Appendix 12A: Ground Investigation Report

The ground investigation report has been produced by Aecom based on the Design Freeze 3 iteration. The Environmental Statement considers the potential significant environmental effects that would arise as a result of the Design Freeze 7 iteration. The information contained within the ground investigation report remains valid as the report compiles information from previous ground investigations within the study area to produce a baseline. The study area and baseline for both Design Freeze 3 and 7 are comparable and equally relevant.

Geotechnical

Stockport Metropolitan Borough Council February 2011

SEMMMS, A6 to Manchester Airport, Relief Road, Ground Investigation Report

Page deliberately blank for double sided printing

Prepared by: .... Angus Wheeler
Principal Geotechnical Engineer

Checked by: .... Martin de Kretser
Associate Director

Approved by: .... Paul Roberts
Regional Director

SEMMMS, A6 to Manchester Airport, Relief Road

Rev No	Comments	Checked by	Approved by	Date
1	First Issue		PAR	18/2/11

Lynnfield House, Church Street , Altrincham, Cheshire, WA14 4DZ
Telephone: 0161 927 8200 Website: http://www.aecom.com

Job No 6018694 Reference 03 Date Created. February 2011

f:\projects\geotechnics\semms\reports\gir\6018694-001_03_01- gir 14_02_11.docx

Table of Contents

Executive Summary

Capabilities on project:
Geotechnical

Page deliberately blank for double sided printing

Capabilities on project:
Geotechnical

1 Executive Summary

1.1 Reason for the Report

AECOM (formerly Faber Maunsell) was appointed in 2010 by Stockport Metropolitan Borough Council (SMBC) to provide geotechnical and environmental advisory services for the South East Manchester Multi Modal Study (SEMMMS) A6 to Manchester Airport Relief Road. SMBC is the lead authority for a consortium for this relief road, which also includes Cheshire County Council (CCC) and Manchester City Council (MCC).

AECOM was instructed by SMBC to prepare a Ground Investigation Report for the route from the A6 at Hazel Grove to Manchester Airport to interpret both existing data available from the A6(M) investigations that were carried out during in the 1980's and 1990's and subsequent investigations for the Manchester Airport Metrolink.

This report updates previous interpretative reports in light of the revised Design Freeze 3 alignment from the A6 at Hazel Grove to Manchester Airport and also incorporates data from a ground investigation for the Metrolink to Manchester Airport that was not previously available.

This report has been written to fulfil the requirements of Highways Agency Highway Design Note HD 22/08 (August 2008) and has been written in general accordance with the suggested HA format.

1.1 Project Details

The SEMMMS route relates to the proposed 10km dual carriageway which runs from the A6 at Hazel Grove through to the Airport spur road, and incorporates an existing section of the A555.

For ease of reporting the route has been split into eight sub sections, namely: A6 to Hazel Grove (Stockport – Buxton railway Crossing) (CH100 – 1345 on realigned A6 & CH8250 – CH8500 on new route); Hazel Grove to Norbury Brook (CH8500 – CH10400); Norbury Brook to the West Coast Mainline (WCML) crossing (CH10400 – CH11950); WCML to the Woodford Road (A5102) interchange (CH11950 – CH13350); Woodford Road to Wilmslow Road (B5358) (CH13350 – CH550 (new chainage)); Wilmslow Road to the Styal railway crossing (CH550 – CH2100); Styal Railway Crossing to Styal North Roundabout (CH0 – CH500 (New chainage))and Styal North Roundabout to Manchester International Airport (MIA) (CH100-CH2140).

The route has already been constructed between Woodford Road and Wilmslow Road.

Ground investigation data is not available for the section of the route between the A5102 interchange and Styal North Roundabout. Only limited information is available between Styal North Roundabout and MIA.

1.2 Ground Conditions

Between the A6 realignment and the Red Rock Fault at CH9100 the superficial cover mostly comprises glacial till over Coal Measures bedrock. Shallow mine workings may be present under some of the structures and further investigation is recommended.

Rock is at shallow depth or subcrops over part of this section of the route and excavation will be required into the solid.

Between the Red Rock Fault and Norbury Brook the superficial cover mostly comprises glacio-fluvial granular deposits over sandstone bedrock. Till and glacio-fluvial cohesive deposits are interbedded with the granular deposits. Near the stream alluvial deposits are present.

Between the stream and the WCML crossing the superficial deposits mostly comprise glacial till over granular deposits over the Sherwood sandstone bedrock.

Between the WCML crossing and the A5102 crossing the superficial deposits comprise till over granular deposits, changing to a sequence of glacio cohesive deposits over granular deposits close to the A5102 interchange. Bed rock was not proved in this area.

Between the A5102 and Styal railway the ground conditions are expected to be glacial till over the Sherwood sandstone bedrock.

From the Styal railway crossing to Styal North Roundabout the ground conditions are expected to be till over mudstones of the Mercia Mudstone group.

Between Styal North Roundabout and MIA the available information shows till over mudstone with minor granular components.

Made Ground is present in limited areas between the realigned A6 and Norbury Brook and also in the vicinity of MIA.

Main geotechnical risks are perceived to be:

- the lack of ground investigation data in the central part of the route;
- the risk of shallow mine workings near Hazel Grove;
- the risk of aggressive ground conditions at Hazel Grove and potentially in the areas underlain by the Mercia Mudstone;
- excavation into rock;
- the control of ground water.

1.3 Limitations of the Report

This document has been prepared by AECOM Limited for the sole use of our client (the “Client”) and in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM Limited and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM Limited, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM Limited

Introduction

Page deliberately blank for double sided printing

2 Introduction

2.1 Scope and objective of the report

AECOM (formerly Faber Maunsell) was appointed in 2010 by Stockport Metropolitan Borough Council (SMBC) to provide geotechnical and environmental advisory services for the South East Manchester Multi Modal Study (SEMMMS) A6 to Manchester Airport Relief Road. SMBC is the lead authority for a Consortium for this relief road, which also includes Cheshire County Council (CCC) and Manchester City Council (MCC).

AECOM was instructed by SMBC to prepare a Ground Investigation Report (GIR) for the route from the A6 at Hazel Grove to Manchester Airport to evaluate the existing data available from the A6(M) investigations that were carried out in the 1980's and 1990's. Further ground investigation will be carried out during the detailed design stage and this report will be updated once the results of that investigation are known. The subsequent ground investigation will infill gaps in the existing data.

This GIR is based on the revised alignment as defined by Design Freeze 3 from the A6 at Hazel Grove to Manchester Airport and all relevant ground investigations carried out along the route to date.

This report has been produced to fulfil the requirements of Highways Agency Highway Design Note HD 22/08 (August 2008) and has been written in general accordance with the suggested HA format.

The objectives of this GIR are to interpret the existing desk study and fieldworks data in relation to the route and to provide geotechnical design parameters to be used in subsequent detailed design. As noted above the data will be supplemented at a later stage by further ground investigation. An assessment will be made of the geotechnical risks associated with the scheme, implications and feasibility of the scheme options.

2.2 Description of the project (including site description)

The SEMMMS route relates to the proposed 10km dual carriageway which runs from the A6 at Hazel Grove through to the Airport spur road, and incorporates an existing section of the A555.

The proposed route for the SEMMMS Relief Road is shown on Figure 1. Drawing 60186094/GEO/001 is the Key Plan for subsequent drawings in this report. Briefly, the proposed route lies to the south east of Manchester from the A6 (Buxton Road) at Hazel Grove to the eastern end of the existing A555, and then from the western end of the existing A555 to Manchester Airport. The route is approximately 10km in length.

The route starts at the A6 interchange and runs south-westward into a cutting passing under the Stockport-Buxton railway. The route turns westward to run due west towards the A523 Macclesfield road. The route then turns south-westward over open land crossing over the West Coast mainline on an embankment. The route continues westward through open land to the south of Bramhall and connects to the existing A555. At the western end of the existing A555 the alignment continues west, crossing the Styal Railway and turning northwards along the existing Styal road and turns westwards again onto Ringway Road to Manchester Airport.

For ease of description the route has been split into a number of sub sections:

- A6 to Hazel Grove Railway (including the realignment of the A6).
- Hazel Grove Railway to Norbury Brook
- Norbury Brook to West Coast Mainline

- West Coast Mainline to Woodford Road (A5102)
- Woodford Road to Wilmslow Road (B5358)
- Wilmslow Road to Styal Railway Line
- Styal Railway Line to Styal Road North Roundabout
- Styal Road North Roundabout to Manchester International Airport.

The sub section limits are shown on Figure 1.

2.3 Geotechnical Category of the Project

The project includes conventional types of geotechnical structures, earthworks and activities with no exceptional geotechnical risks, unusual or difficult ground or loading conditions and is therefore classed as Geotechnical Category 2 under the Highways Agency categorisation.

2.4 Other Relevant Information

This report should be reviewed along the AECOM Preliminary Sources Study (Ref. 6018694-001-02-02, dated February 2011) which also covered the Design Freeze 3 alignment.

The Environmental Protection Department of Stockport Metropolitan Borough Council (SMBC) were consulted to determine the contents of registered landfill sites and the contents of their Contaminated Land Register (held for the purposes of Part II of the Environmental Protection Act 1990), however no information was available.

SMBC also contacted Cheshire East Council to determine whether they had any other ground investigation data relating to the A555. No response was received.

SMBC contacted Network Rail to determine whether they had any geotechnical information relating both to the Manchester Airport Rail link and Styal bridges. No response was received.

.

Existing Information

Page deliberately blank for double sided printing

3 Existing Information

3.1 Topographical Maps (old and recent)

Topography

3.1.1 A6 to Hazel Grove

From north to south the realigned A6 climbs from an elevation of around 90m OD at the northern junction with the existing A6, to around 130m OD at the southern junction with the existing road.

The junction with the new SEMMMS route is at an elevation of 110m OD.

Ground levels to the Stockport Buxton railway bridge are constant at 110m OD.

3.1.2 Hazel Grove to Norbury Brook

From the railway the proposed route follows the side of the valley to Norbury Brook. The existing ground level of the proposed route falls from 110m OD to just under 100m OD over around 250m in two stages, dropping 5m to an intermediate terrace and then a further 5m 100m later. It then falls gently to around 80m OD at Poynton Brook, before rising slightly and then dropping to 77m OD at the Norbury Brook crossing.

3.1.3 Norbury Brook to West Coast Mainline

Up chainage of Norbury Brook the ground levels rise to 88m OD over 50m before flattening out to around 88 - 90m OD to the West Coast Main Line.

3.1.4 West Coast Mainline to Woodford Road (A5102)

Ground levels remain consistent at around 89-90m OD over this part of the route.

3.1.5 Woodford Road (A5102) to Wilmslow Road (B5358)

Up chainage of the A5102 the ground levels show a gradual fall to around 78m OD onto the alignment of the current A555. Topographic data is not available along the length of the A555 but levels at Wilmslow Road, where the proposed route restarts, are also around 77-78m OD. Ordnance Survey 1:25,000 mapping shows the intermediate area to be generally flat.

3.1.6 Wilmslow Road (B5358) to Styal Railway

From the OS mapping the ground levels rise slightly to a high point of around 83m OD with levels at the top of the railway cutting at just over 80m OD. The cutting is approximately 5m deep.

3.1.7 Styal Railway to Styal North Roundabout

Between the Styal Railway crossing and Styal North Roundabout the OS mapping levels drop from around 80m OD to around 77m OD at the existing rail bridges over the Manchester Airport rail link to 76.5m OD at the Styal North roundabout.

The Manchester Airport rail link is in cutting at this point.

3.1.8 Styal North Roundabout to Manchester International Airport

Between the roundabout and the airport the ground levels have a very gradual fall to the west, from 76.5m OD at the roundabout to 71m OD at the tie in with the airport infrastructure. Existing ground levels rise slightly to 75m OD between CH750 and CH1000 of the airport link, just down chainage of the junction with Ringway Road and under the Flight Path Take Off and Landing corridor.

The existing ground levels of the Terminal 2 Link Road are generally between 69 and 70m OD, rising to 76m OD between Thorley Lane Roundabout and the Link Road end point at the Terminal 2 Roundabout.

Historical Development

The historical development of the area has been inferred from study of historical OS maps dating from the mid-1800s to the present day. The potential geotechnical hazards identified by the review are listed below and are plotted on drawings DWG 60186094/GEO/002-013. Where the feature is now no longer present it is marked in green.

3.1.9 A6 to Hazel Grove railway

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H1.1	A field named ‘Brick Field’ and a pond named ‘Robin Hood Pool’ are present in the area where the eastern junction with the A6 is proposed.	1874-1882	DWG60186094/GEO/002
	More ponds are indicated in the area where the eastern junction with the A6 is proposed.	1897-1899	
	The ponds are no longer shown, suggesting they have been infilled.	1969 - 1977	
H1.2	Norbury Colliery is indicated immediately to the south of the area where the eastern junction with the A6 is proposed. Shafts and a gasometer are indicated.	1874-1882	
	Norbury Colliery is indicated as being disused.	1909-1938	
	Area of former colliery buildings appears to have been redeveloped.	1977-2010	
H1.3	Several water courses and ponds are indicated in the area.	1874-1882	
	A ‘drain’ crosses the proposed alignment.	1969-1977	
	A pond is suggested along a water course close to the proposed eastern junction with Buxton Road.	1999-2010	
H1.4	A ‘works’ is indicated immediately to the north of the proposed western junction with Buxton Road.	1954-1961	

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
	The works is indicated to be a ‘depot’, and later a garage with a substation.	1981-1984	
H1.5	A ‘works is shown to the west of the proposed alignment between Buxton Road and the railway.	1981-1984	
H1.6	A covered reservoir is indicated close to the proposed eastern junction with Buxton Road.	1999-2010	
H1.7	Two lines of electricity transmission towers and overhead lines are shown close to the proposed crossing of Hazel Grove railway.	1954-1961	
	One of the lines of electricity transmission towers and overhead lines is no longer shown.	1969-1977	
	The lines of electricity transmission towers and overhead lines are no longer shown.	1989-1995	
H1.8	The railway (Hazel Grove railway) is shown in its current location.	1874-1882	

3.1.10 Hazel Grove Railway to Norbury Brook

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H2.1	The site of Norbury Chapel is indicated on the map on the alignment of the proposed road.	1874-1882	DWG60186094/GEO/003
H2.2	Norbury Brook appears to flow in its current course.	1874-1882	
H2.3	Norbury corn mill is indicated where Mill Lane crosses the proposed road alignment. The mill includes a watercourse called ‘Mill Lade’ that joins the mill with Norbury Brook. A sluice is indicated at the mill where the watercourse enters.	1874-1882	
	Mill Lade is no longer indicated.	1935-1938	
H2.4	Ponds are indicated to the north of the proposed road alignment near Norbury Hall.	1874-1882	
H2.5	An unnamed water course is shown to cross the proposed road alignment.	1874-1882	
	The water course is now a drain. A weir is present in Norbury Brook to the east to the water course. Some earthworks are indicated where the drain	1954-1961	

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
	meets Norbury Brook.		
H2.6	A garden centre and car park are shown immediately to the south of the proposed road alignment where it crosses Macclesfield Road.	1981-1984	
H2.7	A swimming pool is indicated to the north of where the proposed road alignment crosses Norbury Brook.	1935-1938	DWG60186094/GEO/004

3.1.11 Norbury Brook to West Coast Mainline

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H3.1	The railway (West Coast Mainline) is shown in its current location. Woodford road is carried over the railway on a bridge.	1874-1882	DWG60186094/GEO/005
H3.2	Ponds are indicated on and close to the proposed road alignment	1874-1882	DWG60186094/GEO/004
	Several ponds are no longer shown, suggesting they have been infilled.	1935-1938	
H3.3	A well is indicated on the proposed road alignment (approximate NGR = 391790, 384880).	1897-1899	DWG60186094/GEO/004
	The well is no longer indicated.	1935-1938	

3.1.12 West Coast Mainline to Woodford Road

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H4.1	A Roman Road “site of” is indicated. The road crosses the proposed road alignment in a northwest-southeast orientation.	1874-1882	DWG60186094/GEO/005
	Old marl pits are indicated on the eastern side of the Roman Road to the north of the proposed road alignment.	1897-1899	
	The Roman Road (site of) is no longer indicated.	1935-1938	
H4. 2	Several ponds are indicated within fields and at Distaff Farm.	1874-1882	DWG60186094/GEO/005

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H4.2.1	A pond close to the proposed junction with Chester Road is no longer shown suggesting that it has been infilled.	1909-1912	DWG60186094/GEO/005
H4.2.2	Several ponds at Distaff Farm and ponds near Woodford Road are no longer shown.	1969 - 1977	DWG60186094/GEO/005

3.1.13 Woodford Road to Wilmslow Road (A555)

3.1.13.1 Woodford Road Junction

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H5.1	Two ponds are indicated to the north of the location of the proposed junction and a pond is indicated immediately west of Hawthorn Farm.	1874-1882	DWG60186094/GEO/006
	One of the two ponds is no longer shown.	1935-1938	
	The pond to the north of the proposed junction and the pond at Hawthorn Farm are no longer shown. The recreation ground is shown.	1969 - 1977	

3.1.13.1.1. Retaining Wall DF3/R009 on the north side of the Existing A555, west of A34

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H5.2	Works and warehouses are shown to the north and south of the site. The site is within the boundaries of some of the works but buildings are not shown at the site. Works include a 'depot', 'Globe Works', and an electric components works. Earl Road crosses the site.	1976-1978	DWG60186094/GEO/008
	More buildings associated with the works and warehouses are shown.	1984-1987	
	The A55 and its junction with the A34 are shown. A retail park and industrial estate are shown to the north of the site and a depot is shown to its south.	1999	
H5.3	An unnamed water course is shown to cross the site of the proposed retaining wall approximately half way along its length.	1898-1899	DWG60186094/GEO/008

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
	A drain is indicated approximately half way along the site of the proposed retaining wall.	1954-1967	

3.1.14 Wilmslow Road to Styal Railway Line

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H6.1	The site and surrounding areas are shown as fields. Several ponds are indicated in the fields to the north and south of the proposed alignment in their current locations.	1876-1882	DWG60186094/GEO/009
H6.2	A pond is shown on the proposed road alignment.	1909-1911	DWG60186094/GEO/009
	A pond that was present on the alignment is no longer shown.	1935-1938	
H6.3	Three earthworks type structures are indicated in the field north of Clay Lane.	1954 - 1969	DWG60186094/GEO/009
	A building is shown in the field north of Clay Lane.	1984-1987	

3.1.15 Styal Railway Line to Styal Road North Roundabout

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H7.1	The railway that runs in a north-south orientation is shown as ‘Railway in course of construction’.	1909-1911	DWG60186094/GEO/010
	The railway is called ‘London Midland & Scottish Railway’. The footbridge that crosses the railway north of the proposed road crossing is present.	1935-1938	
H7.2	A railway junction comprising two lines connecting a new railway line that runs westward is shown. Styal Road is carried over the junction lines on a bridge/bridges.	1992-1999	DWG60186094/GEO/010
H7.3	A pond is indicated west of Hollin Lane at its junction with Moss Lane.	1898-1899	DWG60186094/GEO/010
	The pond that was west of Hollin Lane at its junction with Moss Lane is no longer shown.	1935-1938	
H7.4	Surrounding areas include ‘Shadow Moss’, ‘Moss	1898-1899	

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
	Nook', and Moss Lane.		

3.1.16 Styal Road North Roundabout to Manchester International Airport

Hazard Reference	Potential Geotechnical Hazards	Relevant Maps	Drawing
H8.1	Three ponds are indicated on the proposed road alignment.	1876-1882	DWG60186094/GEO/012
	Two of the three ponds are no longer shown.	1990-1999	
H8.2	The Manchester airport branch line is shown to the south of the proposed road alignment.	1990-1999	DWG60186094/GEO/012
H8.3	Buildings are shown on the alignment to the south of Ringway Road.	1990-1999	DWG60186094/GEO/012
H8.4	'Brick Fields' are indicated close to the western side of the proposed road alignment.	1876-1882	DWG60186094/GEO/013
	A pond is shown to the west of the proposed road alignment.	1898-1899	
H8.5	A drain is shown to cross the alignment of the proposed road just east of Woodhouse Lane.	1990-1999	DWG60186094/GEO/012
H8.6	Moss House Farm.	1882- 1977	DWG60186094/GEO/013
	Site of Moss House farm redeveloped.	1999-2010	
H8.7	An unnamed water course is shown to cross the alignment of the proposed road.	1954 - 1969	DWG60186094/GEO/013
	Water course partially culverted.	1999-2010	

3.2 Geological maps and memoirs

The entire route is contained within the Cheshire Plain, and along its length the road crosses the solid and superficial geology summarised below and on Figures 2 and 3 respectively. The following geological descriptions are based on the British Geological Survey 1:50,000 Solid Edition Map Sheet 98, the 1:63,360 (one inch to 1 mile) drift edition and the BGS Memoir "Geology of the Country Around Stockport and Knutsford".

Summary of Geology

Route Section	Superficial Geology	Solid Geology	Comments
A6 to Hazel Grove Railway	Glacial Till (Boulder Clay)	Westphalian (Coal Measures) with coal crops to the east	N-S trending fault with downthrown to the west coincides with the crossing of the Stockport –Buxton railway line. Potential for encountering boulders and perched water tables in the drift deposit. Also potential for shallow mine workings.
Hazel Grove Railway to Norbury Brook	Glacial Till (Boulder Clay) with Glacial Sand and Gravel and Alluvium by Norbury Brook	Westphalian (Coal Measures) to Old Mill Lane and Collyhurst Sandstone and Manchester Marl (Sherwood Sandstone Group) to Norbury Brook	N-S trending fault forms the boundary between the Westphalian (Coal Measures) and Manchester Marl.
Norbury Brook to West Coast Mainline	Glacial Till (Boulder Clay)	Chester Pebble Beds (Sherwood Sandstone Group)	N- S trending fault near Woodford Road with downthrow to the east
West Coast Mainline to Wilmslow Road	Glacial Till (Boulder Clay)	Upper Mottled (Wilmslow) Sandstone and Chester Pebble Beds (Sherwood Sandstone Group)	N-S to NW-SE trending faults present near London Road, Chester Road and Woodford Road
Wilmslow Road to Styal Railway Line	Glacial Till (Boulder Clay)	Upper Mottled (Wilmslow) Sandstone with 'Keuper' Helsby) sandstone by Styal Railway line (Sherwood Sandstone Group)	N-S trending fault by Styal Railway line
Styal Railway Line to Styal Road North Roundabout	Glacial Till (Boulder Clay)	Lower 'Keuper' Marl (Bollin Mudstone - Mercia Mudstone Group)	-
Styal Road North Roundabout to Manchester International Airport	Glacial Till (Boulder Clay) with Glacial Sand and Gravel on the central area of Ringway Road	Lower 'Keuper' Marl (Bollin Mudstone - Mercia Mudstone Group)	-

Recent deposits in the area are the result of alluvial deposition along the course of Norbury Brook.

Glacial deposits dating from Pleistocene times cover most of the region and these are the prevalent unit at surface across most of the route. Glacial strata consist mainly of glacial till (Boulder Clay), with deposits of glacial sand and gravel and fluvio-glacial gravels around the southern edge of Hazel Grove. The distribution of drift deposits is shown on Figure 3.

The general solid succession of the area consists of Triassic marls of the Mercia Mudstone Group over sandstones and pebble beds of the Sherwood Sandstone Group, over Manchester Marl, Lower Stockport Marl and Collyhurst Sandstone, over mudstones of the Ardwick Group, the latter being at the top of the Westphalian Group (formerly Coal Measures). The general succession dips towards the west. The distribution of solid deposits is shown on Figure 2.

The Collyhurst Sandstone is a soft, uncemented sandstone which is free from pebbles and strongly cross bedded.

The lower part of the Manchester Marl is a series of red calcareous mudstones with limestone bands. The marl becomes sandier in the younger sequences.

The pebbles, in the Chester Pebble Beds are more abundant in the lower part as they occur in lenticular bands; in the upper part of the pebbles are more sporadic. The pebbles are mostly of quartzite with some igneous rocks also recorded.

The Wilmslow Sandstone is a medium to coarse grained false bedded sandstone.

The Helsby Sandstone is a fine to medium grained quartz sandstone.

The Keuper Marl is comprised of rhythmic predominantly argillaceous sequences. In the area of interest the marl contains gypsum in crystals and veins. The route is not underlain by the lower Keuper “saliferous” Beds which contain economically viable quantities of halite.

The area is marked by a series of north south striking faults, which control the sub-surface geology. In the route area the Red Rock ‘Fault’, described as a fault controlled scarp in the Manstock Mining Report (1985), separates the Triassic and Permian strata from the underlying Westphalian (Coal Measures).

The differentiation of the solid sub-surface geology is significant from a geotechnical perspective as this dictates those areas where shallow coal mining may be possible.

3.3 Aerial photographs (old and recent)

Aerial photographs of the major structures along the route were contained in the AECOM 2006 Preliminary Sources Study.

Google satellite imagery was examined as part of this study.

3.4 Records of mines and mineral deposits

A mining report by Manstock Geotechnical Consultancy Services (MGCS) addresses areas of coal mining instability along the route of the formerly proposed A6(M). The alignment of the A6(M) is very similar to that of the currently proposed A555 extension and the conclusions in the MGCS report are therefore considered relevant to the current proposals.

A Coal Authority report was not purchased for the scheme as it was considered that a computer generated report would not add any additional detail to the Manstock report which was prepared in consultation with local National Coal Board officials.

The main MGCS report (dated November 1985) follows on and repeats much of the information contained in an earlier (May 1983) MGCS desk study report. MGCS also undertook geophysical investigations over parts of the original route in an attempt to determine the locations of shafts and shallow workings (January 1984). The original alignment was divided up into four major areas. The two areas of interest to the current route are discussed below.

Area 3 – Hazel Grove to Macclesfield Road (A523) (CH 8300 – CH 9500)
The alignment lies over Westphalian A & B deposits. There is historic evidence of working in this area, with some recorded locations being on the proposed alignment (e.g. CH 8500 & CH 9000). Collapsed workings were recorded at a

depth of 14.85m bgl (~13m below rockhead) at the site of the A6 bus bridge. Voiding was noted at around 5 below rockhead around CH9000, near the proposed pedestrian bridge.

A disused shaft is noted in the area of cut on the north side of the road at CH8730. Voiding was also noted in a borehole adjacent to this position (NWG Main GI BH229) at a depth below proposed formation level of around 3.5m.

Area 4 – Macclesfield Road to A555 (CH 9500 – CH 13700)
The area to the west of the Red Rock Fault has not historically undergone mining due to the presence of the overlying Permo-Triassic rocks and the consequential much greater depth of the coal-bearing Carboniferous rocks. It is therefore very unlikely that coal mining will have been undertaken in the area.

Further ground investigation for mine workings is recommended in the Hazel Grove to Macclesfield Road area in the area of new structures not previously investigated. A topsoil strip is recommended as part of the preliminary works for the main ground investigation.

In the detailed design an assessment should be made of the effects of mining on the structures and whether any precautions are required for the protection of the road formation, particularly in the area between CH8700 and CH9050.

Allowance should be made within the project programme for remediation (excavation/infilling, grouting) during construction.

Remedial works likely to be required for workings include capping, infilling with granular material, grouting with cementitious PFA grout and excavation and replacement. A geogrid may be required to support the road construction.

Guidance for design measures for highway structures in mining areas is given in DMRB - BD10/97.

The Envirocheck report purchased for the scheme indicates that Brine pumping may have occurred in the vicinity of Manchester Airport. This is not thought likely as no brine production facilities are in the area and the underlying solid geology does not suggest that large quantities of halite could be present. The risk of subsidence due to brine pumping is therefore considered low. This was confirmed after discussion with the Brine Board which stated that the airport was included in the buffer zone where if any subsidence occurred a claim could be made against under the Brine Compensation Act, adding however, that as the site is not underlain by saliferous deposits no brine pumping would have occurred under the site.

3.5 Land use and soil survey information

The following overview of land use is based on Google satellite photography. For a detailed description refer to Paragraph 4.1 Walkover Survey.

- A6 to Hazel Grove Railway (including the realignment of the A6)

  The majority of the current land use is rough grazing and arable.

- Hazel Grove Railway to Norbury Brook

  Mostly rough grazing with minor arable and woodland.

- Norbury Brook to West Coast Mainline

  Mostly rough grazing.

- West Coast Mainline to Woodford Road (A5102)

Rough grazing, arable and golf course.

- Woodford Road to Wilmslow Road (B5358)

  Existing A555. Immediately east of the elevated junction with the B5358 there is a rough area which is on the route of the proposed alignment and lies between two “slip” roads which take the current A555 up to the elevated junction.

- Wilmslow Road to Styal Railway Line

  The majority of the area is a golf course with a minor area of rough grazing and an area of hard standing adjacent to the B5358.

- Styal Railway Line to Styal Road North Roundabout

  Rough grazing.

- Styal Road North Roundabout to Manchester International Airport

  Rough grazing, allotments and overspill car parking which appears to be unsurfaced.

The National Soil Resources Institute online mapping indicates that the vast majority of the route is underlain by topsoils classified as “Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils”. Between the railway at Hazel Grove and Norbury Brook there is a small area of “freely draining slightly acid loamy soils”

3.6 Archaeological and historical investigations

None undertaken as part of this study.

3.7 Existing ground investigations

A number of ground investigations have been undertaken along or near the current proposed alignment. These consisted of both intrusive (i.e. boreholes and trial pits) and non-intrusive (i.e. geophysical methods undertaken from surface). The previous factual and interpretative reports are summarised in Table 1.

Table 1: Previous Reports

Title/Subject:	By:	Date:
Stockport N-S Bypass – Preliminary Geotechnical Appraisal No 517	Cheshire County Council	June 1975
Preliminary Ground Investigation – Vol 1	Norwest Holst	March 1983
Desk Study Mining Report	MGCS	May 1983
Preliminary Geotechnical Report	Mouchel	September 1983
Geophysical Investigation Over Parts Of Proposed A6(M)	MGCS	January 1984
Main Ground Investigation: Site Investigation Report: Vols 1-10	Norwest Holst	September 1984
Supplementary Ground Investigation – Vol 1	Norwest Holst	August 1985

Title/Subject:	By:	Date:
Mining Report	MGCS	November 1985
Geotechnical Report – Vols 1 & 2	Mouchel	December 1985
2nd Supplementary Ground Investigation – Vols 1-4	Soil Mechanics	June 1990
Foggbrook Bridge Ground Investigation	Norwest Holst	July 1991
A6(M) / A523 Bypass Ground Investigation – Vols 1 & 2	Ground Engineering	October 1991
A523 Poynton Bypass GI Vols 1-5	Exploration Associates	August 1992
Geotechnical Interpretative Report – Vols 1 & 2	Mouchel	October 1992
3rd Supplementary Ground Investigation – Vols 1 & 2	Exploration Associates	November 1992
A6(M) Environmental Statement	Mouchel	January 1995
Preliminary Sources Study	Faber Maunsell	January 2006
Geo-Environmental Interpretative – Phase 1 Ground Investigation	Faber Maunsell	October 2005
Earthworks report	Faber Maunsell	August 2005
Rail Report	Faber Maunsell	January 2006
Metrolink Airport Extension Ground Investigation	Geotechnics	September 2010
Preliminary Sources Study, Ref: 6018694-001-02-02	AECOM	February 2011

3.8 Consultation with Statutory Bodies and Agencies

The Environmental Protection Department of Stockport Metropolitan Borough Council (SMBC) were consulted to determine the contents of registered landfill sites and the contents of their Contaminated Land Register (held for the purposes of Part II of the Environmental Protection Act 1990), however no information was available.

SMBC also contacted Cheshire East Council to determine whether they had any other ground investigation data relating to the A555. No response has been received.

SMBC contacted Network Rail to determine whether they had any geotechnical information relating both to the Manchester Airport Rail link and Styal bridges. No response was received.

A full list of consultees is included in Appendix 1 of the Mouchel EIA Scoping Report, dated February 2010.

3.9 Flood Records

The Environment Agency (EA) flood maps indicate that the immediate area of the confluence of Norbury Brook and Poynton Burn, just downstream of the Norbury crossing, is within a zone of flooding that has a 1 per cent (1 in 100) or greater chance of flooding each year. A reed bed and attenuation pond is planned in this area.

The EA flood maps also show that the area to the south west of the existing A555 and A34 junction is in an area at risk from extreme flooding, i.e. the chance of flooding is between 1:100 and 1:1000 per annum. A small portion of the extreme flooding area is actually at the higher, 1:100 or less per annum risk. This smaller area is approximately 200m south of the A555.

3.10 Contaminated Land

The Faber Maunsell Geo-environmental Interpretative Report, dated October 2005, stated that, other than agricultural usage, the railway lines at Hazel Grove and Bramhall, and the oil depot and associated pipelines at Bramhall, there is no evidence for historical activities that could be classed as potentially contaminated land uses. A thin layer of made ground of gravel was noted at Hazel Grove. This may have been deposited to help improve site drainage or access. These sites were investigated and reported in the October 2005 report.

The Geo-environmental report stated that there was no identified direct evidence of ground contamination on the sites, nor pollutant linkages to potentially sensitive receptors. In conclusion, there are no significant contamination issues to human health or controlled ground waters identified from the work undertaken and the overall environmental liability associated with these sites, and the risks associated with site development for the By-pass usage are considered to be low.

The chemical test results from the top 1m of selected exploratory holes indicate that the natural material beneath the topsoil, from all three site locations, is likely to classify as non hazardous waste and 'Inert' for waste disposal and landfill.

In terms of re-use potential the test results indicate the material does not fall into a Class U1B or U2 category, and subject to geotechnical suitability the material will be acceptable for site earthworks.

The classification of the material for disposal will require to be updated and re-assessed at detail design stage and further sampling and testing is recommended during any additional ground investigation, particularly of areas not previously investigated and of those which the updated desk study indicate may have had a previous potentially contaminative land use.

3.11 Other relevant information

Hydrology

The proposed route crosses a number of minor water courses with main water course being Norbury Brook, which is crossed at CH10300. The minor water courses will be crossed by way of culverts and Norbury Brook by a main structure.

Between Norbury Brook and the Woodford Road (A5102) there are numerous small ponds on or near the proposed alignment. These are also seen between Wilmslow Road and the Styal Railway.

A minor stream is crossed by main alignment and the Terminal Two link road, immediately north of the main terminal buildings.

Hydrogeology

Since 1 April 2010 there are new aquifer designations that replace the former 'Minor' and 'Major' designations. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. There are two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits.

- Bedrock -solid permeable formations.

The description of the aquifer designations is as follows:

- Principal Aquifers

These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

- Secondary Aquifers

These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:

Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;

Secondary B - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Undifferentiated - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

- Unproductive Strata

These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Within the aquifers where there is an existing abstraction well the presence of ‘Groundwater source protection zones’ can also be determined.

Groundwater source catchments are classified into three zones. The zones are divided as follows:

SPZ1 – Inner protection zone. This is defined as the 50 day travel time from any point below the water table to the source. This zone has a minimum radius of 50 metres.

SPZ2 – Outer protection zone. This is defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction.

SPZ3 – Source catchment protection zone. This is defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area where the ratio of groundwater abstraction to aquifer recharge (average recharge multiplied by outcrop area) is >0.75.

The following table summarises the aquifer designation for the superficial deposits and bedrock along the proposed alignment together with any recorded Groundwater source catchments.

Summary of Aquifer designation

Route Section	Superficial Geology	Solid Geology	Ground Water Source Protection Zone
A6 to Hazel Grove railway	Unproductive - within the Glacial Till.	Secondary A - within the Coal Measures	None
Hazel Grove Railway to Norbury Brook	Secondary A - within the glacial sand and gravel in the area of Norbury Brook. Unproductive - elsewhere within the glacial till	Principal - within Collyhurst Sandstone and Pebble Beds (Sherwood Sandstone) Secondary A - within the Coal Measures. Secondary B - within Manchester Marl (Sherwood Sandstone)	None
Norbury Brook to West Coast Mainline	Secondary A - within the glacial sand and gravel in the area of Norbury Brook. Unproductive - elsewhere within the glacial till	Principal - within Collyhurst Sandstone and Pebble Beds (Sherwood Sandstone)	None
West Coast Mainline to Wilmslow Road	Unproductive - within the glacial till	Principal - within Upper Mottled Sandstone and Pebble Beds (Sherwood Sandstone	Yes, within SPZ 3, 'total catchment' zone to the east of the existing A555.
Wilmslow Road to Styal Railway Line	Unproductive - within the glacial till	Principal - within Pebble Beds and 'Keuper' Sandstone (Sherwood Sandstone)	None
Styal Railway Line to Styal Road North Roundabout	Unproductive - within the glacial till	Secondary B - within the Lower 'Keuper' Marl (Mercia Mudstone Group)	None
Styal Road North Roundabout to Manchester International Airport	Unproductive - within the glacial till Secondary A - glacial sand and gravel	Secondary B- within the Lower 'Keuper' Marl (Mercia Mudstone Group)	None

Page deliberately blank for double sided printing

Field and Laboratory Studies

Page deliberately blank for double sided printing

4 Field and Laboratory Studies

4.1 Walkover survey

A walkover survey of the proposed route was undertaken on 18th and 19th November 2010. The survey was limited to areas accessible by the public highway or public footpaths. Photographs from these surveys are presented in Section 8.0 and the findings are summarised below.

4.1.1 A6 to Hazel Grove Railway

- The land use in the area is generally agricultural. Fields are grassed and contain livestock (Photographs 1 to 3).
- The ground is hummocky with a general increase in level in a northwest to southeast direction.
- Houses are present along the A6 close to each of the proposed junctions.
- The railway is on a low height embankment where the crossing is proposed (Photograph 4). Mill Lane passes under the railway (Photograph 5).
- Wooded areas are present at the extreme north of the alignment (Photograph 6).

4.1.2 Hazel Grove Railway to Norbury Brook

- Old Mill Lane reduces in level from Mill Lane to the proposed road alignment and where Norbury Brook is located (Photograph 7).
- A retaining wall that is possibly associated with the former mill buildings is visible (Photograph 8).
- A footbridge crosses Norbury Brook (Photograph 9).
- The land on the proposed road alignment either side of Macclesfield Road is grassed fields (Photograph 10 and 11).
- A slope / ridge crosses the field to the west of Macclesfield Road. The ridge appears to be approximately 3m high (Photograph 10).
- Brookside Garden Centre car park is present to the south of the alignment east of Macclesfield Road.
- Ground levels reduce significantly from Mill Hill Hollow (road). The reduction in ground level appears to be associated with the valley of Norbury Brook. Ground level reduces towards Norbury Brook in a north-easterly direction (Photograph 12).

4.1.3 Norbury Brook to West Coast Mainline

- Land along the proposed road alignment is grassed fields used by livestock (Photograph 13).
- Land rises to the north at the proposed Woodford Road crossing (Photograph 14).
- The west coast mainline passes under Woodford Road in an approximately 4m deep cutting. The cutting reduces in depth towards the proposed road alignment (Photograph 15).

4.1.4 West Coast Mainline to Woodford Road (A5102)

- The land along the proposed road alignment is farm fields in the east of the area (Photograph 16) and a golf course in the west. The land is slightly hummocky in this area.
- A depot that appears to be a fuel storage depot is located to the north of the proposed alignment (Photograph 17). The road to the depot from Chester Road has a concrete surface.
- A pond is present on the proposed alignment within the golf course (Photograph 18). The majority of the golf course was not accessible.
- The land surrounding Chester Road is generally flat. Houses are present on the southeast side of the road (Photograph 19).

4.1.5 Woodford Road (A5102) to Wilmslow Road (B5358)

The site walkover within this section comprised a walkover of the site of the proposed junction with Woodford Road and the site of the proposed retaining wall northeast of the existing A555 junction with the A34 at Stanley Green Retail Park.

- The existing A555 joins Woodford Road at a roundabout. The A555 reduces in level to the west from Woodford Road (Photograph 20).
- Woodford recreation ground is located on the northern side of the A555 immediately west of the existing junction with Woodford Road. The recreation ground comprises flat fields with access roads and a sports pavilion. The sports pavilion is a single storey building (Photograph 21).
- A small bund is present in the recreational ground to the east of the sports pavilion. The bund is approximately 1m high (Photograph 22).
- The crest of the existing A555 cutting is populated with trees (Photograph 22).
- A house and maintenance yard is present to the south of the access to the recreational ground from Woodford Road (Photograph 23).
- A farm is located on the southern side of the existing A555, immediately west of the junction with Woodford Road. Farm buildings are located within the proposed alignment. The farm fields are grassed and occupied by livestock (Photograph 24).
- A footbridge crosses over the A555 at top of cutting level, approximately 500m east of the junction with Woodford Road.
- Woodford Road is in cutting between the footbridge and Woodford Road. The cutting reduces in depth from the footbridge from approximately 10m deep to at grade at Woodford Road. The cutting slopes are vegetated with trees and bushes (Photograph 25).
- Stanley Green Retail Park is located on the north side of the existing A555, north of the east bound exit slip road to the junction with the A34.
- The existing A555 is on an approximately 6m high embankment at the site (Photograph 26).
- The A555 is carried over Earl Road on a bridge which appears to have reinforced earth abutments and wing walls (Photograph 27).

4.1.6 Wilmslow Road (B5358) to Styal Railway Line

- The existing A555 junction with Wilmslow Road comprises the eastbound entry slip road and the west bound exit slip road. Both roads terminate at separate roundabouts which are connected by a road carried by a bridge. This bridge spans an unfinished section of the A555 which ends in a cutting slope on the east side of the bridge (Photograph 28). Raised manholes are visible in the unfinished section of road to the east of Wilmslow Road (Photograph 29).
- The fields to the north of Clay Lane, immediately west of the Woodford Road Junction appear to be affected by some flooding.
- A children’s nursery and an airport car park are located immediately to the west of the Wilmslow Road Junction.
- The land along this section is predominantly fields that are grassed or rough grass land (Photograph 30 and 31 respectively). Ponds are present within the fields on and adjacent to the alignment, including one immediately east of the proposed footbridge (Photograph 30).

- The fields immediately east of Styal Railway line are grassed. Mobile phone transmission masts are located to the north and south of the proposed alignment (Photograph 32).

4.1.7 Styal Railway Line to Styal Road North Roundabout

- Styal Railway line is in an approximately 5m deep cutting at the proposed crossing. A brick arched farm access bridge is present to the north of the proposed crossing (Photographs 33 and 34).
- The land between Styal Railway Line and Styal Lane where the southerly of the two roundabouts is proposed is a grassed field (Photograph 35).
- Styal Road crosses the Manchester airport line on two bridges over two cuttings (Photographs 36 to 38), one joining the north bound Styal railway and one joining the southbound direction (Photograph 39).
- The railway is electrified with overhead line equipment (Photograph 39).
- A large electricity substation is located within the land bound by the three rail cuttings and Styal Road.
- The land where the proposed northern Styal Road roundabout is located is grassed fields (Photograph 40).

4.1.8 Styal Road North Roundabout to Manchester International Airport

- Ringway Road crosses over the Manchester Airport rail line on a bridge (Photograph 41).
- Ringway Road West is in a low height cutting, approximately 1.5m deep, along the alignment (Photograph 42).
- Aviator Way joins Ringway Road West at a roundabout (Photograph 43).
- A pond is present immediately to the west of the Ringway Road West/Aviator Way roundabout (Photograph 44). Ringway Road West crosses over a brook that flows into the pond on a bridge.
- A roundabout joins Ringway Road West with Outwood Lane. The proposed alignment crosses over this roundabout (Photograph 45).
- The land on the alignment to the east and west of the proposed Thorley Lane roundabout is occupied by hard surfaced car parks and landscaped areas (Photograph 46).

The proposed alignment joins the Manchester Airport junction of the M56 at an existing roundabout. The roundabout is on embankment at the site and is carried by two bridges over the M56 (Photograph 47).

4.2 Geomorphological/geological mapping

Not carried out as part of this study.

4.3 Ground Investigations

4.3.1 Description of fieldwork

Holes relevant to the Design Freeze 3 alignment were selected from the previous ground investigations. The existing data indicates that a total of 167 cable percussion holes (some with rotary follow on), 12 rotary cored (RC) holes, 16 rotary open (RO) holes, 33 trial pits (TPs) and 16 window sample (WS) holes are relevant to the current alignment.

Cable percussion (CPs) holes and rotary follow-on varied in depth between 4.6m and 45m, RC only holes varied in depth between 14.5m and 42m, RO only holes varied in depth between 10.73m and 46.5m, TPs varied in depth between 2m and 4.7m and the window samples holes varied in depth between 0.68m and 6.65m.

Individual Sections were as follows:

A6 to Hazel Grove

6 Cable Percussion holes (some with rotary cored follow on), depth range 8 – 45m

5 Rotary Open holes, depth range 20.2 – 30m

11 Trial Pits, depth range 1.8 – 3.5m

Hazel Grove to Norbury Brook (including both crossings)

55 Cable Percussion holes (some with rotary cored follow on), depth range 14.5 – 45m

9 Rotary Open holes, 10.7 - 46.5m

18 Trial Pits, 2 - 4.7m

Norbury Brook to West Coast Main line (including crossing)

24 Cable Percussion holes, depth range 6.2m – 23.6m

2 Rotary Open holes, depth range 10.7m – 14.9m

West Coast Main line to Woodford Road (A5102)

67 Cable Percussion holes, depth range 5 – 30.4m

Woodford Road (A5102) to Wilmslow Road (B5358)

No available ground investigation data.

Wilmslow to Styal Railway

No available ground investigation data.

Styal Railway to Styal North Roundabout

No available ground investigation data.

Styal North Roundabout to Airport

5 Cable Percussion holes (One with rotary cored follow on), depth range 7 – 20m

4 Trial Pits, depth range 3.1 – 3.3m

16 Window Sample holes, depth range 0.7 – 6.7m

4.3.2 Ground investigation report

The results of the previous ground investigations are contained in the reports listed in Table 1. The results of the ground investigations are also reported in AGS format.

4.3.3 Results of in situ tests

In situ testing comprised standard penetration tests in cable percussion holes, hand vanes in trial pits and in situ CBR values in trial pits on the line of the Metrolink extension.

The results of the testing are reported in the various factual reports.

4.4 Drainage studies

Not carried out as part of this study.

4.5 Geophysical surveys

Geophysical surveys were carried out on behalf of Manstock Geotechnical Consultancy Services on all areas that are subcropped by Westphalian rocks. For the Design Freeze 3 alignment the area covered by the survey was Hazel Grove to Macclesfield Road.

The purpose of the survey was to attempt to identify shallow mine workings and shafts. The survey was carried out using Magnetometry and Conductivity techniques.

A number of anomalies were picked up by the surveys. Some of the anomalies were investigated as part of the Norwest Holst Main Ground Investigation with a recommendation for the remainder to be investigated as part of the preliminary works for the main road construction project.

4.6 Pile Tests

Not carried out as part of this study.

4.7 Other field work

No additional field works was carried out.

4.8 Laboratory investigations

4.8.1 Description of tests

The following laboratory tests have been carried out as part of the investigations:

Test	Number
All Areas	
Natural Moisture Content	2838
Liquid Limit	607
Plastic Limit	582
Bulk Density	522
Undrained Shear Strength	479
1D Consolidation Test	83
CBR	17
Shearbox	48
Compaction	18
MCV	24
Point Load	7
Rock Moisture Content	1
A6 to Hazel Grove	
Natural Moisture Content	14
Liquid Limit	11
Plastic Limit	11
Bulk Density	10
Undrained Shear Strength	10
1D Consolidation Test	2
Hazel Grove to Norbury (Including rail and stream crossings)	
Natural Moisture Content	472
Liquid Limit	111

Plastic Limit	108
Bulk Density	78
Undrained Shear Strength	72
1D Consolidation Test	22
CBR	7
Shearbox	14
Compaction	3
Norbury to WCML Crossing (including rail crossing)	
Natural Moisture Content	706
Liquid Limit	165
Plastic Limit	159
Bulk Density	160
Undrained Shear Strength	131
1D Consolidation Test	37
Shearbox	15
West Coast Main line to Woodford Road (A5102)	
Natural Moisture Content	1567
Liquid Limit	287
Plastic Limit	275
Bulk Density	274
Undrained Shear Strength	259
1D Consolidation Test	22
Shearbox	19
Styal North Roundabout to Airport	
Natural Moisture Content	79
Liquid Limit	33
Plastic Limit	29
Undrained Shear Strength	7
CBR	10
Compaction	15

MCV	24
Point Load	7
Rock Moisture Content	1

4.8.2 Copies of test results

The results of the laboratory testing carried out as part of the previous ground investigations are contained in the reports listed in Table 1. The results of the ground investigations are also reported in AGS format.

.

Ground Summary

Page deliberately blank for double sided printing

5 Ground Summary

5.1 General

Ground conditions across the site have been interpreted from the study of the published geological information and information contained within the reports from previous investigations relevant to the Design Freeze 3 alignment. The following sections outline the anticipated ground conditions along each section of the proposed route. Analysis of the likely geotechnical design parameters will be included in Section 6.

5.2 Topography

From its new junction with the A6 the Design Freeze 3 alignment runs along the northern side of the Norbury Brook Valley, falling from 110m OD to 80m OD at Poynton Brook, rising slightly before crossing Norbury Brook at 77m OD.

From Norbury Brook the ground levels rise to around 88-90m OD and remain fairly constant to the A5102 (Woodford Road). Just west of the A5102 ground levels fall around 10m.

Between the A5102 and the B5358 the route is generally flat with a gradual fall in level to around 77-78 m OD at the B5358. There is a slight raise prior to the Styal railway crossing. Top of cutting is around 80m OD and the cutting is approximately 5m deep.

Aside from the Manchester Airport railway cutting the topography of the remainder of the route is generally flat with a gradual fall in levels to around 70m OD at the junction of the Terminal 2 link road. The Terminal 2 roundabout at the end of the proposed link road is around 6m higher than the remainder of the link road which will have to raise to meet it.

5.3 Geology

5.3.1 A6 to Hazel Grove Railway

The ground conditions encountered during the ground investigations are shown on Drawings 60186094/GEO/002 and 60186094/GEO/003. The geology comprises firm to stiff glacial till overlying the mudstone, siltstone and sandstone of the Westphalian Coal Measures. Cohesive made ground was encountered between CH1000 and CH1200.

The Westphalian Coal Measures are relatively shallow, typically occurring 2-3m beneath the proposed realignment of the A6. Excavations into bedrock may be required at Chainages 525m and 1050m and in the vicinity of the A6 Bus Bridge and the Buxton to Stockport Rail Bridge.

Coal seams may be encountered in the cutting for rail and bus bridges. A Coal Authority licence will be required for any excavation in the seams.

There is a possibility for shallow mine workings along the line of the route and further investigation by top soil stripping will be required during the advance works for the main construction to reduce the risk of encountering unrecorded shafts during the main construction. Investigation by rotary coring is proposed at structure locations prior to detailed design.

5.3.2 Hazel Grove Railway to Norbury Brook

Between the rail bridge and approximately CH 9150 the route passes through an area where the glacial till is thin (<4m) or absent. There are also minor isolated areas of glacio-fluvial sands and gravels between CH8600 and CH8800. Maximum drift cover is at CH8680 where 3m of glacio-fluvial sands and gravels overlie just over 1m of glacial tills.

The Westphalian Coal Measures mudstones, siltstones and sandstone deposits lie beneath the superficial deposits in this area and outcrop where the superficial deposits are absent.

A number of voids are noted in the Coal Measures. These are discussed in paragraph 3.4

Between CH9150 (just west of Red Rock Fault) and Norbury Brook the superficial deposits thicken with a maximum of 19m bgl proved, just to the north of Norbury Brook. The superficial deposits comprise a mixture of medium dense glacio-fluvial sands and gravels and generally firm to stiff glacial tills. The sands and gravels are River Terrace deposits associated with Norbury Brook. There are also occasional minor interbeds of glacio-fluvial cohesive deposits. The proportion of glacio-fluvial sands and gravels compared to glacial tills increases towards the Norbury Brook crossing, although in the immediate vicinity of the Brook, and for 200m to the east, soft to firm alluvial material is expected.

Where proved in the historic ground investigations the bedrock consisted of sandstone of Sherwood Sandstone Pebble Beds.

The ground conditions encountered are shown on Drawings 60186094/GEO/003 and 60186094/GEO/004.

5.3.3 Norbury Brook to West Coast Mainline

A maximum of 18m of dense to very dense fluvio glacial sands and gravels were proved within 300m of the southern bank of Norbury Brook. Sandstone bedrock was proved at 18m bgl in BH EA POYNTON 97_2. Some glacial tills were interbedded in the sands and gravels. Up chainage of CH10800 the glacial tills become predominant, although sands and gravels and occasional glacio-fluvial cohesive deposits are recorded at 6-9m depth below Woodford Road Bridge and the WCML Bridge.

A layer of firm peat is present between the glacio-fluvial cohesive deposits and the glacial tills in the vicinity of the accommodation bridge at CH11090. The peat is 0.4-0.8 thick at a depth of 1.5m in BH EA POYNTON 91_1 and 4.1m in BH EA POYNTON 90_1.

Sandstone is recorded at a depth of 15m bgl below the WCML crossing.

The ground conditions encountered are shown on Drawings 60186094/GEO/004 and 60186094/GEO/005.

5.3.4 West Coast Mainline to Woodford Road (A5102)

Between the railway and Woodford Road glacial tills were recorded overlying glacio-fluvial sands and gravels. The base of the latter was generally not proved; however in BH EA POYNTON 76_1 the sands and gravels were underlain at 18m bgl by glacio-fluvial clays to a maximum proved depth of 25m bgl.

Up chainage of the A5149 firm to stiff glacio-fluvial clays became more dominant, replacing the glacial tills. In the vicinity of the A5102 Woodford Road junction interbedded glacio-fluvial clays and granular deposits were recorded to depths in excess of 22m bgl. Of these deposits the glacio-fluvial clays were recorded to be up to 15m thick in BH EA POYNTON 69_4.

Small areas of isolated alluvial material are expected, associated with the historic and current ponds noted on the historical mapping.

The ground conditions encountered are shown on Drawings 60186094/GEO/005 and 60186094/GEO/006.

5.3.5 Woodford Road to Wilmslow Road

This section of the route has already been constructed. Although the historical boreholes cannot at present be sourced, the British Geological Survey (BGS) on line mapping indicates that a sequence of glacial tills over the Sherwood Sandstone Chester Pebble Beds and the Wilmslow Sandstone (Upper Mottled Sandstone) is likely in this area. The tills are likely to be firm to stiff.

5.3.6 Wilmslow Road to Styal Railway Line

No ground investigation data is available for this area. The BGS on line mapping and paper maps indicates that glacial till deposits will overlie the Wilmslow Sandstone (Upper Mottled Sandstones) of the Sherwood Sandstone Group. In the immediate vicinity of the Styal Railway cutting the till is expected to overlie the Helsby Sandstone or Keuper Sandstone which is a pebbly sandstone, also of the Sherwood Sandstone Group.

5.3.7 Styal Railway Line to Styal Road North Roundabout

No ground investigation is available for this area. Geological mapping indicates that glacial till overlies the Bollin Mudstone Member (Lower Keuper Marl), part of the Mercia Mudstone Group. The till is expected to be stiff to very stiff.

5.3.8 Styal Road North Roundabout to Manchester International Airport

The ground investigations encountered 4 to 6m of stiff to very stiff glacial tills with mudstone rockhead recorded at 6.2m in GEO METRO BH50_AIR. This was proved to a depth of 10m bgl. One to two metres of glacio-fluvial sands and gravels were recorded overlying the till from the junction between Ringway Road and Shadowmoss Road and just beyond the junction between Ringway Road and Aviator Way, i.e. in the vicinity of the housing estate. Up to 2m of granular made ground was recorded in the vicinity of the Shadowmoss Road junction.

No ground investigation data is available for the Terminal 2 link road, however it is anticipated that the ground conditions will comprise glacial till over mudstone at around 5m depth. Localised alluvial deposits are expected, associated with the small streams in this area.

The ground conditions encountered are shown on Drawings 60186094/GEO/012 and 60186094/GEO/013.

5.4 Hydrogeology

5.4.1 A6 to Hazel Grove Railway

Groundwater levels are based on water strikes recorded during the various ground investigations and limited monitoring carried out as part of previous reports.

With the exception of a borehole at CH625 groundwater levels are generally 1-2m below proposed formation level. At CH625 recorded levels were at formation level. More granular layers within the glacial till may also be water bearing, if present these layers are likely to be discontinuous.

5.4.2 Hazel Grove Railway to Norbury Brook

Ground water levels are generally expected to be greater than 4m below formation, however between the structures and ~CH8900 ground water levels are expected to be above formation level, indeed around CH8630 ground investigation records indicate that sub artesian conditions may be anticipated.

5.4.3 Norbury Brook to West Coast Mainline

Groundwater levels are expected to be around 1-3m bgl. Ground water may also be present in more granular horizons within the glacial till, above the more general water table level.

Numerous ponds are noted in this area suggesting high water levels.

5.4.4 West Coast Mainline to Woodford Road (A5102)

Ground water levels are expected to be variable from near surface to in excess of 5m bgl in the vicinity of Woodford Road junction, though, as previously commented, isolated perched ground water can be expected in more granular horizons in the glacial tills.

Numerous ponds are noted in this area suggesting high water levels.

5.4.5 Woodford Road to Wilmslow Road

Ground water levels are unknown but are likely to be similar to the West Coast Mainline to Woodford Road section.

5.4.6 Wilmslow Road to Styal Railway Line

Groundwater levels are unknown but are also likely to be similar to the West Coast Mainline to Woodford Section, although there is likely to be a localised area of drawdown in the vicinity of the Styal Railway cutting.

Numerous ponds are noted in the area suggesting high water levels away from the railway cutting.

5.4.7 Styal Railway Line to Styal Road North Roundabout

No information is available concerning groundwater, however it is likely to be controlled by the drainage installed in the Styal railway cutting and the two cuttings for the Manchester Airport rail link triangular junction with the Styal railway.

5.4.8 Styal Road North Roundabout to Manchester International Airport

Ground water levels recorded during the ground investigation were generally around 2-3m bgl. In the vicinity of the Terminal 2 link road a number of small streams are crossed.

5.5 Man Made Features and Historical Development

The earliest OS maps dating from the early 1870's show isolated properties scattered over the area. The coal mining heritage of the area is evident at Hazel Grove. The three main line railways crossed by the route are present.

The later pre-1900 maps show little change. The period prior to World War II saw the start of distinct residential areas developing. The industry in the region was for the most part in decline, all of the mills and collieries now being disused.

Manchester Airport opened in 1935.

The post-war era showed significantly greater residential development, all of the current distinct settlements being identifiable. Former industrial sites in the north have been given over to agriculture, whilst golf courses appear to have taken over former farm land in the south. The current setting of the site is described in Section 3.1.

The railway link into Manchester Airport opened in 1993.

Page deliberately blank for double sided printing
.

Ground Conditions and Material Properties

Page deliberately blank for double sided printing

6 Ground Conditions and Material Properties

6.1 Introduction

For the majority of the route there has been no additional ground investigation data since the October 2005 Faber Maunsell Geo-Environmental report, however data pertaining to part of the Styal North Roundabout to Manchester Airport section of the route has been obtained since the October 2005 report and these are included in the discussion below.

Reference should be made to drawings 60186094/GEO/002 to 013 to determine exact positions and thicknesses of different strata types.

Moderately conservative geotechnical parameters have been derived using in situ and laboratory data. Where this data does not exist values have been derived using established correlations[1].

Where undrained strength has been correlated from N values a Stroud and Butler, 1975 correlation factor f_1 of 4.5 has been used for the cohesive deposits. In some areas the Plasticity Index data suggests that a higher factor could be used however it is considered that the factors used are moderately conservative.

Plots of interpreted laboratory data are given in a section by section basis in the Appendix.

Further ground investigation is recommended at detailed design stage to infill gaps in the data and to update the material properties. Parameters have been given for each section of the route. These should be reviewed at detailed design stage for the individual structures and earthworks.

6.2 Topsoil (TS)

Topsoil was encountered in all areas investigated with thickness varying from 0m to 0.65m (A6 to Hazel Grove, Main GI BH 239), 0.9m (Hazel Grove to Norbury Brook, EA Poynton BH 98_3), 0.9m (Norbury Brook to WCML, EA Poynton BH 98_3), 1.5m (WCML to A5102, EA Poynton BH 51_3) and 0.4m (Styal North Roundabout to MIA, several holes).

Top soil was absent in some locations where Made Ground was present, in NWH Main GI TP36, which was excavated directly into cohesive till, and also in some holes where rotary drilling techniques were used form the ground surface. Topsoil was probably present at the locations where rotary drilling occurred, however, but it was just not recorded.

6.3 Made Ground (MGG & MGC)

The Made Ground has been divided according to the main matrix constituent, namely cohesive or granular. The Cohesive Made Ground (MGC) and Granular Made Ground (MGG) were identified to a maximum depth of 3m (A6 to Hazel Grove, NWH Main GI TP34).

In the A6 to Hazel Grove area the Made Ground was concentrated between CH950 and CH1250 of the realigned A6.

Between Hazel Grove and Norbury Brook the Made Ground is scattered throughout the section, infilling hollows.

Similarly between Styal North Roundabout and the airport the Made Ground appears to have been used to infill hollows.

---

[1] For example BS8002 & Gibson (Phi values from PI data); Stroud and Butler, 1975 (Cu from N Values); Whyte, 1982 (Cu from Liquidity Index); Skempton and Terzaghi & Peck (Cc from PI data), Hobbs, 1986 (Cc from mc for peats)

The major difference between exploratory holes was the size and lithology of the gravel, which became coarser together with gravel sized sandstone and fine to medium sand in the granular made ground. The quantity of the granular material was used to determine the classification as either MGC or MGG. Fragments of brick as well as clay pipe, charcoal, ash was generally found comprising the fill. In NWH Main GI TP 34 (A6 – Hazel Grove) 0.5m of organic domestic and industrial refuse of wood, tyres, metal etc. was recorded.

The March/April 2005 investigation findings indicated limited Made Ground deposits, which is consistent with the mainly agricultural usage and lack of historical development in the route as a whole. Where identified the Made Ground appears to be limited in vertical extent and associated with man-made works such as pathways or access improvements for soft ground.

6.4 Material Types

6.4.1 Alluvium (AL)

The main areas where Alluvium is present is in the vicinity of Norbury Brook (CH 10100 to CH10400), which has a maximum thickness of around 2m, and between CH 12550 and CH 13100 (WCML to A5102), where a maximum thickness of around 1m has been recorded;

In the vicinity of Norbury Brook the alluvium is mostly described as firm sandy Clay or Silt. Between CH12550 and CH 13100 the material is described as very soft to firm sandy, occasionally silty, Clay, frequently with organic material. This material probably originally infilled the old ponds which the historical maps indicates were at one time much more common in this vicinity than they are now.

Plasticity data indicates that the material is low plasticity Clay to intermediate plasticity Silt.

Moderately conservative geotechnical parameters for the alluvium, derived from in situ and laboratory testing (where available) are given below. Parameters where it has not been possible to derive a value from laboratory or insitu data are marked with a "-"

Parameter	Moderately Conservative Value
N	7
MC	22%
PI	15%
c_u	30 kPa
c_c	0.2
c_s	0.03
e_o	0.59
Bulk Density	2.1 kN/m^3
Ø'	26-28° (from PI data)
CBR	3-4%
NB Ground conditions across the route are variable. Moderately conservative parameters are given to comply with standards however it is strongly recommended that these are reassessed on an individual structure/earthwork basis at detailed design.	

6.4.2 Peat

Up to 0.8m of peat was encountered underlying glaciofluvial cohesive deposits in two holes between CH11050 and CH11200, between Norbury Brook and the WCML. Peat was also encountered around CH12900, between the WCML and the A5102, where it overlay the alluvium in the old pond described in Paragraph 6.4.1. At this location it was 1.3m thick.

Between Norbury Brook and the WCML the peat was described as being firm with silt and clay layers. In one hole the peat is described as amorphous and in the other fibrous.

The peat at CH 12900 was described as spongy and fibrous.

One plasticity test on the amorphous Peat indicates that it is of medium plasticity. Only one other moisture content test has been carried out. A plasticity test on the glacio-fluvial clays immediately above the peat has been carried out. This material is described as having bands of peat and the PI of 105% suggests that the test was carried out in one of the bands.

Parameters for Norbury Brook to WCML are based on these results are described below. It should be noted, however, that the descriptions indicate that the Peat is highly variable and therefore the results should be used with caution. No viable data is available for the peat at CH12900 and it is recommended that this is dug out and replaced with granular material.

Parameter	Moderately Conservative Value
N	-
MC	120%
PI	105%
c_u	40 kPa (from description)
c_c	0.96 (from mc)
c_s	0.1
e_o	3.2
Bulk Density	1.4 kN/m^3
$Ø_p$’ & $Ø_r$’	18° & 9° (from PI data)
NB Ground conditions across the route are variable. Moderately conservative parameters are given to comply with standards however it is strongly recommended that these are reassessed on an individual structure/earthwork basis at detailed design.	

6.4.3 Glacial Till (CT)

Glacial till was encountered in all areas of the route investigated, with the exception of between CH8700 and approximately CH8850 where the Westphalian rock outcrop, and between CH9850 and Norbury Brook where it was not encountered within the superficial deposits.

The till is commonly interbedded with glaciofluvial granular and cohesive deposits. The maximum depth proved was just over 10m in the vicinity of the WCML although in some area the total thickness may be greater as the bottom of the till was not always proved.

The till is normally described as firm to stiff, occasionally soft or occasionally very stiff, sandy Clay with occasional to some gravel of sandstone, siltstone and coal.

PI data indicates that the till is generally classified as low to intermediate plasticity, with the proportion of low plasticity material increasing to the west of Norbury Brook. In the area between Styal North Roundabout and Manchester Airport the till is predominantly low plasticity.

The material is classified as Class 2 in accordance with the Highways Agency Specification.

Parameter	Moderately Conservative Value	
N	A6-Hazel Grove (HG)	N=10
	HG – Norbury Brook (NB)	0-4m N=12 >4m N=20
	NB – WCML	0-2m N=10 >2m N=15
	WCML – A5102	0-2m N=10 >2m N=15
	N Styal Rdabt – MIA	0-4m N=12 >4m N=20
MC	A6-Hazel Grove (HG)	20%
	HG – Norbury Brook (NB)	0-2m 18% 2-12m 12% >12m 15%
	NB – WCML	0-8m 18% 8-14 20% >14m 15%
	WCML – A5102	13%
	N Styal Rdabt – MIA	15%
PI	A6-Hazel Grove (HG)	12%
	HG – Norbury Brook (NB)	0-2m 20% 2-12m 12% >12m 20%
	NB – WCML	0-8m 15% 8-14 25% >14m 12%
	WCML – A5102	12%

Parameter	Moderately Conservative Value	
	N Styal Rdabt – MIA	15%
Optimum MC and Max. Dry Density	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	8.4% 2.19Mg/m^3
	NB – WCML	-
	WCML – A5102	-
	N Styal Rdabt – MIA	8% & 2.02 Mg/m^3
c_u	A6-Hazel Grove (HG)	70kPa
	HG – Norbury Brook (NB)	0-4m 50kPa >4m 120kPa
	NB – WCML	0-9m 90kPa >9m 120kPa
	WCML – A5102	0-8m 80kPa >8m 120kPa
	N Styal Rdabt – MIA	0-2m 60kPa >2m 100kPa
c_c	A6-Hazel Grove (HG)	0.15
	HG – Norbury Brook (NB)	0.15
	NB – WCML	0.15
	WCML – A5102	0.12
	N Styal Rdabt – MIA	0.13
c_s	A6-Hazel Grove (HG)	0.03
	HG – Norbury Brook (NB)	0.02
	NB – WCML	0.02
	WCML – A5102	0.03
	N Styal Rdabt – MIA	0.03
e_o	A6-Hazel Grove (HG)	0.5
	HG – Norbury Brook (NB)	0.4
	NB – WCML	0.5
	WCML – A5102	0.4
	N Styal Rdabt – MIA	0.4

Parameter	Moderately Conservative Value	
Bulk Density	A6-Hazel Grove (HG)	2.1 kN/m^3
	HG – Norbury Brook (NB)	2.2 kN/m^3
	NB – WCML	2.1 kN/m^3
	WCML – A5102	2.2 kN/m^3
	N Styal Rdabt – MIA	2.2 kN/m^3
$Ø_p$' & $Ø_r$' (from PI data)	A6-Hazel Grove (HG)	31° & 27°
	HG – Norbury Brook (NB)	0-2m 28° & 23° 2-12m 31° & 27° >12m 28° & 23°
	NB – WCML	0-8m 30° & 25° 8-14m 27° & 22° >14m 31° & 27°
	WCML – A5102	31° & 27°
	N Styal Rdabt – MIA	30° & 25°
CBR		3-4%
NB Ground conditions across the route are variable. Moderately conservative parameters are given to comply with standards however it is strongly recommended that these are reassessed on an individual structure/earthwork basis at detailed design.		

6.4.4 Glacio-fluvial Cohesive (GFC)

GFC material was encountered in isolated patches on the realigned A6 at the eastern end of the scheme; in limited amounts, interbedded with the till between Norbury Brook and the WCML; and in the vicinity of the A5102 Woodford Road junction. Between CH12700 and CH13300 it formed the main unit encountered during previous ground investigations.

The maximum depth proved was just over 21.5m, in the vicinity of the A5102 junction, however the base of the unit was not proved in this area.

The GFC is normally described as a firm sandy silty Clay although occasionally it can be soft to stiff. In some places it is laminated and or has greater than 50% silt content. It is distinguished from the till by a much lower gravel content though in some areas the units are very similar.

PI data indicates that the GFC is generally low plasticity with minor intermediate and occasional high plasticity clays.

