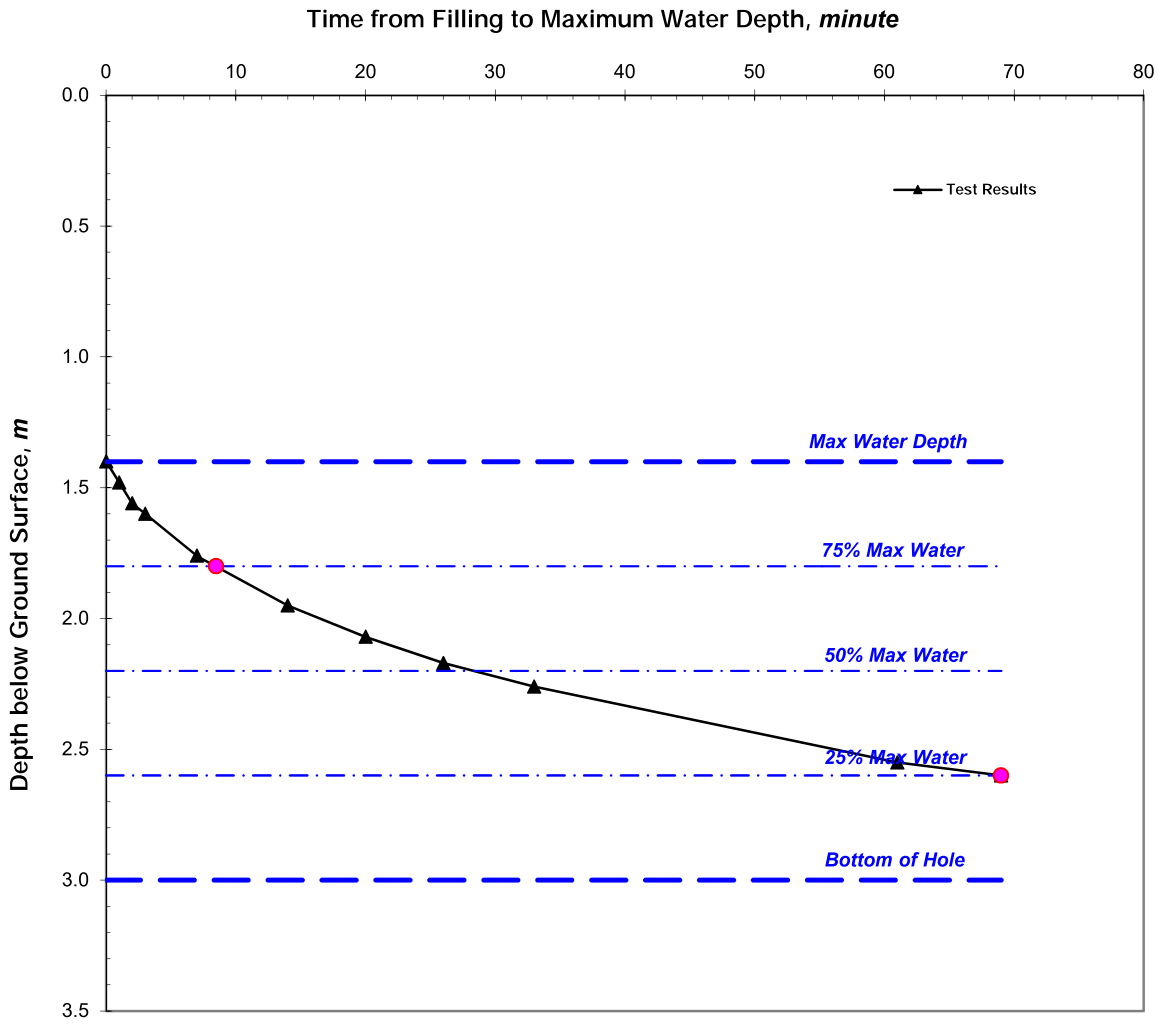
Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

ST Consult

BRE Digest DG365 Soakage Test

Test Hole No: S1
Test No: Test No 1 (Initial)



Pit Length, m	1.600	Depth to Water at Start of Test, *m*	1.400
Pit Width, m	0.450	Max Water Dropdown during Test, *m*	1.200
Depth to Pit Base, m	3.000	Total Soakage Test Time, *min*	69.0
Depth to Top of Permeable Soils, *m*	1.200	Mean Internal Discharge Area, m^2	4.000
Depth to Groundwater Surface, *m*		Discharge Rate, *litre/min*	3.807
Depth to Top of Granular Fill, *m*	1.330	Soakage Rate, $litre/m^2/min$	**0.952**
Voids Assumed for Granular Fill, %	40%	BRE Soil Infiltration Rate, *m/sec*	**1.59E-05**

