Wimbledon Park Lake

Site Investigation Report

merton

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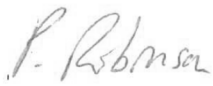
Prepared by:	Peter Robinson Geo-Environmental Engineer	Signed: 

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1	27 January 2020	V1 – DRAFT FOR COMMENT
2	14 April 2020	Final

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APPENDICES

EXECUTIVE SUMMARY

Instruction	WYG were commissioned by the London Borough of Merton in November 2019 to undertake an intrusive ground and visual structural investigation of the north east and east shore of Wimbledon Park Lake in order to provide monitoring information to meet the safety requirements of the Reservoirs Act (1975).
The Site	Wimbledon Park Lake is centred on Landranger Grid Reference TQ 24701 72385 within the grounds of Wimbledon Park which is a Grade II* designated park in South West London. The lake covers an area of approximately 8.5 Hectares, widening from approximately 100m in the South to 450m in the north and is surrounded by the open spaces of Wimbledon Park. This investigation is focused on the north east and east banks of the lake and includes the following sections; retaining embankment forming the north east and east bank of the lake; the sheet pile retaining wall running along the north east and east embankment frontage; the overflow weir, stilling pond and associated drainage culverts; and the retaining wall boundary between the Bowls Pavilion and Boat Compound;
Site History	The earliest map of the site (1746) shows that the site was originally occupied by open fields sloping from north to south. The lake was created by Lancelot 'Capability' Brown for the first Earl Spencer in 1765 to act as a central feature of a landscaped park, providing better drainage and improving farming/grazing potential. The lake was created by building a dam across the valley to convert two confluent brooks and surrounding bog into a lake. Early surveys confirm the Brown lake to be c.12 hectares (30 acres). Comparisons with 19C maps indicate some restoration work to the original lake, since reduced to the present-day c.9 hectares area. By the mid-20th century the area to the north of the lake comprises open ground and includes a cricket ground, athletics track, tennis courts bowling and putting greens. The lake and surrounds were heavily bombed during WWII and there is considered high potential for UXO to be present within the lake and associated structures. Light sheet piles were installed with a timber capping beam along the length of the embankment between 1970 and 1980. The overflow channel was also reportedly installed during the period.
Geology,	Published information shows the site to be underlain by superficial deposits (Head) which overly the London Clay Formation. Locally London Clay Formation overlies the Lambeth Group at a depth of approximately 100m bgl, which in turn overlies the Thanet Sands and White Chalk at a depth of approximately 114m.
Hydrogeology	The superficial deposits are classified as a Secondary Aquifer (undifferentiated), with the solid bedrock geology (London Clay Formation) being classified as Unproductive Strata.
Hydrology	Wimbledon Park Lake is part of the wider surface drainage system. Water exits the reservoir via a controlled weir overflow structure into a stilling pond, before it drains

	into a network of culverts into the Thames Water surface water sewer network before discharging into the River Wandle.
Site Investigation	The site investigations were undertaken between the 11th – 19th November 2019 and consisted of non-intrusive surveys including; Service clearance by GPR and CAT scanning, GPS positioning, down hole magnetometry, CCTV condition surveys of lake drainage culverts and visual inspections of the sheet piles, retaining wall and stilling pond head wall. Intrusive investigations comprising of 4No. Hand Pits, and 6No. Window samples were undertaken, with the window sample locations installed for downhole magnetometry and return ground water monitoring visits.
Structural Surveys	The structural survey of the sheet pile determined that the corrosion of the sheet pile was limited to the top of the pile, at the air/water interface. No corrosion was identified below the water surface level. The structural survey of the retaining wall noted no obvious signs of settlement, rotation or other distress and therefore the foundation is assumed to be adequate.
Down Hole Magnetometry	Magnetometer surveys on WS02, WS03 and WS06 recorded positive signals to approximately 3m depth, which could be indicative of the base of the sheet pile.
MOLA geoarchaeological watching brief	MOLA report concluded the site to be of low archaeological and palaeoenvironmental potential and the proposed works will have little to no impact on any significant archaeological and palaeoenvironmental remains.
Ground Conditions	Ground conditions were broadly consistent with those anticipated from published information and the site development history and comprised of localised fine soils (Made Ground) forming the lake embankment overlying Superficial Deposits of Head and Bedrock of the London Clay Formation.

1.0 INTRODUCTION

1.1 Instruction

WYG Environment Ltd (WYG) were commissioned by the London Borough of Merton (LBM) to undertake an intrusive ground and visual structural investigation of the northeast and east shore of Wimbledon Park Lake in order to provide monitoring information to meet the safety requirements of the Reservoirs Act (1975).

Instructions to proceed were detailed in the Purchase Order Ref E20072234 dated 7th November 2019.

1.2 Brief

The suggested investigation brief detailed in LBMs Statement of Requirements (dated 8th August 2019) was modified in the accepted WYG tender proposal. The agreed scope of work is summarised as follows:

- Undertake a desk-based review of existing geological, hydrogeological, and historical information.
- Obtain plans from statutory undertakers.
- Undertake a non-intrusive geophysical survey using ground penetrating radar (GPR) and electromagnetic surveying (CAT Scanning) of the retaining embankment crest / footpath.
- Undertake a waterborne visual structural survey of the lake's perimeter sheet pile retaining wall.
- Undertake visual inspections of the masonry retaining wall adjacent to the bowls pavilion and the stilling pond head wall.
- Undertake a CCTV survey of the stilling pond culvert, draw down pipe and culvert beneath the café pavilion building.
- Investigate the geotechnical characteristics of the earth fill embankment using 3No. window sample boreholes with undisturbed (U70) sampling and standard penetration testing (SPTs)
- Undertake downhole magnetometer or parallel seismic surveys to help to estimate the sheet pile depth
- Provide a combined interpretative report.

1.3 Information Provided

Information available and referred to during the compilation of this report is summarised in Tables 1 and 2.

Table 1 Reference Listing of Reports

Ref	Report Reference	Date	Notes / Description
1	Supervising Engineer's Annual Statement - Stillwater Associates	Dec 2019	Annual Statement under Section 12(2) & Section 12(2A) of the Reservoirs Act 1975 for the period up to 31/12/2019.
2	Supervising Engineer's Annual Statement - Stillwater Associates	Dec 2016	Annual Statement under Section 12(2) & Section 12(2A) of the Reservoirs Act 1975 for the period up to 31/12/2016.
2	Preliminary Ecological Appraisal – Salix Ecology	May 2018	
3	Tree Survey – Tree King Consulting	May 2018	
4	Wimbledon Park Lake Project Historic Environment Assessment: P18-077 – MOLA	May 2018	Assessment of the baseline archaeological potential.
4.1	Tony Matthews, Surrey Gardens Trust; Dr Dave Dawson and other sources	Jan 2015	Capability Brown's Wimbledon Park, In His Day and Ours'
4.2	Steffie Shields MBE	2016	Moving Heaven & Earth: Capability Brown's Gift of Landscape'
4.3	Dr Dave Dawson	Feb 2019	Major works proposed at Wimbledon Park Lake
5	Considerations for Dealing with the Sediment Build Up - Miles Waterscapes	March 2016	Options appraisal for silt management, inclusive of laboratory screening of silt samples.
6	Preliminary UXO Risk Assessment – 1st Line Defence	March 2018	
7	Wimbledon Park and Lake Masterplan – LDA Design	Dec 2018	25-year Master Plan.
7.1	WPL Stoplog Levels	Not provided	Summary notes on historic stoplog levels.

Table 2 Reference Listing of Drawings

Ref	Drawing Reference	Date	Description
7	Topographic Survey Including Lake Base and Silt Levels – Miles Water Engineering	Jan 2016	Plans with spot levels of the lake base, silt and bank levels including contours.
8	Wimbledon Park & Lake: 22811 OGL – Greenhatch Group	Nov 2015	Topographic Survey covering the area to the north of the lake.
9	WPGC Historic Drawing Sections 01-Model CH 20m	Not indicated	Sections of the lake profile showing the sheet pile wall, water level, base level and bank level with proposed 15m deep borehole.
10	WPGC Historic Drawing Sections 01-Model CH 140m		
11	WPGC Historic Drawing Sections 01-Model CH 300m		

Table 3 Reference Listing of Aerial Photographs

Reference	Report Reference	Date	Description
12	Google AP1	1945	Aerial photograph
13	Google AP2	2002	Aerial photograph
14	Google AP3	2006	Aerial photograph
15	Google AP4	2019	Aerial photograph

1.4 Limitations

The information contained in this report is intended for the use of the London Borough of Merton. WYG can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

The recommendations and opinions expressed in this report are based on information obtained as part of the investigation or provided by others. Information provided from other sources is taken in good faith and WYG cannot guarantee its accuracy.

This report is subject to the report conditions presented in Appendix A.

2.0 SITE INFORMATION

2.1 Location

Wimbledon Park Lake is centred on Landranger Grid Reference TQ 24701 72385 within the grounds of Wimbledon Park which is a Grade II* designated park in Wimbledon, South West London.

This investigation is focused on the north east and east side of the lake and includes the following elements;

- the retaining embankment forming the north east and east bank of the lake;
- the sheet pile retaining wall running along the north east and east embankment frontage;
- the overflow weir, stilling pond and associated drainage culverts;
- the retaining wall boundary between the Bowls Pavilion and Boat Compound;

all of which are referred to as 'The Site' detailed herein.

2.2 General Area Context

The lake covers an area of approximately 8.5 Hectares, widening from approximately 100m in the South to 450m in the North and is surrounded by the open spaces of Wimbledon Park.

The lake is an online water body, forming part of the wider surface water drainage system, and is currently included in the Heritage Risk Register for London due to the present condition, appearance and setting. The site is also used extensively for recreation including local sailing and fishing clubs.

The following extract from Surrey Gardens Trust [ref 4.1] summarises the general status and context of the lake.

'Today like many lakes in lowland Britain, it is eutrophic with extensive beds of pondweed. The catchment is predominantly suburban and has extensive hard surfaces, such as houses and roads whose runoff carries pollutants. This was exacerbated in the late 1990s by construction of an extra inflow to take runoff from the AELTC. Other sources of pollution are intensive management of the golf course, feeding of the carp by fishermen, large populations of waterfowl and excess bird feeding by the public. The lake has lost its beds of waterlilies and submerged water plants can be a problem. It has also been slowly silting up. Once up to 2.5 metres deep, there are now few places deeper than a metre. To provide sufficient depth for water sports, the outflow weir has to be kept high, and this causes a high-water table and some flooding.'

The surrounding land uses are summarised in Table 4.

Table 4 Surrounding Land Uses

	Description
North	The north of the site is bordered by 'The Great Field' which includes the Athletics Track, Bowling Greens and Tennis Courts, all of which our bounded by the London Underground infrastructure (Wimbledon to Earl's Court branch of the District line).
East	Wimbledon Park Golf Club bounded by Home Park Road located 150m from the lake.
South	Wimbledon Park Golf Club which extends 500m south towards residential properties along Rectory Orchard.
West	The west of the site is bordered by the All England Lawn Tennis Club followed by residential properties

2.3 Site History

The historical development of the site and surrounding area has been described in detail by MOLA in report ref. P18-077[ref 4]. This information has been further expanded upon by an independent Landscape Historian (Steffie Shields) who was recommended to us by the LBM Heritage team. The following summary provides key details of the site's historical development which is considered relevant / potentially to this assessment.

- The earliest map of the site and surrounding area dated from 1746 (Rocques 1746; Image No 1, Appendix J) shows that the site was originally occupied by open fields sloping from north to south.
- The lake was created by Lancelot 'Capability' Brown for the first Earl Spencer in 1765 to act as a central feature of a landscaped park while providing better drainage and improved farming/grazing potential. The lake, located northwest of the family mansion house, was constructed on relatively high ground and was created by building an extensive 317 to 340 metre-long dam raised up to 4m high across the valley to convert two confluent marshy stream watercourses; Bigden Brook west and Rushmere Brook southwest; both of which both flow eastward from the surrounding plateau down to the River Wandle in Earlsfield stream and surrounding bog into a lake [ref 4].
- Surveys undertaken by Richardson in 1768, Haynes in 1770, & Corris in 1787 (see Images No.2 to 5 inclusive, Appendix J) indicate the original scale of the lake (approximately 12 hectares). In comparing maps from 1810 & 1865 (Appendix J), a restoration seems likely to have taken place at some stage during this period to increase the lake extent / capacity to Brown's original expanse of water. However, since this period, when considering the present-

day lake area is now approximately 9 hectares, it is likely there has again been considerable sediment build-up. The lake generally conforms to the original Brown design although the southern extremity has possibly been reclaimed.

- Several grand plans besides Highclere, including Wimbledon and Blenheim, evolved into a pioneering 'tri-corn' design for an organic shaped lake with pronounced convex sides directly across from concave banks on the opposing shore. Young George Spencer wrote to his mother Georgiana, Countess Spencer about developments 'in the pure air' at Wimbledon (formerly Surrey):

  'There is a pretty boat put in the pond and a thing made for the swans in an island of the pond.'

- Everywhere Brown worked he advised strategic maintenance, including periodically lowering the waters for silt clearance. This also gave an opportunity for easy fishing, as Lady Georgiana observed:

  '1781 Nov 15 The Great Water is almost let off (drained) and we had a most extraordinary draught of fishes there. We caught 63 brace of carp, most of them very large, and a brace of very fine pike at one haul.' (ref 4.2)

- According to Richard Milward, writing in his book documenting the history of the Spencers in Wimbledon, 'during the two years 1765 and 1766, Brown oversaw the creation of a 30-acre lake, draining swampy areas by linking two older fishponds. This was stocked with fish and a boathouse was built at one end, with Greek and Roman statues on pedestals dotted around the edge. It (the lake) was certainly the focal point in the celebrated view towards London from what had previously been the Duchess of Marlborough's manor house. The two older ponds from which it had been formed originated in springs at the edge of the flat gravel terrace occupying the top of the hill to the south and west. In Brown's day the catchment was predominantly common land, parkland and farms. The water quality was good and there was a fine fishery.' (ref 4.1)

- The Ordnance Survey (OS) map dated 1865 shows the lake roughly occupying its present-day extent with the boathouse indicated in the north (see photo No.8 Appendix J).

- The OS map dated from 1913 shows a pavilion building next to a boathouse. Photo No 8. shows this pavilion to be an extended cottage and boathouse beside dense planting behind the dam. This is also illustrated on a newspaper advertisement: 'Boats on hire Dinners & Teas at the Cottage Wimbledon Park Farm' (Surrey Advertiser 1892). See Appendix J.

- The lake passed into public ownership in the early 20th Century, 1913-1915 Wimbledon Council acquired Wimbledon Lake and part of the park, 1925 Wimbledon Park Public Park opened as a Public Park and is now the responsibility of the Merton Council.

  '*The catchment of the brooks remains the catchment of today's lake, but they now run in pipes underground and flow down to the lake from the high ground, which lies west and south. …an underground drain from All England Lawn Tennis Club (1985) and smaller land drains from the golf course and The Wimbledon Club. The crest of the dam is the lakeside path in the public park. Most of the dam is within the public park, but the south-east extremity is within the Wimbledon Park Golf Course'* (Article: Dave Dawson (February 2019): *Major works are proposed at Wimbledon Park Lake*, page 6).

  Until late 20C water was pumped from Brown's lake to the AELTC's Water Tower ((Aerial Photo No.11) extant until c2011) for watering the grass tennis courts in the grounds.

- By the mid-20th century the area to the north of the lake comprises open ground and includes a cricket ground, athletics track, tennis courts bowling and putting greens. By 1950 the pavilion building next to the boathouse is no longer shown on the OS maps.

- Notes on the stoplog levels (ref. 7.1) report that light sheet piles were installed with a timber capping beam along the length of the embankment between 1970 and 1980. The overflow channel was also reportedly installed/restored in the same location as Brown's original sluice/spillway. However, the lake outfall weir has since been raised and a stilling pond introduced. *'Previously, the level of the lake was maintained well below current levels. Levels taken in 1884, 1911 and 1932 were 23 cm (9 inches) below the present-day regulated level. Levels now average 9 cm (3.5 inches) above the regulated level so we estimate that the outflow was modified at some time after 1932 to hold the lake level about 31 cm (13 inches) higher than it was in Brown's original design. Anglers report that the regulated level of the lake has increased over the last fifteen years.'* (ref 4.3).

- The 1st Line Defence Preliminary UXO Risk Assessment (ref 6) indicates there was a high amount of bombing recorded on and around the lake area and considered it quite likely that any unexploded bombs which fell within the lake would have gone unobserved and unrecovered. A Merton newspaper diagram catalogues the total number of High Explosive bombs recorded from 7 October 1940 to 6 June 1941 in Wimbledon Park. The two bombs between Wimbledon Park Road and the dam are listed as flying bombs. See also https://www.flickr.com/photos/sarflondondunc/1825914314. In addition, Photos Nos.9,10, 11 would also seem to show a boathouse, likely the 'pavilion' mentioned in the Ist Line Defence Risk Assessment Report that was missing after WWII V1 activity in the south of the site.

NB: Any unaccounted-for bombs may have caused some weakening or structural damage to the head eventually leading to the present-day leak.

2.4 Site Description

The following site description summarises key details of the site at the time of the investigation (during November 2019). Further details, including the current condition of these structures is provided in Section 5.0.

The north east bank of the lake comprises the lake edging / perimeter sheet pile (Photo 01, Appendix C) and embankment which includes a 3m wide asphalt footpath following the crest and concreted areas providing landing areas for boating activities. The east most extent of the lake sheet pile and embankment comprises a 2m wide grass bank followed by trees (Photo 02, Appendix C).

The level of the embankment and grounds to the east of the footpath generally falls to the southeast (Photo 03, Appendix C). The slope includes an ornamental garden with a decorative waterfall which is fed from an outlet from the reservoir. (This is consistent historically with Brown's designs in other historic sites, in controlling outflow with a sluice draining from the lake into a conduit under the centre of his large dams, leading to an open drain or underground conduit likely northeast along a field boundary and beside a pond near the farm east of the dam. (See Richardson 1768 survey Nos 2 and 3 for underground pump conduit in SW; also Image No.6 Map of Wimbledon's Water Supply 1884). The level areas beyond the embankment / slope accommodate bowls pitches and open turf areas with asphalt footpaths. There are several buildings immediately to the east of the reservoir including a sailing clubhouse (Photo 04, Appendix C) and a bowls pavilion (Photo 05, Appendix C). The closest building to the sheet piles at c. 6.5m is the Clubhouse. The piles are c. 1m to 1.5m above the bed level of the reservoir and it is therefore considered unlikely that loads from nearby structures (including the clubhouse) are imposed on the retaining earth and sheet piles forming the lake embankment.

The 20C overflow weir regulating the water level of the lake Is situated at the south end of the dam in the sheet pile eastern extent.

The layout of these features is indicated on Figure A112771-LDN-N-01 (Appendix B.1).

2.4.1 Sheet Pile Retaining Wall and Footpath

The north east shore sheet piles span approximately 300m of the lake boundary and comprise arbed PU Type steel piles. The sheet piles define the lake edge and retain the adjacent pedestrian footpath / grass bank.

The individual pile sections were measured to be approximately 454mm wide and 4mm thick (Photo 06, Appendix C) and a maximum of 1000mm above the bed level of the reservoir.

The sheet piles adjacent to the public path in front of the clubhouse are provided with a fender/rubbing strip comprising a c. 140mm deep x 90mm wide timber strip with metallic capping (Photo 07, Appendix C). The timber is secured with a bolt that passes through a hole in the pile and the metallic capping is screwed to the timber. In some areas the timber fendering has degraded and be lost (Photo 08, Appendix C).

The footpath comprises a 3m wide access road / walkway which extends up to the sheet pile though much of its extent. The asphalt was in poor condition in some areas and key observations are summarised as follows;

- Up to 15mm aperture, 0.3 to 3.0m long cracks running parallel to the lake perimeter, most notably in the area surrounding the mature trees in the central east area of the site and the north part of the site, close to the entrance to the athletics track enclosure. These cracks are suggestive of either minor slope movements and / or shrinkage / settlement of the underlying soils (Photo 09, Appendix C);
- undulations associated with the root balls in the central east area if the site (Photo 10, Appendix C);
- damage / breaching of the asphalt from emerging roots in the central east area (Photo 11, Appendix C);
- Bulging of the sheet pile around trees in the central east area of the site (Photo 12, Appendix C).

The public access route deviates away from the edge of the reservoir and sheet piles to the north of a densely vegetated fenced enclosure located to the east of the lake. The fender/rubbing strip is either not present in this area or in very poor condition (Photos 2 & 13, Appendix C) and it is assumed that the timber fendering has deteriorated and subsequently removed.

2.4.2 Sheet Pile Profile

The plan profile of the sheet piles was clearly visible where the capping has been lost. In these areas the piles stand proud of the adjacent soft ground by approximately 50 to 150mm (see for example (Photo 13, Appendix C). Localised distortion of the pile head was noted, possibly occurring during the installation of the piles, and there is also evidence of corrosion. Vernier callipers confirmed the sheet piles range in thickness between 3.9 and 4.0mm. Accordingly, it is anticipated that the original pile thickness specification is likely to have been 5/32", however the plan profile could not be matched to a recorded historic pile section and the pile section has instead been traced to indicate the plan form (Drawing A112771-LDN-N-03 (Pile Section), included as Appendix B.3).

2.4.3 Retaining Wall

The masonry retaining wall located to the south of the bowling pavilion building forms part of the embankment structure and supports the embankment crest providing a level area for storage / facilities south of the building (Photo 14, Appendix C). The age of the retaining wall has not been confirmed but it is constructed using relatively modern building materials (mortared red brick and concrete block).

At the time of the investigation the embankment crest supported by the wall to the South was used as a storage compound for sailing boats and kayaks for use on the lake. The wall also supports fence posts installed directly behind the wall forming the enclosure for this storage area.

The north end of the retaining wall comprises five blockwork courses and measures approximately 1.4m in height (Photo 14, Appendix C). The blockwork portion of the wall includes returns but it is unclear if these were included to strengthen the wall or to from separate storage areas in front of the wall. The ground level of the embankment crest behind the wall is level with the top of the blockwork wall, and assuming the base of the wall is at or directly below the asphalt surfacing, it is estimated that the wall is retaining c. 1.4m of fill material (Photo 15, Appendix C).

The south end of the wall is constructed in brickwork and comprises a maximum of 16 courses above the ground level in front of the wall which is approximately 1.0m above the lower ground level. The raised ground level at the base of the wall consists of sandy gravelly clay made ground with organic material common throughout. The top three courses of brick are one stretcher wide (c. 102.5mm) but below this it increases to a stretcher and a header (c.180mm) thick, as shown in

Photo 15, Appendix C. The ground level at the base of the wall is approximately 0.4m below the top of the blockwork section (Photo 16, Appendix C).

The ground level of the embankment crest behind the brickwork wall is level with the top of the adjacent blockwork wall. Anecdotal evidence suggests that the higher level of earth in front of the brickwork portion of the wall has been placed after the construction of the wall. If it is assumed that the base of the wall is at or directly below the surfacing (in front of the blockwork wall) then the brickwork wall is retaining c. 1.4m of fill material, and is therefore of similar vertical extent to the blockwork section of the wall.

2.4.4 The Overflow Weir

The overflow weir is situated on the east side of the lake and provides the outlet point for overflow reservoir water. The outlet flows into a stilling pond before it drains into a culvert feeding into the Thames Water surface water channel which connects to the River Wandle further to the north east.

The weir comprises a break in the sheet piling measuring approximately 1.3m wide through which water is controlled by rectangular treated timber stoplogs. At the time of the investigation the crown of the stoplogs was set at approximately 17.504mAOD. This corresponds to a zero-reference elevation of 0.044m) below the water level resulting in a minor flow over the stoplog into the stilling pond at the time of the investigation (Photo 17). The stoplog was secured by steel slots welded to the sheet piles on each side to allow vertical adjustment of the stoplog. A concrete platform supported by the stilling pond retaining walls bridges the weir adjacent to the stoplogs, which limits the height of the channel to 360mm on the upstream side and 500mm on the downstream side. The initial overflow channel is 1.3m wide and tapers into an approximately 700mm wide, and 4m long concrete channel. The base of this channel includes 4No. 200mm high steps.

2.4.5 Stilling Pond

The stilling pond is fed directly by the overflow channel and comprises an approximately 10m by 10m in plan concrete lined pond. At the time of the survey the standing water level within the pond was 16.071 and the base depth was measured at 15.676mAOD.

2.4.6 Drainage Culverts

A subsidiary outlet feeds from the lake into a drain (CV01) immediately to the west of the weir with inspection covers at each end (MH01 and MH02), this drain also feeds into the stilling pond. The

water in the stilling pond feeds into a 450mm diameter, 7.18m long diameter concrete culvert at the south end of the pond (BMH02) (Photo 18, Appendix C), this section connects to a 525mm diameter, 8.06m long section of culvert before reaching a junction at BMH01 where the culvert continues to the north towards the open channel approximately 48.70m to the NNW (Photo 19, Appendix C).

The head wall of the stilling pond outfall comprised a single layer of mortared brickwork constructed on a layer of screed which formed a grouted surround to the culvert. Although the culvert itself appears to be reasonable condition, a 20-30mm aperture crack is present through the mortar and screed layers forming the headwall (Photo 18).

The open channel continues approximately 49.3m to the NWW before turning and continuing in a EEN direction, and then continuing through a culvert commencing to the west of the pavilion building. The culvert then diverges into 2No. 225mm diameter drains at MH006 orientated to the NE and the EEN, the EEN orientated drain continues below the pavilion building. Both drains fall into the open channel to the NE of the pavilion building which connects with the River Wandle to the NE of the site.

The location of the culverts, drains and inspection chambers is indicated in Drawing A112771-LDN-N-01 (Exploratory Hole Location Plan) (Appendix B.1), further commentary on the condition of these structures is provided in Section 5.4.

2.4.7 Services

As part of this assessment service plans were requested from statutory undertakers. Of the 24No. utility companies contacted 15No. responded to confirm that their assets were not present within the survey area and 6No. responses were received indicating that apparatus and / or underground assets are present within or within the vicinity survey area as summarised in Table 5.

Table 5 Summary of Statutory Undertake Responses

Utility	Category	Date Issued	Notes
Environment Agency (EA)	Public Body	12/11/19	The EA confirmed that an environmental permit may be required if you intend to carry out work in, under over or near to a main river flood or sea defence.
Openreach (British Telecoms)	Telecom	12/11/19	Telcom cables a shown connecting the Pavilion to the mains running below Home Park Road to the south.
Southern Gas Networks	Gas	12/11/19	Low pressure mains are indicated below the pavement and carriageway of Wimbledon Park Road and Home Park Road to the north and south respectively. No feeds into Wimbledon Park Lake are indicated.
Thames Water	Water, sewerage	12/11/19	Sewerage plans indicate surface water drainage matching the overflow weir, culverts and open channel observed on site. A foul is indicated to the north of the surface water servicing the club house.
UK Power Networks	Electric	12/11/19	4 Core electricity main within an aluminium duct feeding the Grandstand, Pavilion and Boathouse. The drawings indicate a burial depth of 0.4m bgl.

2.4.8 Topography and Bathymetry

In general, the local topography falls from the NW to the SE resulting in an easterly rise in the embankment crest height relative to the grounds to the N, and the embankment height ranges from approximately 0 in the north west to 3 to 4m in the south east of the survey area.

In the central area of the site this difference in level is accommodated by the retaining wall described in Section 2.4.3 which provides a level area for the Pavilion to the north east and boatyard to the south.

The topographic survey undertaken by others in January 2016[7] provides ordnance datum (OD) levels of the embankment crest, silt level and base levels of the lake. OD Levels of the embankment ranged between 17.751 and 18.020 in the southern and northern extent of the survey area.

Spot check levels obtained during the recent WYG investigation are displayed on Drawing A112771-LDN-N-01 and included on the Engineering logs (Appendix D) and broadly correspond to the levels displayed on previous survey drawings.

Unreferenced cross sections (ref 9-11) across the embankment and lake side at ch. 20, 140 and 300m (moving southwest along the survey area) indicate a consistent configuration of embankment level and water level (17.80 and 17.47m in November 1994 respectively). The cross sections and topographic drawings[8] indicate that the local 'bottom of the lake' levels range between 16.970 in the south west and 16.778m Above OD in the north west of the survey area. Silt levels are indicated to remain relatively consistent across the entirety of the lake confirming the silt thickness increases towards the centre of the lake.

Spot check levels obtained during the recent ground investigation are displayed on Figure A112771-LDN-N-01 and broadly correspond to the base and water levels adjacent to the embankment crest in the survey area as displayed on previous survey drawings.

3.0 GEOLOGY, HYDROGEOLOGY, HYDROLOGY

3.1 Anticipated Geology

Information regarding the geology and hydrogeology of the site has been obtained from the BGS GeoIndex Online database (2019).

Records of historical borehole logs accessible using the BGS GeoIndex Online Archive do not include any borehole records within the site boundary. The closest available record (drilled in 1936) is situated approximately 100m to the south west and shows the London Clay Formation extending to a depth of approximately 93m bgl. Other more remote records show a similar sequence of stratigraphic units, all of which are summarised in Table 6.

In summary, published information shows the site to be underlain by superficial deposits (Head) which overly the London Clay Formation. Based on interpretation of publicly available historic BGS borehole records, the local London Clay Formation overlies the Lambeth Group at a depth of 100m bgl, which in turn overlies the Thanet Sands and White Chalk at a depth of approximately 114m. This outline stratigraphy and thickness, interpreted from the historic information, is considered to be generally line with contemporary understanding of the London Basin geology in south west London.

Table 6 Summary of BGS Historic Borehole Records

Ref	Distance (m) / Direction from site	Notes
TQ27SW166	80 / E	Describes 3.35m of 'Yellow Clay' over 11m of blue clay. Further intercalations of yellow and blue clay and 0.3m layers of 'Rock' to a depth of 106m, over sands and 'mixed coloured clay' to 114m over 'T' and 'CH' to 120m and 124m respectively. *
TQ27SW68	200 / NW	0.60m of Topsoil over firm to stiff silty clay with selenite.
TQ27SW220	300 / SSE	0.20m of Topsoil, over 0.35m of firm brown silt, over firm to stiff silty clay. Water seepage at 2.00m bgl.
TQ27SW223	300 / SSW	0.20m of Topsoil, over 0.35m of firm brown silt, over firm to stiff silty clay. Water seepage at 2.00m bgl.

*Depths derived from imperial measurements indicated on the records

3.1.1 Made Ground

Based on the site's development history, it is anticipated that made ground may occur as locally derived soils which have been used to construct the earth fill embankment.

The earliest map of the site dated 1819 (ref 4) is schematic, however it does indicate a lateral extent of the lake which is smaller than the present day. Therefore, there is potential that lake was enlarged to its present-day extent sometime during the period between 1819 and 1865. This enlargement may have resulted in lake silt, and soils derived from the Head Deposits and the London Clay Formation being excavated and deposited locally to form the earth fill used in the embankment.

It is also considered possible that soils excavated during the landscaping of the surrounding areas within Wimbledon Park could have gained material for the construction of the embankment.

Notwithstanding the above, there also remains potential for the embankment to have been constructed using imported soils.

3.1.2 Superficial Geology

BGS mapping shows the site to be underlain by head deposits which are described as variable soils comprising horizons of clay, silt, sand and gravel.

Edwards Plan from 1819 (ref 4) suggests embankments were located to the east and south of the lake in this period (corresponding to present day high areas). Therefore, the local topography may have originally comprised ground residing at a higher level than the present-day profile. The site lies between the between the River Wandle to the east and Beverley Brook to the west, and the high levels may have been reduced by landscaping undertaken during the initial establishment of the grounds and lake.

On this basis, with consideration of the site topography (ref 7 and 8), it is considered possible that superficial deposits (Head) may have been reduced or removed during landscaping.

3.1.3 Solid Geology

BGS mapping shows bedrock beneath the site to comprise the London Clay Formation which is described in the BGS Lexicon as follows;

"mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occurs in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels."

The site's development history (see Sections 3.1.1. and 3.1.2) potentially includes level reduction and associated removal or reduction in the thickness of the superficial deposits, thus raising the potential for the London Clay Formation to be present at shallow depths outside of the lake embankment footprint.

3.2 Hydrogeology

The superficial deposits are classified by the Environment Agency (EA) as a Secondary Aquifer (undifferentiated). Secondary Aquifers are typically variable in permeability supporting water supplies at a local rather than strategic scale.

The solid bedrock geology (London Clay Formation) is classified as Unproductive Strata due to the low permeability with negligible significance for water supplies or river base flow.

Groundwater vulnerability refers to the potential for impacts on groundwater quality beneath the site from a potential contamination source, and the ability of soils to transmit this contamination to the aquifer. The aquifers beneath the site have not been designated as Groundwater vulnerable zones by the EA.

A review of the DEFRA Magic Map has indicated that no Source Protection Zones (SPZ) are located on the site, or within a 1km radius of the site boundary. The nearest is approximately 2 km to the south east of the site.

3.3 Hydrology

Wimbledon Park Lake is an online waterbody, forming part of the wider surface drainage system. Water exits the reservoir via an existing controlled weir overflow structure into a stilling pond. This water then drains into a culvert which flows through the park in a combination of below ground

culverts and open channels and leaves the park into the Thames Water surface water sewer network before discharging into the River Wandle.

A review of the DEFRA Magic Map shows the site is not in an area of flood risk. However, the lake itself is considered under the Reservoirs Act 1975

4.0 GROUND INVESTIGATION

4.1 Scope and Rationale

The scope and rationale of the investigation completed by WYG between the 11th and 19th November 2019 is summarised in Table 7 and 8.

Table 7 Summary of the Investigation Scope and Rationale – Non-Intrusive Surveys

Method	Location / Feature	Rationale
Ground penetrating radar (GPR) and electromagnetic surveying (CAT Scanning)	Exploratory Hole Locations	Assist in the location of buried services.
GPS Survey	Various locations	Establish OS coordinates and levels at exploratory hole and structural survey locations and provide ground truth information for existing surveys.
Visual Survey	Sheet Piles	Undertake a waterborne visual structural survey of the perimeter sheet pile.
Visual Survey	Retaining wall and stilling pond head wall.	Undertake a visual structural survey of the retaining wall and stilling pond head wall.
Drainage Survey (CCTV)	Drains and Culverts	Provide information to assess the integrity of the local drainage system.
Downhole Magnetometry	Window Sample locations	Obtain magnetometry signals within exploratory holes to help determine sheet pile depth.

Table 8 Summary of the Investigation Scope and Rationale – Intrusive Surveys

Method	Location(s)	Rationale
Tracked Window Sampling	WS01 to WS04 inclusive	Investigate ground conditions through the embankment. Obtain disturbed and undisturbed samples for laboratory environmental and geotechnical assessment. Undertake Standard Penetration Tests (SPTs). Install ground water monitoring apparatus.
Tracked Window Sampling	WS05	Investigate ground conditions below the provisional stockpiling area. Obtain disturbed and undisturbed samples for laboratory environmental and geotechnical assessment. Undertake Standard Penetration Tests (SPTs).
Hand excavation	HP01	Investigate ground conditions below the provisional stockpiling area.
Hand excavation	HP02	Investigate the ground conditions and expose the retaining wall substructure
Hand excavation	HP03 and HP04	Investigate the ground conditions within the area reported as boggy within the waterfall gardens.
Return groundwater monitoring	WS02, WS03, WS04,WS05 and WS06	Obtain groundwater levels within boreholes during and after the investigation period.

The locations of the exploratory holes is presented on the Exploratory Hole location plan (Figure A112771-LDN-N-01).

Factual information including engineering logs and laboratory test reports are provided in Appendices H to J.

4.2 Site Investigation Standards and Methods

Standards employed during the investigation were broadly in accordance with BS5930 Amendment 2 (BS5930 Amendment 2: 'Code of Practice for Site Investigation', 2015) which incorporates EN14688-1&2, Eurocode 7, Geotechnical Design (ref. BS-EN 1997-2:2007).

Exploratory hole locations were agreed during the pre-works site walkover undertaken with LB Merton and WYG in attendance on the 22nd October 2019. Prior to mobilising to site exploratory hole locations were checked with reference to the statutory undertaker utility plans.

Prior to breaking ground, all exploratory locations were scanned using a Cable Avoidance Tool (CAT) and ground penetrating radar.

Hard standing areas were broken out using a hydraulic breaker. Inspection pits were hand excavated using insulated hand tools.

During the investigation, exploratory holes were supervised by an experienced WYG engineer, strata encountered were logged and samples were taken for laboratory testing purposes. Water levels in the lake were monitored throughout the week.

Particular attention was given to the lake water levels, when excavating and drilling adjacent to the lake, and the toe of the embankment was regular checked for ponding water.

Prior to work commencing a UXO safety engineer provided a toolbox talk on UXO risk awareness and remained on site to undertake down hole magnetometry probing to scan for ferrous materials within the exploratory holes during excavation and drilling.

4.3 Groundwater Installations

Groundwater monitoring installations were installed in five of the exploratory boreholes as summarised in Table 9.

Table 9 Summary of Groundwater Monitoring Installations

Hole Ref.	Installation Details	Response zone depth (m bgl)	
		From	To
WS02	19mm diameter HDPE standpipe with a Casagrande type piezometer and sand surround and a > 0.20m thick bentonite seal above the response zone. Finished at ground level with a flush concreted steel cover.	2.50	3.50
WS03	50mm diameter HDPE standpipe with response zone comprising filtered slotted pipe and a 10mm diameter washed pea-shingle gravel surround and > 0.20m thick bentonite seal above the response zone. Finished at ground level with a flush concreted steel cover.	1.00	3.00
WS04		0.20	1.30
WS05		1.00	5.00
WS06		1.00	5.00

4.4 Ground Conditions Encountered

Ground conditions were broadly consistent with those anticipated from published information and the site development history and in summary comprised localised fine soils (Made Ground) forming the lake embankment overlying the Head and London Clay Formation which persisted to the full depth of the investigation.

A summary of the strata depths and thicknesses is provided in Table 10 and detailed descriptions of the soils and conditions encountered are provided in the engineering logs (Appendix D).

Table 10 Summary of Strata Depth and Thicknesses.

Hole Ref	Made Ground		Fill		Head Deposits		London Clay Formation	
	From (m bgl) (mAOD)	Thickness (m)	From (m bgl) (mAOD)	Thickness (m)	From (m bgl) (mAOD)	Thickness (m)	From (m bgl) (mAOD)	Thickness (m)
WS01	GL 17.72	>0.85	NE	NE	NE	NE	NE	NE
WS02	GL 17.77	0.50	0.50 17.27	4.00	4.50 13.27	2.50	7.00 10.77	>2.00
WS03	GL 17.75	1.00	1.00 16.75	3.65	4.65 13.10	4.35	9.00 8.75	>1.00
WS04	GL 17.74	>5.00	NE	NE	NE	NE	NE	NE
WS05	GL 16.55	0.45	0.45 16.10	0.55	1.00 15.55	>4.45	NE	NE
WS06	GL 16.73	0.70	0.70 16.02	2.50	3.20 13.52	1.00	4.20 12.52	>2.05
HP01	GL 17.62	0.50	0.50 17.12	0.60	1.10 16.52	>0.10	NE	NE
HP02	GL 16.38	>0.80	NE	NE	NE	NE	NE	NE
HP03	GL 14.79	0.25	0.25 14.54	>0.75	NE	NE	NE	NE
HP04	GL 15.44	0.10	0.10 15.34	>0.70	NE	NE	NE	NE

GL – Ground Level, NE – Not Encountered, NP – Not Present

4.4.1 Made Ground – Hardstanding / Topsoil / Made Ground

The surface Hardstanding (present at WS01, WS02 and WS06) comprised a 50 to 70mm thick layer of bitumen bound macadam (asphalt).

Other locations were commenced in soft landscaped / turfed areas and encountered a 50 to 100mm thick layer of very soft to soft dark brown sandy organic rich clay / silt with abundant rootlets.

The Made Ground encountered below the hardstanding and topsoil layers below the embankment crest typically comprised an approximately 0.45 to 0.65m thick layer of predominantly fine soils. These soils were characterised by a high quantity of anthropogenic materials such as brick, ceramic

and metal fragments in a variable, predominantly fine matrix of very soft to soft silt clay with lessor variable sand and gravel.

These variable Made Ground soils extended to deeper levels in WS04, where soft slightly gravelly sandy silt and clay with flint, brick, concrete (up to cobble sized), and macadam bound material as well as organic inclusions soils was encountered to 1.5m bgl.

From 1.5m to 1.6m bgl a soft black layer of clay was encountered followed by firm to stiff clay to 3.3m bgl. A further layer of soft clay was noted between 3.3 and 3.5m bgl, overlying a layer of silty, slightly clayey, gravelly sand to 4.10m bgl. This was underlain by firm slightly sandy slightly gravelly clay, with brick, ceramic and flint inclusions to 5.0m bgl. The borehole was extended to 6.0m bgl but recovery was limited by the softer layers and rapid ground water ingress leading to instability and constant collapse and the borehole was consequently terminated at 6.00m bgl.

In peripheral areas away from the embankment (WS05 and HP01) the Made Ground comprised a relatively less extensive, 0.40 to 0.45m thick layer of soft brown sandy silty clay, which included flint gravel and some gravel sized brick and fused ash fragments. This layer was underlain by a less variable 0.50 to 0.60m thick layer of soft brown very sandy very gravelly clay with some brick gravel sized brick fragments.

4.4.2 Made Ground – Head / London Clay Formation Fill

Below the Made Ground within the embankment, the fill consisted of predominantly fine soils comprising firm grey mottled orange brown clay with lessor subordinate sand and flint gravel and some and dark organic rich pockets from a depth of 1.00 (WS03) to 1.60m bgl (WS02). This deposit was confirmed to be 0.55 to 0.60m thick in the grounds to the north of the lake, and between 3.40 and 2.50m below the embankment crest.

The composition, consistency and colour of the soils are considered typical of the Head deposits and London Clay Formation. However, obvious signs of disturbance were noted including the presence of soft pockets, brick, concrete and ceramic fragments, and organic rich pockets / horizons which gained prevalence towards the base of the deposit, potentially originating as former topsoil layers and / or materials dredged from the lake bed during the formation of the embankment.