The material is classified as Class 2 in accordance with the Highways Agency Specification.

Parameter	Moderately Conservative Value	
N	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	20
	NB – WCML	15
	WCML – A5102	15
	N Styal Rdabt – MIA	-
MC	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	18%
	NB – WCML	0-2m 20% 2-4m 18% 10-12m 30% >12m 20%
	WCML – A5102	0-12m 15% 16-22m 17%
	N Styal Rdabt – MIA	-
PI	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	12%
	NB – WCML	0-2m 25% 2-4m 12% 10-12m 25% >12m 12%
	WCML – A5102	0-12m 16% 16-22m 25%
	N Styal Rdabt – MIA	-
c_u	A6-Hazel Grove (HG)	50 kPa (from descriptions)
	HG – Norbury Brook (NB)	70 kPa
	NB – WCML	0-3m 30 kPa >8m70 kPa
	WCML – A5102	80 kPa
	N Styal Rdabt – MIA	-
c_c	A6-Hazel Grove (HG)	-

Capabilities on project:
Geotechnical

Parameter	Moderately Conservative Value	
	HG – Norbury Brook (NB)	0.12
	NB – WCML	0.2
	WCML – A5102	0.16
	N Styal Rdabt – MIA	-
c_s	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	0.02
	NB – WCML	0.03
	WCML – A5102	0.04
	N Styal Rdabt – MIA	-
e_o	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	0.48
	NB – WCML	0.58
	WCML – A5102	0.44
	N Styal Rdabt – MIA	-
Bulk Density	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	2.13
	NB – WCML	2.06
	WCML – A5102	2.2
	N Styal Rdabt – MIA	-
$Ø_p$’ & $Ø_r$’ (from PI data)	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	31° & 26°
	NB – WCML	0-2m 27° & 22° 2-4m 31° & 26° 10-12m 27° & 22° >12m 31° & 26°
	WCML – A5102	0-12m 30° & 25° 16-22m 27° & 22°
	N Styal Rdabt – MIA	-
CBR		3-4%
NB Ground conditions across the route are variable. Moderately conservative parameters are given to comply with standards however it is strongly recommended that these are reassessed on an individual structure/earthwork basis at detailed design.		

6.4.5 Glacial Sands and Gravels (GFS, GFG, S&G)

Glacial sands and gravels were encountered in sporadic locations on the realigned A6, generally interbedded with the glacial tills. Between Hazel Grove the granular deposits were generally up chainage of the Red Rock Fault (CH9100). In this area they were dominant unit proved with minor interbeds of glacial tills and glacio-fluvial cohesive deposits. Maximum depth proved in this area was in excess of 18m (BH EA-Poynton 104_4). This hole is located near Norbury Brook. Although the unit was not bottomed out in this particularly hole, holes in the vicinity proved the underlying sandstone at similar depths.

Between Hazel Grove and the Red Rock Fault the granular deposits are much more sparsely distributed, with a maximum thickness proved of just over 2m (BH 1003)

Between Norbury Brook and the WCML the granular deposits were the main unit until around CH10900. Between CH11300 and WCML the granular deposits generally underlie the glacial tills, with a maximum thickness proved of 9m in EA Poynton 82_3, at the site of the proposed bridge over the WCML.

Between the WCML and the A5249 interchange the granular deposits again underlie the till, and between the A5249 and the A5102, the granular deposits generally underlie the glacial cohesive deposits, although at the A5102 interchange glacio-fluvial cohesive deposits were encountered below the granular deposits in some of the exploratory holes.

Between North Styal Roundabout and the end of the route thin deposits of granular material were encountered between CH750 and CH1450. These deposits generally overlie the till, although in some holes the granular deposits were interbedded with the till. Maximum thickness proved in this area was less than 2m.

From the start of the route to the Norbury Brook area the granular deposits were generally described as being predominantly medium dense, occasionally loose and occasionally dense or very dense. The gravel component was derived from mudstone, sandstone, coal and ironstone. There were occasionally more clayey or silty layers within the granular material. From Norbury Brook the gravel proportion became much more minor and the units were generally described as medium dense sands.

The granular material would normally be classified as Class 1 although each cutting should be considered in turn as the occasional minor fines components may be require the material to be classified as Class 2 in accordance with the Highways Agency Specification.

Parameter	Moderately Conservative Value	
N	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	0-4m 15 >4m 25
	NB – WCML	20
	WCML – A5102	0-4m 23 >4m 13
	N Styal Rdabt – MIA	-
MC	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	0-6m 8%

Parameter	Moderately Conservative Value	
		>6m 12%
	NB – WCML	0-10m 10% >10m 16%
	WCML – A5102	0-25m 10% >25m 21%
	N Styal Rdabt – MIA	14%
Optimum Moisture Content/Max Dry Density	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	-
	NB – WCML	-
	WCML – A5102	-
	N Styal Rdabt – MIA	8% 1.98 Mg/m^3
Ø'	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	33°
	NB – WCML	32°
	WCML – A5102	31°
	N Styal Rdabt – MIA	-
CBR		8%
NB Ground conditions across the route are variable. Moderately conservative parameters are given to comply with standards however it is strongly recommended that these are reassessed on an individual structure/earthwork basis at detailed design.		

6.4.6 Rock

Rock was encountered in the ground investigation at A6-Hazel Grove, Hazel Grove to Norbury Brook, in the vicinity of the WCML crossing and between Styal North Roundabout and Manchester Airport.

The rock outcrops, or is very close to surface between CH500 – CH850 on the A6 realignment, and between CH8700 to CH8950 between Hazel Grove and Norbury Brook.

Between the A6 and CH9150 the rock comprises interbedded mudstones, siltstones, sandstones and coals of the Westphalian System In places the rocks have weathered to a residual soil. These can be 2-3m thick. In its slightly weathered state the rock is generally moderately weak to moderately strong. Where encountered depth to rock varied from between 3m in the vicinity of the Norbury Brook channel, to around 15m bgl..

Between CH9200 and CH10500 the underlying rock comprises sandstone of the Collyhurst Formation. The Collyhurst sandstone was reddish brown and where recovered intact was described as highly weathered very weak to weak. In many places the sandstone was sufficiently weathered that cable percussion boring was able to penetrate to several metres.

Between CH 11600 and the WCML bridge, rock was encountered at around 15m bgl. These were sandstones of the Poynton Pebble Beds which were described as completely weathered to weak reddish brown sandstones. Again cable percussion drilling was able to penetrate several metres.

Between Styal North Roundabout and Manchester Airport mudstones of the Mercia Mudstone Group were encountered at 3m bgl at both CH800 and between CH1650 and CH1750m.

The mudstone is described as an extremely weak reddish brown mudstone.

Parameter	Moderately Conservative Value	
N	A6-Hazel Grove (HG)	>50
	HG – Norbury Brook (NB)	>50
	NB – WCML	>50
	WCML – A5102	-
	N Styal Rdabt – MIA	-
MC	A6-Hazel Grove (HG) (Completely weathered mudstone)	20%
	HG – Norbury Brook (NB)	18% (Completely weathered mudstone) 15% (Completely weathered siltstone)
	NB – WCML (Completely weathered sandstone)	0-8m 11% >8m 20%
	WCML – A5102	-
	N Styal Rdabt – MIA	10%(Completely weathered mudstone) 10.2% (rock moisture content)
PI	A6-Hazel Grove (HG) (Completely weathered mudstone)	21%
	HG – Norbury Brook (NB)	25% (Completely weathered mudstone) 15% (Completely weathered siltstone)
	WCML – A5102	-

Parameter	Moderately Conservative Value	
	N Styal Rdabt – MIA (Completely weathered mudstone)	-
c_c & c_s	A6-Hazel Grove (HG)	0.24 & 0.04
	HG – Norbury Brook (NB)	0.29 & 0.05 (completely weathered mudstone) 0.16 & 0.03 (completely weathered siltstone)
	NB – WCML	-
	WCML – A5102	-
	N Styal Rdabt – MIA	-
Optimum Moisture Content/Max Dry Density	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB)	8.4% 2.15 Mg/m^3
	NB – WCML	-
	WCML – A5102	-
	N Styal Rdabt – MIA	10% 1.95 Mg/m^3
e_o	A6-Hazel Grove (HG)	0.54
	HG – Norbury Brook (NB)	0.48 (completely weathered mudstone) 0.4 (completely weathered siltsone)
	NB – WCML	-
	WCML – A5102	-
	N Styal Rdabt – MIA	-
Bulk Density	A6-Hazel Grove (HG)	2.1
	HG – Norbury Brook (NB)	2.1 (completely weathered mudstone) 2.2 (completely weathered siltstone)
	NB – WCML	-
	WCML – A5102	-
	N Styal Rdabt – MIA	-

Parameter	Moderately Conservative Value	
Ø' $_p$ & Ø' $_r$	A6-Hazel Grove (HG)	28° & 23° (from plasticity data)
	HG – Norbury Brook (NB) (from plasticity data)	27° & 22° (completely weathered mudstone) 30° & 25° (completely weathered siltstone)
	NB – WCML (from shear box data)	38° (completely weathered sandstone)
	WCML – A5102	-
	N Styal Rdabt – MIA	-
Rock Strength Is_{50} & UCS (Is_{50} x 23)	A6-Hazel Grove (HG)	-
	HG – Norbury Brook (NB) (from plasticity data)	-
	NB – WCML (from shear box data)	-
	WCML – A5102	-
	N Styal Rdabt – MIA	0.02 & 0.5 MPa (mudstone) 0.44 & 10.2 MPa (siltstone)
CBR		3-4% (weathered mudstone and siltstone) 8% unweathered mudstone/siltstone) >15% unweathered sandstone
NB Ground conditions across the route are variable. Moderately conservative parameters are given to comply with standards however it is strongly recommended that these are reassessed on an individual structure/earthwork basis at detailed design.		

6.5 Groundwater/Chemistry

6.5.1 Groundwater

Recorded ground water levels are shown on Drawings 60186094/GEO002 - Drawings 60186094/GEO0013.

In the A6-Hazel Grove area ground water strikes were generally at various levels within the rock. Levels are expected to be close to formation around CH 625 and 1175.

Between Hazel Grove and Red Rock Fault (CH 9100) strikes and long term levels were again mostly within the rock. Between CH8350 and CH8700 levels are expected to be at or above grade within the cutting that is proposed for this area.

Up chainage of the fault water strikes were generally in the granular deposits with apparent hydraulic conductivity between interbedded units. Levels close to Norbury Brook are controlled by the stream.

Between CH10400 and CH10600 there appears to be non contiguous water strikes. One at a lower level in the granular deposits and a higher strike, above a glacial till layer. Long term levels for the latter are above formation level.

Between CH11200 and CH11600 long term levels are generally several metres above formation in the cut beneath Woodford Road Bridge.

Between CH11600 and CH12800 ground water strikes and long term levels are generally below formation, however between CH12800 and the A5102 interchange there are a number of strikes and long term levels within the glacial till and glacio cohesive deposits above formation level. In the vicinity of the A5102 interchange there are also strikes at depth in the granular deposits beneath the glacio cohesive deposits. Again these do not appear to be in hydraulic conductivity with the upper strikes.

Between the A5102 and Styal Railway Bridge the numerous ponds suggest that ground water levels will be close to surface.

Between Styal North Roundabout and the Airport water strikes during the investigation indicate levels within 1-2m of existing ground surface.

Seepages can also be expected in more isolated water bearing granular horizons within the till across the route.

6.5.2 Chemistry

The previous ground investigations indicate that Class 3 conditions, in accordance with the now defunct BRE Digest 363, exist in the Westphalian rocks, indicating quite severe conditions.

The Faber Maunsell 2005 Geo-environmental report states that as part of the GEL ground investigation (March/April 2005), water soluble sulphate concentrations and pH values were determined from 0.5m to 17m below ground level. The samples were taken specifically so that the samples coincided approximately with the invert level of the route alignment at Hazel Grove.

The pH values revealed a consistent range of 6.9 to 8.7. Water soluble sulphate values ranged from 0.02 to 0.08g/l. With exception of the low pH value of 5.1, these values fall within Design Sulphate Class DS-1 and an associated Aggressive Chemical Environment for Concrete (ACEC) site classification of AC-1 in accordance with BRE Special Digest 1.

It is recommended that all structures founded in the Carboniferous deposits, i.e. up to Red Rock Fault at CH 9100 should be assessed for vulnerability to sulphate attack. Designs will require assessment against the current standard (BRE Special Digest 1, 2005). This considers cement content, member size and structural performance required in assessing the required degree of protection.

Geotechnical Risk Register

Page deliberately blank for double sided printing

7 Geotechnical Risk Register

7.1. Risk Register

A Geotechnical Risk register is included in the following pages. The register lists those primary risks currently identified, and assesses the impact of these risks on the project.

PROBABILITY (P)		**IMPACT/Consequence (I)**		**TIME and COST Impact (£)**		**Risk Rating**	**Risk (P * I=R)**	**Response**
Probable	4	High	4	>1 week on completion	100k to 1m	Intolerable	13 to 16	Unacceptable
Likely	3	Medium	3	>4 weeks <1 week on completion	10k to 100k	Substantial	9 to 12	Early Attention
Unlikely	2	Low	2	1 to 4 weeks, none on completion	1k to 10k	Tolerable	5 to 8	Regular Attention
Negligible	1	Very Low	1	<1 week to activity, none on completion	<1000	Trivial	1 to 4	Monitor

		PROBABILITY			
		Probable	**Likely**	**Unlikely**	**Negligible**
		4	**3**	**2**	**1**
CONSEQUENCE	4	16	12	8	4
	3	12	9	6	3
	2	8	6	4	2
	1	4	3	2	1

Page deliberately blank for double sided printing

Capabilities on project:
Geotechnical

.	HAZARD/RISK	CAUSE	BEFORE CONTROL			Risk Rating	IMPACT/ Consequences	RESPONSE/Controls	AFTER CONTROL			Review Date	Status
			P	I	R				P	I	R		
1.1	Bearing Capacity of soils/rocks	Unknown strength of soils	3	3	9	Tolerable	Foundation failure	Ground investigation of uninvestigated areas	Not applicable, ground investigation required			02/12/10	Outline Design
1.2		Sloping ground below structures	2	3	6	Tolerable		Ground investigation of uninvestigated areas				02/12/10	Outline Design
1.3		Mine workings/voids	3	3	9	Substantial		Probing of area around Stockport Buxton Bridge				02/12/10	Outline Design
1.4		Unknown depth of rockhead	2	3	6	Tolerable		Ground investigation of uninvestigated areas				02/12/10	Outline Design
1.5		Mine shaft adjacent to NWH Main GI BH 229	3	3	9	Substantial	Health and safety issues	Top soil strip as part of main works to try and locate shaft	1	3	3	01/02/11	Construction
2.1	Slope Instability	Over steepening of base of slopes	2	3	6	Tolerable	Slope failure	Design to allow space for ancillary structures	1	3	6	02/12/10	Outline Design
2.2		Unknown soil properties	3	3	9	Substantial		Ground investigation of uninvestigated areas	Not applicable, ground investigation required			02/12/10	Outline Design
2.3		Adverse discontinuity orientation	3	3	9	Substantial		Design rock slope at 1v:2h and inspect face upon excavation	2	3	6	02/12/10	Outline Design
3.1	Natural buried obstructions	Boulders in till	2	3	6	Tolerable	Obstructions for piling	Ground investigation of uninvestigated areas	Not applicable, ground investigation required			02/12/10	Outline Design
3.2		Rockhead higher/stronger than anticipated at Buxton Stockport Rail crossing	2	3	6	Tolerable	Extra costs for tunnelling options	Ground investigation within Network Rail boundary				02/12/10	Outline Design
4.1	Groundwater	Instability in till slopes	4	3	12	Substantial	Slope failure	Ground investigation of uninvestigated areas				02/12/10	Outline Design
4.2		Drainage issues in rock cuts	4	3	12	Substantial	Pavement failure	Increase capping within rock cuts to act as drainage layer	1	3	3	02/12/10	Outline Design
4.3		In flows into attenuation pond excavations	4	3	12	Substantial	Collapse of pond sides during excavation	Dewater area of ponds prior to excavation	2	3	6	02/12/10	Outline Design
5.1	Man made obstructions	Excavations encountering buried foundations	2	2	4	Trivial - site mostly undeveloped with the exception of a small number of buildings with shallow foundations	Hard spots and obstructions for piling etc.	Ground investigation of uninvestigated areas and grubbing out of foundations	Not applicable, ground investigation required			02/12/10	Outline Design

.	HAZARD/RISK	CAUSE	BEFORE CONTROL			Risk Rating	IMPACT/ Consequences	RESPONSE/Controls	AFTER CONTROL			Review Date	Status
			P	I	R				P	I	R		
6.1	Buried Services	Statutory services and major services into the airport	4	4	16	Intolerable	Health and safety, cost of remedials, public perception	Service search before any intrusive investigation or excavation	2	4	8	02/12/10	Outline Design
7.1	Aggressive Ground Conditions	Pyrites in the Coal Measure Rocks, sulphates in deposits derived from the Mercia Mudstones.	4	3	12	Substantial	Degradation of concrete used in structures. Unsuitability of fill for lime stabilisation/improvement	Ground investigation of uninvestigated areas with testing and analysis in accordance with BRE Special Digest 1.	Not applicable, ground investigation required			02/1	O D
	Settlement	Large immediate settlement	2	4	8	Tolerable	Structural defects	Ground investigation of uninvestigated areas. Design to take into account findings.				02/12/10	Outline Design
		Large consolidation settlement	2	4	8	Tolerable	Structural defects	Ground investigation of uninvestigated areas. Design to take into account findings. Soft material infilling ponds to be excavated and replaced				02/12/10	Outline Design
9.1	Contaminated Ground	Bramhall Oil Depot, Rail crossings	2	3	6	Tolerable	Clean up costs, Client taking ownership of contaminated site	Review of Faber Maunsell Geo-environmental report to determine whether findings are still valid	1	3	3	02/12/10	Outline Design
10.1	Network Rail requirements	Network Rail impose stringent design requirements	4	4	16	Intolerable	Delays to programme and increased costs	Early consultation with Network Rail to determine their requirements. Factor these into programme and project costs	2	2	4	02/12/10	Outline Design
11.1	Insufficient fill material	Properties of excavated materials poorer than expected	2	4	8	Tolerable	Fill has to be imported from elsewhere with inherent increase to costs	Ground investigation of uninvestigated areas	Not applicable, ground investigation required			02/12/10	Outline Design

Drawings and Photographs

Page deliberately blank for double sided printing

8 Drawings and Photographs


Photograph 1 – Northern junction with A6 looking south east


Photograph 3 – Looking west from Werneth View (eastern junction with A6)

Photograph 2 – Looking northeast from Mill Lane


Photograph 4 – Hazel Grove Railway Embankment at Mill Lane looking northeast.

Capabilities on project:
Geotechnical

Photograph 5 – Mill Land Bridge

Photograph 6 – Looking north at proposed A6 crossing.

Photograph 7 – Old Mill Lane looking northwest from proposed road alignment.

Photograph 8 – old mill wall

Photograph 9 – Norbury Brook footbridge at Old Mill Lane

Photograph 11 – looking east from Macclesfield Road

Photograph 10 – Looking west from Macclesfield Road

Photograph 12 – footpath from Mill Hill Hollow looking southeast.

Capabilities on project:
Geotechnical

Photograph 13 – view looking northeast from Lower Park Road towards the proposed footbridge.

Photograph 15 – view of West Coast Mainline looking northeast from Woodford Road

Photograph 14 – View looking north at the proposed Woodford Road crossing.

Photograph 16 – Farm fields viewed from footpath looking northwest towards location of the proposed roundabout.

Photograph 17 – Possible fuel storage depot.

Photograph 19 – Location of proposed Chester Road junction looking southwest.

Photograph 18 –Pond at the proposed roundabout.

Photograph 20 – A555 viewed from Woodford Road.

Capabilities on project:
Geotechnical

Photograph 21 – Woodford Recreation Ground and pavilion - looking west.

Photograph 23 – Access road to Woodford Recreation Ground – Looking west.

Photograph 22 – Crest of A555 northern cutting slope at Woodford Recreation Ground – Looking west.

Photograph 24 – Farm fields to southwest of A555/Woodford Road Junction – Looking east.

Photograph 25 – Woodford Road junction viewed from footbridge – looking east.

Photograph 26 – Stanley green retail park, looking south towards A555.

Photograph 27 – Earl Road Bridge eastern abutment and north-eastern wing wall.

Photograph 28 – Alignment east of Wilmslow Road – Looking south.

Photograph 29 – A555 looking east from Wilmslow Road bridge.

Photograph 30 – Grassed fields with pond. Looking east from the site of the proposed footbridge

Photograph 32 – Mobile phone mast south of the alignment, east of Styal Railway Line.

Photograph 31 – Rough grass land – Looking west from site of proposed footbridge.

Photograph 33 – Rail bridge and cutting – looking west.

Capabilities on project:
Geotechnical

Photograph 34 – Rail bridge – looking west

Photograph 36 – Western side of northern Styal Road rail bridge – looking south east

Photograph 35 – Site of proposed southern Styal Road roundabout – Looking west.

Photograph 37 – Western side of southern Styal Road rail bridge – looking south east

Photograph 38 – Styal Road where it crosses railway looking south.

Photograph 40 – Site of proposed northern Styal Road roundabout.

Photograph 39 – Manchester Airport Rail Line looking west from Styal Road

Photograph 41 – Ringway Road Bridge – Looking north.

Photograph 42 – Ringway Road West cutting – looking south.

Photograph 43 – Ringway Road West/Aviator Way roundabout – Looking west.

Photograph 44 – Pond to east of Ringway Road West/Aviator Way roundabout.

Photograph 45 - Ringway Road West / Outwood Lane roundabout – Looking east.

Photograph 46 – Site of proposed Thorley Lane roundabout – Looking west.

Photograph 47 – M56 Junction roundabout – Looking north from the western roundabout bridge.

Page deliberately blank for double sided printing

References

Page deliberately blank for double sided printing

9 References

Aecom	SEMMMS, A6 to Manchester Airport Relief Road, Initial Design Report, 2010
Aecom	SEMMMS, A6 to Manchester Airport Relief Road, Preliminary Sources Study, 2011
British Geological Survey	1:50,000 sheets 98 Stockport (Drift) and 98 (Solid).
British Geological Survey	Geology of the Country Around Stockport, 1963
BS8002	Code of Practice for Earth Retaining Structures
Cheshire County Council	Preliminary Geotechnical Appraisal, 1975
Exploration Associates	A523 Poynton Bypass GI Vols 1-5, 1992
Exploration Associates	3rd Supplementary Ground Investigation – Vols 1 & 2, 1992
Faber Maunsell –	South East Manchester Multimodal Study - Earthworks Report, 2005
Faber Maunsell –	South East Manchester Multimodal Study - Geo-environmental Interpretative Report, 2005
Faber Maunsell -	South East Manchester Multimodal Study – Preliminary Sources Study, 2006
Faber Maunsell -	South East Manchester Multimodal Study – Rail Report, 2006
Geotechnics Limited	MML3B AIRPORT LINE EXTENSION Ground Investigation Factual Reports, 2010
Gibson, R.E.	Experimental Determination of the True Cohesion and True Angle of Internal Friction in Clays, Proceedings of 3rd International Conference on Soil Mechanics and Foundation Engineering 1953
Ground Engineering	A6(M) / A523 Bypass Ground Investigation – Vols 1 & 2, 1991
Highways Agency	HD22/08 Managing Geotechnical Risk
Highways Agency	IAN73/06 Rev 1 Design Guidance for Road Pavements
Hobbs, N.B.,	Mire Morphology and the Properties and Behaviour of Some British and Foreign Peats, Quarterly Journal of Engineering Geology, 1986
MGCS	Mining Report, 1985
Mouchel	Preliminary Geotechnical Report, 1983
Mouchel	Geotechnical Report Vol1 and 2, 1985
Mouchel -	A6(M) Stockport North South Bypass – Geotechnical Interpretative Report, 1992
Mouchel	A6(M) Environmental Statement, 1995
Mouchel	SEMMMS A6 to Manchester, Airport Relief Road, Environmental Scoping Report
Norwest Holst	Preliminary Ground Investigation, Volume 1, 1983
Norwest Holst	Foggbrook Bridge Ground Investigation, 1991
Skempton, A. W.	Notes on the compressibility of clays, Quarterly Journal of the Geological Society, 1944
Soil Mechanics	2nd Supplementary Ground Investigation Vols 1-4, 1990
Stroud, M.A. and Butler, F.G.	The Standard Penetration Test and the Engineering Properties of Glacial Materials, Proc. Symp. Engineering Properties of Glacial Materials, Midlands Soil Mechanics and Foundation Society, 1975
Terzaghi, K. And peck, R.B.,	Soil Mechanics in Engineering Practice, 1967
Trenter, N.A, -	Earthworks, A Guide, Thomas Telford, 2001

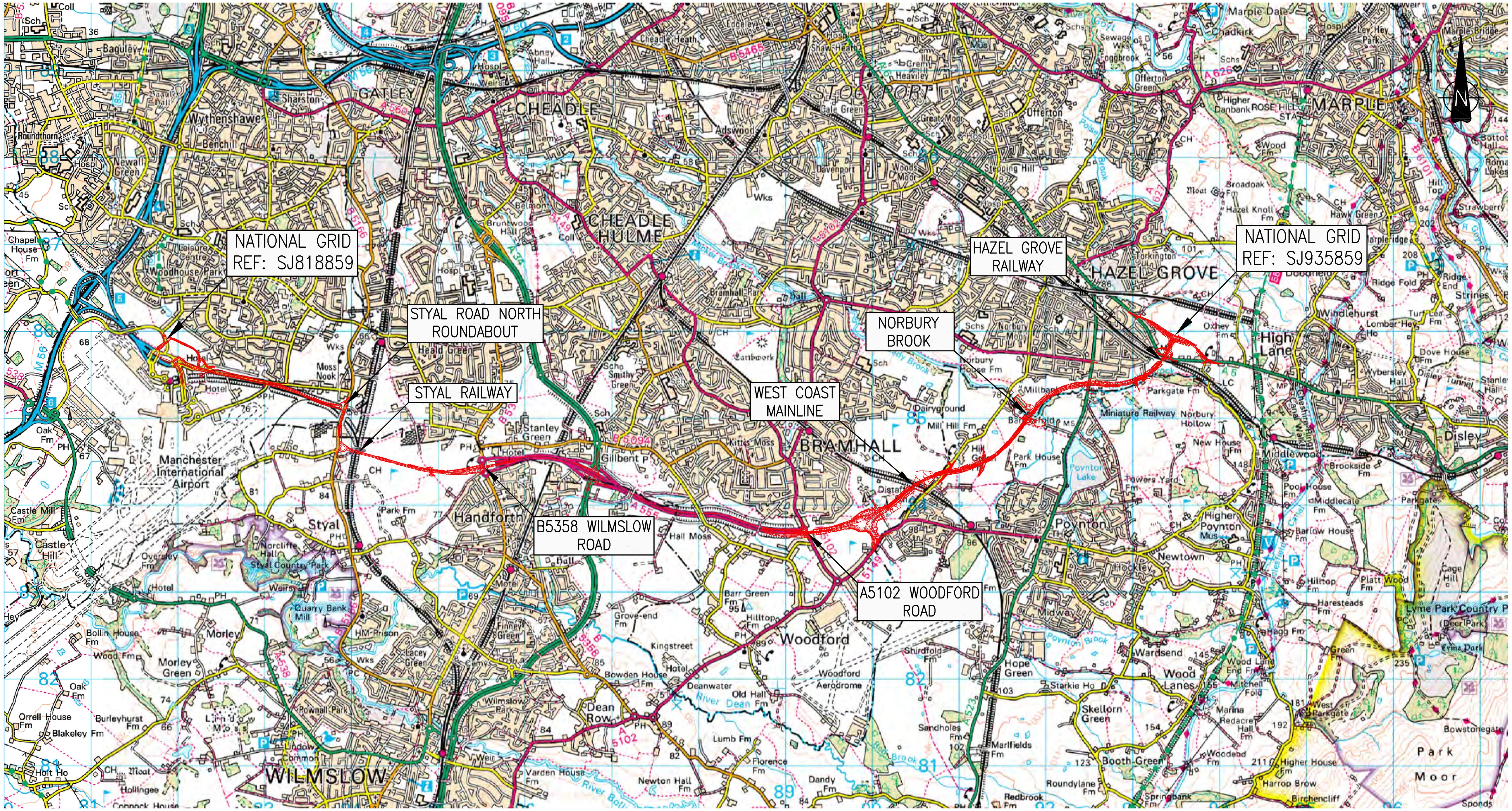
Page deliberately blank for double sided printing

Capabilities on project:
Geotechnical

Appendix

Capabilities on project:
Geotechnical

Page deliberately blank for double sided printing

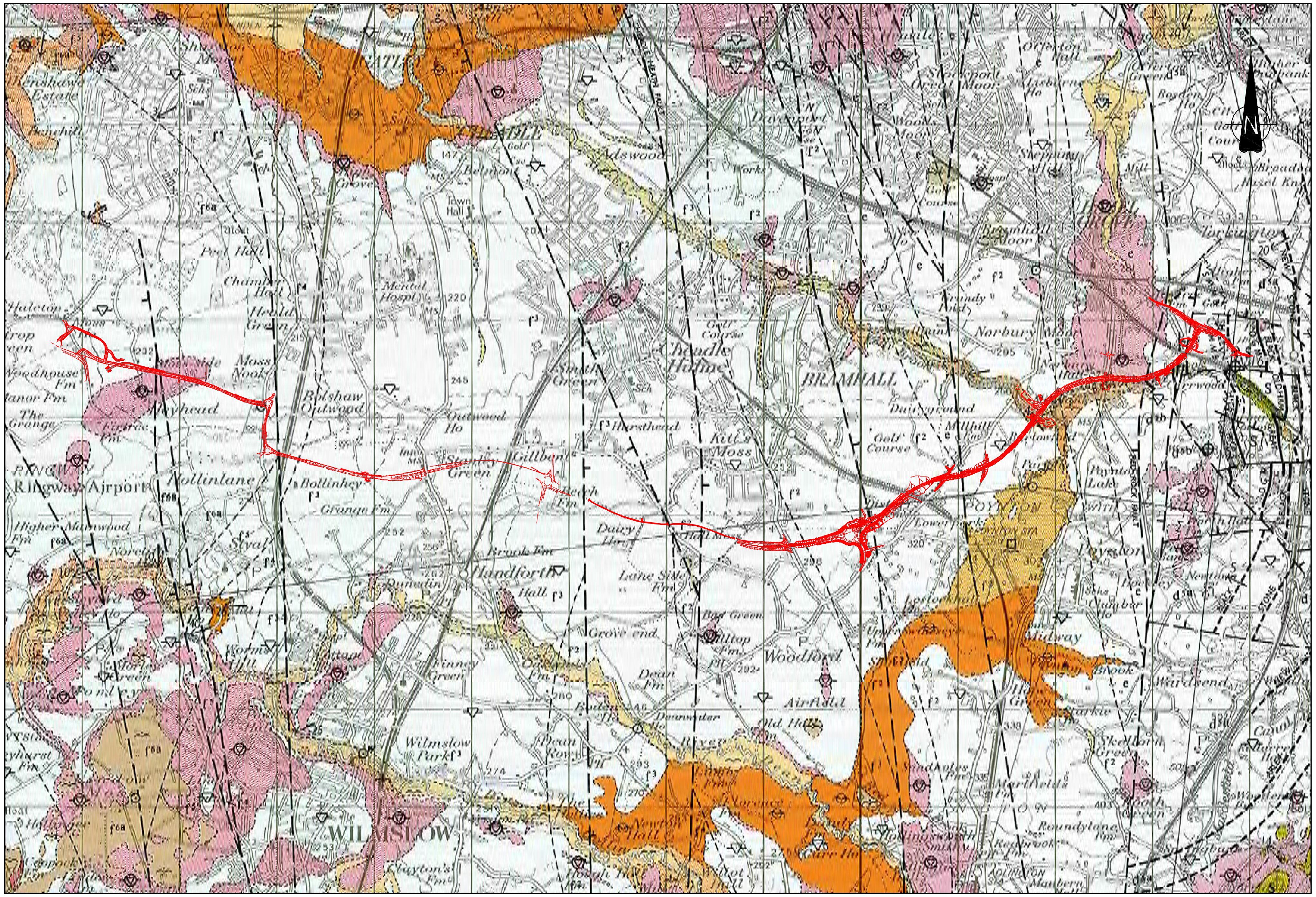


Client: semmms (south east manchester multi modal strategy) — Stockport, Cheshire East, Manchester City Council	Title: SITE LOCATION PLAN	AECOM	Design: RPA / CAD: RPA
			Chk'd: ABSW / App'd: MdK
Project: SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT		First Floor, One Trinity Gardens, Quayside, NEWCASTLE UPON TYNE, NE1 2HF — Tel: +44 (0) 191 224 6500 Fax: +44 (0) 191 224 6599 www.aecom.com	Date: FEBRUARY 2011 / Scale: 1:50,000
			No. 60186094/GEO/02/FIGURE 1 / Rev: -

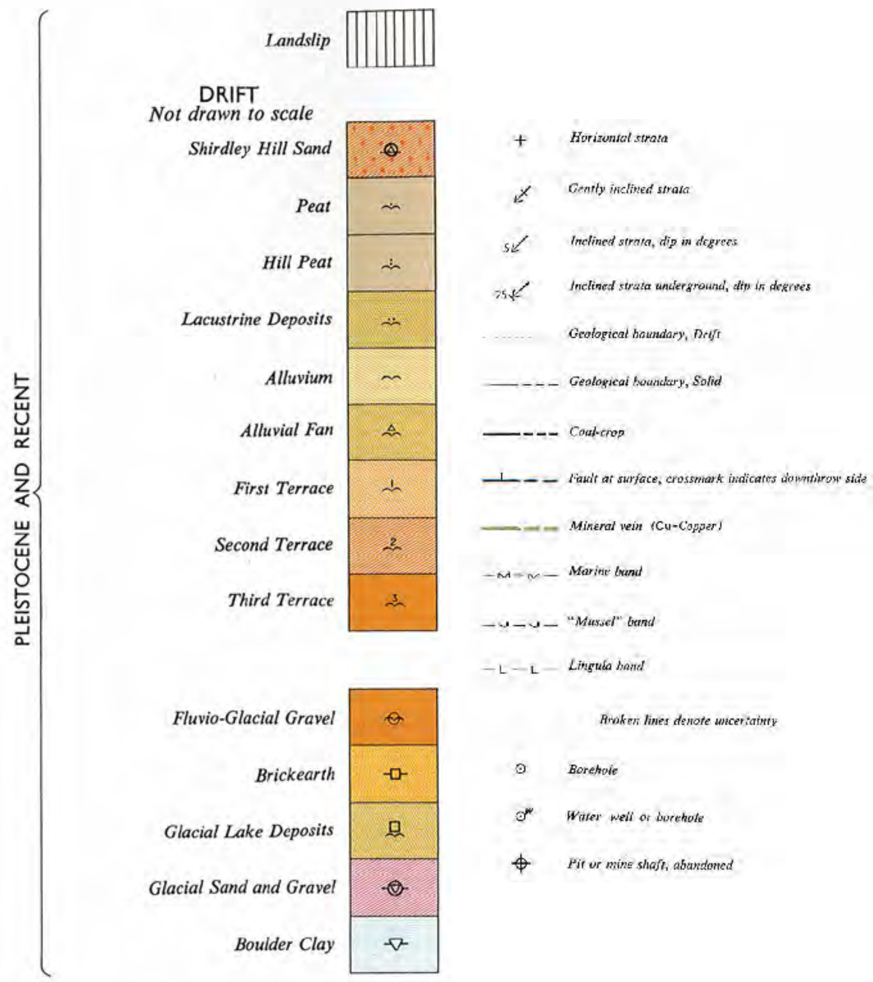
[AutoCAD Location]

cm

A3



KEY



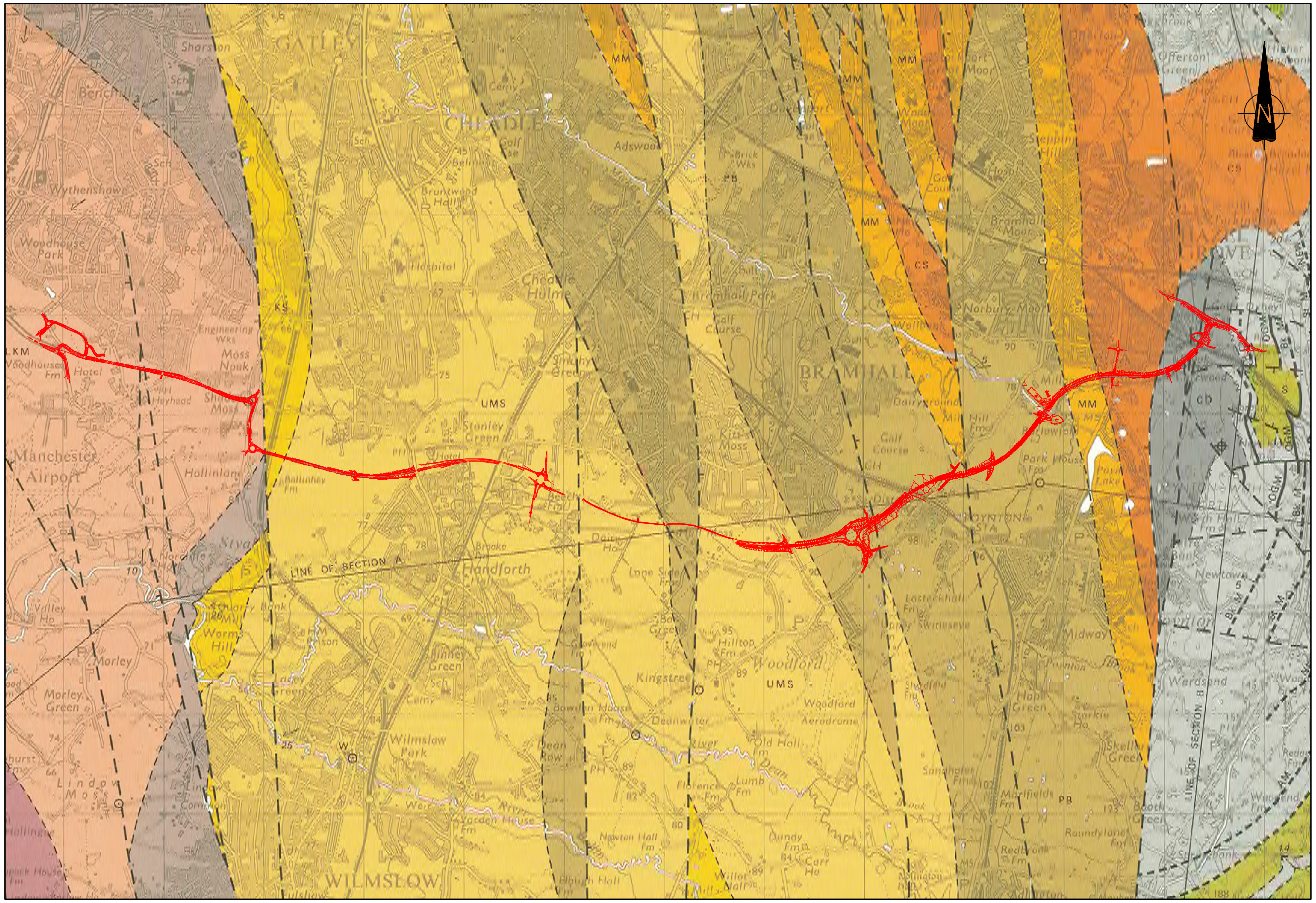
NOTES

1. MAP EXTRACT TAKEN FROM BGS 1:63,360 (ONE INCH TO ONE MILE) DRIFT EDITION MAP SHEET 98 - STOCKPORT.
2. DF3 HIGHWAY ALIGNMENT SHOWN.

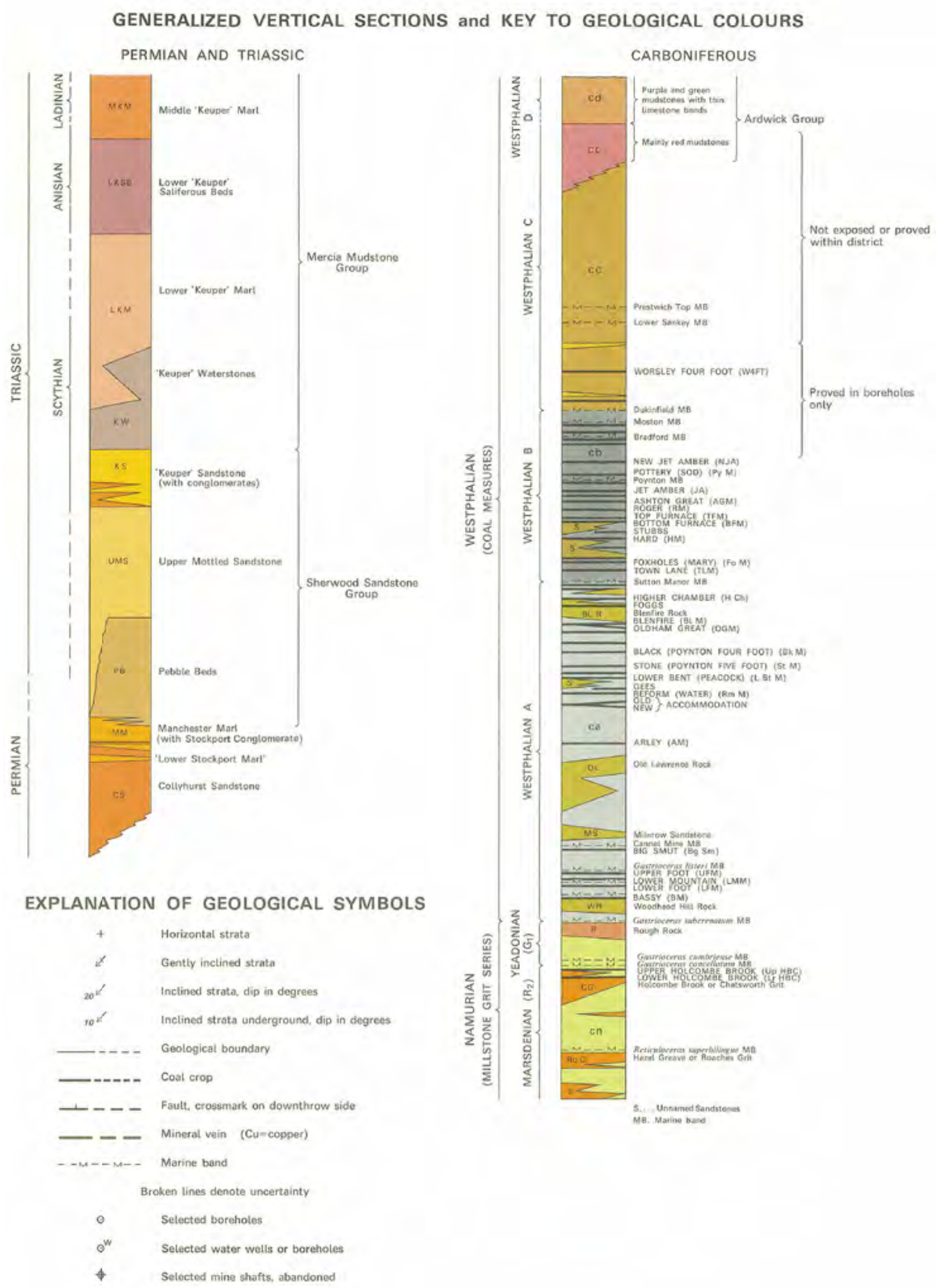
Client: south east manchester multi modal strategy semmms STOCKPORT MANCHESTER CITY COUNCIL	Title: BGS DRIFT GEOLOGY MAP	AECOM	Design: RPA / CAD: RPA
			Chk'd: ABSW / App'd: MdK
Project: SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT		First Floor, One Trinity Gardens, Quayside, NEWCASTLE UPON TYNE, NE1 2HF / Tel: +44 (0) 191 224 6500 Fax: +44 (0) 191 224 6599 www.aecom.com	Date: DECEMBER 2010 / Scale: 1:50,000
		[AutoCAD Location]	No. 60186094/GEO/02/FIGURE 2 / Rev: -

cm

cm A3



KEY



NOTES

1. MAP EXTRACT TAKEN FROM BGS 1:50,000 SOLID EDITION MAP SHEET 98 - STOCKPORT.
2. DF3 HIGHWAY ALIGNMENT SHOWN.

Client:	semmms — south east manchester multi modal strategy; Stockport; Cheshire East; Manchester City Council
Project:	SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT
Title:	BGS SOLID GEOLOGY MAP

AECOM
First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

[AutoCAD Location]

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	1:50,000
No.	60186094/GEO/02/FIGURE 3	Rev:	-

cm

A3

NOTES

Drawings are produced at appropriate scales to display the exploratory hole information. The electronic data should be referenced for specific dimensions.

The information given on the drawings is based on historical ground investigation information from different third parties. The investigations that have provided information for the drawings are referenced as follows:

NWH PRE	Norwest Holst, Preliminary Ground Investigation - Vol 1 and 2, March 1983
NWH MAIN GI	Norwest Holst, Main Ground Investigation - Vol's 1-10, September 1984
NWH 1ST SUPP	Norwest Holst, Supplementary Ground Investigation, August 1985
SM 2ND SUPP	Soil Mechanics, 2nd Supplementary Ground Investigation, Vol's 1-4, 1990
EA POYNTON	Cheshire CC, A523 Poynton By-Pass, Factual Report on Ground Investigation, Vol's 1-5, August 1992
EA 3RD SUPP	Exploration Associates, 3rd Supplementary Ground Investigation, Vol 1-2, November 1992
GE	Ground Engineering, A6(M)/A523 By-Pass - Ground Investigation Vol 1-2, October 1991
GEL	Geotechnical Engineering Limited, Bredbury, Hazel Grove, Bramhall, Supplementary Ground Investigation, June 2005
GEO METRO	Geotechnics Ltd, Manchester Metrolink Phase 3B - Airport Extension, Volume 1, September 2010.

The information given herein is based on information supplied to AECOM by other parties. AECOM has proceeded in good faith on the assumption that this information is accurate. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from others.

The information presented on the long sections does not necessarily represent the expected ground conditions along the road alignment. The sections have been formed by translocating information from exploratory holes both on and some distance perpendicular to the alignment, and in some cases the exploratory hole locations may fall outside the footprint of the scheme. Not all of the exploration holes shown on the plan have been used in the formation of long sections, however the exploration holes shown on the sections are those closest to the alignment.

Client: south east manchester multi modal strategy semmms — STOCKPORT — Cheshire East Council — MANCHESTER CITY COUNCIL

Project: SEMMMS RELIEF ROAD SCHEME
A6 - AIRPORT

Title: GEOLOGICAL LONG SECTION
KEY PLAN AND GROUND
INVESTIGATION REFERENCE LIST

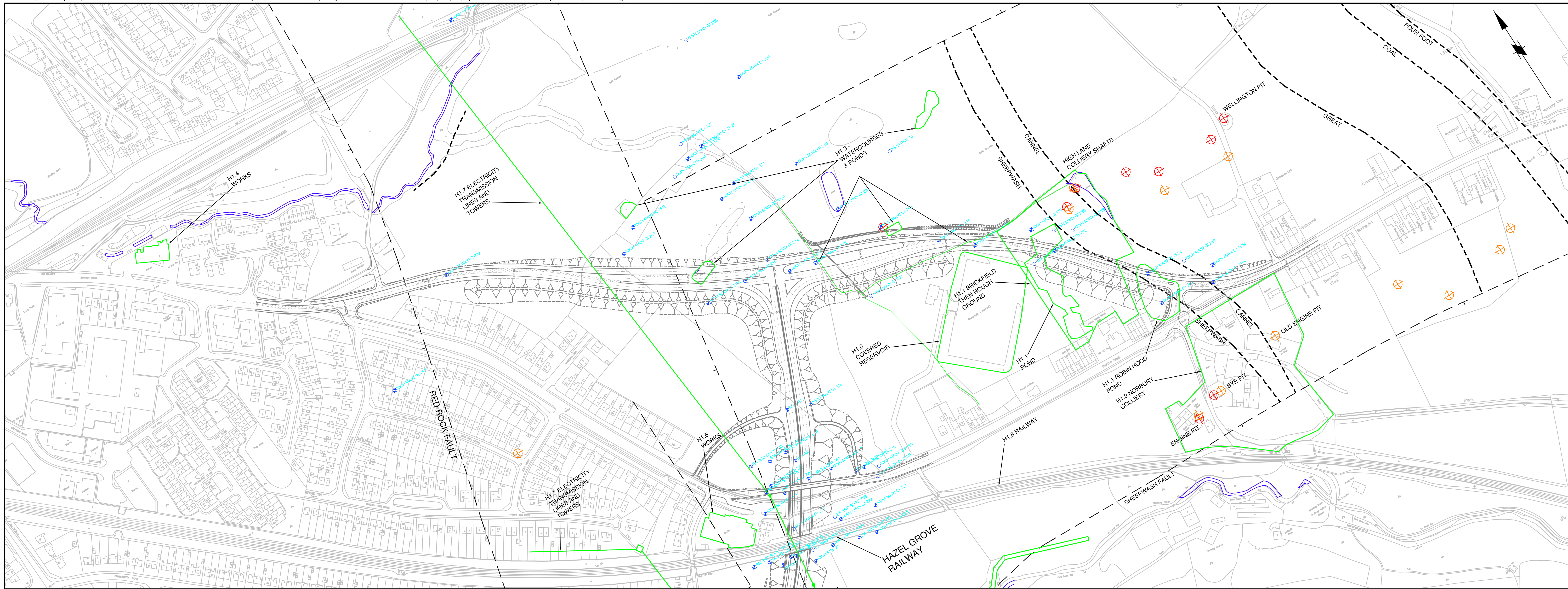
AECOM
First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

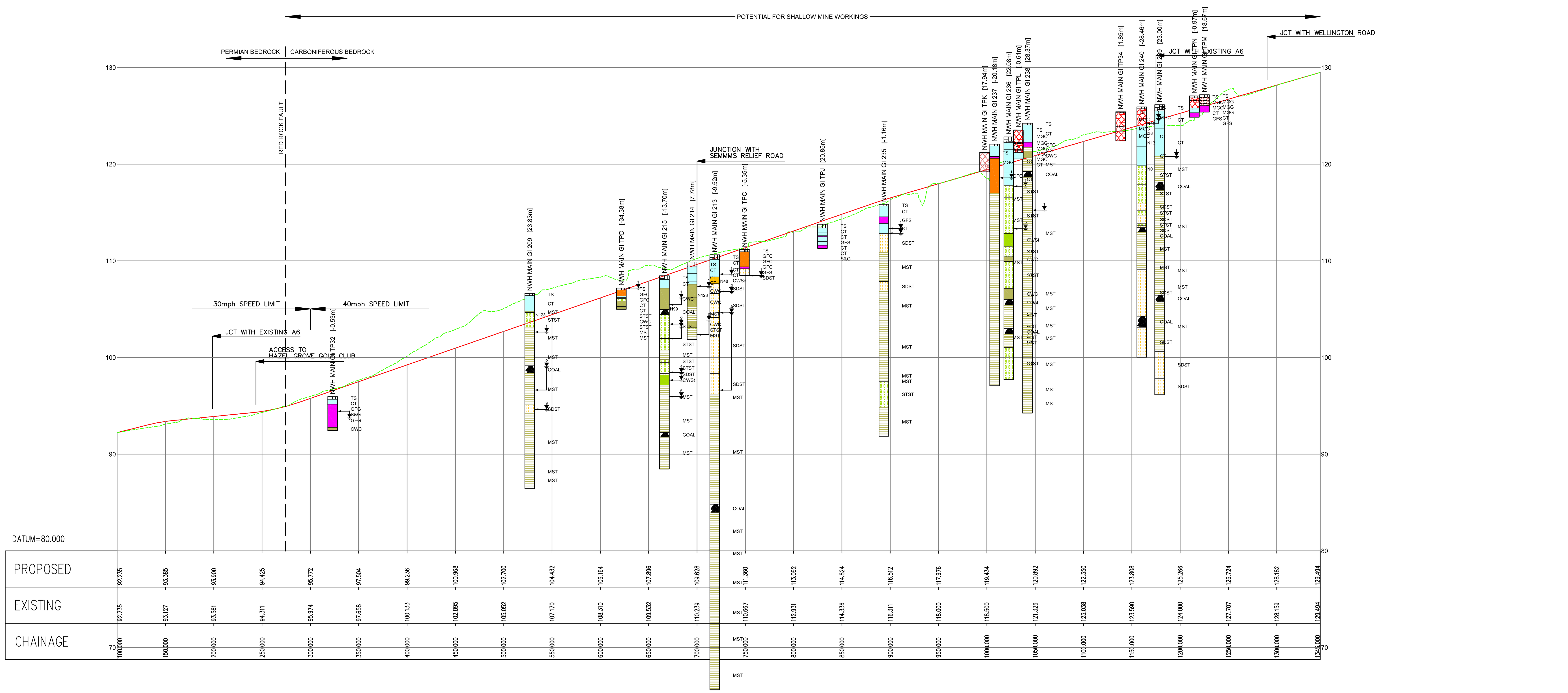
[AutoCAD Location]

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	1:50,000
No.	60186094/GEO/001	Rev:	A

cm

cm A3





SECTION ALONG CENTRELINE OF REALIGNED A6

NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/173.

2. GEOLOGICAL INFORMATION TAKEN FROM BGS 1:10,560 MAP SHEET SJ98NW.

3. ADDITIONAL SHAFT POSITIONS TAKEN FROM A6(M) STOCKPORT NORTH-SOUTH MINING INVESTIGATION REPORT BY MANSTOCK GEOTECHNICAL CONSULTANCY SERVICES LTD DATED OCTOBER 1985.
NOTE: NOT ALL FEATURES FROM THE ABOVE REPORT HAVE BEEN PRESENTED.

KEY

- FAULT FROM BGS MAP
- COAL SEAM FROM BGS MAP
- SHAFT - BGS MAP
- SHAFT - MANSTOCK MINING AND GEOLOGY PLAN
- FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS
- WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL
MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
CT	COHESIVE TILL
AL	ALLUVIUM
GFC	GLACIO FLUVIAL COHESIVE
PEAT	PEAT
GFS	GLACIO FLUVIAL - SAND
GFG	GLACIO FLUVIAL - GRAVEL
S&G	GLACIO FLUVIAL - SAND & GRAVEL
CWC	COMPLETELY WEATHERED MUDSTONE
CWST	COMPLETELY WEATHERED SILTSTONE
CWSD	COMPLETELY WEATHERED SANDSTONE
COAL	COAL
MST	MUDSTONE
STST	SILTSTONE
SDST	SANDSTONE
VOID	VOID

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client: south east manchester multi modal strategy semmms — STOCKPORT METROPOLITAN BOROUGH COUNCIL, Cheshire East Council, MANCHESTER CITY COUNCIL

Project:

SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3 GEOLOGICAL LONG SECTION SHEET 1 OF 12

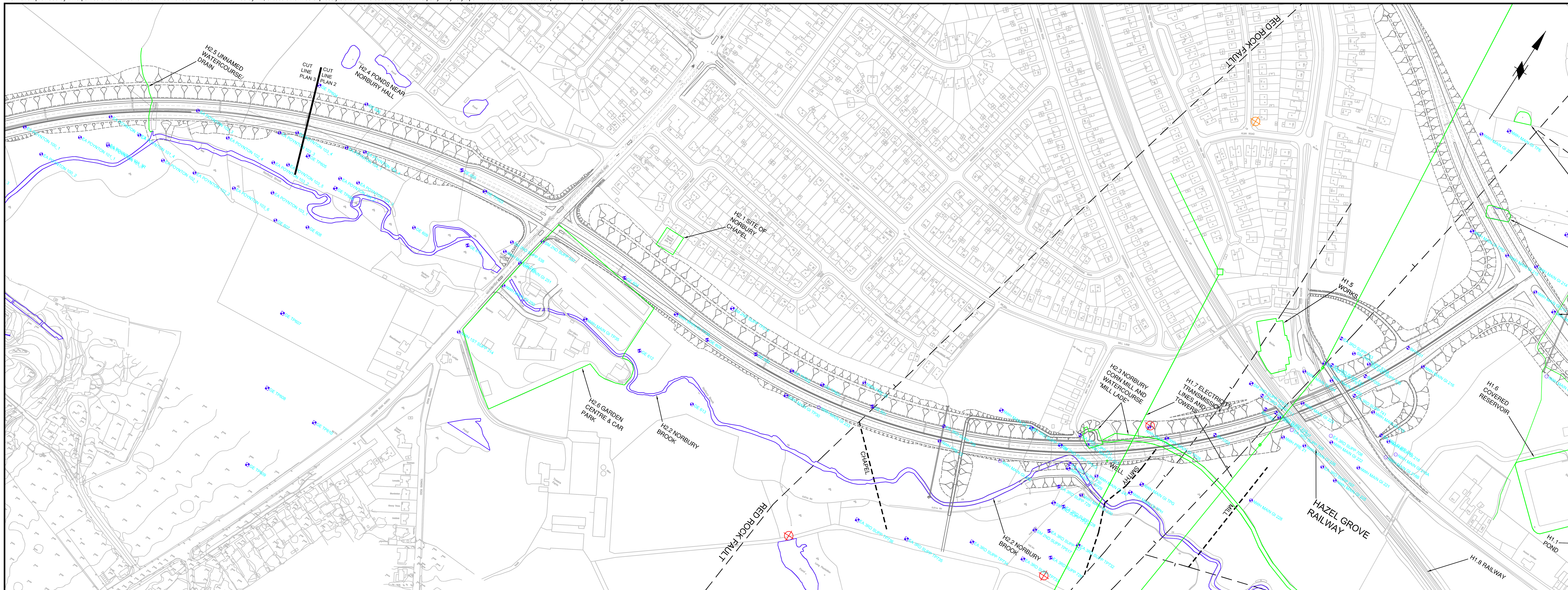
Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

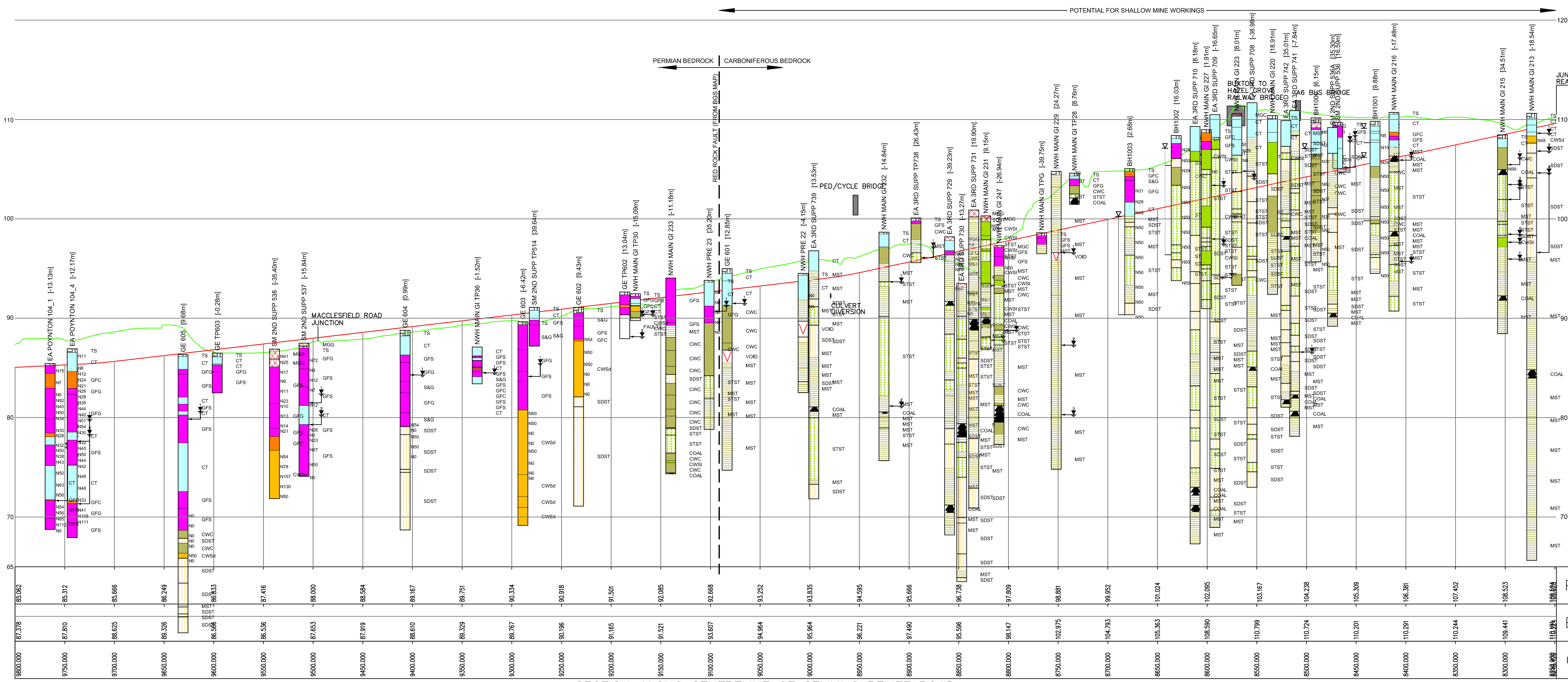
AECOM

First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/002 Rev: B

[AutoCAD Location] cm A1





SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
A6 JCT TO A555 (SPEED LIMIT 50MPH)

NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/174.
2. GEOLOGICAL INFORMATION TAKEN FROM BGS 1:10,560 MAP SHEET SJ98NW.
3. ADDITIONAL SHAFT POSITIONS TAKEN FROM A6(M) STOCKPORT NORTH-SOUTH MINING INVESTIGATION REPORT BY MANSTOCK GEOTECHNICAL CONSULTANCY SERVICES LTD DATED OCTOBER 1985.
NOTE: NOT ALL FEATURES FROM THE ABOVE REPORT HAVE BEEN PRESENTED.

