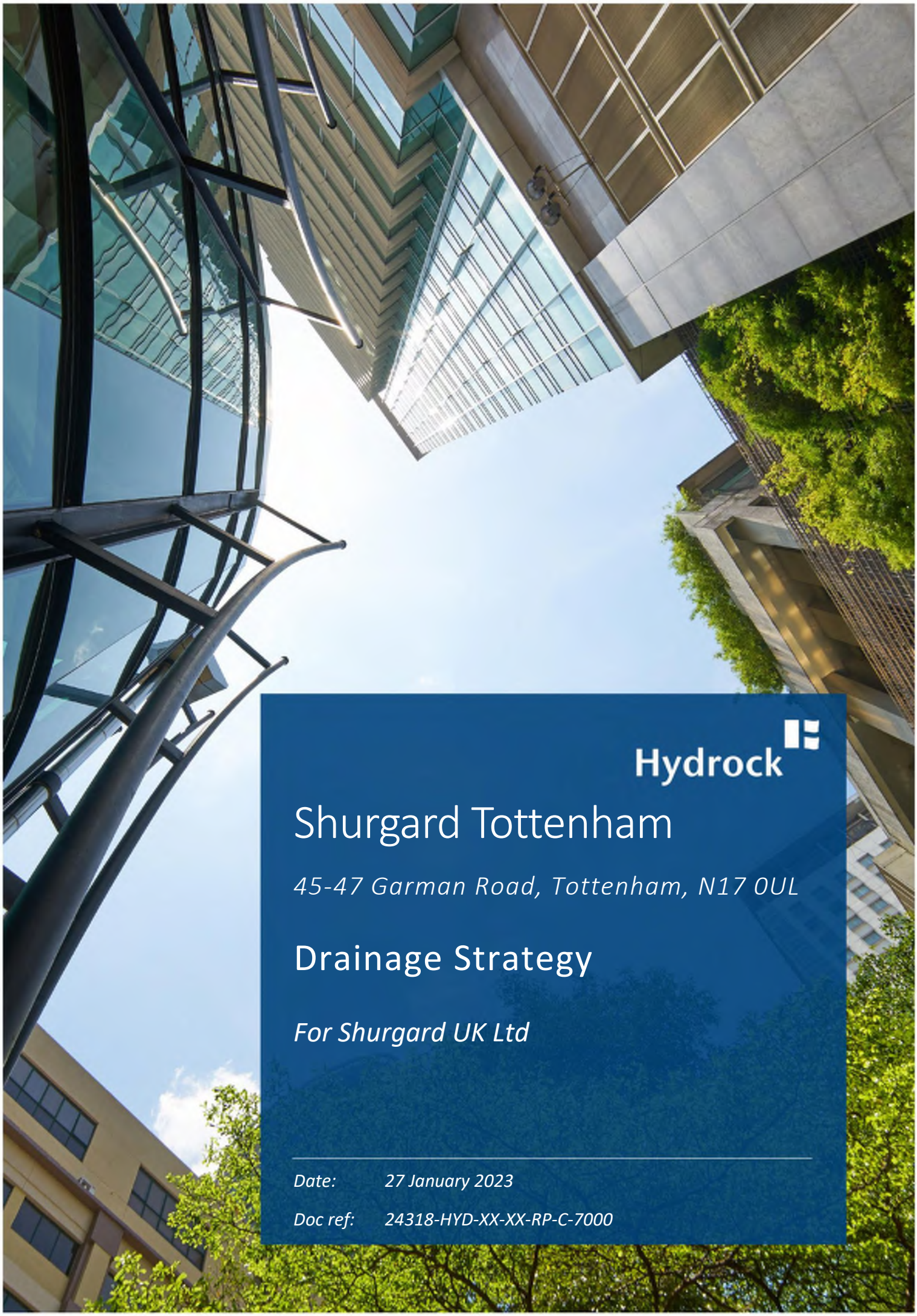

Hydrock

Shurgard Tottenham

45-47 Garman Road, Tottenham, N17 0UL

Drainage Strategy

For Shurgard UK Ltd

Date: *27 January 2023*

Doc ref: *24318-HYD-XX-XX-RP-C-7000*

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1. INTRODUCTION

Hydrock have been appointed by Shurgard UK Ltd to provide a Drainage Strategy report for the approval of Haringey Council Lead Local Flood Authority.