Exceptions to this generalised description of the Head / London Clay Derived Fill were noted. Notably in WS04 where soils displayed greater variability in terms of composition and consistency (as described in Section 4.3.1).

4.4.3 Head Deposits

The Head Deposits were encountered below the Head / London Clay Derived Fill in five of the exploratory hole positions at depths ranging between 1.00m and 1.10m bgl north of the embankment, and between 3.20 and 4.65m bgl below the embankment crest.

The deposit ranged in thickness between 1.0 and greater than 4.45m and comprised relatively uniform soils consisting of firm to stiff orange brown clay with subordinate silt, sand and localised fine to coarse, subrounded to angular flint (WS06). The deposit was similar in composition to the underlying London Clay Formation indicating a close association. The boundary between these formations has therefore only tentatively been assigned where dark organic remnants and coarse soils are no longer present.

4.4.4 London Clay Formation

The London Clay Formation was encountered below the Head Deposits in three of the exploratory holes at depths ranging between 4.20 and 9.00m bgl and persisted to the full depth of the investigation at 10.45m bgl. Based on a broad overview of the limited information available, the surface of the London Clay Formation appears to deepen across the site towards the south east from a level of 12.52mAOD in WS06, to 8.75mAOD in WS03. This deepening coincides with the thickening layer of Head Deposits towards the southeast.

4.4.5 Sub Structures - Embankment Crest

WS01 was progressed through the surface hard standing / Made Ground and encountered a concrete obstruction 0.85m bgl. Rapid and constant ingress of ground water occurred during the excavation preventing deeper progression. The water attained a static level (0.32m bgl) approximately 0.05m lower than the lake water level (0.27m bgl) after bailing. The pit was excavated alongside a vertical wall of a concrete mass running south to west, which corresponded to a scar on the surface tarmac. A second vertical sub structure of mortared brick was also noted which ran parallel to the lake sheet piles and possibly forms part of the historic or current retaining structure. The horizontal obstruction extended across the base of the pit but visual identification was not possible due to the rapid and constant ingress of heavily silted water.

4.4.6 Sub Structures - Retaining Wall Foundation

HP02 was hand excavated at the base of a mortared brick section of the retaining wall supporting the embankment to the south of Bowls Pavilion and Boat Compound. The excavation confirmed the vertical wall continued through the Made Ground and was supported by a concrete strip at 0.40m bgl (15.98mAOD). The lateral extent of the concrete measured 0.55m from the face of the retaining wall and the excavation was progressed through Made Ground down the side of the foundation.

Undermining of this substructure confirmed its thickness (0.05m) which increased to at least 0.15m immediately below the wall, suggestive of concrete 'overspill' during construction from the foundation trench which is likely to be deeper. The base depth of the foundation was not established.

The Made Ground adjacent to the foundation comprised soft sandy gravelly clay with flint, brick, ceramic, plastic and organic inclusions. The formation layer supporting the strip foundation was not encountered.

Figure A112771-LDN-N-02 (Appendix B.2) shows a schematic cross section of the foundation and further commentary of the structures associated with the retaining wall is provided in Section 5.0.

4.4.7 Groundwater

Groundwater was encountered at various locations during the investigation as summarised in Table 11.

In general, from observations of water levels during the investigation, there appears to be localised hydraulic continuity between the water level in the lake and the groundwater levels recorded within the crest of the embankment. It was not established whether the groundwater recharge within the inspection pits and window samples occurred at high level through the freeboard section of the sheet pile or through high piezometric pressures at deeper levels. The variability of the embankment fill, which includes some pockets and horizons of permeable soils would afford some permeability and there is potential for flow through the embankment fill.

Table 11 Summary Details of Groundwater Strikes During the Investigation

Hole Ref.	Depth (m bgl)	Strata	Notes
WS01	0.37	Made Ground	Rising to 0.32m bgl after 20minutes.
WS02	0.50	Made Ground	Slow seepage from within the inspection pit.
WS03	GL	Topsoil	Water overlapping through the top of the sheet pile had resulted in ponded surface water adjacent to this location. No groundwater strike was observed during drilling.
WS04	0.80	Made Ground	Seepage from the base of the inspection pit.
WS04	3.50 to 4.10	Made Ground	Saturated soils of variable composition.
WS05	NE	NE	Groundwater not encountered
WS06	NE	NE	Groundwater not encountered
HP03	GL to 0.25	Topsoil	Waterlogged to 0.25m bgl.
HP04	NE	NE	Dry

HP03 was excavated within an area of reportedly boggy ground alongside the decorative waterfall. It is understood that this area remains boggy when the feed from the lake to the waterfall is isolated.

The excavation encountered very soft, waterlogged slightly sandy clay with high organic matter content to a depth of 0.25m bgl. This was underlain by soft slightly sandy clay with occasional rootlets which was notably drier than the soil above.

HP04 was excavated 4m upslope from HP03 and 2m downslope of the decorative waterfall's mid-pool. The excavation encountered dark brown woodchips overlying soft to firm slightly sandy slightly gravelly clay. No groundwater water was observed in this hole and soils were relatively dry with low saturation.

4.4.8 Groundwater Monitoring

Groundwater levels were monitored using a dual phase dip-meter during two return monitoring visits as summarised in Table 12.

Table 12 Ground Water Monitoring

Hole Ref	Date	Water depth	Base depth	Water Level
		(m bgl)	(m bgl)	(m AOD)
WS02	25/11/19	0.32	3.00	17.45
WS02	14/01/20	0.30	3.00	17.47
WS03	25/11/19	0.28	3.10	17.47
WS03	14/01/20	0.18	3.10	17.57
WS04	25/11/19	0.78	1.39	16.96
WS04	14/01/20	0.82	1.39	16.92
WS05	25/11/19	0.48	4.80	16.07
WS05	14/01/20	0.45	4.80	16.10
WS06	25/11/19	1.08	5.20	16.65
WS06	14/01/20	1.00	5.20	16.73

4.5 Laboratory Geotechnical Assessment

Laboratory geotechnical testing on samples recovered from the exploratory holes was scheduled by WYG. Testing has been undertaken by Professional Soils Laboratory Ltd, who are UKAS accredited for a wide range of geotechnical tests. All testing was carried out in accordance with BS1377:1990 Methods of Test for Soils for Civil Engineering Purposes as summarised in Table 13 and results are included in Appendix F.

Table 13 Summary of Laboratory Geotechnical testing

Test	Standard	Scheduled	Completed
Particle Size Distribution (Wet Sieving Method)	BS1377: Part 2: 1990, Clause 9.2	5	5

Test	Standard	Scheduled	Completed
Particle Size Distribution (Sedimentation Analysis)	BS1377: Part 2: 1990, Clause 9.4	5	5
Moisture Content	BS1377: Part 2:1990, Clause 3.2	7	21
Liquid Limit (one point method)	BS1377: Part 2:1990, Clause 4.4	14	14
Plastic Limit	BS1377: Part 2:1990, Clause 5.3	14	14
Plasticity Index	BS1377: Part 2: 1990, Clause 5.4	14	14
Bulk and Dry density	BS1377-2:7 & BS EN ISO 17892-2	6	6
Oedometer Consolidation (20,40,60kPa - Loading and unloading)	BS 1377:1990 - Part 5 : 5	1	1
pH and Sulphate	BS1377:1990 3/9	2	4
Organic Content	BS 1377:1990 - Part 3 : 5.2	9	9
BRE SD1 Concrete Aggressivity Chemical Testing Full Suite	BRE Digest SD1: 2005 Concrete Aggressivity Suite (Suite D)	4	4

4.6 Laboratory Environmental Assessment

Environmental laboratory testing scheduled by WYG, was undertaken by ALS Laboratory who are UKAS and MCERTS accredited for a wide range of chemical tests.

Laboratory testing was carried out in accordance with BS10175:2011+A1:2013 Investigation of Potentially Contaminated Sites - Code of Practice.

The testing suites are listed in Table 14 and results are included in Appendix G.

Table 14 Summary of Laboratory Environmental Testing

Testing Suite	Testing Included	No.
Soils – WYG Suite A	Arsenic, Boron, Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide (free & total), Water Soluble Sulphate as SO_4 2:1 extract, PAH Phenols, TPH, Total Organic Carbon, pH and Asbestos (screen).	6
Soils – Asbestos ID	Where the asbestos screen has identified either fibrous material or building materials, this indicates the possible presence of asbestos and testing will identify if this is the case.	4

5.0 STRUCTURAL OBSERVATIONS

5.1 Sheet Pile Retaining Wall

Across the freeboard zone (at and above the water level) the sheet piles forming the lake bank were generally in a poor condition and the following defects were noted in localised areas as indicated on Drawing A112771-LDN-N-01 (Exploratory Hole Location Plan);

- areas of total loss of section/detachment of the top 150mm through corrosion within the freeboard zone;
- areas of clutch failure leaving the top 150mm of adjacent piles disengaged within the freeboard zone.

Below the water level no obvious signs of loss of section or clutch failure were observed or detected by visual inspection / touch. This is not unexpected because this section of the pile is fully immersed in reduced oxygen conditions with relatively reduced wave and weathering action, whereas the edge of the pile head is fully exposed and prone to impact damage and delamination from weathering and corrosion.

It is anticipated that the poor condition of the top 150mm of the piles is the result of previous timber fendering which was installed tight against the outer pan of the piles. This would hold water against the face of the piles, particularly when the timber fendering itself was in poor condition and subject to decay. Where the fendering has been removed the fixing holes are left exposed resulting in further weakening of the section and accelerated localised delamination and corrosion.

It is also noted that there is also a possibility that the pile heads were damaged / distorted or weakened by the drive head during their original installation.

Whilst these theoretical processes cannot be categorically proven, they are well supported by the localised areas of corrosion which are most prevalent on the outer pans where the current timber fendering has been lost, whereas the in-pans show limited evidence of corrosion. Localised areas of corrosion, and conversely intact sections of freeboard pile are indicated on Drawing A112771-LDN-N-01 (Exploratory Hole Location Plan). Photographic records of these features are provided in Appendix C.

Further key observations along the sheet pile and embankment are annotated on Drawing A112771-LDN-N-01 (Exploratory Hole Location Plan) and summarised as follows.

- Mature trees and associated root systems growing within the embankment crest have disturbed the sheet piles resulting in visible distortion / deflection of the piles at several locations along the Lake edge (see Photo 12).
- Roots have penetrated the interface between the sheet piles and the timber capping / fendering resulting in separation and accelerated weathering / corrosion (see Photo 11).
- Minor organic algal and moss growth was noted on the outer face of the piles (Photos 23 & 25).
- Access to the sheet piles during the waterbourne survey was impeded in some locations by submerged tree branches.
- The grill screen covering the intake that feeds the water waterfall in the ornamental garden was noted to be loose and became separated during inspection by the engineer. It was noted to have been held in place with 2 no. screws which were heavily corroded. The opening was also noted to be irregularly formed, so it was either cut inaccurately or has been distorted by corrosion.

5.2 Magnetometry

On completion of drilling at locations WS02, WS03 and WS06 the installed boreholes were probed using a downhole magnetometer to survey the presence of magnetic fields potentially associated with ferrous substructures. Given the proximity of the steel sheet piles to the borehole locations (between 1.0 and 2.0 m), and the increase in strength of the signal with lateral proximity at ground level, it is considered likely that the magnetic fields identified at each position are associated with the sheet pile. It is further noted that the sharp signal strength reduction occurred immediately below depths of approximately 3m bgl at each location, and it is therefore considered likely that the sheet piles terminate at or before this depth.

5.3 Retaining Wall

In summary, both the brick, and to a lesser extent, the block sections of the retaining wall displayed signs of structural instability. Notable features are summarised below.

- The brickwork section of the wall showed some structurally significant vertical cracking between 1.0 and 2.0m in height (Photos 26 & 28).
- Cracking generally followed the horizontal and vertical mortar joints but some split bricks were also noted (Photo 26 & 27).
- Apertures of up to approximately 20mm, were noted and in one 1.5m wide area 4 to 5 of the uppermost courses of brickwork have become detached and deposited at the base of the wall (Photo 26).
- In another section the upper most 4 course of brick displayed signs of rotational failure along the horizontal mortar joint. (Photo 27).
- A fence post installed within the crest immediately south of the retaining wall was noted to be loose.
- Other than the close / tight cracks that extend from more significant cracking originating at upper levels, the lower sections of the wall showed limited obvious signs of structural distress. (Photos 14, 15 & 16).
- The blockwork section of the wall is in a better condition, and although several structurally significant cracks were noted, no obvious signs of movement or loss of the structure was observed. (Photo 28).

It is noted that these significant defects often occur adjacent to a semi-mature vegetation at the crest of the retaining wall.

No signs of settlement/rotation or translation, or other obvious signs of structural distress which would typically indicate failure of the foundations at or about the lower sections of the wall were noted. As such it is assumed that the foundations are sound, and that the failure of the brickwork wall is attributable to the vegetation growth, including associated volume change of the soil (discussed in Section 6.0), and also, in localised areas, related to complications with the installation of the fence posts, e.g. during driving / and displacement of the soils which may have created increased local surcharges. A cross sectional diagram of the retaining wall structure and observed foundations is included as Drawing A112771-LDN-N-02 (Retaining Wall Diagram) (Appendix B.2).

5.4 Drainage Survey

The CCTV drainage survey was undertaken using a robotic mobile CCTV drainage camera and where restricted using an endoscope. The survey includes video footage and photos which allow an assessment to be made regarding the condition of the drainage system. The various sections of the drainage system surveyed have been assigned codes which are marked on *Midland Survey drawing number U03506 – 1*. A description of each location has been included in Table 15 for clarity.

Each surveyed section has been assigned a condition grade, based on the Manual of Sewer Condition Classification 5th edition, BS EN 13508-1:2003 and The Drain Repair Book (DRB) 4th edition. The grading system used is summarised as follows, grades A-C are applied to whole sections of drainage whilst grades 1-5 are attributed to specific defects:

- Grade A: Drain is serviceable no recommendations required.
- Grade B: There is an issue that might require remedial works but is not imperative.
- Grade C: There is a defect that requires immediate remedial works, the drain is not serviceable.
- Grade 0: no defects identified.
- Grades 1 to 2: These defects may require remedial monitoring.
- Grades 3 to 4: These defects may require some form of remedial works.
- Grade 5: These are defects that will require remedial repair or replacement.

Overall, the culvert flowing from the stilling pond is in good condition aside from two root mass intrusions, which will require remedial repair. The decorative waterfall culvert is in good condition but partially blocked at the waterfall end preventing full penetration with CCTV. Brick rubble prevented CCTV penetration for the full extent of the culvert under the café from the west heading downstream, and deformation of the culvert prevented penetration of the full extent from the east heading upstream.

The findings are summarised in Table 15 and the full report (Wimbledon Park Drainage Report, Midland Survey, Dec 2019) is appended as Appendix I.1.

Table 15 - Summary of drainage condition survey

Section		Description of location	DRB Grade	Service Grade	Structural Grade	Pipe diameter (mm)	Pipe material	Defect description
From	To							
Outfall 01 - us	Bmh01	Outfall of stilling pond drainage culvert	Grade C	5	0	525	Concrete	- Root mass at joint approx. 1.3m in length, resulting in 20% cross-sectional area loss. - Connection 150mm diameter pipe intruding resulting in 10% cross-sectional area loss.
Outfall 02 - ds	Bmh02	Outfall culvert from the stilling pond	Grade B	3	0	450	Polyvinyl Chloride	- Root mass at joint approx. 1m in length, resulting in 10% cross-sectional area loss.
Bmh02 - ds	Bmh01	Stilling pond outfall culvert	Grade A	0	0	525	Concrete	- N/A
Mh01 ds	Sa	Divert pipe adjacent to overflow sluice	Grade C	4	0	100	Cast Iron	- Rust / corrosion along full length of pipe. Survey abandoned at 4.1m due to rust / corrosion reducing pipe circumference.
Mh01 us	Sa	Divert pipe adjacent to overflow sluice	Grade C	5	0	100	Vitrified Clay (i.e. all clayware)	- Survey abandoned due to build up of leaves / branches resulting in 100% cross-sectional area loss.
Mh02	Mh02	Downstream divert pipe adjacent to overflow sluice	Grade A	0	0	100	Cast Iron	- N/A
Mh03	Mh03	Decorative waterfall inflow	Grade A	0	0	100	Cast Iron	- N/A
Mh04 us	Sa	Decorative waterfall inflow	Grade C	4	0	100	Vitrified Clay (i.e. all clayware)	- Survey abandoned due to build up of branches and vegetation causing 100% cross-sectional area loss.

Section		Description of location	DRB Grade	Service Grade	Structural Grade	Pipe diameter (mm)	Pipe material	Defect description
From	To							
Mh05 ds	Sa	Decorative waterfall inflow	Grade A	0	0	150	Vitrified Clay (i.e. all clayware)	- Survey abandoned due to poor vision underwater and pipe restrictions.
Mh06 ds	Sa	Inflow under café	Grade C	4	0	225	Vitrified Clay (i.e. all clayware)	- Survey abandoned due to settled coarse deposits (possible brick fragments) causing 40% cross-sectional area loss
Outfall 03 us	Sa	Outfall under café	Grade C	5	5	225	Pitch fibre	- Deformed drain/sewer causing 20% loss of cross sectional area from 0 – 1.8m and 40% loss of cross sectional area from 1.9m. Survey abandoned due to pipe deformation.

Sa = survey abandoned
Mh = Manhole
us = upstream
ds = downstream

5.5 Archaeological watching brief

The archaeological potential of the site was monitored by an archaeologist from Museum of London Archaeology (MOLA). The representative was present for WS01 – WS04 inclusive and did not identify and remains or deposits of archaeological or palaeoenvironmental significance.

The MOLA report (*Wimbledon Park Lake Geoarchaeological Watching Brief*, Dec 2019) (included as Appendix I.2) therefore concludes that the site is of low archaeological and palaeoenvironmental potential and the proposed works will have little to no impact on any significant archaeological and palaeoenvironmental remains.

6.0 GROUND MODEL

6.1 Introduction

In summary, the encountered ground conditions comprised variable Made Ground overlying the Head and London Clay Formation derived Fill forming the Lake Embankment which locally overlies the Head and London Clay Formation.

The Made Ground was variable with localised areas of more variable disturbed soils persisting to relatively deeper levels within the Lake embankment. Below the Made Ground, and forming the majority of the embankment fill, soils were relatively uniform and comprised predominantly fine soils (Head and London Clay Formation derived Fill).

Groundwater was encountered at shallow levels approximating to the water level within the lake within the embankment, and it is considered likely that preferential pathways for groundwater originated from the lake and precipitation may exist in areas of deeper Made Ground / disturbed soils.

Full descriptions of the soils encountered are provided on the engineering logs (Appendix D) and summarised in Section 5.1. The sequence of strata encountered within boreholes and trial pits has been summarised in Table 16.

Table 16 - Summary of Strata Sequence

Strata	Unit	Description	Depth to Top (m bgl)	Level of Top (m AOD)
Made Ground	A1	Variable soft to firm clay with subordinate sand and gravel.	GL*	+17*
Fill – Embankment Only	A2	Soft to firm slightly sandy, slightly gravelly CLAY.	0.50	+16.50
Head	B1	Soft to firm silty sandy CLAY	1.00 to 4.50**	+16.50 to 12.00**
London Clay Formation	B2	Firm to stiff silty CLAY.	4.50 to 9.00**	+12.00 to 8.60**

* Uncharcterisable due to high variability
** Depth dependant on embankment height / Fill thickness.

6.2 Geotechnical Parameters

This section discusses the key geotechnical characteristics of each encountered stratum as determined from field observations and laboratory geotechnical testing.

In most cases, characteristic values or profiles will be assessed based on conservative best estimate of the available data set. Such values are referred to as moderately conservative. The selection process will take into account the variability of the data, but extreme or unrepresentative data values will be ignored. Additionally, comparisons with other published data, correlations with other parameters and engineering judgement are also used to arrive at a characteristic value. Moderately conservative values will be used, where appropriate, with appropriate safety factors.

It should be noted that it is intended that the designer must use his judgment and consider the appropriateness of individual design values to the level of strain and application of loading that applies to the specific design case and to the sensitivity of the structure or remedial strategy to which they may be applied.

6.3 Unit A1: Made Ground

Below the hardstanding / turf and topsoil, the presence of Made Ground to deeper levels (as opposed to the more uniform Fill), was only confirmed in WS04. Although predominantly fine, these soils also contained a variable subordinate coarse soil content comprising flint and brick, ceramic and concrete fragments, including a discrete 0.60m thick horizon of predominantly coarse soils at a depth of 3.50m bgl. Due to this variability the soils are essentially considered to be uncharacterizable, however for general guidance some laboratory geotechnical assessment has been undertaken on these soils.

6.3.1 A1: Classification

Atterberg limit tests were carried out on two samples of Made Ground. Moisture content values were constant at 35%. Liquid Limit (LL) values range between 57% and 68%. Plastic Limit (PL) values range between 25% and 29%, with the in-situ (natural) moisture content at or exceeding the Plastic Limit. The Plasticity Index varies between 32% and 39%, with an average of 83% passing the 0.225mm sieve the average modified Plasticity Index (PI') is 29.4%. The volume change potential is therefore indicated to be medium.

A plot of soil plasticity testing results is presented in Appendix F. Both test results lie above the 'A' line, showing the deposit to be predominantly clayey and typically of high (CH) plasticity.

Bulk and dry density determined on a single sample of the Made Ground obtained from a depth of 1.60m bgl measured a bulk density of 1.86Mg/m^3 and a dry density of 1.42Mg/m^3.

6.3.2 A1: Shear Strength

The range and variation of SPT N obtained from the Made Ground is summarised in Table 17.

Table 17 Summary of Made Ground SPT N Data

Unit	No. of SPTs	SPT N Range	SPT N Average
A1	5	3 - 13	7.2

SPT data showed no discernible patten reflecting the heterogenous nature of Made Ground, the uncorrected N-values indicate an overall loose relative density.

From the limited data available the characteristic shear strength of A1 and it is recommended that a conservative value is adopted based on the lower bound value. A characteristic undrained shear strength (Cu) of 30kPa is considered appropriate for Unit A1.

6.4 Unit A2: Head and London Clay Formation Derived Fill (Fill)

The lake embankment in combination with the sheet piles is constructed using Head and London Clay Derived Fill (Fill). The soils were relatively uniform in composition and predominantly comprised fine soils.

6.4.1 A2: Classification

Particle Size distribution (PSD) testing undertaken on three samples of the Unit A2: Fill has typically confirmed engineer's descriptions of the soils. WS03 PSD showed a higher percentage of SAND than anticipated, and conflicts with the engineers unity classification of sandy CLAY, however given the inert heterogeneous nature of Unit A2: Fill, it is likely that this represent a discreet sandy layer within an overall dominantly clayey unit. A summary of PSD tests is provided in Table 18.

Table 18 Summary of Particle Size Distribution tests

Unit	Range Min – Max (%)			
	Fines	Sand	Gravel	Cobbles
A2	37-87	8-63	0-15	0*

* The cobble content is likely to have been under represented by PSD Testing during the selection of materials for sampling

Atterberg limit tests were carried out on six samples of Fill. Moisture content values range between 19% and 32%. Liquid Limit (LL) values range between 34% and 63%. Plastic Limit (PL) values range between 16% and 26%, with the in-situ (natural) moisture content at or exceeding the Plastic Limit. The Plasticity Index varies between 18% and 37%, with an average of 92.5% passing the 0.225mm sieve the average modified Plasticity Index (PI') is 24.8%. The volume change potential of the Fill is therefore generally medium.

All the test results lie above the 'A' line, showing the deposit to be predominantly clayey, however plasticity is shown to range from low (CL) to high (CH) plasticity within the samples tested.

Bulk and dry density determined on two samples of Fill measured bulk densities ranging between 1.87 and 1.97Mg/m^3 and dry densities ranging between 1.55 and 1.59 Mg/m^3.

6.4.2 A2: Shear Strength

The range and variation of SPT N obtained from the Fill is summarised in Table 19.

Table 19 Summary of Fill SPT N Data

Unit	No. of SPTs	SPT N Range	SPT N Average
A2	9	1 - 10	7.2

SPT data showed no discernible patten reflecting the heterogenous nature of the Fill, the uncorrected N-values indicate an overall Lose density.

From the limited data available no firm conclusions can be drawn regarding the characteristic shear strength of the Fill and it is recommended that a conservative value is adopted based on the lower bound value. Therefore, a characteristic undrained shear strength (Cu) of 35kPa and characteristic weight density of 19 kN/m^3 are considered appropriate for the Fill.

According to BS8002, a recommended critical angle of shear resistance (Φ'_{crit}) for a clay soil with a plasticity index of 24% is 27°.

6.4.3 A2: Stiffness, Consolidation and Compressibility

The presence of organic materials and zones of highly disturbed / compositionally variable soil with variable moisture content will have a considerable impact on soil stiffness, consolidation and compressibility parameters of the embankment Fill. Therefore, the Fill forming the embankment within the lake embankment is not considered to be characterizable due to the heterogenic nature and variable organic of these soils and it is recommended that highly conservative parameters are used. Tomlinson (2001) states that typical m_v values for organic clays and peats are above 1.50 MN/m^2 and are typically of very high compressibility.

6.4.4 A2: Chemical (Concrete Class)

The ground chemistry has been determined for the Fill encountered during the ground investigation. The Design Sulfate Class and ACEC Class have been obtained from the Building Research Establishment (BRE) Special Digest 1 "Concrete in Aggressive Ground".

One sample in the Fill was analysed and showed a Total Potential Sulfate content of 30mg/l, with a pH of 6.8. Therefore, the Design Sulphate Class for the Fill is DS-1 and the ACEC Class is AC-1 assuming mobile groundwater conditions.

6.5 Unit B1: Head

The Head is relatively uniform in composition and predominantly comprised fine soils with subordinate sand and flint gravel.

6.5.1 B1: Classification

Particle Size distribution (PSD) testing undertaken on a single sample of the Head has confirmed engineer's descriptions of the soils. A summary of PSD tests is provided in Table 20.

Table 20 Summary of Head Particle Size Distribution Testing

Unit	% Passing			
	Fines	Sand	Gravel	Cobbles
B1	97	3	0	0*

* The cobble content is likely to have been under represented by PSD Testing during the selection of materials for sampling

Atterberg limit tests were carried out on four samples of Head. Moisture content values range between 32% and 38%. Liquid Limit (LL) values range between 74% and 77%. Plastic Limit (PL) values range between 30% and 32%, with the in-situ (natural) moisture content at or exceeding the Plastic Limit. The Plasticity Index varies between 43% and 45%, with an average of 99%

passing the 0.225mm sieve the average modified Plasticity Index (PI') is 43.8%. The volume change potential of the Head is therefore generally high.

All the test results lie above the 'A' line, showing the deposit to be predominantly clayey and are very high (CV) plasticity.

6.5.2 B1: Shear Strength & Density

The range and variation of SPT N obtained from the Head is summarised in Table 21.

Table 21 Summary of Head SPT N Data

Unit	No. of SPTs	SPT N Range	SPT N Average
A2	11	7 - 19	12

Based on the relationship Cu = SPT N *4.5, a characteristic undrained shear strength (Cu) of 54kPa and characteristic weight density of 1900 kg/m^3 are considered appropriate for the Head.

Based on Terzaghi, Peck and Mesri (1996) plotted plasticity index values for various clay soils against friction angle, for the average plasticity index value of 43%, a conservative characteristic angle of friction Φ' = 23° is recommended for Unit A2.

6.5.3 B1: Stiffness

An assessment of Young's Modulus was undertaken based on the general expressions:

- $E_u = 400c_u$ (for normally consolidated soils) and $E' = 0.7E_u$

Therefore, based on the lower bound undrained shear strength estimated from SPT N (Section 6.5.2) a value of Young's Modulus of 50Mpa is considered appropriate for the Head.

6.5.4 B1: Consolidation and Compressibility

A single oedometer test undertaken on an undisturbed sample recovered from a depth of 2.00m bgl showed that the coefficient of volume compressibility (m_v) within the Head of 0.2 m^2/MN for applied pressures ranging from 20 to 60 kPa. For the applied pressure range stated, a coefficient of consolidation (Cv) of 22m^2/year has been determined.

The variable nature of the material, in particular the organic content, which ranged between 0.4 and 3.1% on four samples, can have a considerable impact on compressibility and laboratory determined values may not be truly representative of this variability.

Tomlinson (2001) states that typical m_v values for organic clays and peats are above 1.50 MN/m^2 and are typically of very high compressibility and it is recommended that this more conservative value is considered, particularly at shallow levels in this unit.

6.5.5 A2: Chemical (Concrete Class)

The ground chemistry has been determined for the Head encountered during the ground investigation. The Design Sulfate Class and ACEC Class have been obtained from the Building Research Establishment (BRE) Special Digest 1 "Concrete in Aggressive Ground".

The highest sulfate concentration measured in the laboratory tests on two samples of Head is 2000mg/l. The pH recorded on the samples of Head ranged between 7.1 and7.3. Therefore, the Design Sulfate Class for the Head is DS-2 and the ACEC Class is AC-2 assuming mobile groundwater conditions.

6.6 Unit B2: London Clay Formation

The London Clay Formation is relatively uniform in composition and predominantly comprised fine soils.

6.6.1 B2: Classification

Particle Size distribution (PSD) testing undertaken on a single sample of the London Clay Formation has confirmed engineer's descriptions of the soils. A summary of PSD tests is provided in Table 22.

Table 22 Summary of London Clay Formation Particle Size Distribution Testing

Unit	Passing (%)			
	Fines	Sand	Gravel	Cobbles
B1	96	4	0	0

* The cobble content is likely to have been under represented by PSD Testing during the selection of materials for sampling

Atterberg limit testing carried out on a single sample of the London Clay Formation, recorded a moisture content of 33% and Liquid Limit (LL) value of 59%.The sample showed a Plastic Limit (PL) value of 24%, with the in-situ (natural) moisture content exceeding that of the Plastic Limit. The corresponding Plasticity Index was recorded as 35%, with 97% passing the 0.225mm sieve to provide a modified Plasticity Index (PI') of 34%.

All the test results lie above the 'A' line, showing the deposit to be predominantly clayey and of high (CH) plasticity and a volume change potential of medium.

6.6.2 B2: Shear Strength

The range and variation of SPT N obtained from the London Clay Formation is summarised in Table 23.

Table 23 Summary of London Clay Formation SPT N Data

Unit	No. of SPTs	SPT N Range	SPT N Average
B2	6	7 - 19	13

It should be noted that SPT N values typically increased with depth, within the London Clay Formation, the uncorrected N-values indicate an overall firm to stiff consistency.

Based on the relationship Cu = SPT N *4.5, a characteristic undrained shear strength (Cu) of 58kPa and characteristic weight density of 1900 kg/m^3 are considered appropriate for the London Clay.

According to BS8002, a recommended critical angle of shear resistance (Φ'_{crit}) for a clay soil with a plasticity index of 34% is 25°.

6.6.3 B2: Stiffness

An assessment of Young's Modulus was undertaken based on the general expressions:

- $E_u = 400c_u$ (for normally consolidated soils) and $E' = 0.7E_u$

Therefore, based on the average undrained shear strength estimated from SPT N (Section 6.6.2) a value of Young's Modulus of 60Mpa is considered appropriate for the London Clay Formation.

6.6.4 B2: Chemical (Concrete Class)

The ground chemistry has been determined for the London Clay Formation encountered during the ground investigation. The Design Sulfate Class and ACEC Class have been obtained from the Building Research Establishment (BRE) Special Digest 1 "Concrete in Aggressive Ground".

One sample in the London Clay Formation was analysed and showed a Total Potential Sulfate content of 210mg/l, with a pH of 7.1. Therefore, the Design Sulfate Class for the Fill is DS-1 and the ACEC Class is AC-1s assuming static groundwater conditions.

6.7 Seasonal Volume Change Potential

Any remedial design will need to consider the seasonal volume change potential of the soils forming the embankment, particularly in areas of the embankment that are located within the zone of influence of trees. Table 24 summarises the volume change potential of the units encountered

within and below the embankment based on the characteristic PI' and further discussion regarding mitigating design considerations is provided in Section 7.

Table 24 Summary of Unite Volume Change Potential

Unit	Characteristic Modified (PI')	Volume Change Potential
A1	29.4	Medium
A2	24.8	Medium
B1	43.8	High
B2	34	Medium

6.8 Characteristic Geotechnical Parameters Summary

Suggested characteristic material parameters for each unit and the associated rationale are summarised in Table 25.

Table 25 Characteristic Geotechnical Parameters

Stratum	Material Parameter	Characteristic Value	Rationale
Unit A1 – Made Ground	Unit Weight (kN/m³)	17-19	Variable soil - uncharacterisible
Unit A2 – Fill	Unit Weight (kN/m³)	19	Laboratory assessment
	Shear resistance Φ'_{crit} (°)	27	BS8002

Stratum	Material Parameter	Characteristic Value	Rationale
	Undrained shear strength, Cu (kPa)	35	Cautious estimate based on SPTs and engineers description of consistency
Unit B1 – Head	Unit Weight (kN/m³)	19	From published value for silt / clay (Tomlinson, M.J. 2001)
	Shear resistance Φ'_{crit} (°)	23	Terzaghi, Peck and Mesri (1996)
	Undrained shear strength, Cu (kPa)	50	Based on SPTs and engineers description of consistency
	Youngs Modulus (MPa)	50	Based on SPTs
	Consolidation Properties (Cv/m^2)	22	Laboratory assessment
Unit B2 – London Clay Formation	Unit Weight (kN/m³)	19	From published value for organic silt / clay (Tomlinson, M.J. 2001)
	Shear resistance Φ'_{crit} (°)	23	Terzaghi, Peck and Mesri (1996)
	Undrained shear strength, Cu (kPa)	58	Based on SPTs and engineers description of consistency
	Youngs Modulus (MPa)	60	Based on SPTs
	Consolidation Properties (Cv/m^2)	22	Based on SPT N and PI.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Sheet Piles

Brief initial consideration is given to the structural repairs/remedial works needed to extend the ongoing working life of these structures as follows.

It is important to note that the following considerations are based on an initial visual inspection and further inspection and design works will be required before these works can be fully scoped. It is anticipated that the sheet plies below the water level are in a serviceable condition but the top 150mm or so of the piles within the freeboard section are in a poor condition.

It is anticipated that the condition of the piles has been caused or exacerbated by the presence of timber fendering tight against the out pan of the sheet piles, the localised absence of which has also allowed exaggerated weathering of the fixing holes. In addition, the absence of a pile cap / head has exposed the pile edge protection to further weathering resulting in corrosion / delamination.

Based on the above assessment, it is recommended that consideration is given to installing a concrete capping beam along the full length of the sheet piles. This would protect the corroded portions of the piles and stiffen the damaged piles where section loss has occurred. It would be necessary to extend the capping far enough down the piles to allow a secure structural fixing to be achieved. Where the piles remain in reasonable condition it may be possible to achieve this without installing concrete in the water. However, where the top 150mm of the piles have been lost it is anticipated some underwater working would be needed unless the water level in the reservoir could be dropped whilst the work was undertaken. Whilst this approach may be technically challenging, it is highly recommended given that otherwise the more costly alternative of extraction and replacement of the piles is likely to be required.

In addition to the above, the following remedial works are also recommended in order to maximise the ongoing working life of the piles:

Mature trees growing adjacent to the lake edge have distorted the alignment of the sheet piles, and it is understood that selective tree removal [(3)] may form part of proposed arboricultural management. However, it is noted that tree removal will disturb the embankment fill soils which are assessed to be of Medium to High-volume change potential (see Section 6.7 and 7..4) and will also remove the root systems that currently help to stabilise the embankment. Accordingly, it is recommended that specialist arboricultural advice is sought during the design of remedial works. The small tree roots growing out through between the capping and the piles should be cut away to

avoid distortion to the piles (subject to confirmation that this is permissible if the trees are protected). Consideration should also be given to the installation of a root barrier and compressible void on the land side of the sheet piles to accommodate seasonal volume change.

The grill over the water intake for the waterfall that has become detached should be replaced. Consideration should be given to inspecting how this opening was formed in the piles and to ensure that retained material is not passing through this opening.

7.2 Retaining Wall

It is recommended that the vegetation behind the wall is removed and the roots grubbed out and a root barrier / compressible void installed against the retaining wall. The fence posts along the top of the wall should be also be removed, including any failed bases. It is anticipated that the above works could cause further brick loss from the wall and any remaining bricks that are loose should further be removed and the brickwork should then be reinstated up to full height in a like for like manner. The structural cracks to the wall should be stitched with Helifix bars or similar to achieve continuity across the cracks. If the fence posts need to be replaced an appropriate design should be undertaken with an appropriate foundation that does not damage the wall.

7.3 Drainage Culverts

The drainage culverts were found to be in reasonable condition, but remedial works are required to ensure the long-term integrity of the drainage system. The main culvert draining the stilling pond has two identified root masses which have entered the culvert at joints. The drainage culvert feeding the decorative waterfall is impacted by a build up of vegetation which is believed to be drawn in from the lake. Access to the culvert under the café was limited by settled deposits of coarse material which appeared to be brick fragments. The culvert which follows the perimeter of the café could not be fully surveyed due to structural deformation.

7.4 Embankment

Aside from the cracking and undulations noted within the of the asphalt footpath at the embankment crest, which likely relate to tree root penetration and seasonal settlement, no further obvious signs of significant instability were noted within the earth fill embankment.

However, the presence of waterlogged topsoil within the area of the waterfall does suggest that groundwater movement through the embankment could follow preferential pathways, possibly associated with the variable and locally permeable soils within the Unit A1 Made Ground. This mechanism could, overtime, lead to further degradation of local soils with waterlogging and possibly washout / volume loss of materials ultimately resulting in destabilisation of the slope.

The presence of concentrated groundwater flows and localised destabilisation of soils within the embankment has been confirmed in WS04, and this area would benefit from some form of remedial work after the sheet piles have been repaired and any water flows originating from breaches / overtopping of the freeboard sheet pile have been stopped. Remedial work could include excavation / decompaction of soils and possibly injection grouting to help stabilise soils at deeper levels.

With the above in mind, the ground model would further benefit from additional information obtained from an increased density of sampling and testing to check for further zones of degraded or variable fill materials across the extent of the embankment. This information can then be used to undertake detailed slope stability analysis to aid the design of longer-term remedial measures.

In addition to the above, consideration should also be given to the tree growth and the volume change potential of the local soils. Both the mechanical action of roots, and the seasonal volume changes of the high-plasticity clays were visibly impacting on the integrity of the sheet pile and embankment (see Section 7.1 and Section 2.4.1) at the time of the investigation. Furthermore, the presence of high-water demand mature trees such as Oak and Willow will render these mechanisms sensitive to further tree growth / root ball expansion, and the removal of trees and vegetation from the embankment could result in expansion of the soils and the further destabilisation of the embankment through loosening of the soils and creation of concentrated zones of groundwater.