KEY

- FAULT FROM BGS MAP
- COAL SEAM FROM BGS MAP
- SHAFT - BGS MAP
- SHAFT - MANSTOCK MINING AND GEOLOGY PLAN
- FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS
- WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL
MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
CT	COHESIVE TILL
AL	ALLUVIUM
GFC	GLACIO FLUVIAL COHESIVE
PEAT	PEAT
GFS	GLACIO FLUVIAL - SAND
GFG	GLACIO FLUVIAL - GRAVEL
S&G	GLACIO FLUVIAL - SAND & GRAVEL
CWC	COMPLETELY WEATHERED MUDSTONE
CWST	COMPLETELY WEATHERED SILTSTONE
CWSD	COMPLETELY WEATHERED SANDSTONE
COAL	COAL
MST	MUDSTONE
STST	SILTSTONE
SDST	SANDSTONE
VOID	VOID

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:
south east manchester multi modal strategy SEMMMS
STOCKPORT · Cheshire East · MANCHESTER CITY COUNCIL

Project:
SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

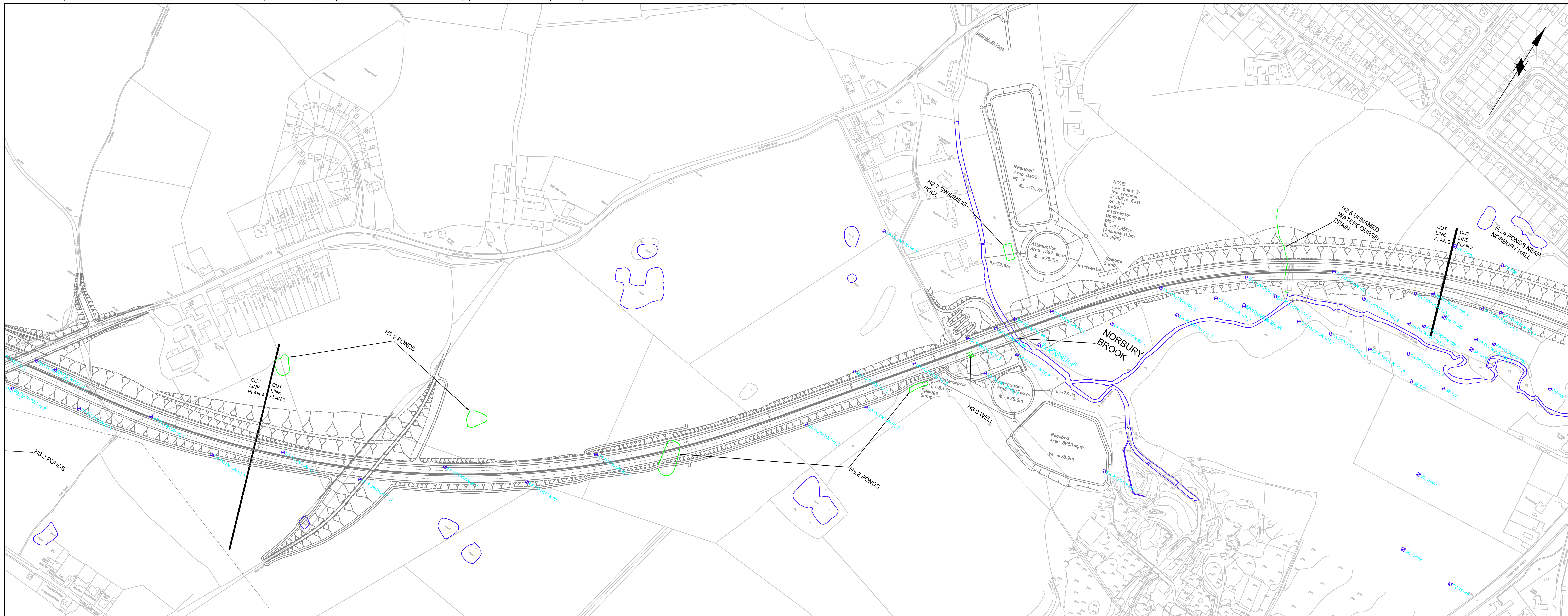
Title:
DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 2 OF 12

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

AECOM
First Floor, One Trinity Gardens, Quayside, NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/003 Rev: B

[AutoCAD Location] cm A1



NOTES

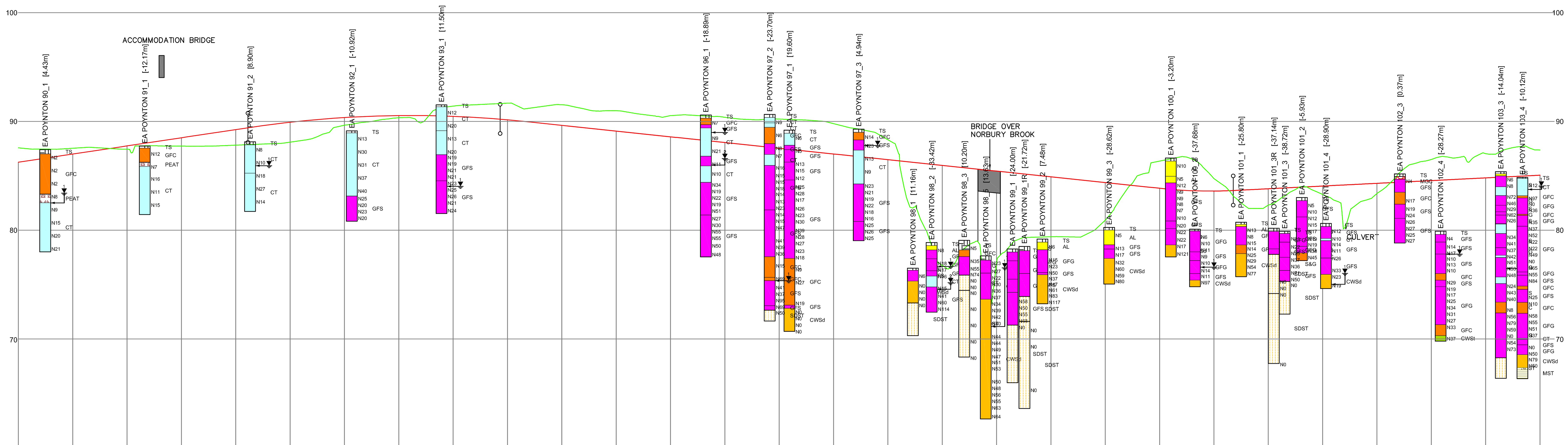
1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/175.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL	
MGG	MADE GROUND - GRANULAR	
MGC	MADE GROUND - COHESIVE	
CT	COHESIVE TILL	
AL	ALLUVIUM	
GFC	GLACIO FLUVIAL COHESIVE	
PEAT	PEAT	
GFS	GLACIO FLUVIAL - SAND	
GFG	GLACIO FLUVIAL - GRAVEL	
S&G	GLACIO FLUVIAL - SAND & GRAVEL	
CWC	COMPLETELY WEATHERED MUDSTONE	
CWST	COMPLETELY WEATHERED SILTSTONE	
CWSD	COMPLETELY WEATHERED SANDSTONE	
COAL	COAL	
MST	MUDSTONE	
STST	SILTSTONE	
SDST	SANDSTONE	
VOID	VOID	



CHAINAGE	PROPOSED	EXISTING
11200.000	86.253	87.576
11150.000	87.003	87.539
11100.000	87.953	87.454
11050.000	88.503	87.733
11000.000	89.853	87.824
10950.000	[illegible]	88.100
10900.000	[illegible]	89.661
10850.000	[illegible]	90.343
10800.000	[illegible]	91.413
10750.000	90.164	91.684
10700.000	89.639	91.544
10650.000	89.113	91.000
10600.000	88.588	90.544
10550.000	88.062	90.385
10500.000	87.537	90.221
10450.000	87.011	89.803
10400.000	86.486	88.321
10350.000	85.960	76.777
10300.000	85.435	77.027
10250.000	84.909	79.401
10200.000	84.384	80.927
10150.000	83.858	86.359
10100.000	83.605	84.748
10050.000	83.812	82.317
10000.000	84.062	83.290
9950.000	84.312	83.383
9900.000	84.562	86.504
9850.000	84.812	87.043
9800.000	85.062	87.378

SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD

A6 JCT TO A555

(SPEED LIMIT 50MPH)

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client: south east manchester multi modal strategy SEMMMS — STOCKPORT, Cheshire East, MANCHESTER CITY COUNCIL

Project: SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT

Title: DRAFT DESIGN FREEZE 3 GEOLOGICAL LONG SECTION SHEET 3 OF 12

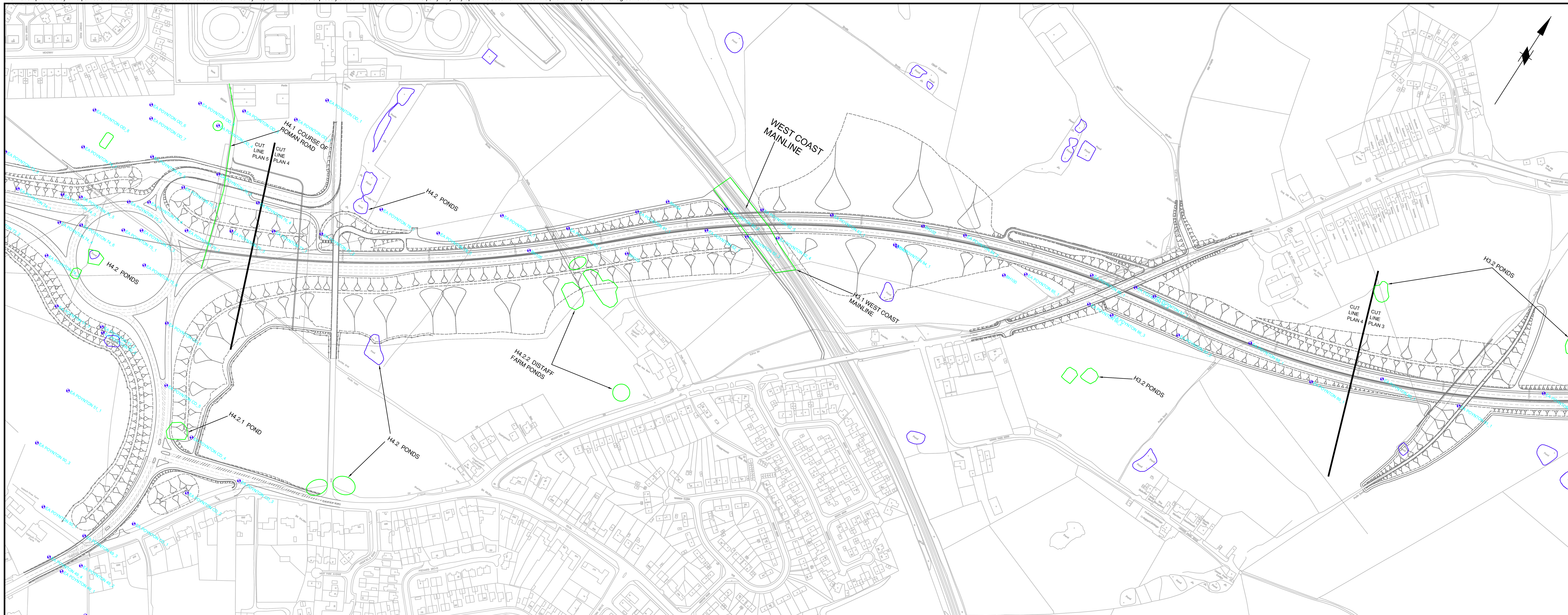
Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

AECOM

First Floor, One Trinity Gardens, Quayside, NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/004 Rev: B

[AutoCAD Location] cm A1



NOTES

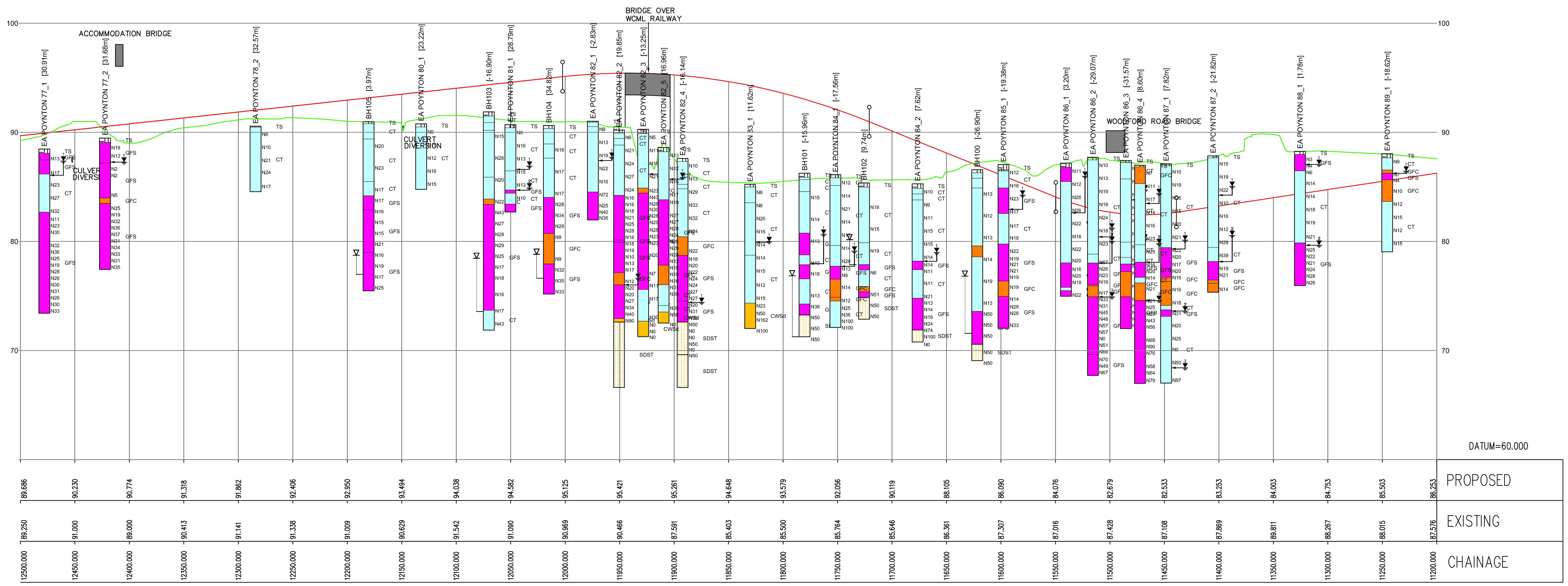
1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/176.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL
MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
CT	COHESIVE TILL
AL	ALLUVIUM
GFC	GLACIO FLUVIAL COHESIVE
PEAT	PEAT
GFS	GLACIO FLUVIAL - SAND
GFG	GLACIO FLUVIAL - GRAVEL
S&G	GLACIO FLUVIAL - SAND & GRAVEL
CWC	COMPLETELY WEATHERED MUDSTONE
CWST	COMPLETELY WEATHERED SILTSTONE
CWSD	COMPLETELY WEATHERED SANDSTONE
COAL	COAL
MST	MUDSTONE
STST	SILTSTONE
SDST	SANDSTONE
VOID	VOID



SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
A6 JCT TO A555
(SPEED LIMIT 50MPH)

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:
south east manchester multi modal strategy
semmms
STOCKPORT METROPOLITAN BOROUGH COUNCIL
Cheshire East Council
MANCHESTER CITY COUNCIL

Project:
SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Title:
DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 4 OF 12

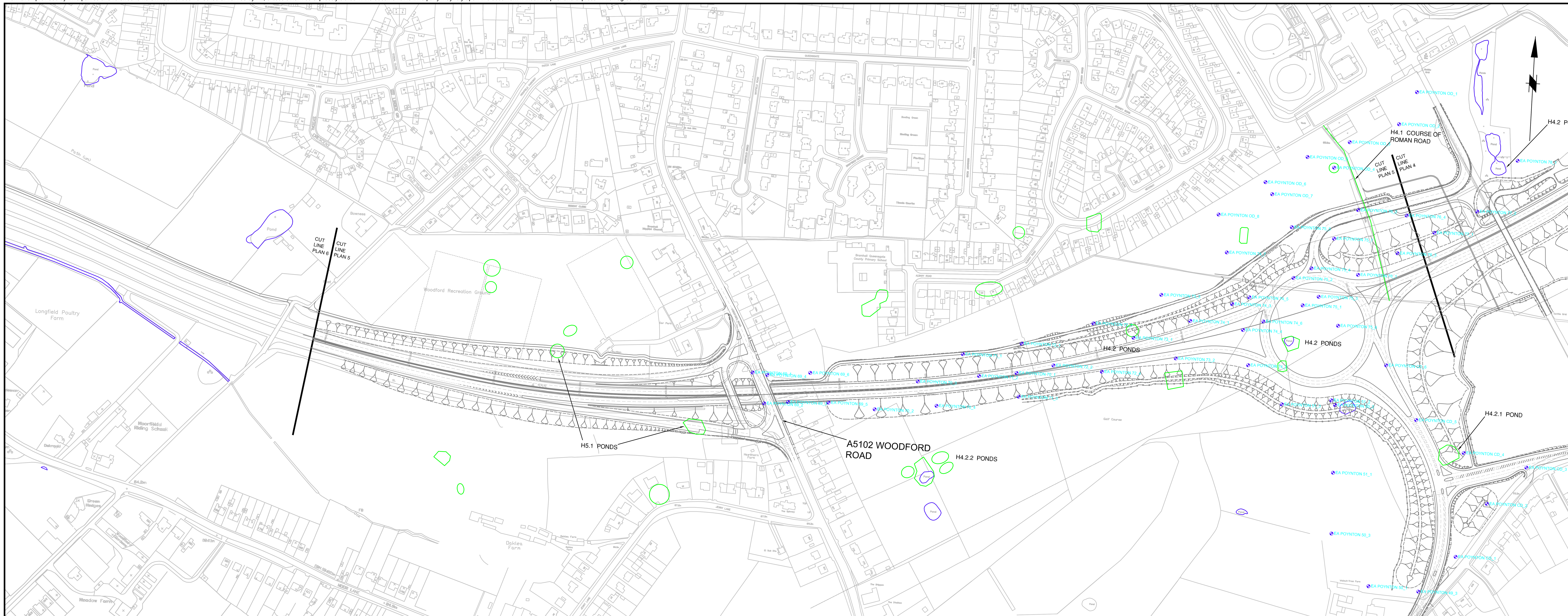
Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	NOVEMBER 2010	Scale:	H1:2500 V1:250 @A1

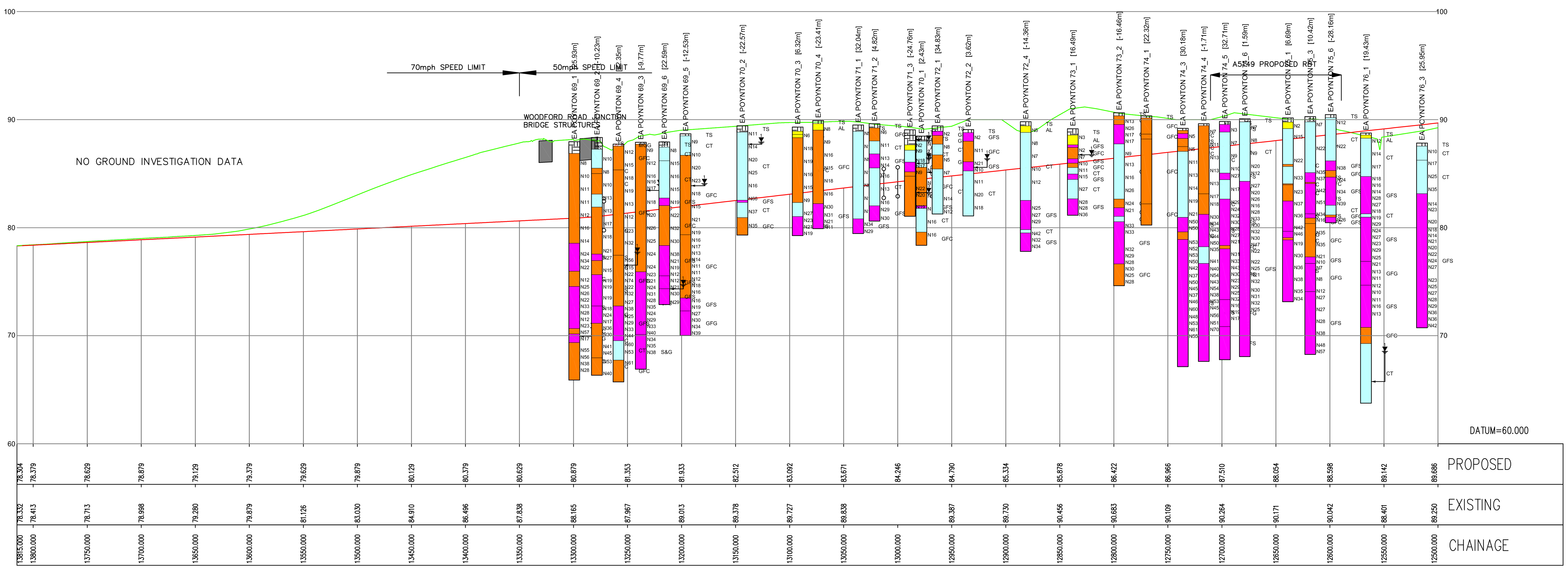
AECOM

First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/005 Rev: B

cm A1





SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD

A6 JCT TO A555

(SPEED LIMIT 50MPH)

NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/177.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL
MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
CT	COHESIVE TILL
AL	ALLUVIUM
GFC	GLACIO FLUVIAL COHESIVE
PEAT	PEAT
GFS	GLACIO FLUVIAL - SAND
GFG	GLACIO FLUVIAL - GRAVEL
S&G	GLACIO FLUVIAL - SAND & GRAVEL
CWC	COMPLETELY WEATHERED MUDSTONE
CWST	COMPLETELY WEATHERED SILTSTONE
CWSD	COMPLETELY WEATHERED SANDSTONE
COAL	COAL
MST	MUDSTONE
STST	SILTSTONE
SDST	SANDSTONE
VOID	VOID

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:

south east manchester multi modal strategy SEMMMS

STOCKPORT METROPOLITAN BOROUGH COUNCIL · Cheshire East · MANCHESTER CITY COUNCIL

Project:

SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3 GEOLOGICAL LONG SECTION SHEET 5 OF 12

Design: RPA		CAD: RPA	
Chk'd: ABSW		App'd: MdK	
Date: DECEMBER 2010		Scale: H1:2500 V1:250 @A1	

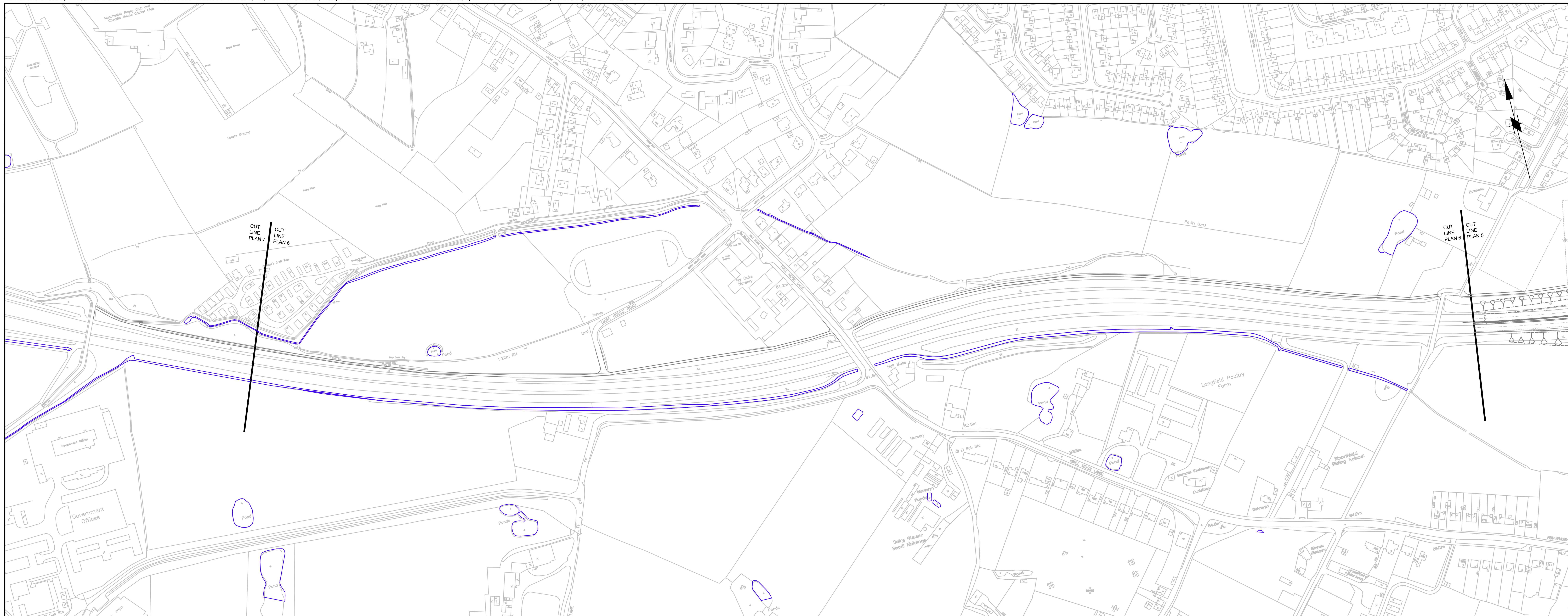
AECOM

First Floor, One Trinity Gardens, Quayside, NEWCASTLE UPON TYNE, NE1 2HF

Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/006 Rev: B

cm A1



NO GROUND INVESTIGATION DATA
OR VERTICAL GEOMETRY AVAILABLE

NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/178.
2. NO GROUND INVESTIGATION DATA OR VERTICAL GEOMETRY AVAILABLE

WATERCOURSE TAKEN FROM OS VECTORMAP

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:

south east manchester multi modal strategy
semmms
STOCKPORT
Cheshire East
MANCHESTER CITY COUNCIL

Project:

SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 6 OF 12

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

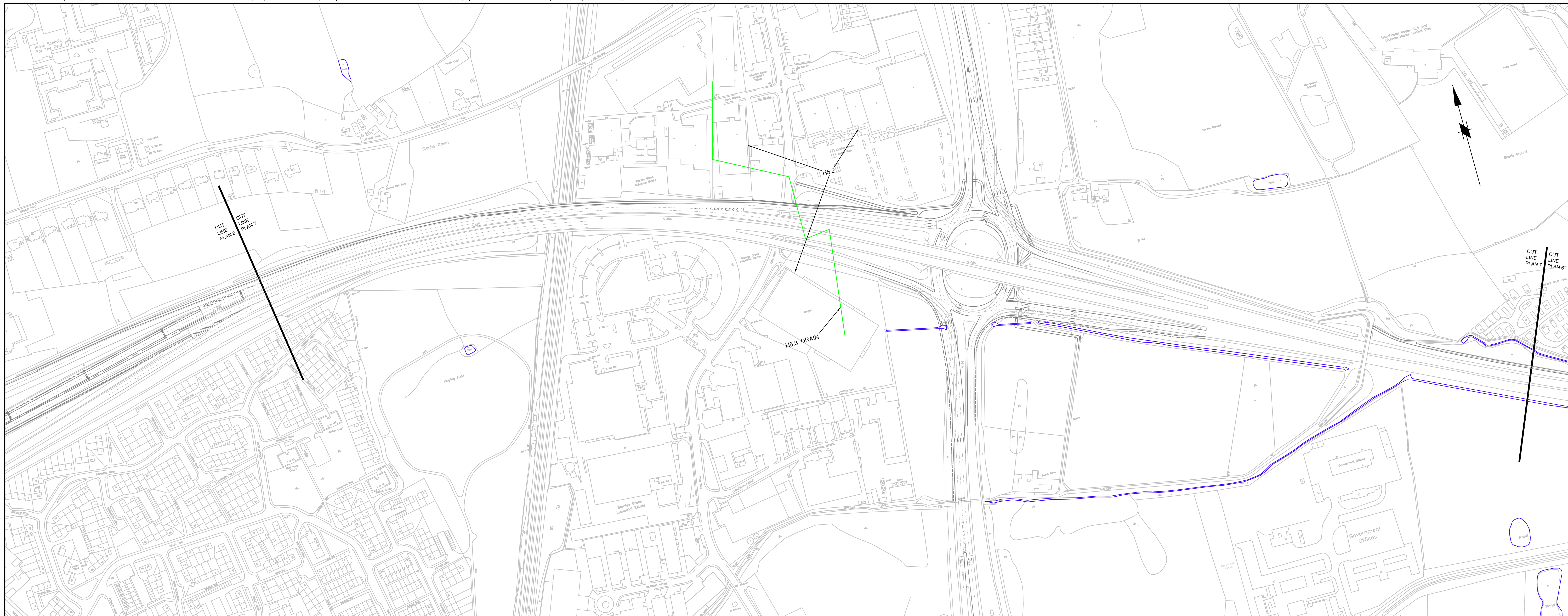
AECOM

First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF

Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/007 Rev: B

cm A1



NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/179.
2. NO GROUND INVESTIGATION DATA OR VERTICAL GEOMETRY AVAILABLE.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

NO GROUND INVESTIGATION DATA
OR VERTICAL GEOMETRY AVAILABLE

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:
south east manchester multi modal strategy
semmms
STOCKPORT
MANCHESTER CITY COUNCIL

Project:
SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

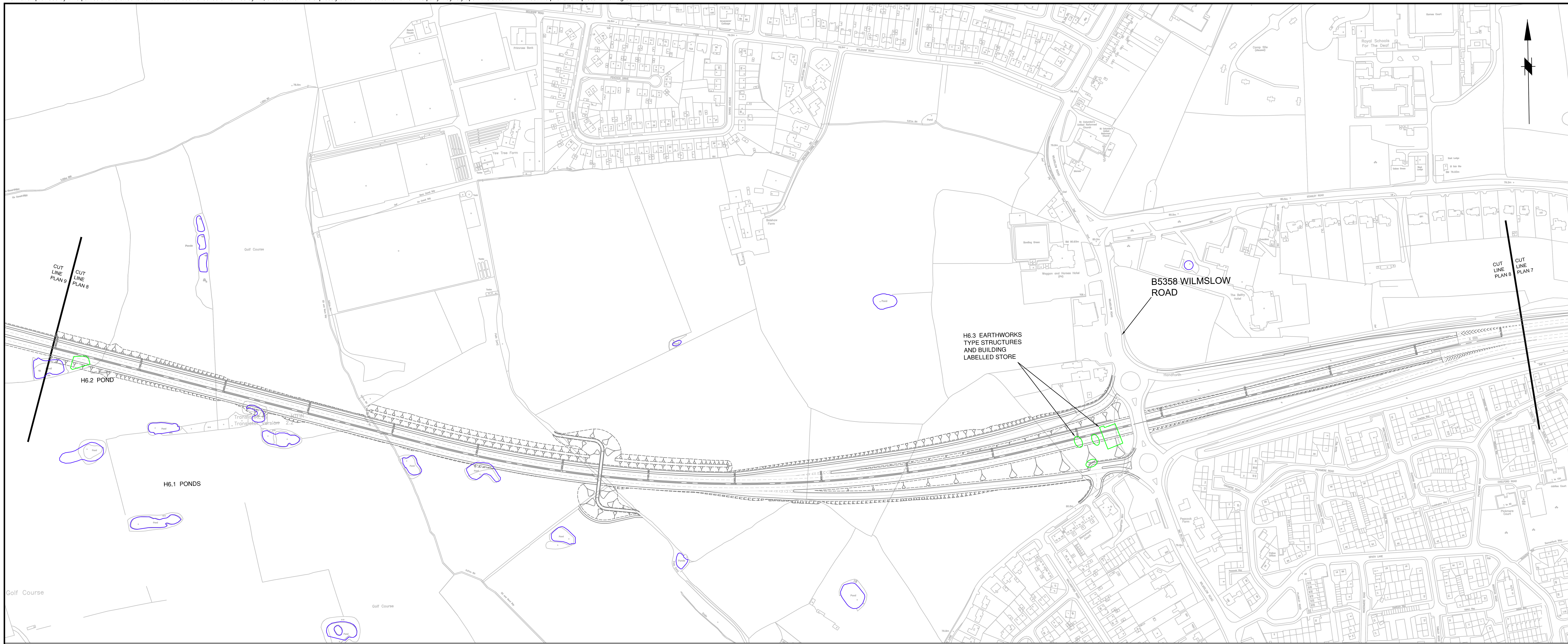
Title:
DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 7 OF 12

Design: RPA		CAD: RPA	
Chk'd: ABSW		App'd: MdK	
Date: DECEMBER 2010		Scale: H1:2500 V1:250 @A1	

AECOM
First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/008 Rev: B

cm A1

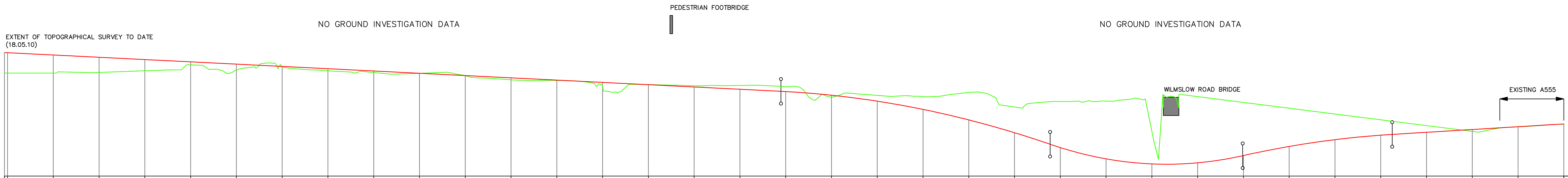


NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/180.
2. NO GROUND INVESTIGATION DATA AVAILABLE.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP



CHAINAGE	PROPOSED	EXISTING
1803.399	85.517	83.274
1800.000	85.500	83.274
1750.000	85.250	83.274
1700.000	85.000	83.340
1650.000	84.750	83.523
1600.000	84.500	84.172
1550.000	84.250	83.613
1500.000	84.000	83.881
1450.000	83.750	83.527
1400.000	83.500	83.330
1350.000	83.250	83.240
1300.000	83.000	82.999
1250.000	82.750	82.534
1200.000	82.500	82.471
1150.000	82.250	81.959
1100.000	82.000	82.009
1050.000	81.750	81.892
1000.000	81.500	81.922
950.000	81.249	81.765
900.000	80.848	80.627
850.000	80.197	80.830
800.000	79.296	80.695
750.000	78.146	81.151
700.000	76.745	79.557
650.000	75.117	80.160
600.000	73.886	80.206
550.000	73.330	76.895
500.000	73.450	80.696
450.000	74.246	80.061
400.000	75.239	79.427
350.000	75.983	78.792
300.000	76.476	78.158
250.000	76.790	77.523
200.000	77.096	76.889
150.000	77.402	77.402
100.000	77.708	77.676

SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
WILMSLOW ROAD TO STYAL ROAD
(SPEED LIMIT 50MPH)

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:
south east manchester multi modal strategy
semmms
STOCKPORT
Cheshire East
MANCHESTER CITY COUNCIL

Project:
SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Title:
DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 8 OF 12

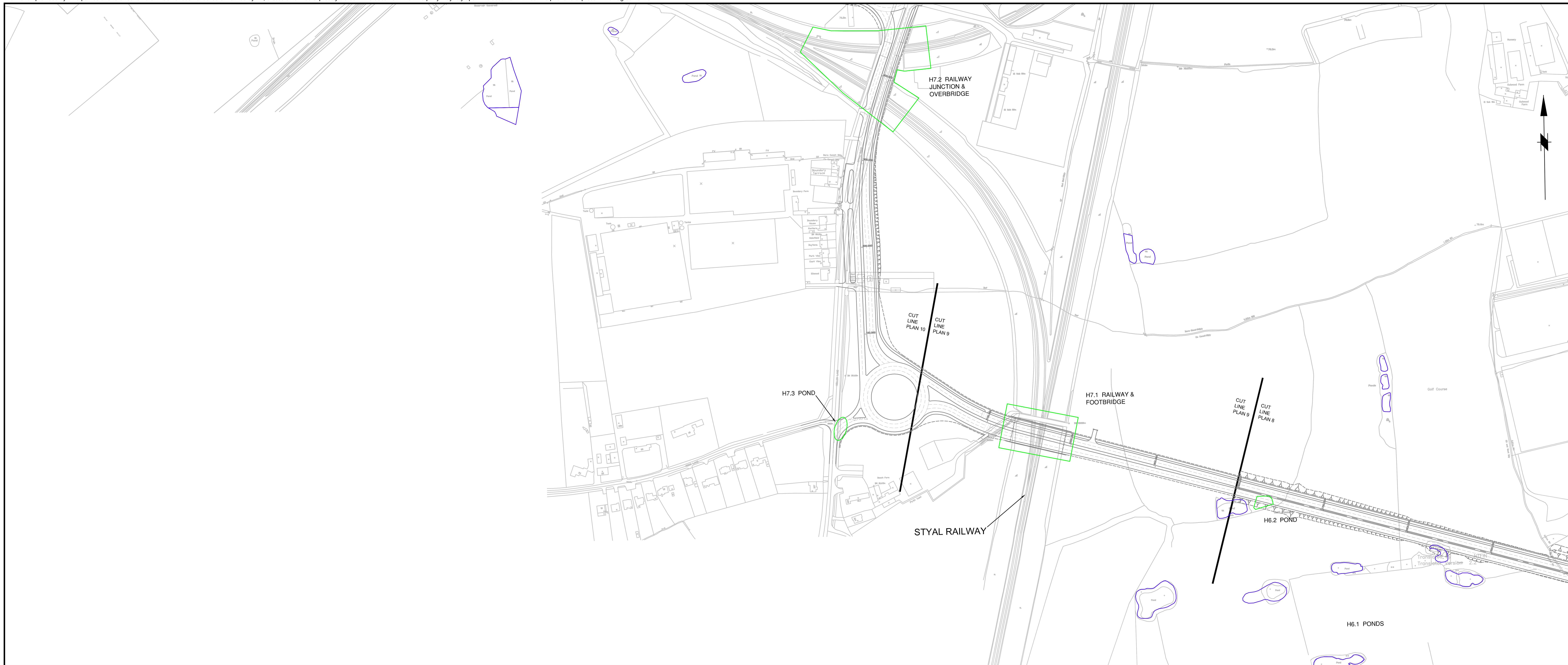
Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

AECOM

First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/009 Rev: B

cm A1



NO GROUND INVESTIGATION DATA
OR VERTICAL GEOMETRY AVAILABLE

NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/181.
2. NO GROUND INVESTIGATION DATA OR VERTICAL GEOMETRY AVAILABLE.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:

south east manchester multi modal strategy
semmms
STOCKPORT
Cheshire East
MANCHESTER CITY COUNCIL

Project:

SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 9 OF 12

Design: RPA	CAD: RPA
Chk'd: ABSW	App'd: MdK
Date: DECEMBER 2010	Scale: H1:2500 V1:250 @A1

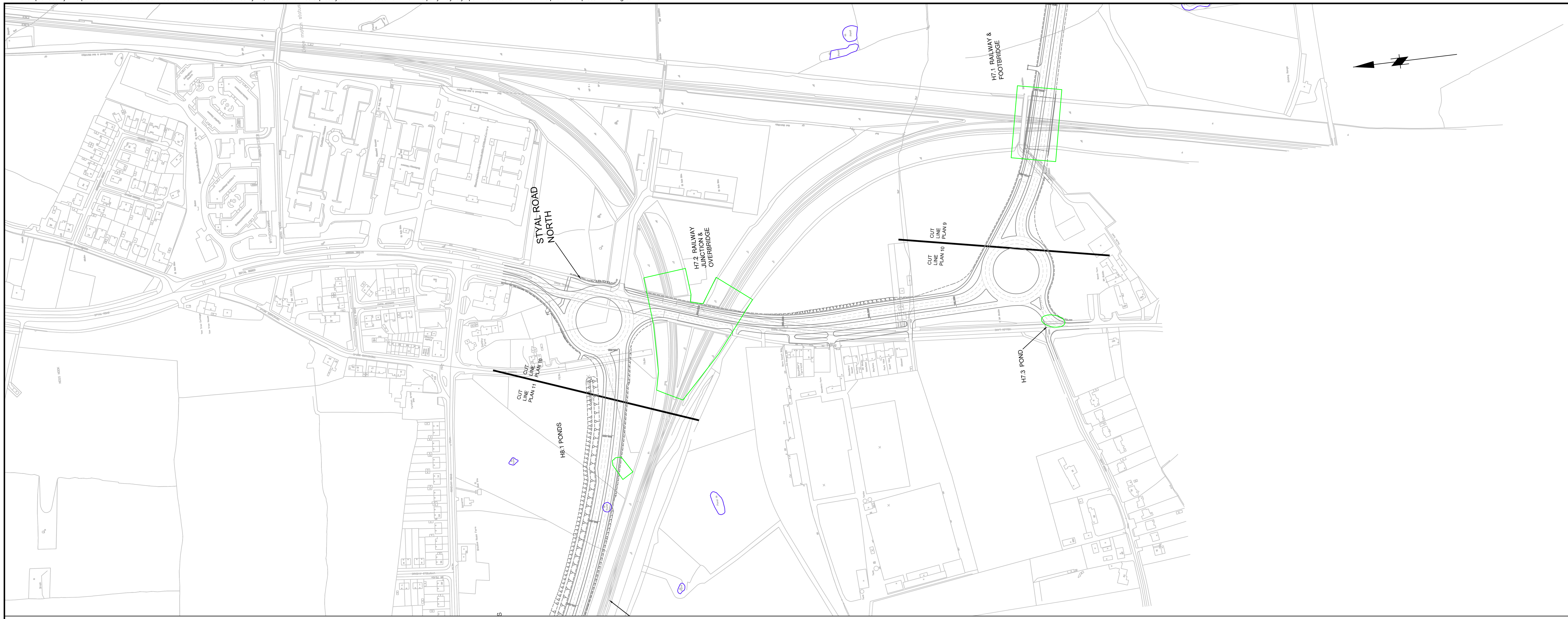
AECOM

First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF

Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/010 Rev: B

cm A1



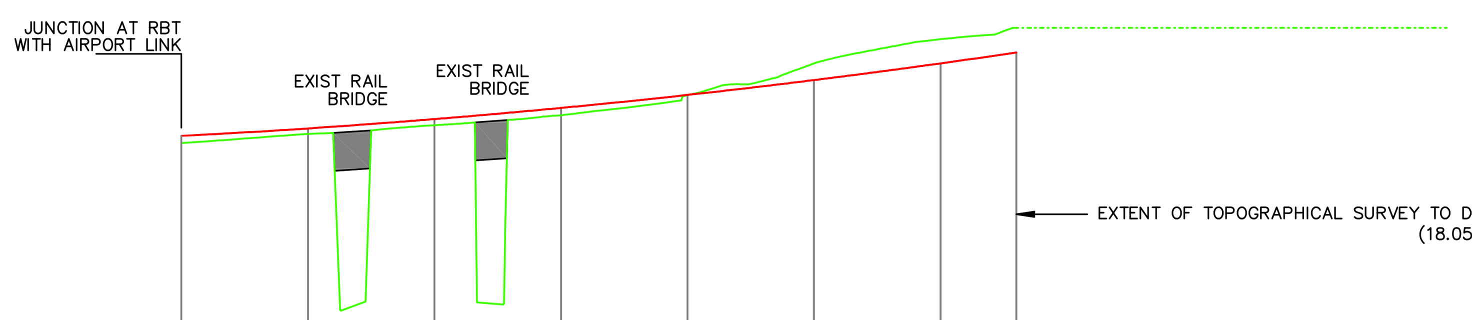
NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/182.
2. NO GROUND INVESTIGATION DATA AVAILABLE.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

NO GROUND INVESTIGATION DATA



DATUM=68.000

PROPOSED	76.469	76.765	77.134	77.575	78.089	78.676	79.335		-999.000	-999.000	-999.000	-999.000
EXISTING	76.191	76.552	76.891	77.284	78.083	79.335	80.291		80.740	80.740	80.740	80.740
CHAINAGE	500.000	450.000	400.000	350.000	300.000	250.000	200.000	170.000	150.000	100.000	50.000	0.000

SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
BETWEEN ROUNDABOUTS ON STYAL ROAD
(SPEED LIMIT 40MPH)

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:

south east manchester multi modal strategy
semmms
STOCKPORT
Cheshire East
MANCHESTER CITY COUNCIL

Project:

SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 10 OF 12

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

AECOM

First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF

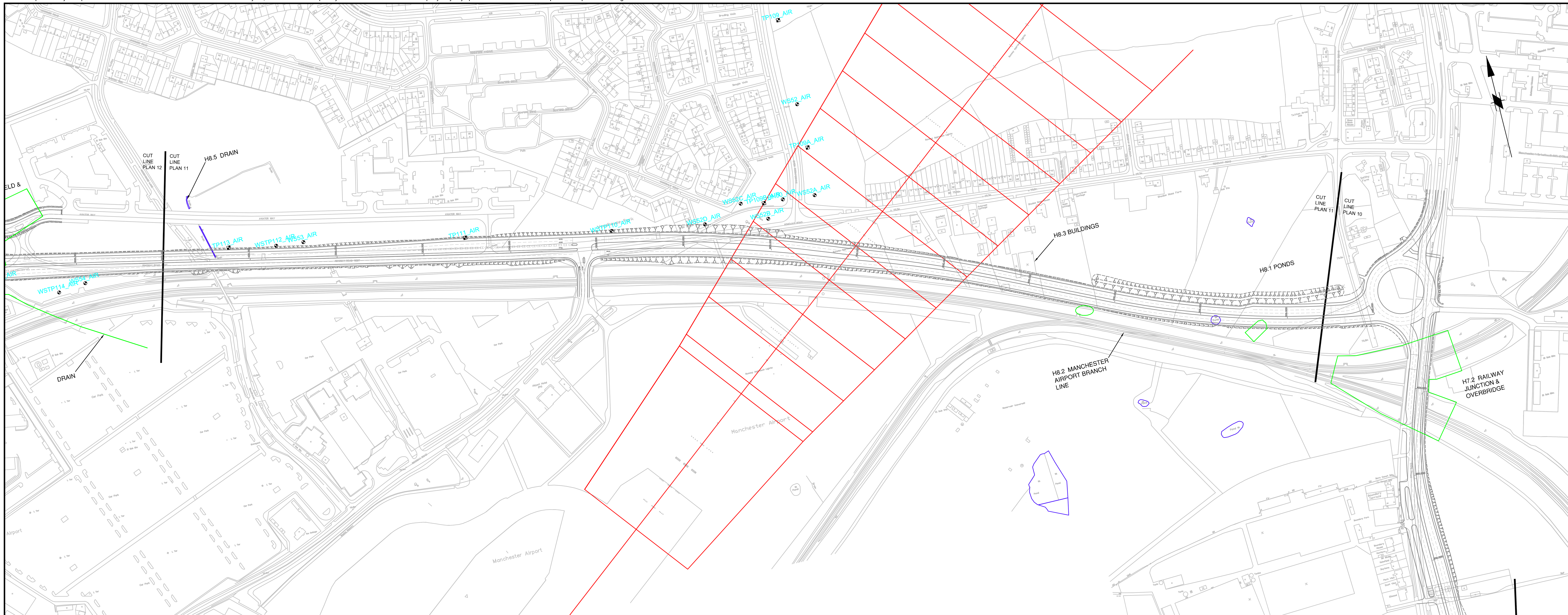
Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/011

Rev: B

cm

A1



NOTES

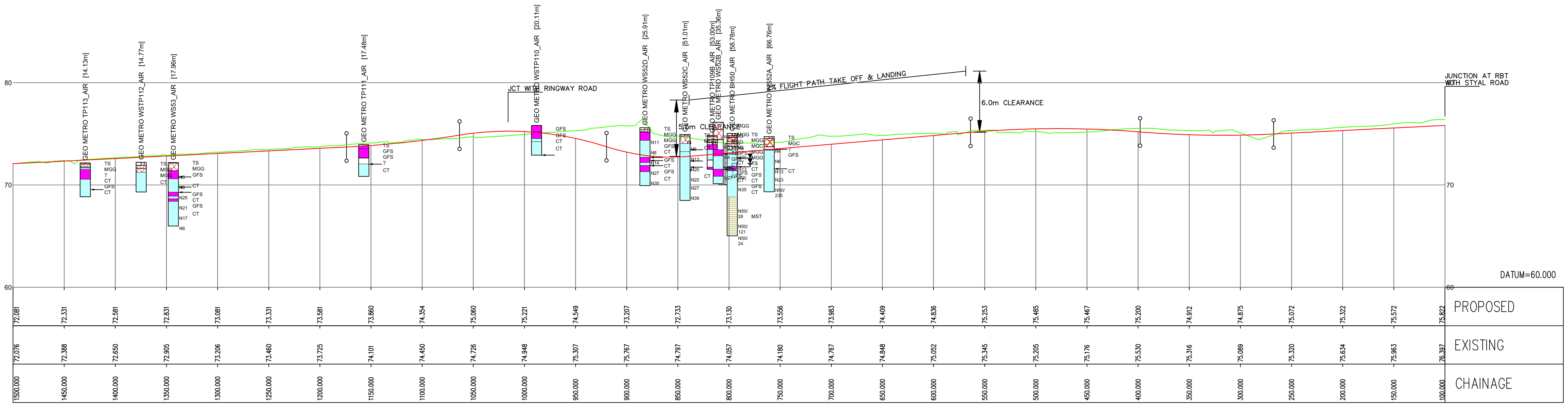
1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/183.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL
MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
CT	COHESIVE TILL
AL	ALLUVIUM
GFC	GLACIO FLUVIAL COHESIVE
PEAT	PEAT
GFS	GLACIO FLUVIAL - SAND
GFG	GLACIO FLUVIAL - GRAVEL
S&G	GLACIO FLUVIAL - SAND & GRAVEL
CWC	COMPLETELY WEATHERED MUDSTONE
CWST	COMPLETELY WEATHERED SILTSTONE
CWSD	COMPLETELY WEATHERED SANDSTONE
COAL	COAL
MST	MUDSTONE
STST	SILTSTONE
SDST	SANDSTONE
VOID	VOID



SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
STYAL ROAD TO MANCHESTER INTERNATIONAL AIRPORT
(SPEED LIMIT 40MPH)

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:

south east manchester multi modal strategy semmms

STOCKPORT · Cheshire East · MANCHESTER CITY COUNCIL

Project:

SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3
GEOLOGICAL LONG SECTION
SHEET 11 OF 12

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

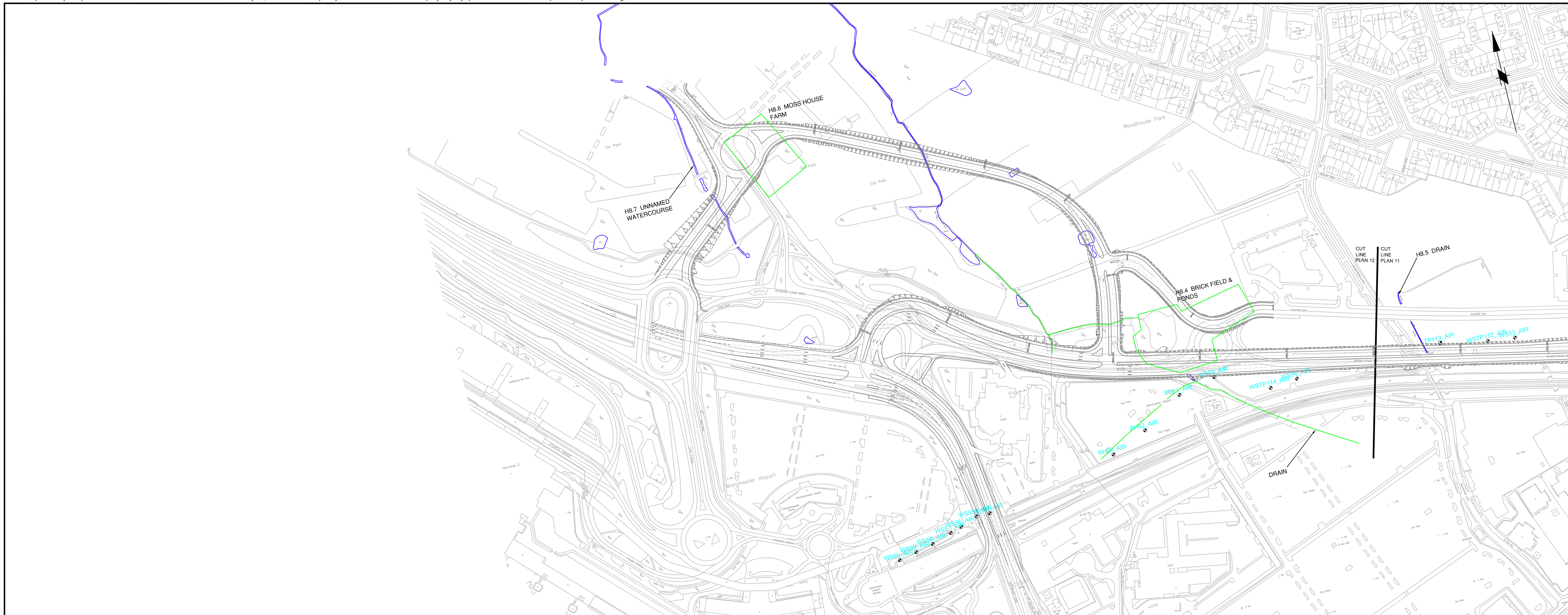
AECOM

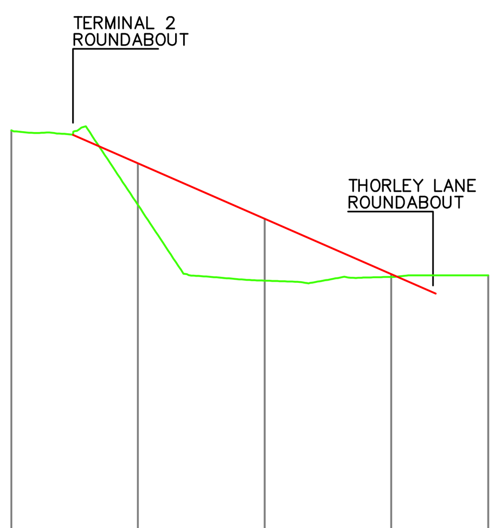
First Floor,
One Trinity Gardens, Quayside,
NEWCASTLE UPON TYNE, NE1 2HF

Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

No. 60186094/GEO/012 Rev: B

cm A1





DATUM=60.000

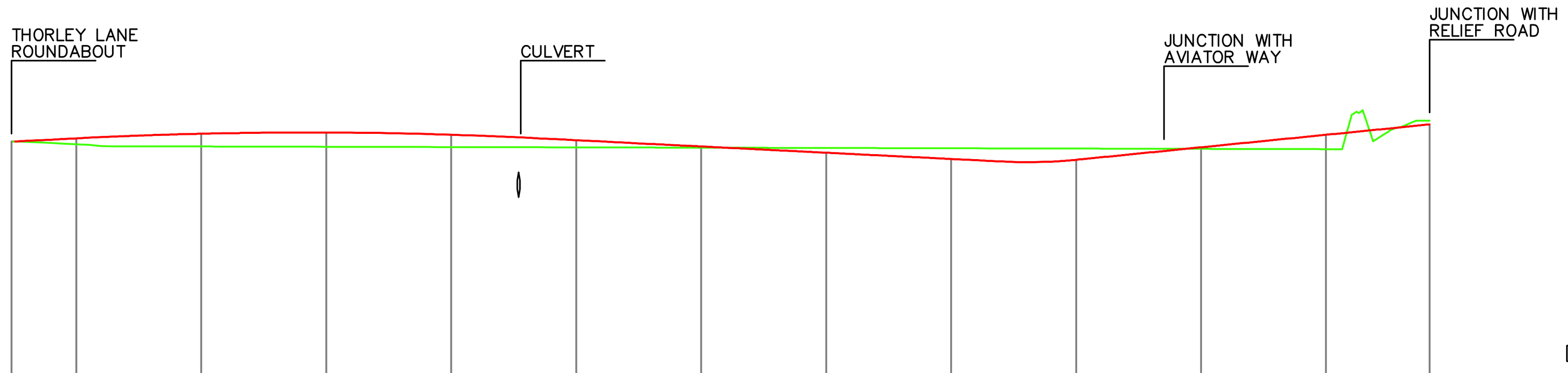
PROPOSED		75.995	74.873	72.682	70.492	69.725
EXISTING	76.167	75.995	73.228	70.237	70.384	
CHAINAGE		24.387	50.000	100.000	150.000	167.497

PROPOSED	
EXISTING	70.445
CHAINAGE	188.304

SECTION ALONG CENTRELINE OF T2 RBT TO THORNLEY LANE RBT LINK

(SPEED LIMIT 30MPH)

NO GROUND INVESTIGATION DATA AVAILABLE

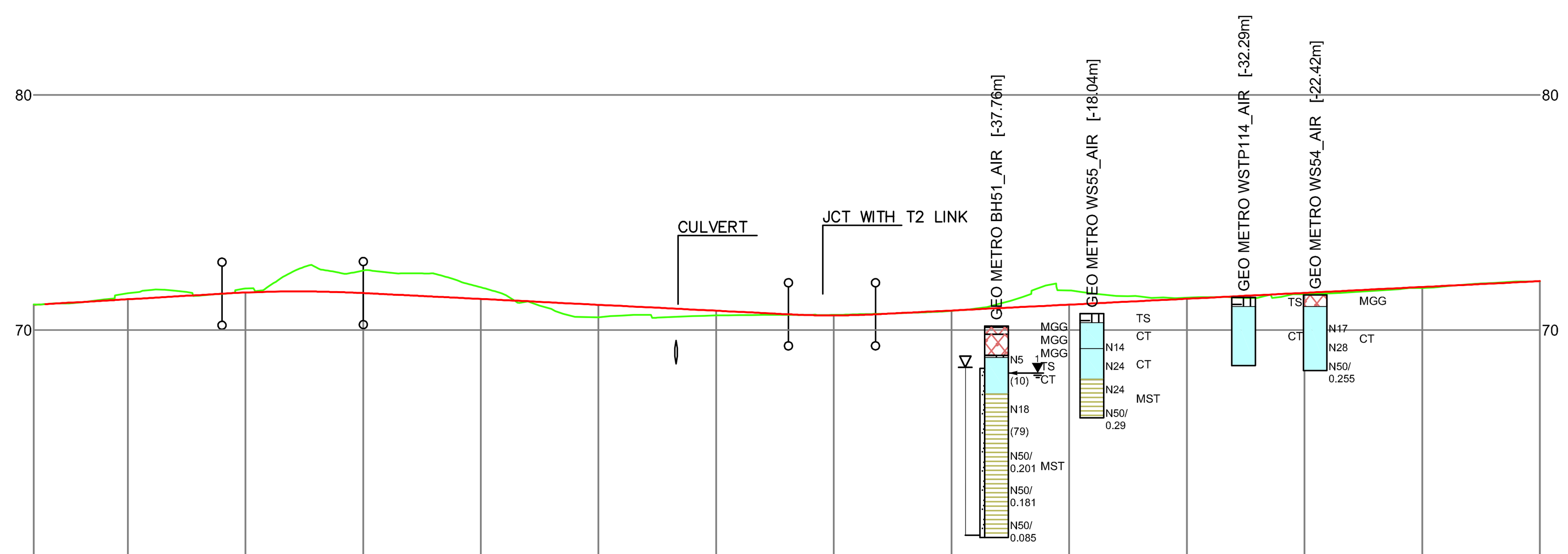


DATUM=60.000

PROPOSED	69.725	69.855	70.040	70.089	70.000	69.781	69.531	69.281	69.031	68.998	69.498	69.998	70.412
EXISTING	69.725	69.621	69.531	69.519	69.507	69.495	69.483	69.471	69.459	69.447	69.435	69.423	70.563
CHAINAGE	675.957	650.000	600.000	550.000	500.000	450.000	400.000	350.000	300.000	250.000	200.000	150.000	108.551

SECTION ALONG CENTRELINE OF TERMINAL 2 LINK ROAD

(SPEED LIMIT 30MPH)



DATUM=60.000

PROPOSED	71.072	71.308	71.595	71.573	71.323	71.073	70.823	70.623	70.831	71.081	71.331	71.581	71.831	72.081
EXISTING	71.090	71.571	71.766	72.561	71.415	70.650	70.647	70.649	70.816	71.686	71.381	71.519	71.786	72.076
CHAINAGE	2140.000	2100.000	2050.000	2000.000	1950.000	1900.000	1850.000	1800.000	1750.000	1700.000	1650.000	1600.000	1550.000	1500.000

SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD STYAL ROAD TO MANCHESTER INTERNATIONAL AIRPORT

(SPEED LIMIT 40MPH)

NOTES

1. HIGHWAY ALIGNMENT AND VERTICAL GEOMETRY TAKEN FROM SMBC DRAWING 1007/3D-DF3/A6-MA/GA/184.

FEATURE IDENTIFIED FROM HISTORIC ORDNANCE SURVEY MAPS

WATERCOURSE TAKEN FROM OS VECTORMAP

STRATA KEY

TS	TOPSOIL
MGG	MADE GROUND - GRANULAR
MGC	MADE GROUND - COHESIVE
CT	COHESIVE TILL
AL	ALLUVIUM
GFC	GLACIO FLUVIAL COHESIVE
PEAT	PEAT
GFS	GLACIO FLUVIAL - SAND
GFG	GLACIO FLUVIAL - GRAVEL
S&G	GLACIO FLUVIAL - SAND & GRAVEL
CWC	COMPLETELY WEATHERED MUDSTONE
CWST	COMPLETELY WEATHERED SILTSTONE
CWSD	COMPLETELY WEATHERED SANDSTONE
COAL	COAL
MST	MUDSTONE
STST	SILTSTONE
SDST	SANDSTONE
VOID	VOID

Rev	Date	Detail	Made	Chk'd	App'd
B	FEB 2011	LABELS ADDED	RPA	ABSW	MdK
A	DEC 2010	ORIGINAL ISSUE	RPA	ABSW	MdK

Client:

south east manchester multi modal strategy semmms

STOCKPORT · Cheshire East · MANCHESTER CITY COUNCIL

Project:

SEMMMS RELIEF ROAD SCHEME A6 - AIRPORT

Title:

DRAFT DESIGN FREEZE 3 GEOLOGICAL LONG SECTION SHEET 12 OF 12

Design:	RPA	CAD:	RPA
Chk'd:	ABSW	App'd:	MdK
Date:	DECEMBER 2010	Scale:	H1:2500 V1:250 @A1

AECOM

First Floor, One Trinity Gardens, Quayside, NEWCASTLE UPON TYNE, NE1 2HF

Tel: +44 (0) 191 224 6500
Fax: +44 (0) 191 224 6599
www.aecom.com

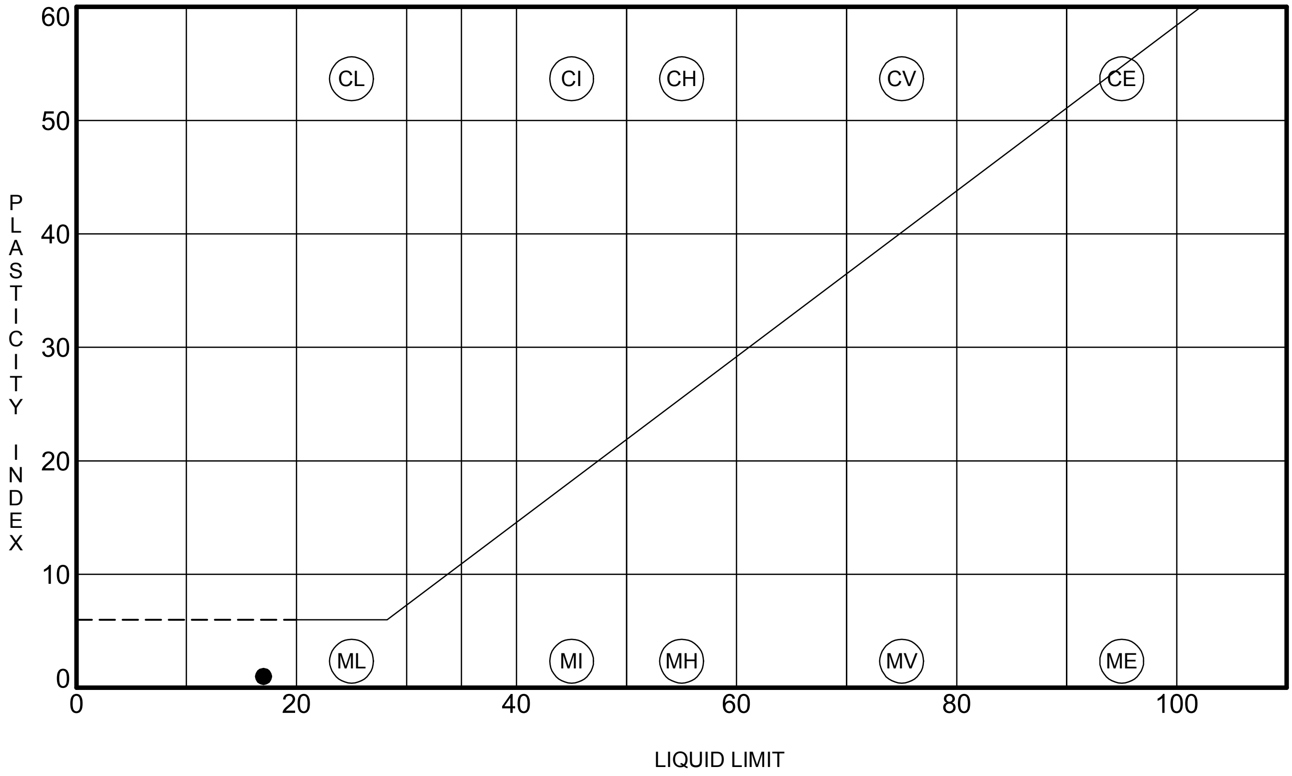
No. 60186094/GEO/013 Rev: B

cm A1

Appendix A1

Geotechnical Plots A6 – Hazel Grove

Page deliberately blank for double sided printing



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**NWH MAIN GI 240**	**0.50**	**17**	**16**	**1**		

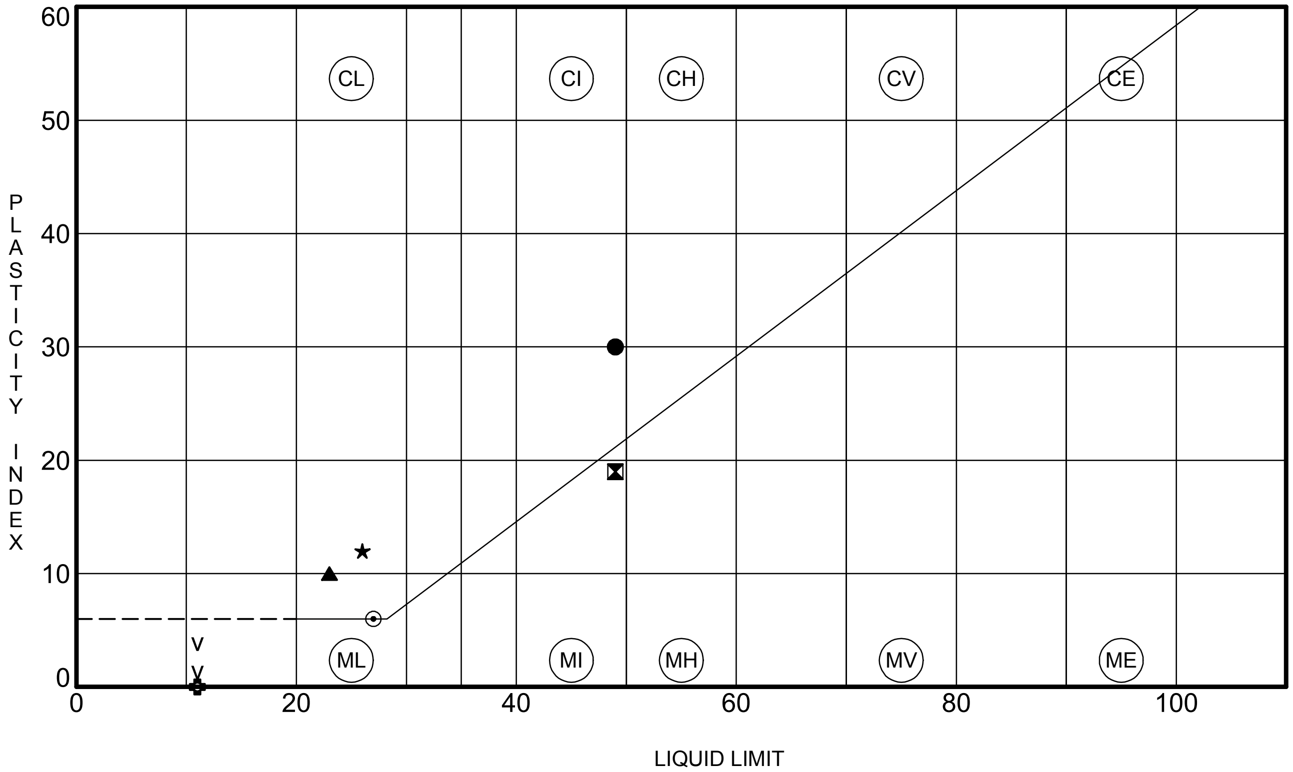
AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT

AECOM

Zone: A6 - Hazel Grove(included)
Strata Type: MGC

ATTERBERG LIMITS RESULTS

Client: SMBC
Project: SEMMMS A6 to Airport Relief Road
Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**NWH MAIN GI 209**	**1.40**	**49**	**19**	**30**		
⧗	**NWH MAIN GI 213**	**1.50**	**49**	**30**	**19**		
▲	**NWH MAIN GI 214**	**1.50**	**23**	**13**	**10**		
★	**NWH MAIN GI 215**	**0.50**	**26**	**14**	**12**		
⊙	**NWH MAIN GI 240**	**2.50**	**27**	**21**	**6**		
✚	**NWH MAIN GI 240**	**5.10**	**11**	**13**	**NP**		

AECOM

Zone: A6 - Hazel Grove(included)
Strata Type: CT

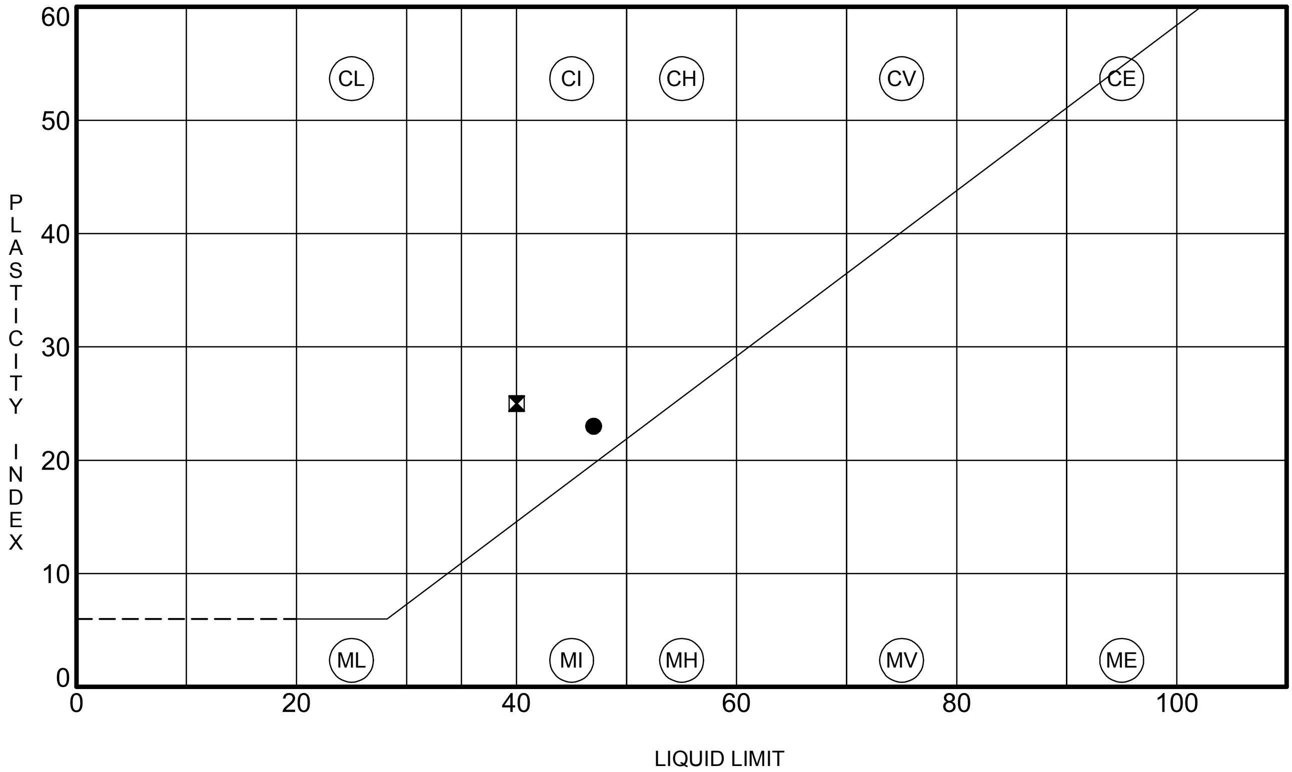
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**NWH MAIN GI 214**	**2.50**	**47**	**24**	**23**		
⧗	**NWH MAIN GI 215**	**2.50**	**40**	**15**	**25**		

ATTERBERG LIMITS RESULTS

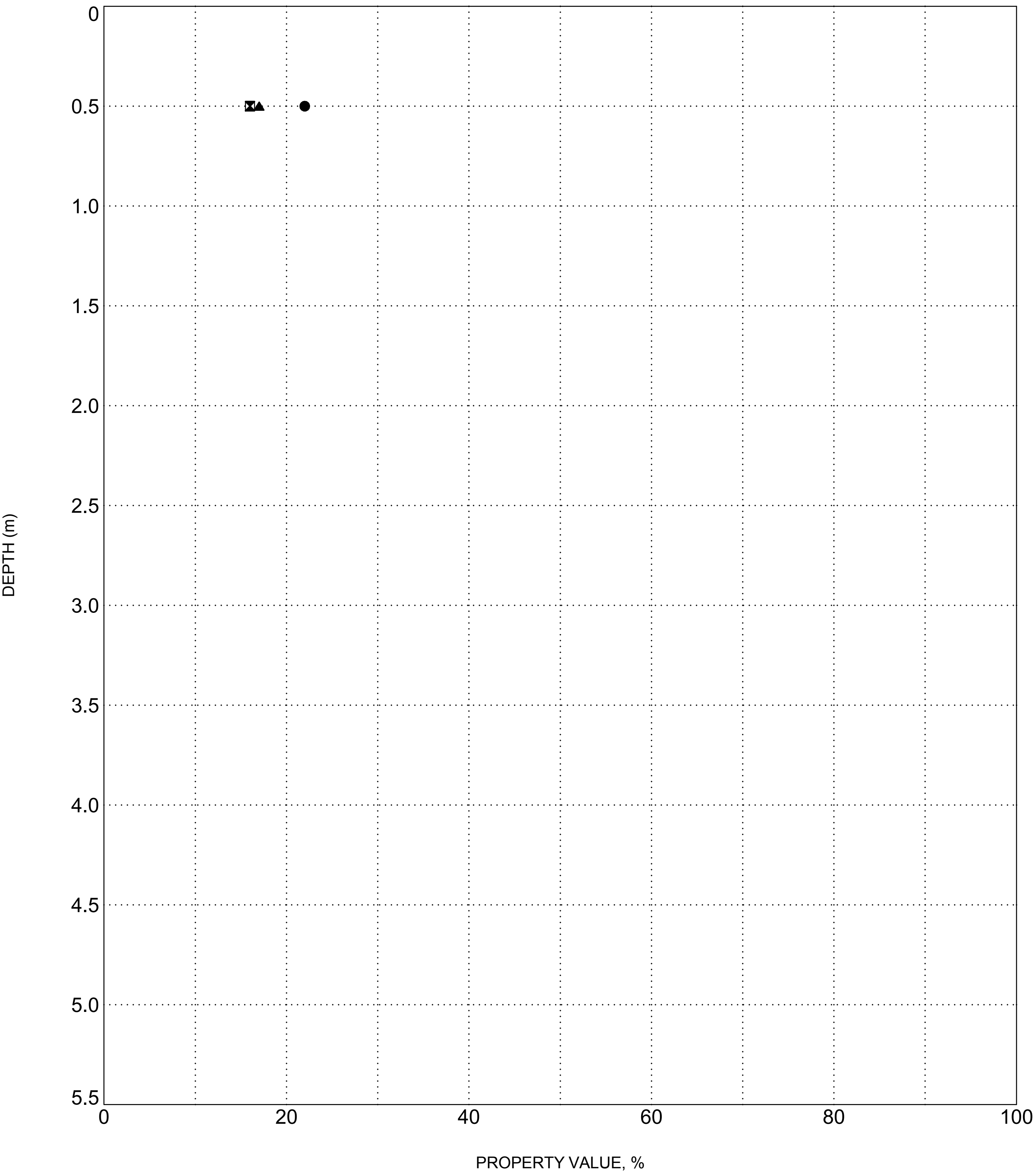
Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

Zone: A6 - Hazel Grove(included)