The proposed drainage strategy will be in accordance with both national guidelines and will incorporate a 'best practise' approach in reducing the impact of the flooding caused by the new development.

The report is based upon sewer asset information provided by the sewerage undertakers Thames Water in relation to assets within the vicinity of the development site.

The report highlights the key stakeholders in terms of ownership and maintenance to ensure the drainage system is kept well maintained and reduce the risk of failure. Should the network fail at any point, clearly defined ownership liabilities will ensure that problems can quickly be rectified thereby reducing the impact of potential damaged caused by flooding.

The information received is summarised within this report. In the event that the information is relied upon and is subsequently found to be incorrect, Hydrock Consultants Ltd accepts no responsibility for any direct and/or consequential loss that may occur as a result.

Appendices

Appendix A: Proposed Site Layout

Appendix B: Topographic Survey

Appendix C: Thames Water Sewer Records

Appendix D: Existing Utilities Survey

Appendix E: Greenfield Runoff Calculation

Appendix F: BGS Borehole Record

Appendix G: Geo-Environmental Assessment

Appendix H: Proposed Drainage Strategy

Appendix I: Supporting Calculations

References / Design Codes

- BS EN 752 - Drain and Sewer Systems Outside Buildings.
- Building Regulations Approved Document Part H - Drainage and waste disposals.
- Local Authority Guidance.
- CIRIA C753 - SuDS Manual.
- National Planning Policy Framework (NPPF).
- DEFRA Non-Statutory Technical Standards for Sustainable Drainage.

2. SITE INFORMATION

2.1 Site Location

The site is located within the Tottenham area of the London Borough of Haringey and the red line planning boundary covers an area of approximately 0.25 hectares.

Table 2.1: Site Referencing Information

Site Address	Shurgard Tottenham
	45-47 Garman Rd Tottenham
	Haringey Borough
	Greater London
	Postcode: N17 0UL
Grid Reference	TQ 35098 91299 E535098 N191299

Figure 1: Site Location

The site is bounded by Sedge Road to the North, industrial units to the South, Watermead Way to the East, and Garman Road to the West.

The site is currently in use as an industrial unit and as such is considered to be a brownfield site.

Figure 2: Site Red Line Boundary

2.2 Topography

A topographical survey of the site was undertaken in February 2022. The majority of the site consists of the existing industrial unit with a strip of dense vegetation in the north and east separating the site from the highway, and a footpath opening directing on the highway along the western boundary.

Levels generally fall back into the site boundary both within the site and from the surrounding area. A 1-in-3 gradient along the eastern boundary supported by a retaining wall outside the site boundary.

The highest level recorded was 11.57m AOD along the eastern boundary.

The lowest level recorded was 9.27m AOD along the northern boundary.

See **Appendix A** for Topographical Survey.

2.3 Development Proposal

The proposed involves the construction of a new self-storage facility (Use Class B8) with associated landscaping, car and cycle parking, and refuse storage. Vehicle and pedestrian access would be via Garman Road.

See **Appendix A** for Architect's Layout.

2.4 Geology

British Geological Survey (BGS) mapping indicates that the site is underlain by superficial layers of Enfield Silt with London Clay bedrock.

BGS borehole record TQ39SE900, taken within Marigold Road 300m to the south of the site, indicates that the site has a layer of gravel from 2.50m bgl to 7.20m bgl. This layer is overlain by clays and made ground and underlain by London Clay.

A site specific ground investigation was undertaken in April 2022. The report identified that the site consisted of a surface layer of made ground to 1.20m bgl below which are layers of clay and gravel.

See Appendix **F** for the Borehole Record and Appendix **G** for the ground investigation report.

2.5 Hydrology & Hydrogeology

The EA Main River Map identifies the nearest main river as Pymes Brook located 250m east of the site.

The BGS borehole struck groundwater at 3.00m bgl and was noted to have the odour of hydrocarbons.

Ground investigation works struck water at 2.60m bgl in the south western corner of the site only. This would suggest that there is potential for the site to infiltrate runoff. However, specific testing to BRE 365 will be required to confirm the site specific infiltration rate and suitability.