Appendix A – Report Conditions

This report is produced solely for the benefit of **London Borough of Merton** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, the physical investigation works as detailed, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined

Appendix B – Drawings

Appendix B.1 Exploratory Hole Location Plan

Appendix B.2 Retaining Wall Diagram

Appendix B.3 Pile Section

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

N

HP01
WS05
BOWLS PAVILION
AREA OF ASPHALT CRACKING
END OF SURVEYED PILES
SAILING CLUB HOUSE
WS01
HP02
STORAGE AREA
RETAINING WAL
WS06
SHEET PILE DEFORMATION ADJACENT TO TREE
DECORATIVE WATERFALL
HP03
HP04
WS02
AREA OF ASPHALT AFFECTED BY TREE ROOTS
SHEET PILE DEFORMATION ADJACENT TO TREE
AREA OF PILES STANDING PROUD OF RETAINED MATERIAL AND PONDING WATER LEADING TO AREAS OF CLUTCH FAILURE
WS03
FISHING CLUB BANK - PILES MISSING CAPPING. INCLUDES AREAS OF DETACHMENT OF TOP 150mm OF PILE
WS04
STILLING POND BASE 15.676m AOD
WEIR 17.504m AOD
BENCHMARK 20.126m AOD
AR

Scale (metres)
0 10 20 30 40 50

KEY

- WINDOW SAMPLE
- HAND PIT
- AR — SURFACE WATER DRAIN

REV	DESCRIPTION	BY	CHK	APP	DATE

Client:
LONDON BOROUGH OF MERTON

11th FLOOR
1 ANGEL COURT
LONDON
EC2R 7HJ

TEL: +44 (0)20 7250 7500
e-mail: london@wyg.com

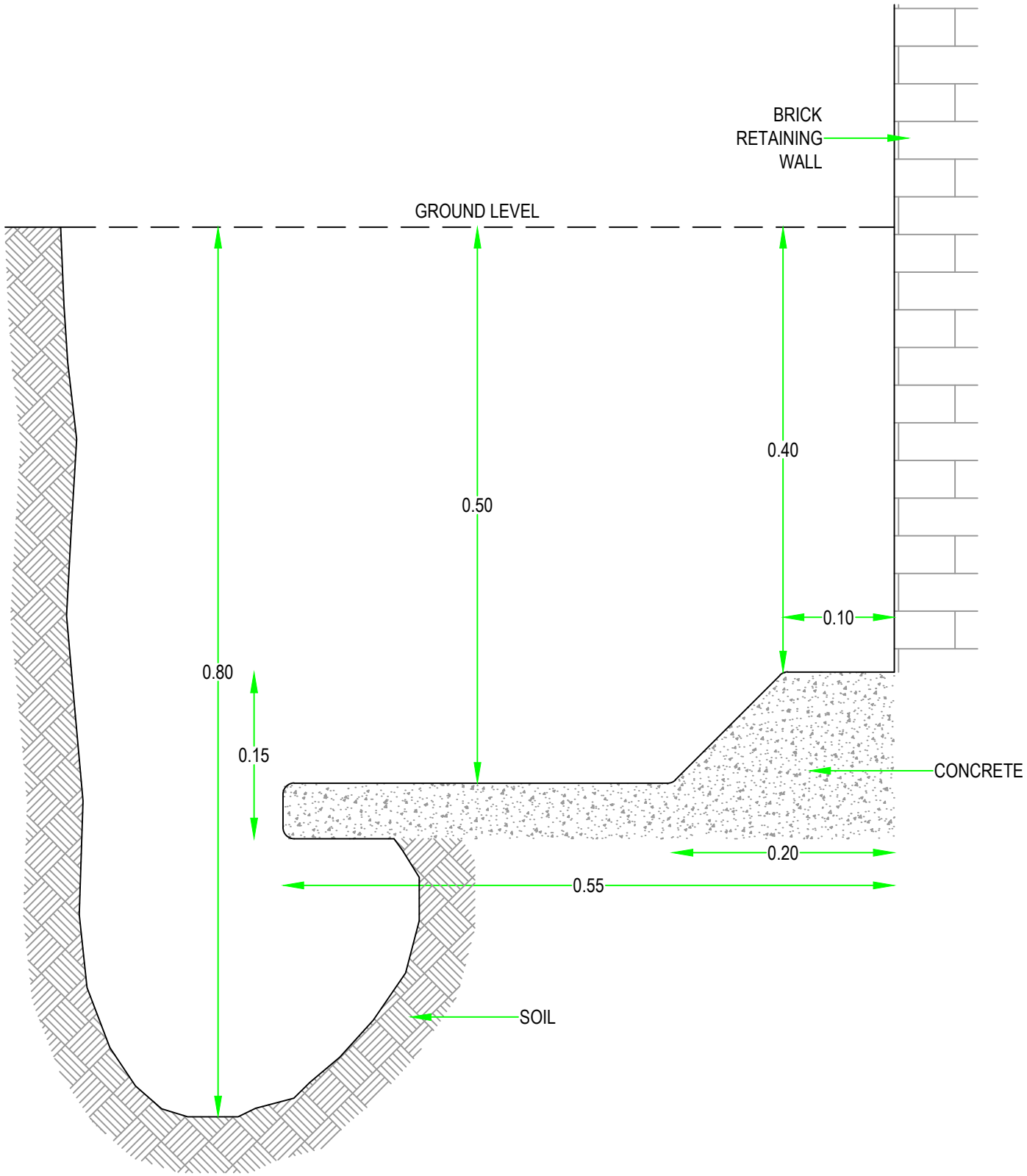
Project: A112771
WIMBLEDON LAKE

Drawing Title:
EXPLORATORY HOLE LOCATION PLAN

Scale @ A3	Drawn Date	Checked Date	Approved Date
1:1,000	CM 28.11.19		

Project No.	Office	Type	Drawing No.	Revision
A112771	LDN	N	01	

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS



0 0.05 0.10 0.15 0.20 0.25m

SCALE 1:5

REV	DESCRIPTION	BY	CHK	APP	DATE

11th FLOOR
1 ANGEL COURT
LONDON
EC2R 7HJ

TEL: +44 (0)20 7250 7500
e-mail: london@wyg.com

Client: LONDON BROUGH OF MERTON

Project: A112771
WIMBLEDON LAKE

Drawing Title:
RETAINING WALL DIAGRAM

Scale @ A4	Drawn	Date	Checked	Date	Approved	Date
1:5	CM	29.11.19				

Project No.	Office	Type	Drawing No.	Revision
A112771	LDN	N	02	

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

Scale mm

Note: Pile section as traced on site and copied into AutoCAD. While reasonable skill and care have been taken to record the pile section, this cannot be considered fully accurate.

REV	DESCRIPTION	BY	CHK	APP	DATE

11th FLOOR
1 ANGEL COURT
LONDON
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Client: LONDON BOROUGH OF MERTON

Project: A112771
WIMBLEDON LAKE

Drawing Title:
PILE SECTION

Scale @ A4	Drawn	Date	Checked	Date	Approved	Date
1:2	CM	27.01.20				

Project No.	Office	Type	Drawing No.	Revision
A112771	LDN	N	03	

Appendix C – Photographic Plates

Plate 1 View from north east to east along the embankment pathway

Plate 2 View north from the eastern most extent along grass fishing bank

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Plate 3 View from embankment crest east, over decorative waterfall

Plate 4 View facing north towards the sailing club

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Plate 5 Bowls Pavillion

Plate 6 Close up of pile top (adjacent to jetty by sailing club)

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Plate 7 Timber fender strip with metallic capping

Plate 8 Degredation of the timber fender/rubbing srip in the foreground

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Plate 9 View east showing cracks in asphalt in the north area of the site

Plate 10 Undulations in the asphalt due to root balls in the central east area of the site

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Plate 11 Damage to the asphalt due to root breaching in the central east area of the site

Plate 12 Bulging of the sheet pile due to trees in the central east area of the site

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Plate 13 Area of sheet pile where timber fendering and metallic capping is not present

Plate 14 Retaining wall to the south of the bowls pavilion

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Plate 15 View along the retaining wall from the top of the adjacent blockwork wall

Plate 16 Retaining wall and block work wall

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Plate 17 Lake overflow stoplogs

Plate 18 Stilling pond drainage culvert

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Plate 19 Outfall of the culvert draining the stilling pond

Plate 20 General view of sheet piles looking north. Note: piles in this area stand proud of the retained material and loss of section to the piles permits water to pass through and pond behind.

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Plate 21	Rear of sheet pile where pile stands proud of the retained material and loss of section to the piles permits water to pass through and pond behind

Plate 22	Close up view of top of piles where timbe fendering has been lost

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Plate 23 Organic growth and minor defects on sheet pile on fishing bank

Plate 24 Degredation of the sheet pile on fishing bank

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Plate 25 Evidence of corrosion on sheet pile at fishing bank

Plate 26 Structural Crack running the full visible height of the brickwork retaining wall

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Plate 27 Top section of brickwok retaining wall rotated about a failure plain along a mortar joint

Plate 28 Structural crack running the fll height of the blockwork wall

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Plate 29 HP01: 0.0-1.2m bgl

Plate 30 HP01 constructed hole

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Plate 31 HP01 post condition

Plate 32 HP02 location

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Plate 33 HP02 depth

Plate 34 HP02 deep end of pit

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Plate 35 Surface water at HP03 location

Plate 36 HP03

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Plate 37 HP03

Plate 38 HP04 location

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Plate 39 HP04

Plate 40 WS01 location

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Plate 41 WS01 Made Ground

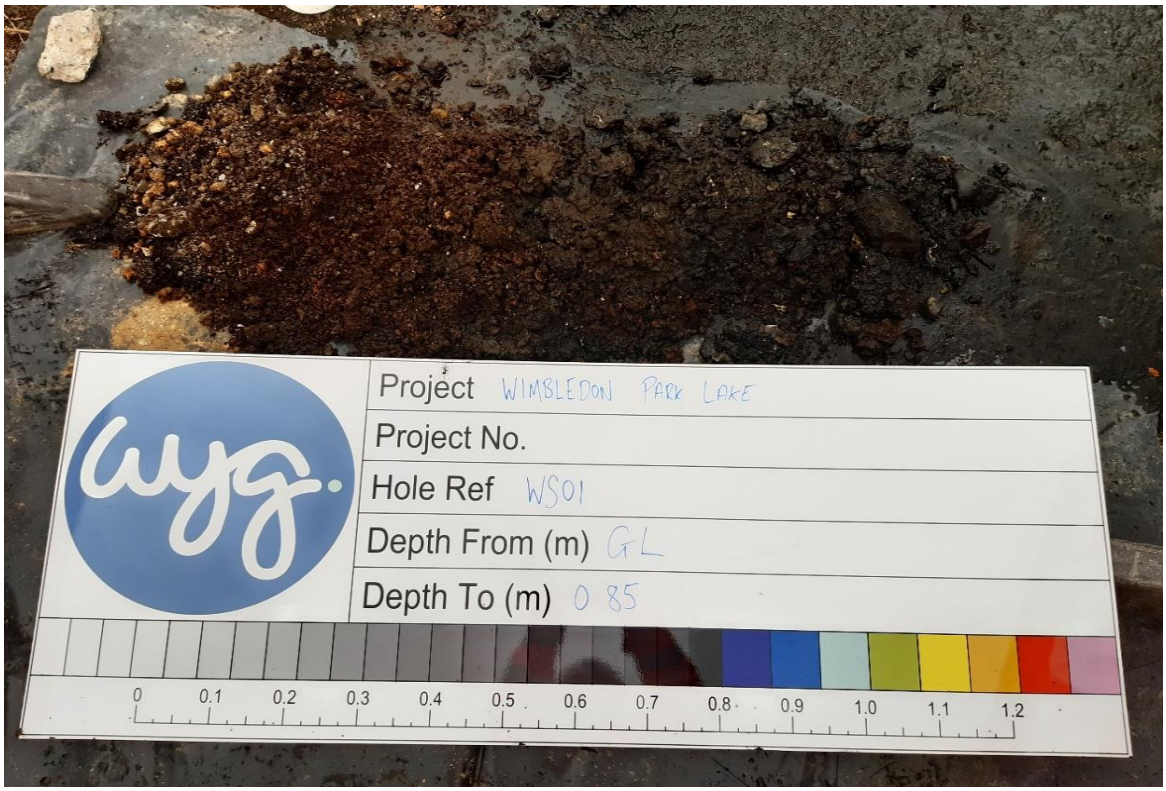

Plate 42 WS01: 0.0-0.85m bgl

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Plate 43 WS01 pit concrete wall in bottom RH corner of picture, possible brick work opposite concrete wall

Plate 44 WS01 depth to water

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Plate 45 WS01 post condition

Plate 46 WS02 location

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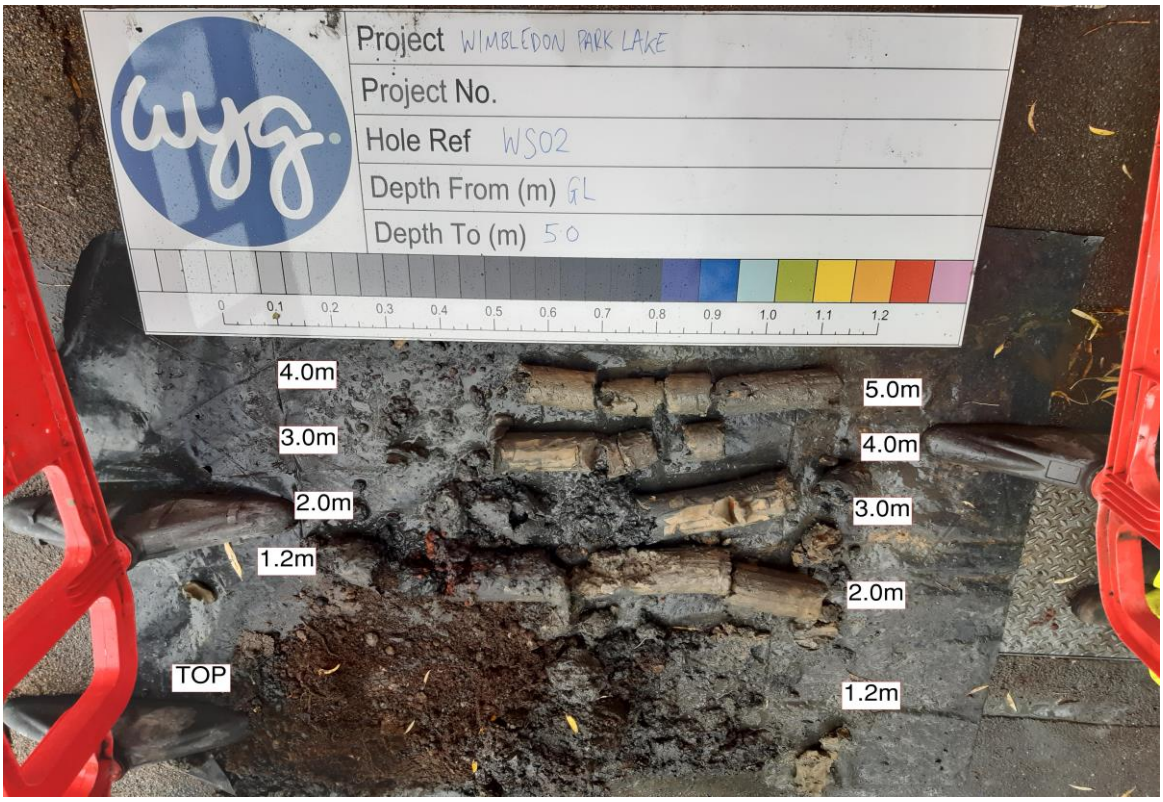

Plate 47 WS02: 0.0-5.0m bgl

Plate 48 WS02: 5.0-6.0m bgl

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Plate 49 WS02: 6.0-7.0m bgl

Plate 50 WS02: 7.0-8.0m bgl

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Plate 51 WS02: 8.0-9.0m bgl

Plate 52 WS02: post condition

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Plate 53 WS03 Location

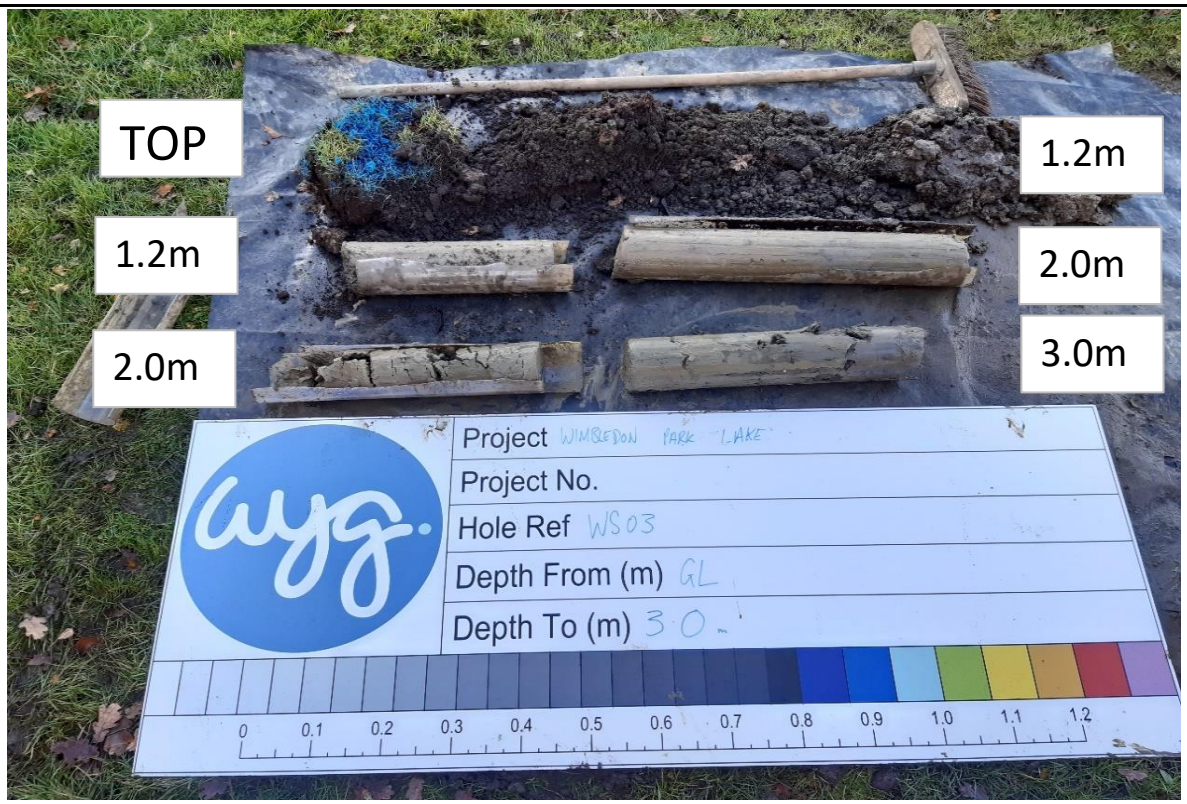

Plate 54 WS03: 0.0-3.0m bgl

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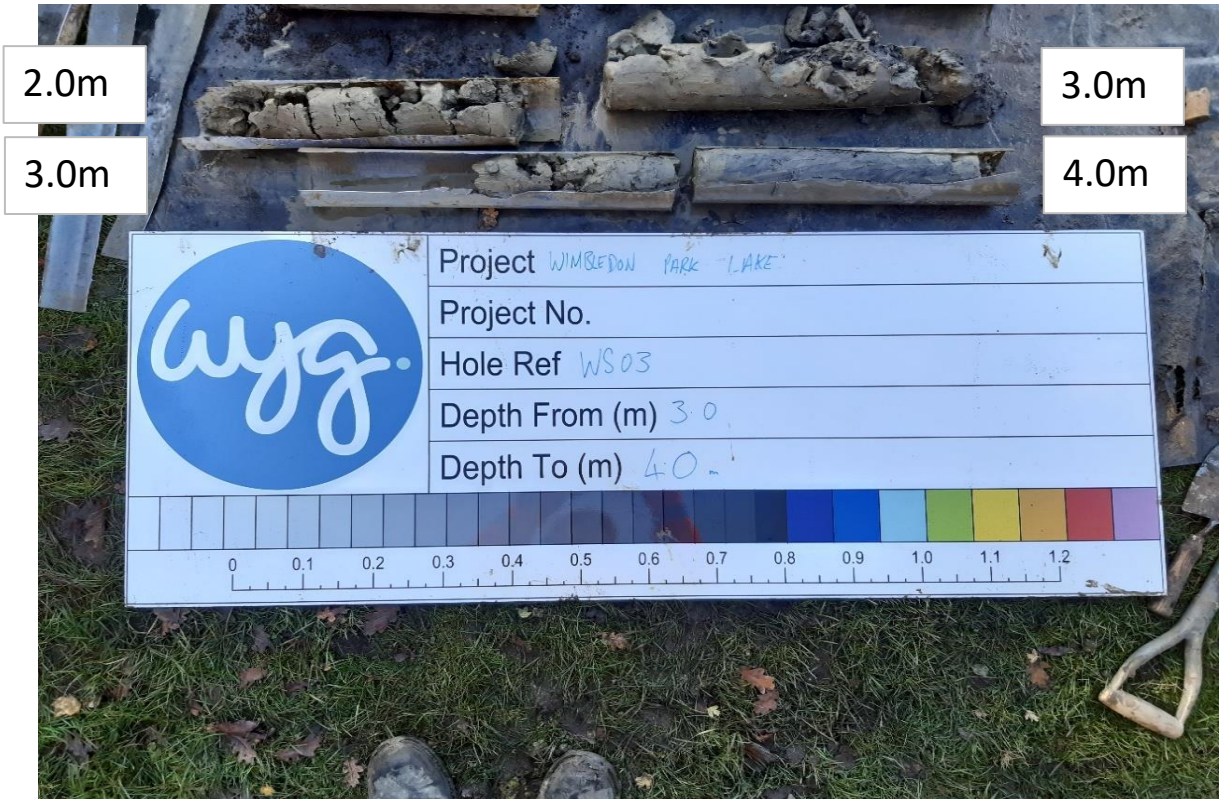

Plate 55 WS03: 3.0-4.0m bgl

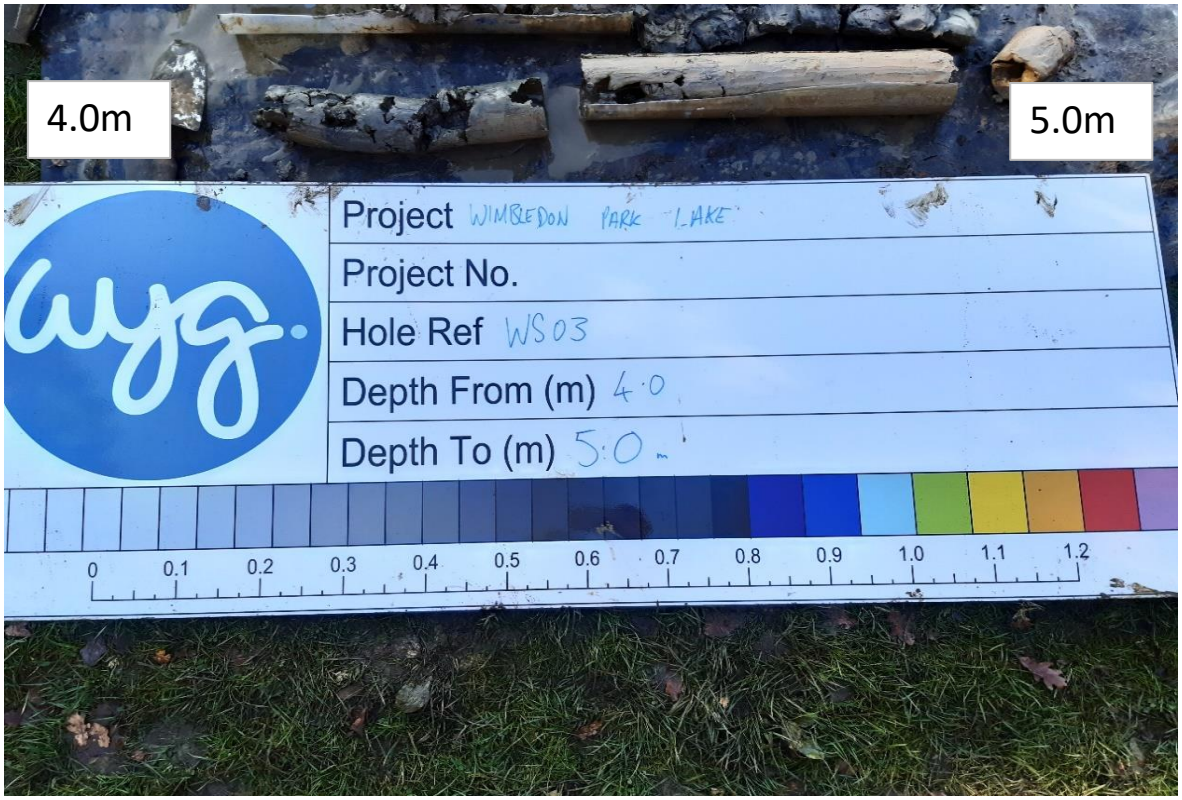

Plate 56 WS03: 4.0 - 5.0m bgl

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Plate 57 WS03: 5.0-7.0m bgl

Plate 58 WS03: 7.0-8.0m

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Plate 59 WS03: 8.0-10.0m bgl

Plate 60 WS03: post condition

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Plate 61 WS04: 0.0-1.2m bgl

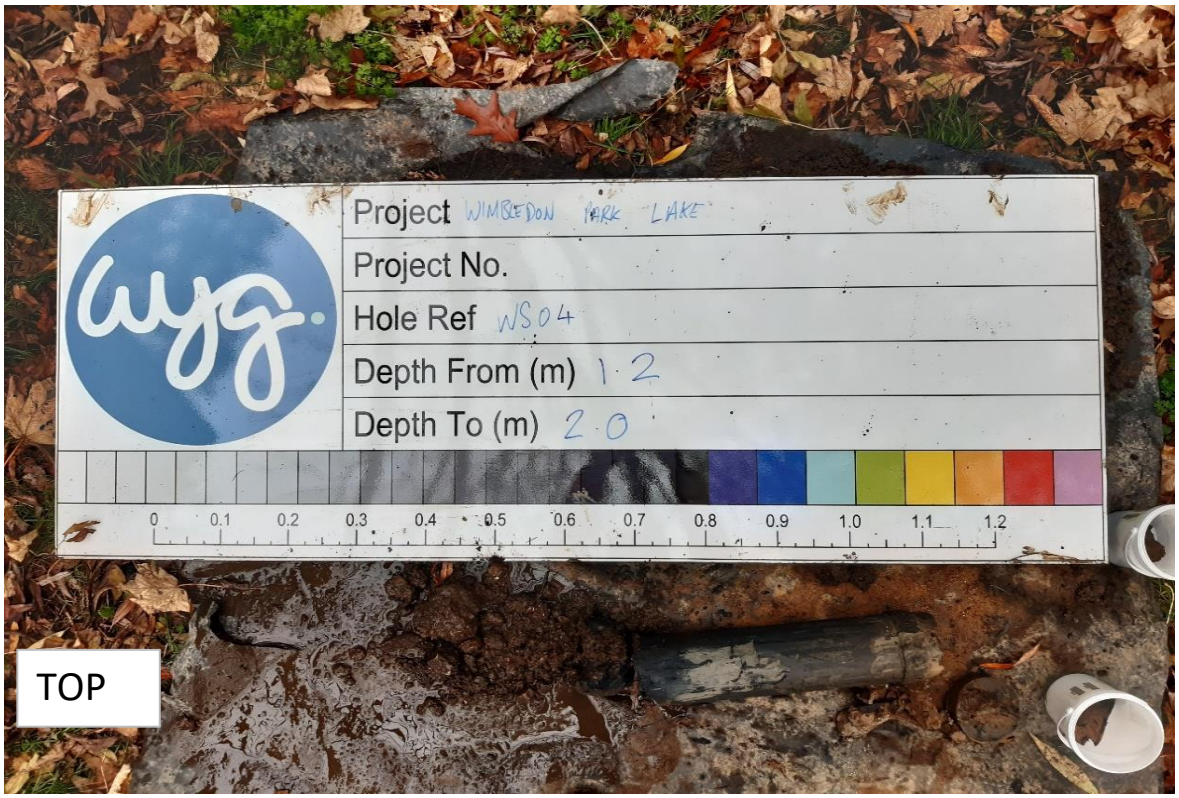

Plate 62 WS04: 1.2-2.0m bgl

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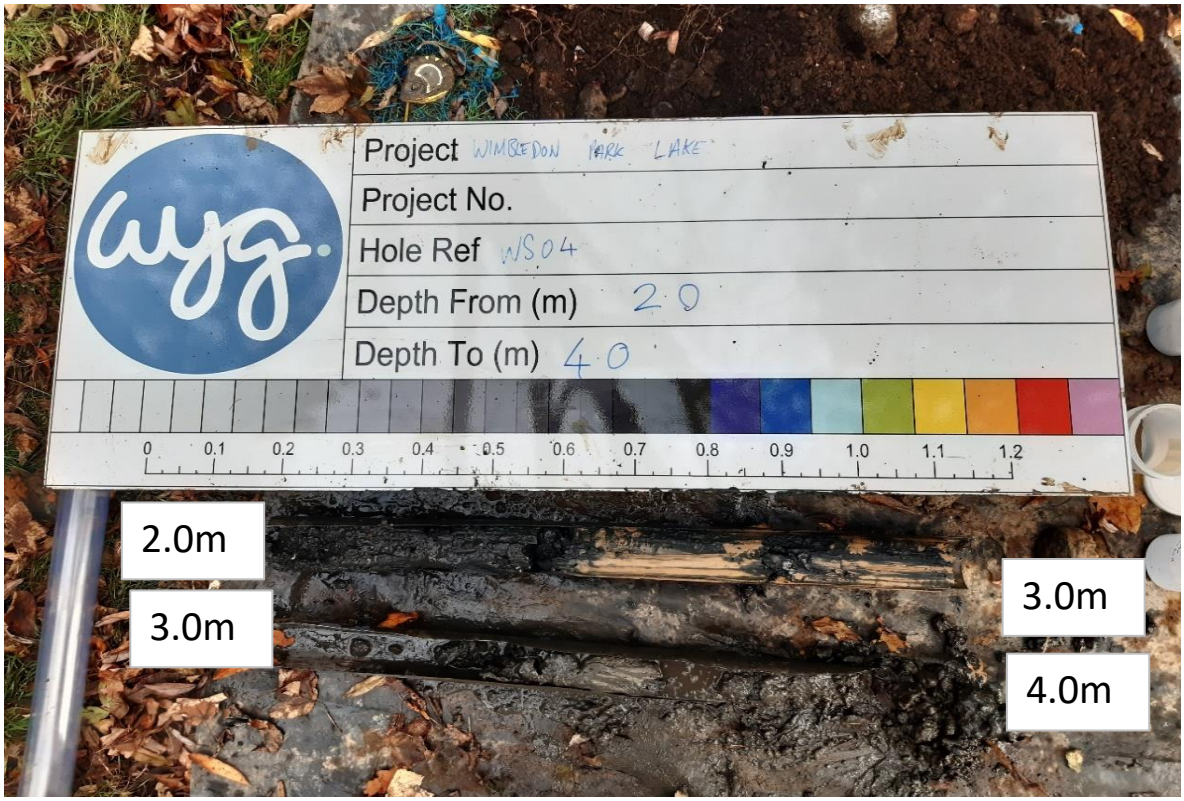

Plate 63 WS04: 2.0-4.0m bgl

Plate 64 WS04: 4.0-5.0m bgl

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Plate 65 WS04 post condition

Plate 66 WS05 location

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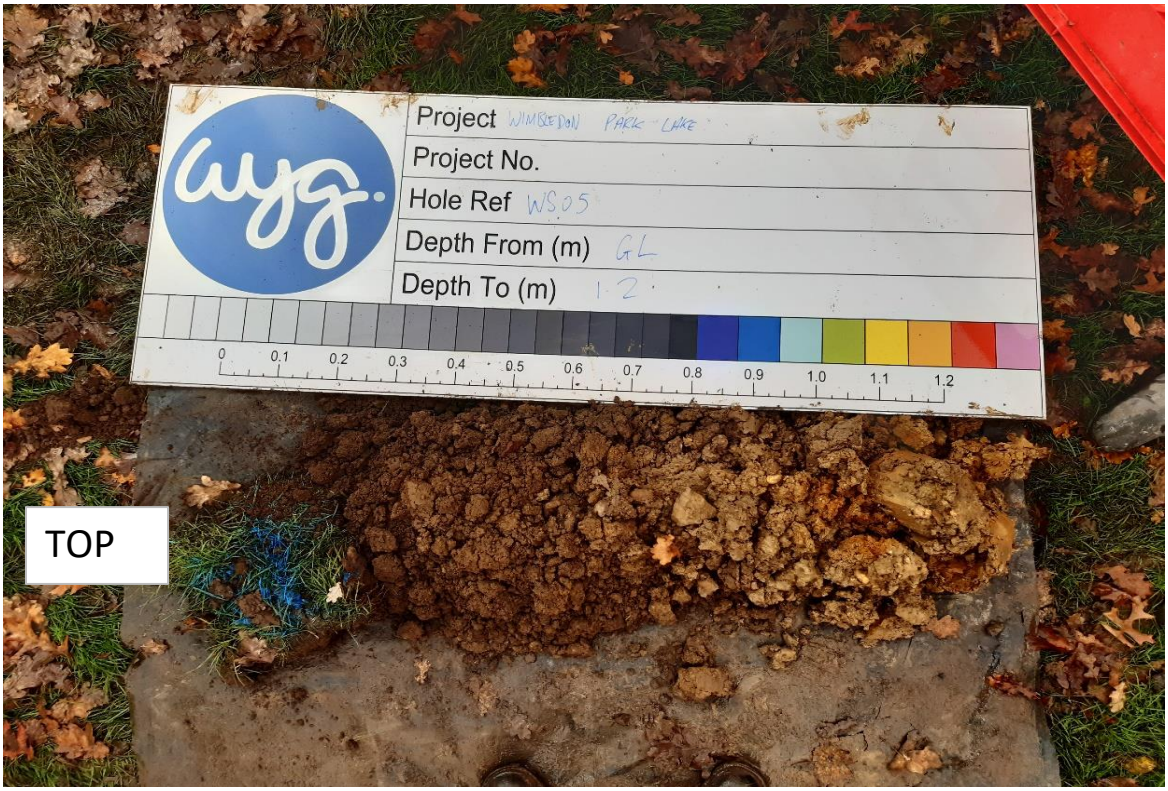

Plate 67 WS05: 0.0-1.2m bgl

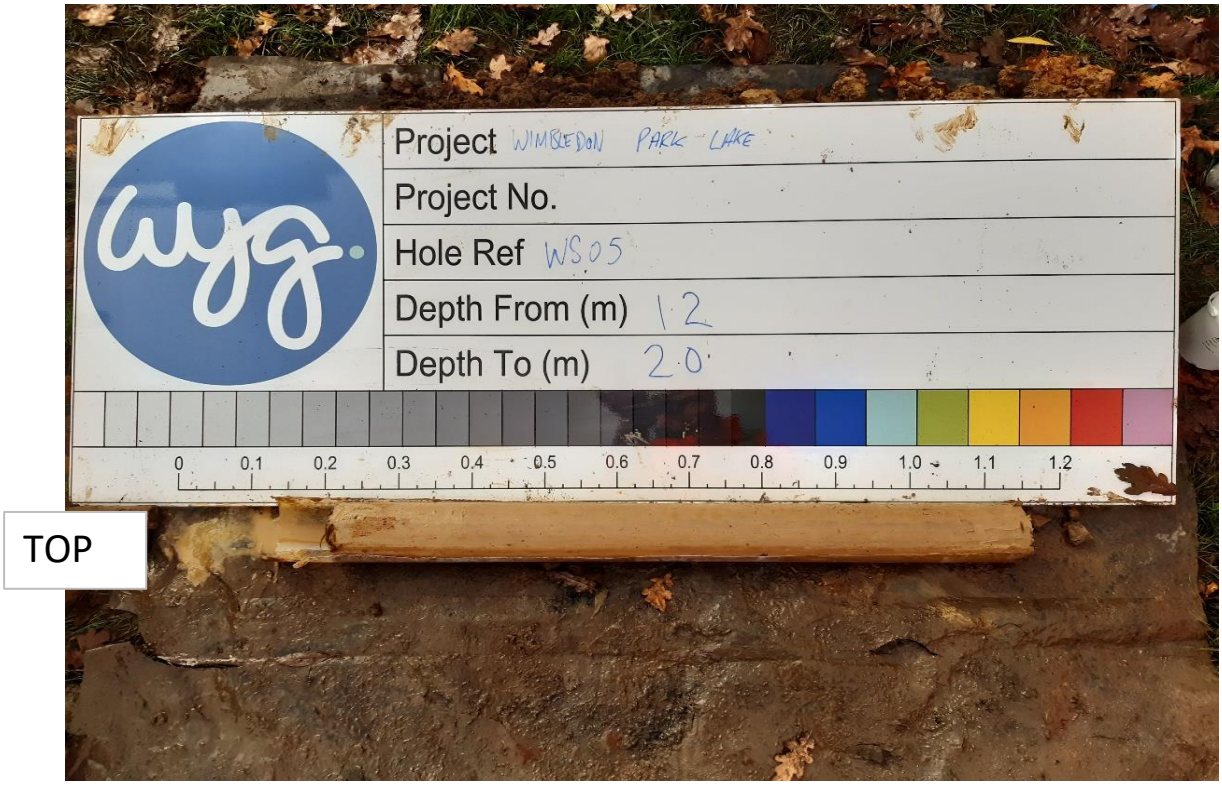

Plate 68 WS05: 1.2-2.0m bgl

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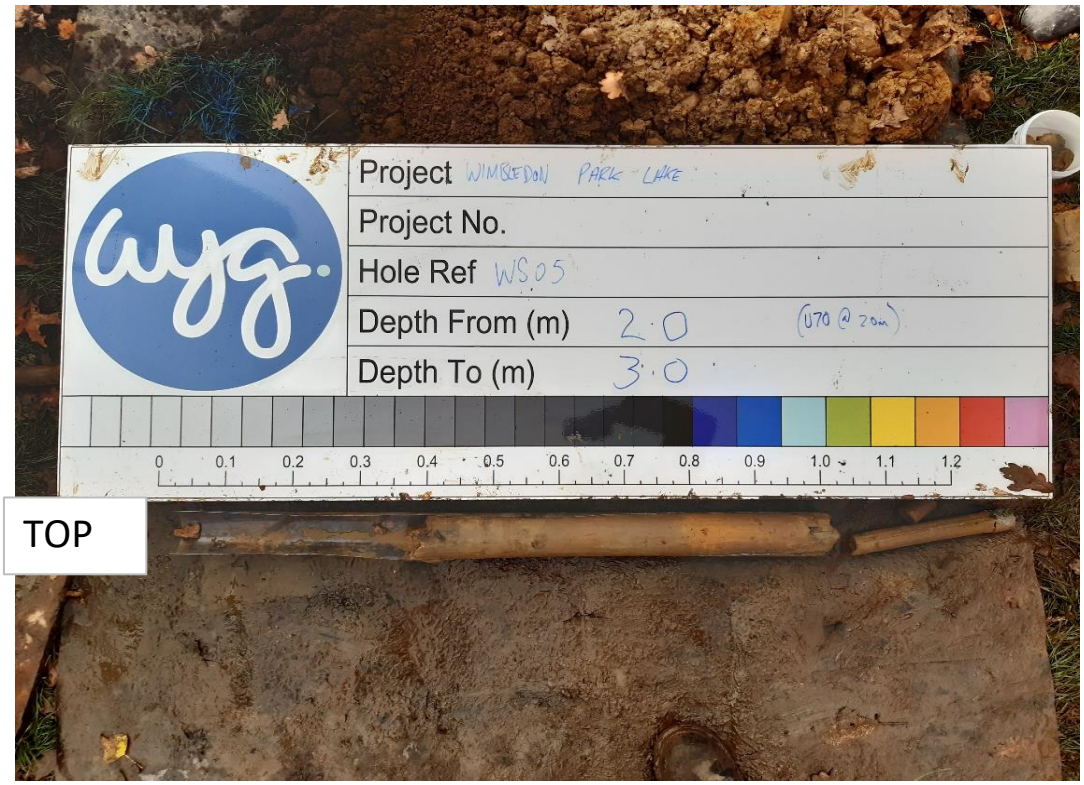

Plate 69 WS05: 2.0-3.0m bgl

Plate 70 WS05: 3.0-4.0m bgl

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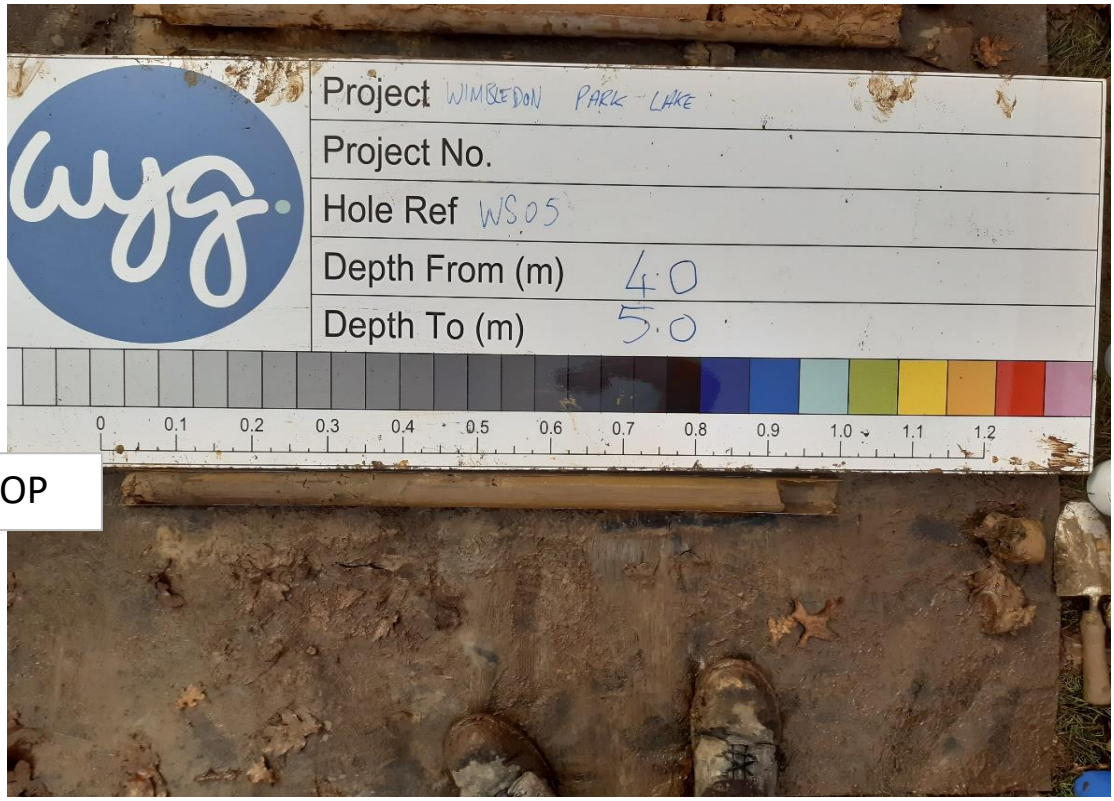

Plate 71 WS05: 4.0-5.0m bgl

Plate 72 WS05 post condition

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Plate 73 Location of WS06

Plate 74 WS06: 0.0-1.2m bgl

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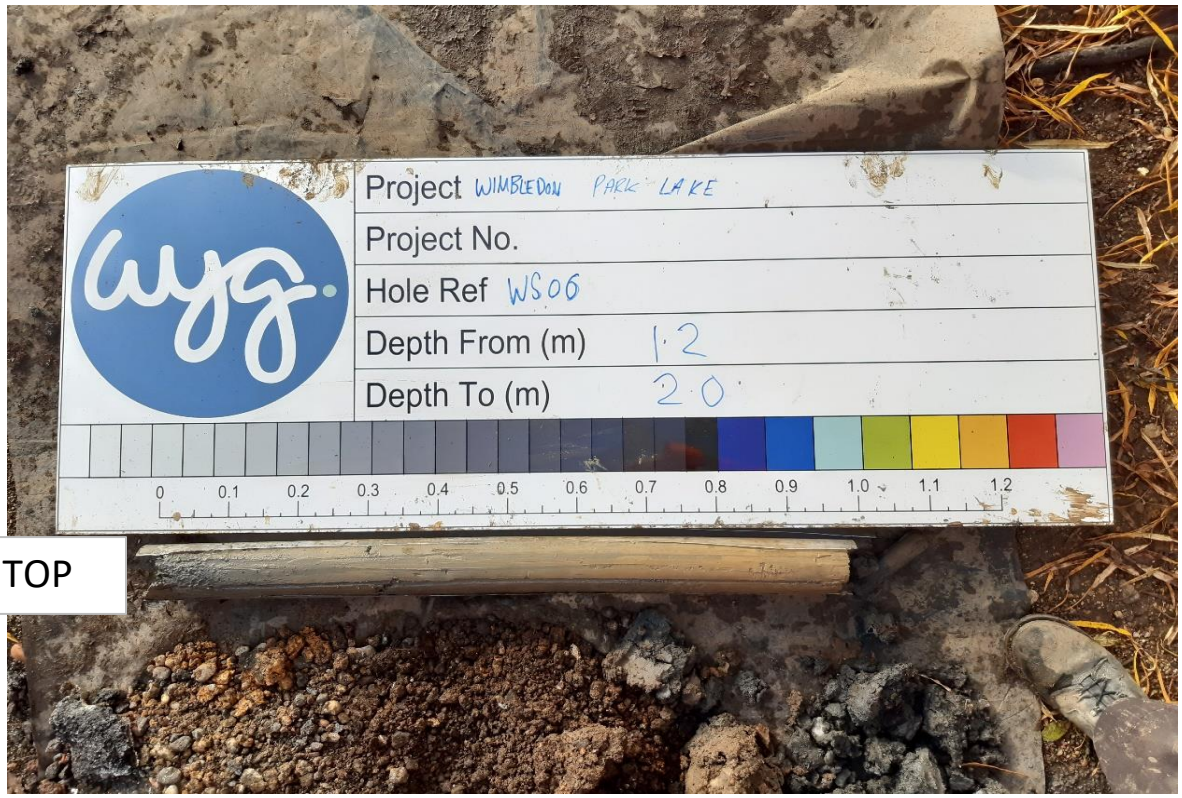

Plate 75 WS06: 1.2-2.0m bgl

Plate 76 WS06: 2.0-3.0m bgl

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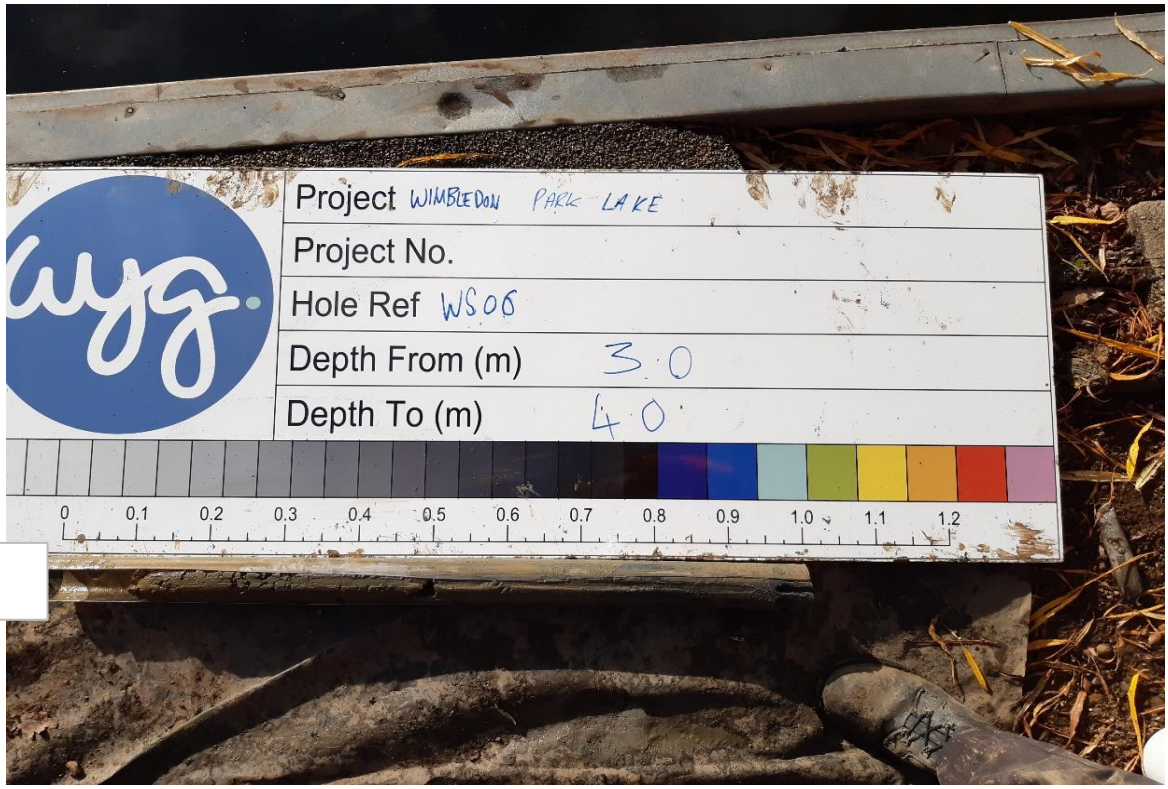

Plate 77 WS06: 3.0-4.0m bgl

Plate 78 WS06: 3.6-4.0m showing organic rich layer

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Plate 79 Sample of organic rich material from WS06 (approx. 3.8m bgl)

Plate 80 WS06: 4.0-5.0m bgl

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Plate 81 WS06: 5.0-6.0m bgl

Plate 82 WS06 post condition

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Appendix D – WYG Investigation Engineering Logs

Project: **Wimbledon Park Lake**	Location Details		Status	Pit Number
Location: **Wimbledon**	Easting: 524738.72	Northing: 172487.67	DRAFT	**HP01**
Client: **London Borough of Merton**	Level: 17.62mAOD	Depth: 1.20m		Sheet 1 of 1
	Logger: PR	Type: IP		

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: PR
0.30m / 0.30m	Shoring: N/A					Approved By: RT
	Stability: Stable					Start Date: 14/11/2019
	Plant: Hand tools					Finish Date: 14/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Grass over soft brown slightly sandy silty CLAY with frequent rootlets. (TOPSOIL)		0.05	17.57					
MADE GROUND: Soft brown slightly sandy silty CLAY.								
MADE GROUND: Soft very sandy very gravelly CLAY. Gravel is fine to coarse rounded to sub angular of flint with brick fragments. (Head / London Clay Fill Material)		0.50	17.12					
Firm to stiff orangish brown slightly sandy CLAY with occasional organic remnants. (Head Deposits)		1.10	16.52					
EOH at 1.20m -		1.20	16.42					

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. No groundwater encountered.
3. The exploratory hole was backfilled with arisings and reinstated with topsoil and turf on completion.