Strata Type: Rock



LEGEND
● Moisture Content
Plastic Limit
▲ Liquid Limit

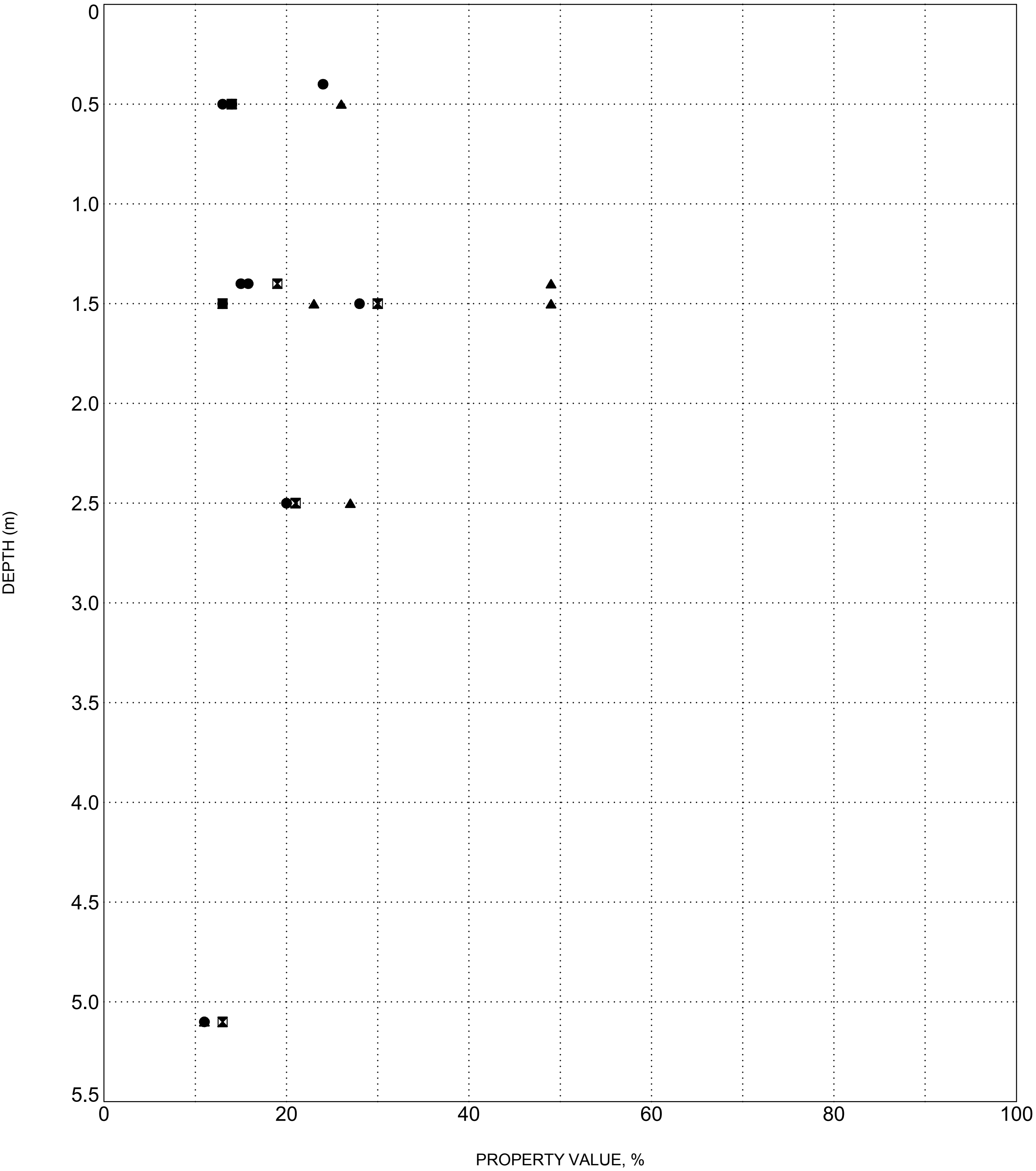
Zone: A6 - Hazel Grove(included)
Strata Type: MGC

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Moisture Content
⊠ Plastic Limit
▲ Liquid Limit

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

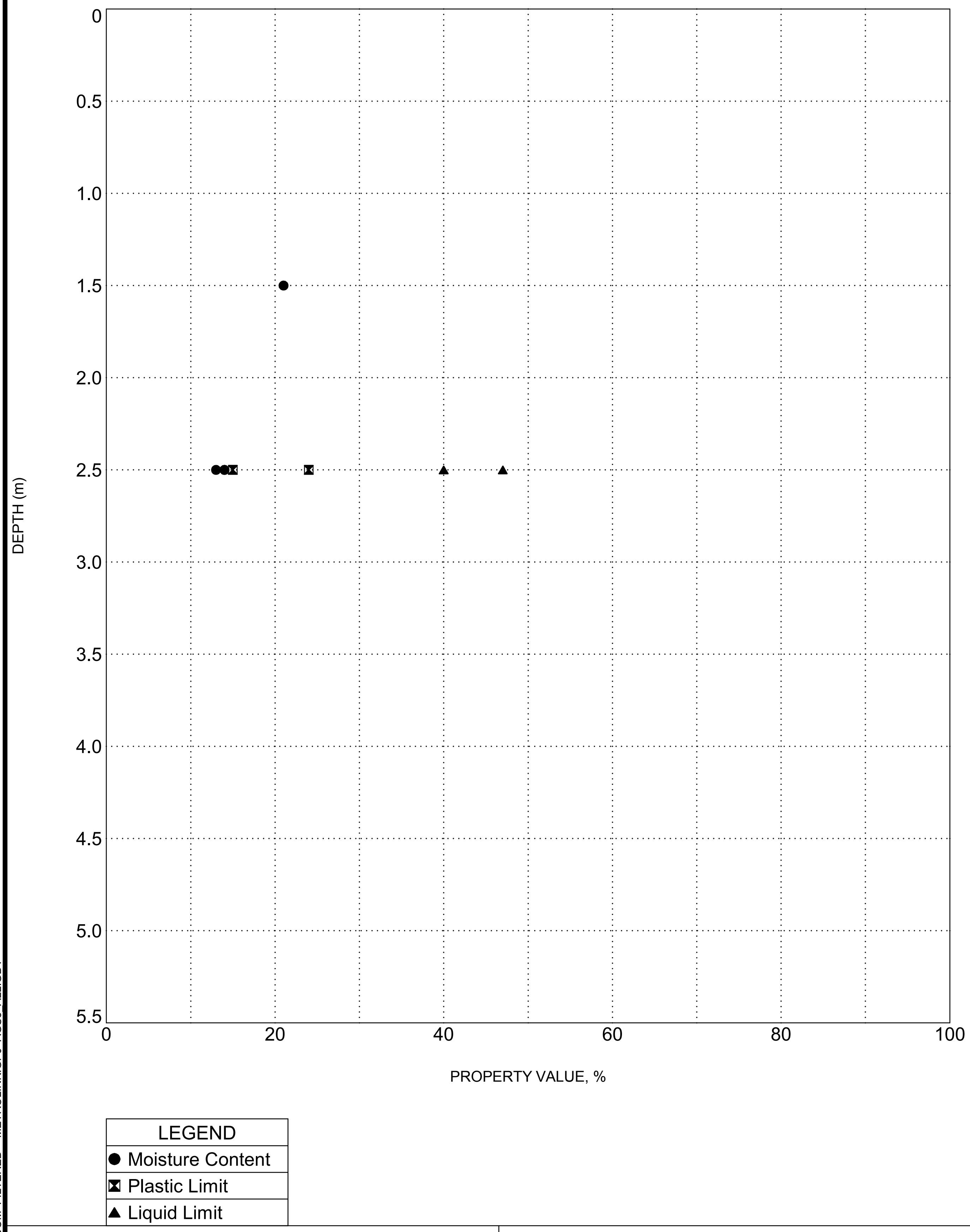
Zone: A6 - Hazel Grove(included)
Strata Type: CT

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

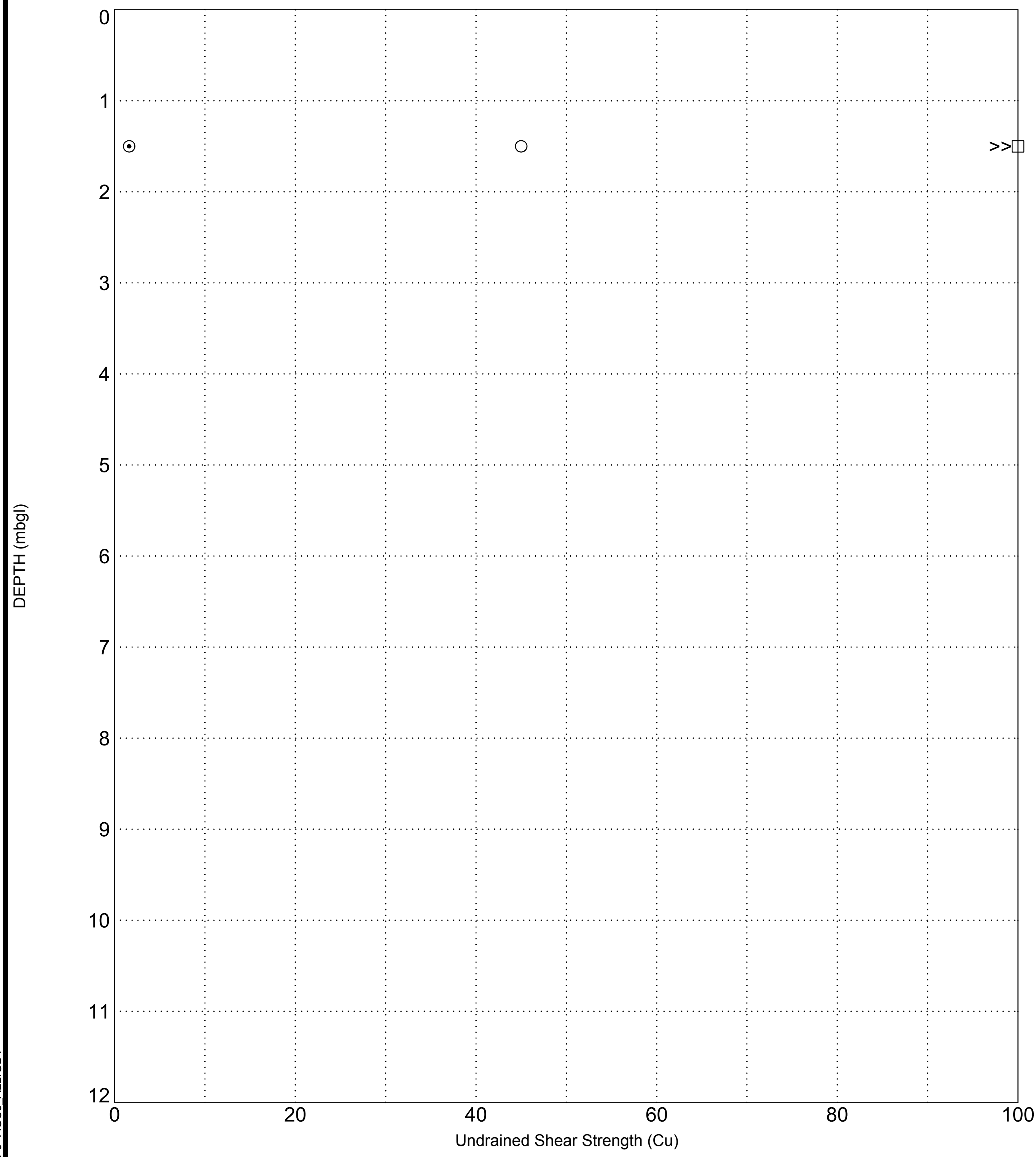
Zone: A6 - Hazel Grove(included)
Strata Type: ROCK

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: A6 - Hazel Grove(included)
Strata Type: MGC

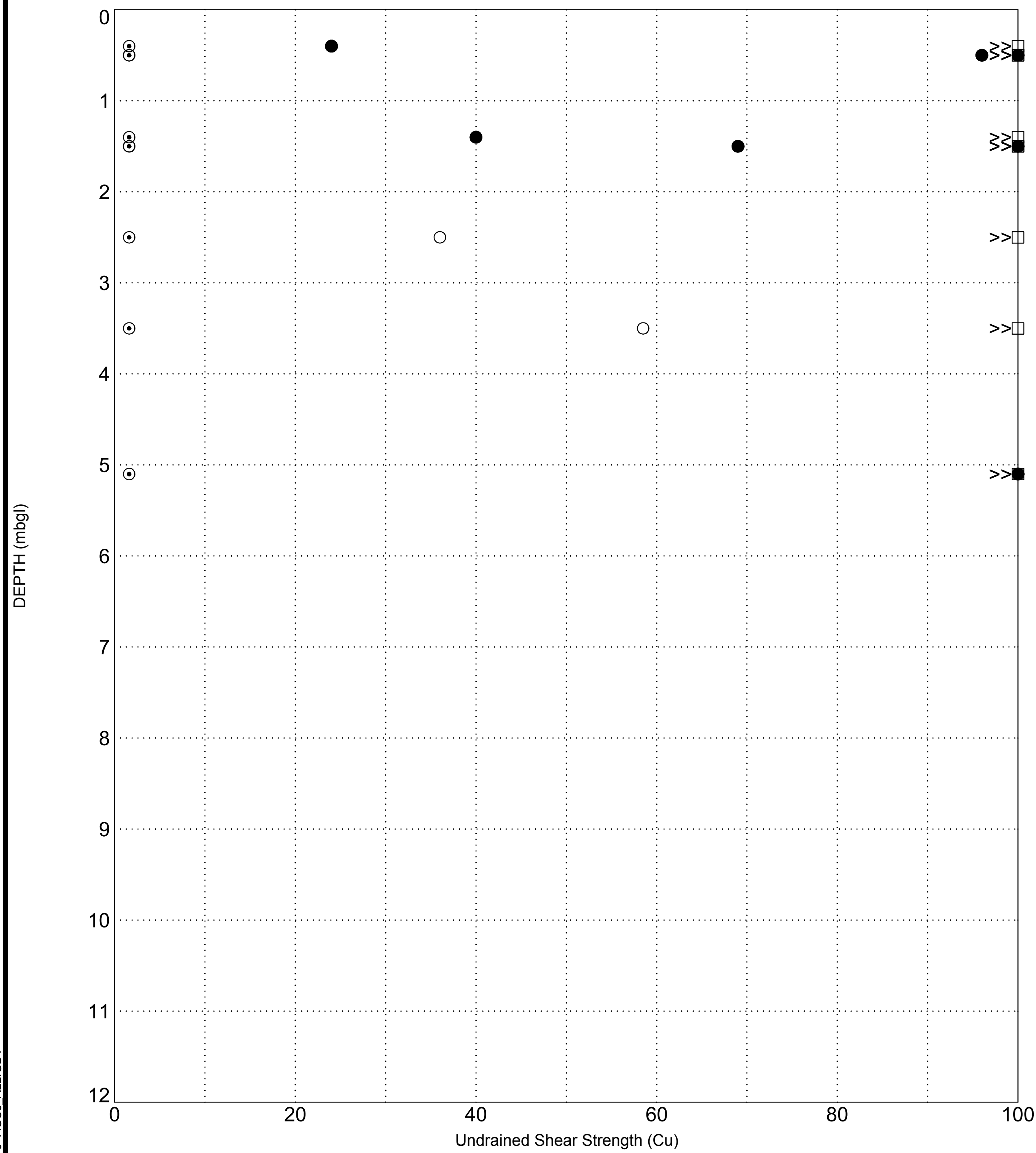
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
☐ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

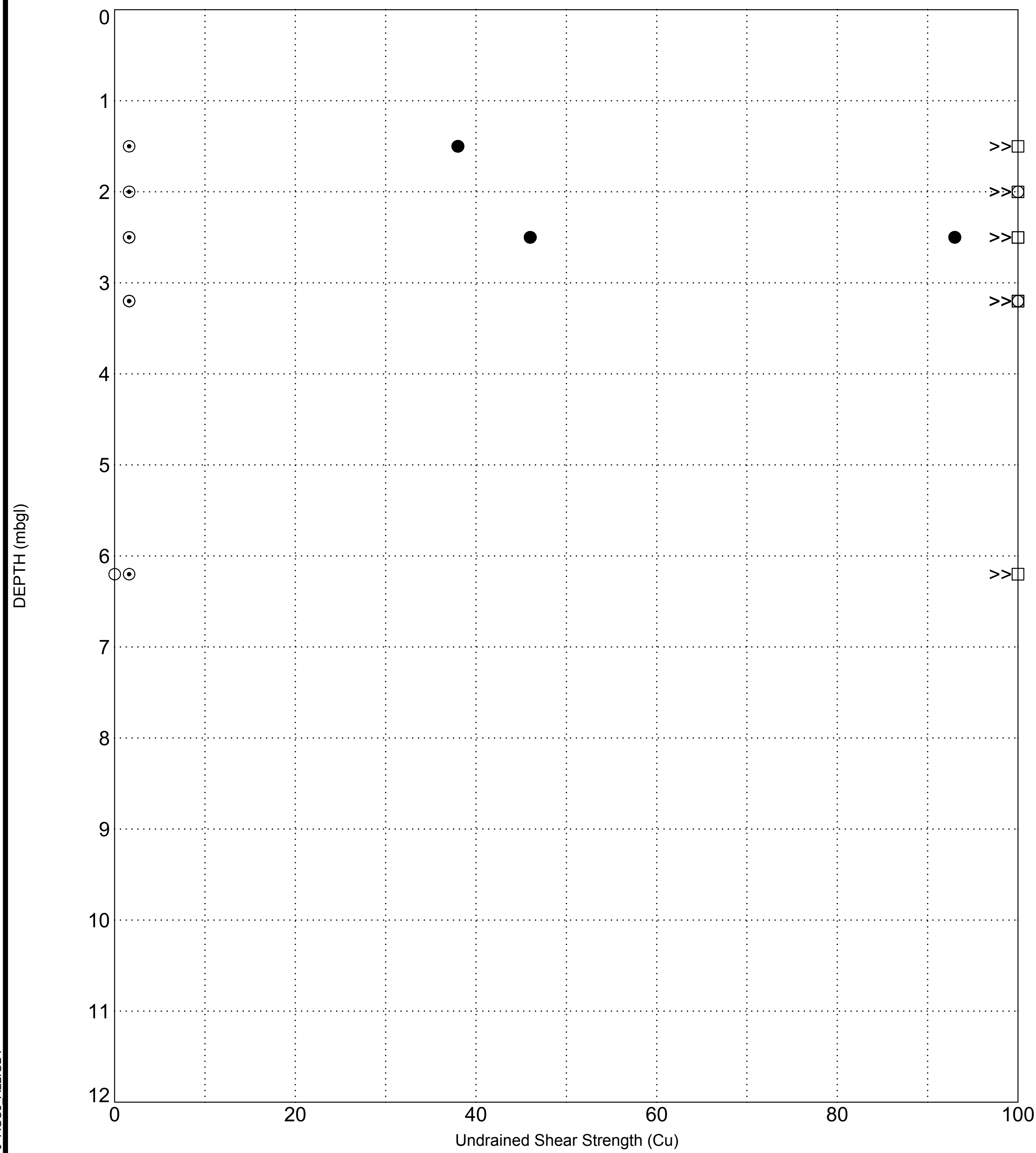
Zone: A6 - Hazel Grove(included)
Strata Type: CT

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: A6 - Hazel Grove(included)
Strata Type: Rock

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

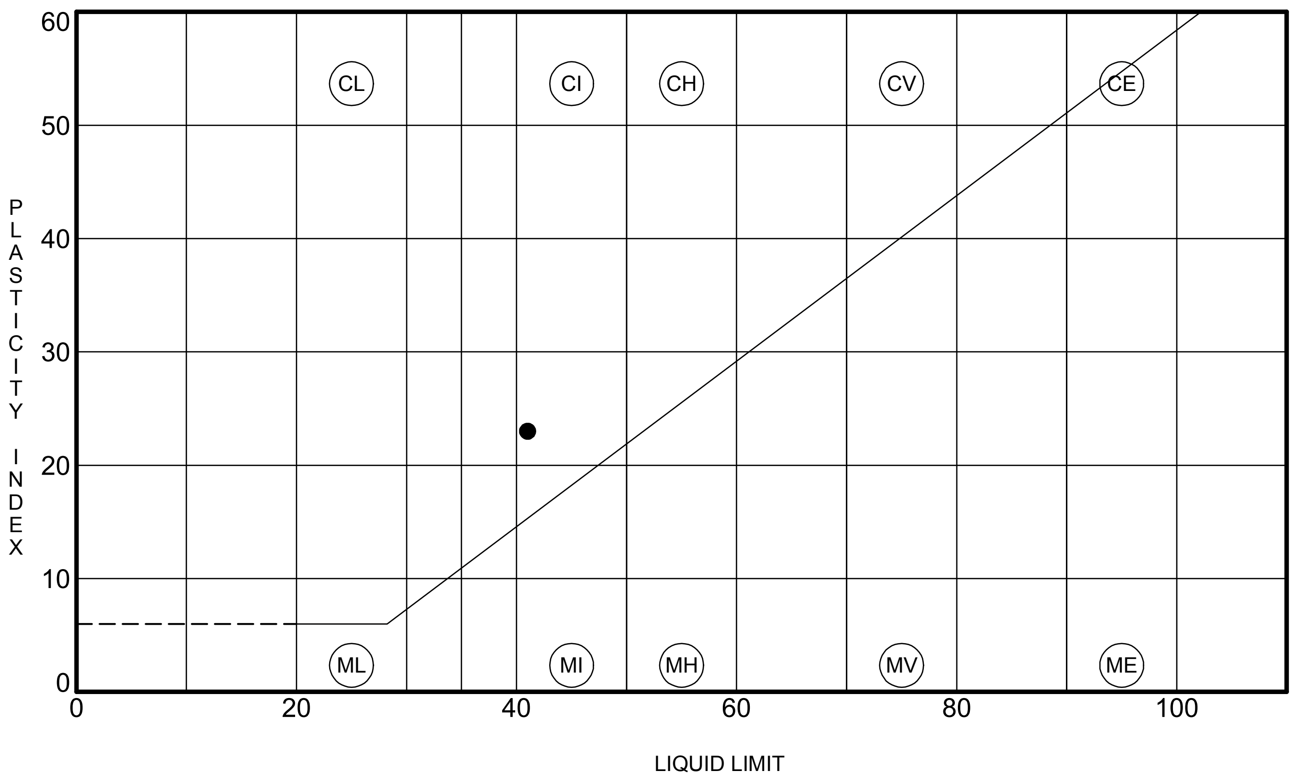
Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

Appendix A2

Geotechnical Plots Hazel Grove – Norbury Brook

Page deliberately blank for double sided printing



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**NWH MAIN GI TP29**	**0.70**	**41**	**18**	**23**		

AECOM

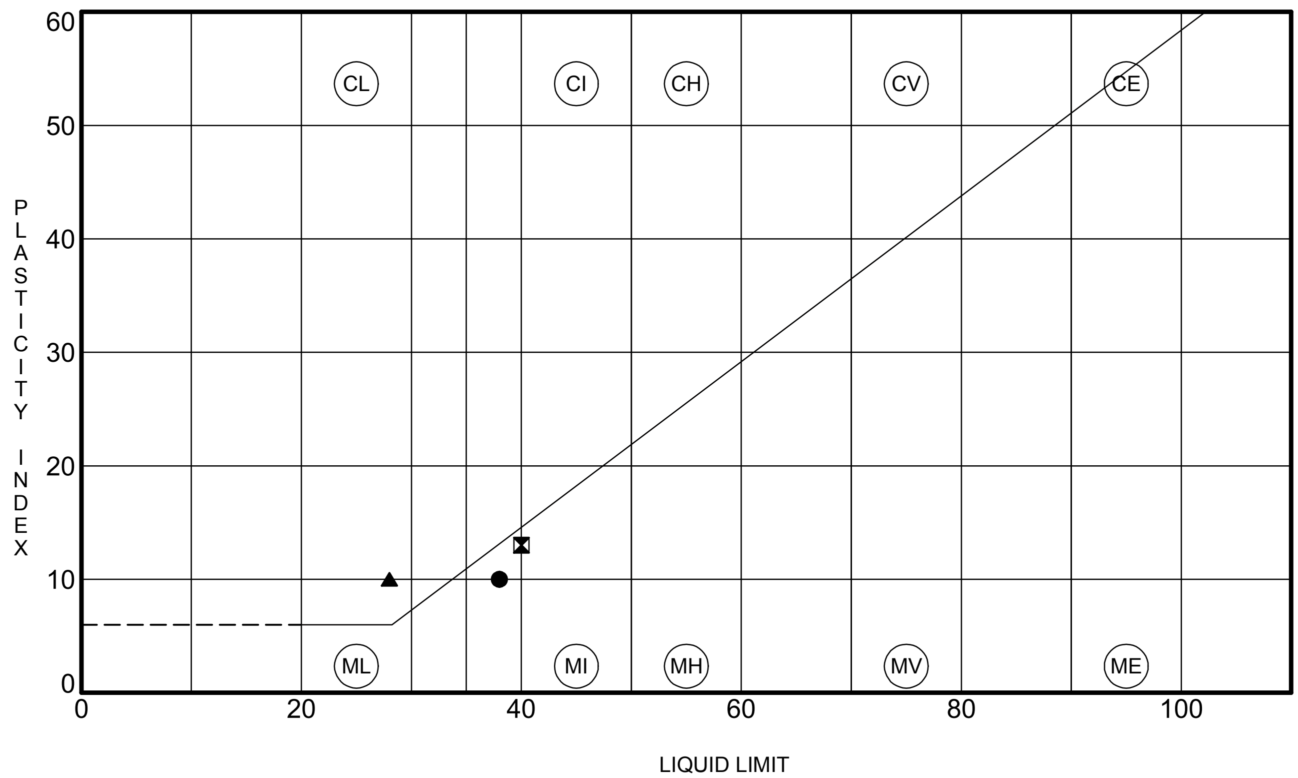
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: MGC

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 100_1**	**1.20**	**38**	**28**	**10**		
⧗	**EA POYNTON 99_2**	**0.50**	**40**	**27**	**13**		
▲	**EA POYNTON 99_3**	**1.20**	**28**	**18**	**10**		

AECOM

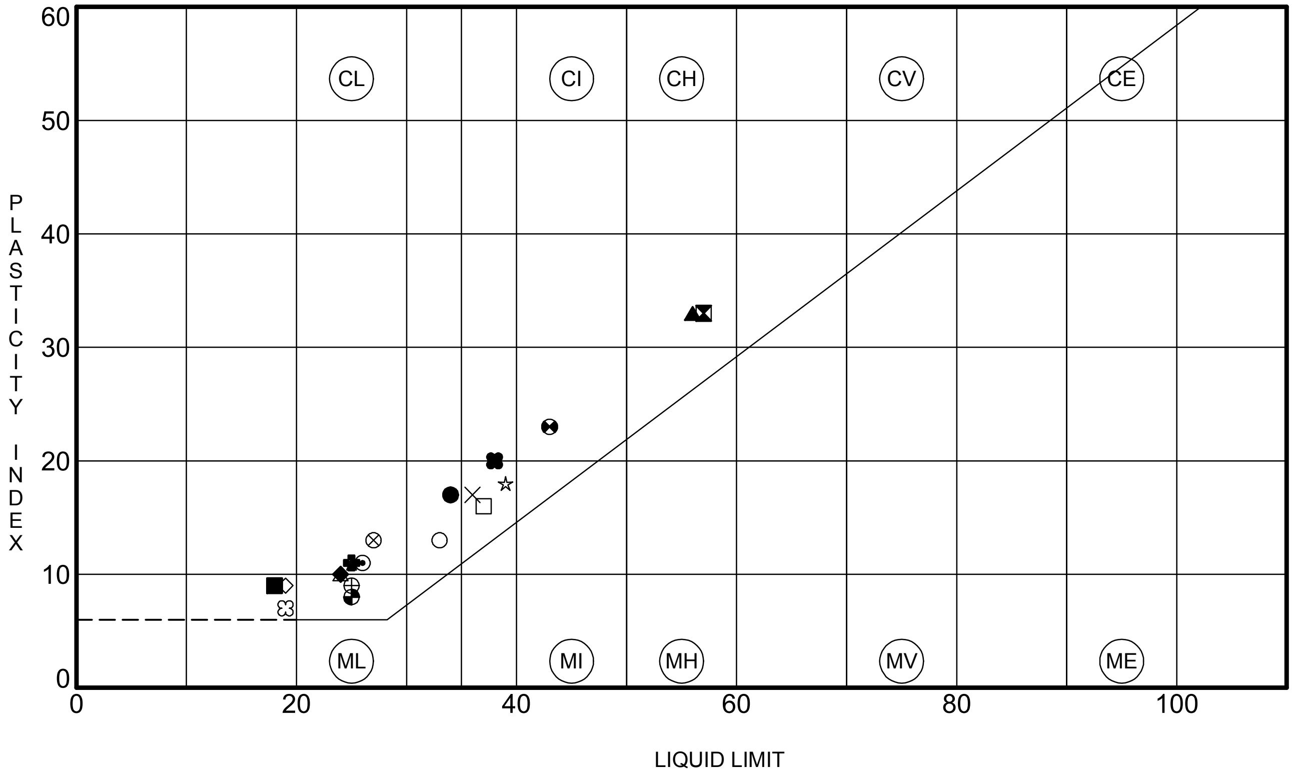
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: AL

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
BH1000	1.20	34	17	17		
BH1001	2.40	57	24	33		
BH1001	2.40	56	23	33		
BH1001	3.90	25	14	11		
EA 3RD SUPP 729	0.50	26	15	11		
EA POYNTON 103_2	3.70	25	14	11		
EA POYNTON 103_3	1.60	33	20	13		
EA POYNTON 103_3	4.80	24	14	10		
EA POYNTON 103_5	5.40	27	14	13		
EA POYNTON 104_1	7.50	25	16	9		
EA POYNTON 104_1	11.50	37	21	16		
EA POYNTON 104_1	12.50	43	20	23		
EA POYNTON 104_2	0.45	25	17	8		
EA POYNTON 104_3	1.20	39	21	18		
EA POYNTON 104_3	10.20	19	12	7		
EA POYNTON 104_3	11.40	18	9	9		
EA POYNTON 104_4	1.20	24	14	10		
EA POYNTON 104_4	8.70	19	10	9		
EA POYNTON 104_4	12.10	36	19	17		
EA POYNTON 104_4	13.30	38	18	20		

AECOM

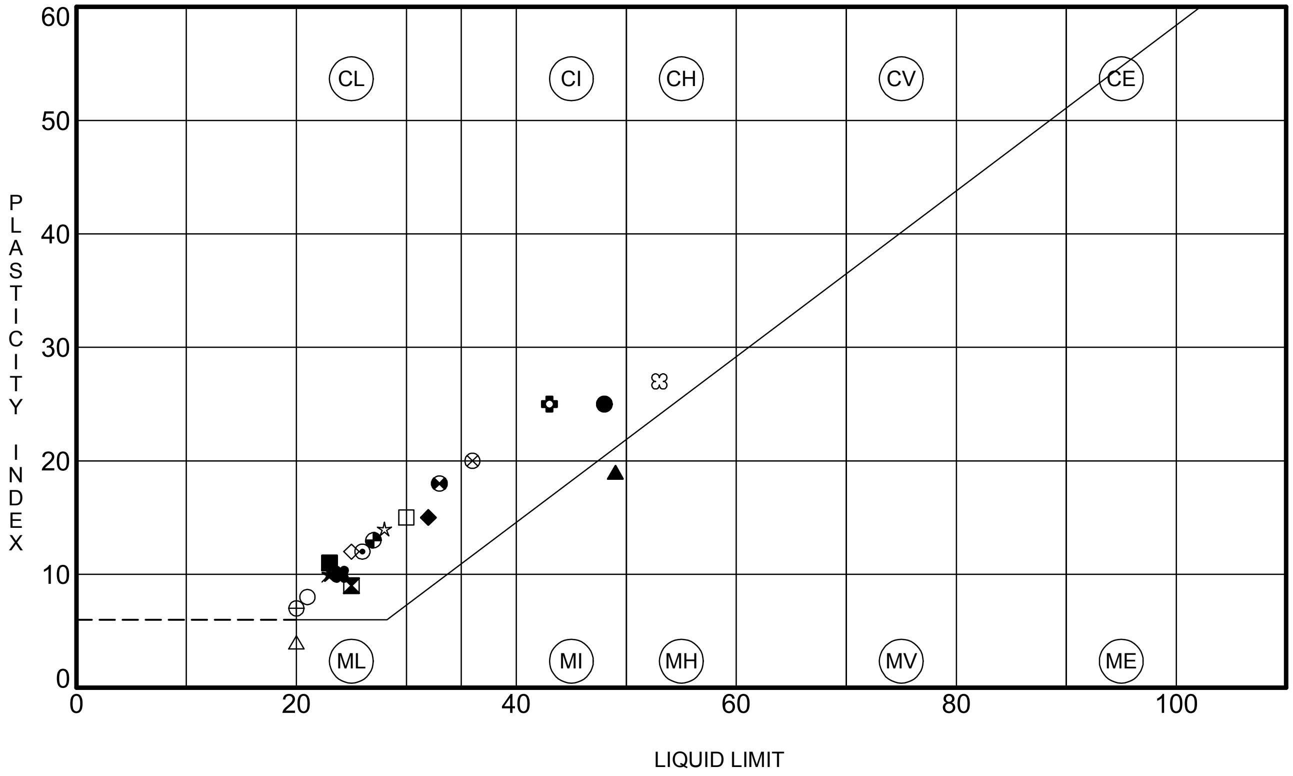
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 104_4**	**14.50**	**48**	**23**	**25**		
⧗	**EA POYNTON 98_2**	**3.50**	**25**	**16**	**9**		
▲	**NWH MAIN GI 213**	**1.50**	**49**	**30**	**19**		
★	**NWH MAIN GI 214**	**1.50**	**23**	**13**	**10**		
⊙	**NWH MAIN GI 215**	**0.50**	**26**	**14**	**12**		
✿	**NWH MAIN GI 216**	**1.50**	**43**	**18**	**25**		
○	**NWH MAIN GI 216**	**3.00**	**21**	**13**	**8**		
△	**NWH MAIN GI 218**	**0.50**	**20**	**16**	**4**		
⊗	**NWH MAIN GI 218**	**1.50**	**36**	**16**	**20**		
⊕	**NWH MAIN GI 218**	**2.50**	**20**	**13**	**7**		
□	**NWH MAIN GI 219**	**1.00**	**30**	**15**	**15**		
⊗	**NWH MAIN GI 219**	**1.50**	**33**	**15**	**18**		
◕	**NWH MAIN GI 219**	**2.65**	**27**	**14**	**13**		
☆	**NWH MAIN GI 219**	**3.50**	**28**	**14**	**14**		
ꕤ	**NWH MAIN GI 220**	**0.50**	**53**	**26**	**27**		
■	**NWH MAIN GI 220**	**2.20**	**23**	**12**	**11**		
◆	**NWH MAIN GI 221**	**0.50**	**32**	**17**	**15**		
◇	**NWH MAIN GI 221**	**2.50**	**25**	**13**	**12**		
×	**NWH MAIN GI 222**	**0.95**	**23**	**13**	**10**		
✖	**NWH MAIN GI 222**	**1.50**	**24**	**14**	**10**		

AECOM

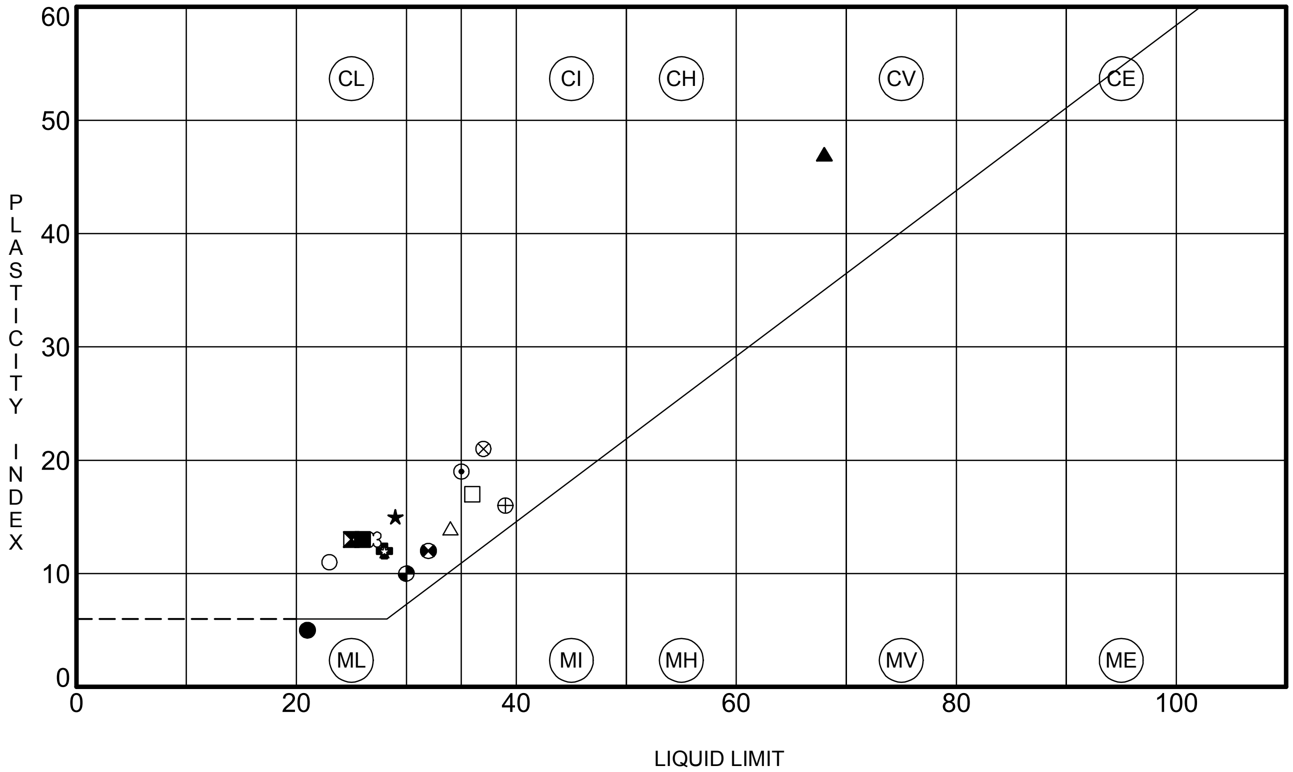
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**NWH MAIN GI 223**	**1.50**	**21**	**16**	**5**		
⧗	**NWH MAIN GI 223**	**2.50**	**25**	**12**	**13**		
▲	**NWH MAIN GI 224**	**1.50**	**68**	**21**	**47**		
★	**NWH MAIN GI 226**	**1.00**	**29**	**14**	**15**		
⊙	**NWH MAIN GI 230**	**0.60**	**35**	**16**	**19**		
✿	**NWH MAIN GI 249**	**1.00**	**28**	**16**	**12**		
○	**NWH MAIN GI 249**	**6.00**	**23**	**12**	**11**		
△	**NWH MAIN GI TP36**	**0.65**	**34**	**20**	**14**		
⊗	**NWH PRE 21**	**1.51**	**37**	**16**	**21**		
⊕	**NWH PRE 22**	**0.50**	**39**	**23**	**16**		
□	**NWH PRE 22**	**1.50**	**36**	**19**	**17**		
⊛	**NWH PRE 22**	**2.00**	**32**	**20**	**12**		
◕	**NWH PRE 23**	**0.50**	**30**	**20**	**10**		
☆	**NWH PRE 23**	**2.00**	**28**	**16**	**12**		
☋	**SM 2ND SUPP 536**	**1.50**	**27**	**14**	**13**		
■	**SM 2ND SUPP 537**	**7.50**	**26**	**13**	**13**		

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

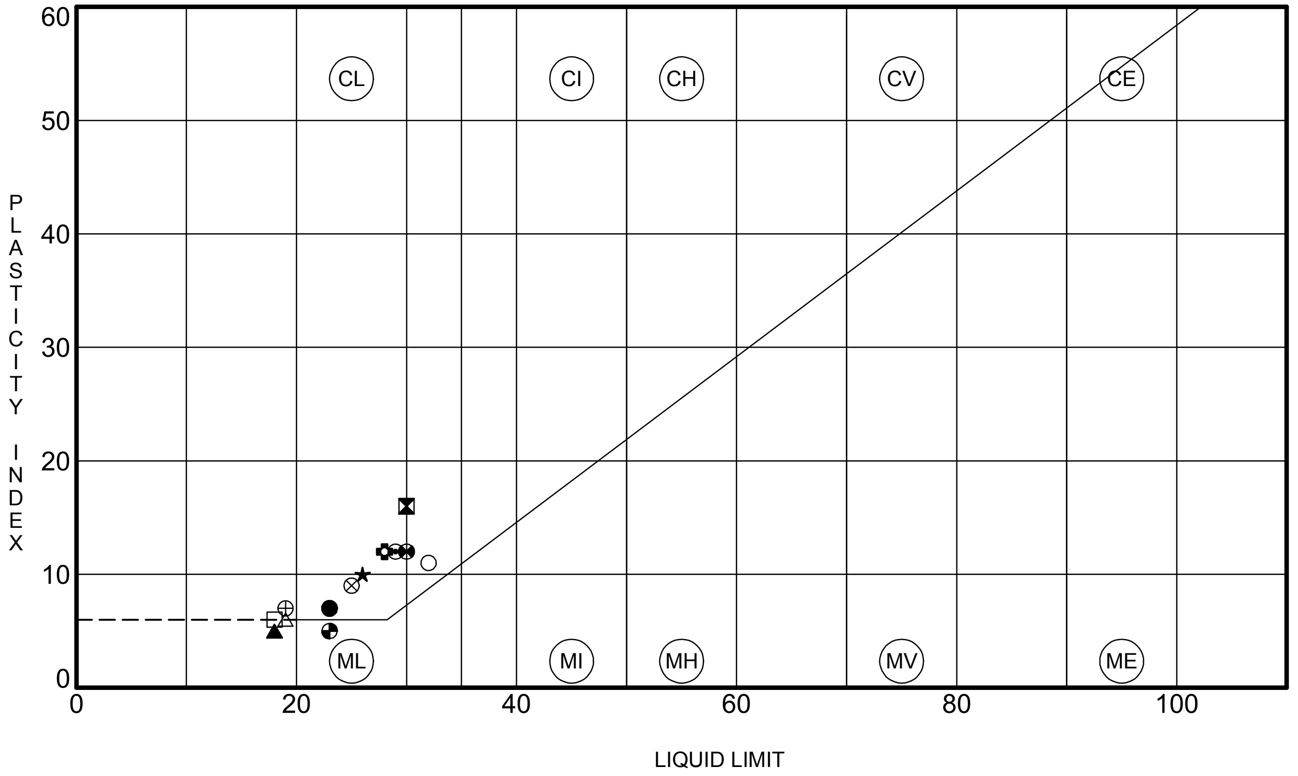
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 102_4**	**4.00**	**23**	**16**	**7**		
⧗	**EA POYNTON 102_4**	**9.20**	**30**	**14**	**16**		
▲	**EA POYNTON 103_2**	**2.20**	**18**	**13**	**5**		
★	**EA POYNTON 103_3**	**12.00**	**26**	**16**	**10**		
⊙	**EA POYNTON 103_4**	**12.00**	**29**	**17**	**12**		
✿	**EA POYNTON 103_5**	**7.20**	**28**	**16**	**12**		
○	**EA POYNTON 104_1**	**1.20**	**32**	**21**	**11**		
△	**EA POYNTON 104_1**	**7.00**	**19**	**13**	**6**		
⊗	**EA POYNTON 104_1**	**13.70**	**25**	**16**	**9**		
⊕	**EA POYNTON 104_2**	**8.45**	**19**	**12**	**7**		
□	**EA POYNTON 104_2**	**9.65**	**18**	**12**	**6**		
⊛	**EA POYNTON 104_4**	**15.50**	**30**	**18**	**12**		
◕	**NWH MAIN GI 227**	**0.40**	**23**	**18**	**5**		

AECOM

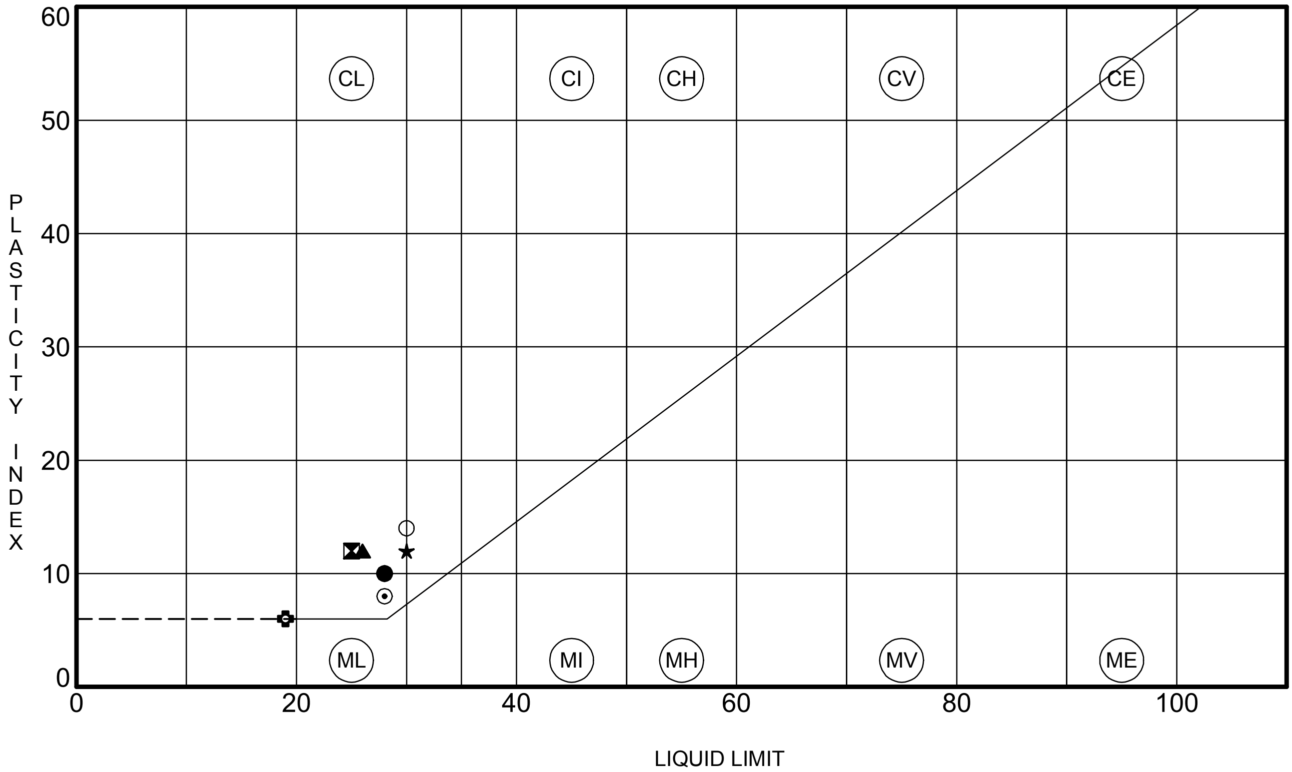
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: GFC

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**BH1003**	**1.20**	**28**	**18**	**10**		
⧗	**EA POYNTON 104_3**	**9.00**	**25**	**13**	**12**		
▲	**NWH MAIN GI 227**	**1.30**	**26**	**14**	**12**		
★	**NWH MAIN GI TP37**	**1.20**	**30**	**18**	**12**		
⊙	**NWH PRE 21**	**0.50**	**28**	**20**	**8**		
✿	**NWH PRE 21**	**1.01**	**19**	**13**	**6**		
○	**NWH PRE 23**	**3.00**	**30**	**16**	**14**		

AECOM

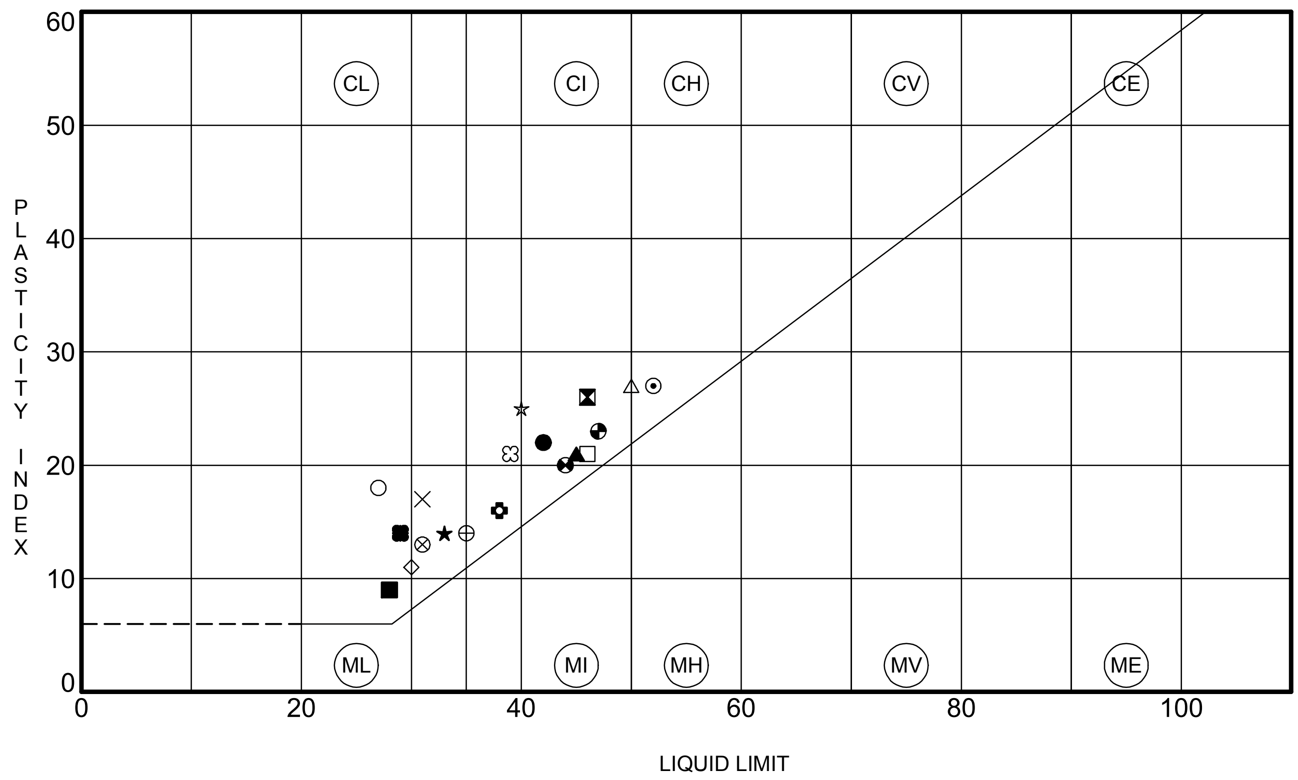
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: Glacio Fluvial - Granular

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**BH1000**	**4.15**	**42**	**20**	**22**		
⊠	**BH1000**	**7.95**	**46**	**20**	**26**		
▲	**BH1000**	**9.70**	**45**	**24**	**21**		
★	**BH1000**	**11.85**	**33**	**19**	**14**		
⊙	**BH1001**	**5.30**	**52**	**25**	**27**		
✪	**BH1001**	**8.40**	**38**	**22**	**16**		
○	**BH1002**	**2.30**	**27**	**9**	**18**		
△	**BH1002**	**3.30**	**50**	**23**	**27**		
⊗	**BH1002**	**11.00**	**31**	**18**	**13**		
⊕	**BH1003**	**4.20**	**35**	**21**	**14**		
□	**BH1003**	**11.70**	**46**	**25**	**21**		
◉	**EA 3RD SUPP TP738**	**1.70**	**44**	**24**	**20**		
◐	**NWH MAIN GI 214**	**2.50**	**47**	**24**	**23**		
☆	**NWH MAIN GI 215**	**2.50**	**40**	**15**	**25**		
✥	**NWH MAIN GI 216**	**3.50**	**39**	**18**	**21**		
■	**NWH MAIN GI 218**	**4.60**	**28**	**19**	**9**		
◆	**NWH MAIN GI 220**	**3.50**	**29**	**15**	**14**		
◇	**NWH MAIN GI 221**	**5.00**	**30**	**19**	**11**		
×	**NWH MAIN GI 226**	**2.40**	**31**	**14**	**17**		
✖	**NWH MAIN GI 227**	**2.30**	**29**	**15**	**14**		

AECOM

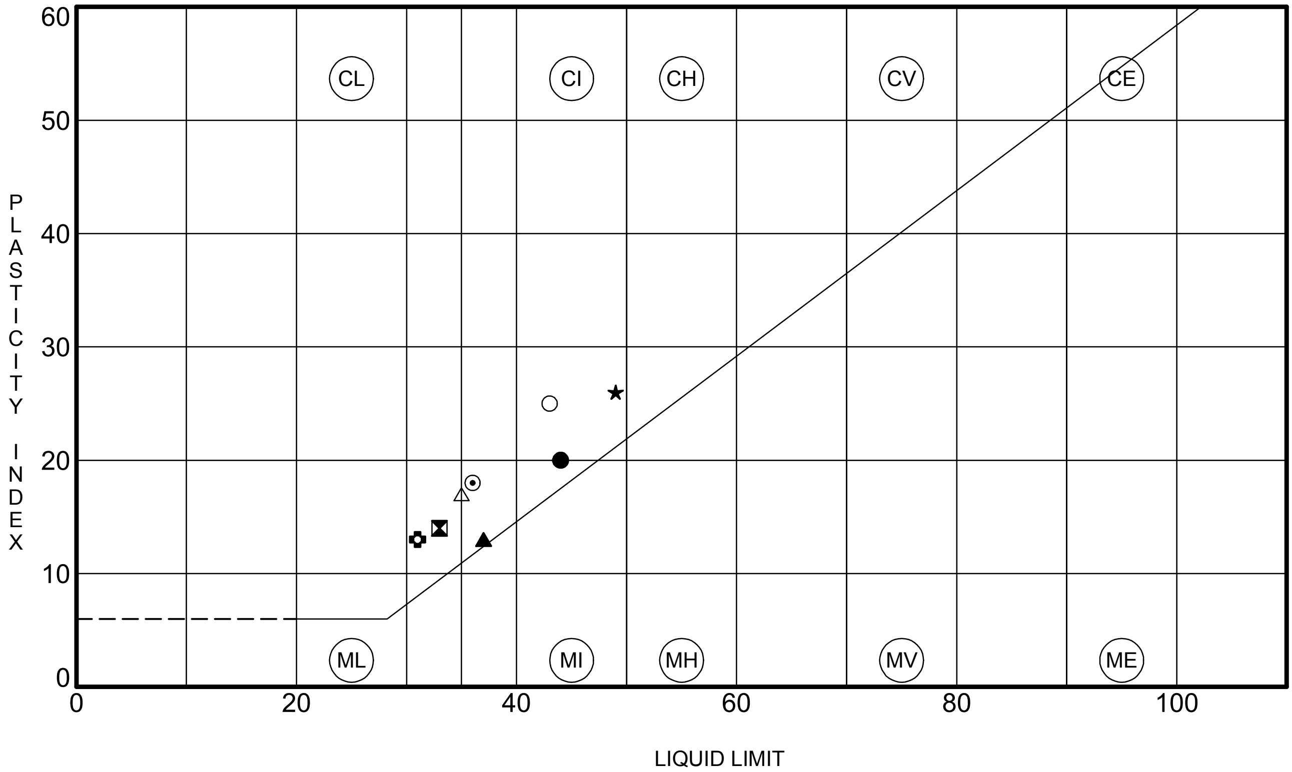
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: Rock

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



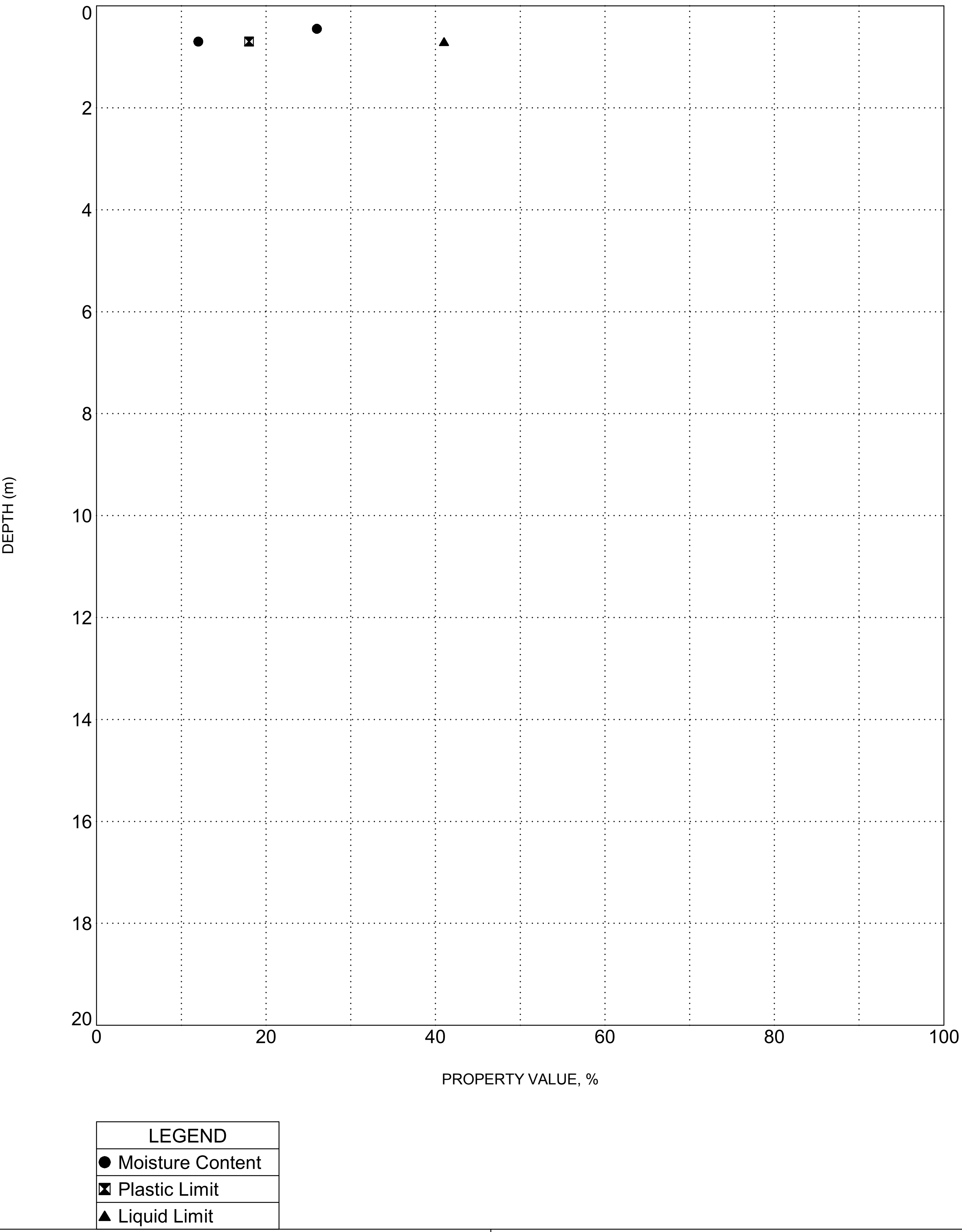
	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**NWH MAIN GI 230**	**1.50**	**44**	**24**	**20**		
⧗	**NWH MAIN GI 231**	**0.80**	**33**	**19**	**14**		
▲	**NWH MAIN GI 247**	**2.20**	**37**	**24**	**13**		
★	**NWH MAIN GI TP28**	**2.00**	**49**	**23**	**26**		
⊙	**NWH MAIN GI TP29**	**1.25**	**36**	**18**	**18**		
✿	**NWH MAIN GI TP37**	**2.20**	**31**	**18**	**13**		
○	**NWH PRE 21**	**2.50**	**43**	**18**	**25**		
△	**NWH PRE 21**	**3.00**	**35**	**18**	**17**		

AECOM

Zone: Hazel Grove to Norbury Brook(included)
Strata Type: Rock

ATTERBERG LIMITS RESULTS

Client: SMBC
Project: SEMMMS A6 to Airport Relief Road
Number: 60186094



AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

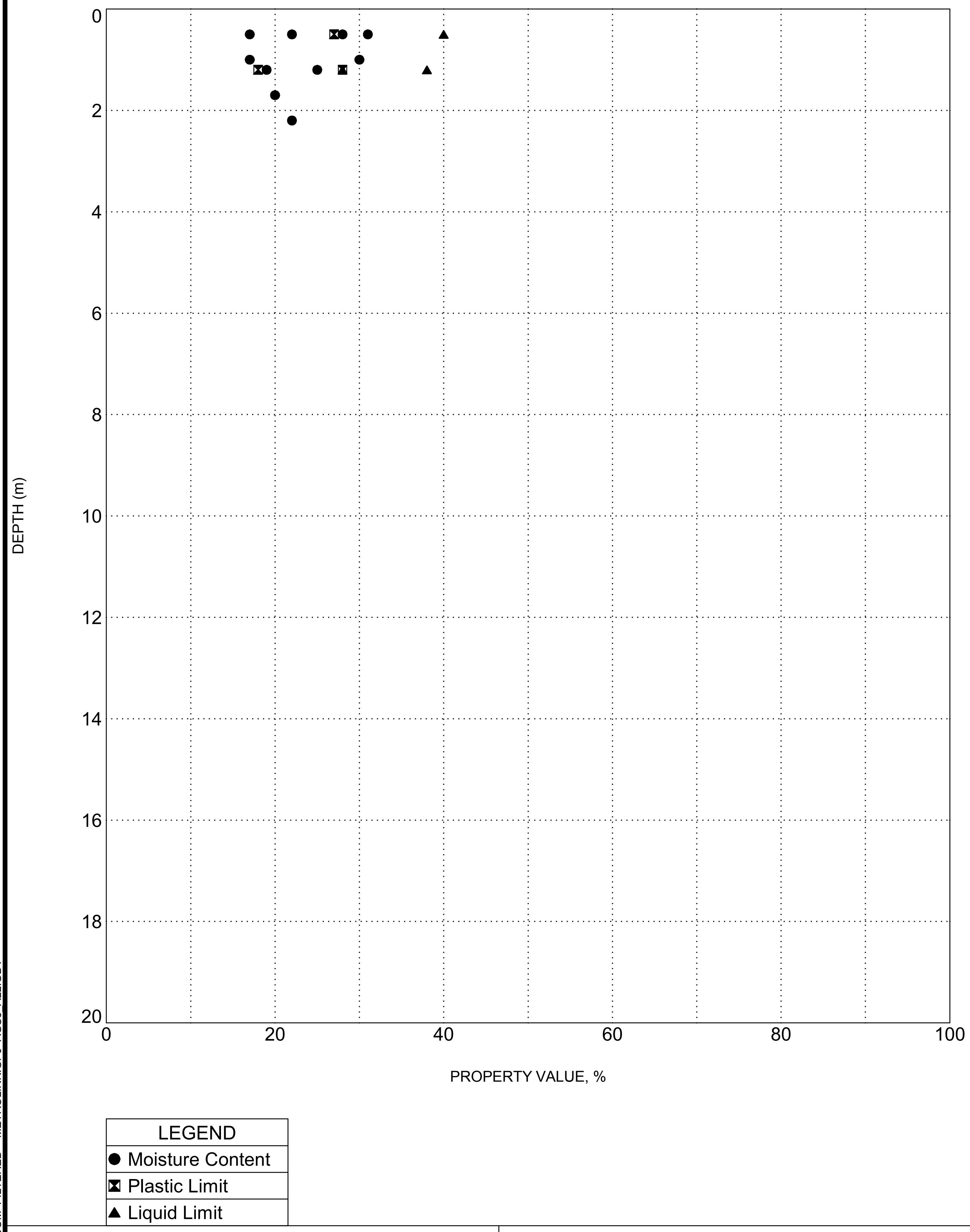
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: MGC

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AECOM

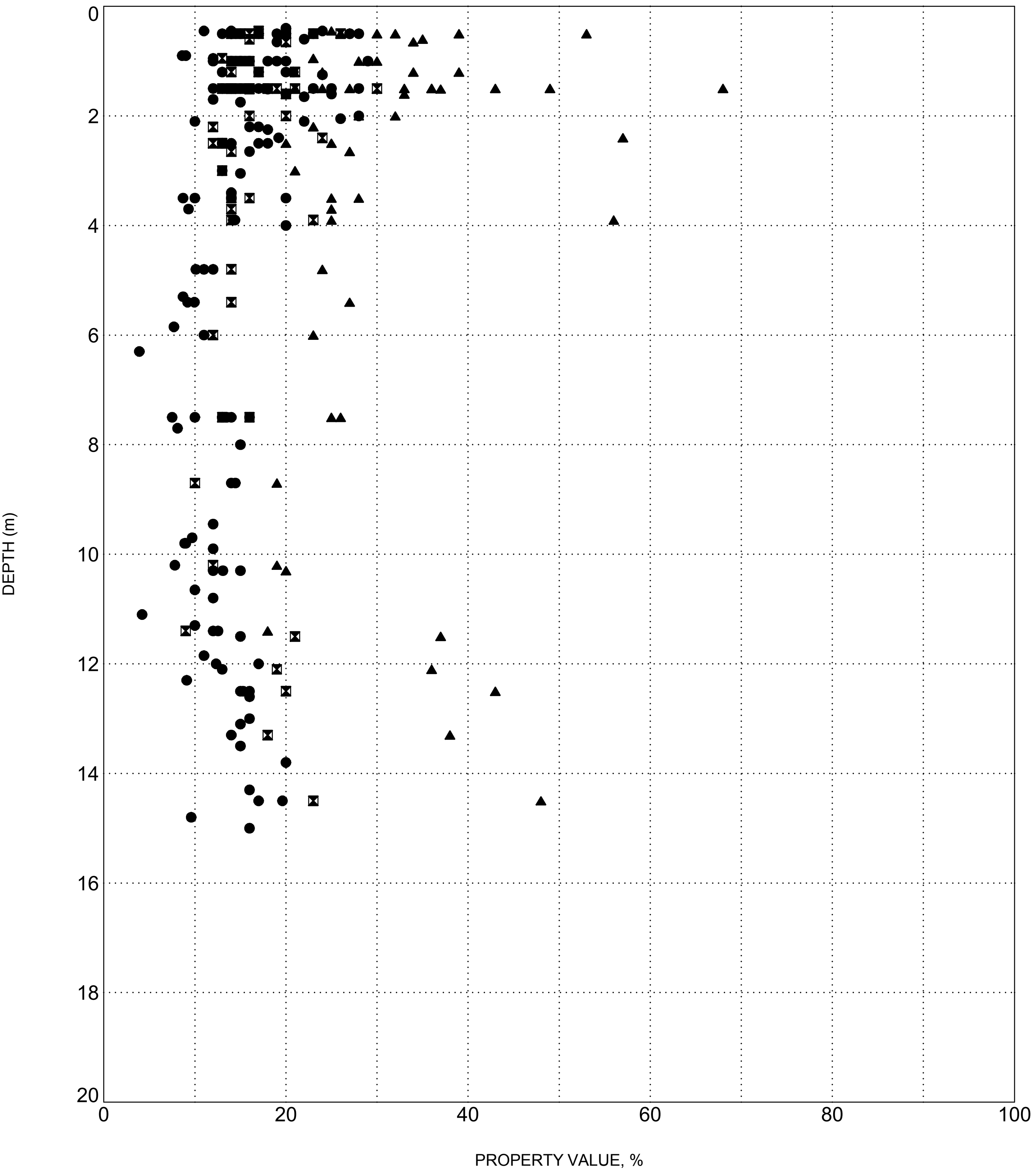
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: AL

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Moisture Content
⊠ Plastic Limit
▲ Liquid Limit