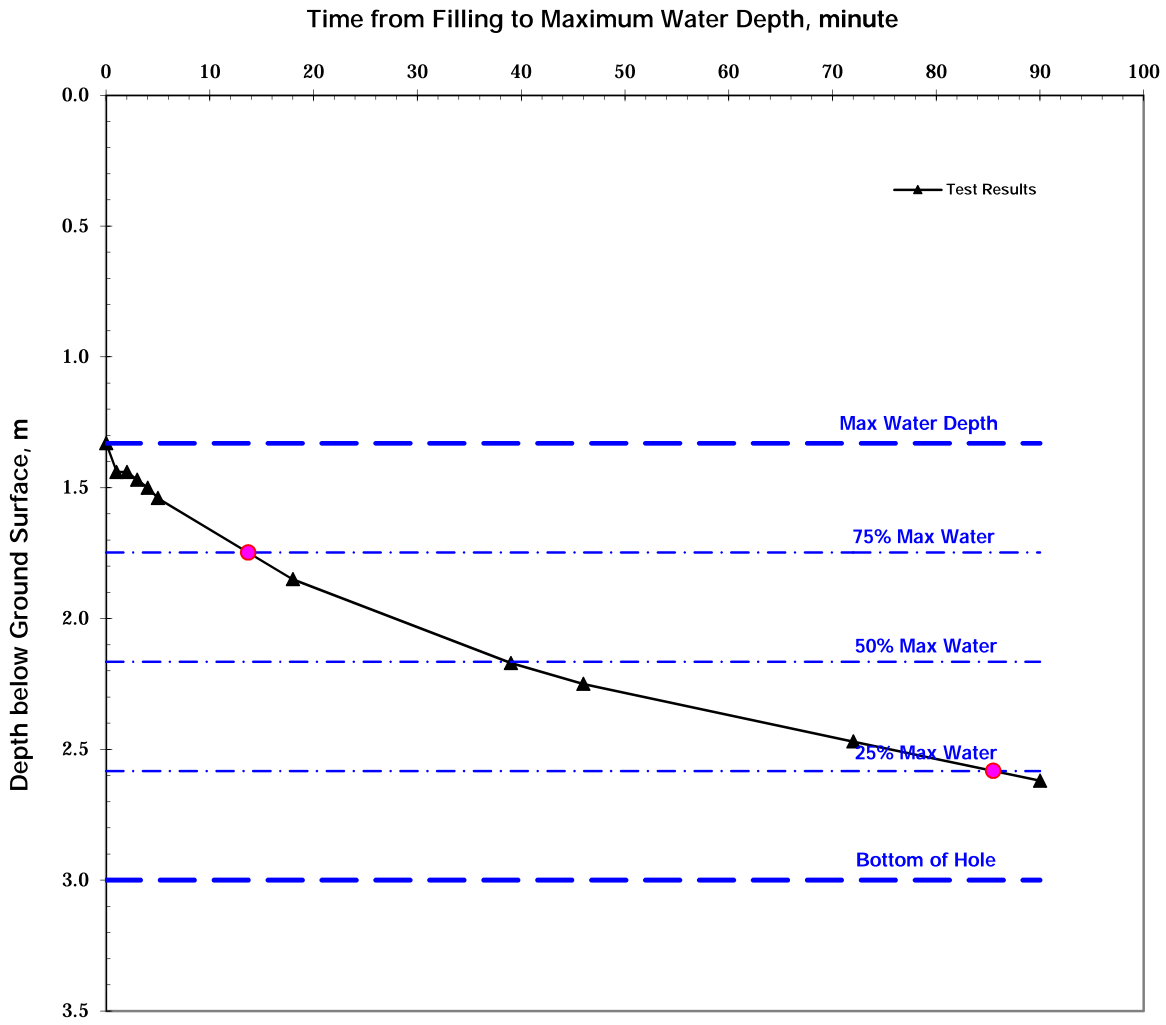
Comments:

Pit was nearly emptied at finish of test.