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Project: **Wimbledon Park Lake** Location: **Wimbledon** Client: **London Borough of Merton**	Location Details Easting: 524836.63 Northing: 172435.53 Level: 16.38mAOD Depth: 0.80m Logger: PR Type: IP	Status DRAFT	Pit Number **HP02** Sheet 1 of 1

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: PR
0.30m x 0.30m	Shoring: N/A					Approved By: RT
	Stability: Stable					Start Date: 14/11/2019
	Plant: Hand tools					Finish Date: 14/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is fine to course angular to sub rounded flint with brick, ceramic and plastic fragments with frequent organic detritus, roots and rootlets. *At 0.40m bgl top of concrete foundation encountered.*								
EOH at 0.80m -		0.80	15.58					

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. No groundwater encountered.
3. Aim of this inspection pit is to investigate the retaining wall foundations.
4. The exploratory hole was backfilled with arisings.

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Project: **Wimbledon Park Lake** Location: **Wimbledon** Client: **London Borough of Merton**	Location Details Easting: 524885.81 Northing: 172374.52 Level: 14.79mAOD Depth: 1.00m Logger: PR Type: IP	Status DRAFT	Pit Number **HP03** Sheet 1 of 1	

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions 0.30m × 0.30m	Orientation: ° Shoring: N/A Stability: Stable Plant: Hand tools	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: PR Approved By: RT Start Date: 14/11/2019 Finish Date: 14/11/2019
		0.00	0.00	20	Soils ground level to 0.25m bgl are waterlogged. Below this soils dry. No water seepage observed from the base or sides of the pit.	

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Very soft brown slightly sandy CLAY with high organic detritus content comprising of leaves grass wood and rootlets. (TOPSOIL)								
From gravel level saturated to 0.25m bgl.		0.25	14.54					
MADE GROUND: Soft brown slightly sandy CLAY with occasional rootlets. (Head / London Clay Fill Material)								
		0.50	14.29					
MADE GROUND: Firm grey slightly sandy CLAY. (Head / London Clay Fill Material)								
		1.00	13.79					1
EOH at 1.00m -								
								2

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. Aim of inspection pit is to identify the source of the surface water ponding at this location
3. The exploratory hole was backfilled with arisings.
4. Note - ponding water was identified to only occupy the top 0.25m .

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Project Number
A112771

Project: **Wimbledon Park Lake** Location: **Wimbledon** Client: **London Borough of Merton**	Location Details Easting: 524881.66 Northing: 172373.05 Level: 15.44mAOD Depth: 0.80m Logger: PR Type: IP	Status DRAFT	Pit Number **HP04** Sheet 1 of 1	

Hole Information		Groundwater				Scale: 1:10
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: PR
0.30m × 0.30m	Shoring: N/A	0.00	0.00	20	No water observed	Approved By: RT
	Stability: Stable					Start Date: 14/11/2019
	Plant: Hand tools					Finish Date: 14/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Dark brown wood chips. (TOPSOIL)								
From gravel level saturated to 0.10m bgl.		0.10	15.34					
MADE GROUND: Soft to firm greyish brown and orangish brown slightly sandy slightly gravelly CLAY. Gravel is find to medium sub angular to sub rounded of flint. (Head / London Clay Fill Material)								
EOH at 0.80m -		0.80	14.64					

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. Aim of inspection pit is to identify source of surface water at HP03 location.
3. The exploratory hole was backfilled with arisings.
4. No water was observed within the excavation.

11th Floor,
Angel Court,
London
EC2R 7HJ
020 7250 7500

Project Number
A112771

Project: **Wimbledon Park Lake**

Location: **Wimbledon**

Client: **London Borough of Merton**

Location Details			
Easting:	524818.09	Northing:	172437.52
Level:	17.72mAOD	Depth:	0.85m
Logger:	PR	Type:	WS
		Inclination:	90°

Status: DRAFT

Borehole Number: **WS01**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	
0.00	0.85	Inspection Pit	Hand Excavated		0.85	300			0.37	-	-	0.32	20	Fast ingress of black and silty water. Water level in the lake approximately 0.27m bgl.	

Scale:	1:50
Checked By:	PR
Approved By:	RT
Start Date:	12/11/2019
Finish Date:	12/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Bitumen bound MACADAM. (ASPHALT SURFACE)		0.07	17.65					
MADE GROUND: Soft orangish brown sandy gravelly CLAY. Gravel is fine to coarse subangular to rounded flint. Sand is coarse.		0.14	17.58			0.20 0.30 - 0.60	ES1 B1	
MADE GROUND: Dark brown very sandy gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded flint with brick and ceramic fragments including 1no half brick.		0.60	17.12			0.65	ES2	
MADE GROUND: Dark brown very sandy gravelly silty CLAY. Gravel is fine to coarse subangular to subrounded flint with brick, ceramic and metal fragments.		0.85	16.87					
EOH at 0.85m - Hole terminated at 0.85m bgl due to possible concrete obstruction.								

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. The surface hard standing was broken out using a hydraulic breaker.
3. The exploratory hole was backfilled with arisings and reinstated with cold lay asphalt.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **A112771**

Project: **Wimbledon Park Lake**

Location: **Wimbledon**

Client: **London Borough of Merton**

Location Details			
Easting:	524863.93	Northing:	172370.29
Level:	17.77mAOD	Depth:	9.00m
Logger:	PR	Type:	WS
		Inclination:	90°

Status: DRAFT

Borehole Number: **WS02**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	
0.00	1.20	Inspection Pit	Hand Excavated		1.20	300			0.50	-	-	0.00	0	Water inflow evident from 0.5 and seepage up from the base of the pit.	
1.20	8.45	Window Sampler	Window Sampler		8.45	-									

Scale:	1:50
Checked By:	PR
Approved By:	RT
Start Date:	12/11/2019
Finish Date:	12/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Bitumen bound MACADAM. (ASPHALT SURFACE)		0.07	17.70			0.10 - 0.50	B1	
MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is fine to coarse sub angular to rounded flint with brick fragments and frequent rootlets.						0.20	ES1	
MADE GROUND: Soft to firm grey sandy gravelly CLAY with black organic remnants. Gravel is fine to coarse sub angular flint with brick fragments including 2no. half bricks. (Head / London Clay Fill Material)		0.50	17.27			0.50 - 1.00	B2	
						0.70	ES2	
						1.20	D1	SPT(S) 1.20m, N=1 (0,0/1,0,0,0)
						1.50 - 2.00	B3	
MADE GROUND: Firm orangish brown and grey slightly sandy slightly gravelly CLAY with organic remnants. Gravel is fine to course sub angular to sub rounded flint with rare brick fragments. (Head / London Clay Fill Material)		1.60	16.17			2.00	D2	SPT(S) 2.00m, N=8 (1,2/2,2,2,2)
						3.00	D3	SPT(S) 3.00m, N=8 (1,0/2,2,2,2)
						4.00	D4	SPT(S) 4.00m, N=8 (0,0/2,2,2,2)
Firm grey slightly sandy CLAY with black spots of organic material. (Head Deposits)		4.50	13.27					
Between 5 - 5.5m bgl increase in organic material (possible former topsoil horizon).						5.00	D5	SPT(S) 5.00m, N=12 (1,2/3,3,3,3)
Firm to stiff orangish brown slightly sandy CLAY with common organic remnants. (Head Deposits)		5.50	12.27					
						6.00	D6	SPT(S) 6.00m, N=8 (1,1/2,2,2,2)
Stiff to very stiff orangish brown CLAY. With rare grey staining along fissures. (London Clay Formation)		7.00	10.77			7.00	D7	SPT(S) 7.00m, N=11 (1,1/2,3,3,3)
						7.00 - 8.00	B4	
						8.00	D8	SPT(S) 8.00m, N=15 (2,2/3,4,4,4)
EOH at 9.00m -		9.00	8.77			9.00	D9	
						10.00	D10	

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. The surface hard standing was broken out using a hydraulic breaker.
3. Plastic 25mm diameter piezometer in a sand cell from 2.90m to 3.00m bgl, backfilled with bentonite pellets to 0.50m bgl and finished with a concreted flush steel cover.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **A112771**

Project: **Wimbledon Park Lake**

Location: **Wimbledon**

Client: **London Borough of Merton**

Location Details			
Easting:	524882.10	Northing:	172333.05
Level:	17.75mAOD	Depth:	10.45m
Logger:	PR	Type:	WS
		Inclination:	90°

Status: DRAFT

Borehole Number: **WS03**

Sheet 1 of 2

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.20	Inspection Pit	Hand Excavated		1.20	300								
1.20	10.45	Window Sampler	Window Sampler		10.45	-								

Scale: 1:50
Checked By: PR
Approved By: RT
Start Date: 13/11/2019
Finish Date: 13/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Grass over soft brown slightly sandy silty CLAY with frequent rootlets. (TOPSOIL)		0.10	17.65			0.20 - 0.50	B1	
MADE GROUND: Soft brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to rounded flint with brick fragments and rootlets.						0.30	ES1	
MADE GROUND: Soft brownish grey slightly sandy CLAY.		0.70	17.05			0.70 - 1.20	B2	
MADE GROUND: Firm grey mottled orange and greenish grey sandy CLAY. Frequent black/ dark brown organic remnants. Rare fine to medium rounded gravel flint. (Head / London Clay Fill Material)		1.00	16.75			1.00	ES2	1
						1.50 - 2.00	B3	HV 1.50m, (p)=70,54,64 kPa (r)= kPa
						2.00	D1	SPT(S) 2.00m, N=8 (1,1/2,2,2,2) 2
						2.50 - 3.00	B4	HV 2.50m, (p)=62,62,64 kPa (r)= kPa
						3.00	D2	SPT(S) 3.00m, N=8 (1,1/2,2,2,2) 3
						3.00 - 4.00	B5	
						4.00 - 4.50	D3	SPT(S) 4.00m, N=9 (1,1/2,2,2,3) 4
Firm to stiff orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium flint. (Head Deposits) *At 4.65m bgl black organic material (possible former topsoil horizon).*		4.65	13.10			4.70 - 5.00	D4	
						5.00	D5	SPT(S) 5.00m, N=10 (1,1/2,2,3,3) 5
						5.00 - 6.00	B6	
						6.00	D6	SPT(S) 6.00m, N=14 (1,2/3,3,4,4) 6
						7.00	D7	SPT(S) 7.00m, N=14 (1,2/3,3,4,4) 7
						7.00 - 8.00	B7	HV 7.00m, (p)=65,64,62 kPa (r)= kPa
At 7.80m bgl peat like material observed 15cm/20cm laminations in orange brown clay.						8.00	D8	SPT(S) 8.00m, N=19 (3,3/4,5,5,5) 8
Very stiff greyish brown CLAY with orange staining along fissures and laminae. (London Clay Formation)		9.00	8.75			9.00	D9	SPT(S) 9.00m, N=18 (3,3/5,4,4,5) 9
						10.00	D10	SPT(S) 10.00m, N=19 (3,3/4,4,5,6) 10

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. Groundwater not encountered.
3. Install is plastic 35mm diameter slotted pipe in a gravel cell from 3.00m to 1.00m bgl, backfilled with bentonite pellets to 0.50m bgl and finished with a concreted flush steel cover.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **A112771**

Project: **Wimbledon Park Lake**

Location: **Wimbledon**

Client: **London Borough of Merton**

Location Details			
Easting:	524882.10	Northing:	172333.05
Level:	17.75mAOD	Depth:	10.45m
Logger:	PR	Type:	WS
		Inclination:	90°

Status: DRAFT

Borehole Number: **WS03**

Sheet 2 of 2

Method, Plant and Crew					Diameter		Casing		Groundwater					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00 1.20	1.20 10.45	Inspection Pit Window Sampler	Hand Excavated Window Sampler		1.20 10.45	300 -								

Scale:	1:50
Checked By:	PR
Approved By:	RT
Start Date:	13/11/2019
Finish Date:	13/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Very stiff greyish brown CLAY with orange staining along fissures and laminae. (London Clay Formation)								
		10.45	7.30					
EOH at 10.45m -								

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. Groundwater not encountered.
3. Install is plastic 35mm diameter slotted pipe in a gravel cell from 3.00m to 1.00m bgl, backfilled with bentonite pellets to 0.50m bgl and finished with a concreted flush steel cover.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **A112771**

Project: **Wimbledon Park Lake**

Location: **Wimbledon**

Client: **London Borough of Merton**

Location Details			
Easting:	524900.23	Northing:	172278.75
Level:	17.74mAOD	Depth:	6.00m
Logger:	PR	Type:	WS
		Inclination:	90°

Status: DRAFT

Borehole Number: **WS04**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	
0.00	1.20	Inspection Pit	Hand Excavated		1.20	300			0.80	-	-	0.80	20	Water seepage from base of pit. Water level in lake measured at 0.7m bgl.	
1.20	6.00	Window Sampler	Window Sampler		6.00	-									

Scale:	1:50
Checked By:	PR
Approved By:	RT
Start Date:	13/11/2019
Finish Date:	13/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Grass over soft brown slightly sandy silty CLAY with frequent rootlets. (TOPSOIL)		0.07	17.67			0.20	ES1	
MADE GROUND: Dark brown slightly gravelly sandy SILT with roots >20mm. Gravel is fine to coarse subangular to rounded flint with brick and bitumen bound material with frequent rootlets.		0.30	17.44			0.50	ES2	
						0.50 - 1.00	B1	
MADE GROUND: Soft brown slightly gravelly sandy CLAY with rootlets. Gravel is fine to coarse subangular to rounded flint and brick. 1no cobble of concrete.				▼		1.20	D1	SPT(S) 1.20m, N=3 (1,1/2,1,0,0)
MADE GROUND: Soft black CLAY.		1.50	16.24					
MADE GROUND: Firm grey CLAY with pockets of white silt.		1.60	16.14			1.60 - 2.00	B2	HV 1.60m, (p)=66,60,60 kPa (r)= kPa
At 1.80m bgl becoming orangish brown.								
MADE GROUND: Firm to stiff orangish brown and grey slightly sandy CLAY.		2.00	15.74			2.00	D2	SPT(S) 2.00m, N=8 (1,1/1,2,2,3)
						2.50 - 3.00	B3	HV 2.50m, (p)=50,54,52 kPa (r)= kPa
						3.00	D3	SPT(S) 3.00m, N=8 (1,1/1,2,3,2)
MADE GROUND: Soft grey CLAY.		3.30	14.44					
MADE GROUND: Grey silty slightly clayey gravelly coarse SAND. Gravel is fine to coarse subangular to subrounded flint with ceramic and concrete fragments and pockets of soft clay.		3.50	14.24			3.50	D4	
						4.00	D5	SPT(S) 4.00m, N=13 (2,3/3,3,3,4)
MADE GROUND: Firm orangish brown slightly sandy slightly gravelly CLAY. Gravel is flint with brick and ceramic fragments.		4.10	13.64			4.50	D6	
No recovery.		5.00	12.74			5.00	D7	SPT(S) 5.00m, N=4 (1,1/1,1,1,1)
EOH at 6.00m -		6.00	11.74					

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. Groundwater strike and resting at 0.80m bgl.
3. Install is plastic 50mm diameter slotted pipe in a gravel cell from 1.40m to 0.30m bgl, finished with a concreted flush steel cover.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **A112771**

Project: **Wimbledon Park Lake**	Location Details	Status	Borehole Number
Location: **Wimbledon**	Easting: 514771.94 Northing: 172486.49	DRAFT	**WS05**
Client: **London Borough of Merton**	Level: 16.55mAOD Depth: 5.45m		Sheet 1 of 1
	Logger: PR Type: WS		
	Inclination: 90°		

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	1.20	Inspection Pit	Hand Excavated	
1.20	5.45	Window Sampler	Window Sampler	

Diameter

Depth (m)	Diam (mm)
1.20	300
5.45	-

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks

Scale:	1:50
Checked By:	PR
Approved By:	RT
Start Date:	14/11/2019
Finish Date:	14/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Grass over soft brown silty sandy organic CLAY with rootlets. (TOPSOIL)		0.05	16.50			0.30	ES1	
MADE GROUND: Soft brown sandy slightly gravelly CLAY. Gravel is fine to medium subangular to rounded flint with brick and fused ash (clinker) fragments.		0.45	16.10			0.70 - 1.00	B1	
MADE GROUND: Soft greyish brown and orangish brown very sandy very gravelly CLAY. Gravel is fine to coarse subangular to rounded flint and brick. (Head / London Clay Fill Material)		1.00	15.55			1.20	D1	SPT(S) 1.20m, N=7 (1,1/1,2,2,2)
						1.20	ES2	
Firm to stiff brown mottled orange and grey slightly sandy CLAY with pockets of grey white silt with occasional organic material. (Head Deposits)						1.50 - 2.00	B2	
								HV 1.70m, (p)=64,64,80 kPa (r)= kPa
						2.00	U1	
From 2.50m bgl grey patches becoming more frequent and selenite fragments observed.						2.50 - 3.00	B3	HV 2.50m, (p)=54,54,56 kPa (r)= kPa
						3.00	D2	SPT(S) 3.00m, N=10 (1,1/2,2,3,3)
						3.00 - 4.00	B4	
								HV 3.50m, (p)=88,64,72 kPa (r)= kPa
						4.00	D3	SPT(S) 4.00m, N=14 (1,2/3,3,4,4)
						4.00 - 5.00	B5	
								HV 4.50m, (p)=70,66,68 kPa (r)= kPa
						5.00	D4	SPT(S) 5.00m, N=16 (2,3/3,4,4,5)
EOH at 5.45m -		5.45	11.10					

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. No groundwater encountered.
3. The exploratory hole was installed with a response zone of 1.0 - 5.0m bgl.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number

A112771

Project: **Wimbledon Park Lake**

Location: **Wimbledon**

Client: **London Borough of Merton**

Location Details			
Easting:	524834.05	Northing:	172419.31
Level:	16.73mAOD	Depth:	6.45m
Logger:	PR	Type:	WS
		Inclination:	90°

Status: DRAFT

Borehole Number: **WS06**

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.20	Inspection Pit	Hand Excavated		1.20	300								
1.20	6.45	Window Sampler	Window Sampler		6.45	-								

Scale: 1:50
Checked By: PR
Approved By: RT
Start Date: 14/11/2019
Finish Date: 14/11/2019

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Bitumen bound MACADAM. (ASPHALT SURFACE)		0.05	16.68					
MADE GROUND: Grey/black clayey sandy fine to coarse subangular to rounded flint GRAVEL with brick, glass, concrete fragments and pockets of ash.		0.12	16.60					
		0.22	16.50			0.30 - 0.50	B1	
MADE GROUND: Yellowish brown clayey sandy fine to coarse subangular to rounded flint GRAVEL with brick fragments.						0.50	ES1	
MADE GROUND: Soft brown sandy gravelly CLAY. Gravel is fine to coarse subangular to rounded flint with brick, concrete and ceramic fragments.		0.70	16.02					
MADE GROUND: Soft to firm grey slightly sandy slightly gravelly CLAY with frequent rootlets and dark grey patches. Gravel is fine to medium subangular to rounded with rare brick fragments. (Head / London Clay Fill Material) *From 0.70m to 1.00m bgl soft grey and black sandy clay with high organic content. From 1.20m bgl becoming firm to stiff. At 1.60m bgl orangish brown.*						1.00 - 1.30	B2	
						1.20	D1	SPT(S) 1.20m, N=5 (1,1/1,2,1,1)
						1.30	ES2	HV 1.20m, (p)=42,46,40 kPa (r)= kPa
						2.00	D2	SPT(S) 2.00m, N=10 (1,1/2,3,3,2)
						2.50 - 3.00	B3	
								HV 2.70m, (p)=56,58,68 kPa (r)= kPa
						3.00	D3	SPT(S) 3.00m, N=8 (1,1/2,2,2,2)
Firm greyish brown (with patches of dark grey/black) sandy slightly gravelly CLAY. Gravel is fine to coarse sub rounded to angular flint. (Head Deposits) *From 3.60m to 4.20m bgl high organic content (possible former topsoil horizon).*		3.20	13.52			3.60 - 3.80	D4	
						4.00 - 4.50	D5	SPT(S) 4.00m, N=9 (1,1/2,1,3,3)
Firm brown slightly silty CLAY. (London Clay Formation)		4.20	12.52					
Stiff orangish brown slightly sandy CLAY. (London Clay Formation)		4.60	12.12			5.00	D6	SPT(S) 5.00m, N=13 (2,2/3,3,3,4)
						6.00	D7	SPT(S) 6.00m, N=7 (1,1/1,1,2,3)
EOH at 6.45m -		6.45	10.28					

Observations / Remarks

1. Prior to excavation the exploratory hole location was cleared for buried services using EM and GPR methods.
2. No groundwater encountered.
3. The surface hard standing was broken out using a hydraulic breaker.
3. The exploratory hole was installed with a response zone of 1.0 - 5.0m bgl.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number: **A112771**

Appendix E – Return Monitoring Summary Sheets

WYG Environment

GROUNDWATER MONITORING RECORDS

11th Floor, 1 Angel Court, London, EC2R 7HJ

Site Name:		Wimbledon Park Lake	**Date:** 25/11/2019 & 14/01/20
Job No.:		A112771	**Monitoring Eng.:** PR
Client:		LBM	**Weather:** Overcast

Borehole ID	Date	Water Depth	Base Depth	Ground level	Corrected Water depth	Corrected base depth	Notes
		(mbgl)	(mbgl)	(mAOD)	(mAOD)	(mAOD)	
WS02	25/11/2019	0.32	3.00	17.77	17.45	14.77	
WS02	14/01/2020	0.30	3.00	17.77	17.47	14.77	
WS03	25/11/2019	0.28	3.10	17.75	17.47	14.65	
WS03	14/01/2020	0.18	3.10	17.75	17.57	14.65	
WS04	25/11/2019	0.78	1.39	17.74	16.96	16.35	
WS04	14/01/2020	0.82	1.39	17.74	16.92	16.35	
WS05	25/11/2019	0.48	4.80	16.55	16.07	11.75	
WS05	14/01/2020	0.45	4.80	16.55	16.10	11.75	
WS06	25/11/2019	1.08	5.20	17.73	16.65	12.53	
WS06	14/01/2020	1.00	5.20	17.73	16.73	12.53	

Appendix F – Laboratory Geotechnical Results

LABORATORY REPORT

4043

Contract Number: PSL19/7411

Report Date: 17 December 2019

Client's Reference: A112771

Client Name: WYG London
11th Floor
1 Angel Court
London
EC2R 7HJ

For the attention of: Peter Robinson

Contract Title: Wimbledon Park Lane, Wimbledon

Date Received: 4/12/2019
Date Commenced: 4/12/2019
Date Completed: 17/12/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Eyre (Senior Technician)	S Royle (Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS02	3	B	1.50	2.00	MADE GROUND brown mottled grey gravelly slightly sandy clay.
WS02	3	D	3.00		Brown mottled grey slightly gravelly slightly sandy CLAY.
WS02	5	D	5.00		Brown mottled grey slightly gravelly slightly sandy CLAY.
WS02	6	D	6.00		Brown mottled grey slightly sandy CLAY.
WS02	4	B	7.00	8.00	Brown mottled grey slightly sandy CLAY.
WS02	7	D	7.00		Brown mottled grey slightly sandy CLAY.
WS02	10	D	10.00		Brown mottled grey slightly sandy CLAY.
WS03	3	B	1.50		Grey very sandy very silty CLAY.
WS03	4	B	2.50	3.00	Brown slightly gravelly sandy CLAY.
WS03	5	B	3.00	4.00	Dark brown slightly gravelly sandy CLAY.
WS03	6	B	5.00	6.00	Brown CLAY.
WS03	7	B	7.00	8.00	Brown mottled grey CLAY.
WS03	9	D	9.00		Brown mottled grey CLAY.
WS04	2	B	1.60	2.00	Brown slightly sandy CLAY.
WS04	3	B	2.50	3.00	Brown slightly gravelly slightly sandy CLAY.
WS04	5	D	4.00		Brown slightly gravelly slightly sandy CLAY.
WS04	7	D	5.00		Brown very gravelly slightly sandy CLAY.
WS05	1	U	2.00		Brown slightly sandy CLAY.
WS05	4	B	3.00	4.00	Brown CLAY.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS05	5	B	4.00	5.00	Brown CLAY.
WS06	2	B	1.00	1.30	Brown slightly gravelly slightly sandy CLAY.
WS06	3	B	2.50	3.00	Brown mottled grey slightly gravelly sandy CLAY.
WS06	5	D	4.00	4.50	Brown slightly gravelly slightly sandy CLAY.
WS06	7	D	6.00		Brown mottled grey slightly sandy CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS02	3	B	1.50	2.00	30			57	24	33	82	High plasticity CH.
WS02	3	D	3.00		21							
WS02	5	D	5.00		33			74	31	43	96	Very high plasticity CV.
WS02	4	B	7.00	8.00	38							
WS02	7	D	7.00		37							
WS02	10	D	10.00		32							
WS03	3	B	1.50	2.00	19			34	16	18	92	Low plasticity CL.
WS03	4	B	2.50	3.00	27			47	23	24	95	Intermediate plasticity CI.
WS03	5	B	3.00	4.00	24			44	21	23	93	Intermediate plasticity CI.
WS03	6	B	5.00	6.00	38			77	32	45	100	Very high plasticity CV.
WS03	7	B	7.00	8.00	38							
WS03	9	D	9.00		33							
WS04	3	B	2.50	3.00	35			65	28	37	96	High plasticity CH.
WS04	5	D	4.00		35			68	29	39	97	High plasticity CH.
WS04	7	D	5.00		37			57	25	32	69	High plasticity CH.
WS05	4	B	3.00	4.00	32			76	31	45	100	Very high plasticity CV.
WS05	5	B	4.00	5.00	34			74	30	44	100	Very high plasticity CV.
WS06	2	B	1.00	1.30	32			63	26	37	98	High plasticity CH.
WS06	3	B	2.50	3.00	21			49	23	26	95	Intermediate plasticity CI.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Wimbledon Park Lane, Wimbledon

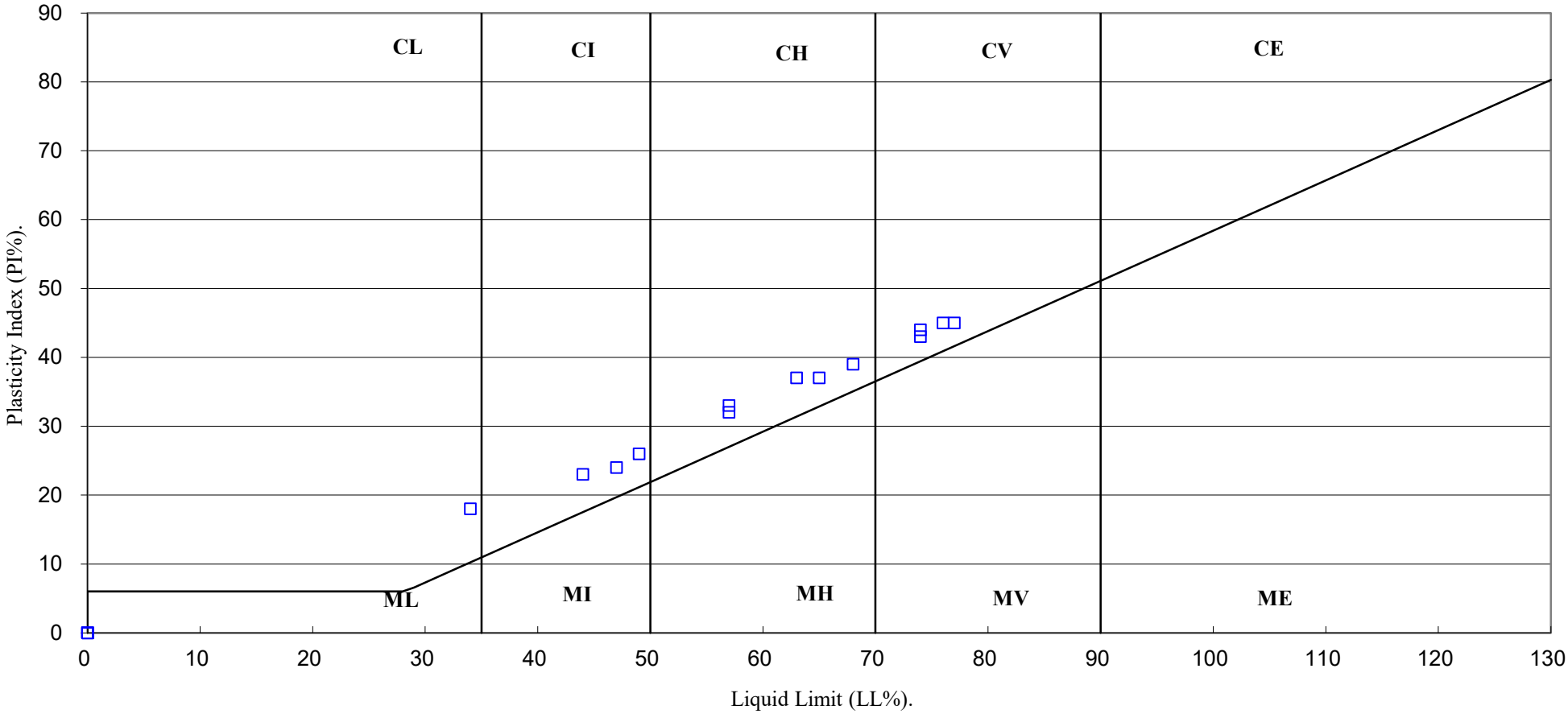
Contract No:

PSL19/7411

Client Ref:

A112771

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	Wimbledon Park Lane, Wimbledon	Contract No: PSL19/7411
			Client Ref: A112771

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS06	5	D	4.00	4.50	33			59	24	35	97	High plasticity CH.
WS06	7	D	6.00		34							

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

Wimbledon Park Lane, Wimbledon

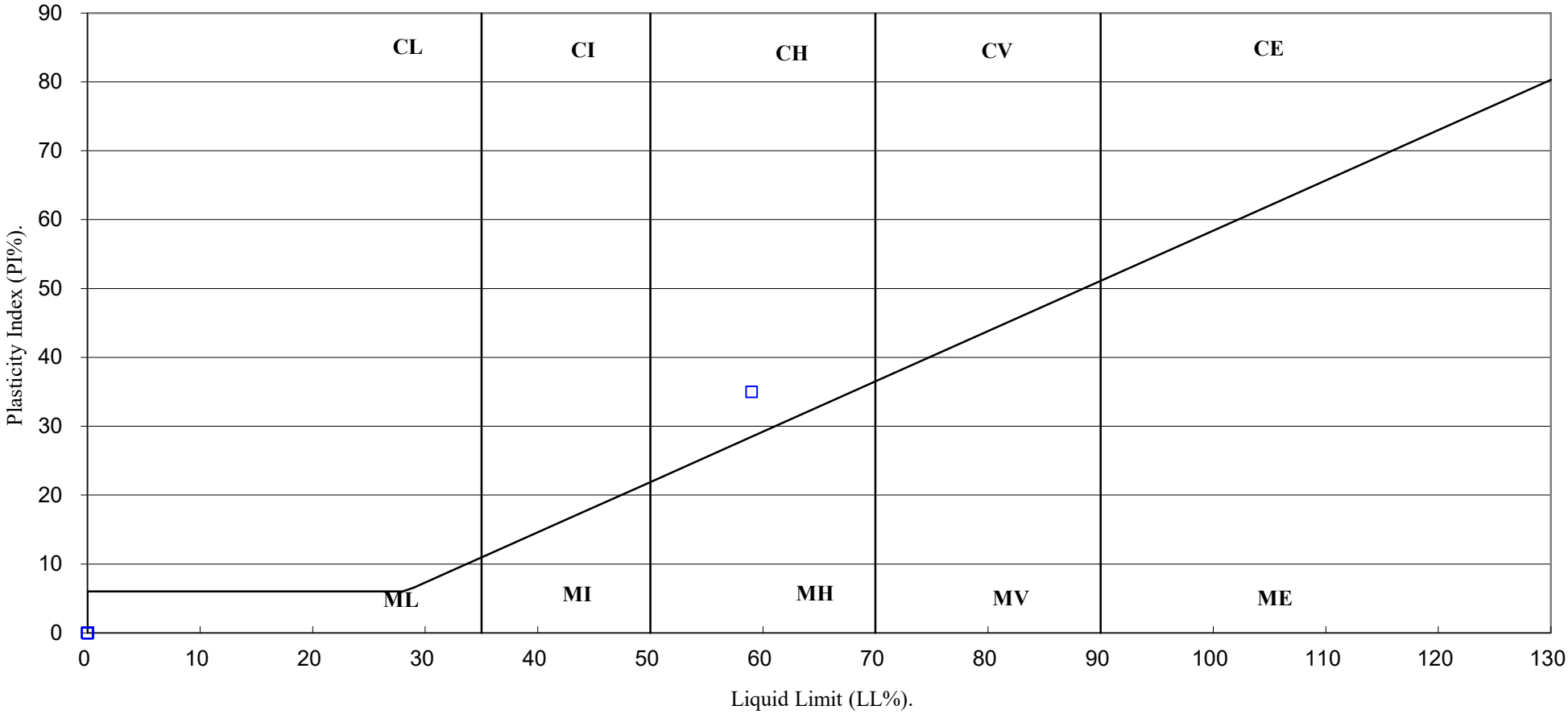
Contract No:

PSL19/7411

Client Ref:

A112771

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



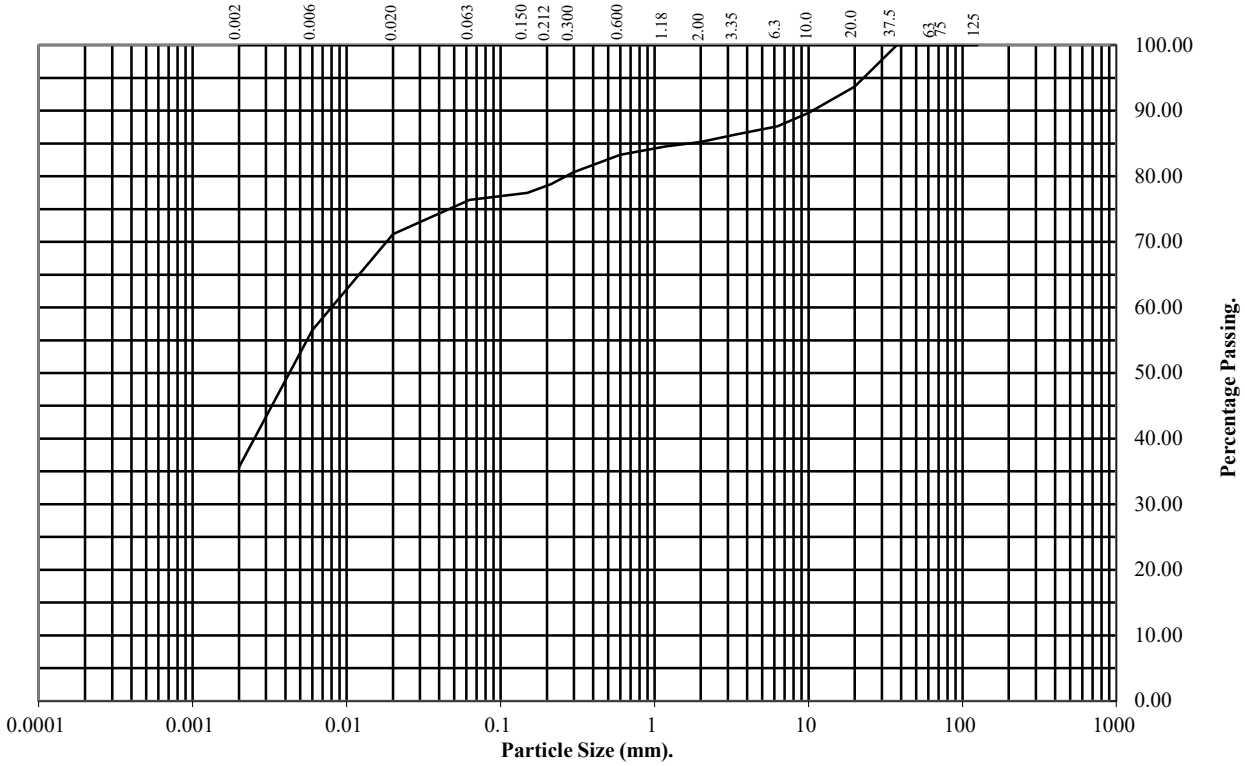
UKAS TESTING 4043	PSL Professional Soils Laboratory	Wimbledon Park Lane, Wimbledon	Contract No: PSL19/7411
			Client Ref: A112771