The DEFRA Magic Map identifies that the site is within Source Protection Zone 2.

2.6 Flood Risk

The Environment Agency (EA) Updated Flood Map for Planning indicates that the site lies entirely within Flood Zone 2, i.e., land identified as having a 1 in 100 to 1 in 1,000 annual probability of river flooding in any one year.

Figure 3 Extract from the Updated Flood Map for Planning (June '22)

The EA Updated Surface Water Flood Map for Planning identifies that the site is at low risk of flooding from overland flows. The mapping indicates that flows would be directed south along Garman Road.

The EA Risk of Flooding from Reservoirs map identifies that the site is at risk of flooding from reservoirs. However, whilst the consequences of a reservoir failure would be severe, the probability of a catastrophic dam failure are considered to be extremely low.

As noted above, the site is underlain by a superficial layer of clay with the water table at 3m bgl. Therefore, the site is considered to be at low risk of groundwater flooding.

The risk of flooding from sewers is considered to be low.

Refer to **Hydrock Flood Risk Assessment** for further information.

3. SURFACE WATER MANAGEMENT STRATEGY

3.1 Pre-Development Surface Water Drainage

Thames Water:

Sewer records and a utilities survey identify that a 1350mm diameter surface water sewer intrudes into the site's northern area flowing west to east. A manhole for this sewer was identified within the vegetation in the north eastern corner of the site. There is a defined easement over this sewer that cannot be built in.

An additional 225mm diameter surface water sewer at the head of the network is within Garmin Road off the site's north-western corner.

For the purpose of this report the drainage has been taken from the sewer asset map information only. It is recommended a full drainage CCTV survey is undertaken to determine accurate routes of the existing drainage so the proposed network can be suitably coordinated.

Private:

The utilities survey identified that the site currently drains via gravity towards the west and has been taken that the this connects into the Thames Water (TW) public sewer network in Garman Road via an existing 150m diameter pipe.

The private drainage serving the site will largely be removed and replaced to enable the re-development of the site. However, it is proposed that the existing connection into the TW public sewer is reused.

See **Appendix D** for the Utilities Survey.

3.2 Pre-Development Surface Water Catchments

The table below indicates each catchment type area, pre-development as taken from the topographic survey:

Table 3.1: Pre-Development Catchment Areas

Pre-Development Catchment	Area (m2)
Impermeable	
Building / Roof	1603
Roads / Hardstanding	604
Permeable	
Soft Landscaping	0000
Total Area	**2207**

3.3 Pre-Development Surface Water Run-Off

In order to determine the post-development surface water flows, an assessment has been carried out on the pre-development to ensure that the run-off from the new development will not adversely affect flood risk either within the site boundary, offsite adjacent properties, or the downstream network:

3.3.1 Run-Off Rates

In line with the DEFRA Non-Statutory Technical Standard for Sustainable Drainage Systems (SuDS) and London Plan policy 5.13, it is a requirement that on new developments that consideration be given to limit discharge as close as reasonably practical to the equivalent 'Greenfield' rate for the corresponding storm event. The following table considers what the maximum surface water discharge from the site would be if the site was 'Greenfield' i.e., not developed:

Table 3.2: Pre-Development Greenfield Run-Off Rates

Storm Event	Maximum discharge rate (l/s) Greenfield
1 in 1 year	0.29
1 in 30 year	0.80
1 in 100 year	1.10
QBAR	0.35

In line with the London Plan Sustainable Design and Construction Supplementary Planning Guidance, if the 'Greenfield' run off rate cannot be achieved on a previously developed site, the run off rate should be no more than three times the calculated 'Greenfield' rate.

3.3.2 Run-Off Volumes

The existing drainage network connects into the TW surface water sewer in Garman Road via a 150mm diameter drain located adjacent to the existing site entrance. The utilities survey did not identify any form of flow control restriction limiting discharge to the sewer

It has been calculated that during the 1 in 100-year rainfall event approximately 32m^3 of runoff will be discharged into the public sewer at a rate of 36.3 l/s and 24.5m^3 of flooding will occur within the site following exceedance flow routes to pool around the site perimeter.