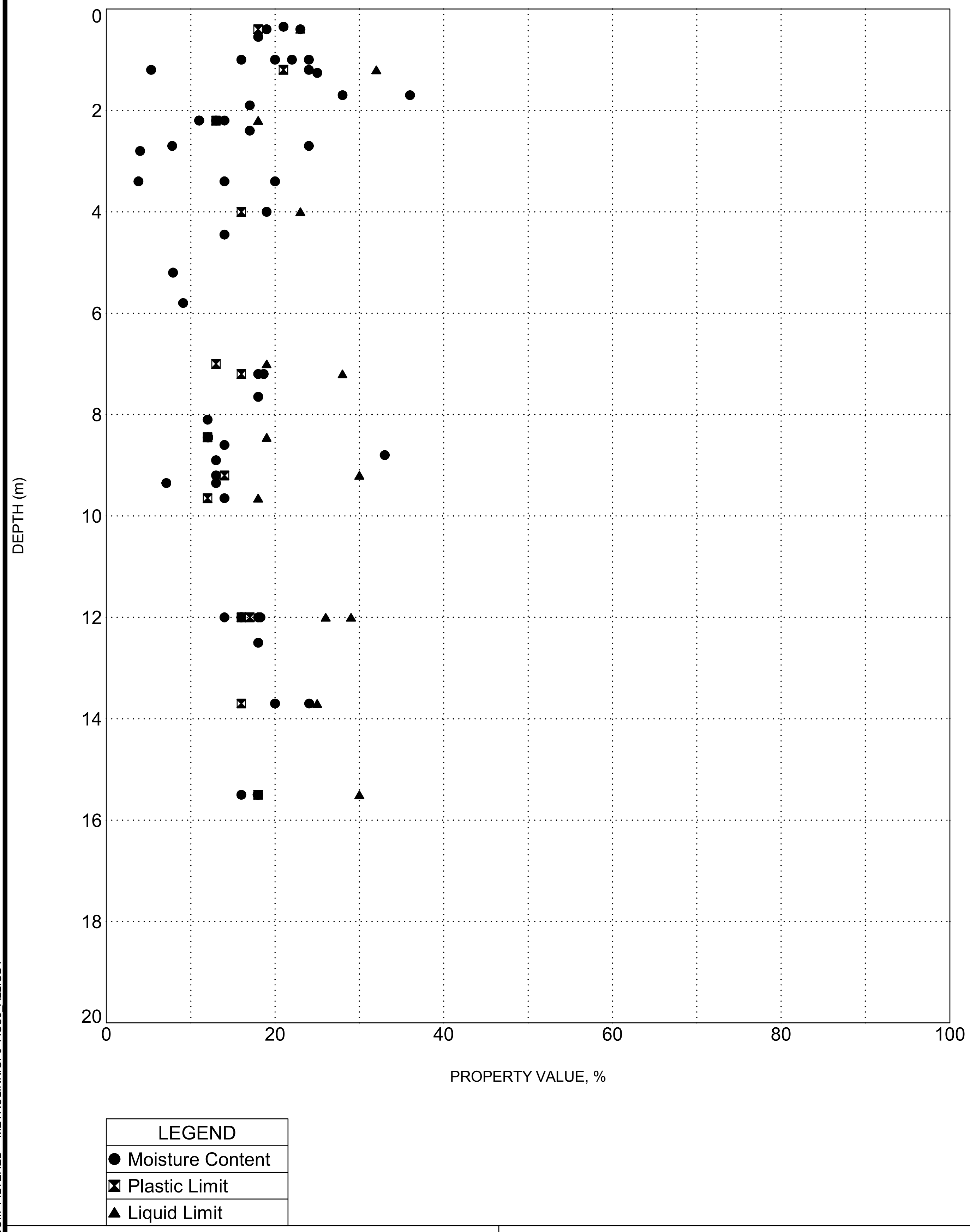
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: CT

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3_ALL.GDT

AECOM

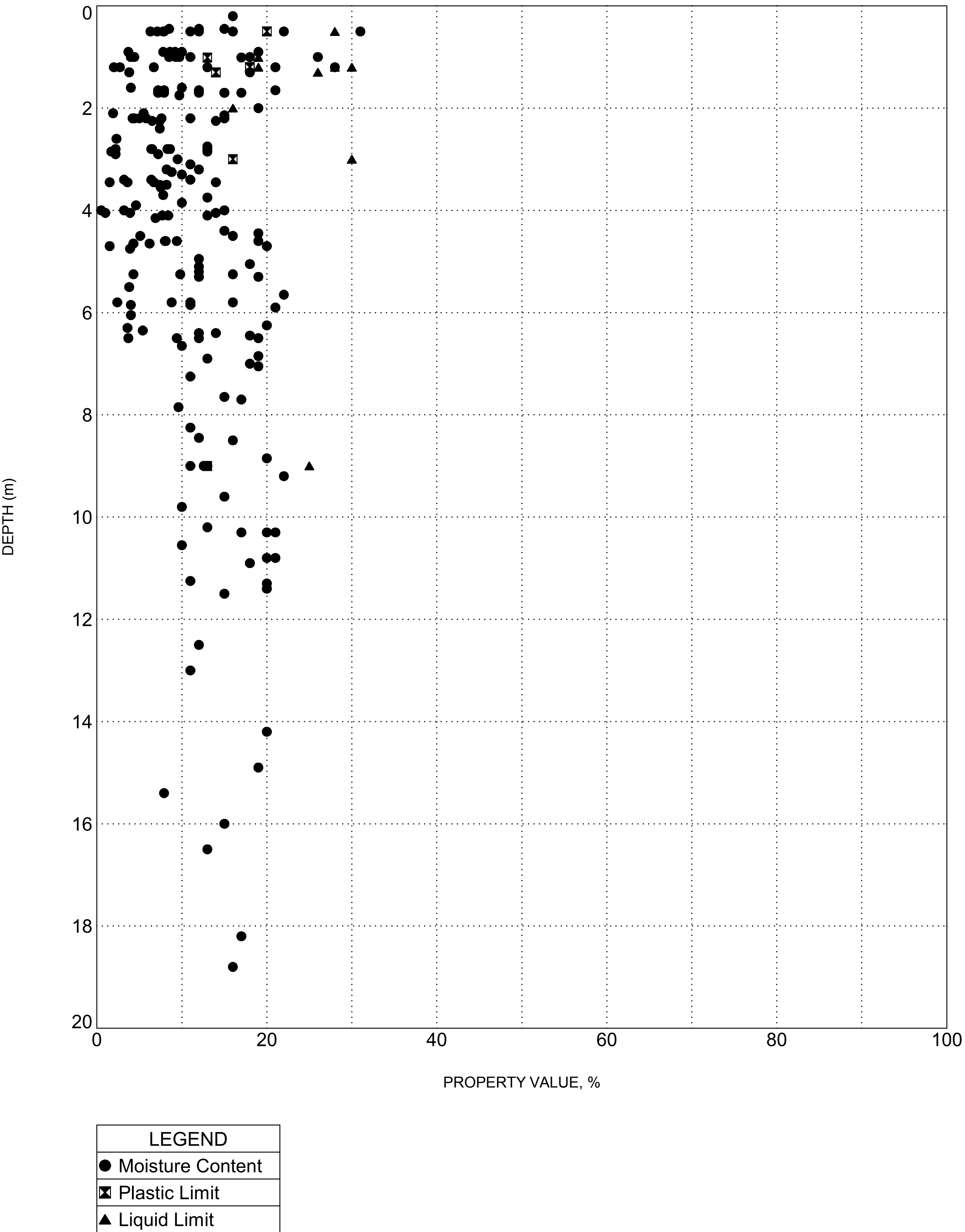
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: GFC

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AECOM

Zone: Hazel Grove to Norbury Brook(included)
Strata Type: Glacio Fluvial Granular

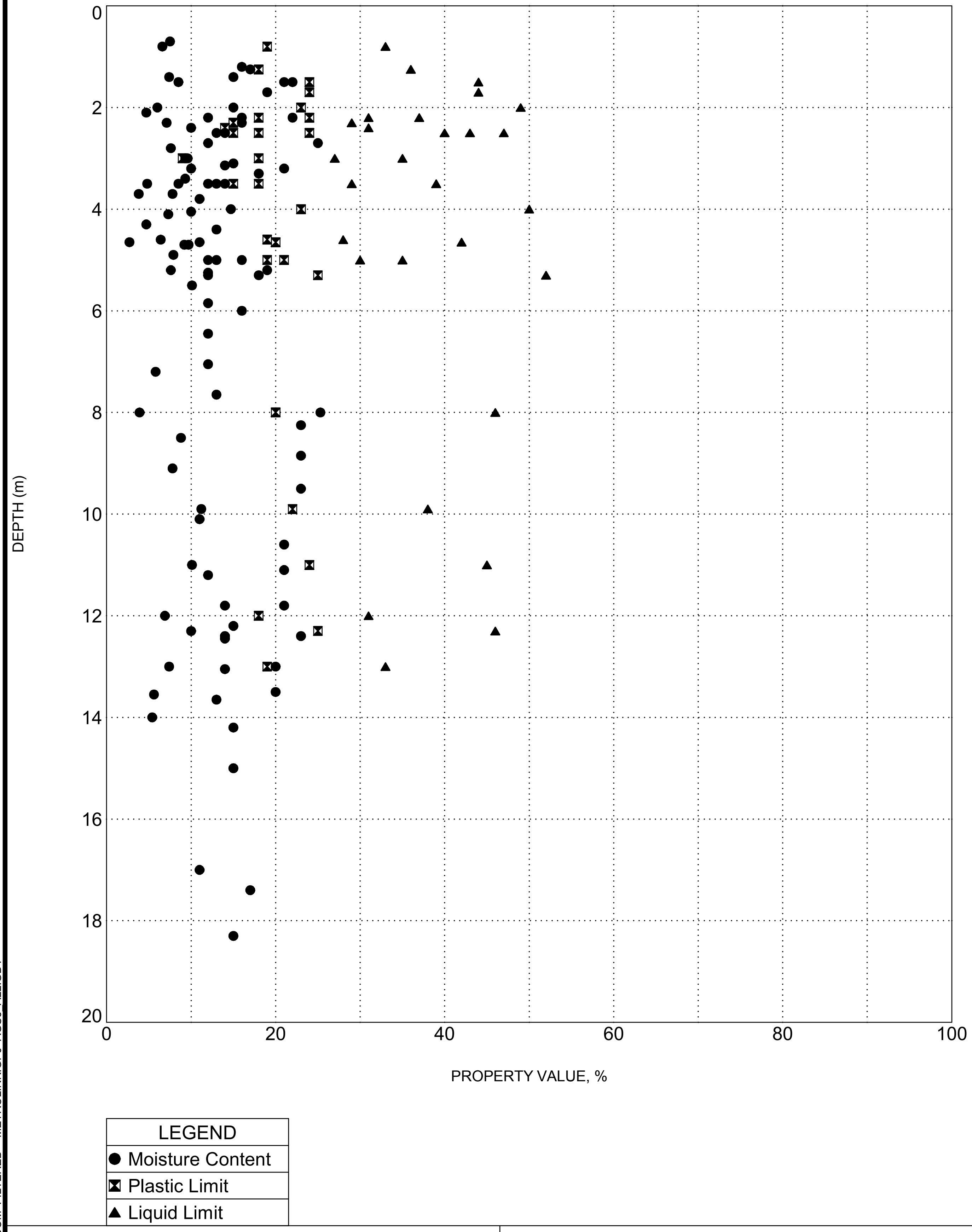
INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT



AECOM

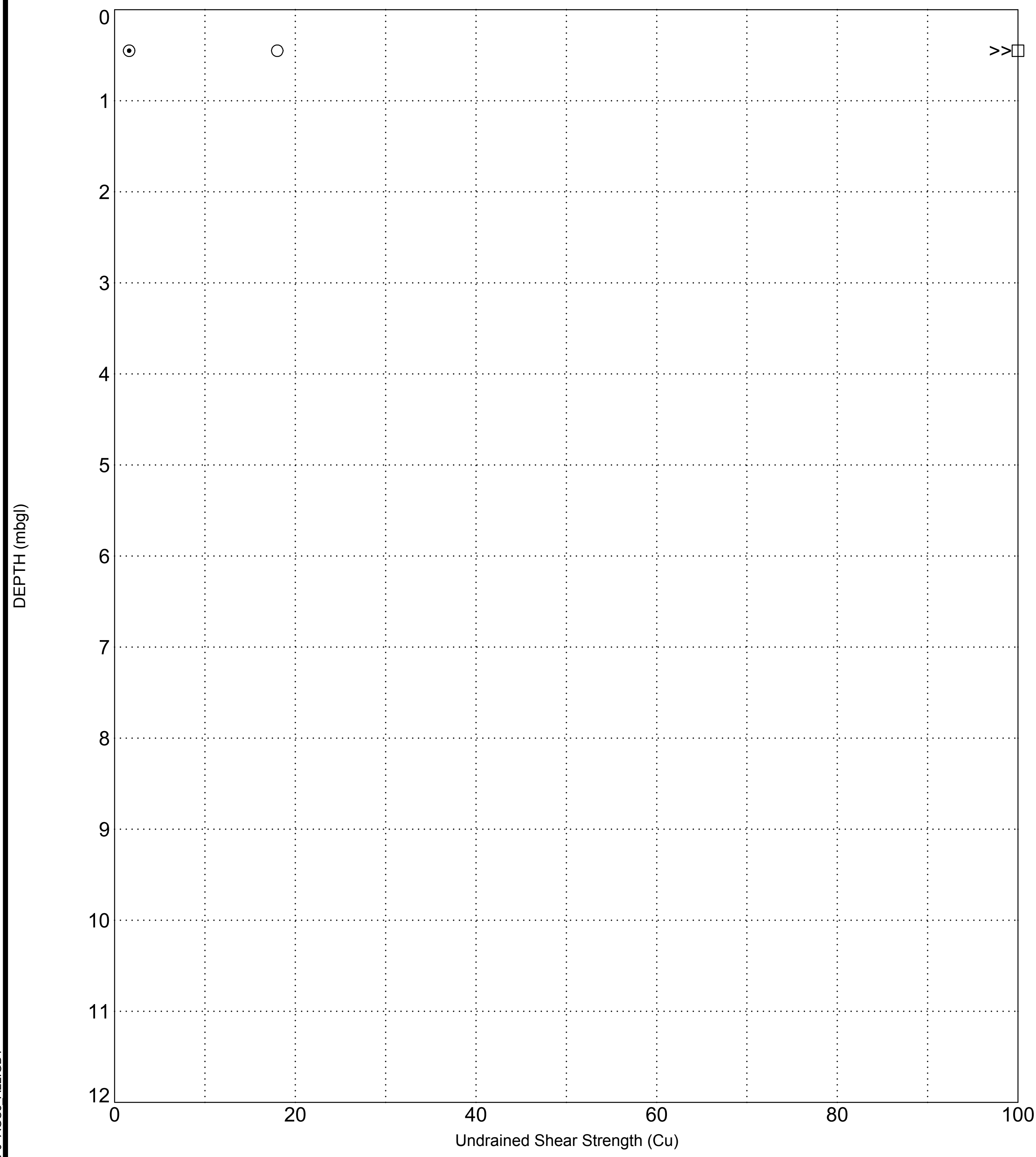
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: Rock

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

Zone: Hazel Grove to Norbury Brook(included)
Strata Type: MGC

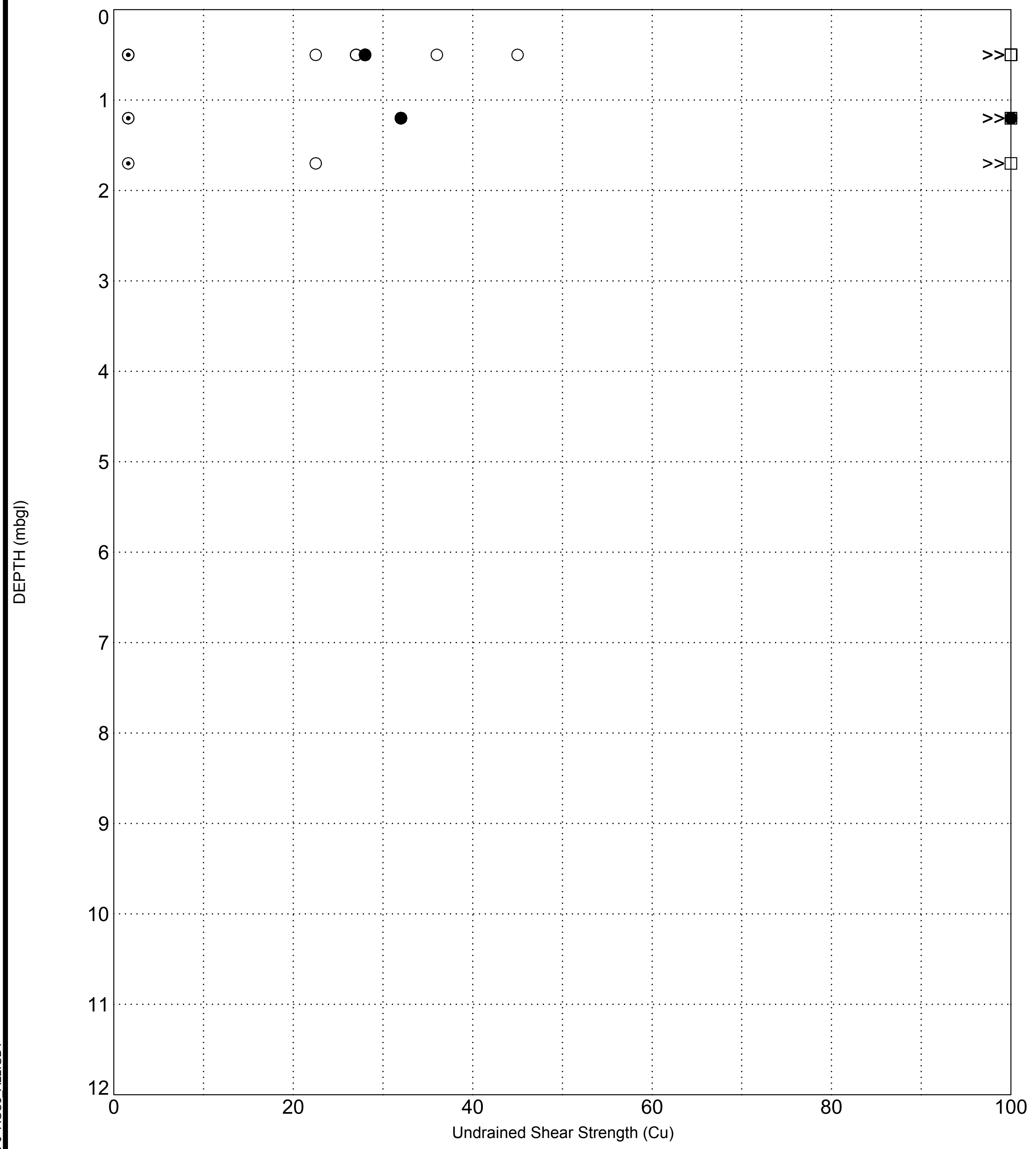
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

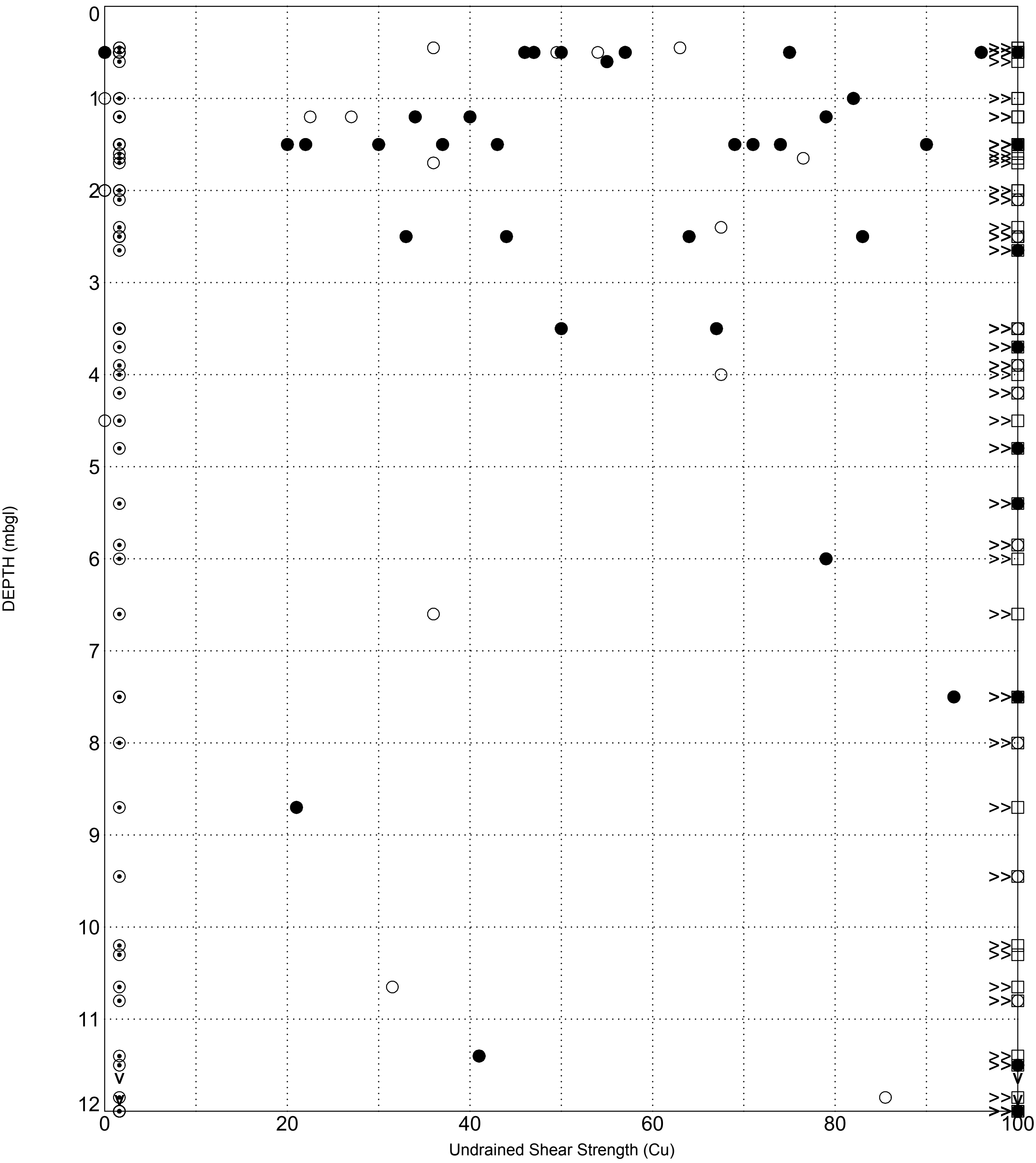
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: AL

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

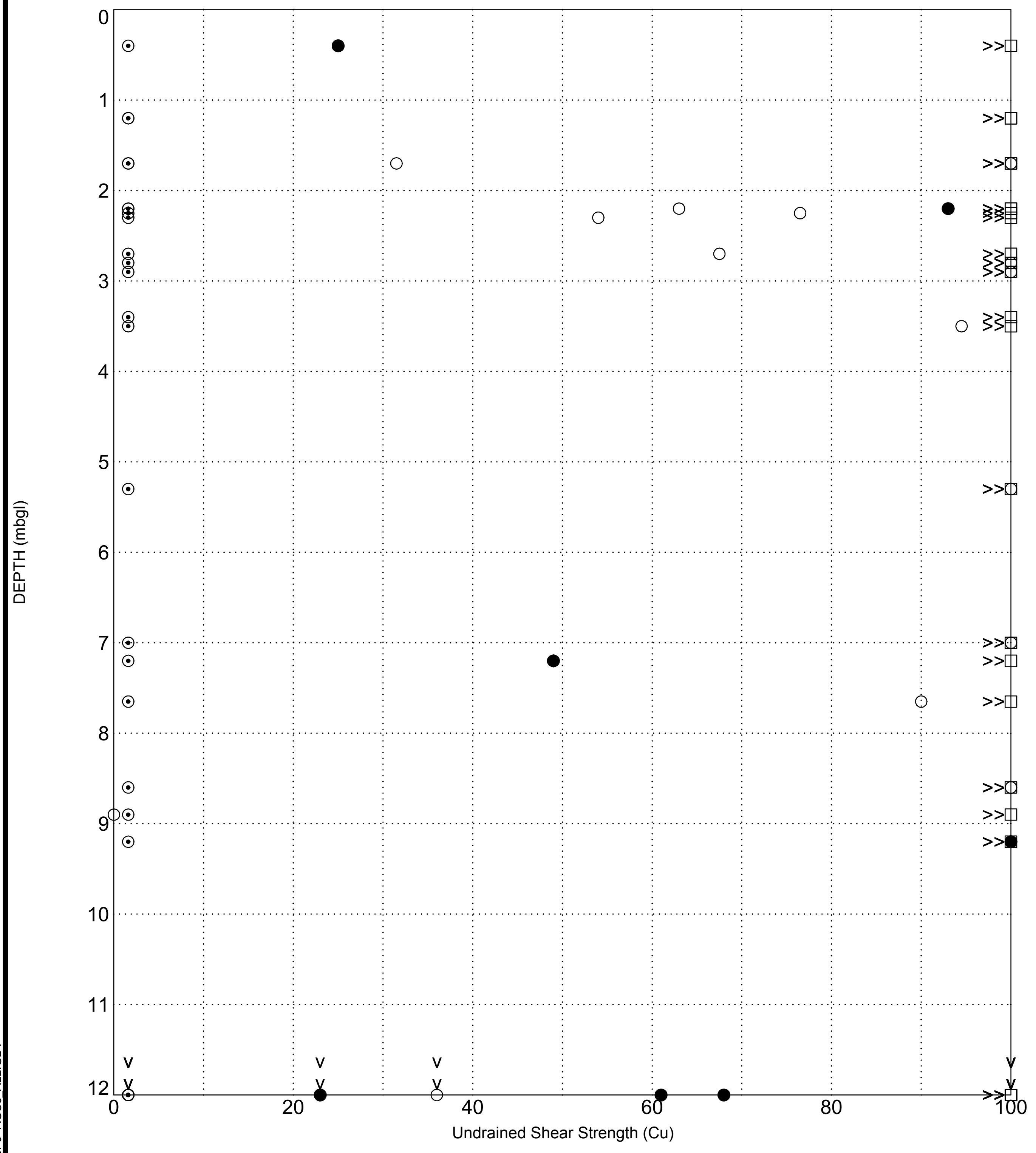
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: CT

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

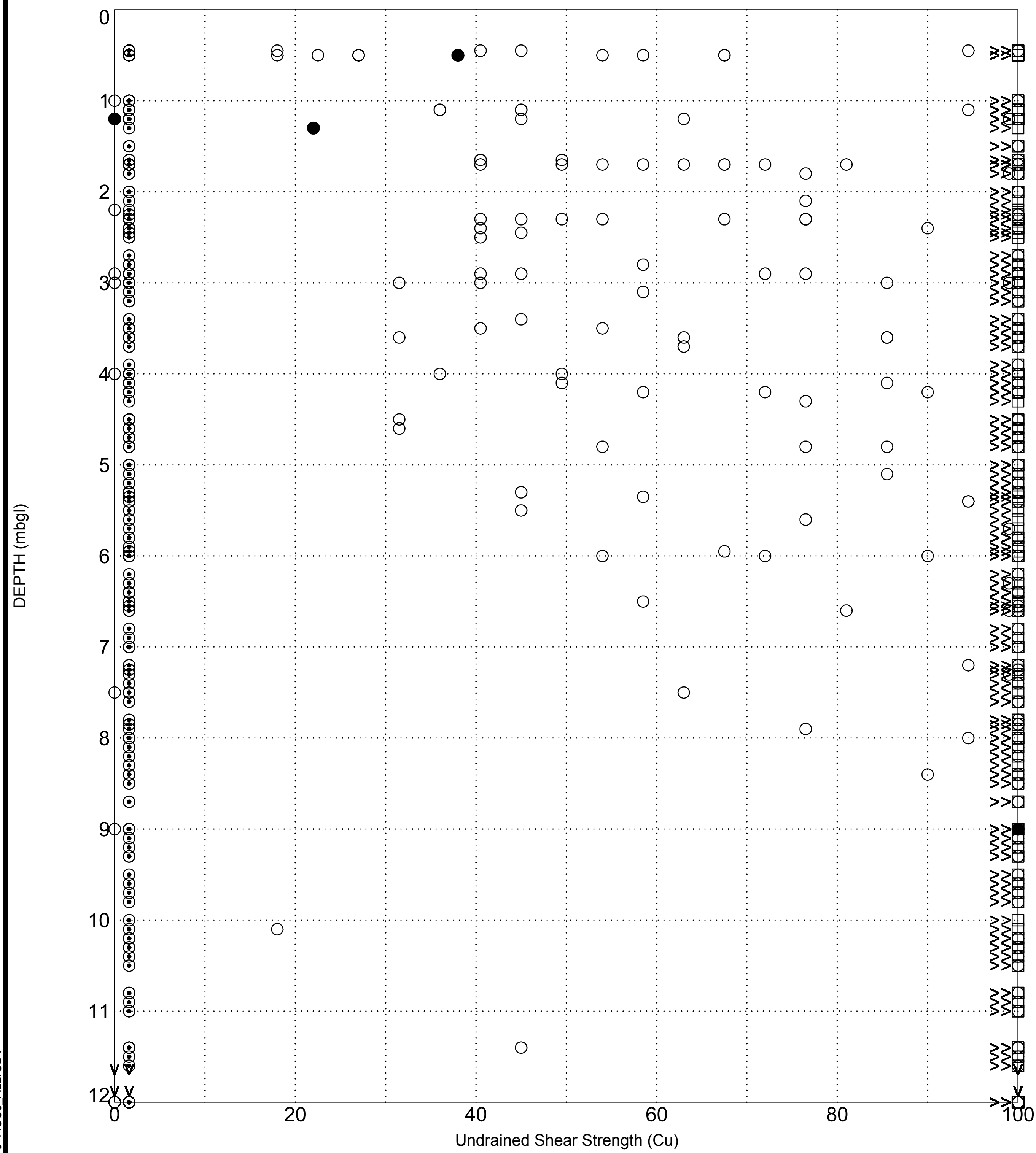
Zone: Hazel Grove to Norbury Brook(included)
Strata Type: GFC

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

Zone: Hazel Grove to Norbury Brook(included)

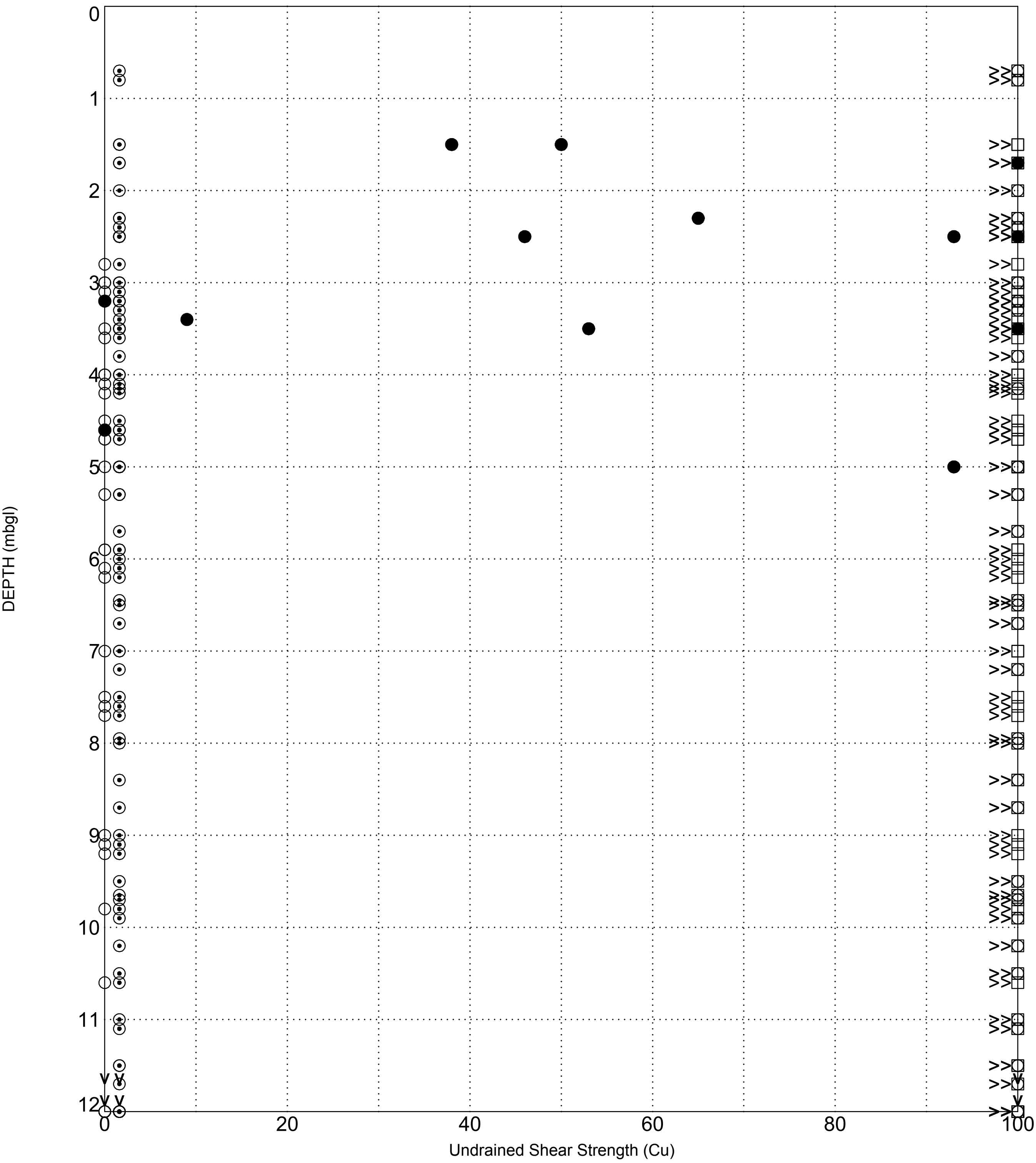
Strata Type: Glacio Fluvial - Granular

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND

- ● Triaxial Cu
- ⊙ CuLi (cu= 1.6*EXP (4.23*1-LI))
- ○ Nval *(F=4.5)
- □ CuLi (cu=150*EXP (-4.6*Li))

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

Zone: Hazel Grove to Norbury Brook(included)
Strata Type: Rock

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

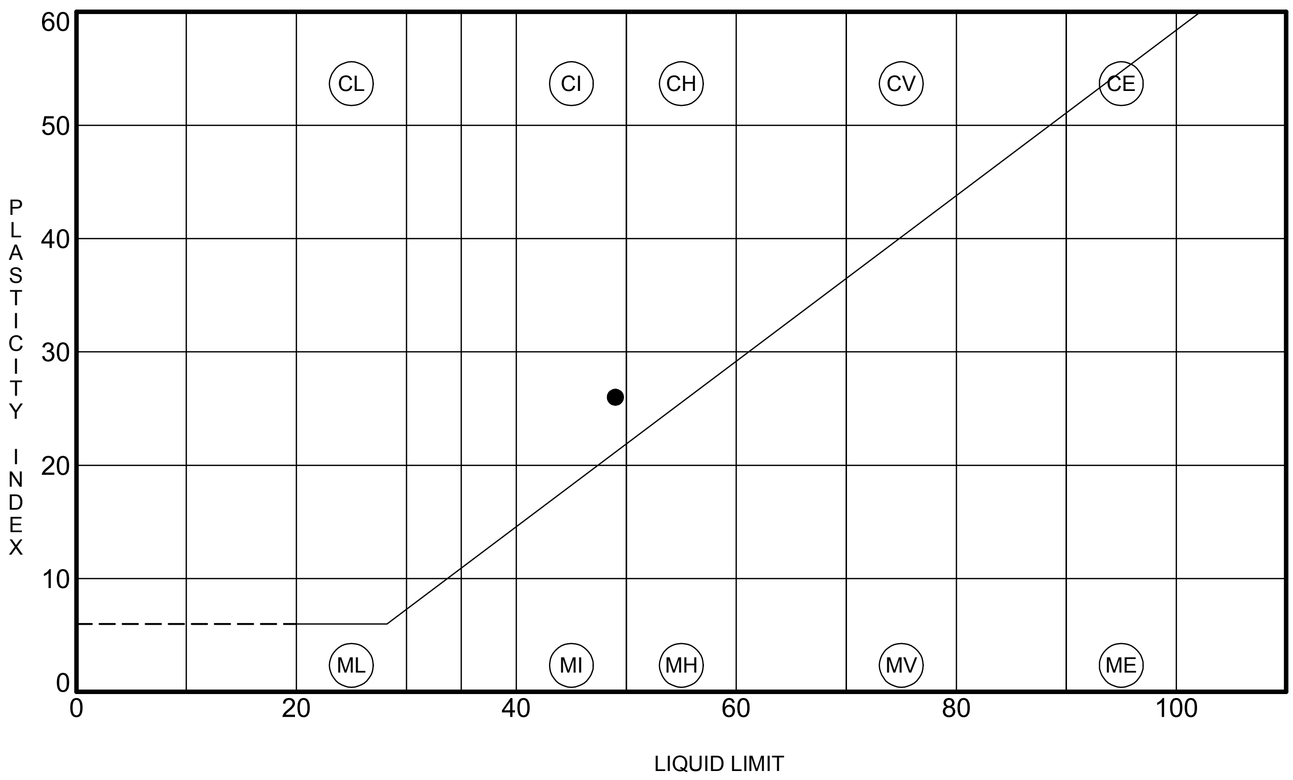
Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

Appendix A3

Geotechnical Plots Norbury Brook - WCML

Page deliberately blank for double sided printing



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 90_1**	**4.80**	**49**	**23**	**26**		

AECOM

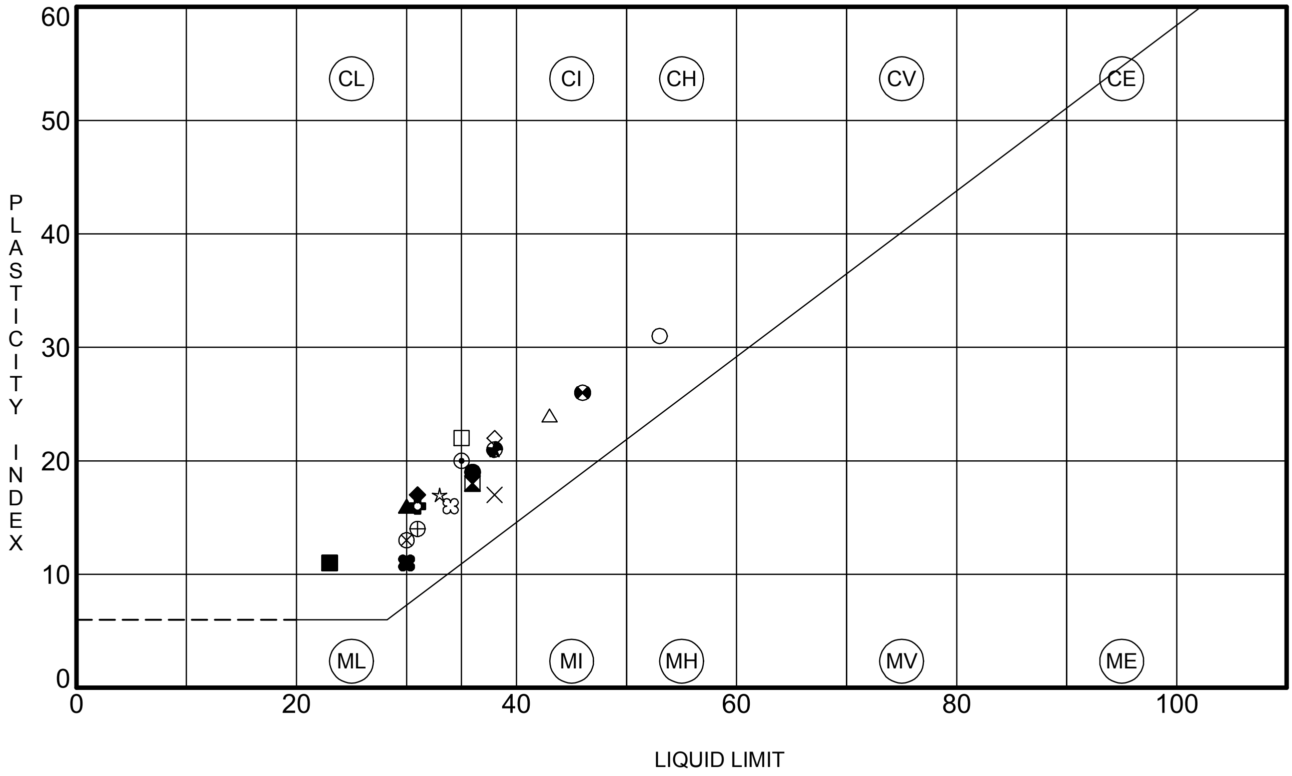
Zone: Norbury Brook to WCML(included)
Strata Type: Peat

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**BH100**	**0.30**	**36**	**17**	**19**		
⧗	**BH100**	**2.00**	**36**	**18**	**18**		
▲	**BH100**	**6.00**	**30**	**14**	**16**		
★	**BH101**	**0.40**	**38**	**17**	**21**		
⊙	**BH101**	**0.60**	**35**	**15**	**20**		
✿	**BH101**	**3.00**	**31**	**15**	**16**		
○	**BH101**	**11.00**	**53**	**22**	**31**		
△	**BH102**	**3.00**	**43**	**19**	**24**		
⊗	**EA POYNTON 82_1**	**1.20**	**30**	**17**	**13**		
⊕	**EA POYNTON 82_1**	**2.40**	**31**	**17**	**14**		
□	**EA POYNTON 82_1**	**3.60**	**35**	**13**	**22**		
⊗	**EA POYNTON 82_1**	**4.80**	**46**	**20**	**26**		
◕	**EA POYNTON 82_1**	**6.00**	**38**	**17**	**21**		
☆	**EA POYNTON 82_2**	**1.20**	**33**	**16**	**17**		
✿	**EA POYNTON 82_2**	**2.40**	**34**	**18**	**16**		
■	**EA POYNTON 82_2**	**3.60**	**23**	**12**	**11**		
◆	**EA POYNTON 82_2**	**4.80**	**31**	**14**	**17**		
◇	**EA POYNTON 82_3**	**1.20**	**38**	**16**	**22**		
×	**EA POYNTON 82_3**	**2.40**	**38**	**21**	**17**		
✖	**EA POYNTON 82_3**	**3.60**	**30**	**19**	**11**		

AECOM

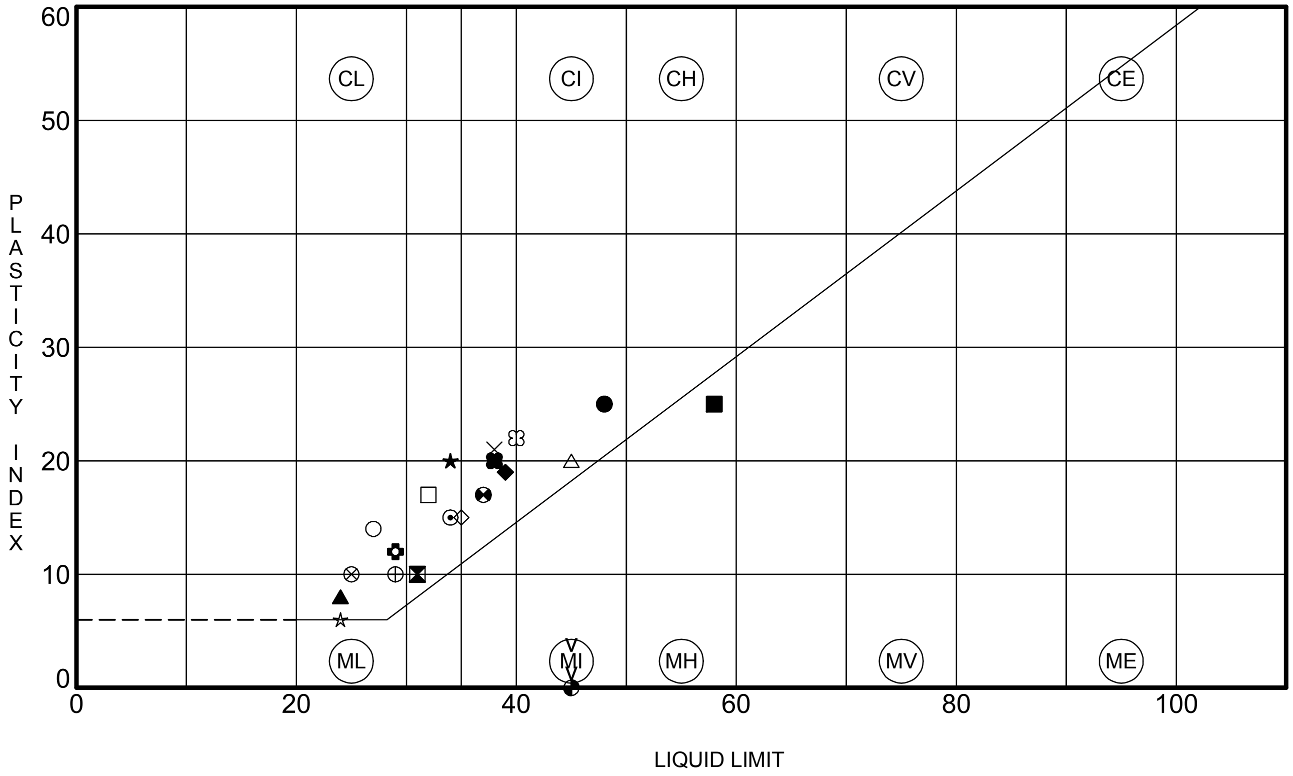
Zone: Norbury Brook to WCML(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 82_3**	**4.90**	**48**	**23**	**25**		
⧗	**EA POYNTON 82_4**	**1.20**	**31**	**21**	**10**		
▲	**EA POYNTON 82_4**	**2.40**	**24**	**16**	**8**		
★	**EA POYNTON 82_4**	**3.60**	**34**	**14**	**20**		
⊙	**EA POYNTON 82_4**	**4.80**	**34**	**19**	**15**		
✿	**EA POYNTON 82_4**	**6.00**	**29**	**17**	**12**		
○	**EA POYNTON 82_5**	**1.20**	**27**	**13**	**14**		
△	**EA POYNTON 82_5**	**13.80**	**45**	**25**	**20**		
⊗	**EA POYNTON 83_1**	**1.20**	**25**	**15**	**10**		
⊕	**EA POYNTON 83_1**	**2.40**	**29**	**19**	**10**		
□	**EA POYNTON 83_1**	**3.60**	**32**	**15**	**17**		
❂	**EA POYNTON 83_1**	**4.80**	**37**	**20**	**17**		
◕	**EA POYNTON 83_1**	**6.00**	**45**	**200**	**NP**		
☆	**EA POYNTON 83_1**	**7.20**	**24**	**18**	**6**		
✣	**EA POYNTON 83_1**	**8.50**	**40**	**18**	**22**		
■	**EA POYNTON 83_1**	**9.70**	**58**	**33**	**25**		
◆	**EA POYNTON 84_1**	**1.20**	**39**	**20**	**19**		
◇	**EA POYNTON 84_1**	**2.40**	**35**	**20**	**15**		
×	**EA POYNTON 84_1**	**3.60**	**38**	**17**	**21**		
✖	**EA POYNTON 84_1**	**4.80**	**38**	**18**	**20**		

AECOM

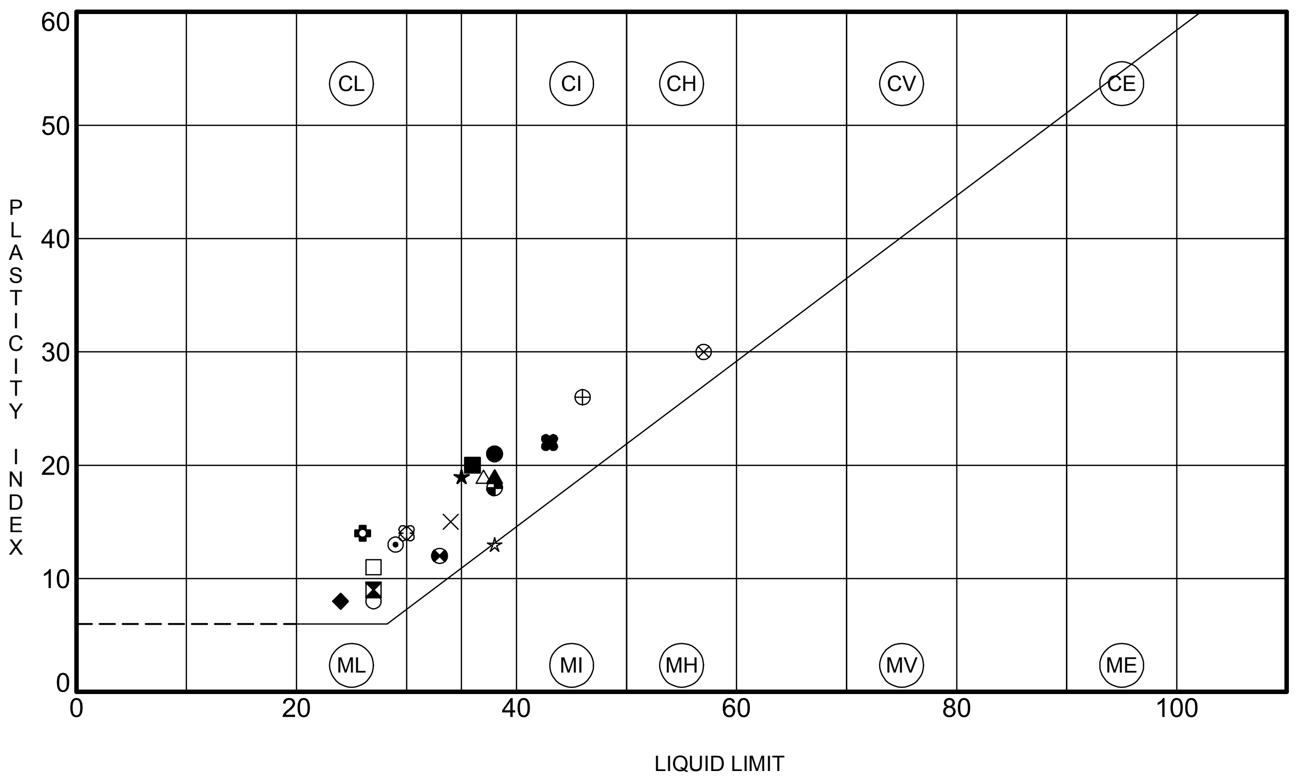
Zone: Norbury Brook to WCML(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
EA POYNTON 84_1	**6.00**	**38**	**17**	**21**		
EA POYNTON 84_1	**7.20**	**27**	**18**	**9**		
EA POYNTON 84_2	**1.20**	**38**	**19**	**19**		
EA POYNTON 84_2	**2.40**	**35**	**16**	**19**		
EA POYNTON 84_2	**3.60**	**29**	**16**	**13**		
EA POYNTON 84_2	**4.80**	**26**	**12**	**14**		
EA POYNTON 84_2	**6.00**	**27**	**19**	**8**		
EA POYNTON 84_2	**8.40**	**37**	**18**	**19**		
EA POYNTON 84_2	**9.60**	**57**	**27**	**30**		
EA POYNTON 85_1	**1.20**	**46**	**20**	**26**		
EA POYNTON 85_1	**6.00**	**27**	**16**	**11**		
EA POYNTON 86_1	**2.40**	**33**	**21**	**12**		
EA POYNTON 86_1	**3.60**	**38**	**20**	**18**		
EA POYNTON 86_1	**4.80**	**38**	**25**	**13**		
EA POYNTON 86_1	**6.00**	**30**	**16**	**14**		
EA POYNTON 86_1	**7.20**	**36**	**16**	**20**		
EA POYNTON 86_1	**8.20**	**24**	**16**	**8**		
EA POYNTON 86_2	**1.00**	**30**	**16**	**14**		
EA POYNTON 86_2	**2.40**	**34**	**19**	**15**		
EA POYNTON 86_2	**3.60**	**43**	**21**	**22**		

AECOM

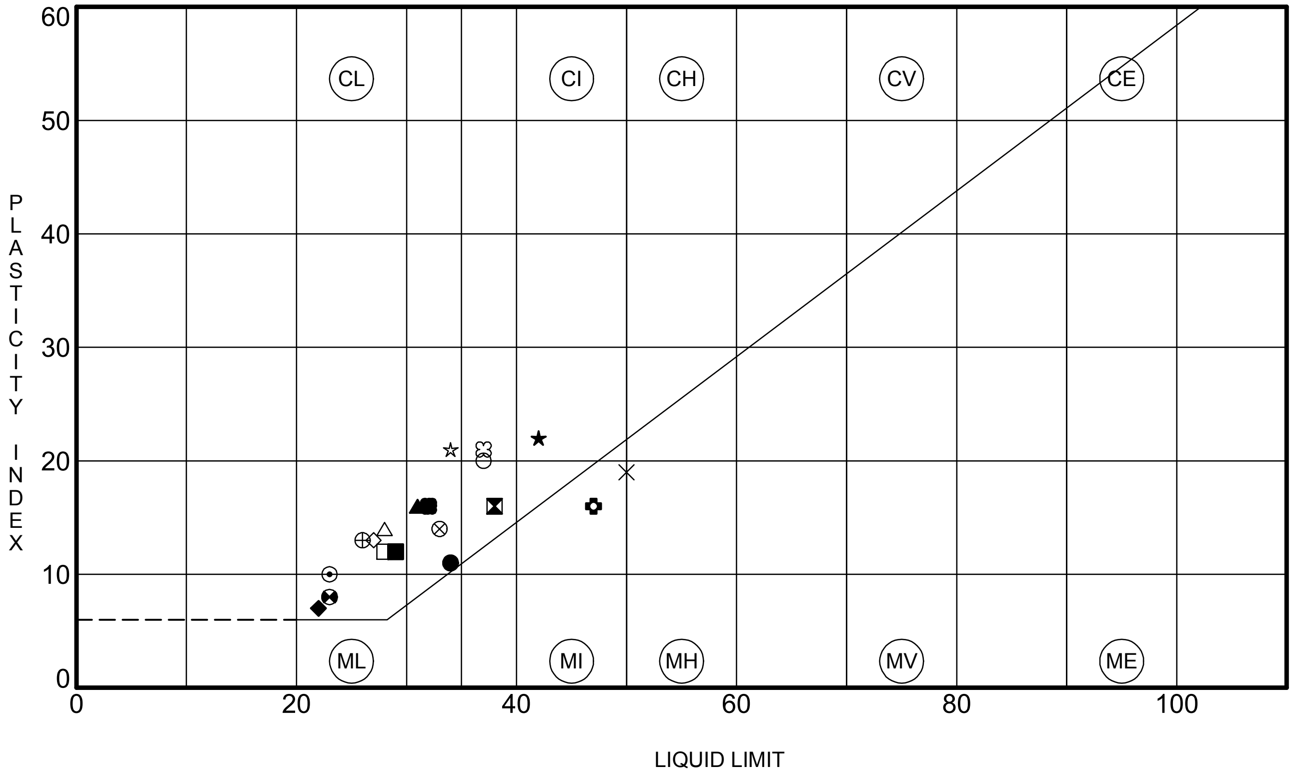
Zone: Norbury Brook to WCML(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 86_2**	**4.80**	**34**	**23**	**11**		
⧗	**EA POYNTON 86_2**	**6.00**	**38**	**22**	**16**		
▲	**EA POYNTON 86_2**	**7.20**	**31**	**15**	**16**		
★	**EA POYNTON 86_2**	**8.40**	**42**	**20**	**22**		
⊙	**EA POYNTON 86_2**	**8.90**	**23**	**13**	**10**		
✿	**EA POYNTON 86_3**	**1.20**	**47**	**31**	**16**		
○	**EA POYNTON 86_3**	**2.40**	**37**	**17**	**20**		
△	**EA POYNTON 86_3**	**3.60**	**28**	**14**	**14**		
⊗	**EA POYNTON 86_3**	**4.80**	**33**	**19**	**14**		
⊕	**EA POYNTON 86_3**	**6.00**	**26**	**13**	**13**		
□	**EA POYNTON 86_3**	**7.20**	**28**	**16**	**12**		
⊗	**EA POYNTON 86_3**	**8.40**	**23**	**15**	**8**		
◕	**EA POYNTON 86_4**	**2.40**	**32**	**16**	**16**		
☆	**EA POYNTON 86_4**	**3.60**	**34**	**13**	**21**		
☋	**EA POYNTON 86_4**	**4.80**	**37**	**16**	**21**		
■	**EA POYNTON 86_4**	**6.00**	**29**	**17**	**12**		
◆	**EA POYNTON 86_4**	**7.20**	**22**	**15**	**7**		
◇	**EA POYNTON 86_4**	**8.40**	**27**	**14**	**13**		
×	**EA POYNTON 86_4**	**10.60**	**50**	**31**	**19**		
✖	**EA POYNTON 87_1**	**1.20**	**32**	**16**	**16**		

AECOM

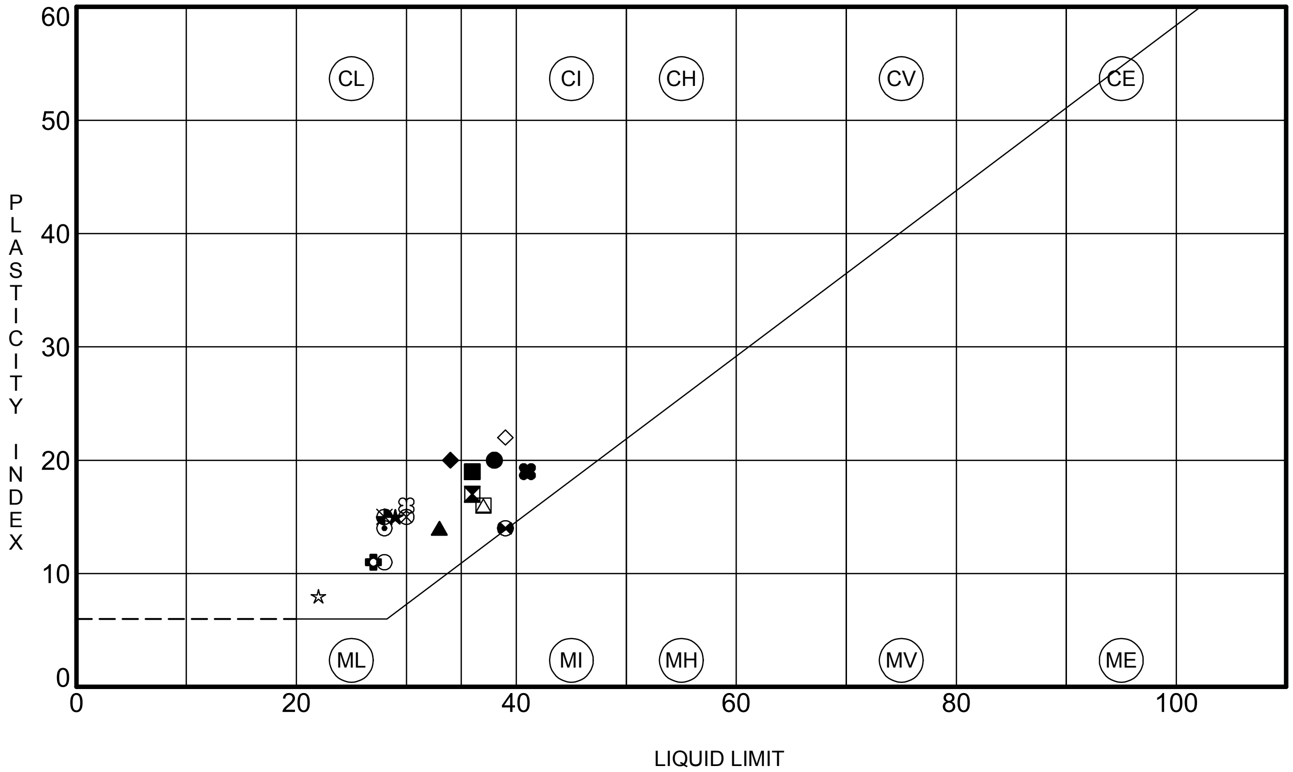
Zone: Norbury Brook to WCML(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 87_1**	**2.40**	**38**	**18**	**20**		
⧗	**EA POYNTON 87_1**	**3.60**	**36**	**19**	**17**		
▲	**EA POYNTON 87_1**	**4.80**	**33**	**19**	**14**		
★	**EA POYNTON 87_1**	**6.00**	**29**	**14**	**15**		
⊙	**EA POYNTON 87_1**	**7.20**	**28**	**14**	**14**		
✿	**EA POYNTON 87_1**	**16.50**	**27**	**16**	**11**		
○	**EA POYNTON 87_1**	**19.10**	**28**	**17**	**11**		
△	**EA POYNTON 87_2**	**1.20**	**37**	**21**	**16**		
⊗	**EA POYNTON 87_2**	**2.40**	**30**	**15**	**15**		
⊕	**EA POYNTON 87_2**	**3.60**	**38**	**18**	**20**		
□	**EA POYNTON 87_2**	**4.80**	**37**	**21**	**16**		
⊗	**EA POYNTON 87_2**	**6.00**	**39**	**25**	**14**		
◕	**EA POYNTON 87_2**	**7.20**	**28**	**13**	**15**		
☆	**EA POYNTON 87_2**	**8.90**	**22**	**14**	**8**		
✤	**EA POYNTON 88_1**	**2.20**	**30**	**14**	**16**		
■	**EA POYNTON 88_1**	**3.40**	**36**	**17**	**19**		
◆	**EA POYNTON 88_1**	**4.60**	**34**	**14**	**20**		
◇	**EA POYNTON 88_1**	**5.80**	**39**	**17**	**22**		
×	**EA POYNTON 88_1**	**7.10**	**28**	**13**	**15**		
✖	**EA POYNTON 89_1**	**1.20**	**41**	**22**	**19**		

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT

AECOM

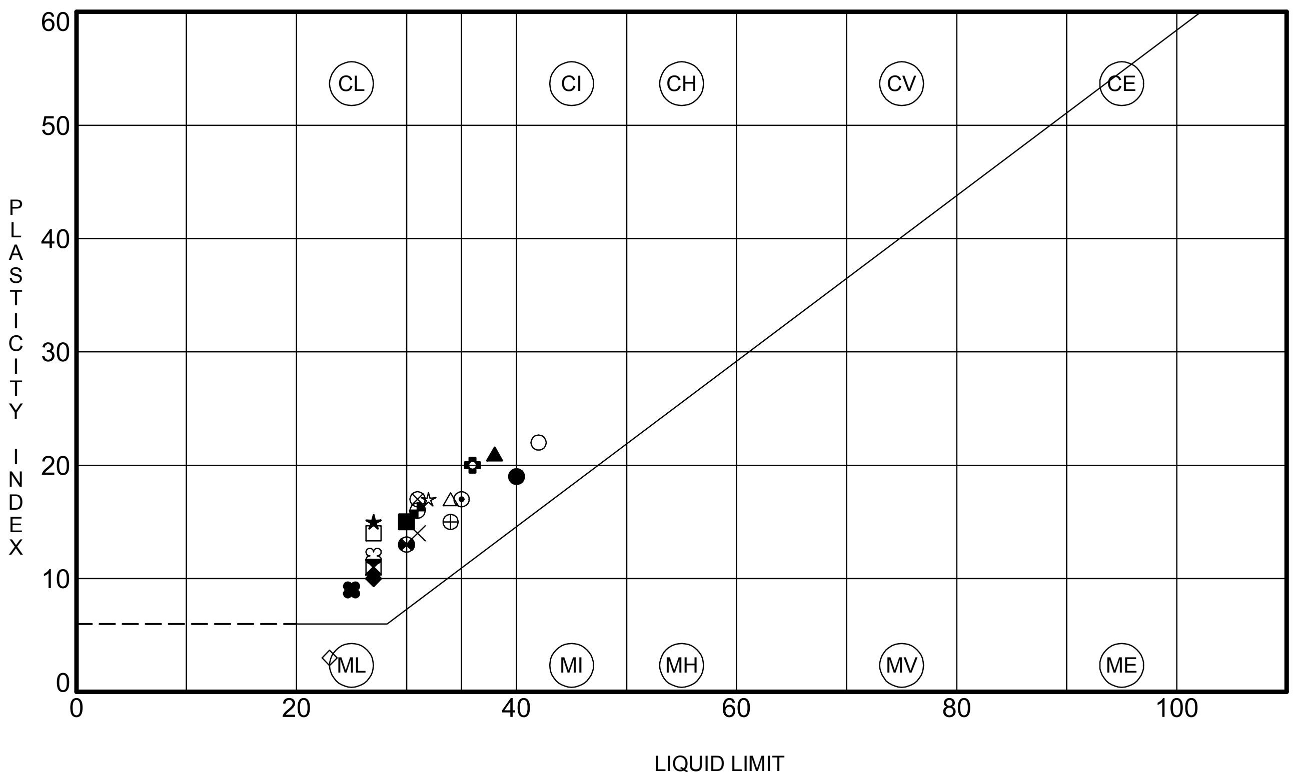
Zone: Norbury Brook to WCML(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 89_1**	**5.10**	**40**	**21**	**19**		
⧗	**EA POYNTON 89_1**	**6.30**	**27**	**16**	**11**		
▲	**EA POYNTON 89_1**	**7.50**	**38**	**17**	**21**		
★	**EA POYNTON 89_1**	**8.50**	**27**	**12**	**15**		
⊙	**EA POYNTON 90_1**	**6.00**	**35**	**18**	**17**		
✪	**EA POYNTON 90_1**	**7.20**	**36**	**16**	**20**		
○	**EA POYNTON 90_1**	**8.40**	**42**	**20**	**22**		
△	**EA POYNTON 91_1**	**2.30**	**34**	**17**	**17**		
⊗	**EA POYNTON 91_1**	**3.50**	**31**	**14**	**17**		
⊕	**EA POYNTON 91_1**	**4.70**	**34**	**19**	**15**		
□	**EA POYNTON 91_1**	**5.80**	**27**	**13**	**14**		
⊛	**EA POYNTON 91_2**	**1.20**	**30**	**17**	**13**		
◕	**EA POYNTON 91_2**	**2.40**	**31**	**15**	**16**		
☆	**EA POYNTON 91_2**	**3.60**	**32**	**15**	**17**		
☋	**EA POYNTON 91_2**	**4.80**	**27**	**15**	**12**		
■	**EA POYNTON 91_2**	**5.90**	**30**	**15**	**15**		
◆	**EA POYNTON 92_1**	**0.50**	**27**	**17**	**10**		
◇	**EA POYNTON 92_1**	**1.20**	**23**	**20**	**3**		
×	**EA POYNTON 92_1**	**2.40**	**31**	**17**	**14**		
✖	**EA POYNTON 92_1**	**3.60**	**25**	**16**	**9**		

AECOM

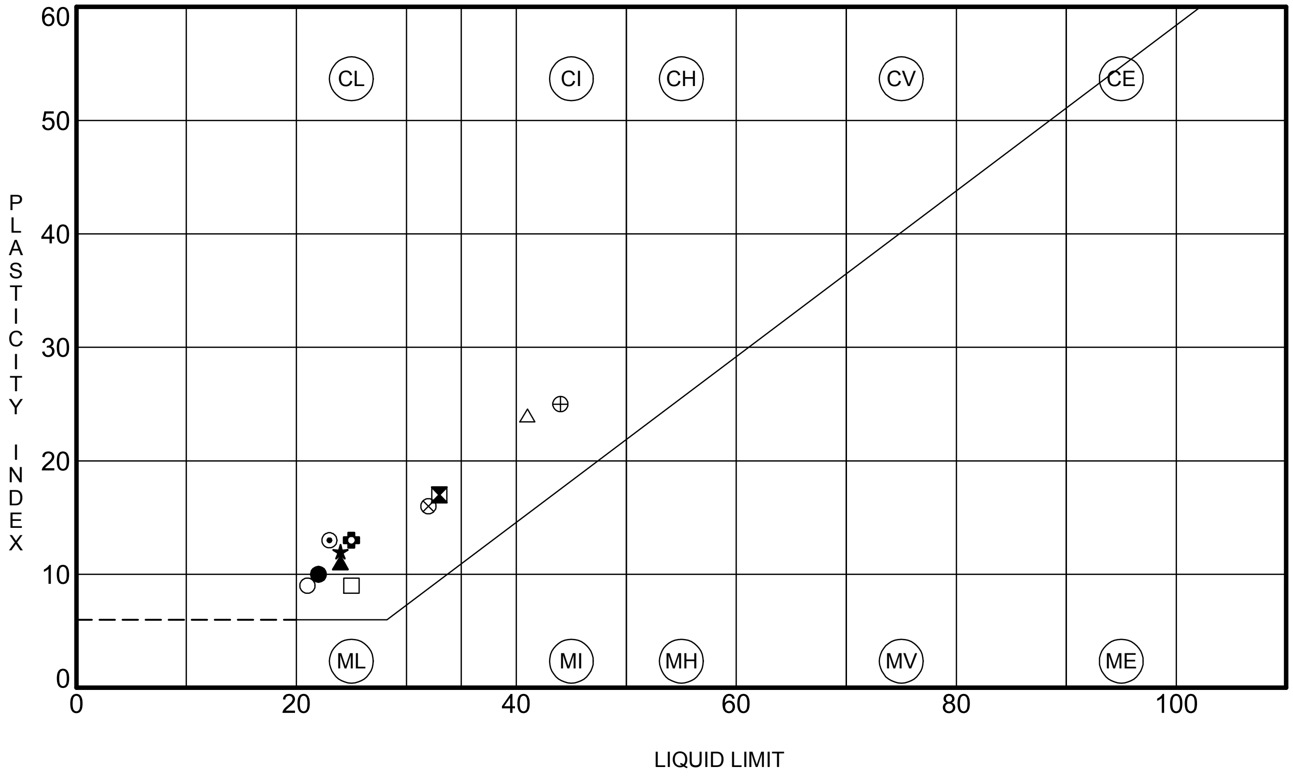
Zone: Norbury Brook to WCML(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 92_1**	**4.80**	**22**	**12**	**10**		
⧗	**EA POYNTON 93_1**	**1.20**	**33**	**16**	**17**		
▲	**EA POYNTON 93_1**	**2.40**	**24**	**13**	**11**		
★	**EA POYNTON 96_1**	**1.40**	**24**	**12**	**12**		
⊙	**EA POYNTON 96_1**	**2.60**	**23**	**10**	**13**		
✿	**EA POYNTON 96_1**	**5.70**	**25**	**12**	**13**		
○	**EA POYNTON 97_2**	**4.20**	**21**	**12**	**9**		
△	**EA POYNTON 97_3**	**2.00**	**41**	**17**	**24**		
⊗	**EA POYNTON 97_3**	**3.20**	**32**	**16**	**16**		
⊕	**EA POYNTON 97_3**	**4.50**	**44**	**19**	**25**		
□	**EA POYNTON 98_2**	**3.50**	**25**	**16**	**9**		