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**WS02**	**Top Depth (m):**	**1.50**
Sample Number:	**3**	**Base Depth(m):**	**2.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	90
6.3	88
3.35	86
2	85
1.18	85
0.6	83
0.3	81
0.212	79
0.15	77
0.063	76

Particle Diameter	Percentage Passing
0.02	71
0.006	57
0.002	36

Soil Fraction	Total Percentage
Cobbles	0
Gravel	15
Sand	9
Silt	40
Clay	36

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

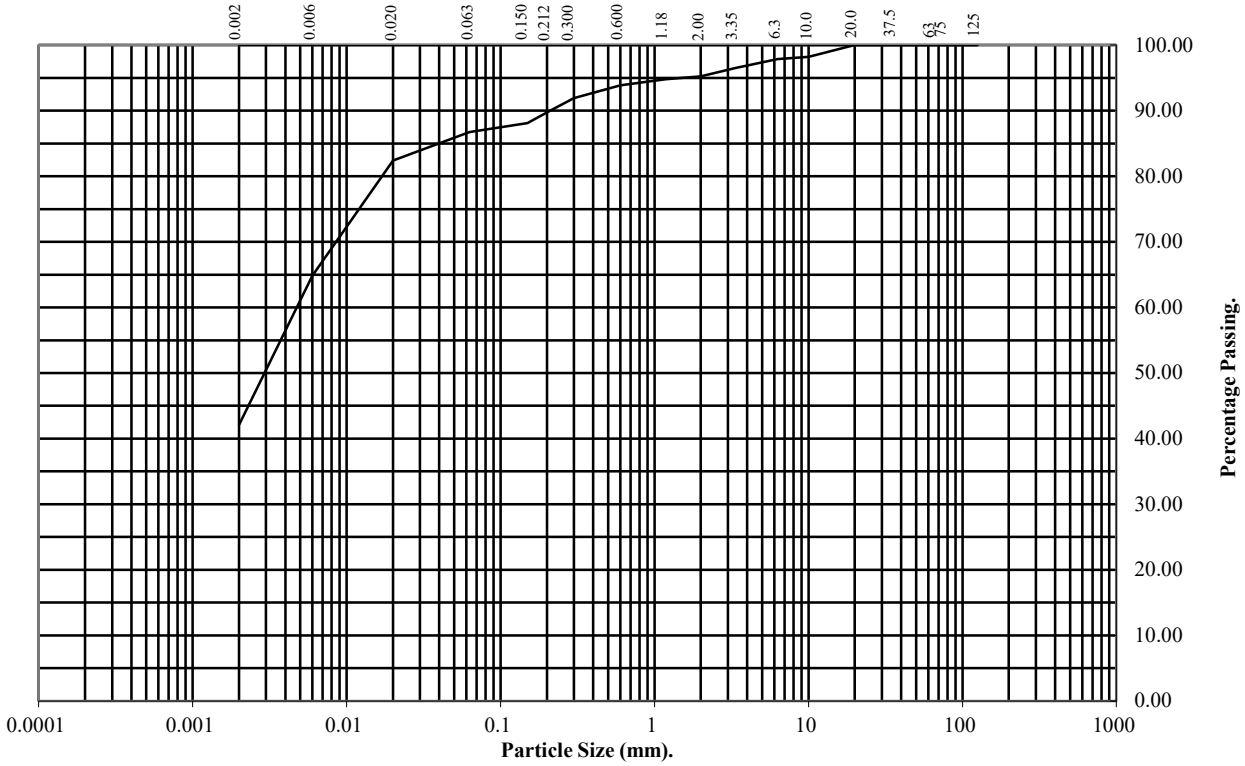
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: WS02 **Top Depth (m):** 3.00

Sample Number: 3 **Base Depth(m):**

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	98
6.3	98
3.35	97
2	95
1.18	95
0.6	94
0.3	92
0.212	90
0.15	88
0.063	87

Particle Diameter	Percentage Passing
0.02	82
0.006	65
0.002	42

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	8
Silt	45
Clay	42

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

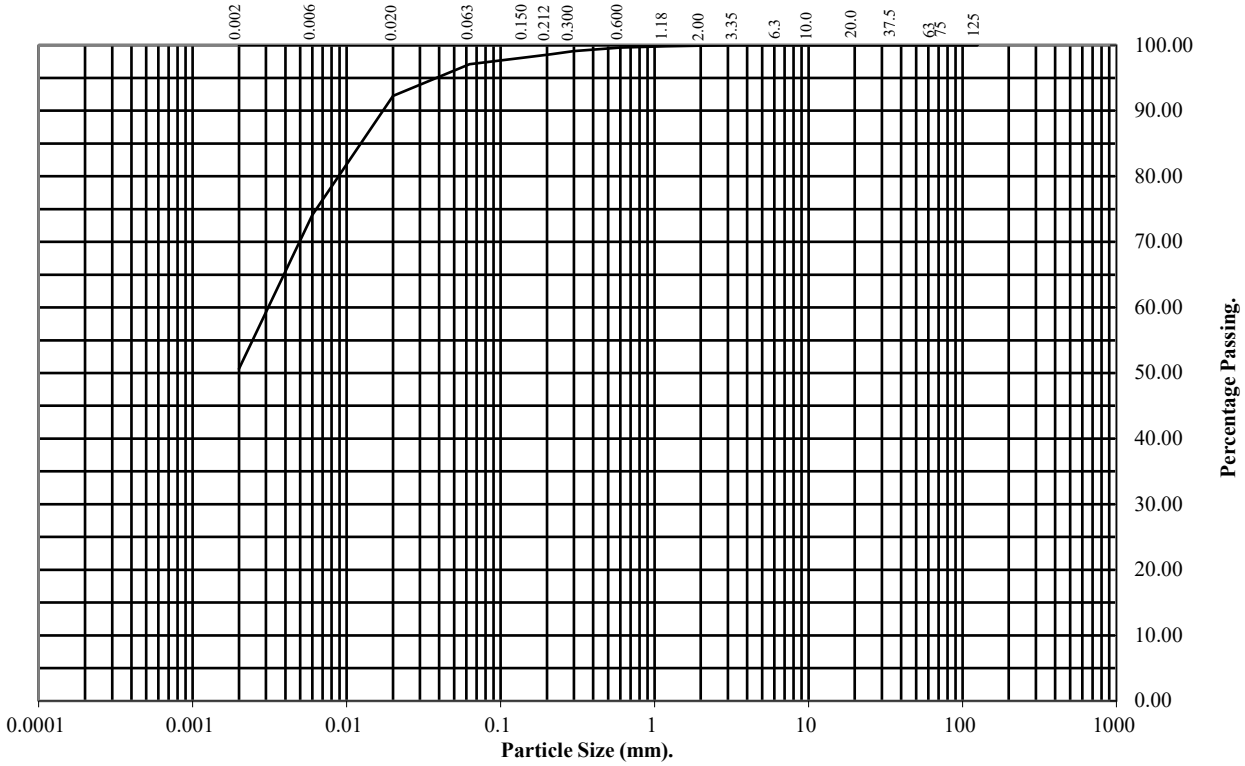
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: WS02 **Top Depth (m):** 6.00

Sample Number: 6 **Base Depth(m):**

Sample Type: D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	100
0.3	99
0.212	99
0.15	98
0.063	97

Particle Diameter	Percentage Passing
0.02	92
0.006	74
0.002	51

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	3
Silt	46
Clay	51

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

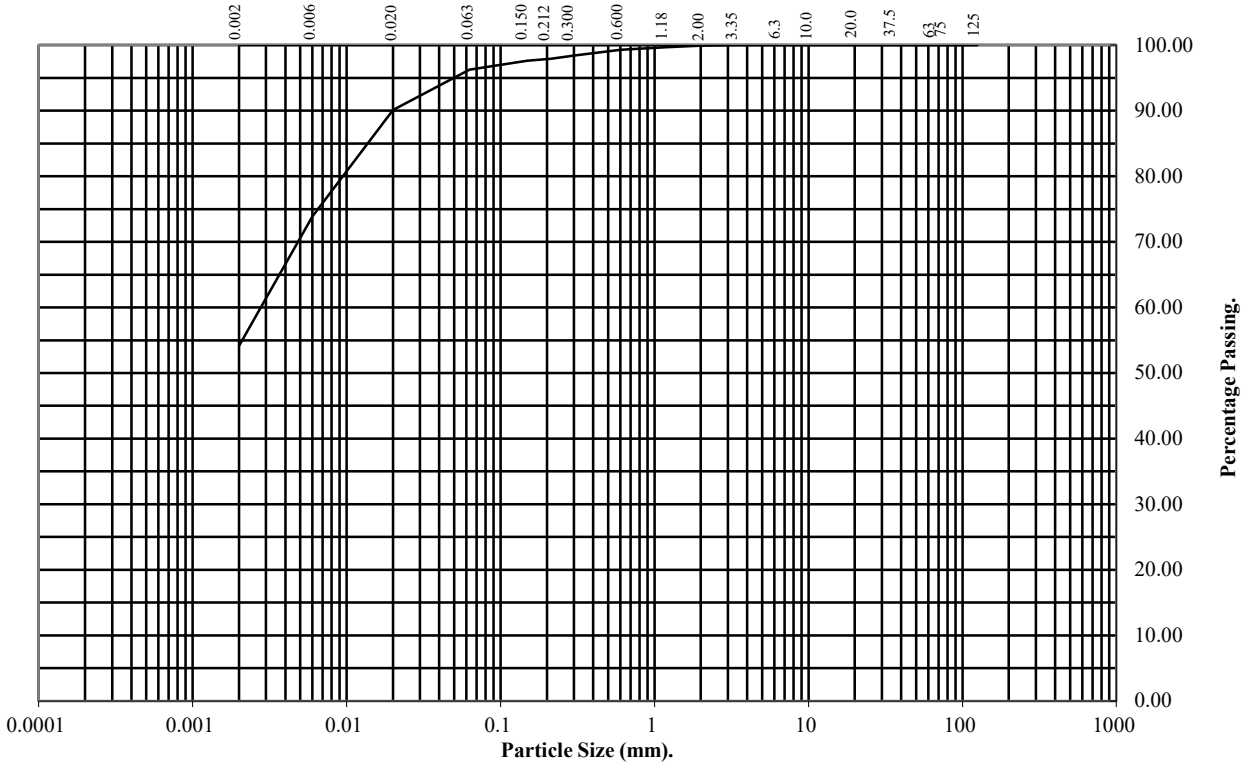
BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number: **WS02** **Top Depth (m):** **10.00**

Sample Number: **10** **Base Depth(m):**

Sample Type: **D**



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	100
0.6	99
0.3	98
0.212	98
0.15	98
0.063	96

Particle Diameter	Percentage Passing
0.02	90
0.006	74
0.002	54

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	4
Silt	42
Clay	54

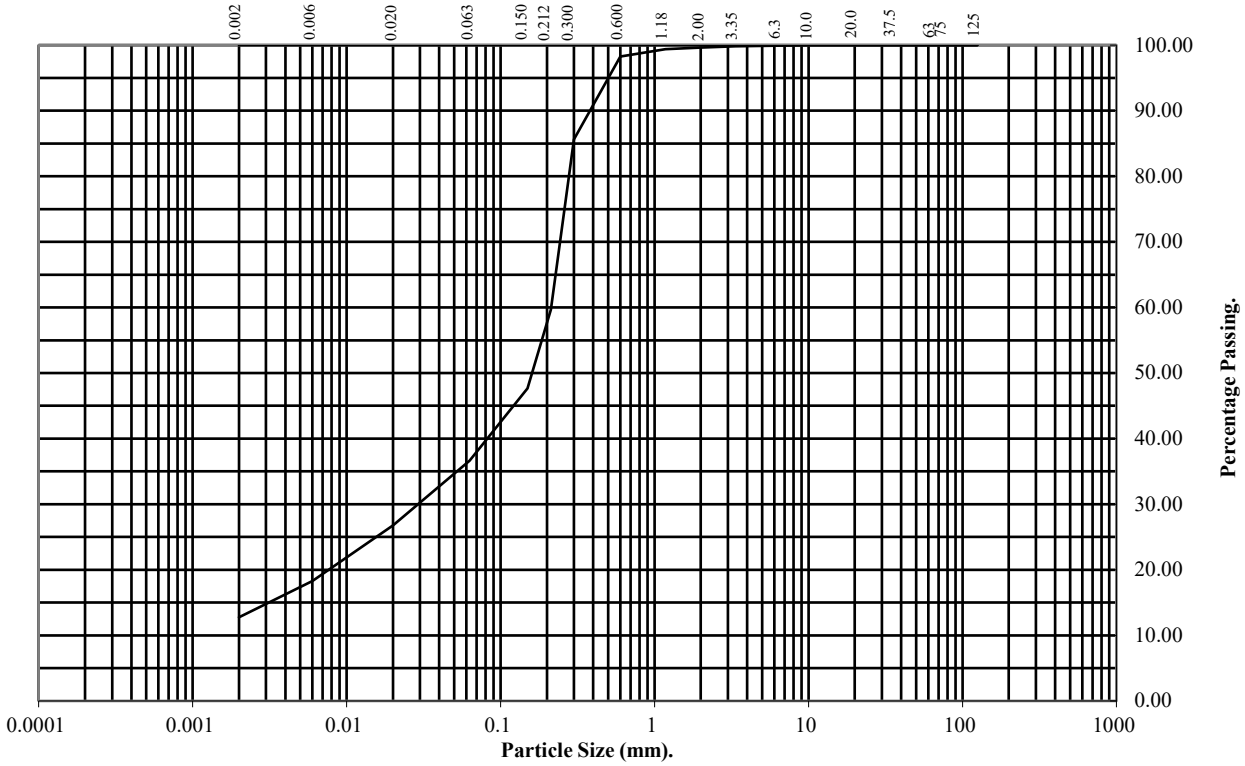
Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Hole Number:	**WS03**	**Top Depth (m):**	**1.50**
Sample Number:	**3**	**Base Depth(m):**	**2.00**
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	100
1.18	99
0.6	98
0.3	86
0.212	60
0.15	48
0.063	37

Particle Diameter	Percentage Passing
0.02	27
0.006	18
0.002	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	0
Sand	63
Silt	24
Clay	13

Remarks:
See Summary of Soil Descriptions

ONE DIMENSIONAL CONSOLIDATION TEST

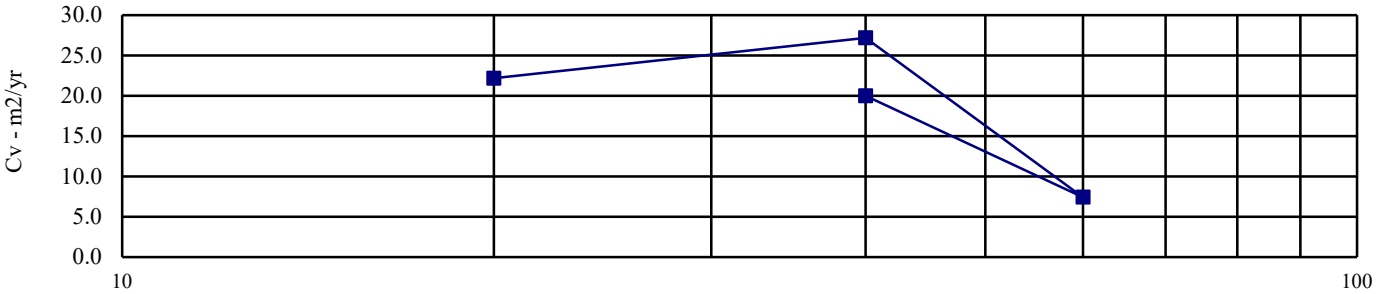
BS 1377: Part 5: 1990: Clause 3

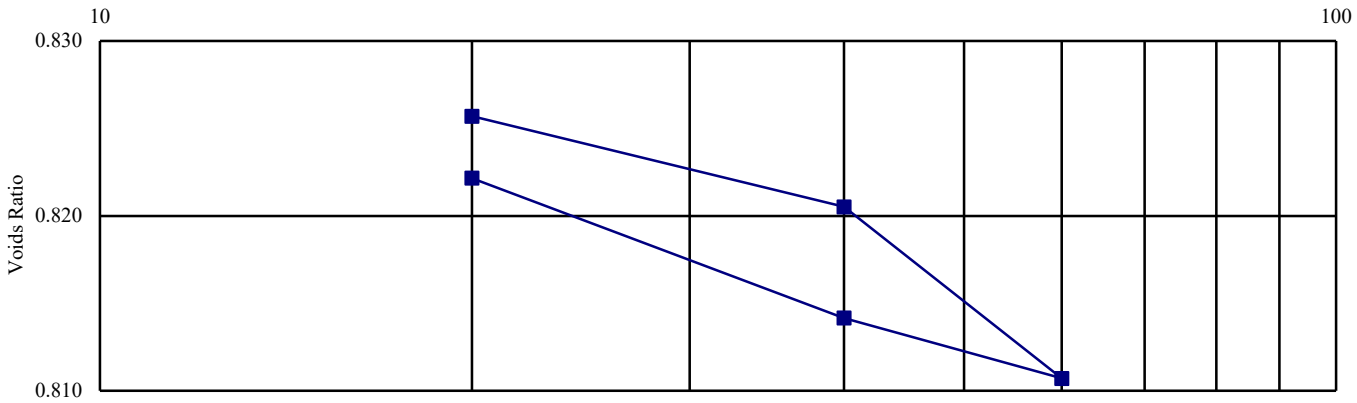
Hole Number: WS05 **Top Depth (m):** 2.00

Sample Number: 1 **Base Depth (m) :**

Sample Type: U

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	30						
Bulk Density (Mg/m3):	1.89	0	20	Swelling	Swelling	Method used to	
Dry Density (Mg/m3):	1.45	20	40	0.142	19.988	determine CV:	T90
Voids Ratio:	0.826	40	60	0.270	7.410	Nominal temperature	
Degree of saturation:	96.6	60	40	0.095	27.170	during test ' C:	20
Height (mm):	20.09	40	20	0.220	22.171	Remarks:	
Diameter (mm)	50.08					See summary of soil descriptions	
Particle Density (Mg/m3): Assumed	2.65						





UKAS TESTING 4043	PSL Professional Soils Laboratory	Wimbledon Park Lane, Wimbledon	Contract No: PSL19/7411
			Client Ref: A112771

SUMMARY OF SOIL DENSITY RELATED TESTS

(BS1377 : PART 2 & 4 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Retained 20mm %	Retained 37.5mm %	Method of compaction kg	Maximum Dry Density Mg/m^3	Minimum Dry Density Mg/m^3	Remarks
WS02	3	D	3.00		21	1.87	1.55						
WS02	4	B	7.00	8.00	38	1.86	1.35						
WS03	5	B	3.00	4.00	24	1.97	1.59						
WS03	6	B	5.00	6.00	38	1.88	1.36						
WS04	2	B	1.60	2.00	31	1.86	1.42						
WS05	4	B	3.00	4.00	32	1.90	1.44						

UKAS TESTING
4043

PSL
Professional Soils Laboratory

Wimbledon Park Lane, Wimbledon

Contract No:
PSL19/7411
Client Ref:
A112771

Certificate of Analysis

Certificate Number 19-25410

20-Dec-19

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 19-25410

Client Reference PSL19/7411

Order No (not supplied)

Contract Title Wimbledon Park Lane

Description 12 Soil samples.

Date Received 11-Dec-19

Date Started 11-Dec-19

Date Completed 20-Dec-19

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis

Soil Samples

Our Ref 19-25410
Client Ref PSL19/7411
Contract Title Wimbledon Park Lane

	Lab No	1611989	1611990	1611991	1611992	1611993	1611994	1611995	1611996	1611997	1611998	1611999	1612000
	Sample ID	WS02	WS02	WS03	WS03	WS03	WS03	WS03	WS03	WS06	WS06	WS06	WS06
	Depth	1.50-2.00	7.00-8.00	2.50-3.00	4.00-4.50	4.70-5.00	5.00-6.00	7.00	9.00	2.50-3.00	3.60-3.80	4.00-4.50	6.00
	Other ID	3	4	4	3	4	6	7	9	3	4	5	7
	Sample Type	B	B	B	D	D	B	D	D	B	D	D	D
	Sampling Date	12/11/19	12/11/19	13/11/19	13/11/19	13/11/19	13/11/19	13/11/19	13/11/19	13/11/19	14/11/19	14/11/19	14/11/19
	Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**										
Metals													
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l			< 10			230			74		24	
Inorganics													
pH	DETSC 2008#		pH	7.6	7.3	6.8			7.3			7.1		7.9	
Organic matter	DETSC 2002#	0.1	%			2.4	1.7	0.7		0.4	0.6	0.8	3.1	0.3	0.7
Chloride Aqueous Extract	DETSC 2055	1	mg/l			17			22			19		14	
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l			< 1.0			< 1.0			< 1.0		< 1.0	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	31	1200	30			2000			730		210	
Sulphur as S, Total	DETSC 2320	0.01	%			0.03			0.54			0.07		0.03	
Sulphate as SO4, Total	DETSC 2321#	0.01	%			0.04			1.2			0.20		0.06	

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 19-25410
Client Ref PSL19/7411
Contract Wimbledon Park Lane

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1611989	WS02 1.50-2.00 SOIL	12/11/19	PT 500ml	pH + Conductivity (7 days)	
1611990	WS02 7.00-8.00 SOIL	12/11/19	PT 500ml	pH + Conductivity (7 days)	
1611991	WS03 2.50-3.00 SOIL	13/11/19	PT 500ml	pH + Conductivity (7 days)	
1611992	WS03 4.00-4.50 SOIL	13/11/19	PT 500ml		
1611993	WS03 4.70-5.00 SOIL	13/11/19	PT 500ml		
1611994	WS03 5.00-6.00 SOIL	13/11/19	PT 500ml	pH + Conductivity (7 days)	
1611995	WS03 7.00 SOIL	13/11/19	PT 500ml		
1611996	WS03 9.00 SOIL	13/11/19	PT 500ml		
1611997	WS06 2.50-3.00 SOIL	13/11/19	PT 500ml	pH + Conductivity (7 days)	
1611998	WS06 3.60-3.80 SOIL	14/11/19	PT 500ml		
1611999	WS06 4.00-4.50 SOIL	14/11/19	PT 500ml	pH + Conductivity (7 days)	
1612000	WS06 6.00 SOIL	14/11/19	PT 500ml		

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix G – Laboratory Environmental Results

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

WYG Geo-Environment
11th Floor
1 Angel Court
London
Middlesex
EC2R 7HJ

Attention: Peter Robinson

CERTIFICATE OF ANALYSIS

Date of report Generation:	10 December 2019
Customer:	WYG Geo-Environment
Sample Delivery Group (SDG):	191121-37
Your Reference:	
Location:	Wimbledon Park Lake
Report No:	533483

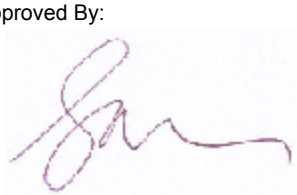
We received 12 samples on Thursday November 21, 2019 and 6 of these samples were scheduled for analysis which was completed on Tuesday December 10, 2019. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.

Approved By:



Sonia McWhan

Operations Manager

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
21188003	WS01		0.20	12/11/2019
21188004	WS01		0.65	12/11/2019
21188015	WS02		0.20	12/11/2019
21188016	WS02		0.70	12/11/2019
21188005	WS03		0.30	13/11/2019
21188006	WS03		1.00	13/11/2019
21188007	WS04		0.20	13/11/2019
21188008	WS04		0.50	13/11/2019
21188011	WS05		0.30	14/11/2019
21188012	WS05		1.20	14/11/2019
21188013	WS06		0.50	14/11/2019
21188014	WS06		1.30	

Maximum Sample/Coolbox Temperature (°C) : **6.0**

ISO5667-3 Water quality - Sampling - Part3 -
During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C.

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Results Legend

X Test

N No Determination Possible

Sample Types -
S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			21188004	21188005	21188006	21188008	21188011	21188012			
Customer Sample Reference			WS01	WS03	WS03	WS04	WS05	WS05			
AGS Reference											
Depth (m)			0.65	0.30	1.00	0.50	0.30	1.20			
Container			1kg TUB	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	1kg TUB	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)
Sample Type			S	S	S	S	S	S	S	S	S	S
Anions by Kone (soil)	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X			X		X		X		
Boron Water Soluble	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
Metals in solid samples by OES	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
PAH by GCMS	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
pH	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
Phenols by HPLC (S)	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
Sample description	All	NDPs: 0 Tests: 6		X	X		X		X		X	X
TPH c6-40 Value of soil	All	NDPs: 0 Tests: 6		X	X		X		X		X	X

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	**fine**	0.063mm - 0.1mm	**medium**	0.1mm - 2mm	**coarse**	2mm - 10mm	**very coarse**	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
21188004	WS01	0.65	Black	Sandy Loam	Tile/Insulation Board	Stones
21188005	WS03	0.30	Dark Brown	Sandy Clay Loam	Stones	Vegetation
21188006	WS03	1.00	Dark Brown	Clay Loam	Brick	Stones
21188008	WS04	0.50	Dark Brown	Loamy Sand	Stones	Brick
21188011	WS05	0.30	Dark Brown	Sandy Loam	Stones	Crushed Brick
21188012	WS05	1.20	Light Brown	Clay	None	Stones

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-3+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	WS01	WS03	WS03	WS04	WS05	WS05
			Depth (m)	0.65	0.30	1.00	0.50	0.30	1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/11/2019	13/11/2019	13/11/2019	13/11/2019	14/11/2019	14/11/2019
			Sampled Time	.	.	.	.	.	.
			Date Received	21/11/2019	21/11/2019	21/11/2019	21/11/2019	21/11/2019	21/11/2019
			SDG Ref	191121-37	191121-37	191121-37	191121-37	191121-37	191121-37
			Lab Sample No.(s)	21188004	21188005	21188006	21188008	21188011	21188012
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		23	20	27	17	13	20
Phenol	<0.01 mg/kg	TM062 (S)		<0.01 @ M	<0.01 @ M	<0.01 @ M	<0.01 @ M	<0.01 @ M	<0.01 @ M
Cresols	<0.01 mg/kg	TM062 (S)		<0.01 @ M	0.0125 @ M	<0.01 @ M	<0.01 @ M	<0.01 @ M	<0.01 @ M
Xylenols	<0.015 mg/kg	TM062 (S)		<0.015 @ M	<0.015 @ M	<0.015 @ M	<0.015 @ M	<0.015 @ M	<0.015 @ M
Phenols, Total Detected monohydric	<0.035 mg/kg	TM062 (S)		<0.035 @ M	<0.035 @ M	<0.035 @ M	<0.035 @ M	<0.035 @ M	<0.035 @ M
pH	1 pH Units	TM133		7.98 M	8.22 M	6.82 M	7.78 M	6.84 M	8 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Free	<1 mg/kg	TM153		<1 @ M	<1 @ M	<1 @ M	<1 @ M	<10 @ M	<1 @ M
TPH >C6-C8	<10 mg/kg	TM154		<10 @	<10 @	<10 @	<10 @	<10 @	<10 @
TPH >C8-C10	<10 mg/kg	TM154		<10 @	<10 @	<10 @	<10 @	<10 @	<10 @
TPH >C10-C12	<10 mg/kg	TM154		<10 @	<10 @	<10 @	<10 @	<10 @	<10 @
TPH >C12-C16	<10 mg/kg	TM154		<10 @	<10 @	<10 @	43.1 @	<10 @	<10 @
TPH >C16-C21	<10 mg/kg	TM154		<10 @	69.5 @	<10 @	516 @	<10 @	19.4 @
TPH >C21-C40	<10 mg/kg	TM154		63.8 @	430 @	62.1 @	1750 @	26.9 @	87 @
TPH >C6-C40	<10 mg/kg	TM154		71.7 @	505 @	73.7 @	2320 @	30.7 @	108 @
TPH >C8-40	<10 mg/kg	TM154		71.7 @ #	505 @ #	73.7 @ #	2320 @ #	30.7 @ #	108 @ #
Arsenic	<0.6 mg/kg	TM181		51.5 M	14.1 M	14.2 M	43.8 M	9.68 M	11.7 M
Cadmium	<0.02 mg/kg	TM181		<0.02 M	0.509 M	0.0743 M	0.0273 M	0.104 M	<0.02 M
Chromium	<0.9 mg/kg	TM181		4.57 M	22.8 M	37.8 M	24.9 M	13.3 M	42.3 M
Copper	<1.4 mg/kg	TM181		140 M	52.9 M	31.7 M	365 M	30.1 M	21.1 M
Lead	<0.7 mg/kg	TM181		447 M	209 M	63.9 M	428 M	126 M	15.4 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Nickel	<0.2 mg/kg	TM181		57.6 M	21.6 M	42.6 M	58.2 M	10.4 M	46.6 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Zinc	<1.9 mg/kg	TM181		573 M	181 M	96.2 M	173 M	45.1 M	64 M
Boron, water soluble	<1 mg/kg	TM222		1.42 M	1.04 M	2.24 M	<1 M	<1 M	4.28 M
Water Soluble Sulphate as SO4 2:1 Extract	<0.004 g/l	TM243		0.191 M	0.0562 M	0.0993 M	0.0598 M	0.0184 M	0.0684 M

Validated

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-3+5@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	WS01	WS03	WS03	WS04	WS05	WS05
			Depth (m)	0.65	0.30	1.00	0.50	0.30	1.20
			Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
			Date Sampled	12/11/2019	13/11/2019	13/11/2019	13/11/2019	14/11/2019	14/11/2019
			Sampled Time	.	.	.	.	.	.
			Date Received	21/11/2019	21/11/2019	21/11/2019	21/11/2019	21/11/2019	21/11/2019
			SDG Ref	191121-37	191121-37	191121-37	191121-37	191121-37	191121-37
			Lab Sample No.(s)	21188004	21188005	21188006	21188008	21188011	21188012
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		94.3	94.5	86.5	91.9	98.1	91.3
Acenaphthene-d10 % recovery**	%	TM218		89.5	91.9	87.6	90.9	100	89.6
Phenanthrene-d10 % recovery**	%	TM218		91.2	91.4	91.2	95.9	103	86.8
Chrysene-d12 % recovery**	%	TM218		75	77	84.6	82.5	98	85.2
Perylene-d12 % recovery**	%	TM218		89.1	88.1	86.6	95.5	98.9	85.5
Naphthalene	<9 µg/kg	TM218		<45 @ M	121 @ M	241 @ M	448 @ M	10.6 @ M	<9 @ M
Acenaphthylene	<12 µg/kg	TM218		87.6 @ M	1010 @ M	235 @ M	3000 @ M	14.1 @ M	<12 @ M
Acenaphthene	<8 µg/kg	TM218		<40 @ M	206 @ M	870 @ M	293 @ M	<8 @ M	<8 @ M
Fluorene	<10 µg/kg	TM218		<50 @ M	250 @ M	799 @ M	931 @ M	<10 @ M	<10 @ M
Phenanthrene	<15 µg/kg	TM218		146 @ M	4170 @ M	8750 @ M	11900 @ M	92.9 @ M	27.5 @ M
Anthracene	<16 µg/kg	TM218		<80 @ M	992 @ M	1790 @ M	3300 @ M	<16 @ M	<16 @ M
Fluoranthene	<17 µg/kg	TM218		851 @ M	12200 @ M	12700 @ M	28700 @ M	221 @ M	72.5 @ M
Pyrene	<15 µg/kg	TM218		917 @ M	10400 @ M	10500 @ M	24500 @ M	201 @ M	61 @ M
Benz(a)anthracene	<14 µg/kg	TM218		413 @ M	4830 @ M	4580 @ M	12600 @ M	120 @ M	35.7 @ M
Chrysene	<10 µg/kg	TM218		300 @ M	4080 @ M	4330 @ M	8740 @ M	112 @ M	26.4 @ M
Benzo(b)fluoranthene	<15 µg/kg	TM218		570 @ M	4940 @ M	5930 @ M	11800 @ M	172 @ M	31.2 @ M
Benzo(k)fluoranthene	<14 µg/kg	TM218		238 @ M	2010 @ M	2040 @ M	4750 @ M	63.8 @ M	<14 @ M
Benzo(a)pyrene	<15 µg/kg	TM218		547 @ M	5450 @ M	4620 @ M	13300 @ M	132 @ M	31.7 @ M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		410 @ M	3940 @ M	3810 @ M	8660 @ M	91.8 @ M	<18 @ M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<115 @ M	746 @ M	458 @ M	1750 @ M	<23 @ M	<23 @ M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		433 @ M	4080 @ M	3050 @ M	8880 @ M	92.4 @ M	<24 @ M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		4910	59500	64600	144000	1320	286

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Asbestos Identification - Solid Samples

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
*	Subcontracted test.
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS01 0.65 SOLID 12/11/2019 00:00:00 21/11/2019 06:00:00 191121-37 21188004 TM048	10/12/2019	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS03 1.00 SOLID 13/11/2019 00:00:00 21/11/2019 06:00:00 191121-37 21188006 TM048	10/12/19	Andrzej Ferfecki	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS04 0.50 SOLID 13/11/2019 00:00:00 21/11/2019 06:00:00 191121-37 21188008 TM048	10/12/2019	Marcin Magdziarek	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	WS05 0.30 SOLID 14/11/2019 00:00:00 21/11/2019 06:00:00 191121-37 21188011 TM048	10/12/19	Andrzej Ferfecki	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser
TM154	In - house Method	Determination of Petroleum Hydrocarbons by EZ Flash GC-FID in the Carbon range C6-C40
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM218	Shaker extraction - EPA method 3546.	The determination of PAH in soil samples by GC-MS
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer
TM243		Mixed Anions In Soils By Kone

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	21188004	21188005	21188006	21188008	21188011	21188012
Customer Sample Ref.	WS01	WS03	WS03	WS04	WS05	WS05
AGS Ref.						
Depth	0.65	0.30	1.00	0.50	0.30	1.20
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	06-Dec-2019	09-Dec-2019	09-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019
Asbestos ID in Solid Samples	10-Dec-2019		10-Dec-2019	10-Dec-2019	10-Dec-2019	
Boron Water Soluble	05-Dec-2019	09-Dec-2019	09-Dec-2019	05-Dec-2019	05-Dec-2019	09-Dec-2019
Cyanide Comp/Free/Total/Thiocyanate	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	05-Dec-2019
Hexavalent Chromium (s)	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019
Metals in solid samples by OES	06-Dec-2019	10-Dec-2019	10-Dec-2019	06-Dec-2019	06-Dec-2019	09-Dec-2019
PAH by GCMS	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	06-Dec-2019	06-Dec-2019
pH	08-Dec-2019	08-Dec-2019	08-Dec-2019	08-Dec-2019	08-Dec-2019	08-Dec-2019
Phenols by HPLC (S)	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019
Sample description	03-Dec-2019	03-Dec-2019	03-Dec-2019	03-Dec-2019	02-Dec-2019	02-Dec-2019
TPH c6-40 Value of soil	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019

ASSOCIATED AQC DATA

Boron Water Soluble

Component	Method Code	QC 2103	QC 2117	QC 2120
Water Soluble Boron	TM222	**93.0** 85.80 : 112.50	**95.5** 85.80 : 112.50	**96.0** 85.80 : 112.50

Cyanide Comp/Free/Total/Thiocyanate

Component	Method Code	QC 2156	QC 2110	QC 2148
Free Cyanide	TM153	**92.6** 83.05 : 112.74	**95.8** 83.05 : 112.74	**93.6** 83.05 : 112.74
Thiocyanate	TM153	**89.22** 89.81 : 110.19	**90.42** 89.81 : 110.19	**89.22** 89.81 : 110.19
Total Cyanide	TM153	**90.0** 88.29 : 111.43	**102.14** 88.29 : 111.43	**101.43** 88.29 : 111.43

Hexavalent Chromium (s)

Component	Method Code	QC 2198	QC 2179	QC 2159
Hexavalent Chromium	TM151	**100.0** 90.20 : 107.00	**104.0** 90.20 : 107.00	**102.0** 90.20 : 107.00

Metals in solid samples by OES

Component	Method Code	QC 2130	QC 2151	QC 2162	QC 2127	QC 2161
Aluminium	TM181	**101.77** 77.84 : 119.01	**100.0** 77.84 : 119.01	**98.23** 77.84 : 119.01	**88.14** 77.84 : 119.01	**85.31** 77.84 : 119.01
Antimony	TM181	**97.15** 84.28 : 107.67	**102.44** 84.28 : 107.67	**95.12** 84.28 : 107.67	**86.99** 84.28 : 107.67	**85.37** 84.28 : 107.67
Arsenic	TM181	**103.2** 87.05 : 109.36	**105.81** 87.05 : 109.36	**103.49** 87.05 : 109.36	**98.26** 87.05 : 109.36	**97.09** 87.05 : 109.36
Barium	TM181	**100.0** 82.49 : 109.34	**99.08** 82.49 : 109.34	**97.25** 82.49 : 109.34	**90.37** 82.49 : 109.34	**85.87** 82.49 : 109.34
Beryllium	TM181	**103.73** 85.44 : 109.61	**106.72** 85.44 : 109.61	**105.22** 85.44 : 109.61	**98.88** 85.44 : 109.61	**96.64** 85.44 : 109.61
Boron	TM181	**95.42** 73.51 : 104.66	**93.98** 73.51 : 104.66	**95.7** 73.51 : 104.66	**88.83** 73.51 : 104.66	**85.96** 73.51 : 104.66
Cadmium	TM181	**96.3** 81.46 : 106.43	**97.94** 81.46 : 106.43	**99.59** 81.46 : 106.43	**88.07** 81.46 : 106.43	**89.71** 81.46 : 106.43
Chromium	TM181	**93.51** 82.26 : 104.55	**99.19** 82.26 : 104.55	**97.16** 82.26 : 104.55	**91.48** 82.26 : 104.55	**89.45** 82.26 : 104.55
Cobalt	TM181	**93.08** 86.54 : 106.87	**95.28** 86.54 : 106.87	**93.71** 86.54 : 106.87	**88.68** 86.54 : 106.87	**87.11** 86.54 : 106.87
Copper	TM181	**93.66** 82.40 : 105.45	**99.47** 82.40 : 105.45	**97.89** 82.40 : 105.45	**92.61** 82.40 : 105.45	**90.32** 82.40 : 105.45
Iron	TM181	**98.41** 82.95 : 110.58	**100.79** 82.95 : 110.58	**98.41** 82.95 : 110.58	**89.68** 82.95 : 110.58	**88.1** 82.95 : 110.58
Lead	TM181	**91.89** 78.24 : 104.05	**95.27** 78.24 : 104.05	**105.63** 78.24 : 104.05	**92.57** 78.24 : 104.05	**87.84** 78.24 : 104.05

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Metals in solid samples by OES

		QC 2130	QC 2151	QC 2162	QC 2127	QC 2161
Manganese	TM181	**109.44** 94.29 : 119.51	**115.0** 94.29 : 119.51	**114.44** 94.29 : 119.51	**106.67** 94.29 : 119.51	**103.06** 94.29 : 119.51
Mercury	TM181	**98.07** 83.74 : 105.34	**100.97** 83.74 : 105.34	**98.31** 83.74 : 105.34	**93.24** 83.74 : 105.34	**93.0** 83.74 : 105.34
Molybdenum	TM181	**102.47** 87.11 : 106.87	**101.65** 87.11 : 106.87	**101.23** 87.11 : 106.87	**96.71** 87.11 : 106.87	**93.83** 87.11 : 106.87
Nickel	TM181	**95.6** 81.92 : 102.18	**96.09** 81.92 : 102.18	**94.62** 81.92 : 102.18	**89.98** 81.92 : 102.18	**88.02** 81.92 : 102.18
Phosphorus	TM181	**114.95** 94.56 : 124.28	**111.52** 94.56 : 124.28	**111.52** 94.56 : 124.28	**105.25** 94.56 : 124.28	**105.05** 94.56 : 124.28
Selenium	TM181	**100.39** 86.28 : 110.48	**103.92** 86.28 : 110.48	**103.92** 86.28 : 110.48	**98.43** 86.28 : 110.48	**98.43** 86.28 : 110.48
Strontium	TM181	**89.53** 79.13 : 102.79	**96.21** 79.13 : 102.79	**94.21** 79.13 : 102.79	**87.31** 79.13 : 102.79	**85.3** 79.13 : 102.79
Thallium	TM181	**95.58** 82.94 : 111.86	**103.1** 82.94 : 111.86	**99.56** 82.94 : 111.86	**96.02** 82.94 : 111.86	**92.92** 82.94 : 111.86
Tin	TM181	**103.42** 90.25 : 108.86	**105.32** 90.25 : 108.86	**102.66** 90.25 : 108.86	**98.48** 90.25 : 108.86	**97.34** 90.25 : 108.86
Titanium	TM181	**91.6** 66.23 : 102.06	**88.55** 66.23 : 102.06	**89.31** 66.23 : 102.06	**83.97** 66.23 : 102.06	**83.97** 66.23 : 102.06
Vanadium	TM181	**97.8** 86.37 : 107.94	**101.83** 86.37 : 107.94	**100.0** 86.37 : 107.94	**93.41** 86.37 : 107.94	**89.01** 86.37 : 107.94
Zinc	TM181	**100.0** 84.68 : 113.99	**104.72** 84.68 : 113.99	**101.85** 84.68 : 113.99	**96.51** 84.68 : 113.99	**93.63** 84.68 : 113.99

PAH by GCMS

Component	Method Code	QC 2194	QC 2145	QC 2199	QC 2100
Acenaphthene	TM218	**90.5** 76.79 : 103.90	**93.5** 70.00 : 130.00	**94.5** 70.00 : 130.00	**102.5** 70.00 : 130.00
Acenaphthylene	TM218	**89.0** 78.40 : 108.66	**92.5** 70.00 : 130.00	**93.5** 70.00 : 130.00	**100.5** 70.00 : 130.00
Anthracene	TM218	**88.5** 76.15 : 110.07	**92.5** 70.00 : 130.00	**93.0** 70.00 : 130.00	**99.5** 70.00 : 130.00
Benz(a)anthracene	TM218	**92.5** 73.77 : 119.26	**87.5** 68.12 : 118.39	**100.0** 68.12 : 118.39	**106.0** 68.12 : 118.39
Benzo(a)pyrene	TM218	**92.5** 73.20 : 114.18	**87.5** 71.72 : 115.31	**97.5** 71.72 : 115.31	**108.0** 71.72 : 115.31
Benzo(b)fluoranthene	TM218	**90.0** 75.36 : 117.58	**84.5** 66.89 : 120.40	**96.5** 66.89 : 120.40	**102.5** 66.89 : 120.40
Benzo(ghi)perylene	TM218	**87.0** 70.73 : 116.12	**84.5** 67.82 : 118.49	**95.5** 67.82 : 118.49	**101.5** 67.82 : 118.49
Benzo(k)fluoranthene	TM218	**89.5** 75.98 : 116.59	**88.0** 73.10 : 117.03	**100.5** 73.10 : 117.03	**113.0** 73.10 : 117.03
Chrysene	TM218	**88.0** 74.82 : 114.18	**83.5** 69.58 : 115.47	**97.5** 69.58 : 115.47	**105.0** 69.58 : 115.47
Dibenzo(ah)anthracene	TM218	**90.5** 69.17 : 115.30	**89.0** 67.32 : 121.35	**91.0** 67.32 : 121.35	**104.0** 67.32 : 121.35
Fluoranthene	TM218	**89.5** 75.88 : 112.84	**96.0** 75.16 : 117.28	**99.5** 75.16 : 117.28	**106.0** 75.16 : 117.28
Fluorene	TM218	**89.5** 78.50 : 114.02	**92.5** 70.00 : 130.00	**93.5** 70.00 : 130.00	**102.0** 70.00 : 130.00
Indeno(123cd)pyrene	TM218	**89.5** 70.26 : 117.95	**80.0** 68.91 : 117.62	**92.0** 68.91 : 117.62	**102.0** 68.91 : 117.62

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

PAH by GCMS

		QC 2194	QC 2145	QC 2199	QC 2100
Naphthalene	TM218	**90.0** 75.24 : 111.26	**94.0** 70.00 : 130.00	**94.0** 70.00 : 130.00	**100.0** 70.00 : 130.00
Phenanthrene	TM218	**88.0** 77.07 : 107.43	**91.5** 70.00 : 130.00	**94.0** 70.00 : 130.00	**103.5** 70.00 : 130.00
Pyrene	TM218	**90.0** 78.74 : 112.56	**93.0** 75.68 : 119.23	**99.5** 75.68 : 119.23	**106.0** 75.68 : 119.23

pH

Component	Method Code	QC 2174	QC 2191	QC 2100
pH	TM133	**99.3** 97.44 : 100.93	**98.6** 97.44 : 100.93	**99.42** 97.44 : 100.93

Phenols by HPLC (S)

Component	Method Code	QC 2117	QC 2171
2.3.5 Trimethyl-Phenol by HPLC (S)	TM062 (S)	**84.42** 83.23 : 109.71	**83.12** 65.50 : 89.50
2-Isopropyl Phenol by HPLC (S)	TM062 (S)	**86.55** 76.34 : 104.11	**80.7** 86.25 : 116.25
Catechol by HPLC (S)	TM062 (S)	**67.62** 22.43 : 157.02	**90.48** 19.39 : 135.70
Cresols by HPLC (S)	TM062 (S)	**93.53** 85.60 : 112.00	**87.27** 81.00 : 112.20
Napthol by HPLC (S)	TM062 (S)	**125.0** 75.62 : 124.38	**110.0** 57.50 : 102.50
Phenol by HPLC (S)	TM062 (S)	**107.28** 79.53 : 120.47	**94.7** 88.67 : 124.67
Resorcinol HPLC (S)	TM062 (S)	**96.86** 71.43 : 129.59	**93.08** 69.99 : 127.22
Xylenols by HPLC (S)	TM062 (S)	**95.0** 89.90 : 107.23	**89.27** 90.22 : 114.22

TPH c6-40 Value of soil

Component	Method Code	QC 2156
Diesel QC	TM154	**97.1** 87.23 : 107.46
Lube Oil QC	TM154	**101.65** 88.86 : 105.23
TPH C6-40 Corrected	TM154	**99.25** 89.77 : 105.84

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.
The figure detailed is the percentage recovery result for the AQC.
The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.

CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Chromatogram

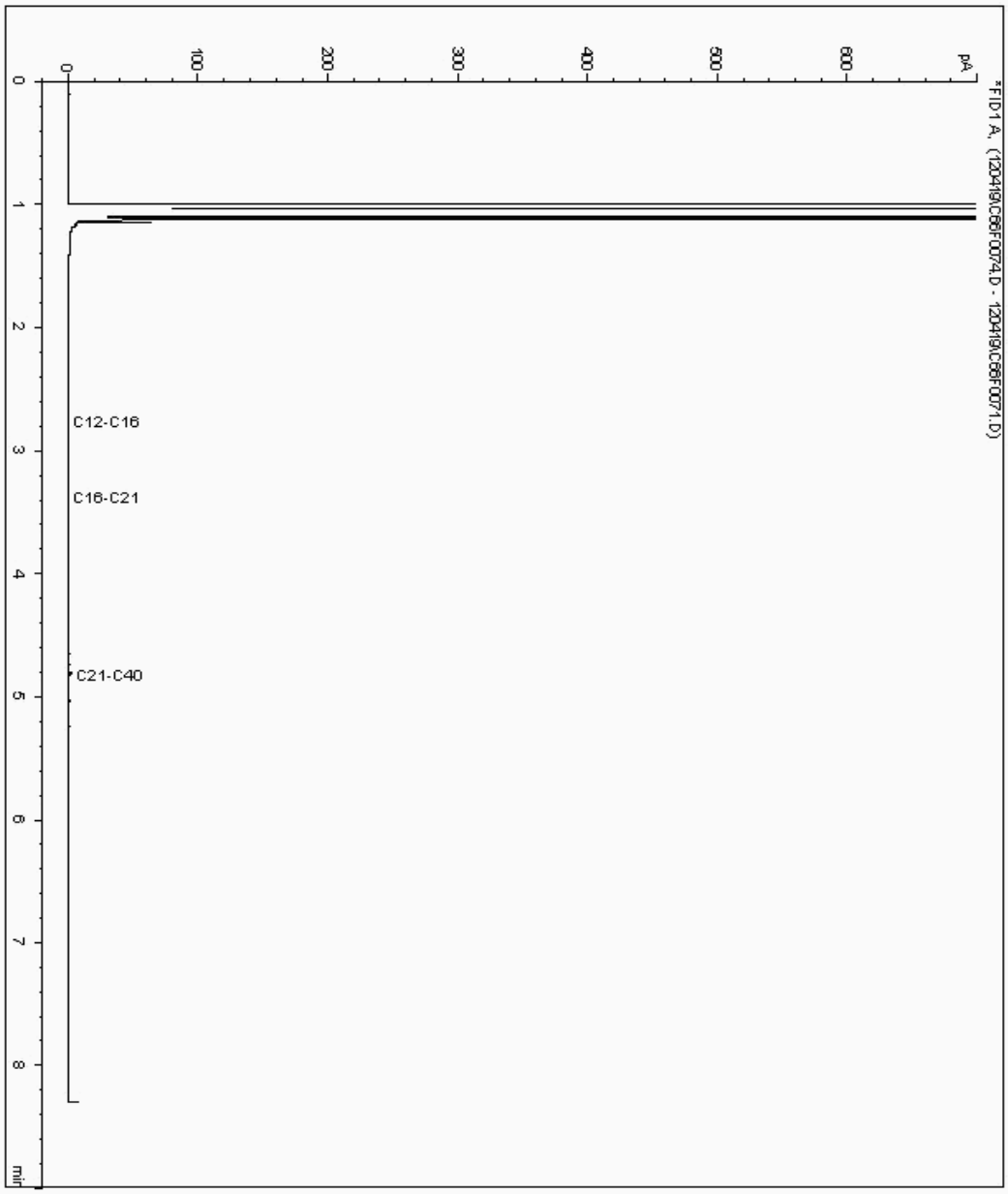
Analysis: TPH c6-40 Value of soil

Sample No : 21273219
Sample ID : WS05

Depth : 0.30

Flash GC TM154 (C6 - C40)

Sample Identity : 19983011-
Date Acquired : 05/12/2019 06:20:36 PM
Units : mg/kg
Sample Multiplier : 1.724
Dilution : 1.000
Download class :



CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Chromatogram

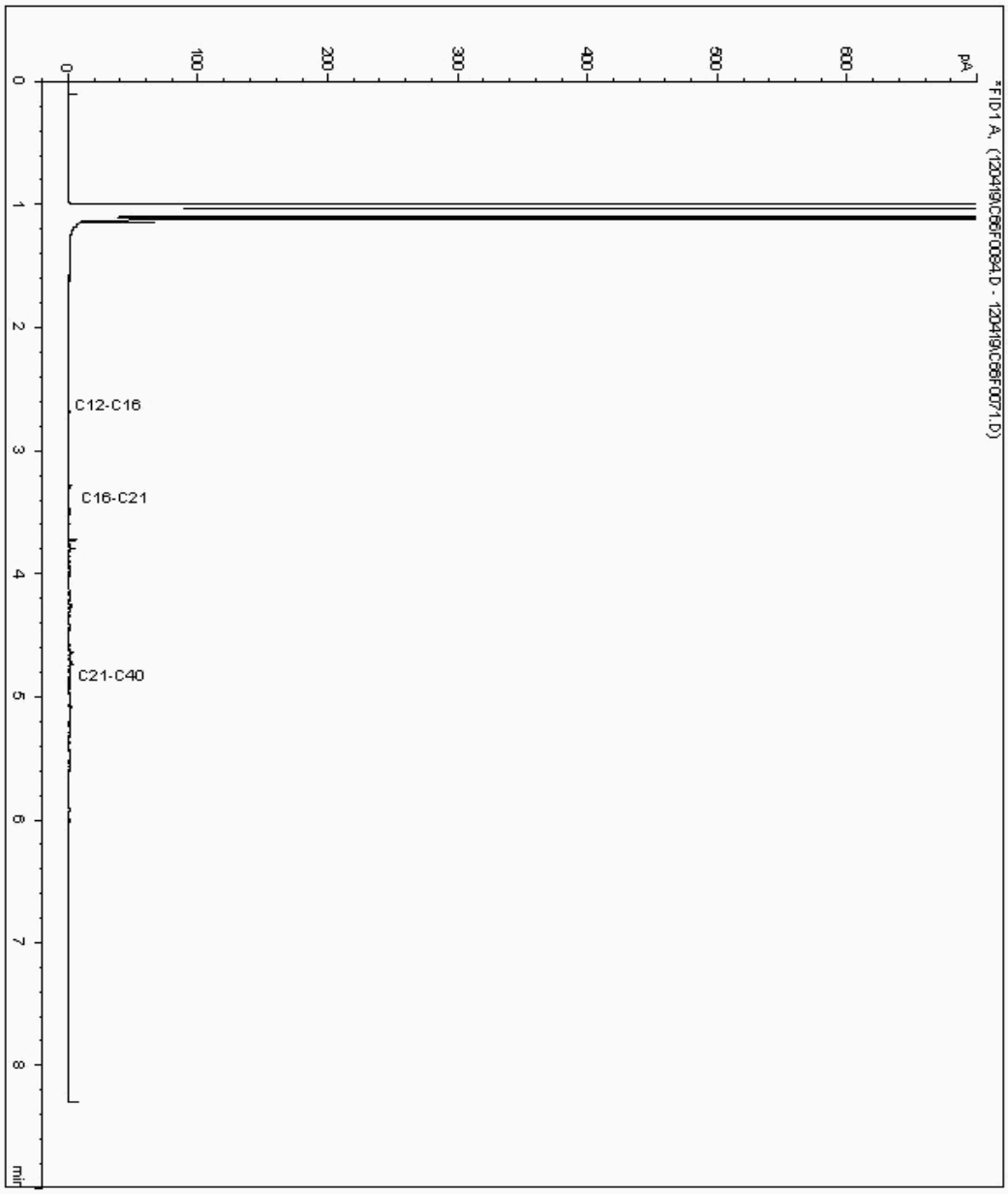
Analysis: TPH c6-40 Value of soil

Sample No : 21273282
Sample ID : WS05

Depth : 1.20

Flash GC TM154 (C6 - C40)

Sample Identity : 19983041-
Date Acquired : 05/12/2019 09:16:16 PM
Units : mg/kg
Sample Multiplier : 2.222
Dilution : 1.000
Download class :



CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Chromatogram

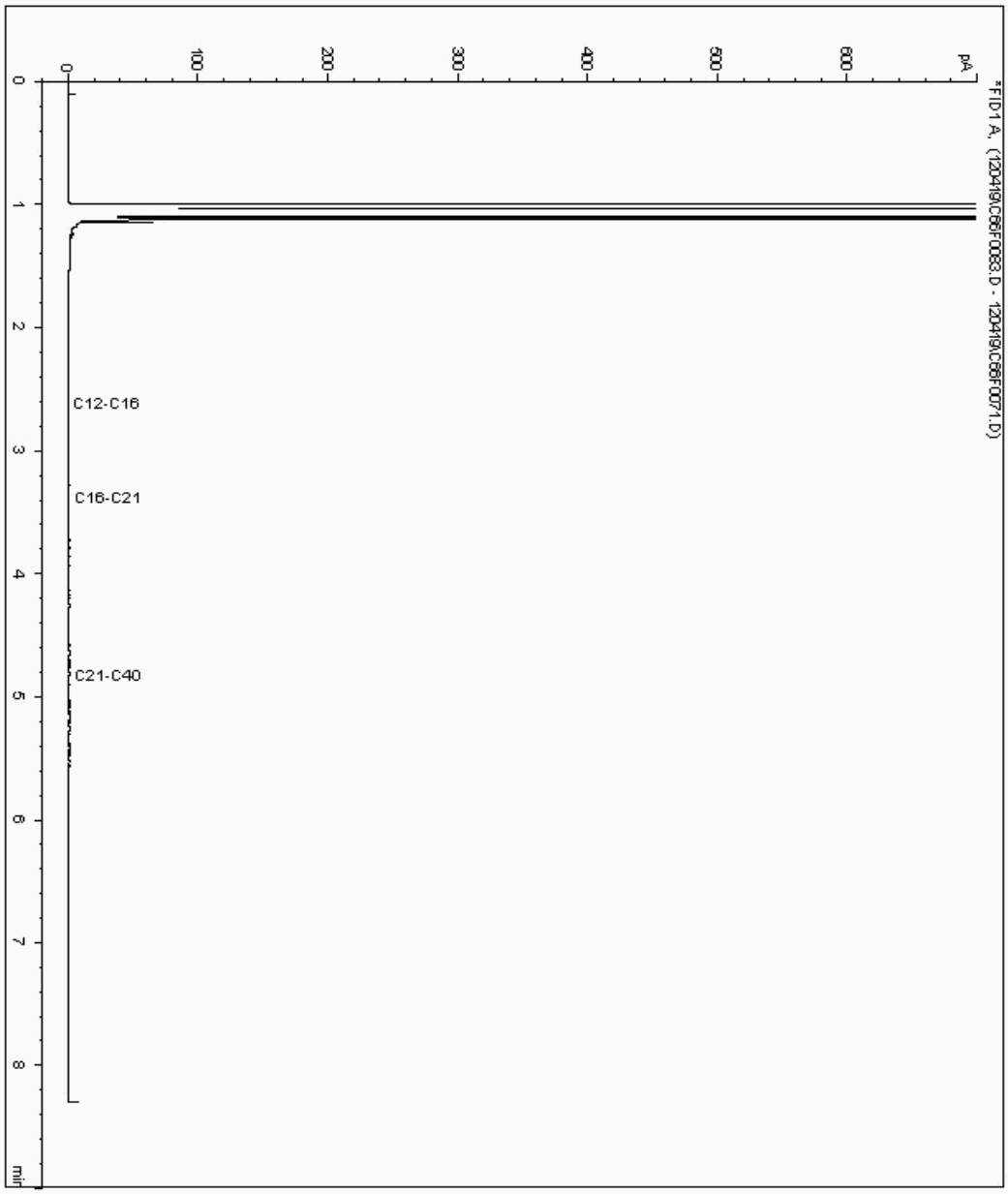
Analysis: TPH c6-40 Value of soil

Sample No : 21277987
Sample ID : WS03

Depth : 1.00

Flash GC TM154 (C6 - C40)

Sample Identity : 19982980-
Date Acquired : 05/12/2019 08:58:43 PM
Units : mg/kg
Sample Multiplier : 2.041
Dilution : 1.000
Download class :



CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Chromatogram

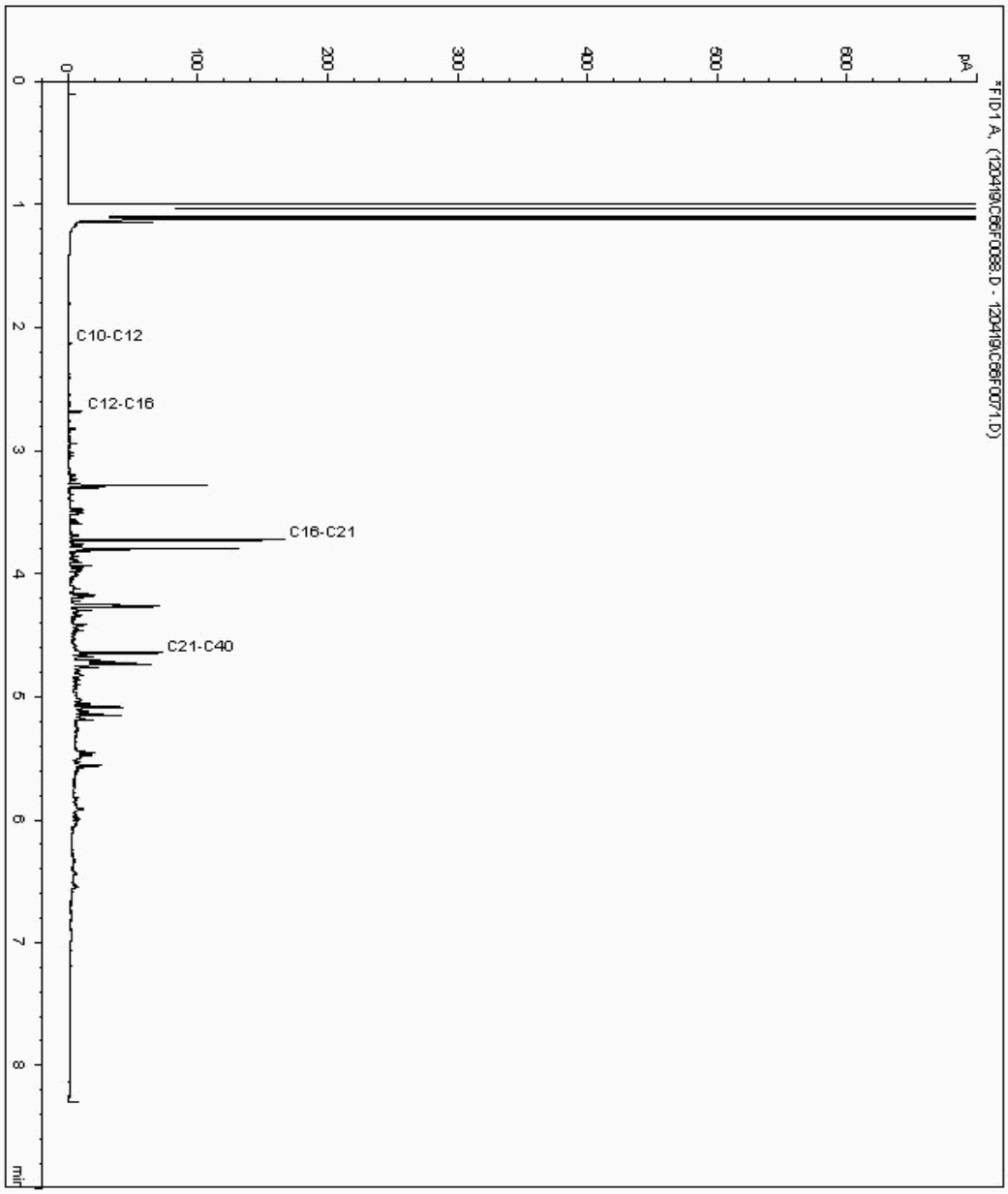
Analysis: TPH c6-40 Value of soil

Sample No : 21278113
Sample ID : WS04

Depth : 0.50

Flash GC TM154 (C6 - C40)

Sample Identity : 19982997-
Date Acquired : 05/12/2019 10:44:30 PM
Units : mg/kg
Sample Multiplier : 2.041
Dilution : 1.000
Download class :



CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Chromatogram

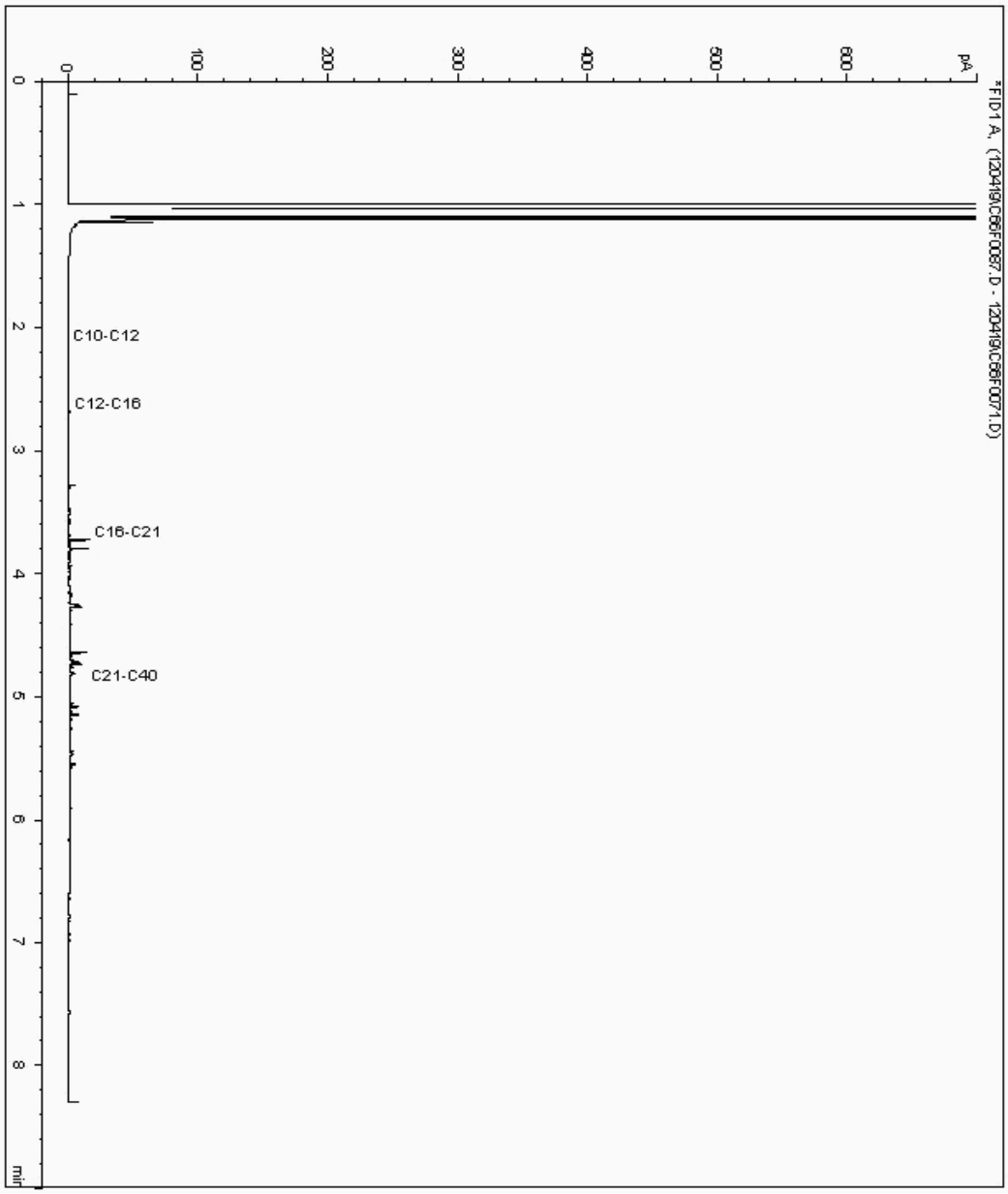
Analysis: TPH c6-40 Value of soil

Sample No : 21278165
Sample ID : WS03

Depth : 0.30

Flash GC TM154 (C6 - C40)

Sample Identity : 19982942-
Date Acquired : 05/12/2019 10:27:00 PM
Units : mg/kg
Sample Multiplier : 2.439
Dilution : 1.000
Download class :



CERTIFICATE OF ANALYSIS

SDG:	191121-37	**Client Reference:**		**Report Number:**	533483
Location:	Wimbledon Park Lake	**Order Number:**	19/8116/4016/WL/11	**Superseded Report:**	

Chromatogram

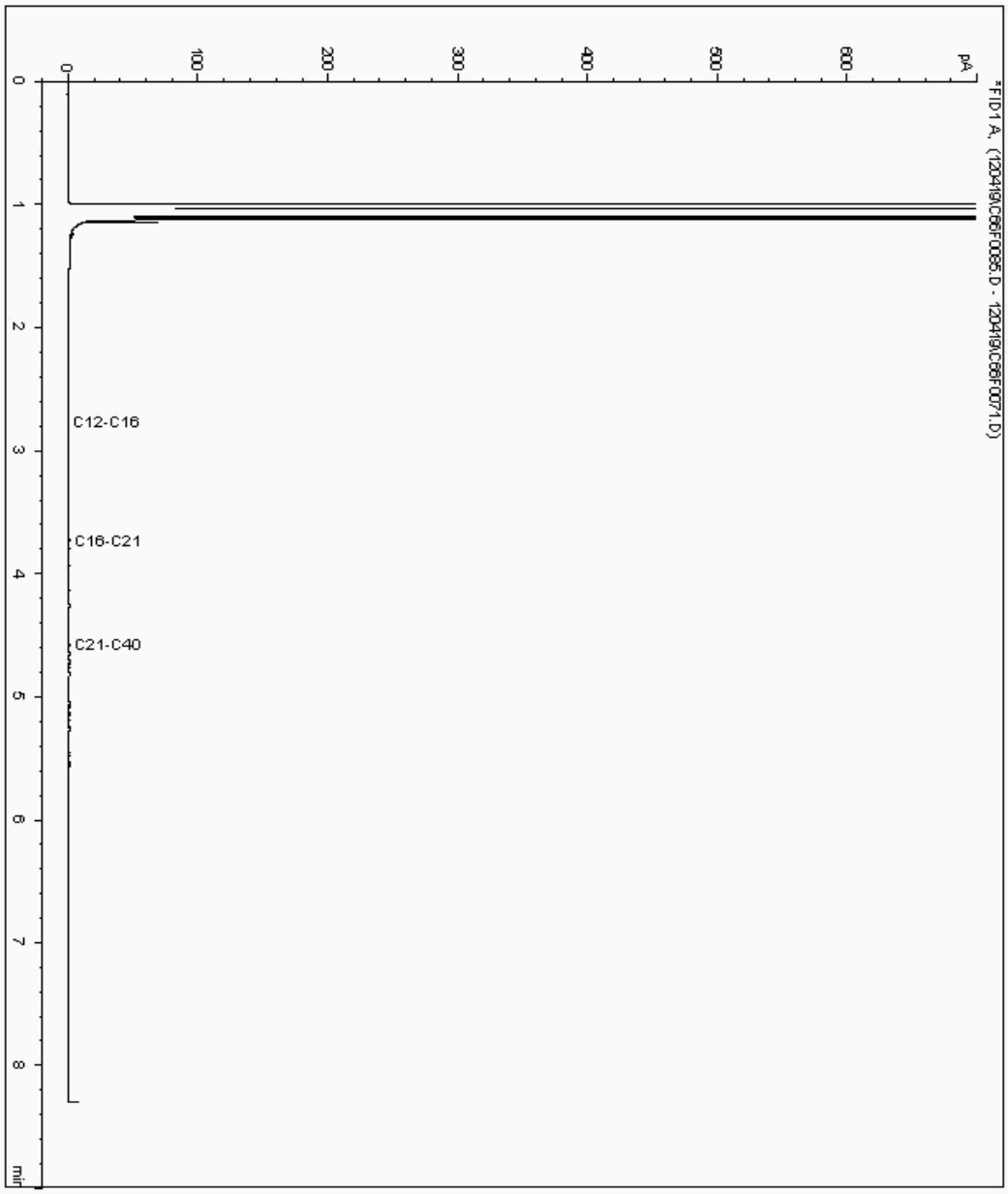
Analysis: TPH c6-40 Value of soil

Sample No : 21278228
Sample ID : WS01

Depth : 0.65

Flash GC TM154 (C6 - C40)

Sample Identity : 19982881-
Date Acquired : 05/12/2019 09:51:24 PM
Units : mg/kg
Sample Multiplier : 2.174
Dilution : 1.000
Download class :



Appendix General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

18. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
§	**Sampled on date not provided**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**

19. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.
Standing Committee of Analysts, *The Quantification of Asbestos in Soil (2107).*

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix H – Preliminary Unexploded Ordnance (UXO) Threat Assessment

1st Line Defence Limited
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Herts, EN11 0EX
Tel: +44 (0)1992 245 020
E-mail: info@1stlinedefence.co.uk
Company No: 7717863
VAT No: 128 8833 79

www.1stlinedefence.co.uk

Express Preliminary UXO Risk Assessment

Client	London Borough of Merton
Project	Wimbledon Park
Site Address	Home Park Road, Wimbledon, London, SW19 8AU
Report Reference	EP6223-00
Date	16/03/18
Originator	EC

Assessment Objective

This preliminary risk assessment is a qualitative screening exercise to assess the likely potential of encountering unexploded ordnance (UXO) at the Wimbledon Park site. The assessment involves the consideration of the basic factors that affect the potential for UXO to be present at a site as outlined in Stage One of the UXO risk management process.

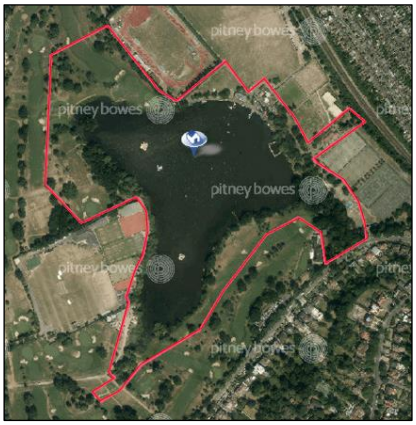
Background

This assessment uses the sources of information available in-house to 1st Line Defence Ltd to enable the placement of a development site in context with events that may have led to the presence of German air-delivered or Allied military UXO. The report will identify any immediate necessity for risk mitigation or additional research in the form of a Detailed UXO Risk Assessment. It makes use of 1st Line Defence's extensive historical archives, library and unique geo-databases, as well as internet resources, and is researched and compiled by UXO specialists and graduate researchers.

The assessment directly follows CIRIA C681 guidelines "Unexploded Ordnance, a Guide for the Construction Industry". The document will therefore assess the following factors:

- Basic Site Data
- Previous Military Use
- Indicators of potential aerial delivered UXO threat
- Consideration of any Mitigating Factors
- Extent of Proposed Intrusive Works
- Any requirement for Further Work

It should be noted that the vast majority of construction sites in the UK will have a low or negligible risk of encountering UXO and should be able to be screened out at this preliminary stage. The report is meant as a common sense 'first step' in the UXO risk management process. The content of the report and conclusions drawn are based on basic, preliminary research using the information available to 1st Line Defence at the time this report was produced. It should be noted that the only way to entirely negate risk from UXO to a project would be to support the works proposed with appropriate UXO risk mitigation measures. It is rarely possible to state that there is absolutely 'no' risk from UXO to a project.

Risk Assessment Considerations	
Site location and description/current use	The site is located in the London Borough of Morden, in Wimbledon Park. The site is bordered by Home Park Road to the south-east and an area of railway to the east. Wimbledon Park Athletics Track border an area of the northern site boundary and The Wimbledon Club and Wimbledon Park Golf Course border the west and south of the site. Recent aerial photography shows the site to be occupied mainly with Wimbledon Park Lake and surrounding areas of open, vegetated ground. The site is approximately centred on the OS grid reference: **TQ 2467972334**. 
Are there any indicators of current/historical military activity on/close to the site?	In-house data sets do not indicate any Allied military features directly within the site area. Evidence does indicate a heavy anti-aircraft (HAA) battery and Wimbledon Common Camp, located in Wimbledon Common approximately 1.6km to the west of the site. The presence of these features are not thought to impact upon the site area.
What was the pre- and post-WWII history of the site?	The site area is consistently shown to be occupied with Wimbledon Park Lake and surrounding open areas in pre- and post-war mapping. Mapping shows a *Cricket Ground* adjacent to the west of the site. The only notable change on post-war mapping is the presence of a number of bowling greens and tennis courts adjacent to the north-easternmost area of the site.
Was the area subject to bombing during WWII?	During WWII the site was mostly located within the Municipal Borough of Wimbledon which sustained a high bombing density according to official Home Office statistics, with an average of 110.5 items of ordnance recorded per 1,000 acres. This comprised of 305 high explosive (HE) bombs, 11 oil bombs, 5 phosphorous bombs and 34 V-1 pilotless aircraft. This totalled 355 items across 3,213 acres. A small section in the north of the site was located within the Metropolitan Borough of Wandsworth, however due to the size of this area relative to the size of the site the bombing density for Wimbledon is considered to be more representative. Consolidated bomb mapping shows multiple bomb strikes within the site area. London bomb maps show at least four HE bomb strikes within the site area, positioned within western areas of the site. V-1 mapping for London also shows two strikes adjacent to the south-easternmost area of the site, on Home Park Road.
Is there any evidence of bomb damage on/close to the site?	No available bomb damage mapping covers the site area. Equally, the lack of structures within the site mean it is not possible to assess the presence of bomb damage using pre- and post-war OS mapping. However, a *Pavillion* formerly shown adjacent to the south of the site is notably absent in post-war mapping. It is conceivable that this structure suffered considerable bomb damage. Given the number of strikes within the site and the presence of V-1 incidents in close proximity, it is considered likely that there would have been significant ground disturbance in areas of the site that experienced bombing.

To what degree would the site have been subject to access?	It is not thought likely that the site was subject to regular access or specific post-raid checks for items of UXO. This is especially thought to be the case in areas of water, such as Wimbledon Park Lake that occupies the centre site area. It is considered unlikely that any items falling in this area would have been observed or discovered.
To what degree has the site been developed post-WWII?	Little discernible development has occurred within the site. Development has occurred in the surrounding areas, such as the installation of tennis courts, bowling greens and an athletics track to the west, east and north of the site. It is possible that these developments impacted upon the site area. The chance of an item of unexploded remaining is only considered to be mitigated at the exact locations and depths of post-war excavations.
What is the nature and extent of the intrusive works proposed?	Whilst the exact extent of planned works has not been made available, the project is understood to involve the removal of a large amount from silt from Wimbledon Park Lake.

Summary and Conclusions

During WWII, the site was located within the Municipal Borough of Wimbledon, which sustained a high bombing density according to official statistics, with an average of 110.5 items of ordnance recorded per 1,000 acres. A small section in the north of the site was located within the Metropolitan Borough of Wandsworth, however due to the size of this area relative to the size of the site the bombing density for Wimbledon is considered to be more representative.

Consolidated London bomb mapping shows multiple HE strikes within the site area and its surrounds. V-1 mapping also shows two strikes adjacent to the south-easternmost area of the site, on Home Park Road. Given the site's occupation by areas of open ground and a large body of water, it is not thought likely that it would have received a regular level of access throughout WWII. It is especially considered likely that areas of water were not accessed throughout the war. Any item of unexploded ordnance failing in this location is unlikely to have been noticed unless it was actively observed falling into the body of water. It is therefore considered possible that items of unexploded ordnance could have fallen within the site unnoticed.

Recommendations

1st Line Defence can undertake further research in the form of a Detailed UXO Risk Assessment to acquire additional resources not available in-house; such as high-quality WWII-era aerial photography, written bombing records for the area and other archival sources. However, given the high amount of bombing recorded on and around the lake area, it is considered likely that undertaking additional research would not enable the risk to be negated. It is considered quite likely that any unexploded HE bombs, incendiary bombs or anti-aircraft projectiles which fell within the lake would have gone unobserved and unrecovered. It is therefore recommended that prior to or in lieu of a detailed assessment, appropriate UXO Risk Mitigation Measures are provided for any works within Wimbledon Park Lake. This is most likely to be the provision of UXO safety and awareness briefings to site workers, and UXO specialist watch and brief during the dredging works themselves.

If the client has any anecdotal or empirical evidence of UXO risk on site, please contact 1st Line Defence.

Appendix I – Subcontractor Reports

Appendix I.1 Wimbledon Park Drainage Report, Midland Survey, Dec 2019

Appendix I.2 Wimbledon Park Lake Geoarchaeological Watching Brief, MOLA, Dec 2019

WIMBLEDON PARK LAKE
Wimbledon
London SW19

London Borough of Merton

Geoarchaeological watching brief report

December 2019

MOLA

REGISTERED ORGANISATION CIfA

Museum of London Archaeology
Mortimer Wheeler House
46 Eagle Wharf Road, London N1 7ED
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https://www.mola.org.uk
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WIMBLEDON PARK LAKE
Wimbledon Park
London
SW19

Site Code WBD19
NGR 524845 172415
OASIS reference molas1-375833

Report on a geoarchaeological watching brief

Sign-off History:

Issue No.	Date:	Prepared by:	Checked/ Approved by:	Reason for Issue:
1	09.12.2019	Imogen Gabriel (Geoarchaeologist)	Phil Stastney	First issue

Graphics: Juan Jose Fuldain

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Summary

This report presents the results of a geoarchaeological watching brief carried out by Museum of London Archaeology (MOLA) at Wimbledon Park Lake, Wimbledon, London Borough of Merton, SW19. The report was commissioned from MOLA by WYG Environment Planning Transport Limited on behalf of the client Future Merton (Environment and Regeneration Department, London Borough of Merton).

The report summarises the archaeological potential of the sediments revealed in the window samples across the site and makes recommendations for further work.

The site is located in Wimbledon Park, with works being undertaken along the earthen embankment which lies on the north-eastern shore of the lake, c. 200m south-west of the Revelstoke Road entrance to Wimbledon Park.

Four window samples (WBD19_WS01 to WS04) were recorded. The sequence observed in two window samples (WBD19_WS02 and WS03) consisted of London Clay overlain by redeposited London Clay and/or Head deposits which was capped by Made ground. The two other window samples (WBD19_WS01 and WS04) were either entirely made ground or disturbed to depth with modern intrusions. No remains or deposits of archaeological or palaeoenvironmental significance were recorded.

As a result of the low archaeological and palaeoenvironmental potential of the site, it is anticipated that these works will have little to no impact on any significant archaeological and palaeoenvironmental remains.

However, the decision on the appropriate archaeological response to the deposits revealed within the site rests with the LPA as advised by the Greater London Archaeological Advisory Service

Contents

List of Figures

List of Tables

1 Introduction

1.1 Site background

1.1.1 The site is located in the centre of Wimbledon Park, along the earthen embankment which lies along the north-eastern shore of the Wimbledon Park lake, *c.* 200m south-west of the Revelstoke Road entrance to Wimbledon Park (NGR 524845 172415, Fig 1).

1.2 Planning and legislative framework

1.2.1 The Planning and legislative background to the site has been fully set out in the *Historic Environment Assessment* (HEA) (MOLA 2018) and *Health and Safety Risk Assessment* (RAMs) (MOLA 2019).

1.3 Origin and scope of the watching brief

1.3.1 MOLA was commissioned by WYG Environment Planning Transport Limited on behalf of the client, Future Merton (Environment and Regeneration Department, London Borough of Merton).

1.3.2 This geoarchaeological report has been prepared within the terms of the relevant standards specified by the Chartered Institute for Archaeologists (CIFA 2014), and in reference to relevant guidance issued by Historic England (2015).

1.3.3 The works that were subject to the geoarchaeological watching brief were intended to inform the design of improvement works on Wimbledon Park Lake, including alterations to the existing embankment and overflow structures to ensure compliance with the requirements of the Reservoir Act 1975.

1.3.4 An archaeological watching brief is normally a limited fieldwork exercise. It is not the same as full excavation, though individual features may be fully excavated.

1.3.5 All research is undertaken within the priorities established in the Museum of London's (2002) *A research framework for London Archaeology*.

2 Topographical and historical background

2.1 Topography and geoarchaeological background

2.1.1 The British Geological Survey (BGS) mapping for the area (bgs.ac.uk) records superficial Head deposits (grey sandy clay with organics and sand lenses) overlying London Clay bedrock. The bedrock pre-dates the evolution of hominin groups and has no archaeological potential in itself, although its characteristics often determined the nature of succeeding environments and landscapes occupied and exploited by communities in the past.

2.1.2 The lake seemingly exploits a shallow natural depression in the London Clay, with the ground surface lying at *c* 17m OD, compared to slightly higher ground in the west (*c* 22m to 25m OD, TQ27SW56 and TQ27SW58) and east (*c* 20m OD, TQ27SW166).