Client:	Glanville	**Job No:**	JN1246	**Test Date:**	29/May/2024		
Site:	Wrexham	**Tested By:**	PB	**Engineer:**	CN	**Fig.**	**S1**

BRE Digest DG365 Soakage Test

Test Hole No: S1
Test No: Test No 2 (Repeated)



Pit Length, m	1.600	Depth to Water at Start of Test, m	1.330
Pit Width, m	0.450	Max Water Dropdown during Test, m	1.290
Depth to Pit Base, m	3.000	Total Soakage Test Time, min	90.0
Depth to Top of Permeable Soils, m	1.200	Mean Internal Discharge Area, m^2	4.144
Depth to Groundwater Surface, m		Discharge Rate, litre/min	3.349
Depth to Top of Granular Fill, m	1.330	Soakage Rate, litre/m^2/min	0.808
Voids Assumed for Granular Fill, %	40%	BRE Soil Infiltration Rate, m/sec	1.35E-05

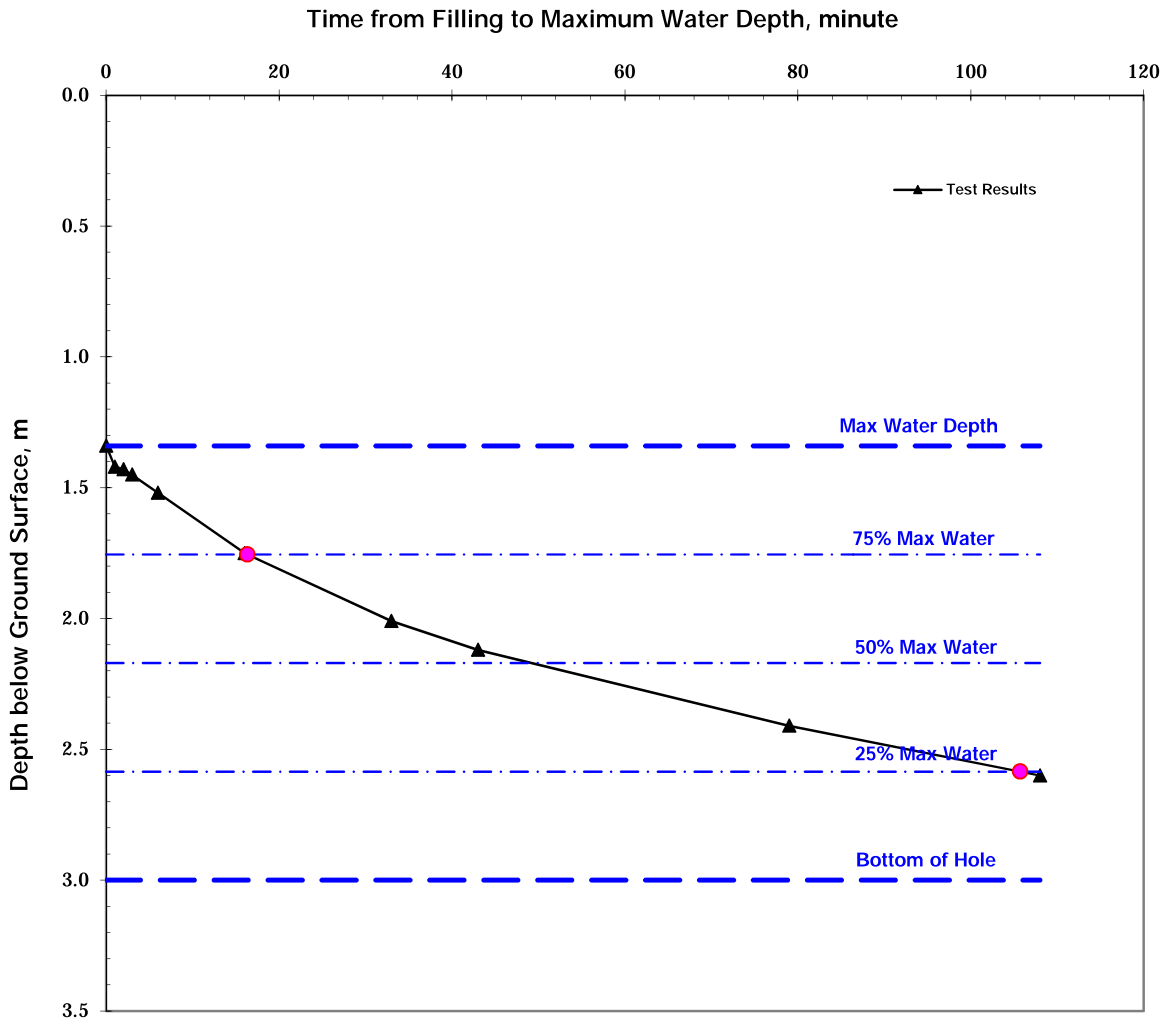
Comments:

Pit was nearly emptied at finish of test.