AECOM

Zone: Norbury Brook to WCML(included)
Strata Type: CT

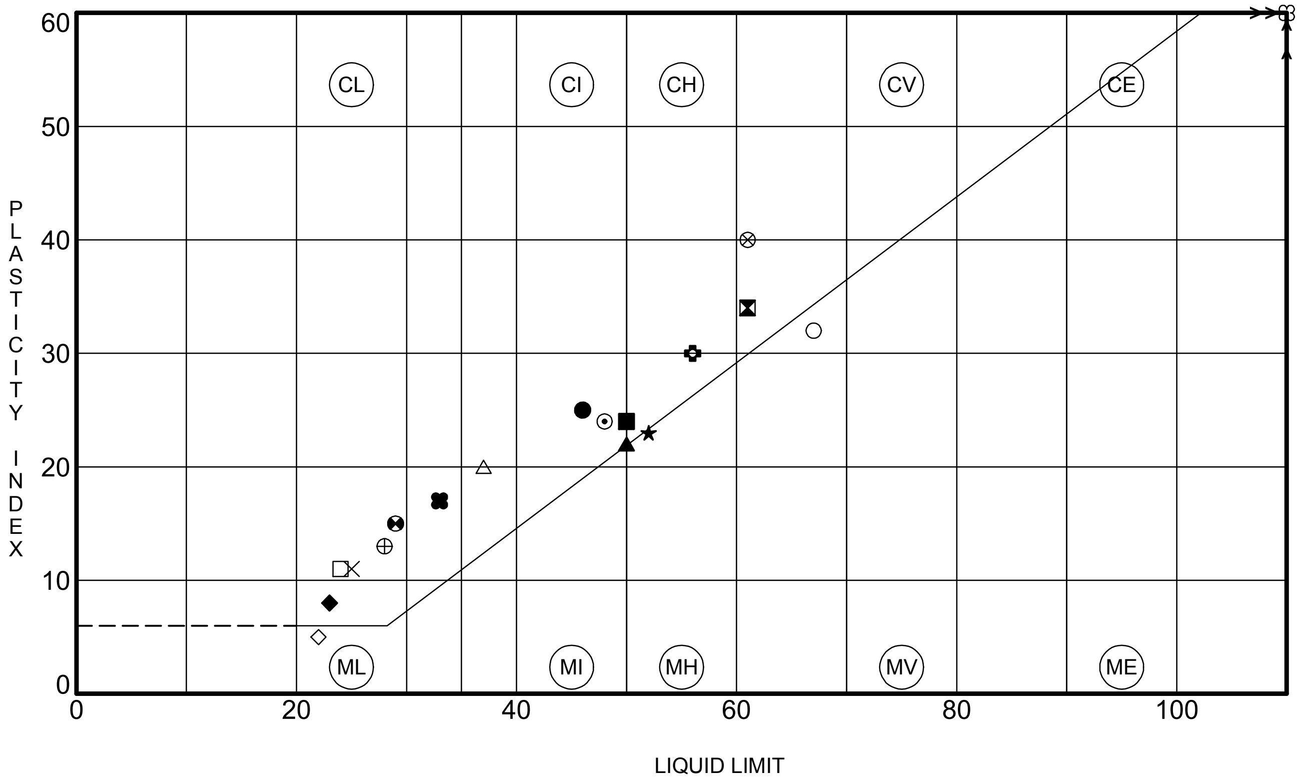
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 84_1**	**9.60**	**46**	**21**	**25**		
⧗	**EA POYNTON 84_1**	**10.80**	**61**	**27**	**34**		
▲	**EA POYNTON 85_1**	**11.60**	**50**	**28**	**22**		
★	**EA POYNTON 86_2**	**11.70**	**52**	**29**	**23**		
⊙	**EA POYNTON 86_3**	**10.80**	**48**	**24**	**24**		
✿	**EA POYNTON 86_3**	**12.00**	**56**	**26**	**30**		
○	**EA POYNTON 86_4**	**11.70**	**67**	**35**	**32**		
△	**EA POYNTON 87_1**	**10.80**	**37**	**17**	**20**		
⊗	**EA POYNTON 87_1**	**12.00**	**61**	**21**	**40**		
⊕	**EA POYNTON 87_2**	**11.50**	**28**	**15**	**13**		
□	**EA POYNTON 89_1**	**2.70**	**24**	**13**	**11**		
◕	**EA POYNTON 89_1**	**3.90**	**29**	**14**	**15**		
◑	**EA POYNTON 90_1**	**1.20**	**46**	**21**	**25**		
☆	**EA POYNTON 90_1**	**2.40**	**52**	**29**	**23**		
✤	**EA POYNTON 90_1**	**3.60**	**325**	**220**	**105**		
■	**EA POYNTON 91_1**	**1.20**	**50**	**26**	**24**		
◆	**EA POYNTON 97_1**	**13.30**	**23**	**15**	**8**		
◇	**EA POYNTON 97_1**	**15.00**	**22**	**17**	**5**		
×	**EA POYNTON 97_2**	**1.20**	**25**	**14**	**11**		
✖	**EA POYNTON 97_2**	**2.40**	**33**	**16**	**17**		

AECOM

Zone: Norbury Brook to WCML(included)
Strata Type: GFC

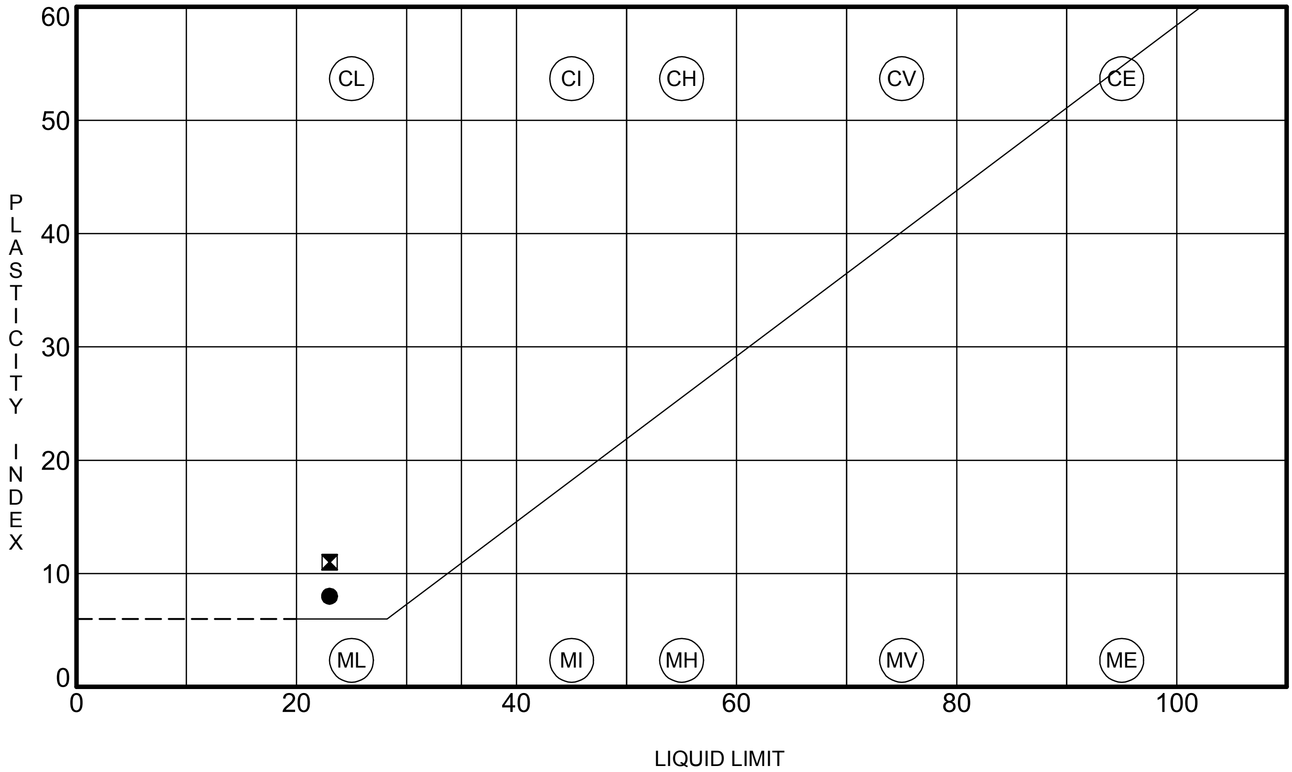
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 97_2**	**13.20**	**23**	**15**	**8**		
⊠	**EA POYNTON 97_2**	**14.40**	**23**	**12**	**11**		

AECOM

Zone: Norbury Brook to WCML(included)
Strata Type: GFC

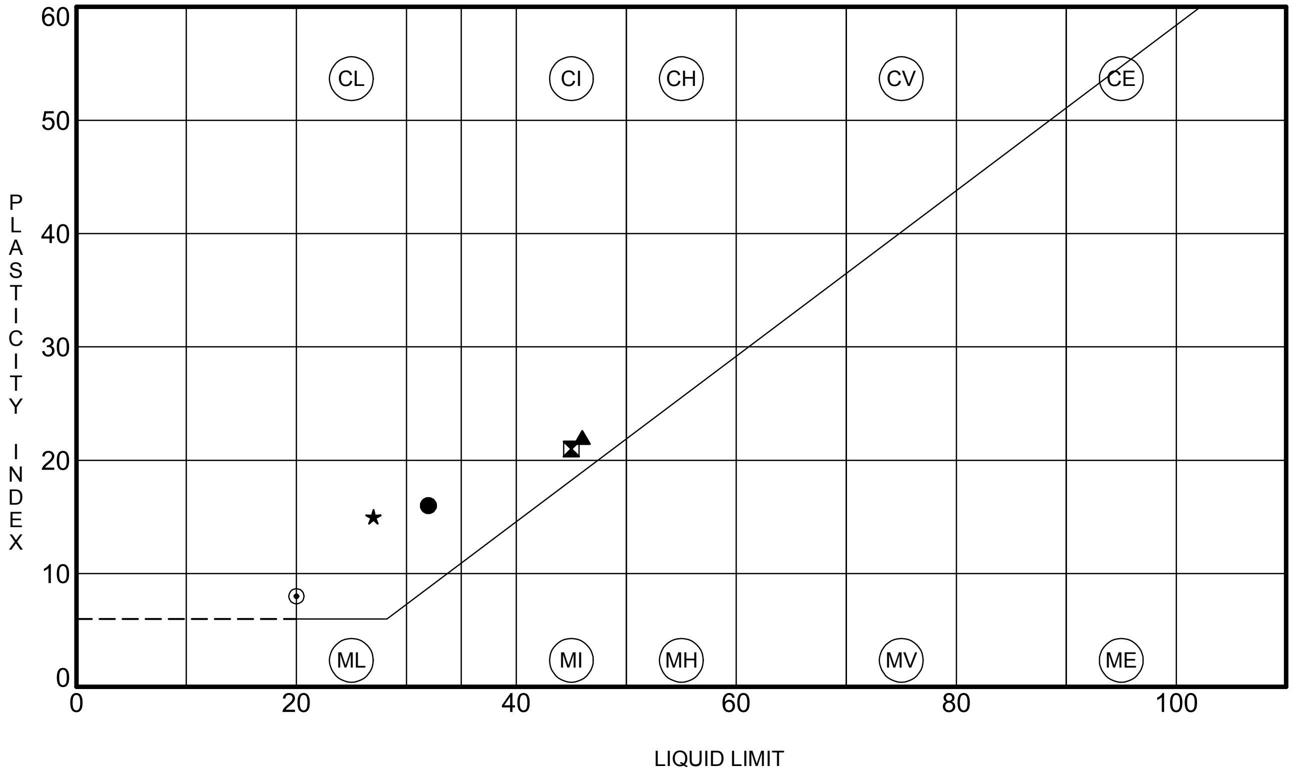
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 85_1**	**2.40**	**32**	**16**	**16**		
⧗	**EA POYNTON 85_1**	**3.60**	**45**	**24**	**21**		
▲	**EA POYNTON 85_1**	**7.30**	**46**	**24**	**22**		
★	**EA POYNTON 86_1**	**1.20**	**27**	**12**	**15**		
⊙	**EA POYNTON 87_1**	**10.20**	**20**	**12**	**8**		

AECOM

Zone: Norbury Brook to WCML(included)
Strata Type: Glacio Fluvial - Granular

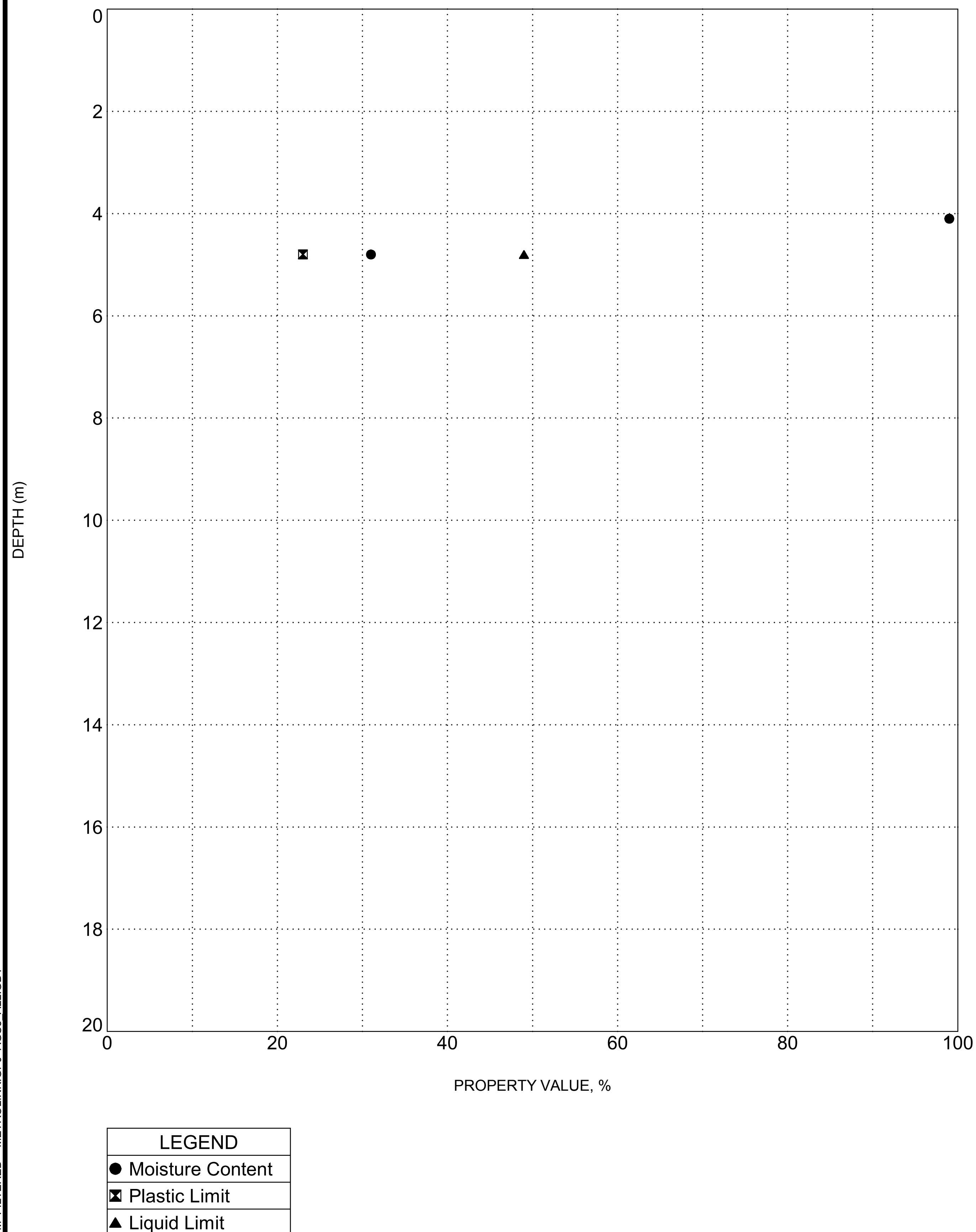
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT



INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

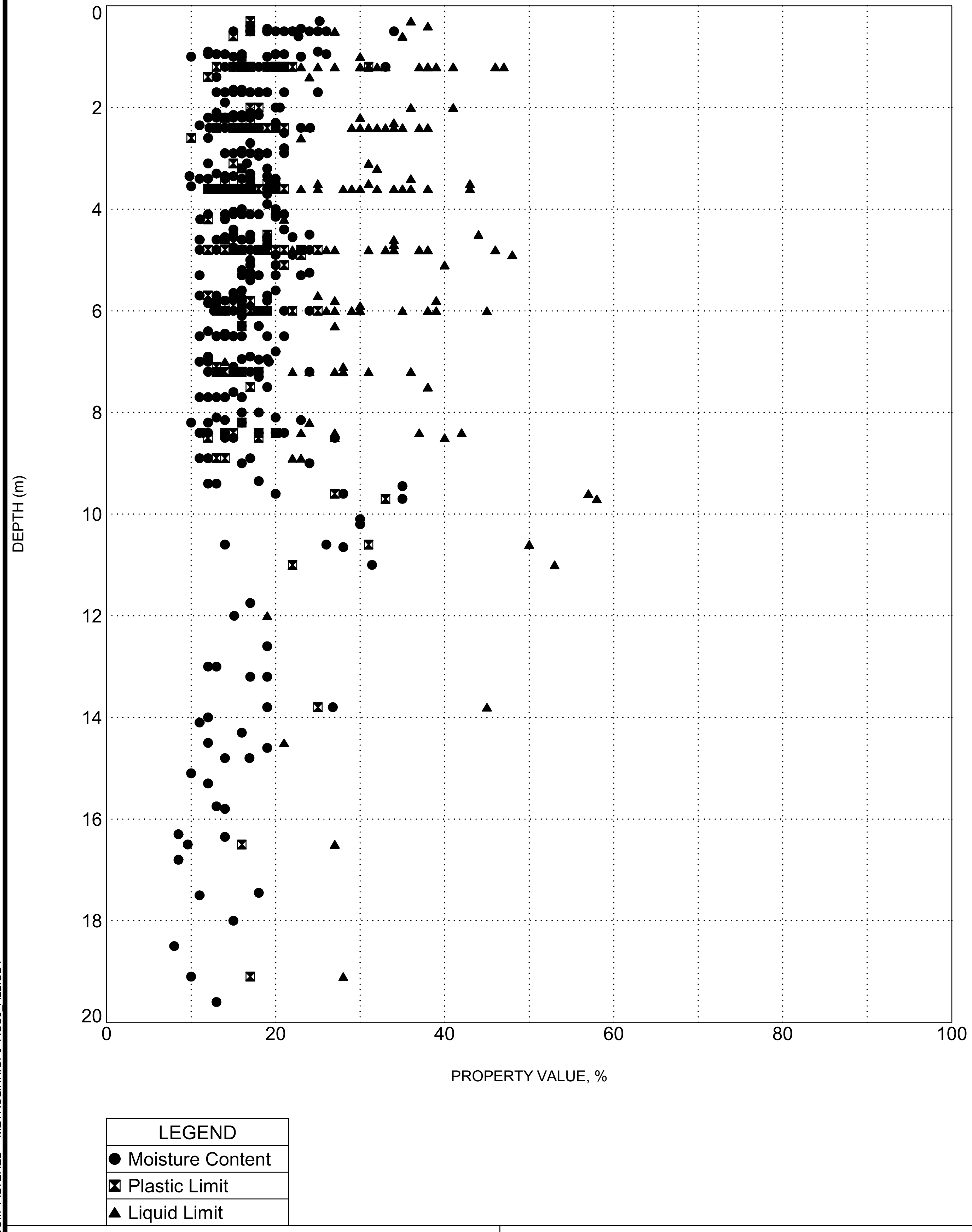
Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

Zone: Norbury Brook to WCML(included)

Strata Type: PEAT

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3_ALL.GDT



AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3_ALL.GDT

AECOM

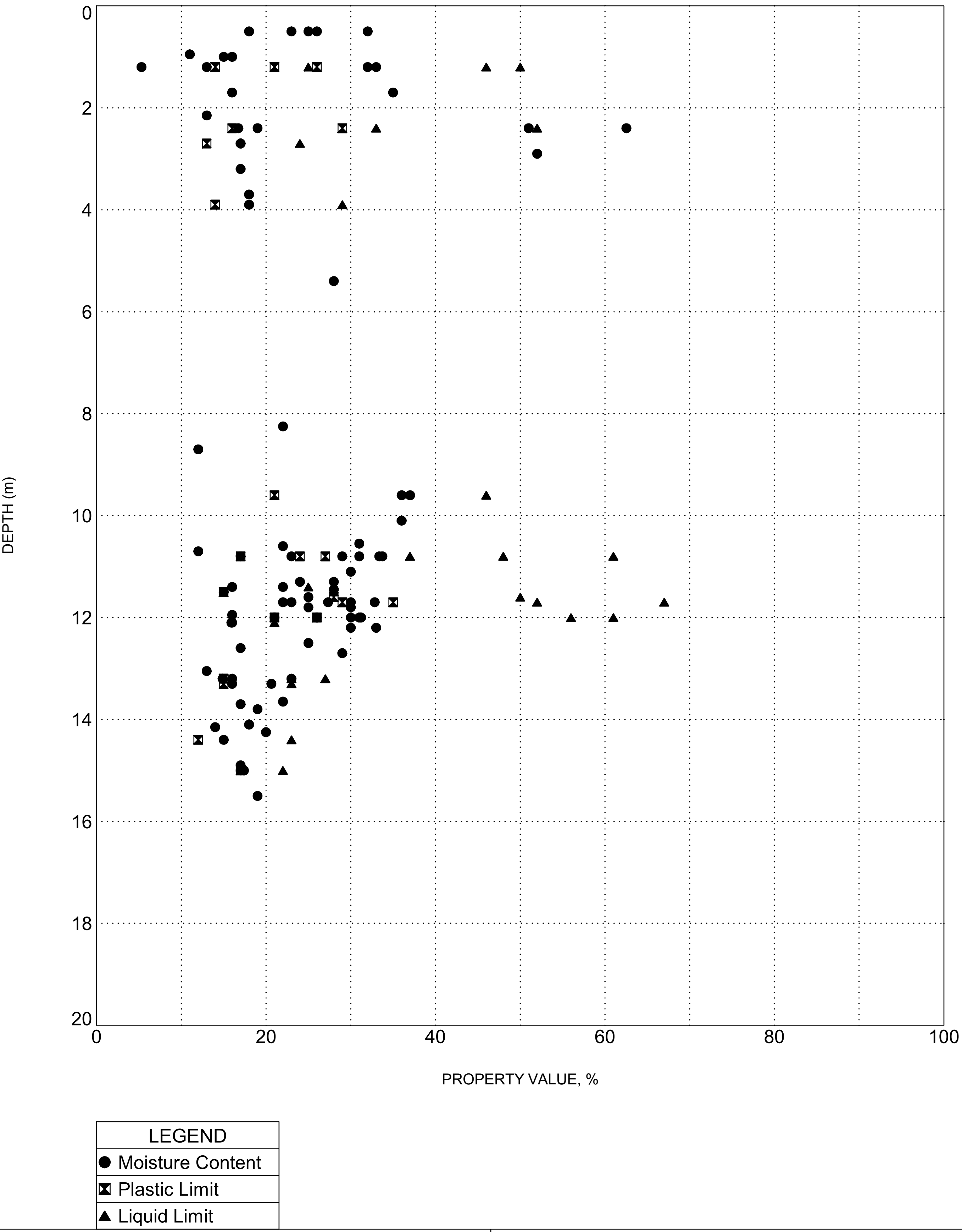
Zone: Norbury Brook to WCML(included)
Strata Type: CT

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AECOM

Zone: Norbury Brook to WCML(included)
Strata Type: GFC

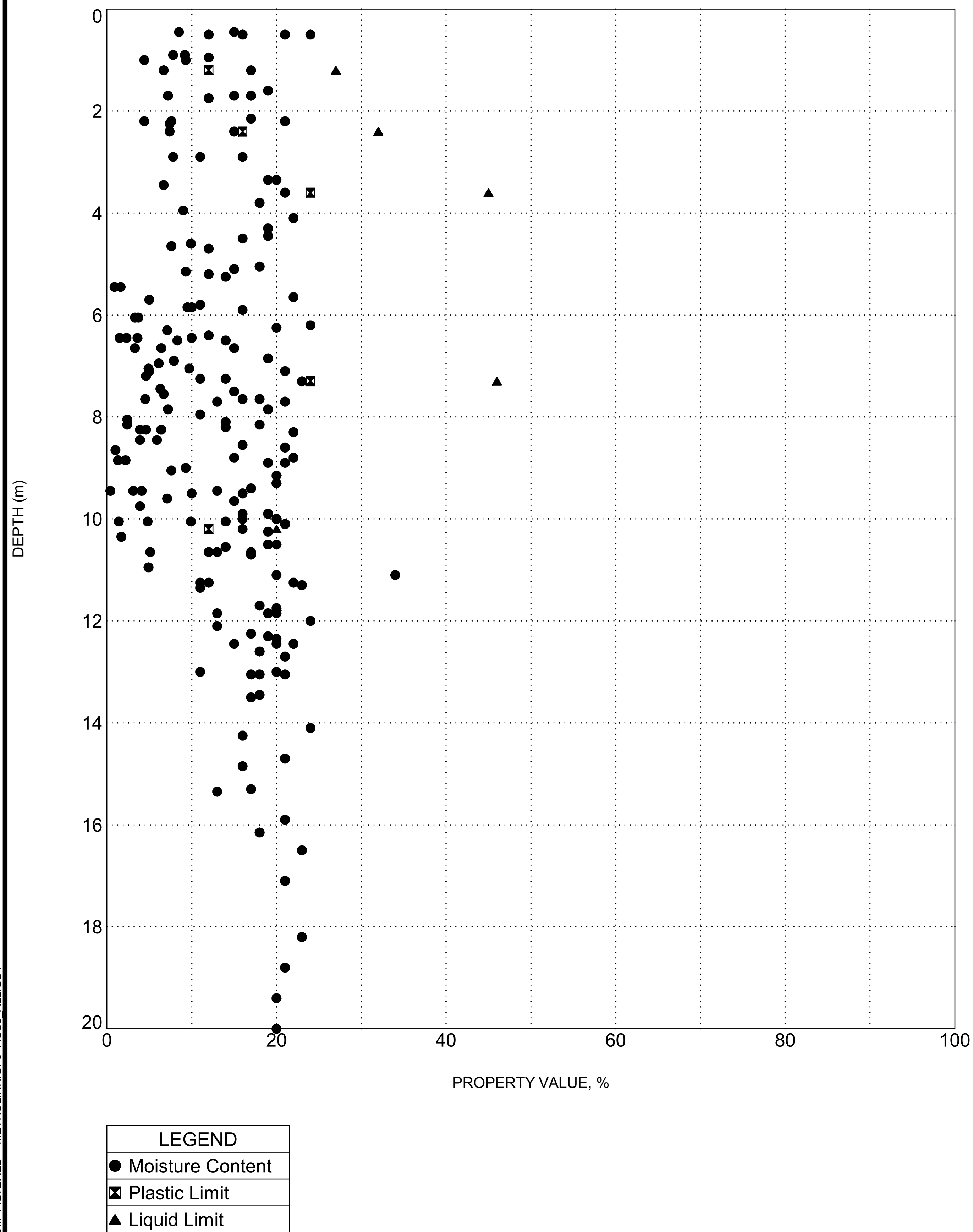
INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3_ALL.GDT



AECOM

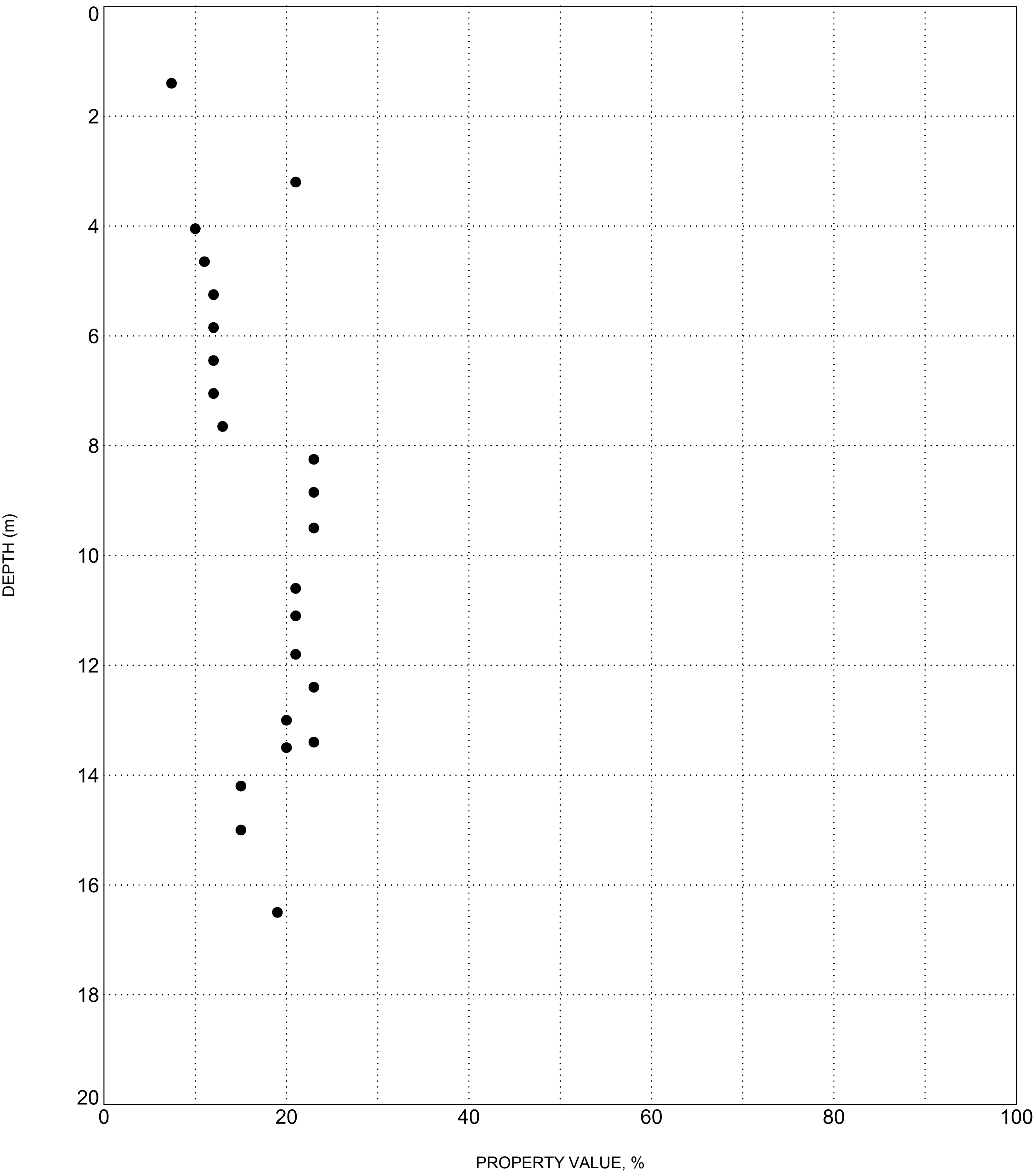
Zone: Norbury Brook to WCML(included)
Strata Type: Glacio Fluvial Granular

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Moisture Content
Plastic Limit
▲ Liquid Limit

AECOM

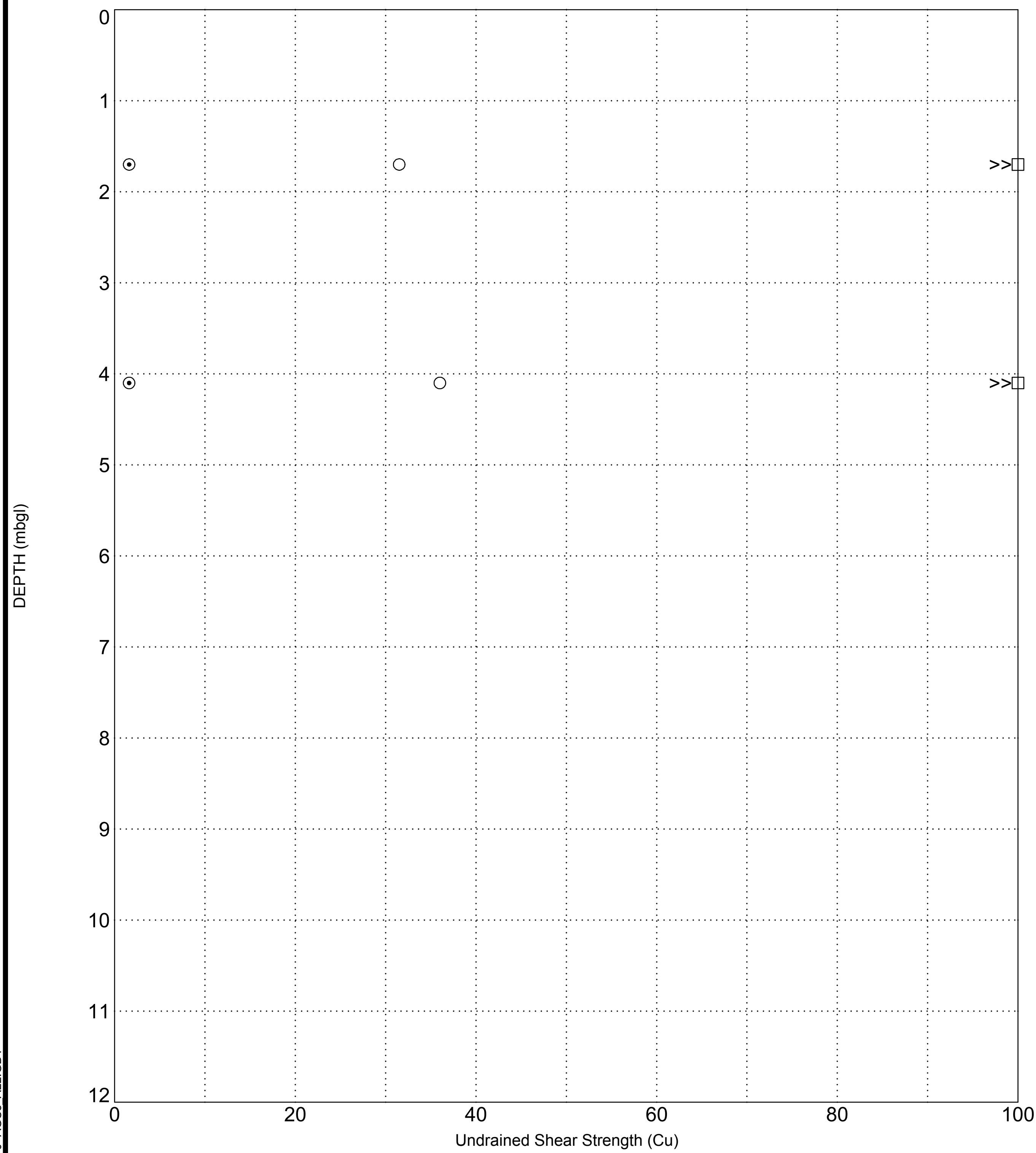
Zone: Norbury Brook to WCML(included)
Strata Type: Rock

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
☐ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

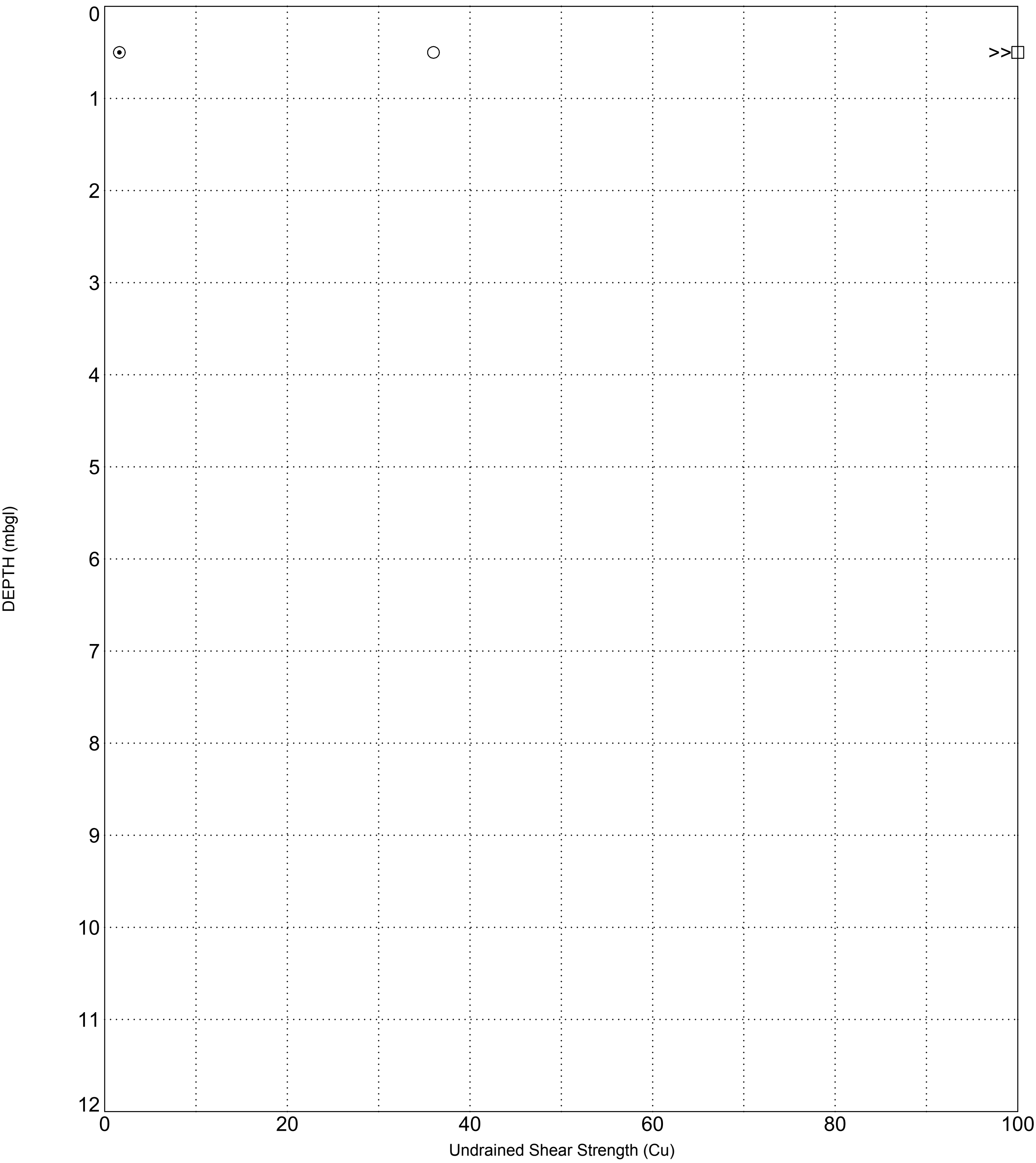
Zone: Norbury Brook to WCML(included)
Strata Type: Peat

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

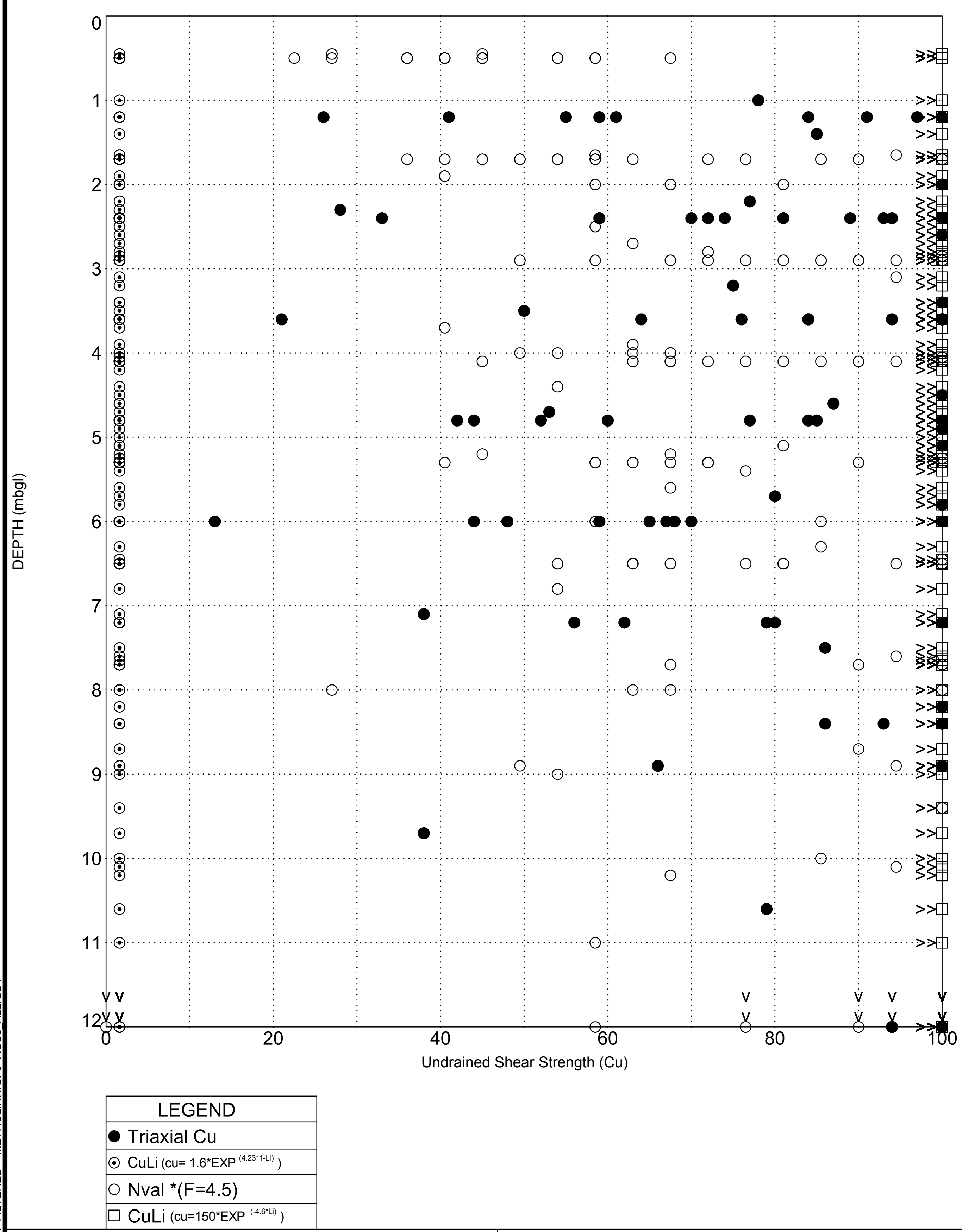
Zone: Norbury Brook to WCML(included)
Strata Type: AL

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



Zone: Norbury Brook to WCML(included)
Strata Type: CT

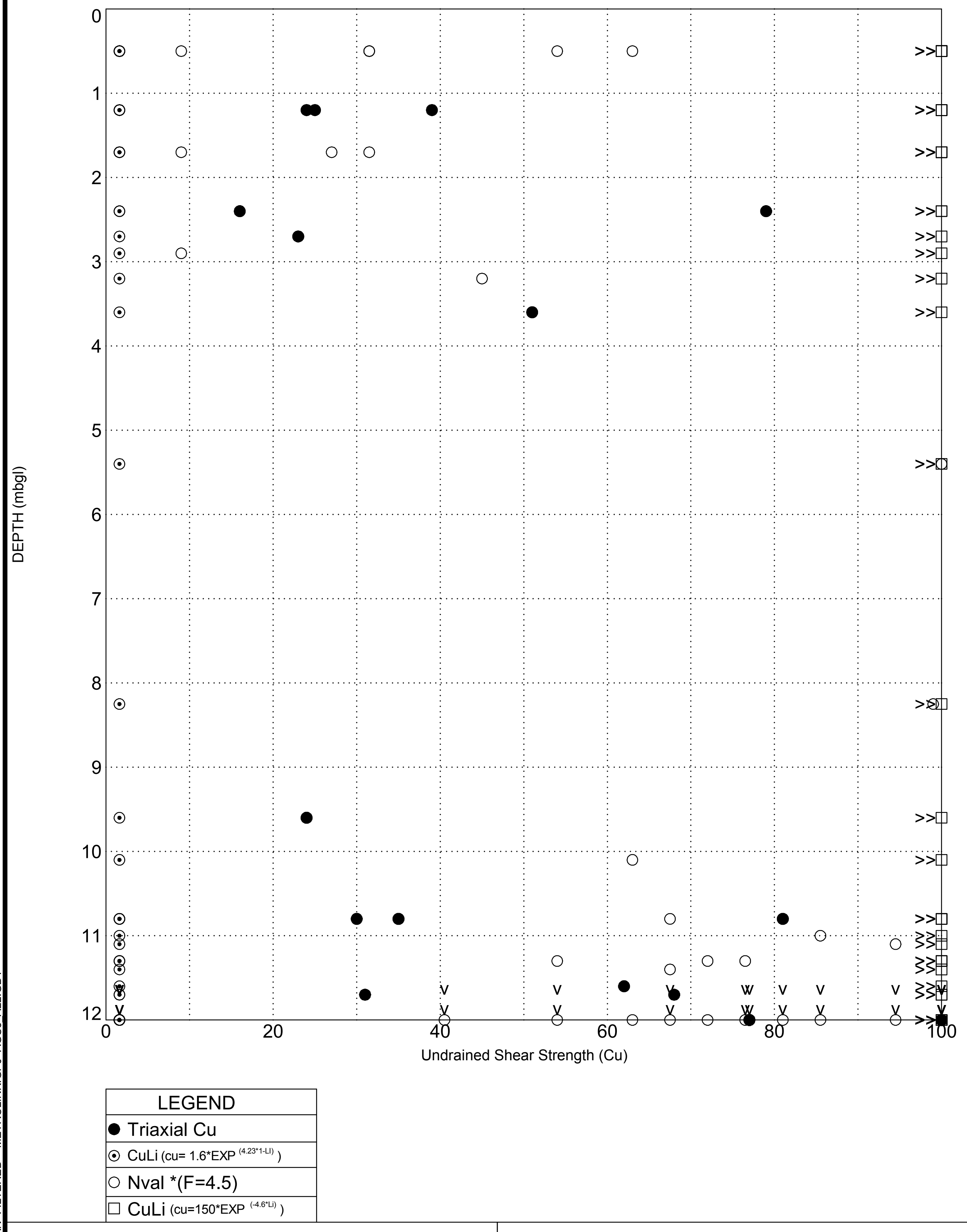
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

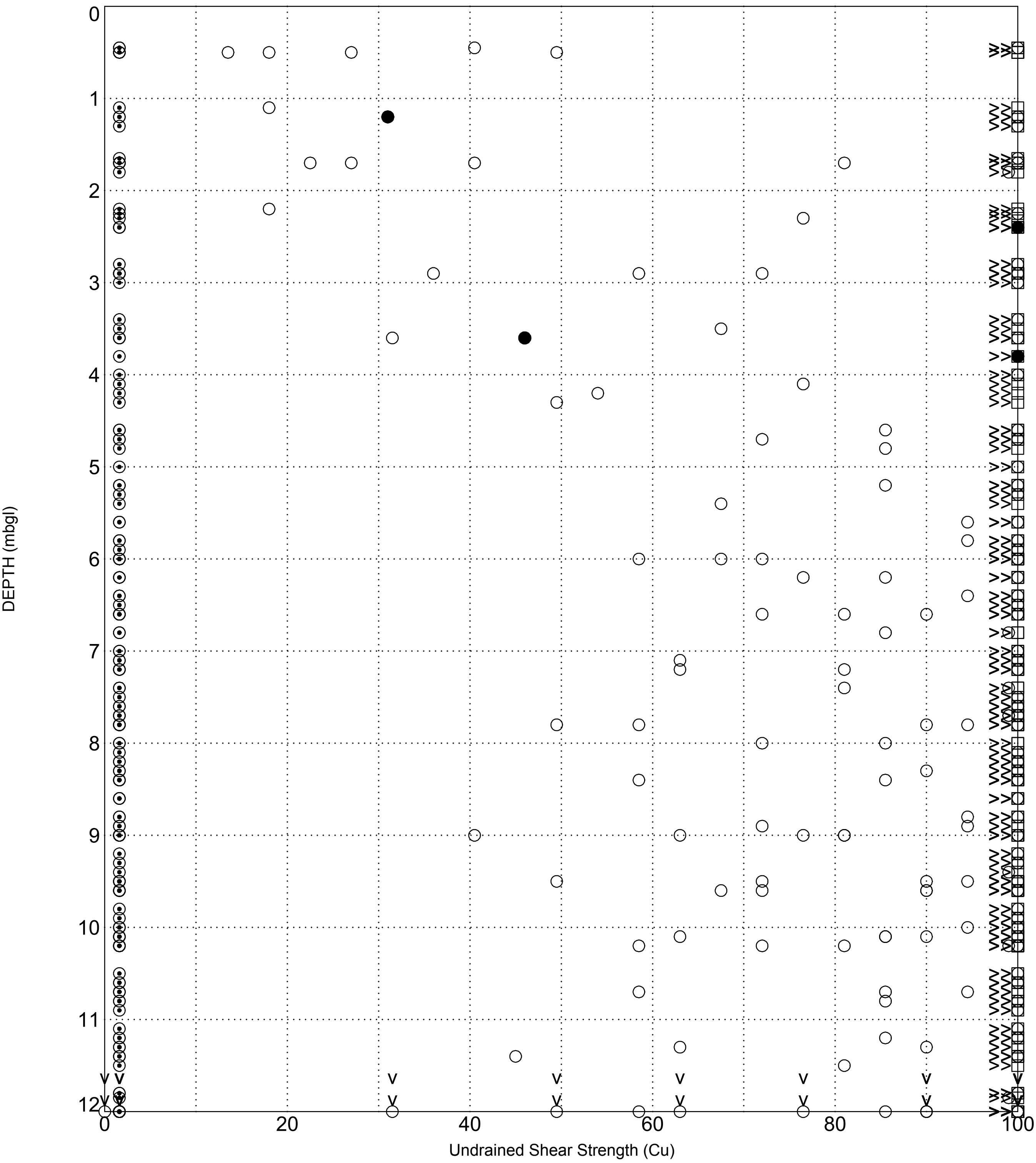
Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AECOM

Zone: Norbury Brook to WCML(included)

Strata Type: GFC



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: Norbury Brook to WCML(included)

Strata Type: Glacio Fluvial - Granular

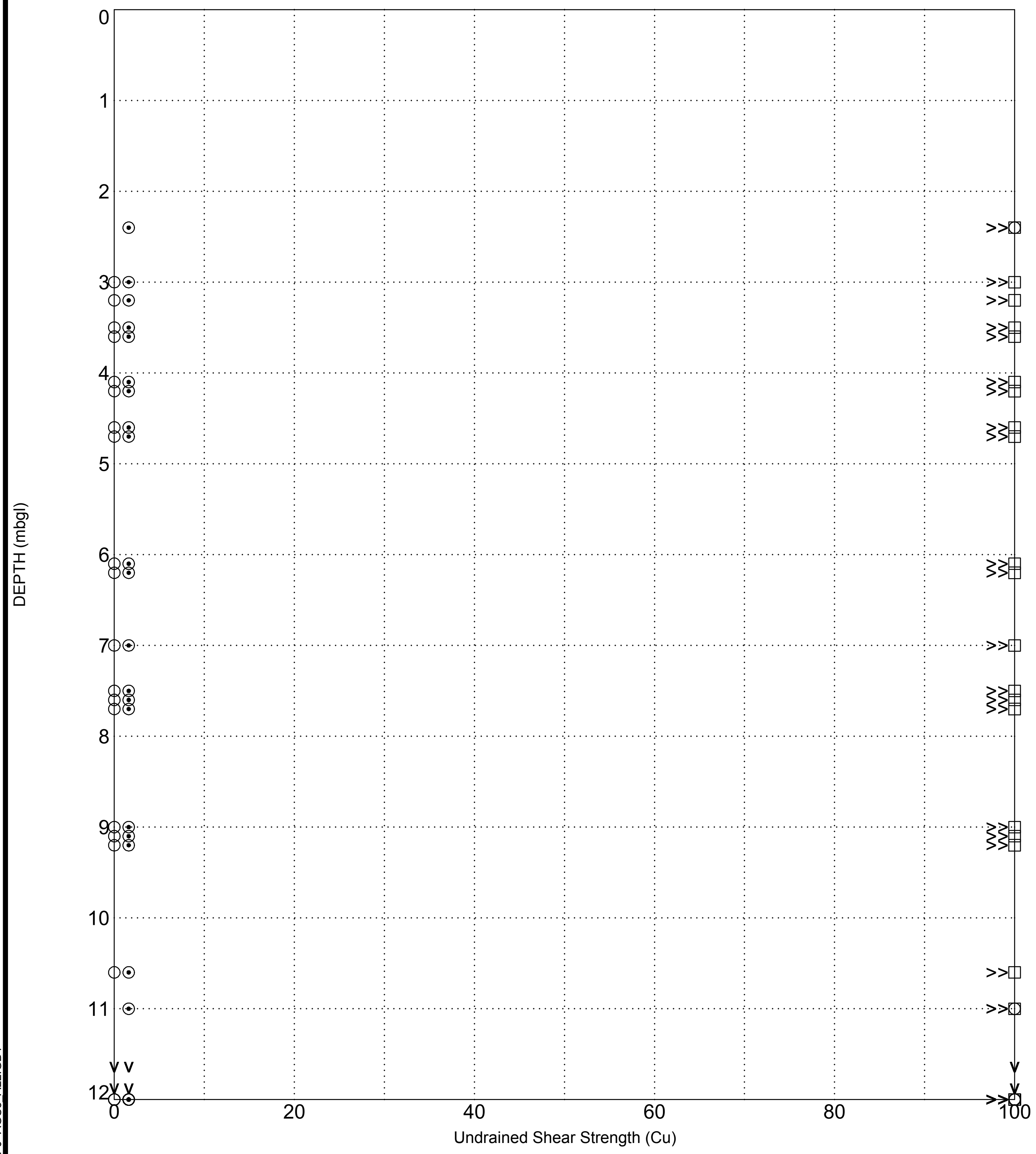
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP (4.23*1-LI))
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP (-4.6*Li))

AECOM

Zone: Norbury Brook to WCML(included)
Strata Type: Rock

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

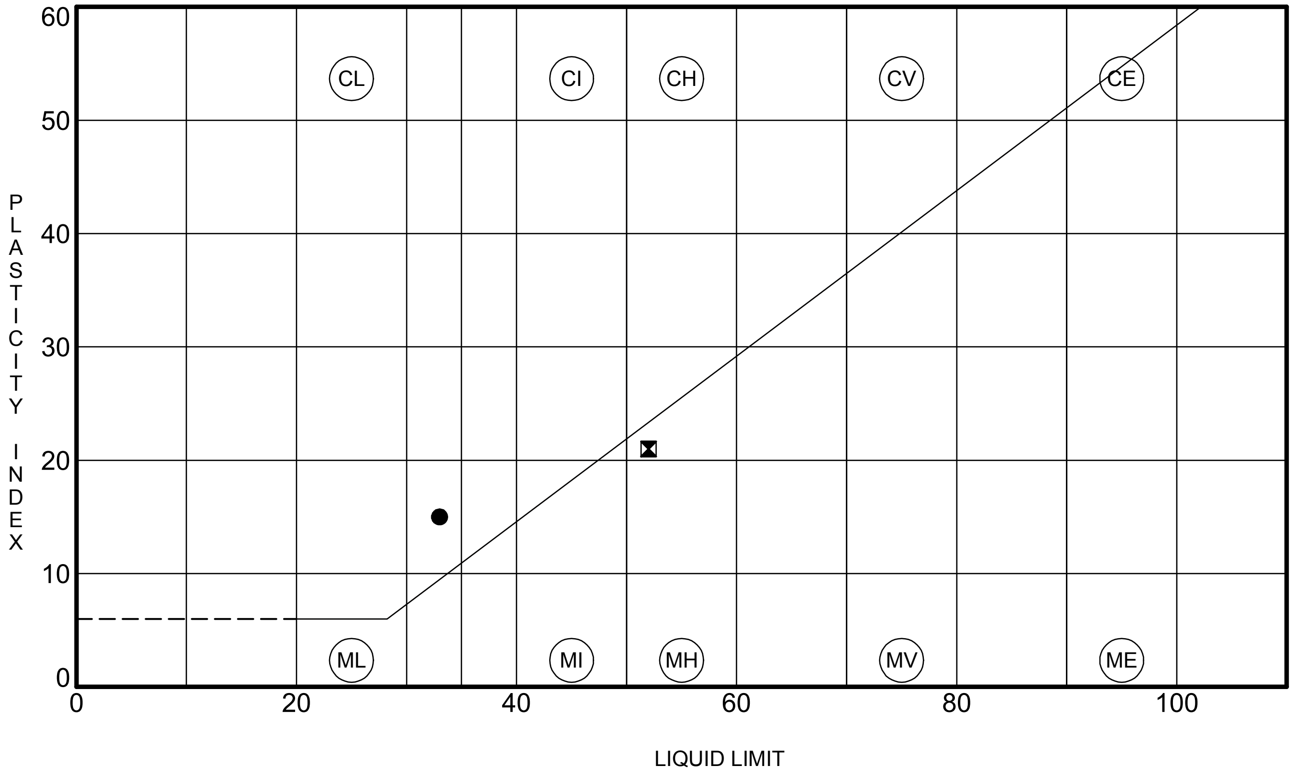
Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

Appendix A4

Geotechnical Plots WCML – A5102

Page deliberately blank for double sided printing



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 71_3**	**1.65**	**33**	**18**	**15**		
⧗	**EA POYNTON 73_1**	**1.20**	**52**	**31**	**21**		

AECOM

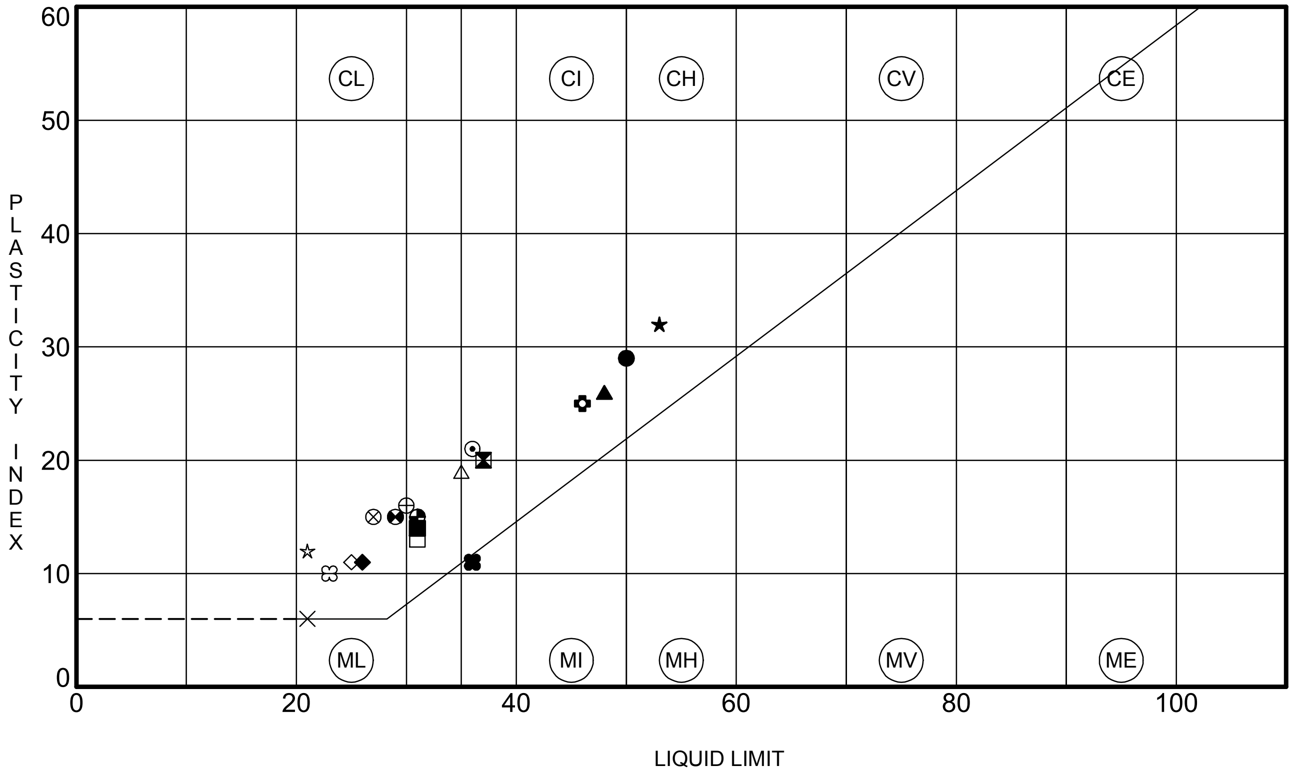
Zone: WCML to Styal Railway(included)
Strata Type: AL

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**BH103**	**0.40**	**50**	**21**	**29**		
⧗	**BH103**	**4.00**	**37**	**17**	**20**		
▲	**BH103**	**6.00**	**48**	**22**	**26**		
★	**BH104**	**0.50**	**53**	**21**	**32**		
⊙	**BH104**	**2.00**	**36**	**15**	**21**		
✿	**BH104**	**5.00**	**46**	**21**	**25**		
○	**BH105**	**0.50**	**31**	**16**	**15**		
△	**BH105**	**3.00**	**35**	**16**	**19**		
⊗	**BH105**	**5.00**	**27**	**12**	**15**		
⊕	**EA POYNTON 49_1**	**1.20**	**30**	**14**	**16**		
□	**EA POYNTON 49_1**	**3.60**	**31**	**18**	**13**		
●	**EA POYNTON 49_2**	**1.30**	**29**	**14**	**15**		
●	**EA POYNTON 49_2**	**2.50**	**31**	**16**	**15**		
☆	**EA POYNTON 49_3**	**2.40**	**21**	**9**	**12**		
✿	**EA POYNTON 49_4**	**1.30**	**23**	**13**	**10**		
■	**EA POYNTON 49_4**	**2.50**	**31**	**17**	**14**		
◆	**EA POYNTON 50_1**	**1.20**	**26**	**15**	**11**		
◇	**EA POYNTON 50_1**	**2.40**	**25**	**14**	**11**		
×	**EA POYNTON 50_1**	**3.60**	**21**	**15**	**6**		
✖	**EA POYNTON 50_1**	**4.80**	**36**	**25**	**11**		

AECOM

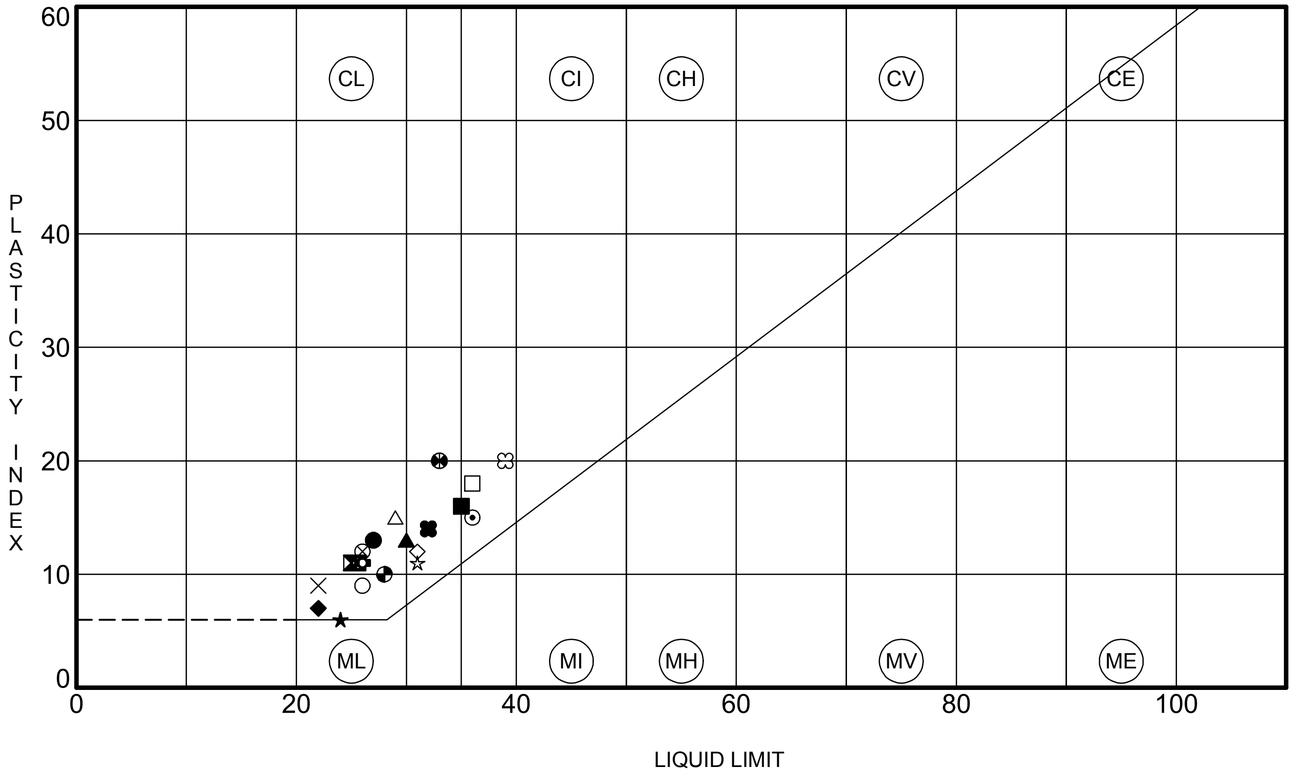
Zone: WCML to Styal Railway(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 50_1**	**7.80**	**27**	**14**	**13**		
⧗	**EA POYNTON 50_2**	**1.20**	**25**	**14**	**11**		
▲	**EA POYNTON 50_2**	**2.40**	**30**	**17**	**13**		
★	**EA POYNTON 50_2**	**3.60**	**24**	**18**	**6**		
⊙	**EA POYNTON 51_2**	**1.20**	**36**	**21**	**15**		
✿	**EA POYNTON 51_2**	**2.50**	**26**	**15**	**11**		
○	**EA POYNTON 51_2**	**3.60**	**26**	**17**	**9**		
△	**EA POYNTON 69_2**	**1.20**	**29**	**14**	**15**		
⊗	**EA POYNTON 69_2**	**6.00**	**26**	**14**	**12**		
⊕	**EA POYNTON 69_5**	**1.20**	**33**	**13**	**20**		
□	**EA POYNTON 69_6**	**1.20**	**36**	**18**	**18**		
⊛	**EA POYNTON 69_6**	**2.40**	**33**	**13**	**20**		
◕	**EA POYNTON 69_6**	**3.60**	**28**	**18**	**10**		
☆	**EA POYNTON 69_6**	**4.80**	**31**	**20**	**11**		
☘	**EA POYNTON 70_1**	**1.20**	**39**	**19**	**20**		
■	**EA POYNTON 70_1**	**2.40**	**35**	**19**	**16**		
◆	**EA POYNTON 70_1**	**7.20**	**22**	**15**	**7**		
◇	**EA POYNTON 70_2**	**1.20**	**31**	**19**	**12**		
×	**EA POYNTON 70_2**	**2.40**	**22**	**13**	**9**		
✖	**EA POYNTON 70_2**	**3.60**	**32**	**18**	**14**		

AECOM

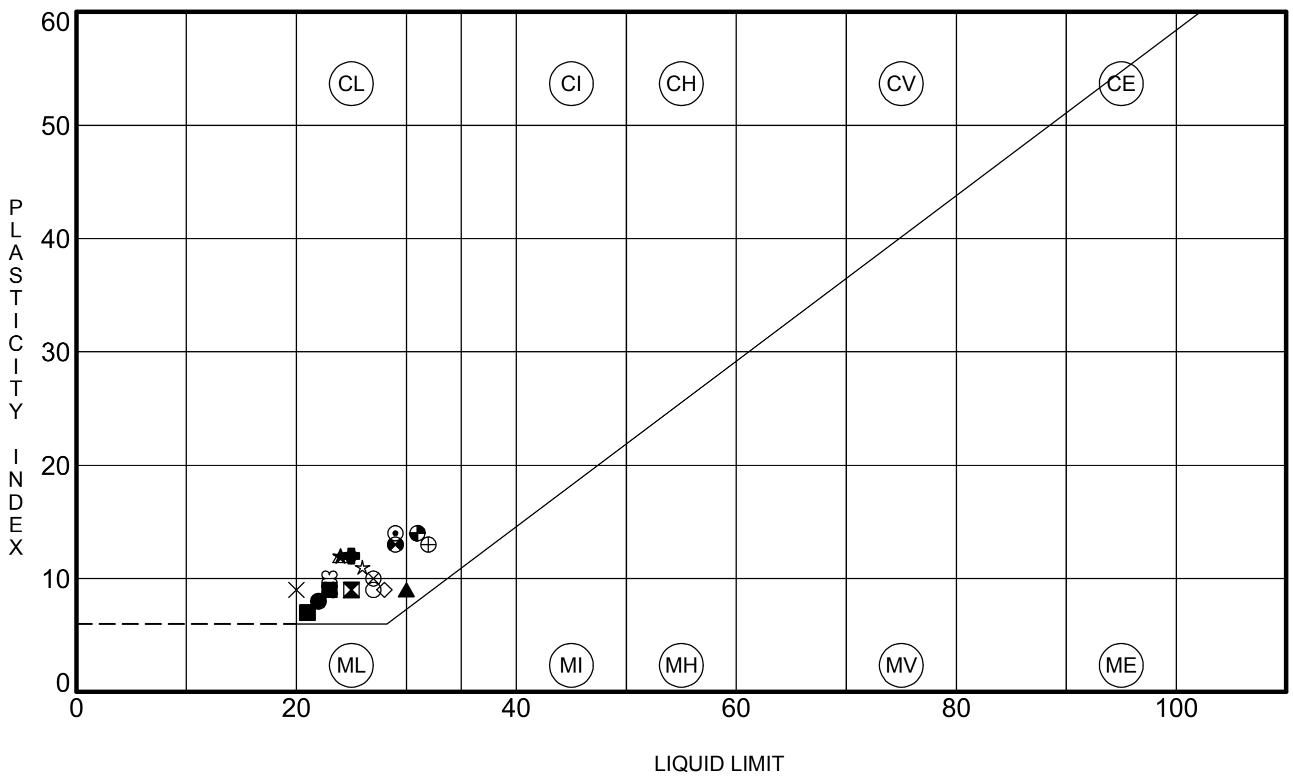
Zone: WCML to Styal Railway(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
● EA POYNTON 70_2	6.00	22	14	8		
⧗ EA POYNTON 70_3	7.75	25	16	9		
▲ EA POYNTON 71_1	1.20	30	21	9		
★ EA POYNTON 71_1	2.40	24	12	12		
⊙ EA POYNTON 71_1	3.60	29	15	14		
✿ EA POYNTON 71_1	4.80	25	13	12		
○ EA POYNTON 71_1	6.00	27	18	9		
△ EA POYNTON 71_1	7.20	24	12	12		
⊗ EA POYNTON 71_1	8.40	27	17	10		
⊕ EA POYNTON 71_2	4.10	32	19	13		
□ EA POYNTON 71_2	6.50	23	14	9		
EA POYNTON 71_3	2.10	29	16	13		
EA POYNTON 72_1	2.40	31	17	14		
☆ EA POYNTON 72_1	4.80	26	15	11		
EA POYNTON 72_1	6.00	23	13	10		
■ EA POYNTON 72_1	7.20	21	14	7		
◆ EA POYNTON 72_2	4.10	25	13	12		
◇ EA POYNTON 72_2	5.30	28	19	9		
× EA POYNTON 72_2	6.50	20	11	9		
EA POYNTON 72_2	7.50	23	14	9		