2.1.3 Across the area of the window sample investigation, both the London Clay and Head deposits were dug out and disturbed during the construction of the lake and embankment in the late 18th Century (MOLA 2018). The surface of the embankment lies at 17.7m OD.

2.1.4 The lake itself is fed by streams flowing from Wimbledon common, with the overflow flowing into the River Wandle, a tributary of the River Thames.

2.2 Archaeological background

2.2.1 The archaeological background to the site has been fully set out in the HEA (MOLA 2018) with the salient points listed below.

2.2.2 A number of Palaeolithic and Neolithic assemblages have been reported in Putney Heath and Wimbledon common to the north and west of the site (Malden 1912). A hillfort known as 'Caesar's Camp' is located *c* 2.6km to the west of the park and has been dated to the Iron Age (Historic England 1932). An urn containing Roman coins dating to the 1st Century AD was recovered from inside the structure.

2.2.3 Historical maps show that throughout the Medieval period, the land appears to have been ploughland associated with the manor of Mortlake (Milward 1983).

2.2.4 The Lake was created for the first Earl Spencer by Lancelot 'Capability' Brown in 1765 as a central feature of heritage landscape, designated at Grade II* in Historic England's Register of Parks and Gardens of Special Historic Interest (Historic England 2016).

2.2.5 Along the north-eastern shore, the Lake is impounded by an earth fill embankment, which is approximately 317m long and up to 4m high. The embankment was constructed by 'Capability' Brown in 1765.

2.2.6 The Lake is currently included in the Heritage Risk Register for London due to the present condition and appearance of the Lake and its setting.

2.2.7 Wimbledon Park Lake is currently used for a variety of recreation, heritage and amenity uses, as well as being an online water body, forming part of the wider surface water drainage system.

3 The watching brief

3.1 Methodology

3.1.1 Four geotechnical window samples (WBD19_WS01 to WS04) were monitored and recorded by a MOLA Geoarchaeologist on the 12th and 13th November 2019. All monitoring work was undertaken according to the RAMs (MOLA 2019).

3.1.2 The window samples were drilled using a terrier rig by a SI subcontractor (Oakland Site Investigation Ltd) under the supervision of an engineer from WYG.

3.1.3 The locations and heights (x, y and z data) of the window samples were recorded by the contractor and supplied to MOLA (see Fig 2).

4 Results

4.1 The Window Samples

4.1.1 The results of the watching brief are presented in the tables below (Tables 1 to 4).

WBD19_WS01						
		NGR	524811.9	172448.431		
		top of core (m OD)	17.6			
Top (m bgl)	**Base (m bgl)**	**from (m OD)**	**to (m OD)**	**Thickness (m)**	**Description**	**Interpretation**
0	0.09	**17.6**	**17.51**	0.09	Tarmac	Made Ground
0.09	0.14	**17.51**	**17.46**	0.05	Mid yellowish orange brown silty clay with gravel up to 20mm- subangular/ subrounded	
0.14	0.4	**17.46**	**17.2**	0.26	Very dark brown silty clay with clinker, ceramic, CBM, concrete	
0.4	0.85	**17.2**	**16.75**	0.45	Very dark grey/black wet silty gravel. WS01 terminated at 0.85m bgl due to obstruction	

Table 1 The sediments recorded in WBD19_WS01

WBD19_WS02						
NGR			524838	172415.093		
top of core (m OD)			17.7			
Top (m bgl)	**Base (m bgl)**	**from (m OD)**	**to (m OD)**	**Thickness (m)**	**Description**	**Interpretation**
0	0.1	**17.7**	**17.6**	0.1	Tarmac	Made Ground
0.1	0.34	**17.6**	**17.36**	0.24	Mid brown silt loamy topsoil with CBM, glass and gravel (up to 30mm, subangular/ subrounded)	
0.34	1.5	**17.36**	**16.2**	1.16	Firm mid grey wet silty clayey gravel with rootlets. CBM fragment at 1.3m bgl	
1.5	3.8	**16.2**	**13.9**	2.3	Stiff light brownish grey clay with mid bluish grey patches, CBM, chalk fragments	
3.8	4.5	**13.9**	**13.2**	0.7	Firm light brownish grey sandy clay with mid bluish grey patches	Redeposited Head deposits
4.5	5	**13.2**	**12.7**	0.5	Mid bluish grey firm silty clay with unidentifiable organic material	
5	5.7	**12.7**	**12**	0.7	Light greenish grey brown firm sandy clay	
5.7	6.25	**12**	**11.45**	0.55	Mid orangish brown stiff clay with occasional unidentifiable plant macrofossils	Redeposited London Clay
6.25	7	**11.45**	**10.7**	0.75	Firm mid bluish grey sandy clay with occasional gravel (subangular up to 10mm)	
7	9	**10.7**	**8.7**	2	Mid orangish brown stiff clay	*In situ* London Clay

Table 2 The sediments recorded in WBD19_WS02

WBD19_WS03						
NGR			524878.5	172337.306		
top of core (m OD)			17.6			
Top (m bgl)	**Base (m bgl)**	**from (m OD)**	**to (m OD)**	**Thickness (m)**	**Description**	**Interpretation**
0	0.1	**17.6**	**17.5**	0.1	Turf	Made Ground
0.1	0.26	**17.5**	**17.34**	0.16	Mid brown silt loam topsoil with frequent rootlets, gravel (subangular/ subrounded up to 30mm). Pockets of mid orange brown clay	
0.26	0.7	**17.34**	**16.9**	0.44	Mid bluish grey clayey silty gravel with some CBM	
0.7	1	**16.9**	**16.6**	0.3	Mid grey wet soft silty clay with some unidentifiable organic material	Redeposited London Clay
1	1.7	**16.6**	**15.9**	0.7	Firm light brownish grey silty clay with flecks of fine gravel and unidentifiable organic material	
1.7	2.67	**15.9**	**14.93**	0.97	Stiff light bluish brownish grey slightly sandy wet clay with occasional gravel (up to 20mm subangular)	
2.67	3	**14.93**	**14.6**	0.33	Light bluish grey stiff silty clay with frequent unidentifiable organic material	
3	3.27	**14.6**	**14.33**	0.27	No recovery	
3.27	4	**14.33**	**13.6**	0.73	Light bluish grey stiff silty clay with frequent identifiable organic material	
4	4.3	**13.6**	**13.3**	0.3	No recovery	
4.3	4.65	**13.3**	**12.95**	0.35	Light bluish grey stiff silty clay with frequent	

					unidentifiable organic material	
4.65	5	**12.95**	**12.6**	0.35	Stiff mid orangish brown silty clay	
5	5.75	**12.6**	**11.85**	0.75	No recovery	
5.75	7	**11.85**	**10.6**	1.25	Stiff mid orangish brown silty clay	
7	7.4	**10.6**	**10.2**	0.4	No recovery	
7.4	8	**10.2**	**9.6**	0.6	Stiff mid orangish brown silty clay. At 7.5m bgl very thin (less than 1mm) possible dark reddish organic horizon?	*In situ* London Clay
8	8.1	**9.6**	**9.5**	0.1	No recovery	
8.1	9	**9.5**	**8.6**	0.9	Stiff mid orangish brown silty clay	
9	9.7	**8.6**	**7.9**	0.7	No recovery	
9.7	10	**7.9**	**7.6**	0.3	Mid grey stiff silty clay with veins of yellow sand	

Table 3 The sediments recorded in WBD19_WS03

WBD19_WS04						
NGR			524891.2	172300.793		
top of core (m OD)			17.8			
Top (m bgl)	**Base (m bgl)**	**from (m OD)**	**to (m OD)**	**Thickness (m)**	**Description**	**Interpretation**
0	0.1	**17.8**	**17.7**	0.1	Turf	Made Ground
0.1	0.41	**17.7**	**17.39**	0.31	Very dark brown silt loam topsoil with rootlets, concrete, frequent gravel (up to 50mm subangular/ subrounded)	
0.41	1.58	**17.39**	**16.22**	1.17	Mid brownish grey silty clayey gravel up to 30mm, subangular. With CBM, tarmac, occasional rootlets	
1.58	1.68	**16.22**	**16.12**	0.1	Very dark bluish grey wet soft organic clay	Redeposited London Clay/Head
1.68	1.9	**16.12**	**15.9**	0.22	Light bluish brownish grey soft silty clay with some organics	
1.9	2	**15.9**	**15.8**	0.1	Stiff mid orangish brown clay with some chalk nodules	
2	2.46	**15.8**	**15.34**	0.46	Soft wet very dark grey gravelly clay	
2.46	3	**15.34**	**14.8**	0.54	Stiff mid orangish brown clay	
3	3.3	**14.8**	**14.5**	0.3	No recovery	
3.3	4.1	**14.5**	**13.7**	0.8	Light grey very wet gravelly subangular soft clay with (subangular up to 50mm) with ceramic	
4.1	5	**13.7**	**12.8**	0.9	Firm mid orangish brown clay with red brick and concrete	
5	6	**12.8**	**11.8**	1	Firm mid grey clay with gravel (up to 50mm) and concrete. WS04 terminated as caved in.	

Table 4 The sediments recorded in WBD19_WS04

4.2 Discussion of Results

4.2.1 Only two of the four observed window samples (WBD19_WS02 and WS03) recorded natural London Clay deposits lying at approximately *c* 11m and 13m OD respectively (see Fig 3). In comparison with the levels of London Clay recorded around the lake (18-25m OD to the west and *c* 20m OD to the east), the levels of London Clay in the window samples indicate truncation, presumably during the lake's construction in the 18th Century.

4.2.2 The *in situ* London Clay is overlain by redeposited London Clay containing frequent organics (eg WBD19_WS03, between 14.93 and 12.95m OD, see Fig 4) and anthropogenic material (eg in WBD19_WS04, ceramic between 14.5m and 13.7m OD, and brick and concrete between 13.7m and 12.8m OD).

4.2.3 Overlying these London Clay deposits in WBD19_WS02, are redeposited Head deposits between *c* 13m and 16m OD. BGS mapping shows Head deposits in this area (see section 2.1.1) and BGS boreholes have recorded *in situ* Head deposits with similar lithological descriptions to the west at *c* 20m OD (TQ27SW56). The redeposited head deposits recorded onsite contained no CBM, which would be a more direct indication of human agency. However, they did contain organic material, therefore, based on this and the assumption that the underlying London Clay is redeposited; the Head deposits have been classed as redeposited. The redeposited London Clay/ Head deposits are likely part of the 18th Century groundworks for the lake construction, but show signs of later disturbance through the presence of concrete at 12.8m OD (WBD19_WS04) (see section 1.1).

4.2.4 The redeposited London clay/Head deposits were in turn overlain by *c* 1m of Made Ground. Made ground deposits contained concrete, red and yellow brick, and occasional pottery. It is probable that these deposits were dumped to raise the ground level of the footpath above the current lake level. The sequence was capped by either 0.1m of tarmac or 0.2m of turf.

4.2.5 WBD19_WS01 only reached a depth of 0.85m bgl due to an obstruction, and therefore only recorded the Made ground deposits.

4.2.6 The results of the window samples are considered entirely consistent with the nature of the surrounding geology, as well as the excavation and deposition of these sediments during the construction of the lake and embankment.

5 Archaeological potential

5.1 Summary of archaeological potential

5.1.1 The deposits recorded at the site of Wimbledon Park Lake are thought to have no archaeological potential and very little palaeoenvironmental potential as the *in situ* London Clay deposits pre-date the known period of human occupation and the overlying London Clay and/or Head deposits which are likely part of the 18th Century grounds of the lake construction and are redeposited. The post 18th Century Made ground which can contain occasional cultural material is however considered of very low archaeological potential or significance.

5.2 Recommendations for further work

5.2.1 Improvement works are being undertaken on the site of Wimbledon Park Lake, which include alterations to the existing embankment and overflow structures to ensure compliance with the requirements of the Reservoir Act 1975.

5.2.2 As a result of the low archaeological and palaeoenvironmental of the sediments seen in the window sampling, it is anticipated that these works are unlikely to impact on any significant archaeological and palaeoenvironmental remains.

5.2.3 However, the decision on the appropriate archaeological response to the deposits revealed within the site rests with the LPA as advised by the Greater London Archaeological Advisory Service

6 Publication and archiving

6.1.1 The results of the watching brief will be made publicly available by means of a database in digital form, to permit inclusion of the site data in any future academic research into the development of Wimbledon Park lake, Wimbledon Park, London SW19.

6.1.2 The site archive containing original records and finds will be stored with the Museum of London Archaeological Archive within 12 months of the end of the watching brief.

6.1.3 A summary of the work will be submitted to the archive as part of the OASIS form.

7 Bibliography

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MOLA, 2019 *Wimbledon Park Lake, Wimbledon Park, London, SW19:* Health & Safety Risk Assessments

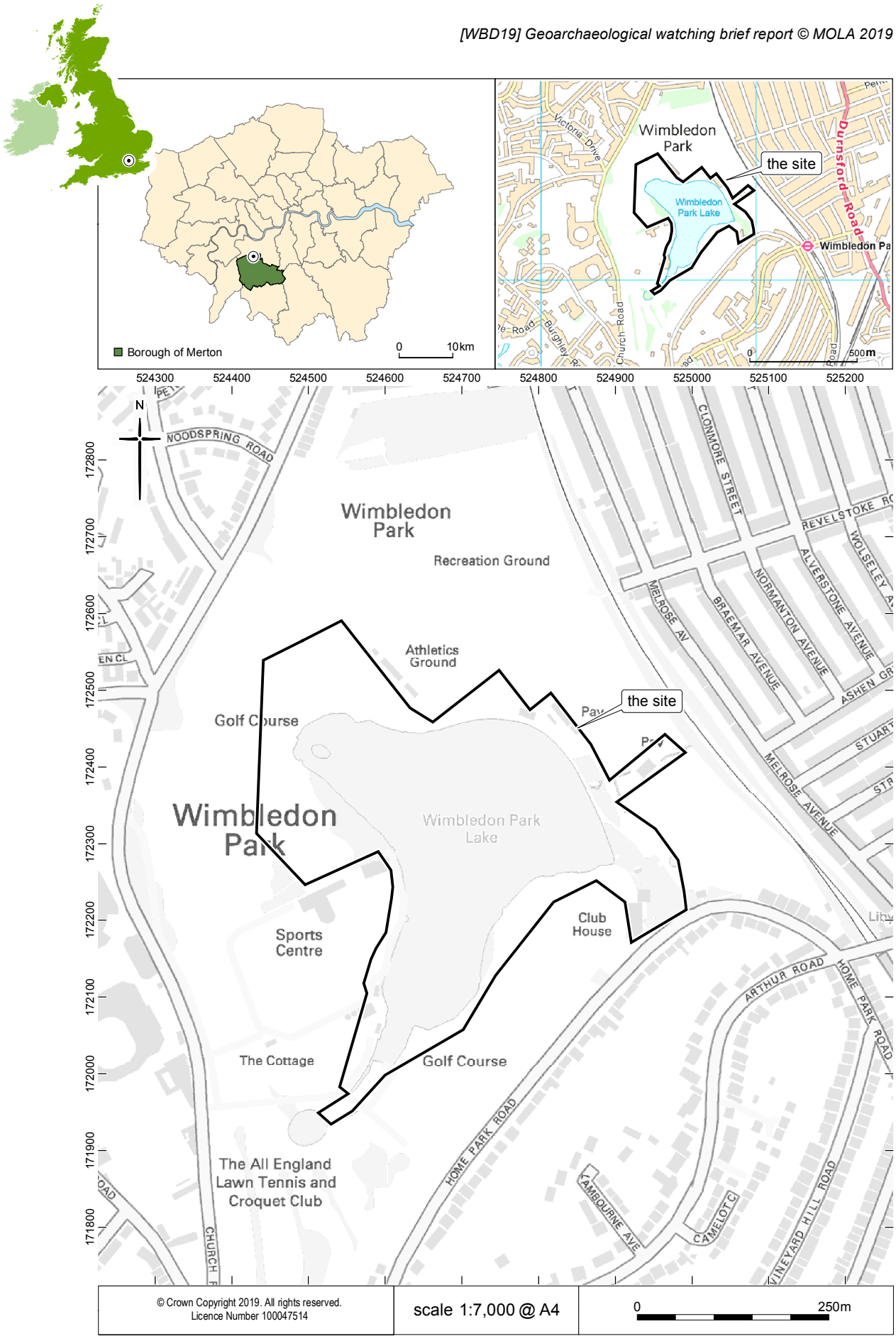


Fig 1 Site location

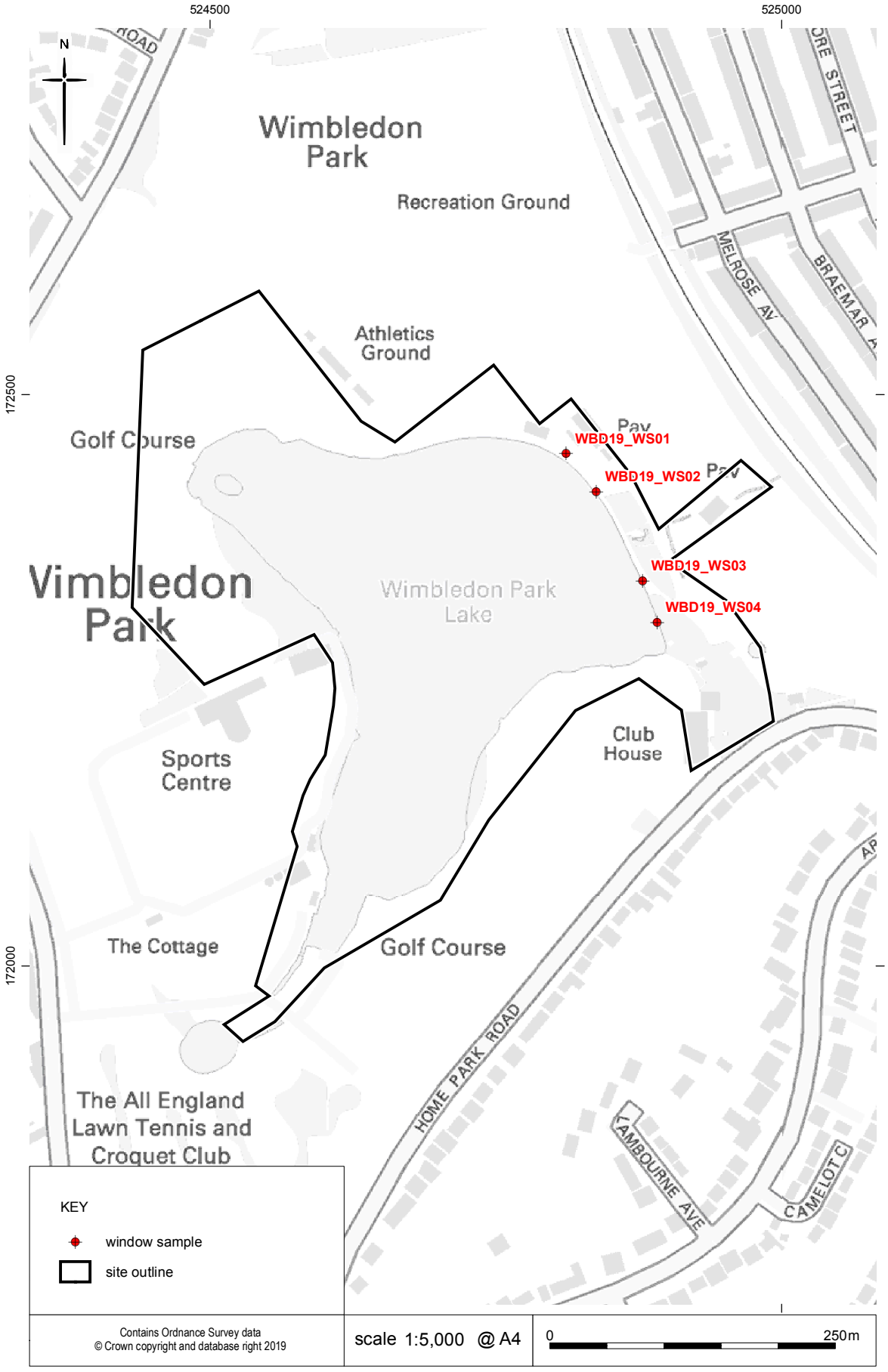


Fig 2 Window sample locations

Fig 3 Photograph showing in situ London Clay from WBD19_WS02

Fig 4 Photograph showing unidentifiable organics and CBM flecks in redeposited London Clay (WBD19_WS03)

8 OASIS archaeological report form

OASIS ID: molas1-375833

Project details

Project name	Wimbledon Park Lake: a geoarchaeological Watching brief
Short description of the project	A geoarchaeological watching brief are intended to inform the design of improvement works on Wimbledon Park Lake, including alterations to the existing embankment and overflow structures to ensure compliance with the requirements of the Reservoir Act 1975. Deposits recorded at the site are thought to have no archaeological potential and very little palaeoenvironmental potential.
Project dates	Start: 12-11-2019 End: 13-11-2019
Previous/future work	Not known / Not known
Any associated project reference codes	WBD19 - Sitecode
Type of project	Recording project
Site status	English Heritage List of Parks and Gardens of Special Historic Interest
Current Land use	Other 14 - Recreational usage
Investigation type	"Watching Brief"
Prompt	Planning condition

Project location

Country	England
Site location	GREATER LONDON MERTON WIMBLEDON AND MERTON Wimbledon Park Lake
Postcode	SW19 7HS
Study area	1500 Square metres
Site coordinates	TQ 524845 172415 50.933860992446 0.17031775911 50 56 01 N 000 10 13 E Point
Height OD / Depth	Min: 10m Max: 16m

Project creators

Name of Organisation	MOLA
Project brief originator	WYG
Project design originator	WYG

Project director/manager	Phil Stastney
Project director/manager	None
Project supervisor	Phil Stastney
Type of sponsor/funding body	WYG Environment Planning Transport Ltd

Project archives

Physical Archive Exists?	No
Digital Archive Exists?	No
Paper Archive Exists?	No

Entered by	Imogen Gabriel (igabriel@mola.org.uk)
Entered on	2 December 2019

Drainage Report

Prepared For

WYG

11th Floor, 1 Angel Court

London

EC2R 7HJ

Site

Wimbledon Park

London

SW19 7HX

MIDLAND SURVEY

Ryan Pearson

cctv@midlandsurvey.co.uk

01926 810811

Total Defects for Project

Total DRB Grades for Project

Wimbledon Lake - CCTV Survey Report : 03/12/19

Name :	MIDLAND SURVEY
Contact :	Adam Hudson
Location :	Cromwell House, Westfield Road
Town :	Southam
Region :	Warwickshire
Postcode :	CV47 0JH
Email :	cctv@midlandsurvey.co.uk
Contact Number :	01926 810811
Surveyor :	Ryan Pearson
Valid Certification No :	

Client Information

Name :	WYG
Contact :	Peter Robinson
Location :	11th Floor, 1 Angel Court
Town :	London
Region :	
Postcode :	EC2R 7HJ
Tel :	
Mobile :	
Email :	
Fax :	

Site Information

Name :	Wimbledon Park
Contact :	
Location :	
Town :	London
Region :	
Postcode :	SW19 7HX
Tel :	
Mobile :	
Email :	
Fax :	

Total Defects for Project

Total DRB Grades for Project

Report interpretation.

Overview:

Each section of the drainage system is allocated a score indicating areas that require attention. These areas are detailed in the overview section on the follwing page and also at the bottom right of the first few pages. We use colour coding as an indicator of severity. Additional information concerning rehabilitation options/recomendations is included in the overview page, which can also be used as an "at a glance" indication of system condtion. More in depth information for each section, inlcuding images can be found later in the report. Grade condtions are as follows:

Grade A: Drain is serviceable no recomendations are required.

Grade B: There is an issue that might require remedial works but is not imperetive.

Grade C: There is a defect that require imediate remidial works, the drain is not serviceable.

Observations:

Each section of drainage reported on (manhole to manhole for example), contains detailed information about that drain and any observations made concerning condtion are detailed below the header section. The observations are colour coded and given a score, with the more significant defects being given a higher score, using a scale of 1to 5 as detailed below:

Grades 1 to 2: These defects may require remedial monitoring.

Grades 3 to 4: These defects may require some form or remedial works

Grade 5: These are defects that will require remedial repair or replacement.

Observations that Require imediate attention are also noted on the acompanying CAD a PDF files Relating to the site.

General:

The information provided is relevant at the time of survey. The coding system in this report is based on the Manual sewer condtion classification, 5th edition (MSCC5) domestic codes (BS EN 13508-1:2003). This is the official standard for the water industry.

The grading system is based on the drain repair book 4th edition recomendations as provided by the WRC and the 1-5 grades represent the severity of individual defects.

Overview

Section: 1 **From: Outfall 01** **To: bmh01**	DRB Grade C	**Structural Grade: 0** **Service Grade: 5** **DRB Grade: C** **Pipe Size: 525** **Material: Concrete** **Use: Surface Water**
Section: 2 **From: Outfall 02 ds** **To: bmh02**	DRB Grade B	**Structural Grade: 0** **Service Grade: 3** **DRB Grade: B** **Pipe Size: 450** **Material: Polyvinyl Chloride** **Use: Surface Water**
Section: 3 **From: bmh02 ds** **To: bmh01**	DRB Grade A	**Structural Grade: 0** **Service Grade: 0** **DRB Grade: A** **Pipe Size: 525** **Material: Concrete** **Use: Surface Water**
Section: 4 **From: mh01 ds** **To: sa**	DRB Grade C	**Structural Grade: 0** **Service Grade: 4** **DRB Grade: C** **Pipe Size: 100** **Material: Cast Iron** **Use: Surface Water**
Section: 5 **From: mh01 us** **To: sa**	DRB Grade C	**Structural Grade: 0** **Service Grade: 5** **DRB Grade: C** **Pipe Size: 100** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**
Section: 6 **From: mh02 photo** **To: mh02 photo**	DRB Grade A	**Structural Grade: 0** **Service Grade: 0** **DRB Grade: A** **Pipe Size: 100** **Material: Cast Iron** **Use: Surface Water**
Section: 7 **From: mh03 photo** **To: mh03 photo**	DRB Grade A	**Structural Grade: 0** **Service Grade: 0** **DRB Grade: A** **Pipe Size: 100** **Material: Cast Iron** **Use: Surface Water**
Section: 8 **From: mh04 us** **To: sa**	DRB Grade C	**Structural Grade: 0** **Service Grade: 4** **DRB Grade: C** **Pipe Size: 100** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**

Total Defects for Project

Total DRB Grades for Project

Section: 9 **From: mh05 ds** **To: sa**	DRB Grade A	**Structural Grade: 0** **Service Grade: 0** **DRB Grade: A** **Pipe Size: 150** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**

Section: 10 **From: mh06 ds** **To: sa**	DRB Grade C	**Structural Grade: 0** **Service Grade: 4** **DRB Grade: C** **Pipe Size: 225** **Material: Vitrified Clay (i.e. all clayware)** **Use: Surface Water**

Section: 11 **From: Outfall 03 us** **To: sa**	DRB Grade C	**Structural Grade: 5** **Service Grade: 5** **DRB Grade: C** **Pipe Size: 225** **Material: Pitch fibre** **Use: Surface Water**

Scores

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
Outfall 01	bmh01	525	Concrete	0	5	0.31	10	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
Outfall 02 ds	bmh02	450	Polyvinyl Chloride	0	3	0.51	4	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
bmh02 ds	bmh01	525	Concrete	0	0	0	0	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh01 ds	sa	100	Cast Iron	0	3	2.44	2	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh01 us	sa	100	Vitrified Clay (i.e. all clayware)	0	4	50	5	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh02 photo	mh02 photo	100	Cast Iron	0	0	0	0	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh03 photo	mh03 photo	100	Cast Iron	0	0	0	0	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh04 us	sa	100	Vitrified Clay (i.e. all clayware)	0	4	2.38	5	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh05 ds	sa	150	Vitrified Clay (i.e. all clayware)	0	0	0	0	0

Total Defects for Project

Total DRB Grades for Project

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
mh06 ds	sa	225	Vitrified Clay (i.e. all clayware)	0	4	1.67	5	0

Start Ref	End Ref	Dia.	Material	Peak Structural Grade	Peak Operational Grade	Mean Operational Score	Peak Operational Score	Peak Structural Score
Outfall 03 us	sa	225	Pitch fibre	5	4	7.37	5	165

Total Defects for Project

Total DRB Grades for Project

Site: , London

Section 1

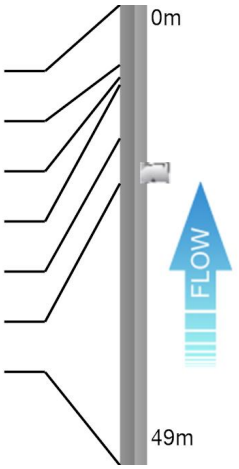
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	Outfall 01	Finish Node Ref:	bmh01	Direction:	U	Height/Dia:	525
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	CO	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	49	

Structural Peak Grade	0	Operational Grade	5	DRB Grade	C

Position	Code	Description	CD	Pic	Video Ref
00.0	OF	Start node type, outfall		0_0	0:00:00
06.4	RM	S1 Roots mass 20%	S1	0_1	0:00:00
07.7	RM	F1 Roots mass 20%	F1	0_-	0:00:00
08.5	CU	S2 Loss of vision, camera under water	S2	0_2	0:00:45
14.2	CU	F2 Loss of vision, camera under water	F2	0_-	0:00:45
19.0	CXI	Connection intruding 09 10% : 150mm Diameter		0_3	0:01:19
49.0	MHF	Finish node type, manhole		0_9	



Total Defects for section

0	1	0	2	0

DRB Grade for Section

C

Descriptive Report with Remarks and Observation Images — Section 1

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	OF		Start node type, outfall, reference Outfall 01 Outfall 01	Image Provided - Ref: 0_0 
06.4m	0:00:00	RM	S1	Roots mass 6.4m - 7.7m: 20% cross-sectional area loss - Severity 4	Image Provided - Ref: 0_1 
07.7m	0:00:00	RM	F1	Roots mass Defect End: 20% cross-sectional area loss - Severity 4	
08.5m	0:00:45	CU W	S2	Loss of vision, camera under water 8.5m - 14.2m	Image Provided - Ref: 0_2 
14.2m	0:00:45	CU W	F2	Loss of vision, camera under water Defect End	

Total Defects for section

0	1	0	2	0

DRB Grade for Section

C

Pos	Video Ref	Code	Cont.	Description	Image
19.0m	0:01:19	CXI		Connection intruding at 09 o'clock: 10% Intrusion : 150mm Diameter - Severity 2	Image Provided - Ref: 0_3 
49.0m		MHF		Finish node type, manhole, reference bmh01 bmh01	Image Provided - Ref: 0_9999 

Total Defects for section

0	1	0	2	0

DRB Grade for Section

C

Site: , London

Section 2

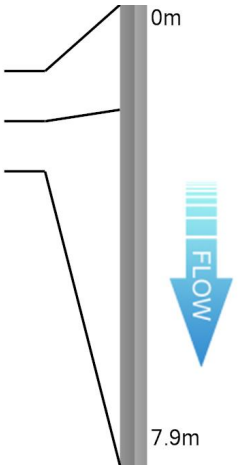
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	Outfall 02 ds	Finish Node Ref:	bmh02	Direction:	D	Height/Dia:	450
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	PVC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	7.9	

Structural Peak Grade	0	Operational Grade	3	DRB Grade	B

Position	Code	Description	CD	Pic	Video Ref
00.0	OF	Start node type, outfall		1_0	0:00:00
01.8	RMJ	Roots mass 10% at joint		1_1	0:00:00
07.9	MHF	Finish node type, manhole		1_9	



Total Defects for section

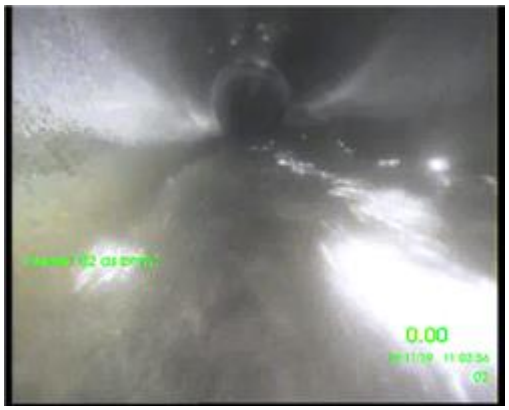
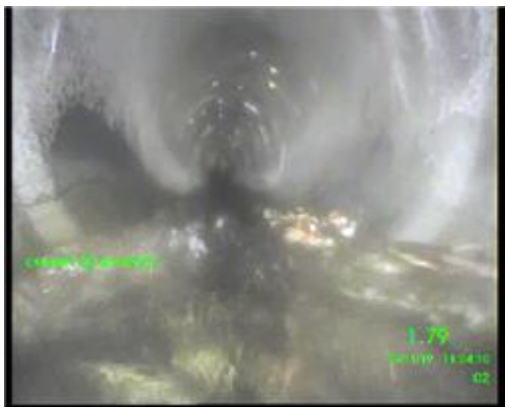
0	0	0	1	0

DRB Grade for Section

B

Descriptive Report with Remarks and Observation Images

Section 2

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	OF		Start node type, outfall, reference Outfall 02 ds Outfall 02 ds	Image Provided - Ref: 1_0 
01.8m	0:00:00	RM		Roots mass: 10% cross-sectional area loss at joint - Severity 4	Image Provided - Ref: 1_1 
07.9m		MHF		Finish node type, manhole, reference bmh02 bmh02	Image Provided - Ref: 1_9999 

Total Defects for section

0 0 0 1 0

DRB Grade for Section

B

Site: , London

Section 3

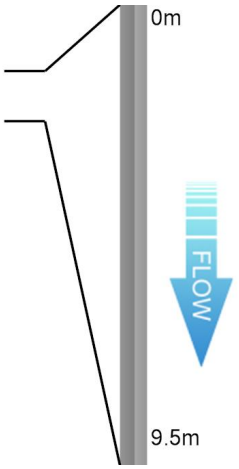
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	bmh02 ds	Finish Node Ref:	bmh01	Direction:	D	Height/Dia:	525
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	CO	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	9.5	

Structural Peak Grade	0	Operational Grade	0	DRB Grade	A

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		2_0	0:00:00
09.5	MHF	Finish node type, manhole		2_9	



Total Defects for section

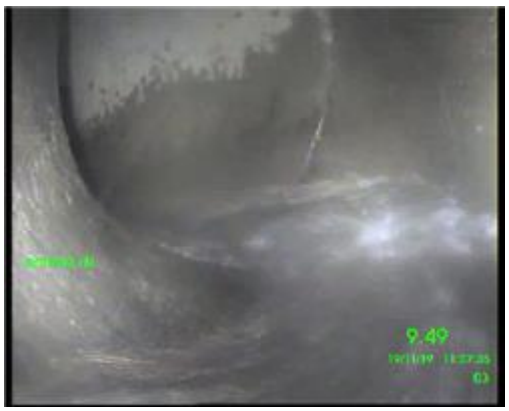
0 0 0 0 0

DRB Grade for Section

A

Descriptive Report with Remarks and Observation Images

Section 3

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference bmh02 ds bmh02 ds	Image Provided - Ref: 2_0 
09.5m		MHF		Finish node type, manhole, reference bmh01 bmh01	Image Provided - Ref: 2_9999 

Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Site: , London

Section 4

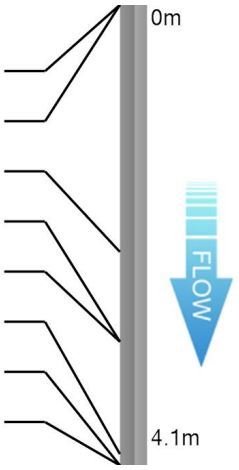
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh01 ds	Finish Node Ref:	sa	Direction:	D	Height/Dia:	100
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	Cl	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	4.1	

Structural Peak Grade	0	Operational Grade	4	DRB Grade	C

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		3_0	0:00:00
00.0	DEZ	S1 Other 12-12 10%	S1	3_1	0:00:00
02.2	DES	Settled deposits fine 5%		3_2	0:00:23
03.0	DEZ	F1 Other 12-12 10%	F1		0:00:00
03.0	DEZ	S2 Other 12-12 20%	S2	3_3	0:00:34
04.0	DEZ	F2 Other 12-12 20%	F2	3_-	0:00:34
04.1	WL	Water level 100%		3_4	0:01:28
04.1	SA	Survey abandoned		3_9	



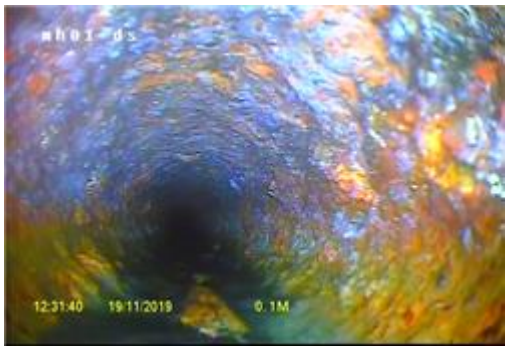
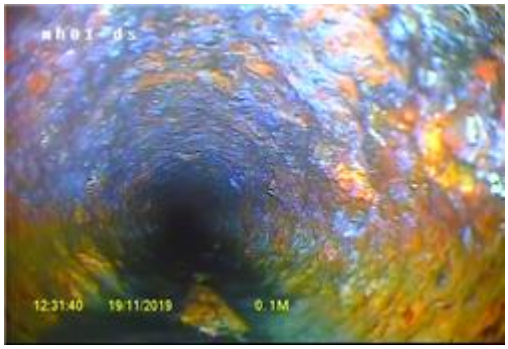
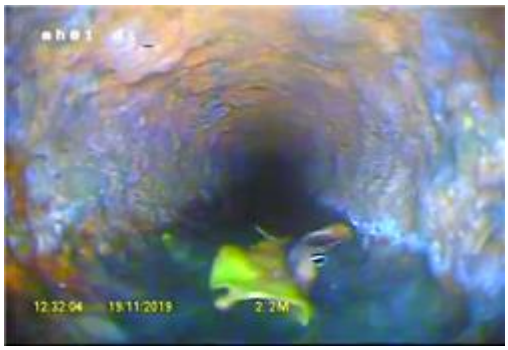
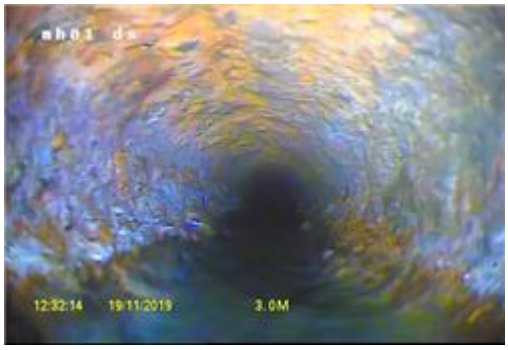
Total Defects for section

0 5 0 0 0

DRB Grade for Section

C

Descriptive Report with Remarks and Observation Images — Section 4

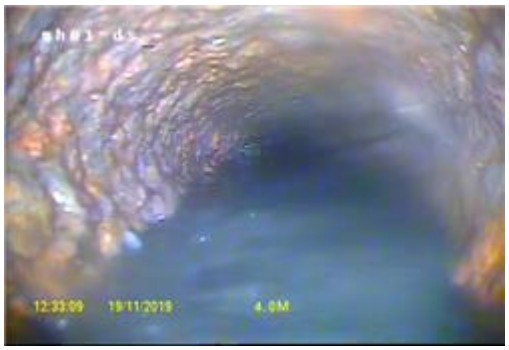
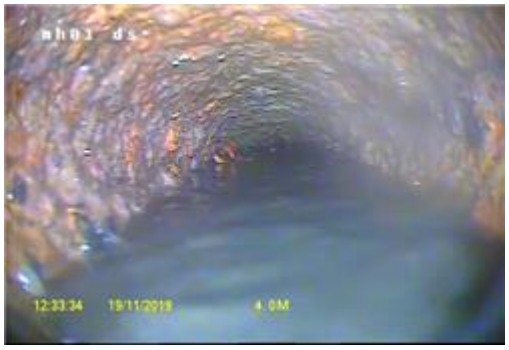
Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh01 ds mh01 ds	Image Provided - Ref: 3_0 
00.0m	0:00:00	DEZ	S1	Other 0m - 3m from 12 o'clock to 12 o'clock: 10% cross-sectional area loss - Severity 2 Rust/Corrosion	Image Provided - Ref: 3_1 
02.2m	0:00:23	DES		Settled deposits fine: 5% cross-sectional area loss - Severity 2 Settled Leaves	Image Provided - Ref: 3_2 
03.0m	0:00:00	DEZ	F1	Other Defect End from 12 o'clock to 12 o'clock: 10% cross-sectional area loss - Severity 2 Rust/Corrosion	
03.0m	0:00:34	DEZ	S2	Other 3m - 4m from 12 o'clock to 12 o'clock: 20% cross-sectional area loss - Severity 2 Rust/Corrosion	Image Provided - Ref: 3_3 

Total Defects for section

0 | 5 | 0 | 0 | 0

DRB Grade for Section

C

Pos	Video Ref	Code	Cont.	Description	Image
04.0m	0:00:34	DEZ	F2	Other Defect End from 12 o'clock to 12 o'clock: 20% cross-sectional area loss - Severity 2 Rust/Corrosion	
04.1m	0:01:28	WL		Water level: 100% Height/Diameter	Image Provided - Ref: 3_4 
04.1m		SA		Survey abandoned Survey Abandoned - Unable to Push Camera Further Due to Rust/Corrosion Reduces Pipe Circumference.	Image Provided - Ref: 3_9999 

Site: , London

Section 5

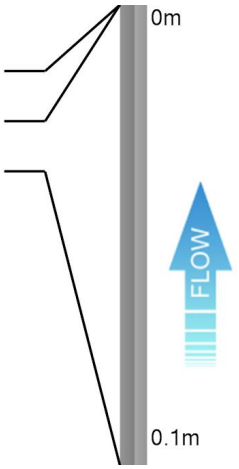
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh01 us	Finish Node Ref:	sa	Direction:	U	Height/Dia:	100
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	0.1	