Client:	Glanville	Job No:	JN1246	Test Date:	29/May/2024		
Site:	Wrexham	Tested By:	PB	Engineer:	CN	Fig.	S2

BRE Digest DG365 Soakage Test

Test Hole No: S1
Test No: Test No 3 (Repeated)



Pit Length, m	1.600	Depth to Water at Start of Test, m	1.340
Pit Width, m	0.450	Max Water Dropdown during Test, m	1.260
Depth to Pit Base, m	3.000	Total Soakage Test Time, min	108.0
Depth to Top of Permeable Soils, m	1.200	Mean Internal Discharge Area, m^2	4.123
Depth to Groundwater Surface, m		Discharge Rate, litre/min	2.674
Depth to Top of Granular Fill, m	1.330	Soakage Rate, litre/m^2/min	0.649
Voids Assumed for Granular Fill, %	40%	BRE Soil Infiltration Rate, m/sec	1.08E-05

Comments:

Pit was nearly emptied at finish of test.

Client:	Glanville	Job No:	JN1246	Test Date:	29/May/2024		
Site:	Wrexham	Tested By:	PB	Engineer:	CN	Fig.	S3

Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN

ST Consult

Summary Sheet

Results of BRE Digest DG365 Soakage Tests

Site :	Wrexham				**Job No :**	JN1246	
Client :	Glanville				**O S Reference :**		
Tested By :	PB		**Engineer:**	CN	**Test Date :**	29/May/2024	
Hole No	**Test No**	**Hole Depth** m	**Soakage Rate for Each Test** litre/m^2/min	**Soakage Rate for Each Hole** litre/m^2/min m/sec	**Water Level at Finish of Test**	**Remarks**	
S1	No 1	3.00	0.952	0.649 1.08E-5	Nearly empty pit.	Depth to top of permeable soils was 1.2m.	
S1	No 2	3.00	0.808		Nearly empty pit.		
S1	No 3	3.00	0.649		Nearly empty pit.		
Mean Value of All Calculated Soakage Rates :				**0.649** litre/m^2/min **1.08E-5** m/sec			

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical



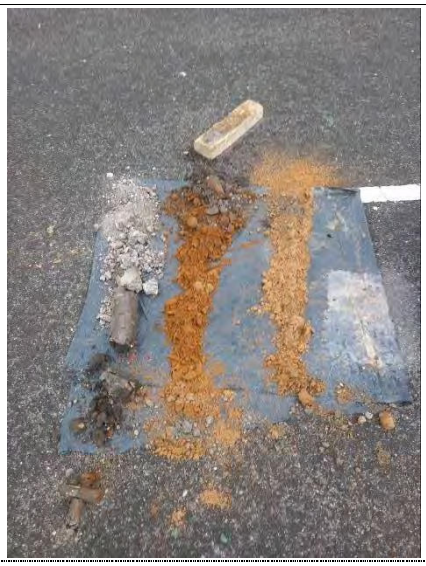
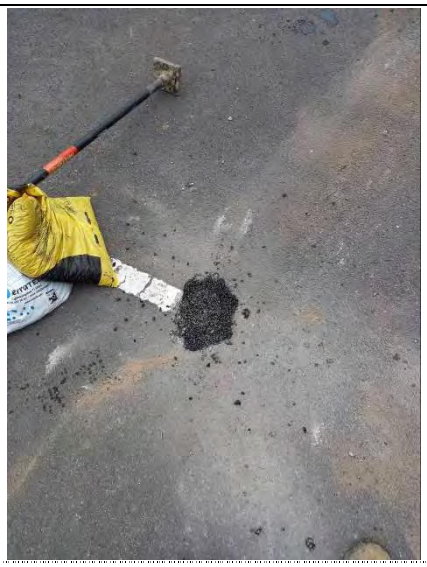
APPENDIX C

Photographs



C

JN1246 Wrexham 2024	
	
Soakaway S1	Skip muck away
	
Spoil area condition	NE corner of site
	
S1 reinstatement	Works entrance fencing & signage

JN1246 Wrexham 2024	
	
WLS10	WLS9
	
South to north across site	WLS11
	
Reinstate WLS11	WLS12