AECOM

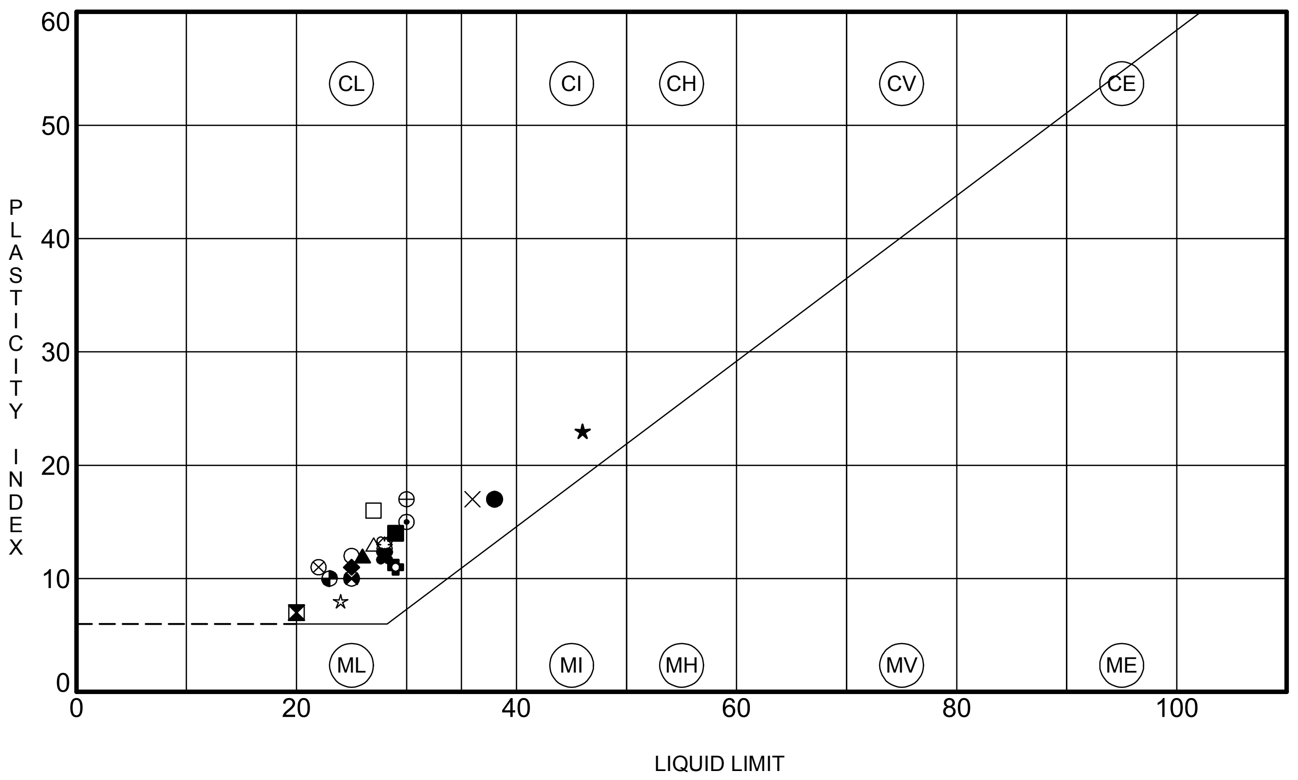
Zone: WCML to Styal Railway(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 72_3**	**3.60**	**38**	**21**	**17**		
⧗	**EA POYNTON 72_3**	**6.00**	**20**	**13**	**7**		
▲	**EA POYNTON 72_3**	**7.20**	**26**	**14**	**12**		
★	**EA POYNTON 72_4**	**1.20**	**46**	**23**	**23**		
⊙	**EA POYNTON 72_4**	**2.40**	**30**	**15**	**15**		
✿	**EA POYNTON 72_4**	**3.60**	**29**	**18**	**11**		
○	**EA POYNTON 72_4**	**4.80**	**25**	**13**	**12**		
△	**EA POYNTON 72_4**	**6.00**	**27**	**14**	**13**		
⊗	**EA POYNTON 73_1**	**4.80**	**22**	**11**	**11**		
⊕	**EA POYNTON 73_1**	**6.00**	**30**	**13**	**17**		
□	**EA POYNTON 73_2**	**3.00**	**27**	**11**	**16**		
	EA POYNTON 73_2	**5.20**	**25**	**15**	**10**		
	EA POYNTON 73_2	**7.60**	**23**	**13**	**10**		
☆	**EA POYNTON 73_2**	**9.60**	**24**	**16**	**8**		
	EA POYNTON 73_3	**3.00**	**28**	**15**	**13**		
■	**EA POYNTON 73_3**	**4.30**	**29**	**15**	**14**		
◆	**EA POYNTON 73_3**	**6.60**	**25**	**14**	**11**		
◇	**EA POYNTON 73_3**	**7.80**	**28**	**15**	**13**		
×	**EA POYNTON 74_2**	**1.20**	**36**	**19**	**17**		
	EA POYNTON 74_2	**2.40**	**28**	**16**	**12**		

AECOM

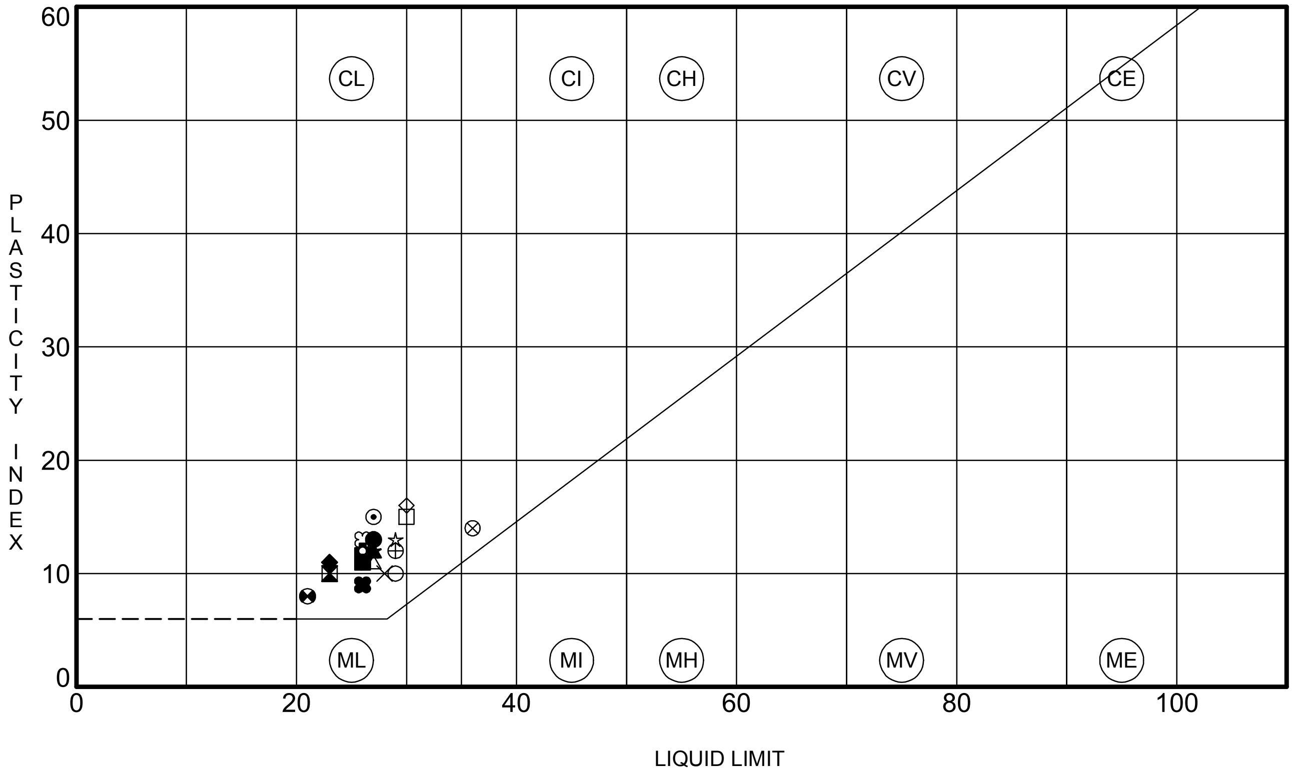
Zone: WCML to Styal Railway(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 74_2**	**3.60**	**27**	**14**	**13**		
⧗	**EA POYNTON 74_2**	**4.80**	**23**	**13**	**10**		
▲	**EA POYNTON 74_2**	**6.00**	**27**	**15**	**12**		
★	**EA POYNTON 74_3**	**2.40**	**27**	**15**	**12**		
⊙	**EA POYNTON 74_3**	**3.60**	**27**	**12**	**15**		
✿	**EA POYNTON 74_3**	**4.80**	**26**	**14**	**12**		
○	**EA POYNTON 74_3**	**6.00**	**29**	**19**	**10**		
△	**EA POYNTON 74_3**	**7.20**	**27**	**16**	**11**		
⊗	**EA POYNTON 74_4**	**12.00**	**36**	**22**	**14**		
⊕	**EA POYNTON 74_5**	**1.20**	**29**	**17**	**12**		
□	**EA POYNTON 74_5**	**5.50**	**30**	**15**	**15**		
⊗	**EA POYNTON 74_5**	**6.70**	**21**	**13**	**8**		
◕	**EA POYNTON 74_6**	**1.20**	**26**	**15**	**11**		
☆	**EA POYNTON 74_6**	**2.40**	**29**	**16**	**13**		
✿	**EA POYNTON 74_6**	**3.60**	**26**	**13**	**13**		
■	**EA POYNTON 74_6**	**5.40**	**26**	**15**	**11**		
◆	**EA POYNTON 74_7**	**1.20**	**23**	**12**	**11**		
◇	**EA POYNTON 74_7**	**2.40**	**30**	**14**	**16**		
×	**EA POYNTON 74_7**	**4.80**	**28**	**18**	**10**		
✖	**EA POYNTON 74_7**	**6.00**	**26**	**17**	**9**		

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: CT

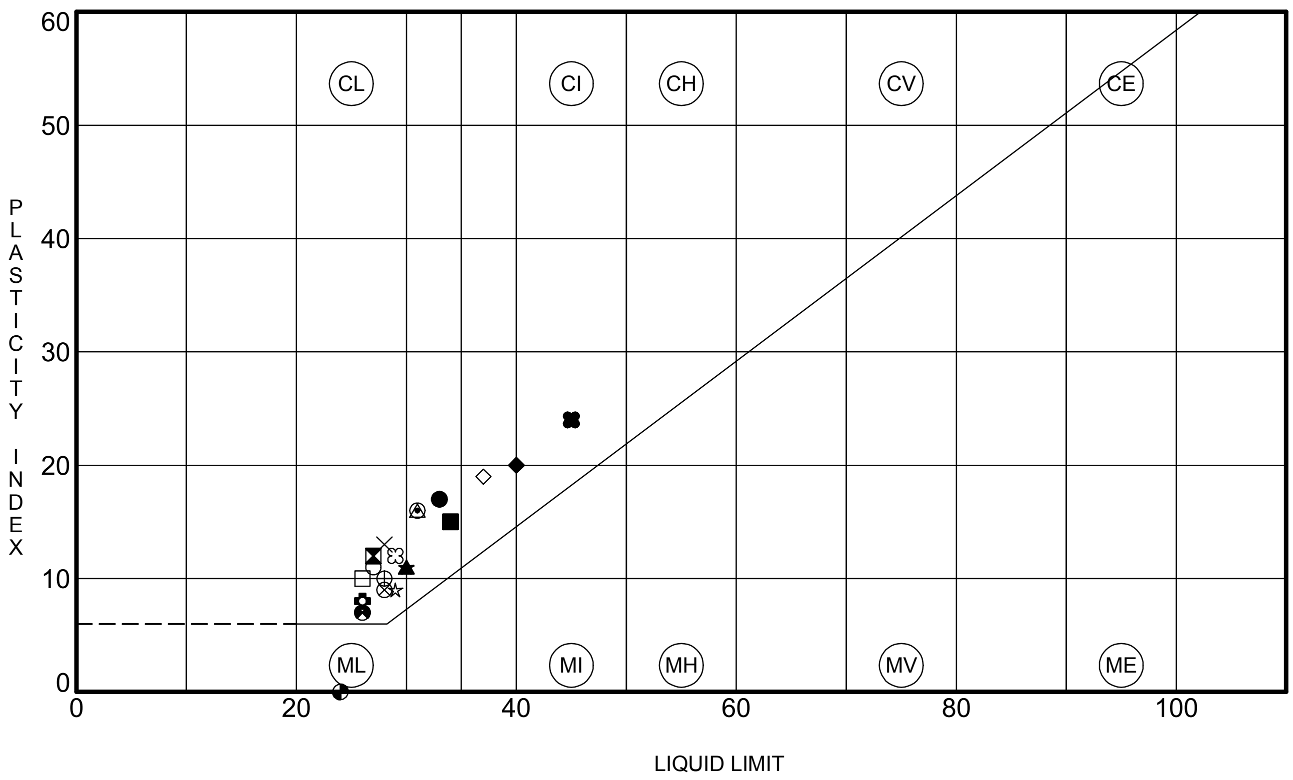
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 74_7**	**7.20**	**33**	**16**	**17**		
⧗	**EA POYNTON 75_1**	**1.50**	**27**	**15**	**12**		
▲	**EA POYNTON 75_1**	**3.70**	**30**	**19**	**11**		
★	**EA POYNTON 75_1**	**4.80**	**30**	**19**	**11**		
⊙	**EA POYNTON 75_1**	**5.30**	**31**	**15**	**16**		
✿	**EA POYNTON 75_2**	**1.70**	**26**	**18**	**8**		
○	**EA POYNTON 75_2**	**3.40**	**27**	**16**	**11**		
△	**EA POYNTON 75_2**	**4.60**	**31**	**15**	**16**		
⊗	**EA POYNTON 75_3**	**2.20**	**28**	**19**	**9**		
⊕	**EA POYNTON 75_3**	**4.40**	**28**	**18**	**10**		
□	**EA POYNTON 75_4**	**3.50**	**26**	**16**	**10**		
⊛	**EA POYNTON 75_5**	**1.20**	**26**	**19**	**7**		
◕	**EA POYNTON 75_5**	**2.40**	**24**	**24**	**NP**		
☆	**EA POYNTON 75_5**	**3.60**	**29**	**20**	**9**		
✣	**EA POYNTON 75_6**	**2.20**	**29**	**17**	**12**		
■	**EA POYNTON 75_6**	**9.00**	**34**	**19**	**15**		
◆	**EA POYNTON 75_7**	**1.70**	**40**	**20**	**20**		
◇	**EA POYNTON 75_7**	**2.20**	**37**	**18**	**19**		
×	**EA POYNTON 75_7**	**3.40**	**28**	**15**	**13**		
✖	**EA POYNTON 76_1**	**1.20**	**45**	**21**	**24**		

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: CT

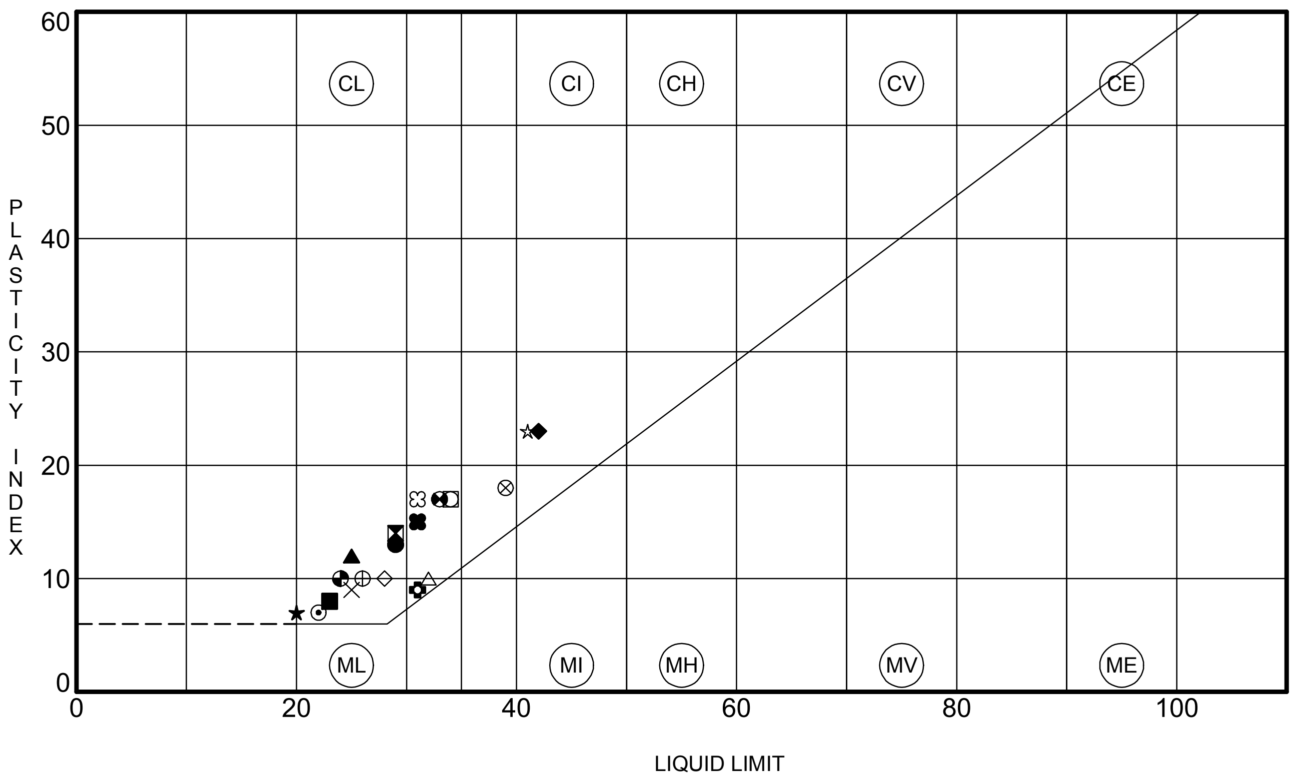
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 76_1**	**2.40**	**29**	**16**	**13**		
⧗	**EA POYNTON 76_1**	**3.50**	**29**	**15**	**14**		
▲	**EA POYNTON 76_1**	**21.00**	**25**	**13**	**12**		
★	**EA POYNTON 76_1**	**22.50**	**20**	**13**	**7**		
⊙	**EA POYNTON 76_1**	**24.00**	**22**	**15**	**7**		
✿	**EA POYNTON 76_2**	**0.50**	**31**	**22**	**9**		
○	**EA POYNTON 76_2**	**2.40**	**34**	**17**	**17**		
△	**EA POYNTON 76_2**	**3.40**	**32**	**22**	**10**		
⊗	**EA POYNTON 76_2**	**5.00**	**39**	**21**	**18**		
⊕	**EA POYNTON 76_2**	**6.90**	**26**	**16**	**10**		
□	**EA POYNTON 76_3**	**1.20**	**34**	**17**	**17**		
◉	**EA POYNTON 76_3**	**2.40**	**33**	**16**	**17**		
◕	**EA POYNTON 76_3**	**3.60**	**24**	**14**	**10**		
☆	**EA POYNTON 76_4**	**1.20**	**41**	**18**	**23**		
☸	**EA POYNTON 76_4**	**2.40**	**31**	**14**	**17**		
■	**EA POYNTON 76_4**	**4.10**	**23**	**15**	**8**		
◆	**EA POYNTON 77_1**	**2.60**	**42**	**19**	**23**		
◇	**EA POYNTON 77_1**	**3.80**	**28**	**18**	**10**		
×	**EA POYNTON 77_1**	**5.00**	**25**	**16**	**9**		
✖	**EA POYNTON 78_1**	**1.20**	**31**	**16**	**15**		

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: CT

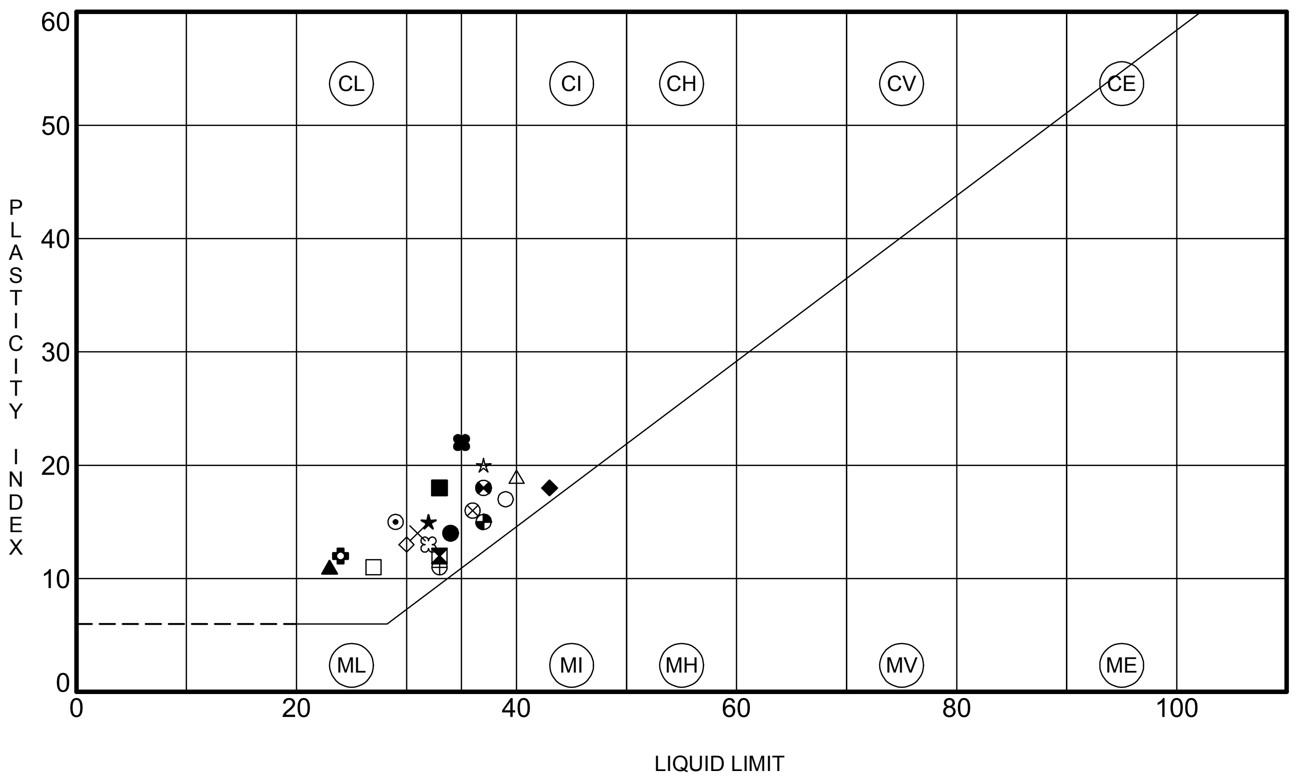
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 78_1**	**2.40**	**34**	**20**	**14**		
⧗	**EA POYNTON 78_1**	**3.60**	**33**	**21**	**12**		
▲	**EA POYNTON 78_1**	**4.80**	**23**	**12**	**11**		
★	**EA POYNTON 78_2**	**1.20**	**32**	**17**	**15**		
⊙	**EA POYNTON 78_2**	**2.40**	**29**	**14**	**15**		
✿	**EA POYNTON 78_2**	**4.80**	**24**	**12**	**12**		
○	**EA POYNTON 79_1**	**2.40**	**39**	**22**	**17**		
△	**EA POYNTON 79_1**	**3.60**	**40**	**21**	**19**		
⊗	**EA POYNTON 79_1**	**4.80**	**36**	**20**	**16**		
⊕	**EA POYNTON 80_1**	**1.20**	**33**	**22**	**11**		
□	**EA POYNTON 80_1**	**2.40**	**27**	**16**	**11**		
◉	**EA POYNTON 80_1**	**3.60**	**37**	**19**	**18**		
◕	**EA POYNTON 80_1**	**4.80**	**37**	**22**	**15**		
☆	**EA POYNTON 81_1**	**1.20**	**37**	**17**	**20**		
✾	**EA POYNTON 81_1**	**2.40**	**32**	**19**	**13**		
■	**EA POYNTON 81_1**	**3.60**	**33**	**15**	**18**		
◆	**EA POYNTON 81_1**	**4.80**	**43**	**25**	**18**		
◇	**EA POYNTON 82_1**	**1.20**	**30**	**17**	**13**		
✕	**EA POYNTON 82_1**	**2.40**	**31**	**17**	**14**		
✖	**EA POYNTON 82_1**	**3.60**	**35**	**13**	**22**		

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: CT

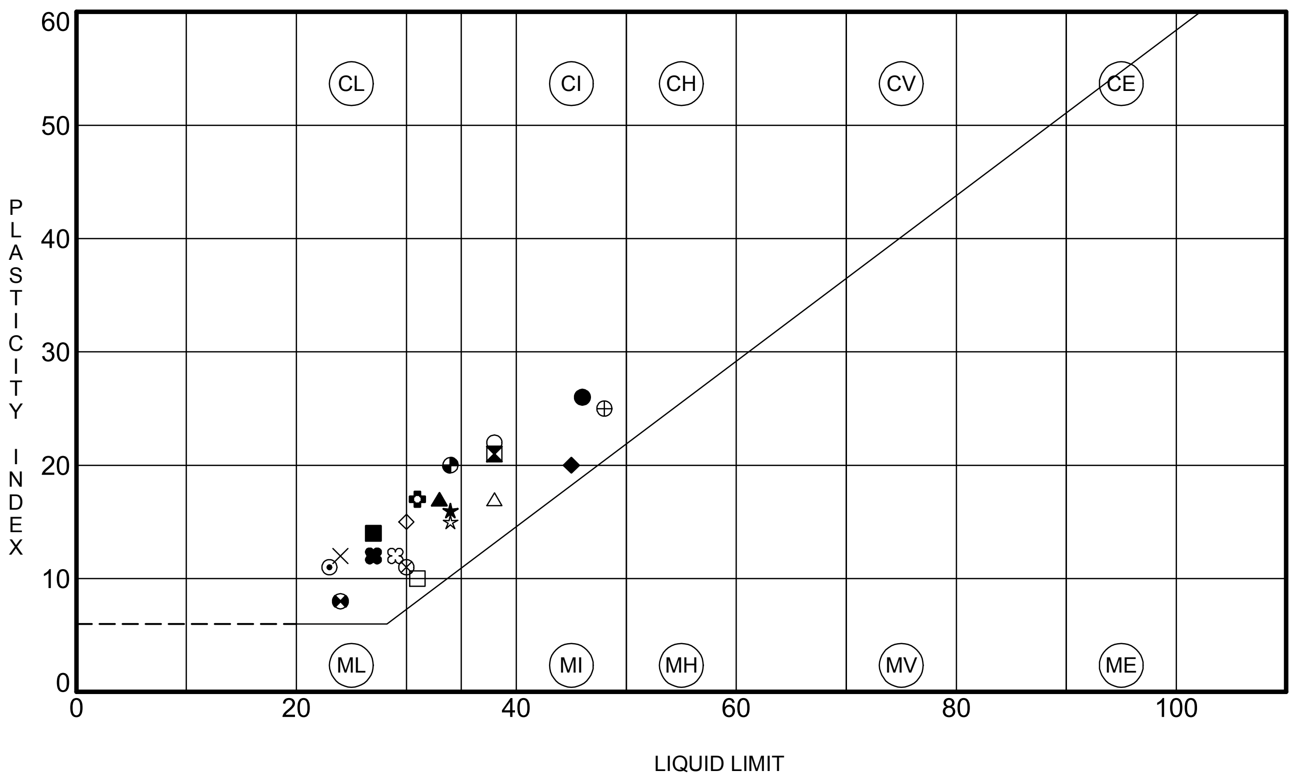
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT



Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
EA POYNTON 82_1	4.80	46	20	26		
EA POYNTON 82_1	6.00	38	17	21		
EA POYNTON 82_2	1.20	33	16	17		
EA POYNTON 82_2	2.40	34	18	16		
EA POYNTON 82_2	3.60	23	12	11		
EA POYNTON 82_2	4.80	31	14	17		
EA POYNTON 82_3	1.20	38	16	22		
EA POYNTON 82_3	2.40	38	21	17		
EA POYNTON 82_3	3.60	30	19	11		
EA POYNTON 82_3	4.90	48	23	25		
EA POYNTON 82_4	1.20	31	21	10		
EA POYNTON 82_4	2.40	24	16	8		
EA POYNTON 82_4	3.60	34	14	20		
EA POYNTON 82_4	4.80	34	19	15		
EA POYNTON 82_4	6.00	29	17	12		
EA POYNTON 82_5	1.20	27	13	14		
EA POYNTON 82_5	13.80	45	25	20		
EA POYNTON CD_1	1.20	30	15	15		
EA POYNTON CD_1	2.50	24	12	12		
EA POYNTON CD_2	2.50	27	15	12		

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: CT

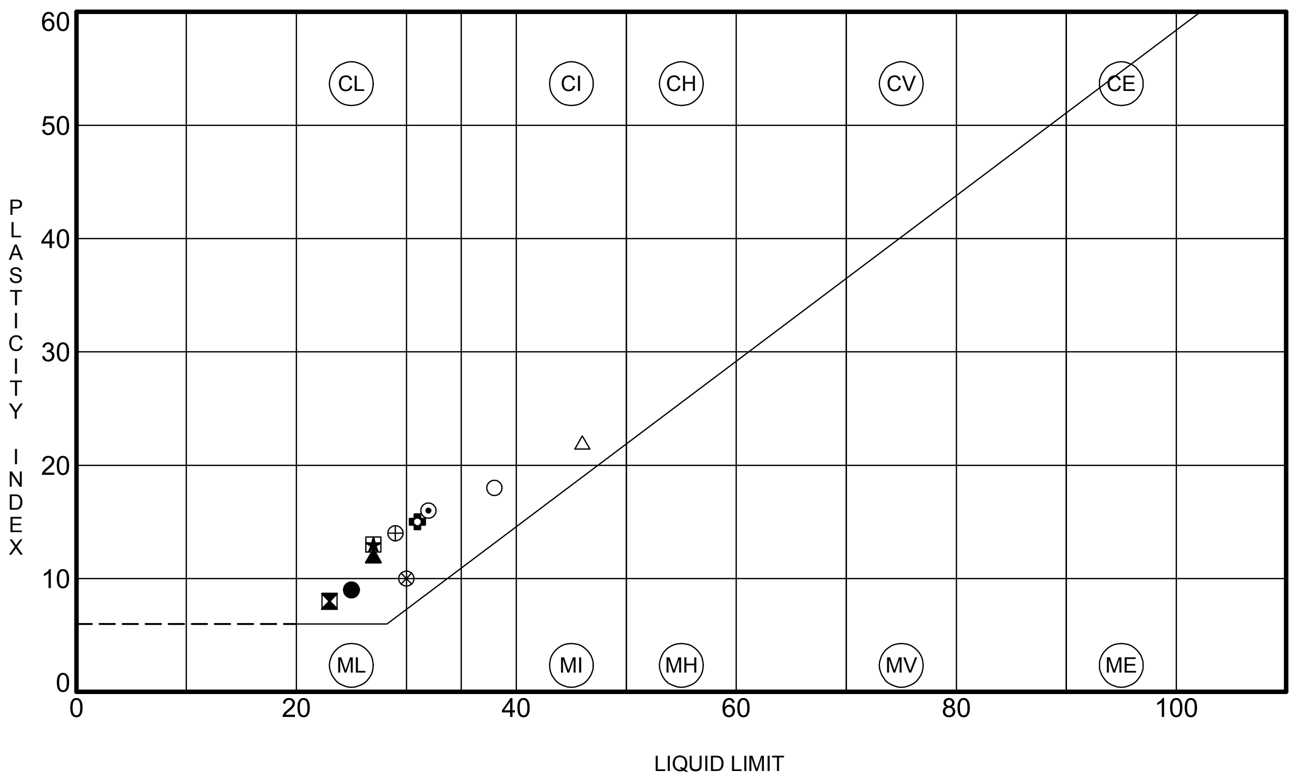
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3 ALL.GDT



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON CD_2**	**3.70**	**25**	**16**	**9**		
⧗	**EA POYNTON CD_2**	**4.70**	**23**	**15**	**8**		
▲	**EA POYNTON CD_3**	**1.20**	**27**	**15**	**12**		
★	**EA POYNTON CD_3**	**3.20**	**27**	**14**	**13**		
⊙	**EA POYNTON CD_5**	**1.20**	**32**	**16**	**16**		
✿	**EA POYNTON CD_5**	**2.40**	**31**	**16**	**15**		
○	**EA POYNTON CD_5**	**5.70**	**38**	**20**	**18**		
△	**EA POYNTON CD_6**	**1.20**	**46**	**24**	**22**		
⊗	**EA POYNTON CD_6**	**1.70**	**30**	**20**	**10**		
⊕	**EA POYNTON CD_6**	**2.90**	**29**	**15**	**14**		
□	**EA POYNTON CD_6**	**5.90**	**27**	**14**	**13**		

AECOM

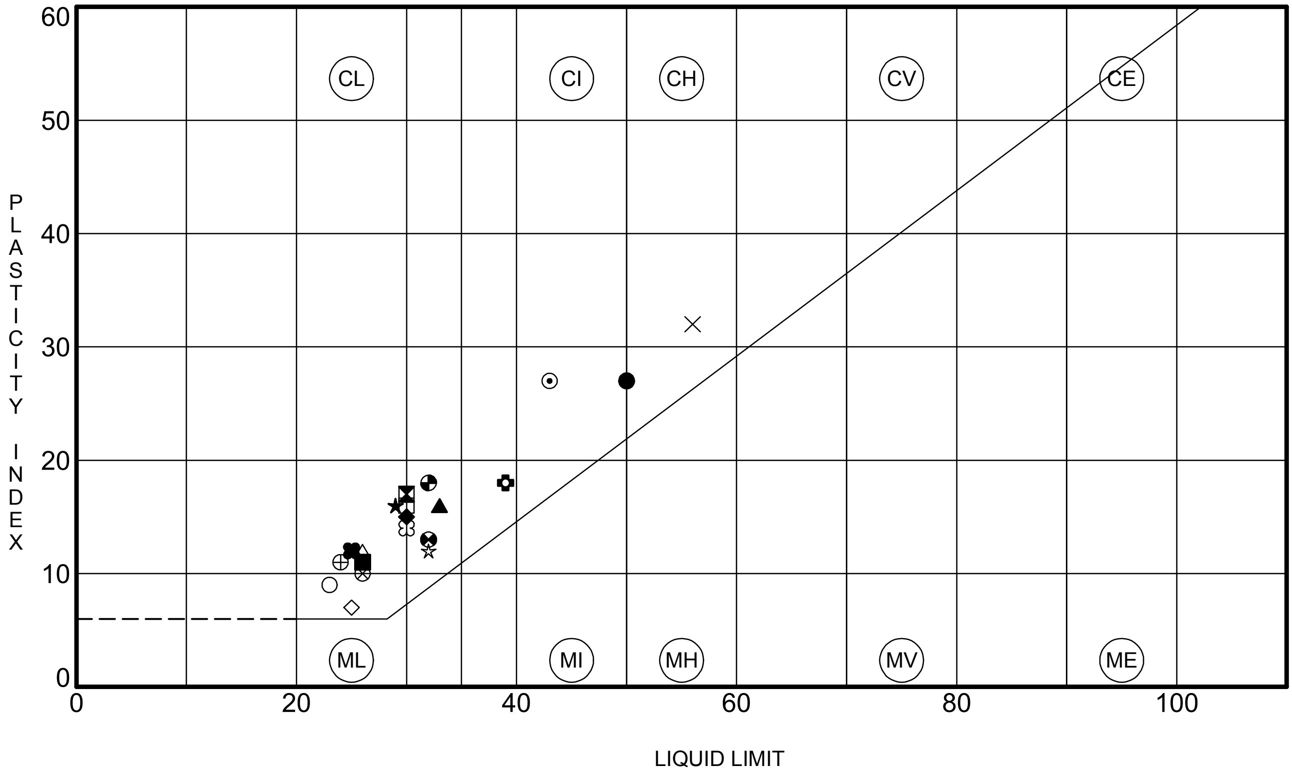
Zone: WCML to Styal Railway(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 49_1**	**17.80**	**50**	**23**	**27**		
⧗	**EA POYNTON 49_2**	**3.70**	**30**	**13**	**17**		
▲	**EA POYNTON 49_3**	**5.20**	**33**	**17**	**16**		
★	**EA POYNTON 49_3**	**6.40**	**29**	**13**	**16**		
⊙	**EA POYNTON 49_3**	**16.60**	**43**	**16**	**27**		
✿	**EA POYNTON 49_3**	**17.80**	**39**	**21**	**18**		
○	**EA POYNTON 50_1**	**8.40**	**23**	**14**	**9**		
△	**EA POYNTON 51_3**	**2.40**	**26**	**14**	**12**		
⊗	**EA POYNTON 51_3**	**3.60**	**26**	**16**	**10**		
⊕	**EA POYNTON 51_3**	**4.80**	**24**	**13**	**11**		
□	**EA POYNTON 51_3**	**7.80**	**30**	**14**	**16**		
⊗	**EA POYNTON 69_1**	**2.40**	**32**	**19**	**13**		
◕	**EA POYNTON 69_1**	**3.60**	**32**	**14**	**18**		
☆	**EA POYNTON 69_1**	**4.80**	**32**	**20**	**12**		
✧	**EA POYNTON 69_1**	**6.00**	**30**	**16**	**14**		
■	**EA POYNTON 69_1**	**8.40**	**26**	**15**	**11**		
◆	**EA POYNTON 69_1**	**12.00**	**30**	**15**	**15**		
◇	**EA POYNTON 69_1**	**17.40**	**25**	**18**	**7**		
×	**EA POYNTON 69_1**	**20.30**	**56**	**24**	**32**		
✖	**EA POYNTON 69_2**	**3.60**	**25**	**13**	**12**		

AECOM

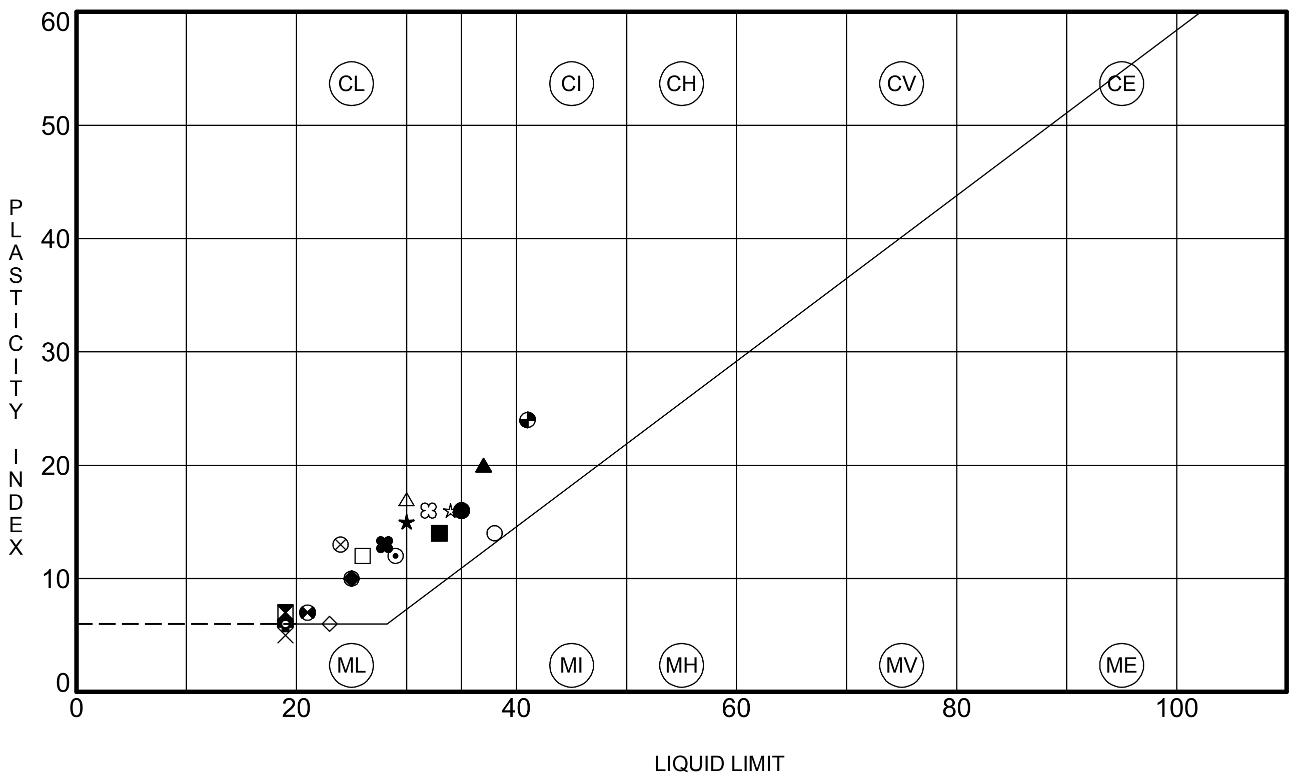
Zone: WCML to Styal Railway(included)
Strata Type: GFC

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**EA POYNTON 69_2**	**4.80**	**35**	**19**	**16**		
⧗	**EA POYNTON 69_2**	**7.20**	**19**	**12**	**7**		
▲	**EA POYNTON 69_2**	**8.40**	**37**	**17**	**20**		
★	**EA POYNTON 69_2**	**9.70**	**30**	**15**	**15**		
⊙	**EA POYNTON 69_2**	**11.50**	**29**	**17**	**12**		
✿	**EA POYNTON 69_2**	**19.10**	**19**	**13**	**6**		
○	**EA POYNTON 69_3**	**1.20**	**38**	**24**	**14**		
△	**EA POYNTON 69_3**	**4.80**	**30**	**13**	**17**		
⊗	**EA POYNTON 69_3**	**6.00**	**24**	**11**	**13**		
⊕	**EA POYNTON 69_3**	**8.40**	**25**	**15**	**10**		
□	**EA POYNTON 69_3**	**9.60**	**26**	**14**	**12**		
⊛	**EA POYNTON 69_3**	**10.55**	**21**	**14**	**7**		
◕	**EA POYNTON 69_4**	**1.20**	**41**	**17**	**24**		
☆	**EA POYNTON 69_4**	**2.40**	**34**	**18**	**16**		
✤	**EA POYNTON 69_4**	**3.60**	**32**	**16**	**16**		
■	**EA POYNTON 69_4**	**4.80**	**33**	**19**	**14**		
◆	**EA POYNTON 69_4**	**7.30**	**25**	**15**	**10**		
◇	**EA POYNTON 69_4**	**8.40**	**23**	**17**	**6**		
×	**EA POYNTON 69_4**	**9.70**	**19**	**14**	**5**		
✖	**EA POYNTON 69_4**	**20.00**	**28**	**15**	**13**		

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: GFC

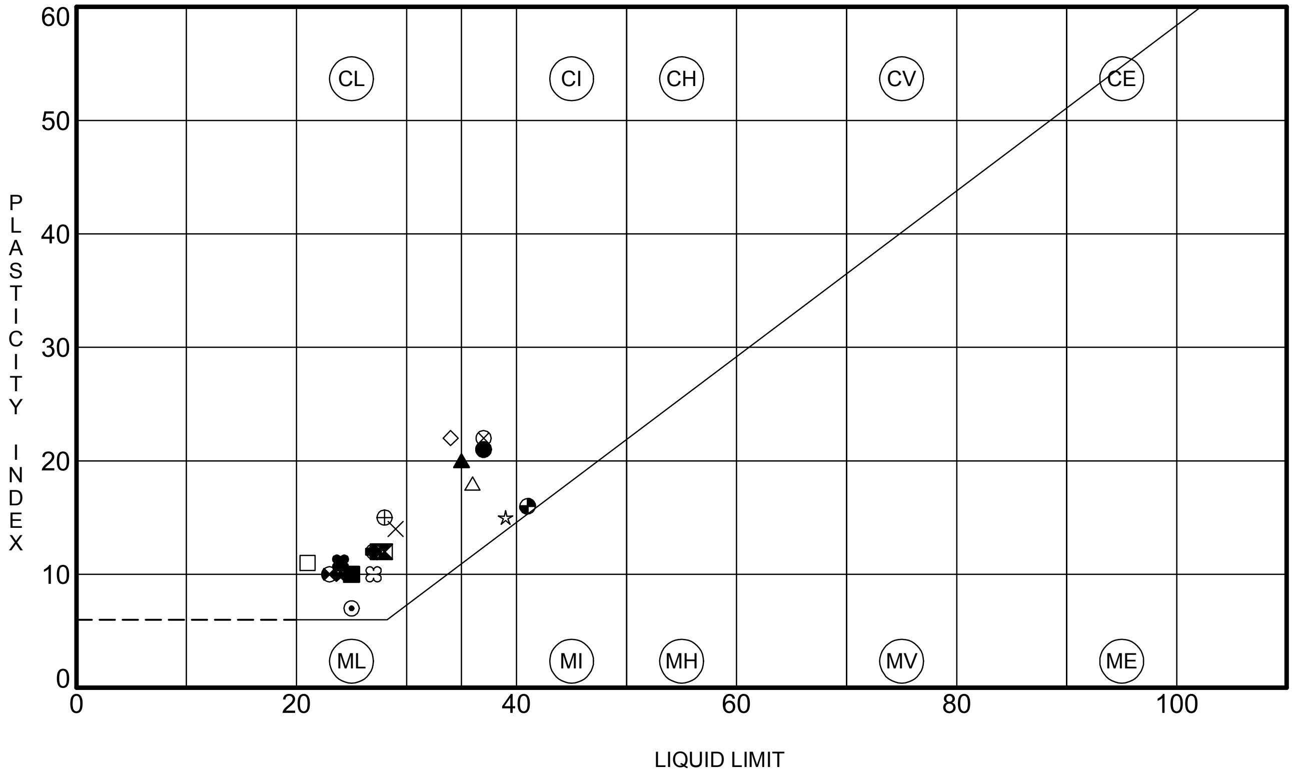
ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 ATTERBERG LIMITS_FILTERED + METROLINK.GPJ AGS3_ALL.GDT



Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
● EA POYNTON 69_5	2.40	37	16	21		
EA POYNTON 69_5	3.60	28	16	12		
▲ EA POYNTON 69_5	4.80	35	15	20		
★ EA POYNTON 69_5	6.00	24	14	10		
⊙ EA POYNTON 69_6	7.20	25	18	7		
EA POYNTON 70_1	3.60	27	15	12		
○ EA POYNTON 70_1	4.80	27	15	12		
△ EA POYNTON 70_3	1.00	36	18	18		
⊗ EA POYNTON 70_3	2.40	37	15	22		
⊕ EA POYNTON 70_3	3.60	28	13	15		
□ EA POYNTON 70_3	4.80	21	10	11		
EA POYNTON 70_3	6.45	23	13	10		
EA POYNTON 70_4	1.20	41	25	16		
☆ EA POYNTON 70_4	2.40	39	24	15		
EA POYNTON 70_4	4.80	27	17	10		
■ EA POYNTON 70_4	6.00	25	15	10		
◆ EA POYNTON 70_4	7.20	27	15	12		
◇ EA POYNTON 71_3	4.20	34	12	22		
× EA POYNTON 71_3	4.70	29	15	14		
EA POYNTON 71_3	6.40	24	13	11		

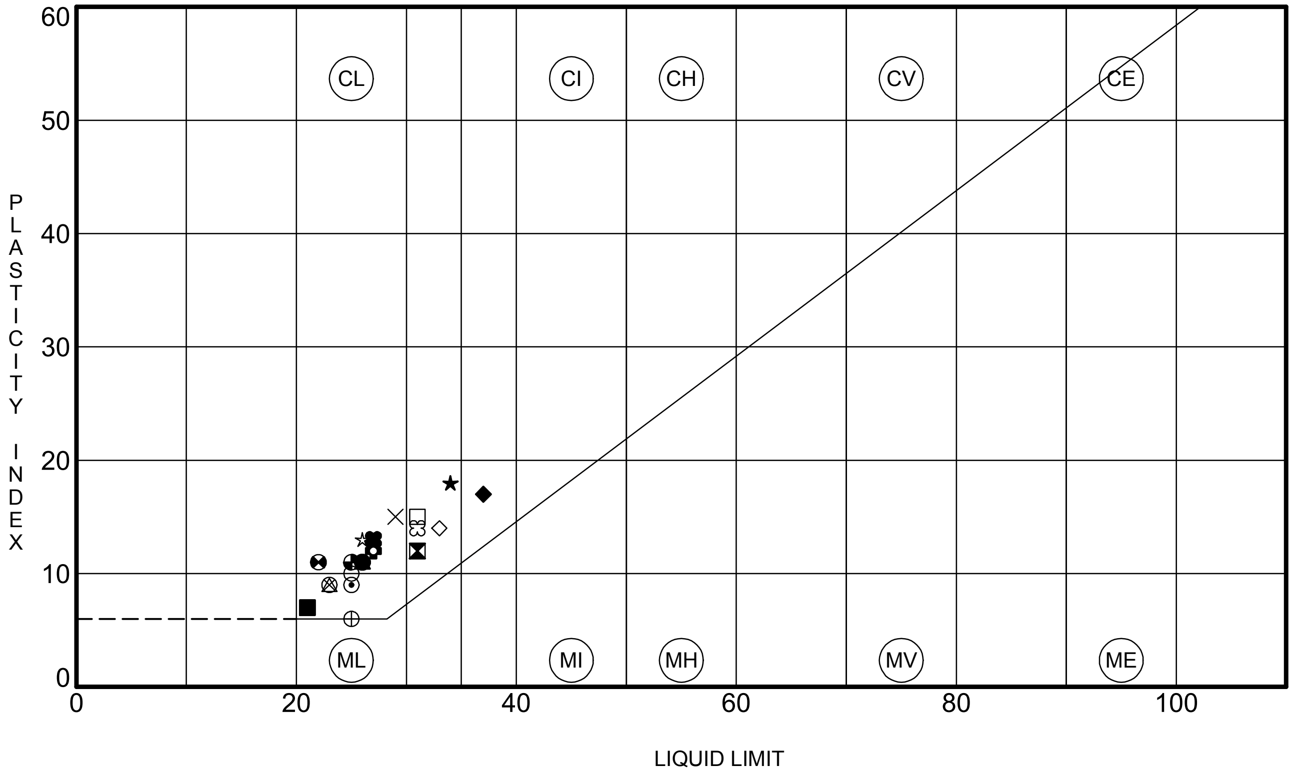
Zone: WCML to Styal Railway(included)
Strata Type: GFC

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
EA POYNTON 71_3	7.50	26	15	11		
EA POYNTON 72_1	1.20	31	19	12		
EA POYNTON 72_1	3.60	26	15	11		
EA POYNTON 72_2	1.20	34	16	18		
EA POYNTON 74_1	2.40	25	16	9		
EA POYNTON 74_1	3.60	27	15	12		
EA POYNTON 74_1	4.80	25	15	10		
EA POYNTON 74_1	6.00	23	14	9		
EA POYNTON 74_1	7.20	23	14	9		
EA POYNTON 74_3	1.20	25	19	6		
EA POYNTON 74_4	1.20	31	16	15		
EA POYNTON 74_4	2.40	22	11	11		
EA POYNTON 74_4	3.60	25	14	11		
EA POYNTON 74_4	4.80	26	13	13		
EA POYNTON 74_4	6.00	31	17	14		
EA POYNTON 74_5	11.50	21	14	7		
EA POYNTON 75_1	6.10	37	20	17		
EA POYNTON 75_4	1.70	33	19	14		
EA POYNTON CD_4	1.20	29	14	15		
EA POYNTON CD_4	2.40	27	14	13		

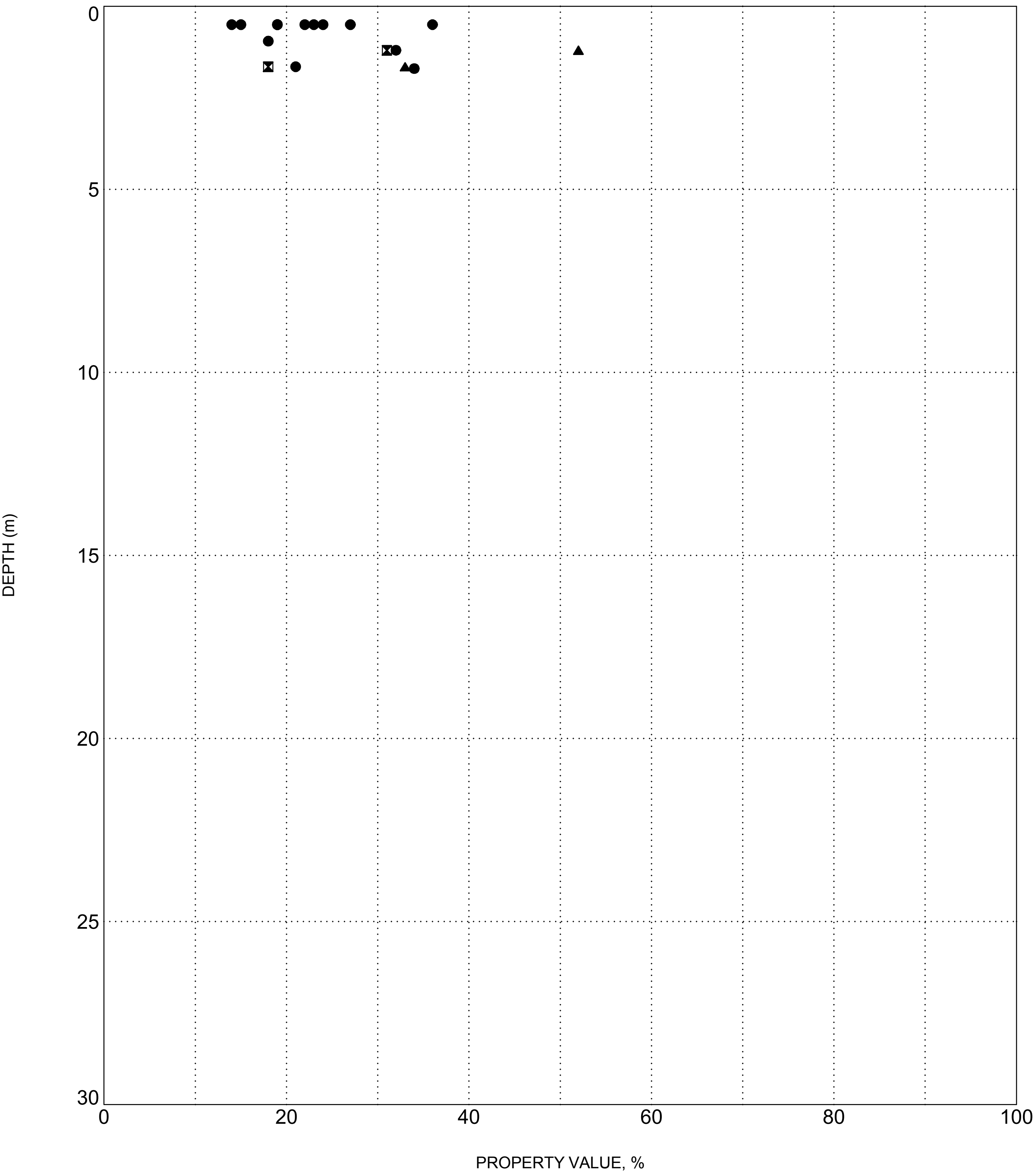
AECOM

Zone: WCML to Styal Railway(included)
Strata Type: GFC

ATTERBERG LIMITS RESULTS

Client: SMBC
Project: SEMMMS A6 to Airport Relief Road
Number: 60186094

AGS3 ATTERBERG LIMITS FILTERED + METROLINK.GPJ AGS3_ALL.GDT



LEGEND
● Moisture Content
⊠ Plastic Limit
▲ Liquid Limit

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: AL

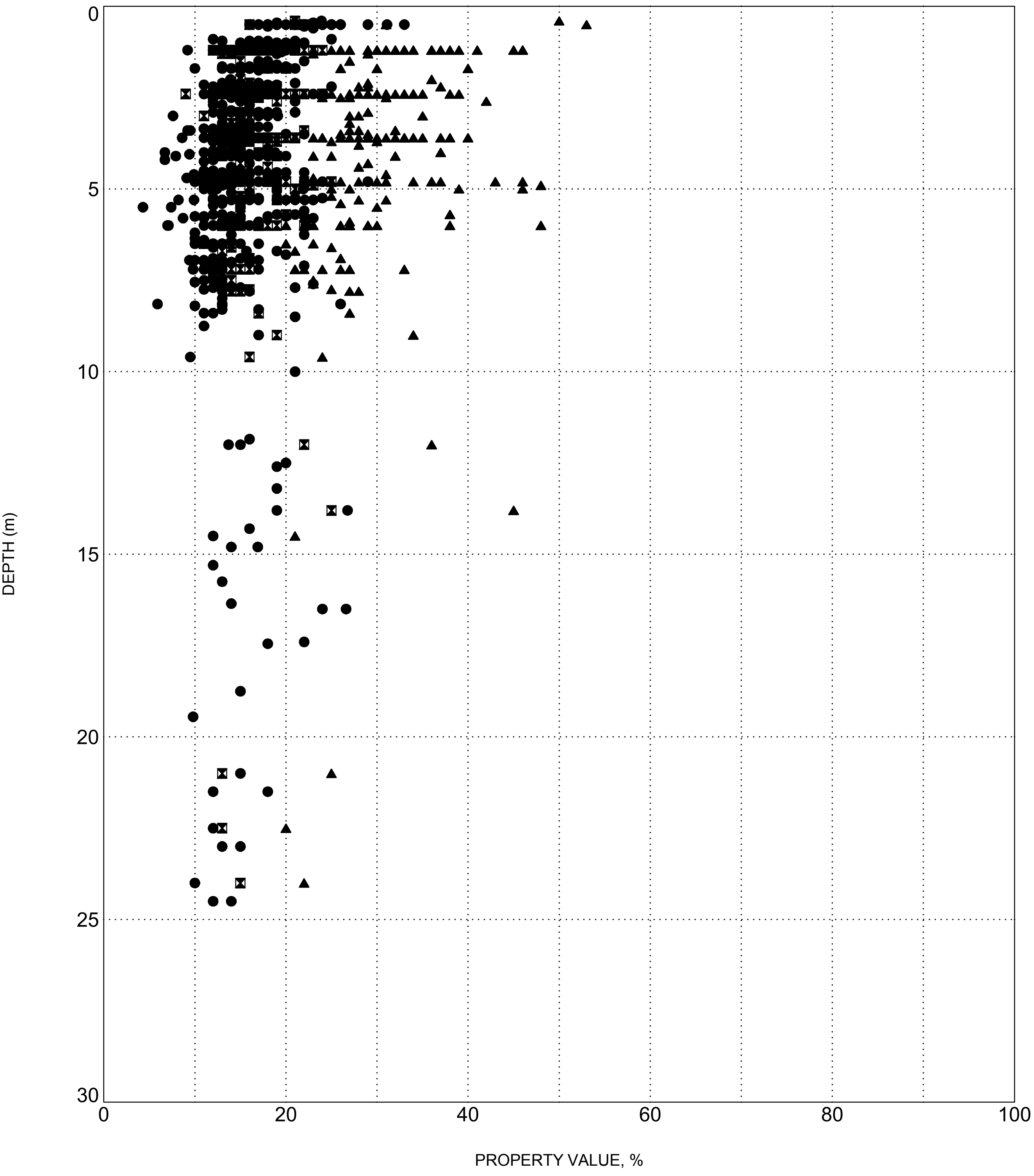
INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Moisture Content
⊠ Plastic Limit
▲ Liquid Limit

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

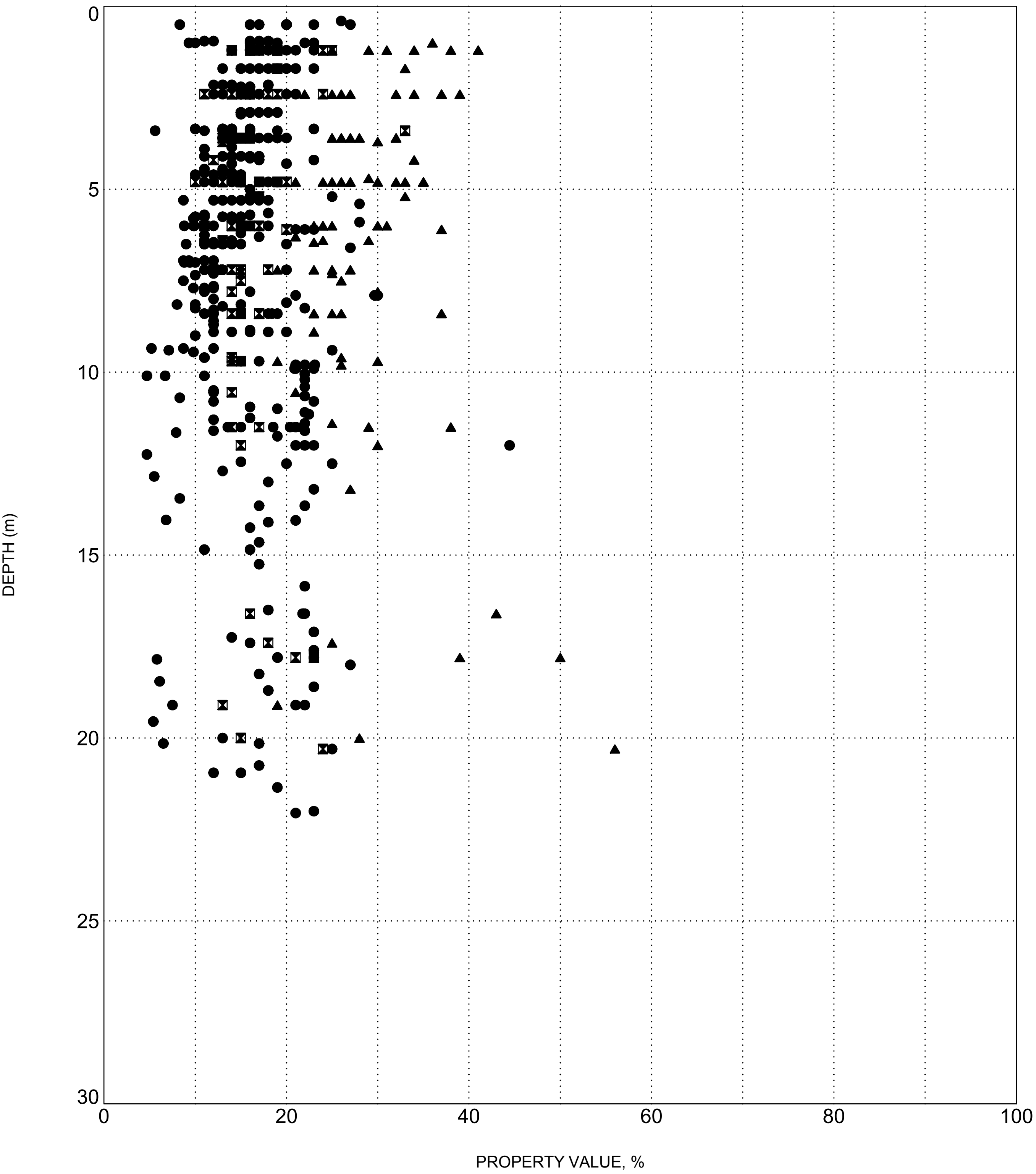
Zone: WCML to Styal Railway(included)
Strata Type: CT

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Moisture Content
⊠ Plastic Limit
▲ Liquid Limit

AECOM

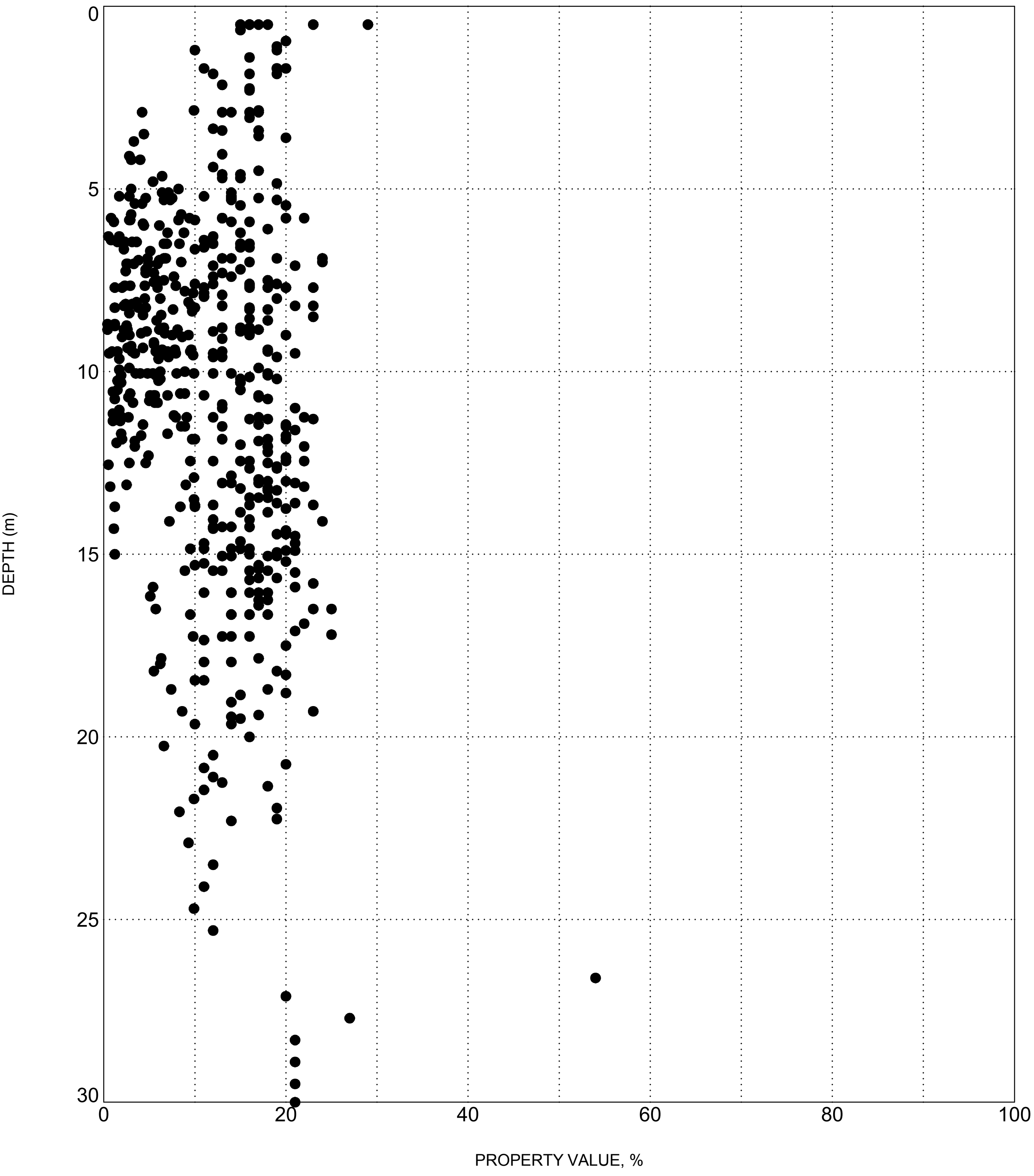
Zone: WCML to Styal Railway(included)
Strata Type: GFC

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Moisture Content
Plastic Limit
▲ Liquid Limit