Structural Peak Grade	0	Operational Grade	5	DRB Grade	C

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		4_0	0:00:00
00.0	DEX	Other settled deposits 100%		4_1	0:00:00
00.1	SA	Survey abandoned		4_9	



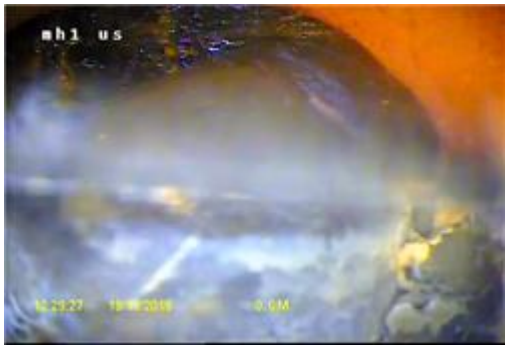
Total Defects for section

0	0	1	0	0

DRB Grade for Section

C

Descriptive Report with Remarks and Observation Images — Section 5

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh01 us mh01 us	Image Provided - Ref: 4_0 
00.0m	0:00:00	DEX		Other settled deposits: 100% cross-sectional area loss - Severity 3 Build up of Leaves/Branches	Image Provided - Ref: 4_1 
00.1m		SA		Survey abandoned Survey Abandoned - Unable to Pass Blockage	Image Provided - Ref: 4_9999 

Total Defects for section

0 0 1 0 0

DRB Grade for Section

C

Site: , London

Section 6

Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh02 photo	Finish Node Ref:	mh02 photo	Direction:	Z	Height/Dia:	100
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	Cl	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	0	

Structural Peak Grade	0	Operational Grade	0	DRB Grade	A

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		5_0	0:00:00
00.0	REM	General remark		5_1	0:00:00
00.0	MHF	Finish node type, manhole		5_9	

Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Descriptive Report with Remarks and Observation Images — Section 6

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh02 photo mh02 photo	Image Provided - Ref: 5_0 
00.0m	0:00:00	REM		General remark Photo of Valve Downstream from mh01	Image Provided - Ref: 5_1 
00.0m		MHF		Finish node type, manhole, reference mh02 photo mh02 photo	Image Provided - Ref: 5_9999 

Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Site: , London

Section 7

Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh03 photo	Finish Node Ref:	mh03 photo	Direction:	Z	Height/Dia:	100
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	Cl	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	0	

Structural Peak Grade	0	Operational Grade	0	DRB Grade	A

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		6_0	0:00:00
00.0	REM	General remark		6_1	0:00:00
00.0	MHF	Finish node type, manhole		6_9	

Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Descriptive Report with Remarks and Observation Images

Section 7

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh03 photo mh03 photo	Image Provided - Ref: 6_0 
00.0m	0:00:00	REM		General remark Photo of Valve Upstream of mh04	Image Provided - Ref: 6_1 
00.0m		MHF		Finish node type, manhole, reference mh03 photo mh03 photo	Image Provided - Ref: 6_9999 

Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Site: , London

Section 8

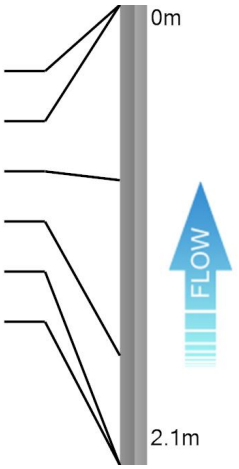
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh04 us	Finish Node Ref:	sa	Direction:	U	Height/Dia:	100
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	2.1	

Structural Peak Grade	0	Operational Grade	4	DRB Grade	C

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		7_0	0:00:00
00.0	CU	Loss of vision, camera under water		7_1	0:00:00
00.8	LR	Line of drain/sewer deviates right		7_2	0:00:06
01.6	LL	Line of drain/sewer deviates left		7_3	0:00:12
02.1	DEX	Other settled deposits 100%		7_4	0:00:15
02.1	SA	Survey abandoned		7_9	



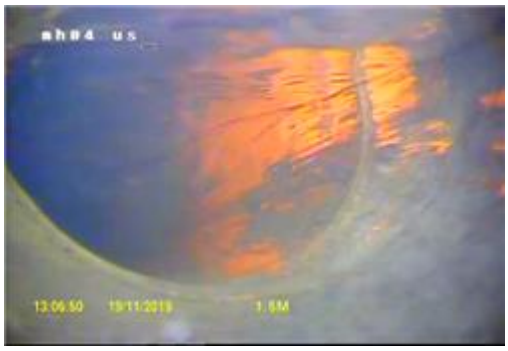
Total Defects for section

0 0 1 0 0

DRB Grade for Section

C

Descriptive Report with Remarks and Observation Images — Section 8

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh04 us mh04 us	Image Provided - Ref: 7_0 
00.0m	0:00:00	CU W		Loss of vision, camera under water	Image Provided - Ref: 7_1 
00.8m	0:00:06	LR		Line of drain/sewer deviates right	Image Provided - Ref: 7_2 
01.6m	0:00:12	LL		Line of drain/sewer deviates left	Image Provided - Ref: 7_3 

Total Defects for section

0 | 0 | 1 | 0 | 0

DRB Grade for Section

C

Pos	Video Ref	Code	Cont.	Description	Image
02.1m	0:00:15	DEX		Other settled deposits: 100% cross-sectional area loss - Severity 3 Branches and Vegetation from Lake	Image Provided - Ref: 7_4 
02.1m		SA		Survey abandoned Survey Abandoned - Unable to Pass Vegetation/Debris	Image Provided - Ref: 7_9999 

Total Defects for section

0	0	1	0	0

DRB Grade for Section

C

Site: , London

Section 9

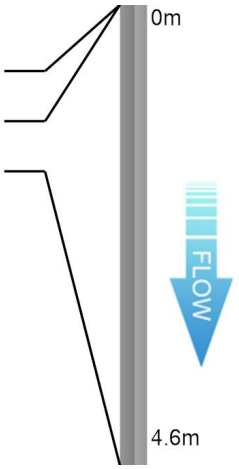
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh05 ds	Finish Node Ref:	sa	Direction:	D	Height/Dia:	150
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	4.6	

Structural Peak Grade	0	Operational Grade	0	DRB Grade	A

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		8_0	0:00:00
00.0	CU	Loss of vision, camera under water		8_1	0:00:00
04.6	SA	Survey abandoned		8_9	



Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Descriptive Report with Remarks and Observation Images

Section 9

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh05 ds mh05 ds	Image Provided - Ref: 8_0 
00.0m	0:00:00	CU W		Loss of vision, camera under water	Image Provided - Ref: 8_1 
04.6m		SA		Survey abandoned Survey Abandoned - Unable to Push Camera Further	Image Provided - Ref: 8_9999 

Total Defects for section

0 0 0 0 0

DRB Grade for Section

A

Site: , London

Section 10

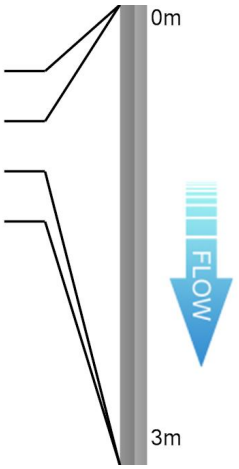
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	mh06 ds	Finish Node Ref:	sa	Direction:	D	Height/Dia:	225
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	3	

Structural Peak Grade	0	Operational Grade	4	DRB Grade	C

Position	Code	Description	CD	Pic	Video Ref
00.0	MH	Start node type, manhole		9_0	0:00:00
00.0	CU	Loss of vision, camera under water		9_1	0:00:00
03.0	DER	Settled deposits coarse 40%		9_2	0:00:23
03.0	SA	Survey abandoned		9_9	



Total Defects for section

0	0	1	0	0

DRB Grade for Section

C

Descriptive Report with Remarks and Observation Images — Section 10

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	MH		Start node type, manhole, reference mh06 ds mh06 ds	Image Provided - Ref: 9_0 
00.0m	0:00:00	CU W		Loss of vision, camera under water	Image Provided - Ref: 9_1 
03.0m	0:00:23	DER		Settled deposits coarse: 40% cross-sectional area loss - Severity 3 Debris Under Water Level	Image Provided - Ref: 9_2 
03.0m		SA		Survey abandoned Survey Abandoned - Unable to Pass Debris Under Water Level	Image Provided - Ref: 9_9999 

Total Defects for section

0	0	1	0	0

DRB Grade for Section

C

Site: , London

Section 11

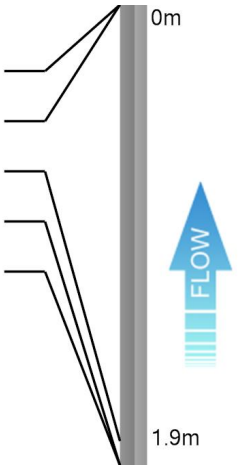
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG		London		Ryan Pearson	03/12/2019

Start Node Ref:	Outfall 03 us	Finish Node Ref:	sa	Direction:	U	Height/Dia:	225
Start Node Depth:	0.00	Finish Node Depth:	0.00	Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	PF	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	1.9	

Structural Peak Grade	5	Operational Grade	5	DRB Grade	C

Position	Code	Description	CD	Pic	Video Ref
00.0	OF	Start node type, outfall		10_	0:00:00
00.0	D	S1 Deformed drain/sewer 20%	S1	10_	0:00:00
01.8	D	F1 Deformed drain/sewer 20%	F1	10_	0:00:00
01.9	D	Deformed drain/sewer 40%		10_	0:00:17
01.9	SA	Survey abandoned		10_	



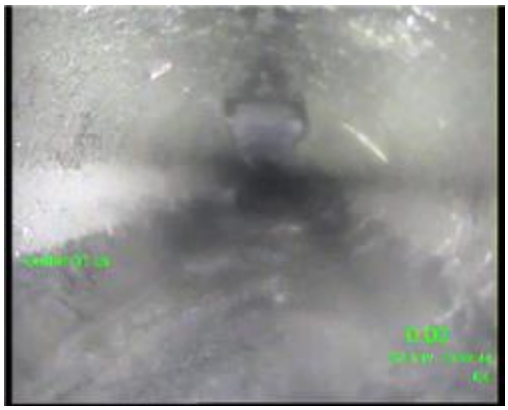
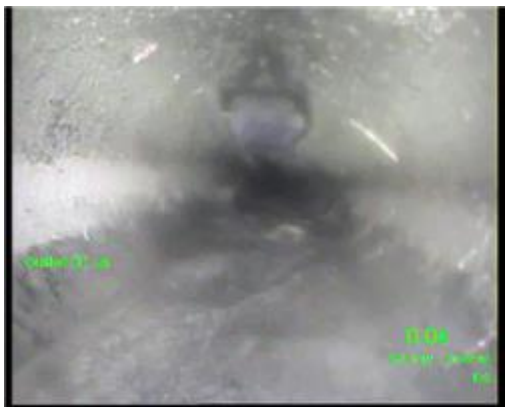
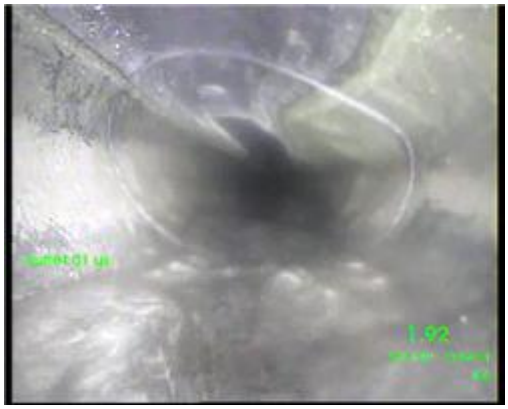
Total Defects for section

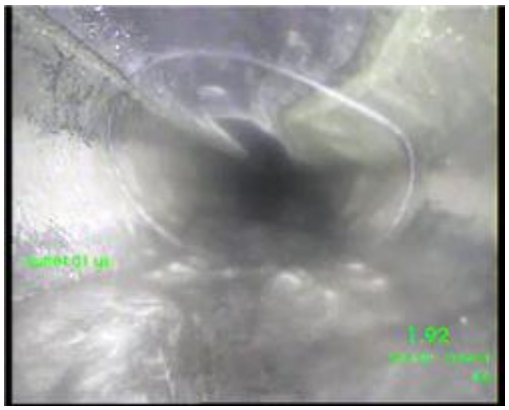
0	0	0	0	3

DRB Grade for Section

C

Descriptive Report with Remarks and Observation Images — Section 11

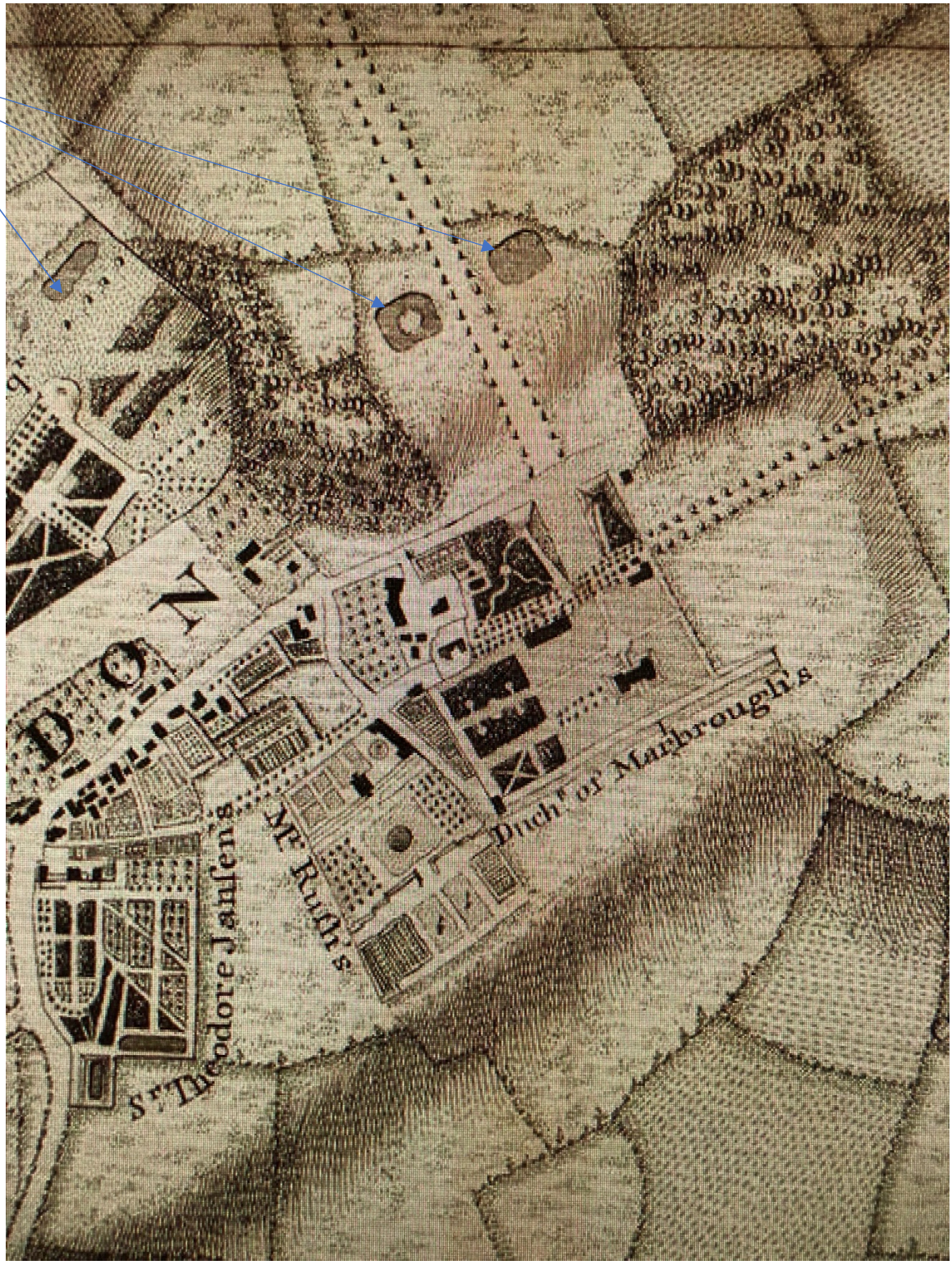
Pos	Video Ref	Code	Cont.	Description	Image
00.0m	0:00:00	OF		Start node type, outfall, reference Outfall 03 us Outfall 01 us	Image Provided - Ref: 10_0 
00.0m	0:00:00	D	S1	Deformed drain/sewer 0m - 1.8m: 20% Cross sectional area loss - Severity 5	Image Provided - Ref: 10_1 
01.8m	0:00:00	D	F1	Deformed drain/sewer Defect End: 20% Cross sectional area loss - Severity 5	
01.9m	0:00:17	D		Deformed drain/sewer: 40% Cross sectional area loss - Severity 5	Image Provided - Ref: 10_2 

Pos	Video Ref	Code	Cont.	Description	Image
01.9m		SA		Survey abandoned Survey Abandoned - Unable to Pass Deformed Sewer	Image Provided - Ref: 10_9999 

Appendix J– Old Maps, Photos and Information about Wimbledon Park

Appendix – Maps, Photos & Historical Information re Wimbledon Park lake ©Steffie Shields

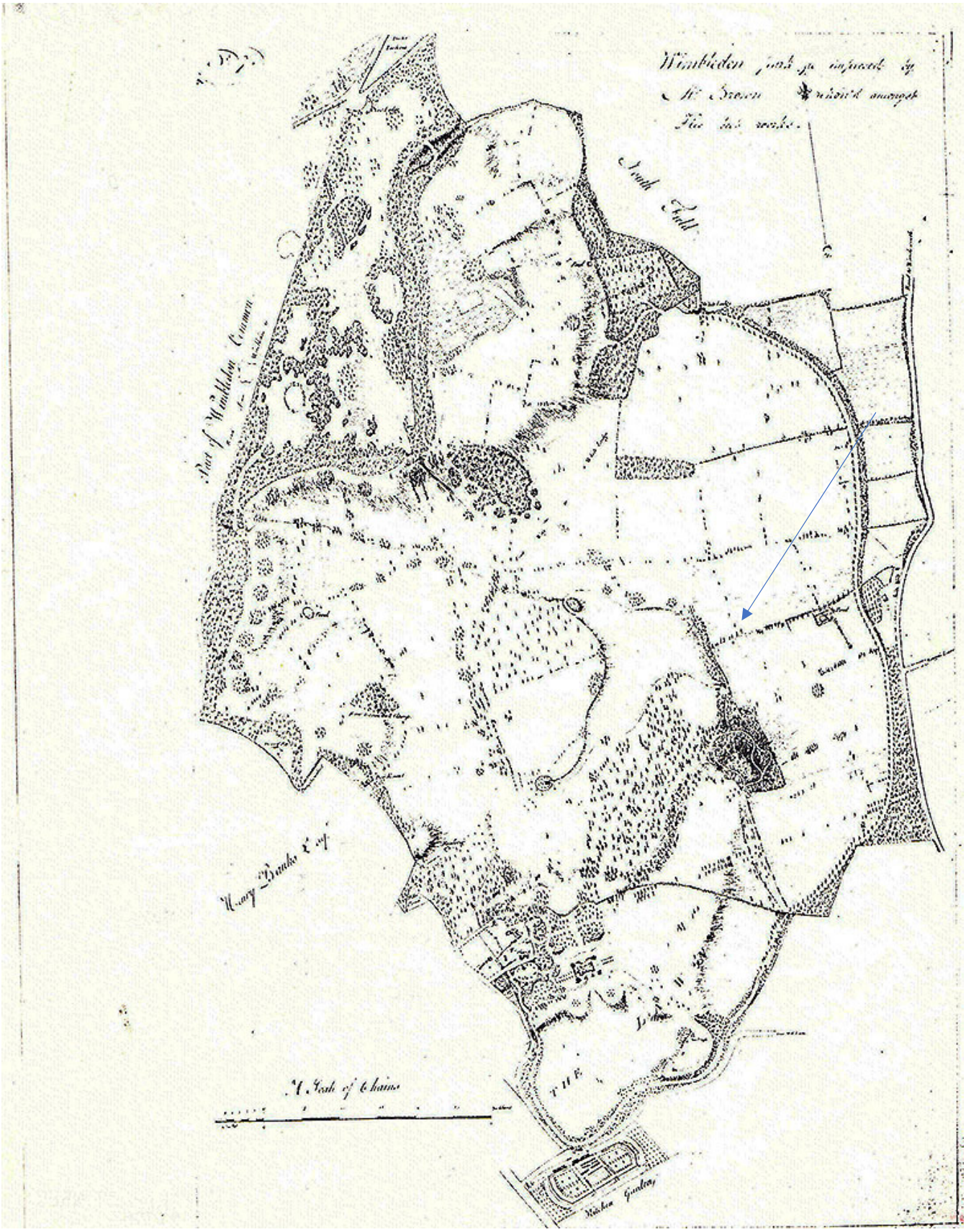
fishponds



1. Rocques 1746 shows south section of the park area below Wimbledon House

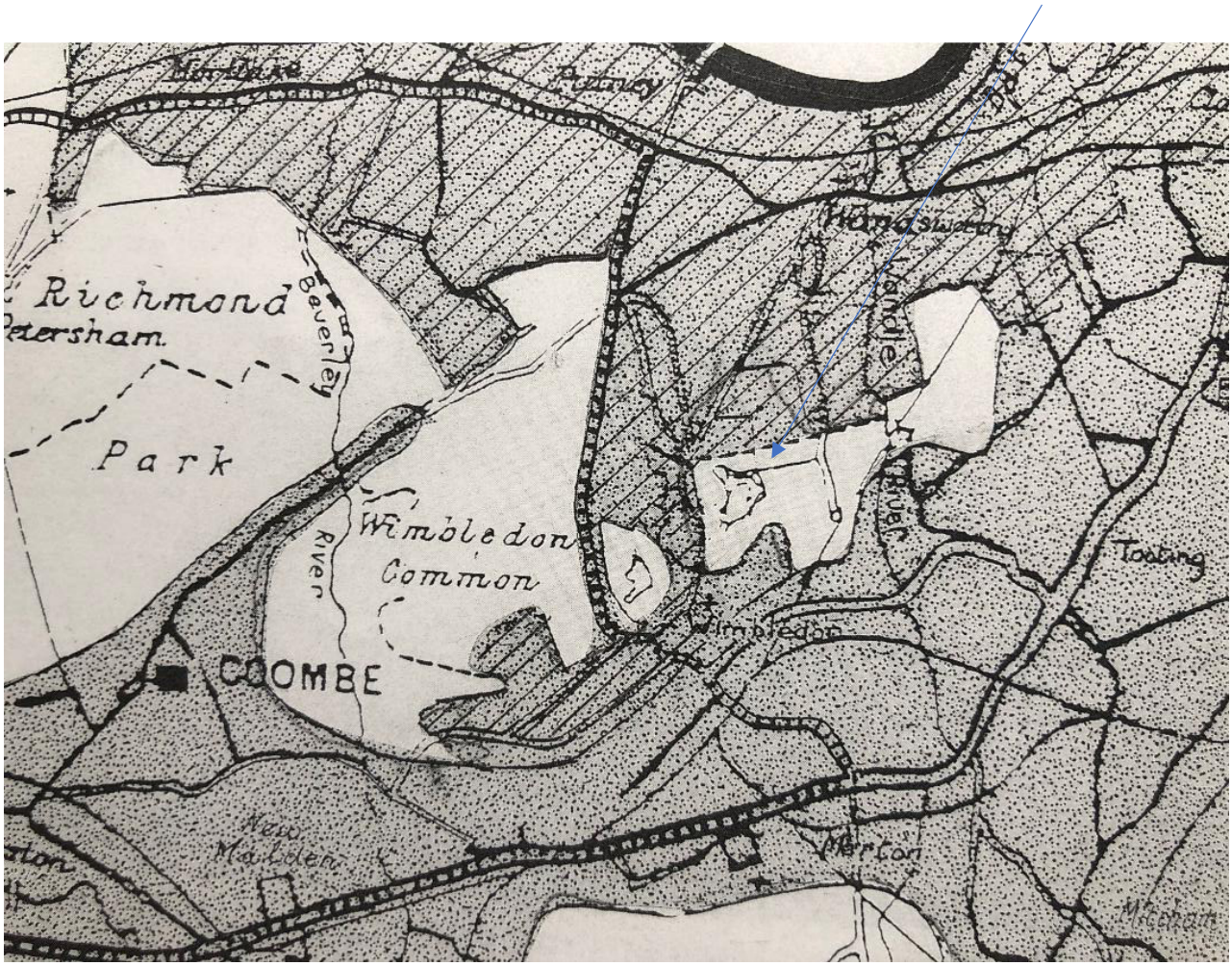
2. <u>Thomas Richardson Survey 1768</u> (central detail) showing Wimbledon Lake and watercourses arrows: Bigden Brook (top left) Rushmere Brook (bottom left) ; (middle arrow) ? sluice near centre of dam? /overflow? underground conduit /open drain? beside farm pond (right) and beyond towards River Wandle

3. Thomas Richardson 1768 (SW Wimbledon Park survey detail)
(with arrow left pump conduit and right Rushden Brook leading to south end of Brown's lake)

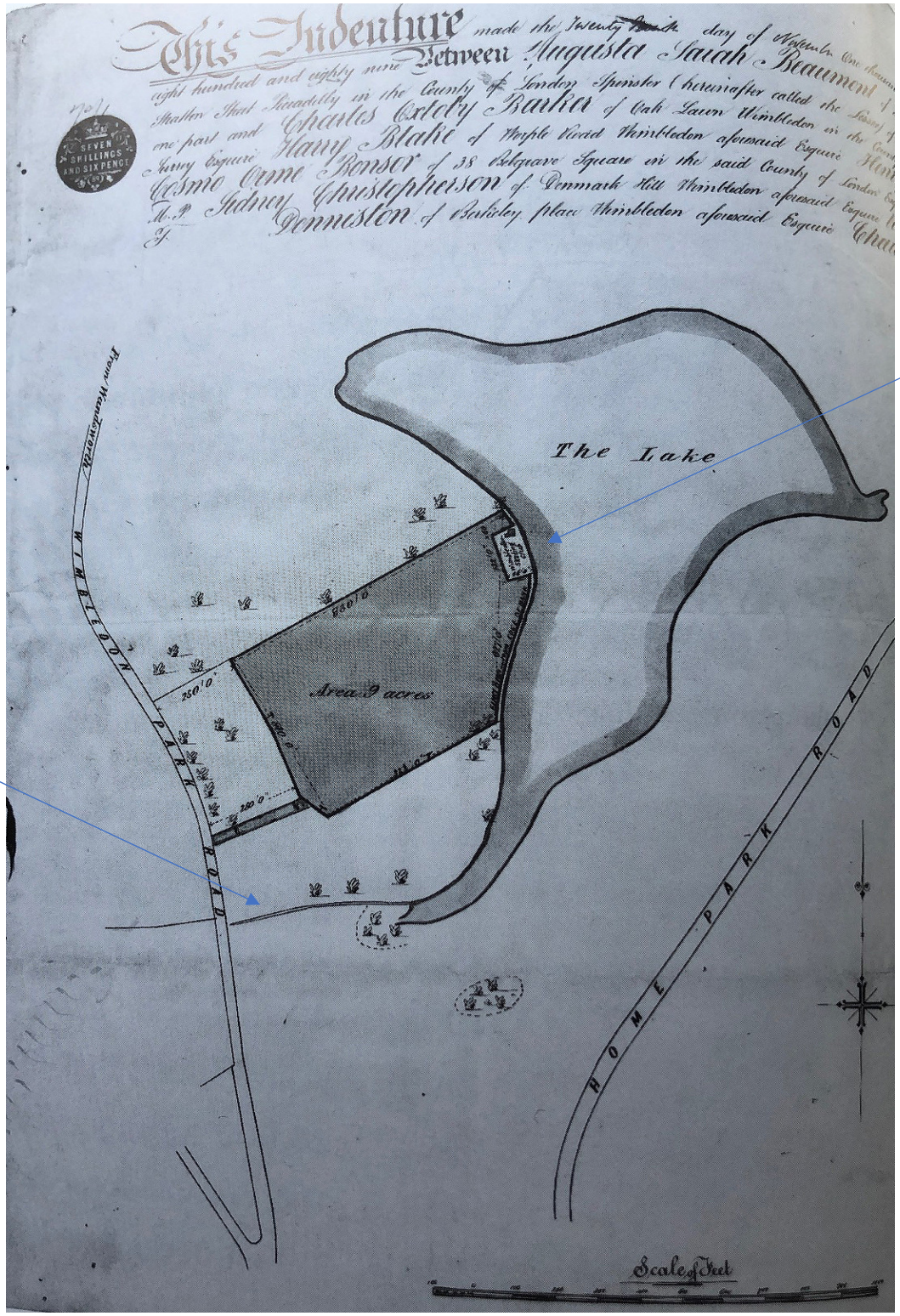


4. John Haynes c1770

5. John Corris (1787)



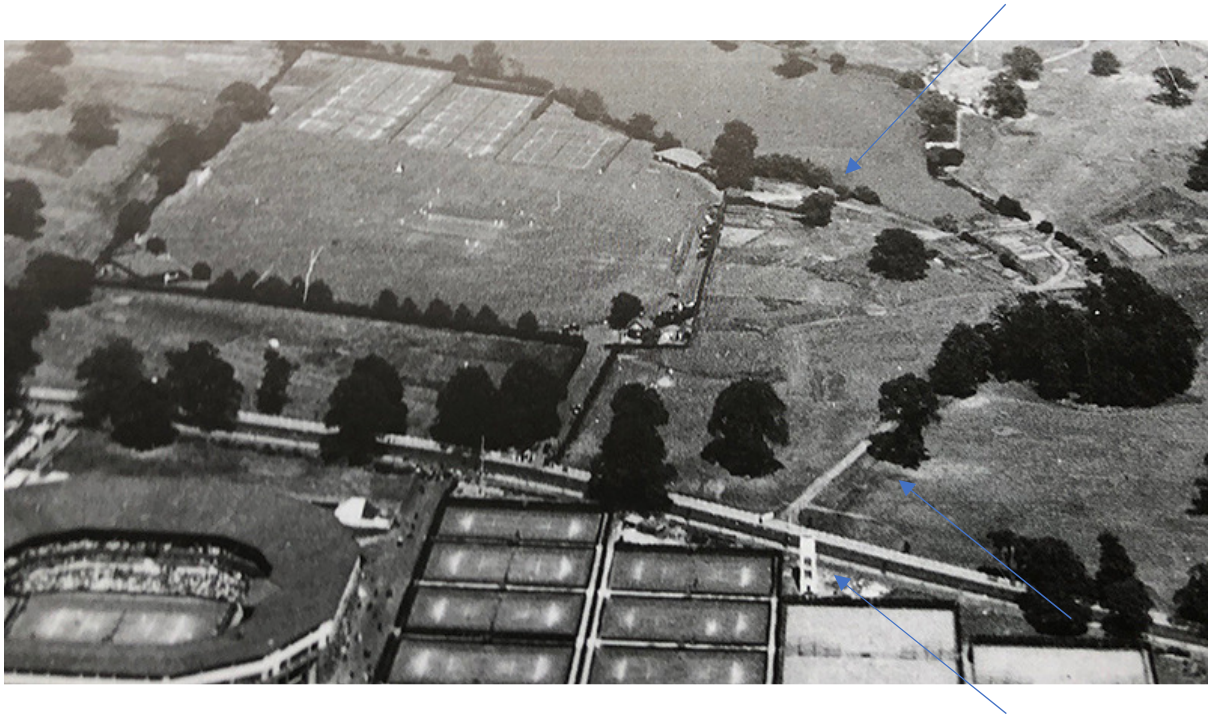
6. Richard Milward 'Wimbledon Past' 1998 page 66; Map of Wimbledon's Water Supply 1884 - with pipes laid by Lambeth Water Company; (arrow)? water supply to cottage or outfall drain?



7. 1889 Indenture Plan re cricket club land shows lake and where Rushmere stream (left arrow) feeds into the lake at the south end. (Note Wimbledon Skating Club Pavilion right arrow a popular pastime then)

8. Fisherman near the dam with Cottage/Café for serving refreshments beyond c1895; note dense planting behind head.
9. (below) Boathouse Wimbledon Lake c1895 taken from east towards the south west

10. View from the dam south to the Spencer house and St Mary's Church on the hill c1895 Boathouse (Pavilion? top arrow) in front of middle righthand clump and Wimbledon Skating Club (right arrow). Note, much as 'Capability' Brown intended for his designs, the defined, managed curving edge of the lake free of reeds and other vegetation



11. Aerial view of part of Wimbledon lake 1922 with water tower near Church Road (bottom right) and line of Rushmere stream (between the two, now channelled underground to the lake?)

Newspaper Cuttings re Wimbledon Park Lake

As water quality improves in late 1870s…. Fishing Club emerges

WIMBLEDON. LOCAL BOARD MEETING.—Nov. Present: Mr. W. Scott, chairman Messrs. Haynes- Jones, Townsend, Handle, Ashby, Mefiin, Thomson, Paxton, and Lamprell. THE LOAM.—Tbe CIXU reported that be had received letter front lb- Local Government Board, the loan for £l5,000 complete the drainage scheme. Regret was expressed' y (he Board that whereas the first estimate of the works amounted to £17,000, the actual outlay would be about £87,000, and hope was expressed that n» further au on account ,,,, THE PARK LAKE.—It was agreed that the sewage now flowing into the Wimbledon Park Lake should be diverted into the new sewer, as suggested by Mr. Oborne. **Surrey Comet - Saturday 04 November 1876**

WIMBLEDON PARK LAKE. FISHING has now commenced with vigour in this fine piece of water, and it is anticipated that some good sport will be obtained during the season. The lake is well stocked with all kinds of fish, those mostly favouring its waters being jack, bream, carp, perch, roach, and dace. Innumerable eels are also here ; and it matters little what weather we are favoured with, as there is such a variety of fish that some are sure to be on the " feed." The lake is well preserved by its owner under the superintendence of an experienced bailiff Tickets, entitling all the members of a family to fish, may be purchased at the insignificant figure of one guinea of the resident agent to the Wimbledon Park Estate, Mr. Osborn•. This gentleman, by his continued perseverance, has succeeded in forming a fishing club of no mean dimensions, and anyone applying to him for information regarding the fishing on the estate, will always meet with a courteous reply. A number of anglers were present on Monday, and the majority stayed for over twelve hours. A great feature certainly connected with the fishing here is, that refreshments of every description can be obtained at the bailiff's lodge. Indeed, on Monday a capital dinner, consisting of roast duck and green peas, was enjoyed by some anglers, others contenting themselves with ham and eggs, &c. Of the fishing we may mention that Mr. Andrews, an experienced hand in these waters, succeeded in capturing 13 fish in six days, weighing in the aggregate 521 b. On Monday a gentleman caught a fine bream weighing 3ilb., while others of a less size were also safely landed. We would strongly advise lovers of fishing to become members of this club. **Fishing Gazette 15 Aug 1879**

South London anglers will hear with satisfaction that the Lake at Wimbledon known as Wimbledon Park lake Fishery is now under new management and bids to be one of the best fishing grounds in the country – restocked with some fine roach and upwards of 10,000 fish. Angling friends speak highly of this fishery

Advert an enjoyable day's fishing within 15 mins of Waterloo to Wimbledon Park Station Boats on hire Dinners & Teas at the Cottage Wimbledon Park Farm **1892**

ANGLING NEWS Saturday the ninth international fly, float, and tournament was held in the grounds of Wimbledon Park Lake. Mr, J. Enright of Castle Connell the amateur champion fly-caster of the world,_was in especially good form, and succeeded in beating his own world's record of 48yards 2 ft, by casting with a 19ft. salmon rod 147ft, Mr. E. B. Shrabrola with a 10 ft trout rod, also made record cast—90ft. with five points added for accuracy. Eastern Evening News - Monday 11 May **1896**

Skating becomes very popular

About 2,500 people visited the 'Wimbledon - park lake on Saturday, and there was also a large assemblage on Sunday, although the fog was very thick Donoghue, the skating champion was present and gave evidence of his extraordinary skill S**urrey** Advertiser - Saturday 17 January 1891

WIMBLEDON PARK LAKE Best ice near London. 30 acres 9.30 – 6.00 Admission 2s. The Sportsman - Saturday 22 February **1902**

1913 Wimbledon Council acquire part of the park and the lake

The Wimbledon Council have decided to acquire, for £66,500, the land at Wimbledon Park leased to Wimbledon Park Golf Club and the Guards' Polo Club, the Wimbledon Park lake, and a plot ground on the west side, altogether about 155 acres. will be used public open space.
Globe - Thursday 05 June **1913** nearly £430 an acre

Bought from Lady Augusta Sarah Lane - Councillor Collier said it was the only open land between Wimbledon and London – a great beauty spot – and it might be eagerly sought after for building sites & soon covered with houses Shoreditch Observer - Saturday 07 June **1913**

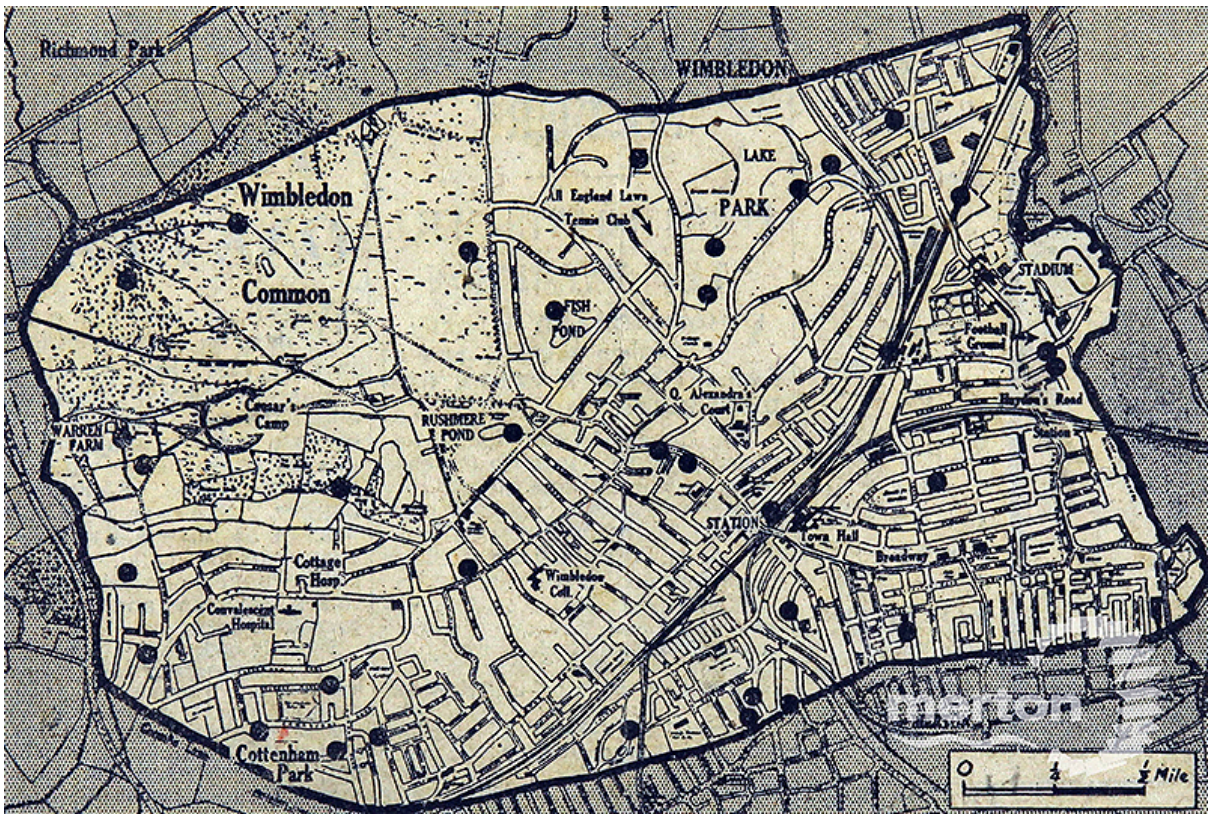
Wimbledon Town Council has now got over the difficulties that prevented it raising money to buy the Wimbledon Park Estate and lake for an open space (150 acres). The Treasury has consented to the Corporation borrowing /30,600 from the Ecclesiastical Commissioners, and Lady Augusta Sarah Lane will let a balance of /40.000 remain on mortgage for ten. years at $4^{1/2}$ per cent. The Tewkesbury Register, and Agricultural Gazette. - Saturday 24 July **1915**

Mosquito plague 1917 To prevent repetition of last year's mosquito plague in the Wimbledon district, the edges of the lake Wimbledon Park and the ponds on the common are being sprayed with petroleum to destroy the larvae. **Cambridge Independent Press - Friday 13 July 1917**

1925 Wimbledon Park Public Park

Skating Wimbledon Park lake, always one the most popular strips ice in London, began yesterday, when it was opened to members of the Royal Skating Club, until recently known as the Wimbledon Skating Club, and members the Wimbledon Park Golf Club Daily Herald - Friday 27 January **1933**

Wimbledon not however, worrying about water restrictions, for the water tower in the grounds can be used to draw off water from Wimbledon Park lake, if necessary. Daily Herald 15 June **1934**
Only used on three separate occasions previously



12. 37= Total number of High Explosive bombs dropped in Wimbledon Park from 7th October 1940 to 6th June 1941 (Merton Newspaper)

References recommended for further info and maps

Richard Milward '*Wimbledon Past*' 1998 Historical Publications Ltd

Richard Milward '*Wimbledon Two Hundred Years Ago'* 1996 Milward Press

Steffie Shields '*Moving Heaven and Earth–'Capability' Brown's Gift of Landscape'* 2016 Unicorn includes Brown's engineering

Article: Tony Matthews, Surrey Gardens Trust; Dr Dave Dawson and other sources '*CAPABILITY BROWN'S WIMBLEDON PARK, IN HIS DAY AND OURS'* (Jan 2015)

Article: Dr. Dave Dawson (Feb2019) *Major works are proposed at Wimbledon Park Lake'*