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

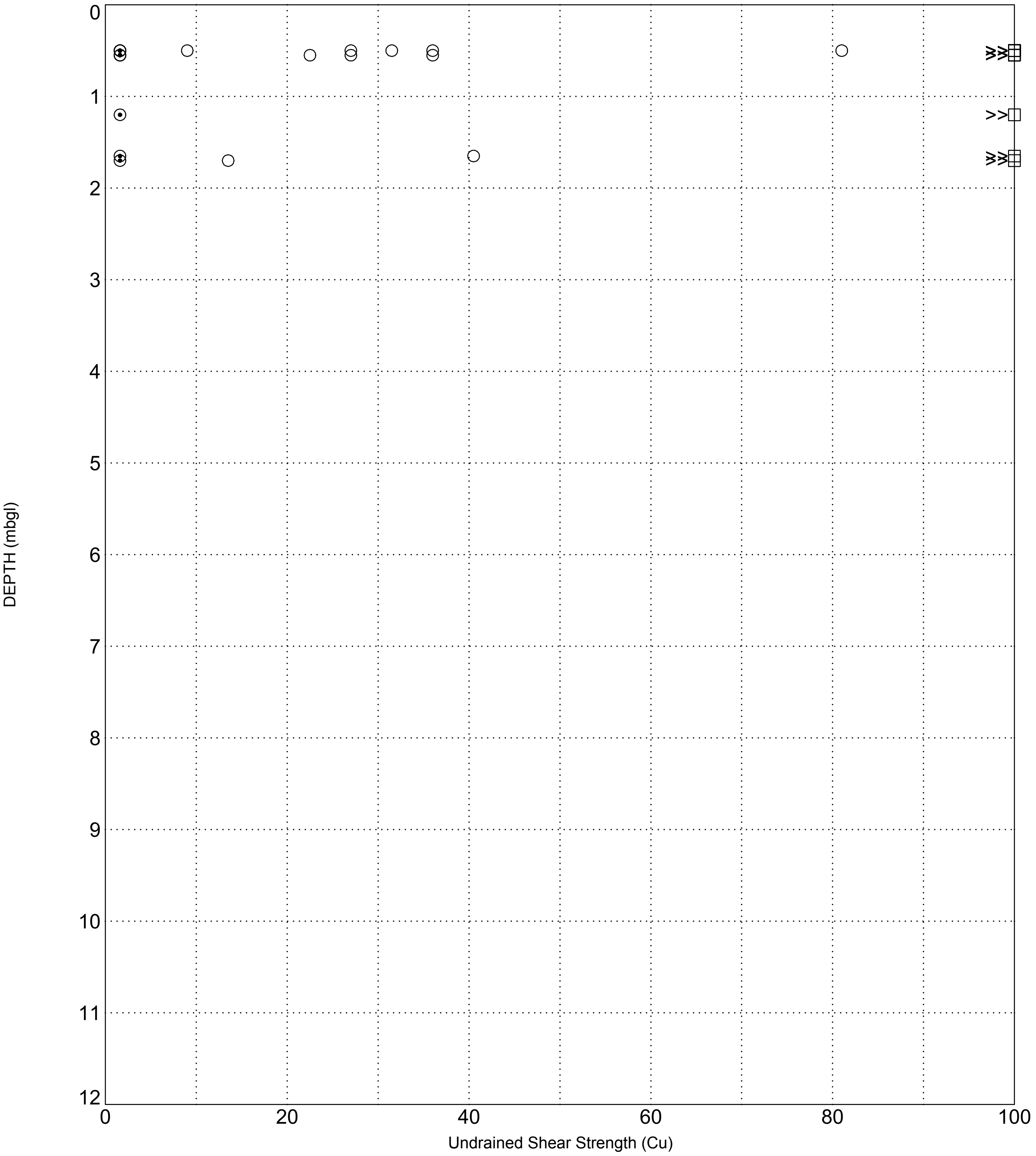
Zone: WCML to Styal Railway(included)
Strata Type: Glacio Fluvial Granular

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: AL

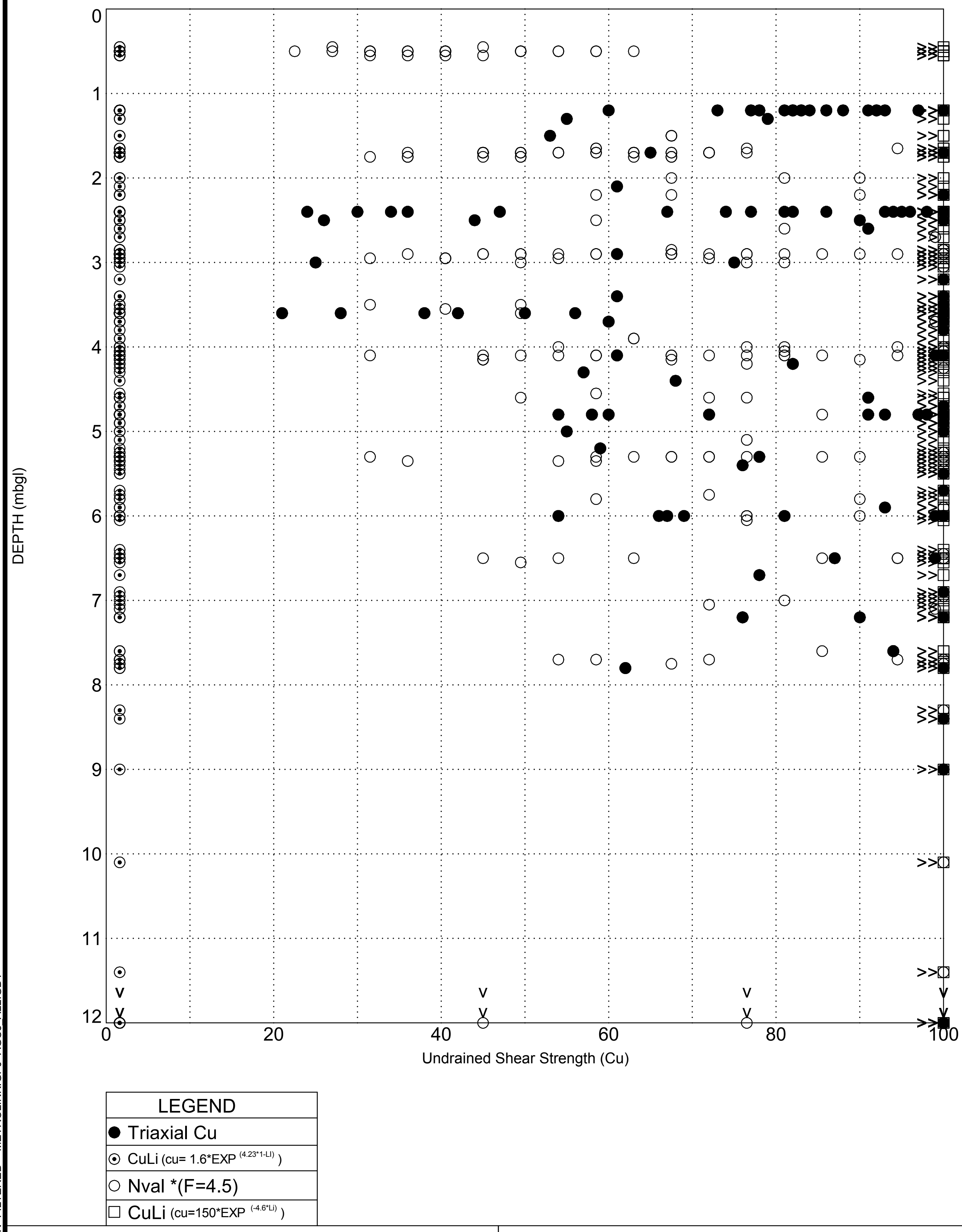
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT

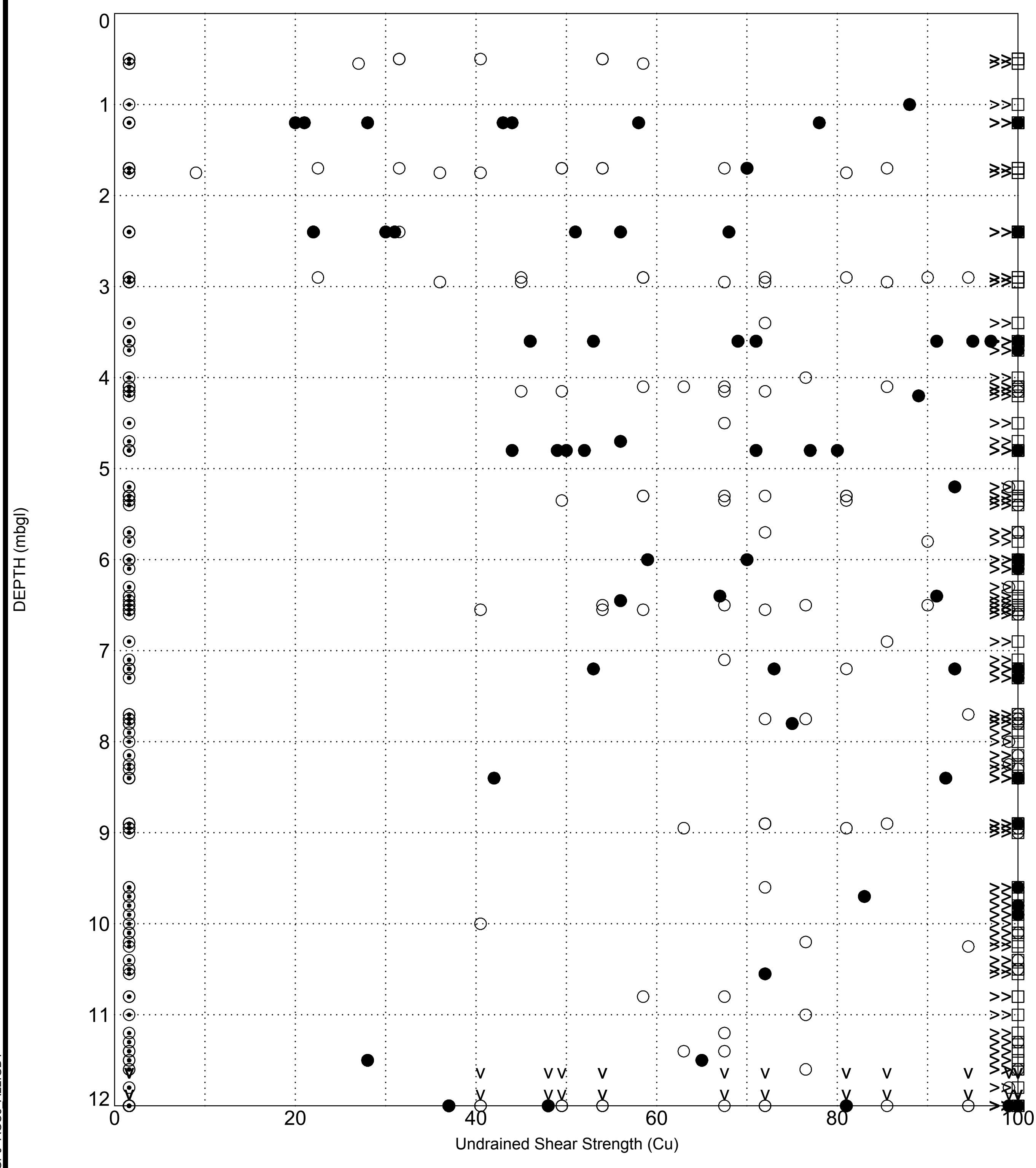
Zone: WCML to Styal Railway(included)
Strata Type: CT

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: GFC

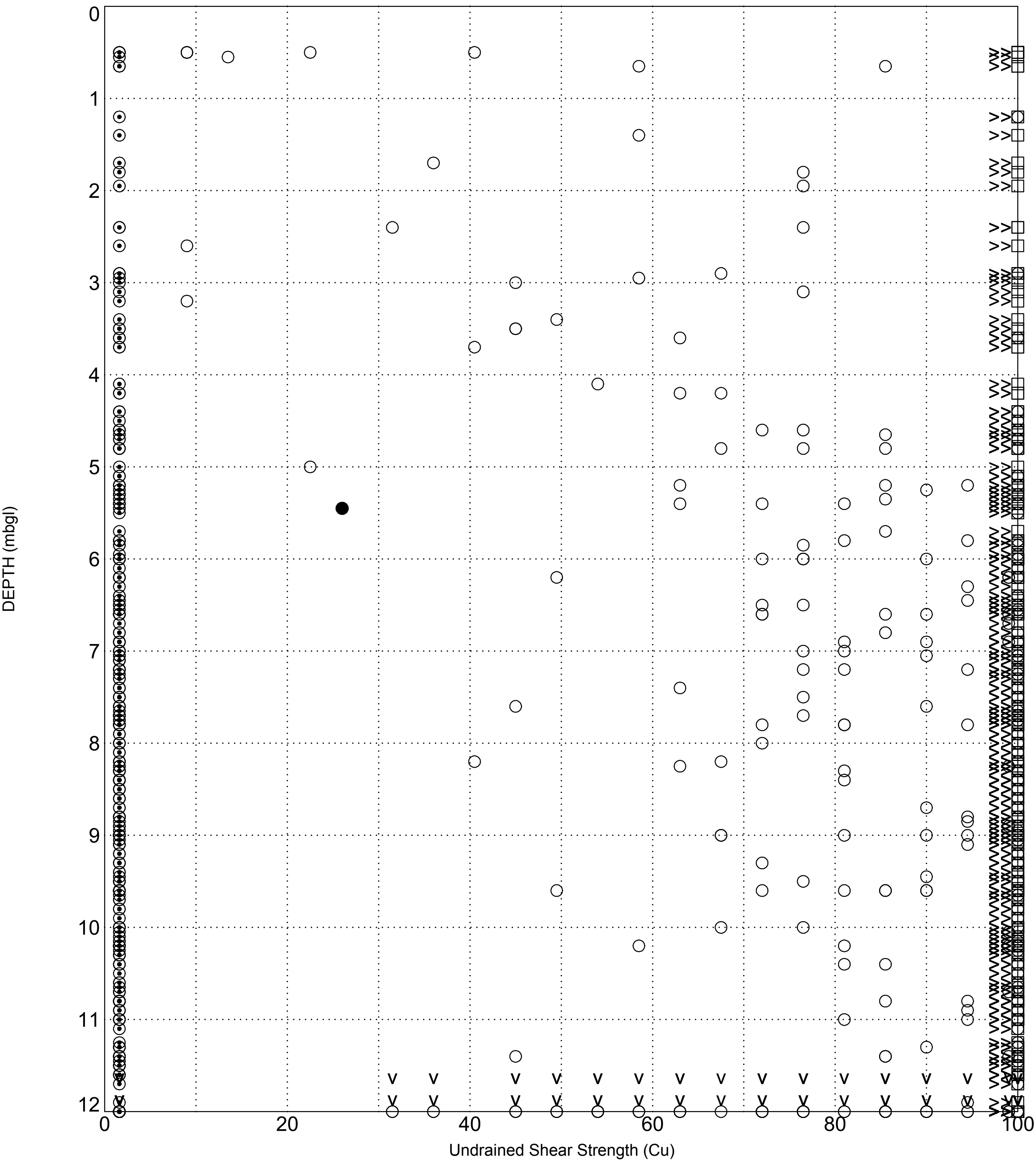
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: WCML to Styal Railway(included)
Strata Type: Glacio Fluvial - Granular

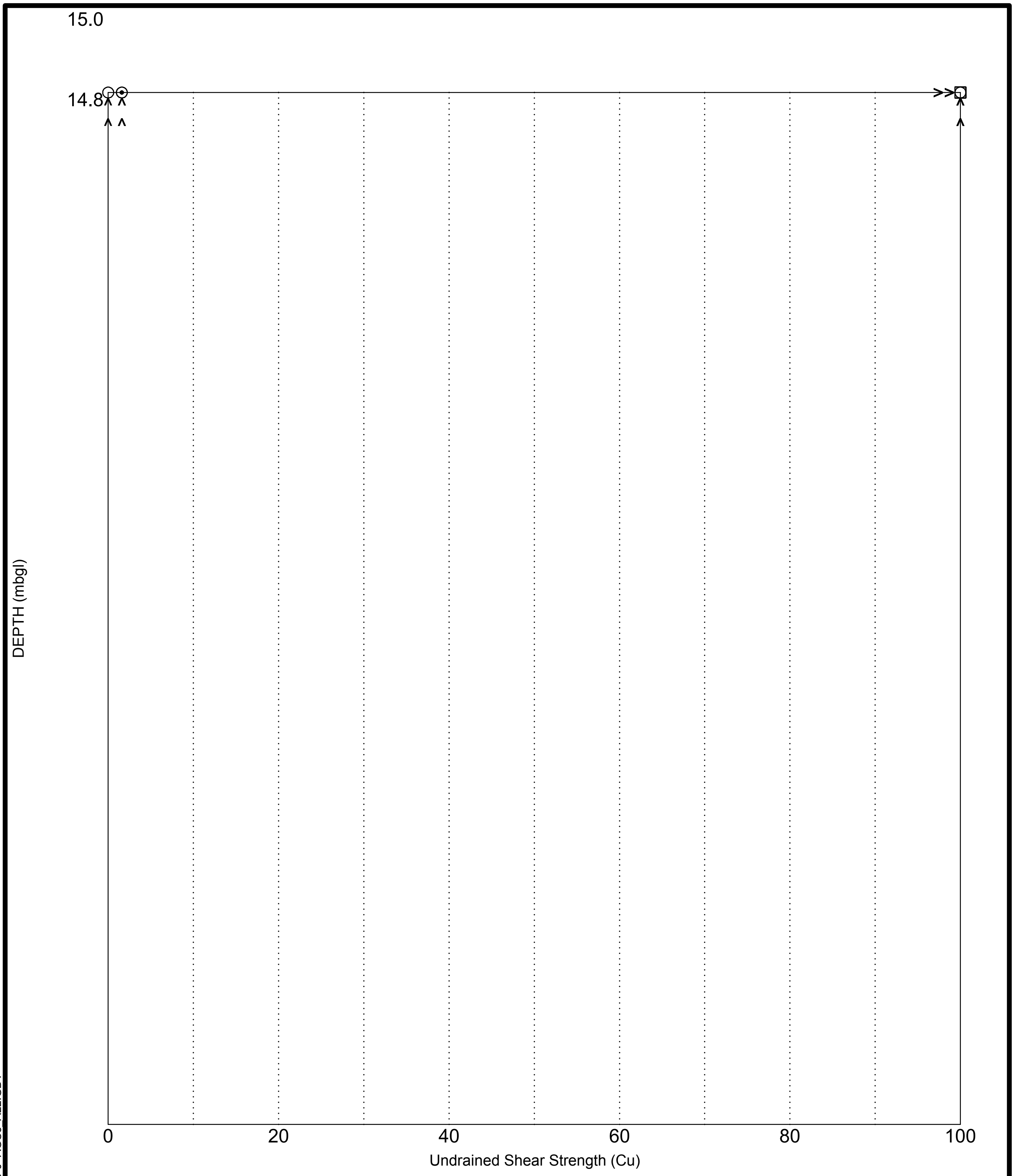
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

Zone: WCML to Styal Railway(included)
Strata Type: Rock

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT

Appendix A5

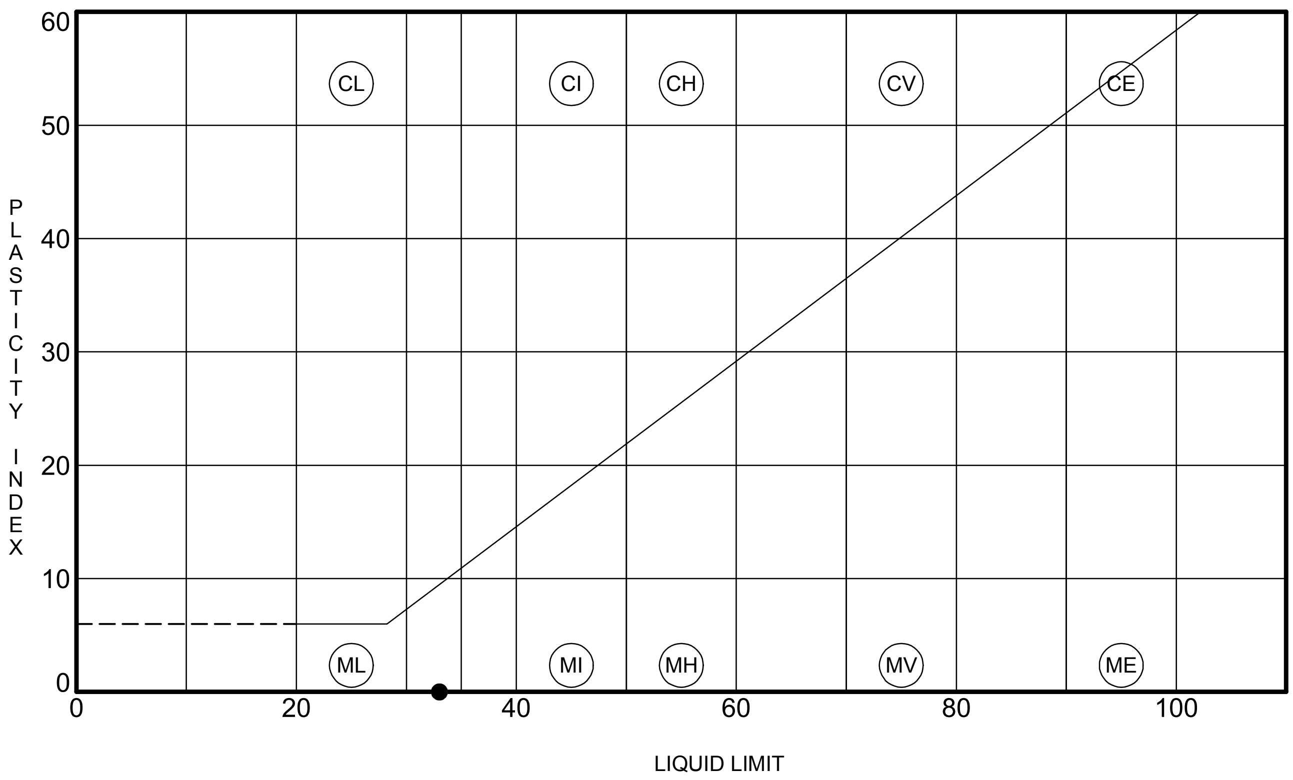
Geotechnical Plots North Styal Roundabout - MIA

Page deliberately blank for double sided printing

Appendix A5

Geotechnical Plots North Styal Roundabout - MIA

Page deliberately blank for double sided printing



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**GEO METRO TP109A_AIR**	**0.40**	**33**	**NP**			

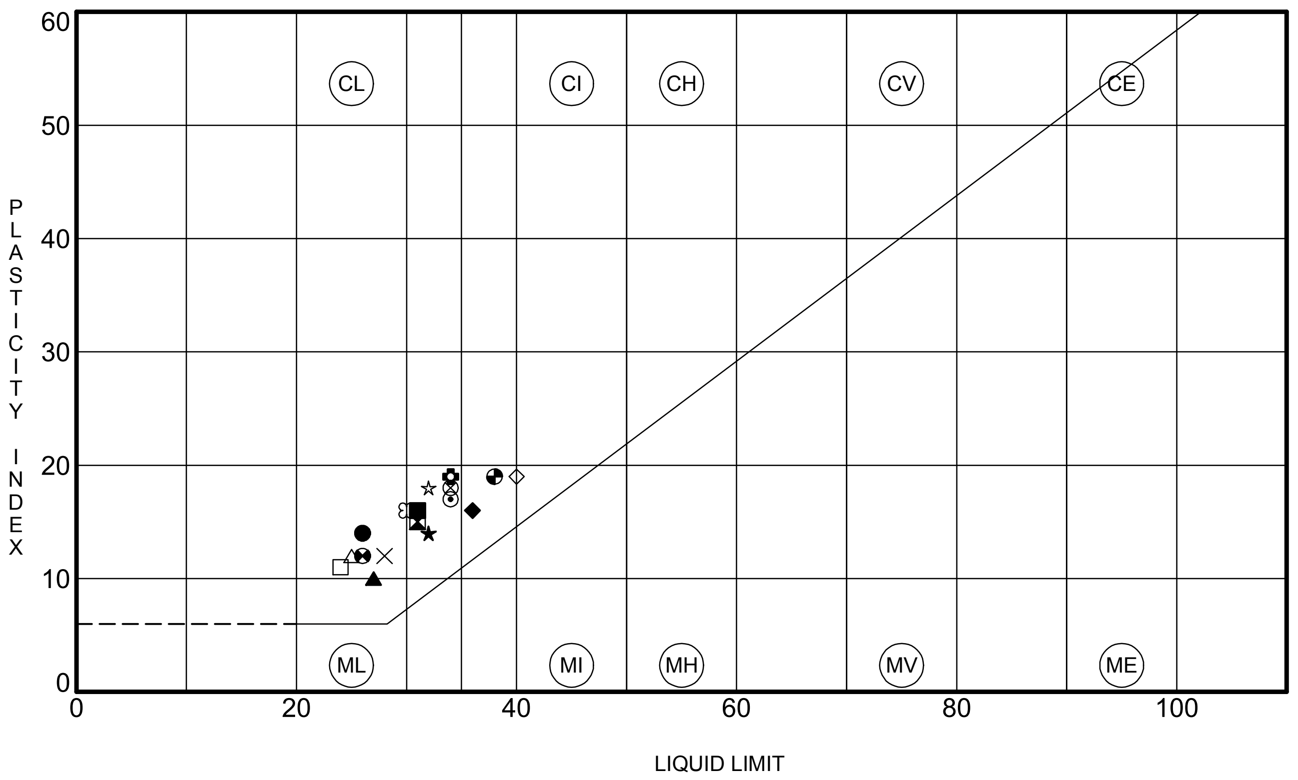
Zone: Manchester Airport(included)
Strata Type: MGC

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID Depth (m)	LL	PL	PI	Fines	Classification
●	GEO METRO BH50_AIR.25	26	12	14		
⊠	GEO METRO BH51_AIR.55	31	16	15		
▲	GEO METRO BH52_AIR.65	27	17	10		
★	GEO METRO BH59_AIR.90	32	18	14		
⊙	GEO METRO TP109A_AIR0	34	17	17		
✿	GEO METRO TP109A_AIR0	34	15	19		
○	GEO METRO TP109B_AIR0	31	15	16		
△	GEO METRO WS52B_AIR0	25	13	12		
⊗	GEO METRO WS52C_AIR0	34	16	18		
⊕	GEO METRO WS52C_AIR0	31	15	16		
□	GEO METRO WS52C_AIR0	24	13	11		
⊗	GEO METRO WS52C_AIR0	26	14	12		
◕	GEO METRO WS52D_AIR0	38	19	19		
☆	GEO METRO WS53_AIR70	32	14	18		
✿	GEO METRO WS53_AIR10	30	14	16		
■	GEO METRO WS54_AIR00	31	15	16		
◆	GEO METRO WS55_AIR30	36	20	16		
◇	GEO METRO WSTP112_AIR 1.30	40	21	19		
×	GEO METRO WSTP114_AIR 1.50	28	16	12		

AECOM

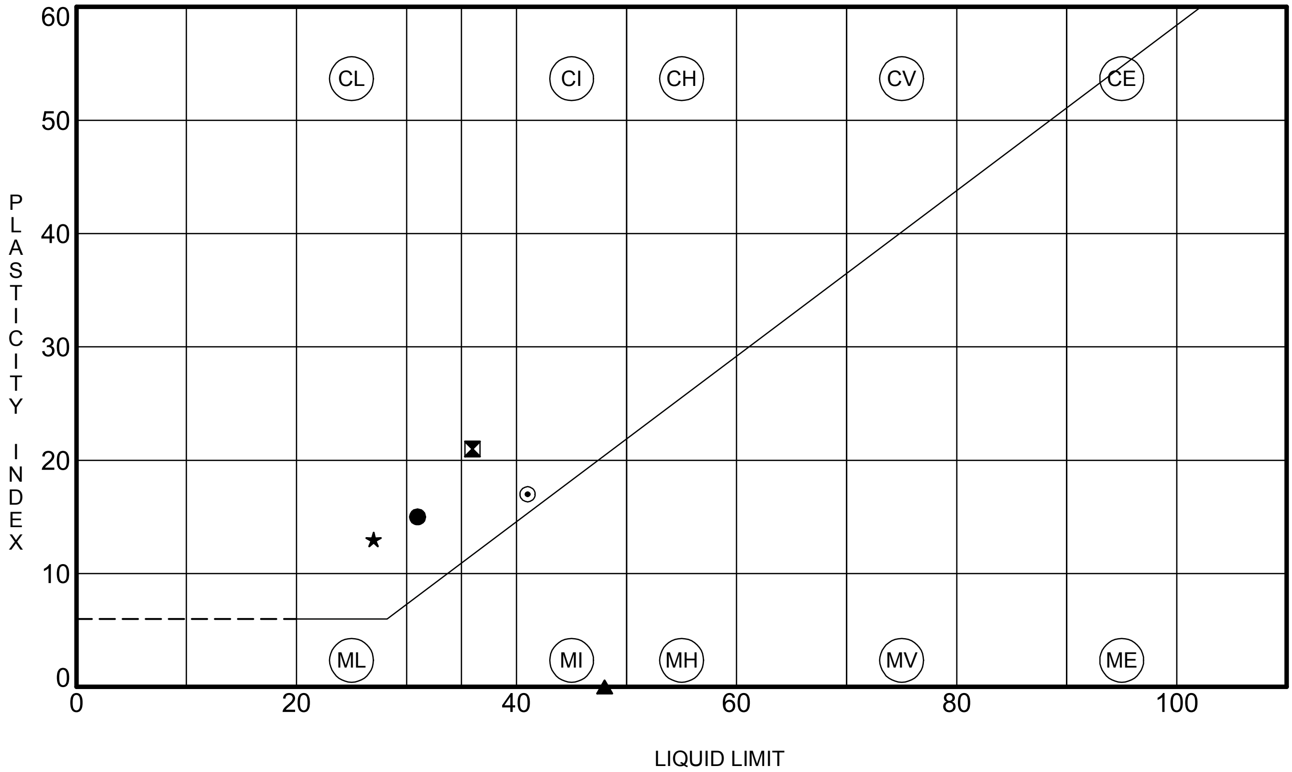
Zone: Manchester Airport(included)
Strata Type: CT

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



	Hole ID	Depth (m)	LL	PL	PI	Fines	Classification
●	**GEO METRO TP109B_AIR**	**2.40**	**31**	**16**	**15**		
⧗	**GEO METRO TP111_AIR**	**1.40**	**36**	**15**	**21**		
▲	**GEO METRO TP113_AIR**	**0.40**	**48**	**NP**			
★	**GEO METRO WS52A_AIR**	**1.20**	**27**	**14**	**13**		
⊙	**GEO METRO WS52B_AIR**	**1.30**	**41**	**24**	**17**		

AECOM

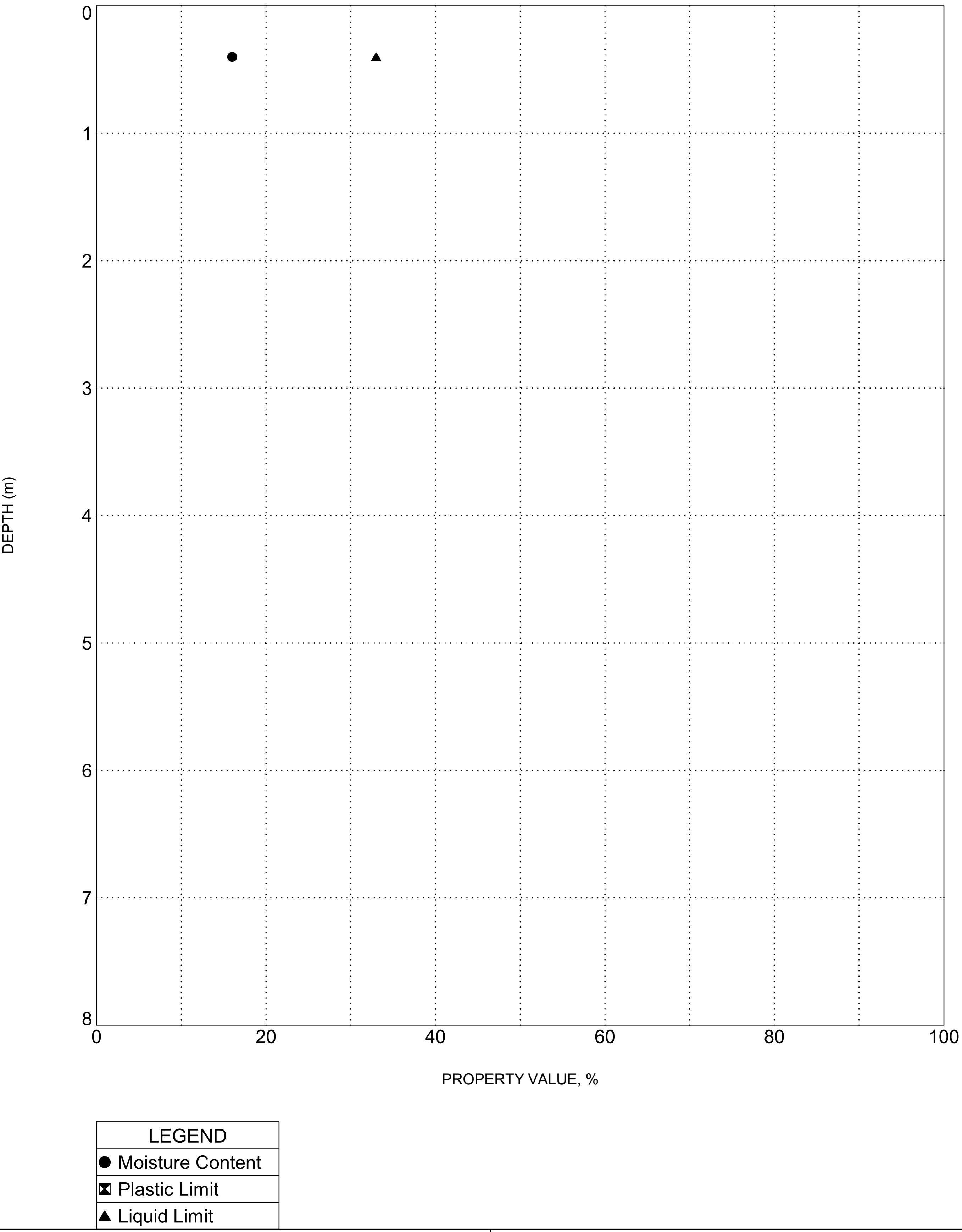
Zone: Manchester Airport(included)
Strata Type: GFC

ATTERBERG LIMITS RESULTS

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AECOM

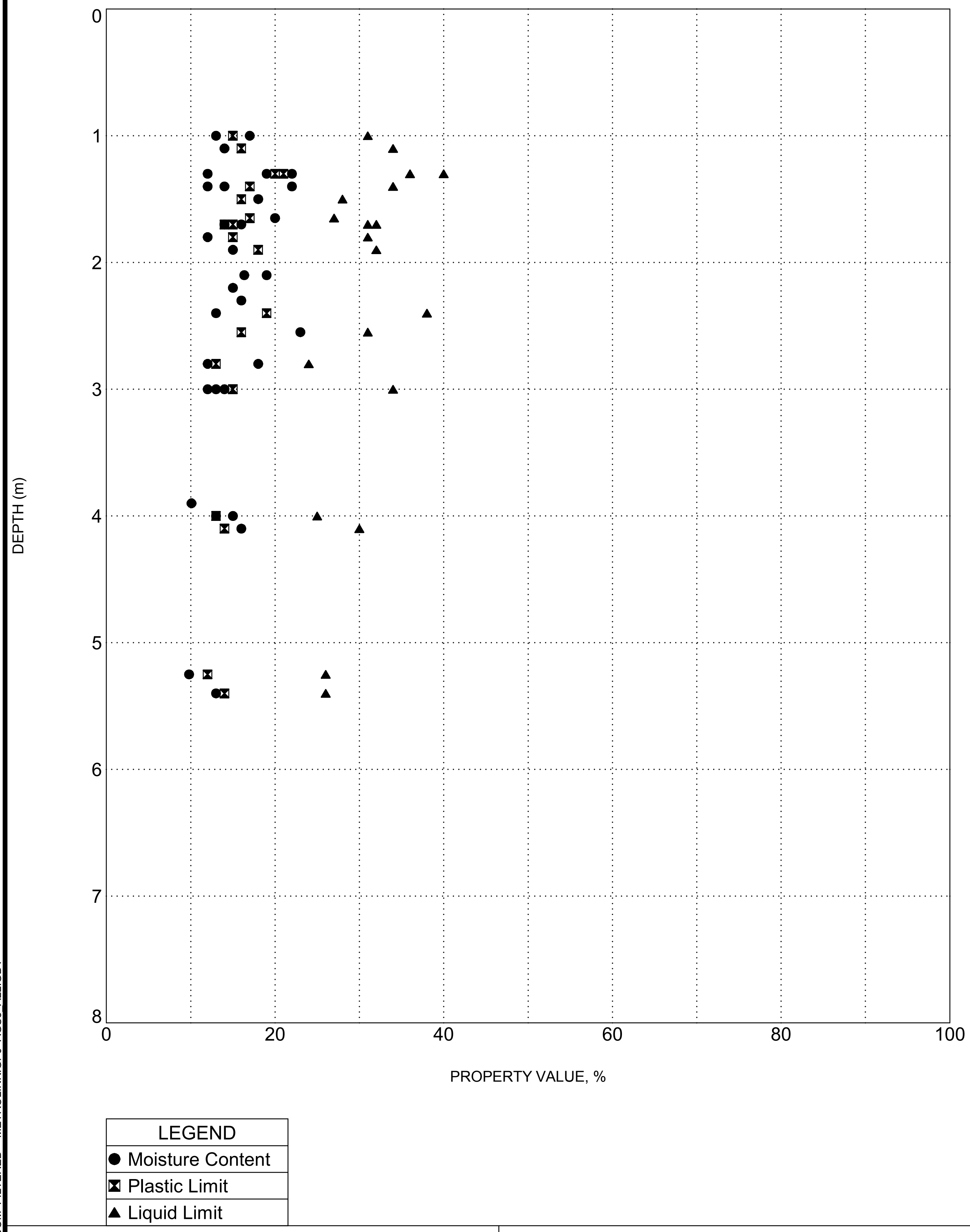
Zone: Manchester Airport(included)
Strata Type: MGC

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3_ALL.GDT

AECOM

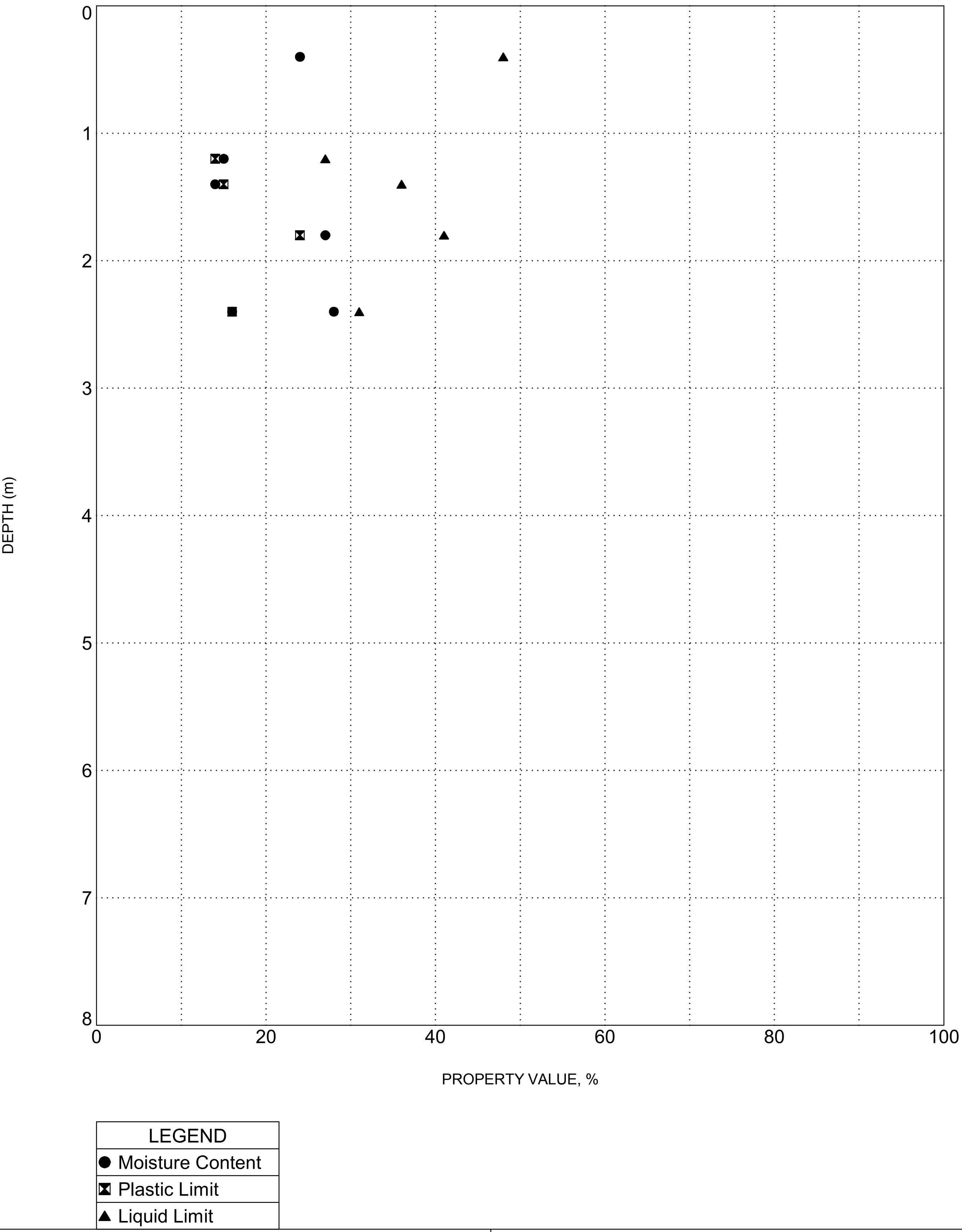
Zone: Manchester Airport(included)
Strata Type: CT

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



AECOM

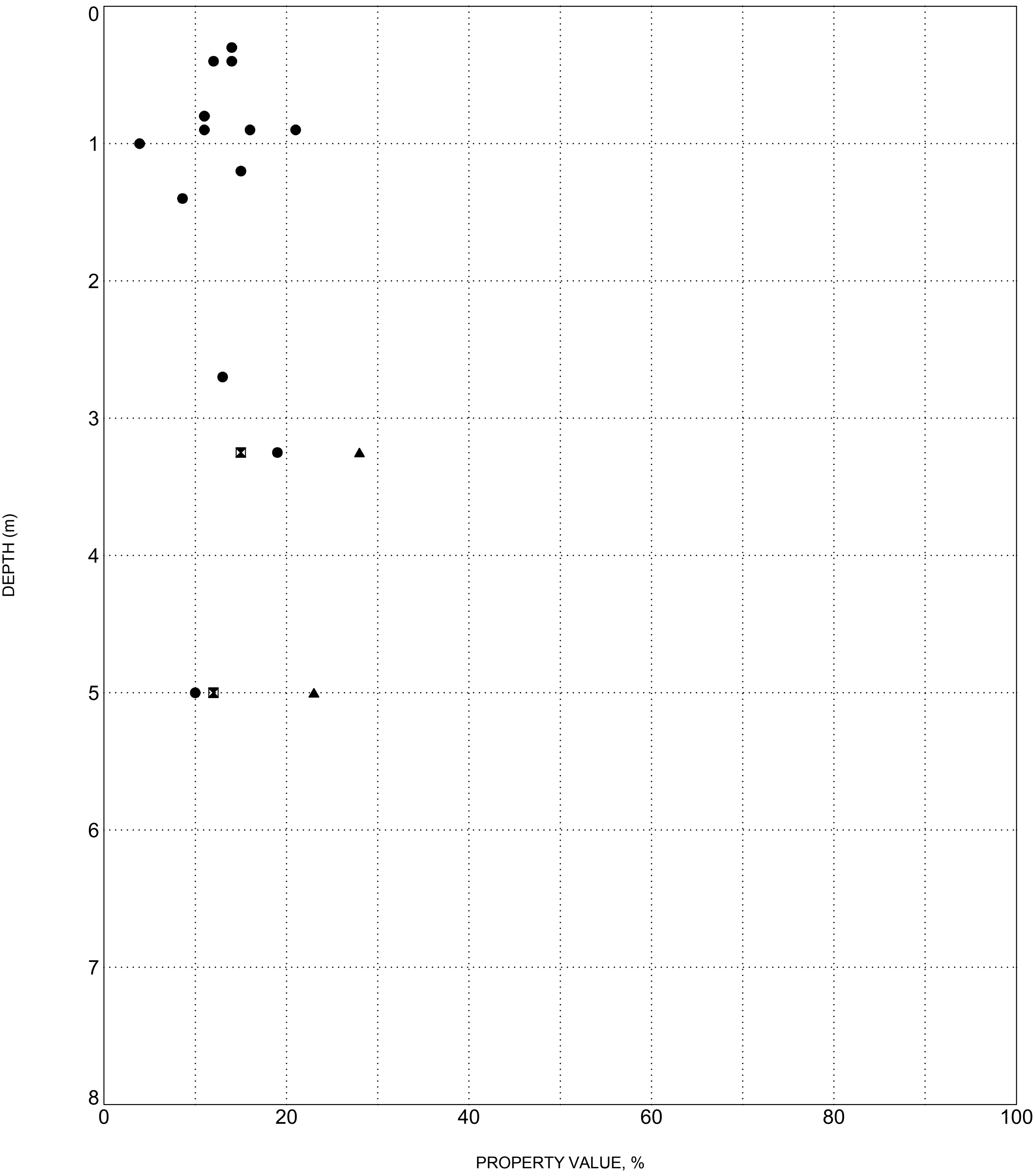
Zone: Manchester Airport(included)
Strata Type: GFC

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Moisture Content
⊠ Plastic Limit
▲ Liquid Limit

AGS3 INDEX PROPS AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

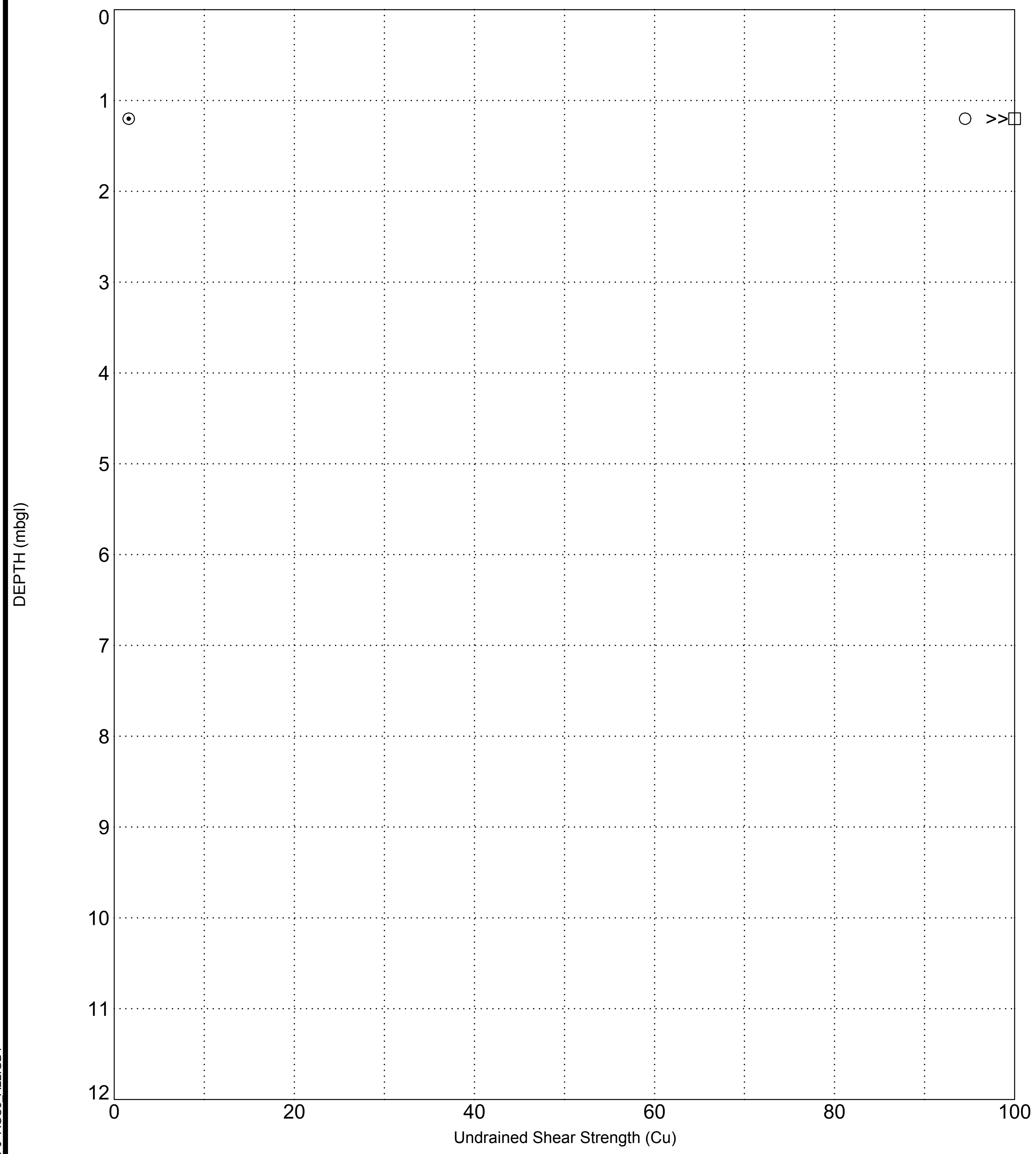
Zone: Manchester Airport(included)
Strata Type: Glacio Fluvial Granular

INDEX PROPERTIES VERSUS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⦿ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

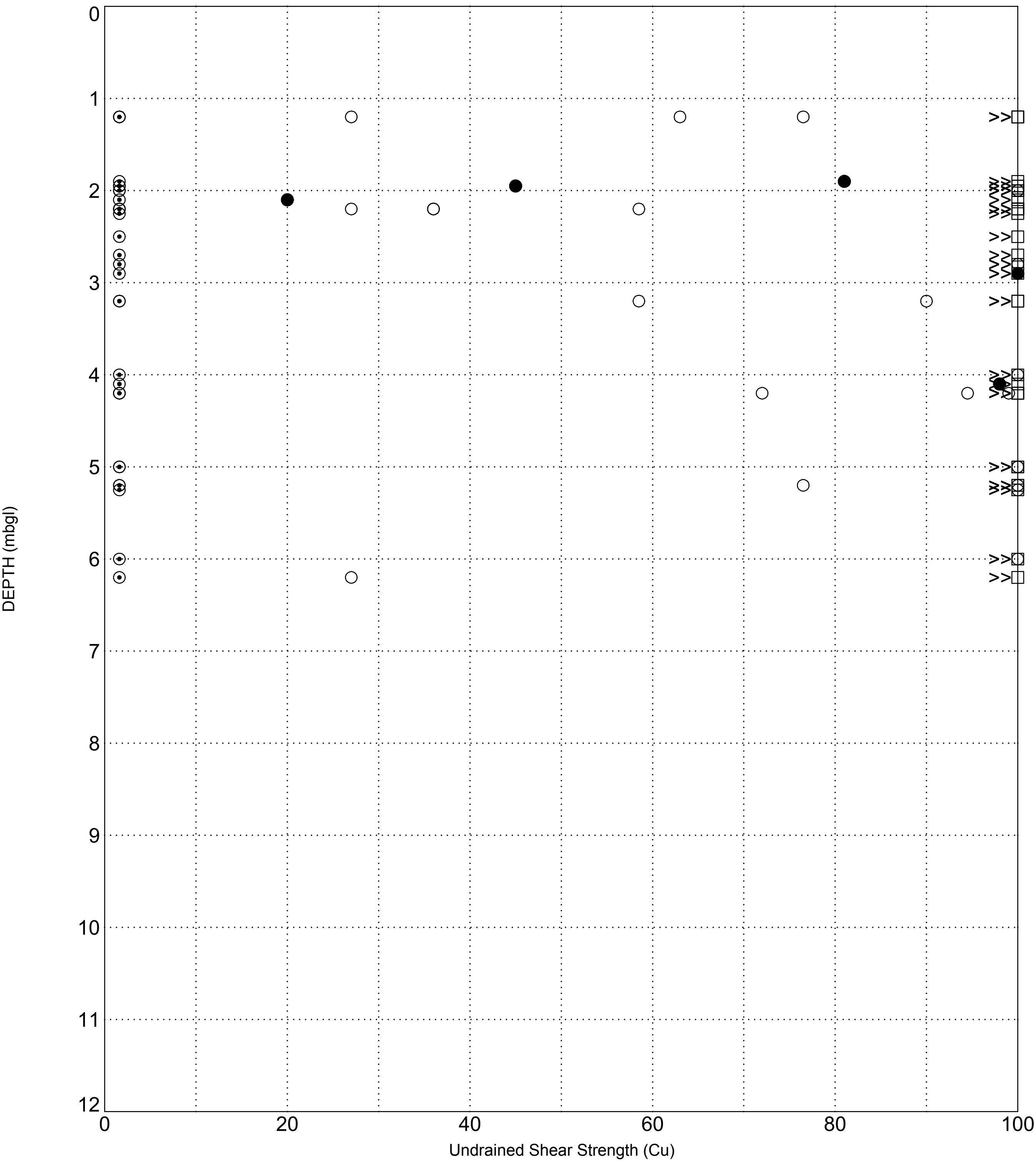
Zone: Manchester Airport(included)
Strata Type: MGC

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP (4.23*1-LI))
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP (-4.6*Li))

AECOM

Zone: Manchester Airport(included)
Strata Type: CT

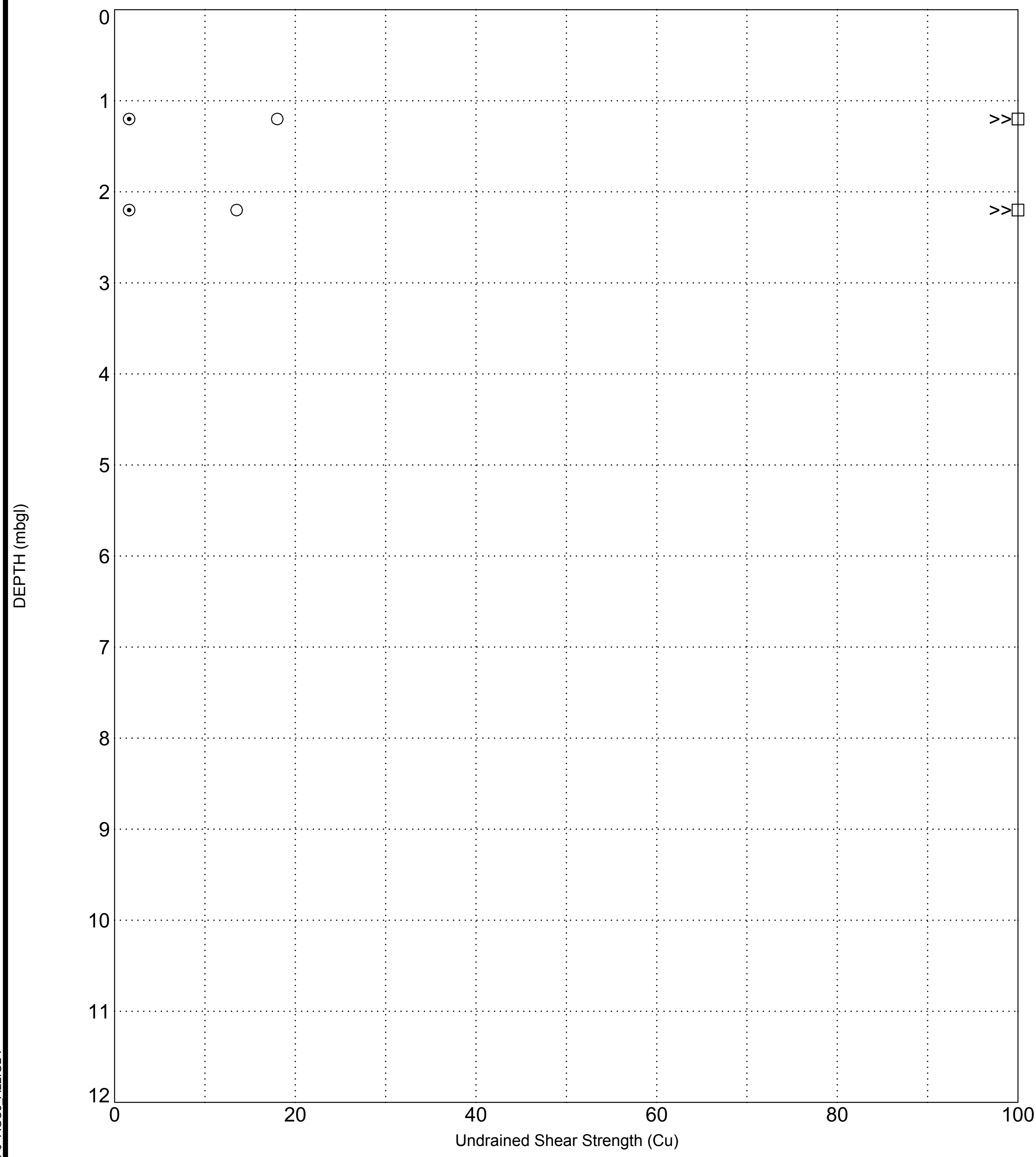
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: Manchester Airport(included)
Strata Type: GFC

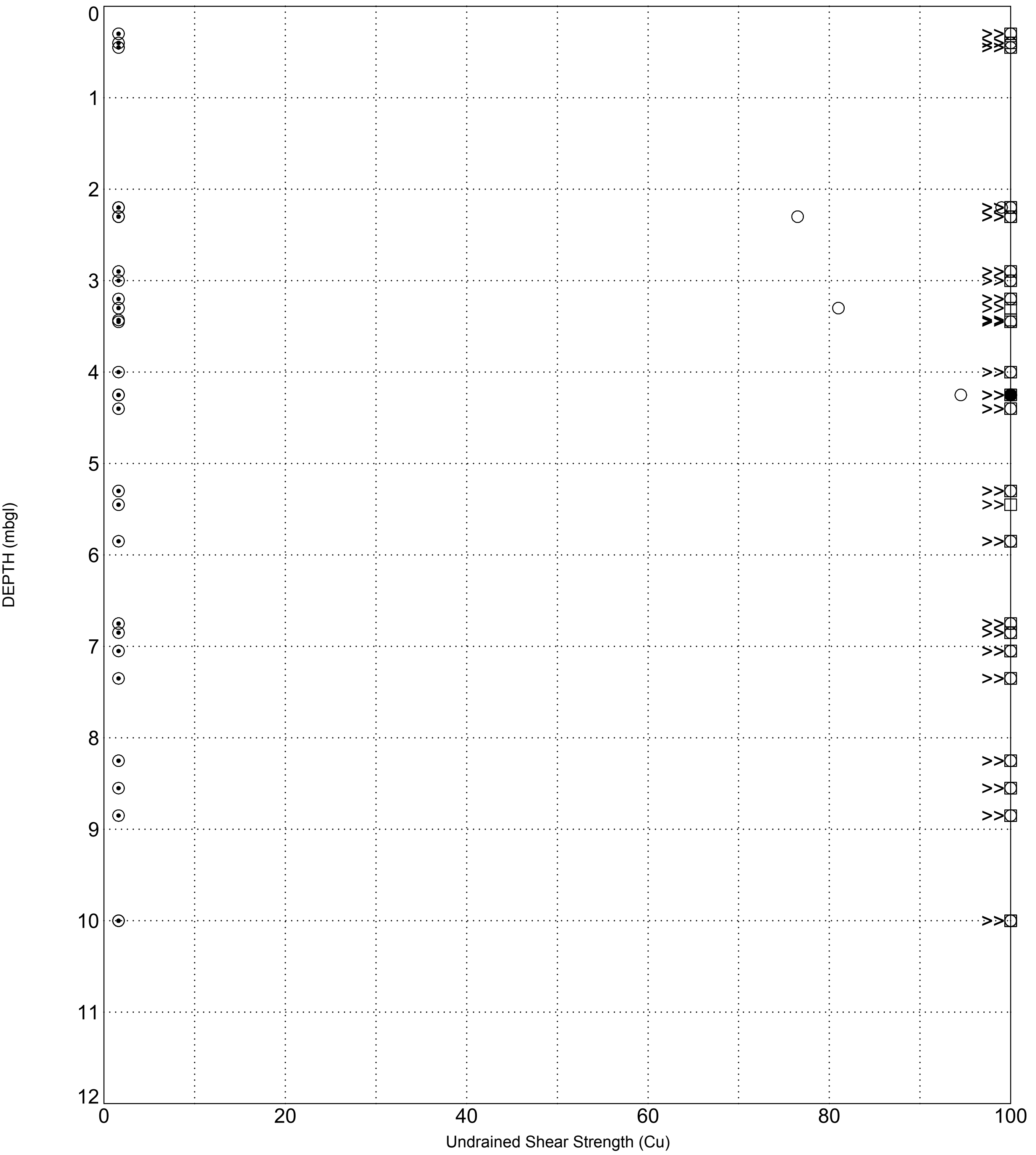
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



LEGEND
● Triaxial Cu
⊙ CuLi (cu= 1.6*EXP $^{(4.23*1-LI)}$)
○ Nval *(F=4.5)
□ CuLi (cu=150*EXP $^{(-4.6*Li)}$)

AECOM

Zone: Manchester Airport(included)

Strata Type: Rock

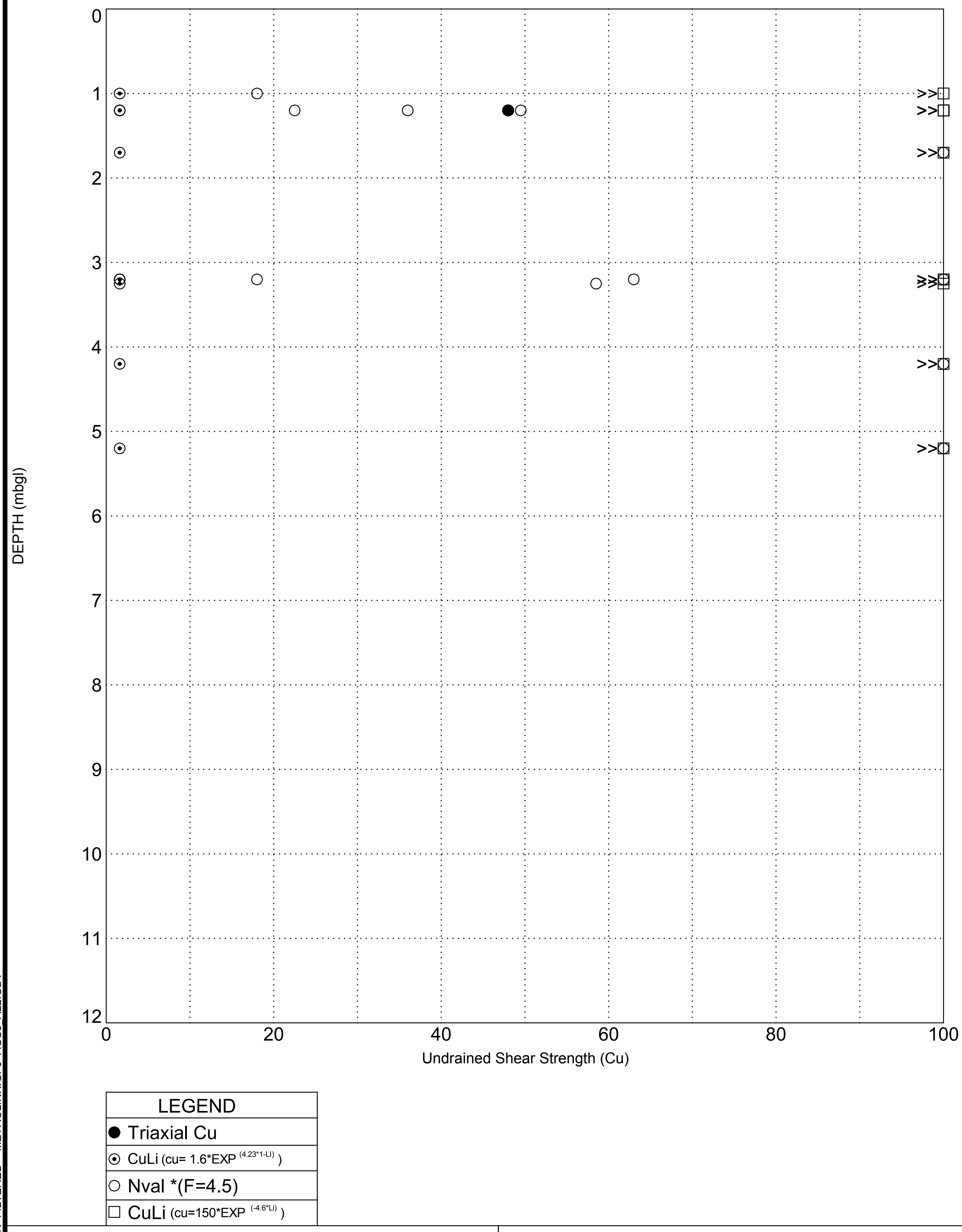
UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

ALL CU V DEPTH NO IVAN FILTERED + METROLINK.GPJ AGS3 ALL.GDT



Zone: Manchester Airport(included)
Strata Type: Glacio Fluvial - Granular

UNDRAINED SHEAR STRENGTH VS DEPTH

Client: SMBC

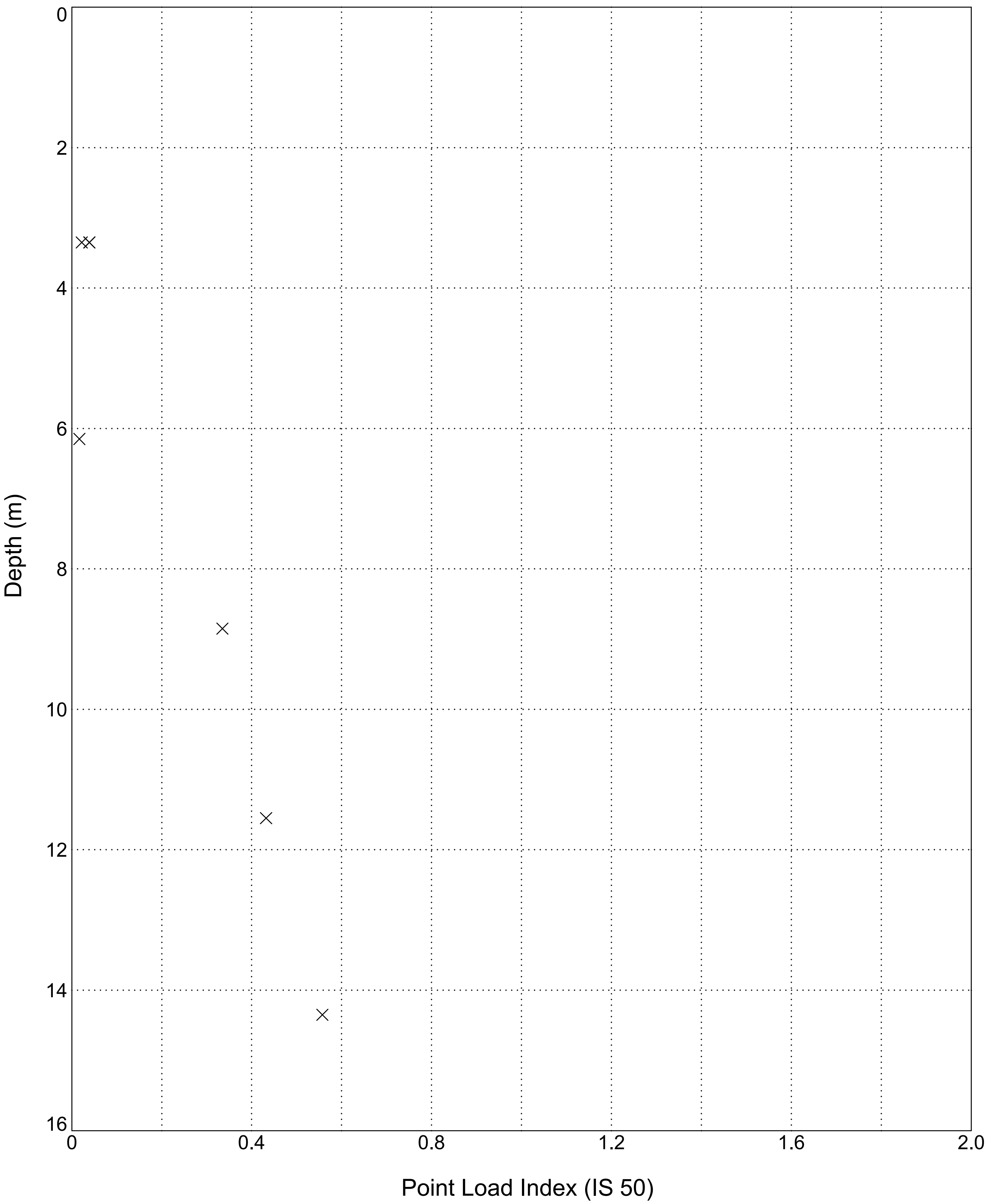
Project: SEMMMS A6 to Airport Relief Road

Number: 60186094

Appendix A6

Geotechnical Plots Point Load Results

Page deliberately blank for double sided printing



POINT LOAD INDEX VS DEPTH MAX 2 AECOM FILTERED + METROLINK.GPJ AGS3 ALL.GDT

AECOM

Zone:

Strata Type: All

POINT LOAD INDEX VS DEPTH

Client: SMBC

Project: SEMMMS A6 to Airport Relief Road

Number: 60186094