3.4 Pre-Development Flood Exceedance Flows

Topographical survey information indicates that prior to demolition exceedance flows will pool around the site boundary. With no positive drainage identified in these areas it has been taken that this water would pond within areas of existing hardstanding.

3.5 Run-off Destinations

An appraisal should be undertaken to confirm the most suitable and sustainable method for managing surface water runoff from the development in accordance with the following hierarchy as highlighted in Part H of Building Regulations and the National Planning Policy Framework (NPPF):

1. Infiltration to the ground using a sustainable drainage system.
2. If this is not feasible, discharge to a watercourse or river; generally, at a controlled rate unless it does not affect flood risk e.g., if to the sea or an estuary.
3. Discharge at a controlled rate to a surface water sewer or drain.
4. Discharge at a controlled rate to a combined sewer system, with the approval from the Water Authority.

5. Only if the above have all been investigated and it has been proved that none of these options are suitable will discharge at a controlled rate to a foul sewer system, with the approval from the Water Authority.

The discharge of surface water run-off has been considered in accordance with the hierarchical approach:

Table 3.3: SuDS Hierarchy

Method	Reasoning	
Interception / Re-use	Development is for a self-storage facility with minimum water requirements	X
Infiltration	Unable to recommend in the absence of site specific infiltration testing	X
Surface water body	No watercourses within or adjacent to the site	X
To dedicated surface water sewer (public, highways or otherwise)	Existing connection to public sewer in Garman Road	✓
To a combined sewer	N/A	X
To a foul sewer	N/A	X

3.6 Suitability of SuDS Components

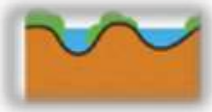
The drainage design should adopt the principles of SuDS where appropriate taking into consideration the site context and location. The principals of SuDS are that they should be designed to maximise the opportunities and benefits that can be secured surface water run-off management in terms of quality, quantity, flood risk, and amenity. The implementation and selection of SuDS techniques is largely dependent on the site layout and context. Some SuDS techniques may be more appropriate than others.

The suitability of SuDS components has been assessed as follows:

Table 3.4: Suitability of SuDS Components

Hierarchy	Description	Setting	Required area	
Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation.	Building	Building integrated.	✓
Rainwater harvesting	Rainwater is collected from the roof of a building or from other paved surfaces and stored in an over ground or underground tank for treatment and reuse locally. Water could be used for toilet flushing and irrigation.	Building	Water storage (Underground or above ground).	X

Soakaway	A soakaway is designed to allow water to quickly soak into permeable layers of soil. Constructed like a dry well, an underground pit is dug filled with gravel or rubble. Water can be piped to a soakaway where it will be stored and allowed to gradually seep into the ground.	Open space	Dependent on runoff volumes, water table and soils.	X
Filter strip	Filter strips are grassed or planted areas that runoff is allowed to run across to promote infiltration and cleansing.	Open space	Minimum length 5m.	X
Permeable paving	Paving which allows water to soak through. Can be in the form of paving blocks with gaps between solid blocks or porous paving where water filters through the block itself. Water can be stored in the sub-base beneath or allowed to infiltrate into ground below.	Street / open space	Can typically drain double its area.	X
Bioretention area	A vegetated area with gravel and sand layers below designated to channel, filter and cleanse water vertically. Water can infiltrate into the ground below or drain to a perforated pipe and be conveyed elsewhere. Bioretention systems can be integrated with tree-pits or gardens.	Street / open space	Typically, surface area is 5-10% of drained area with storage below.	X
Swale	Swales are shallow depressions designed to convoy and filter water. These can be 'wet' where water gathers above the surface, or 'dry' where water gathers in a gravel layer beneath. Can be lined or unlined to allow infiltration.	Street / open space	Account for width to allow safe maintenance typically 2–3 metres wide.	X

Hardscape storage	Hardscape water features can be used to store run-off above ground within a constructed container. Storage features can be integrated into public realm areas with a more urban character.	Street / open space	Could be above or below ground and sized to storage need.	X
Pond / Basin	Ponds can be used to store and treat water. 'Wet' ponds have a constant body of water and run-off is additional, while 'dry' ponds are empty during periods without rainfall. Ponds can be designed to allow infiltration into the ground or to store water for a period of time before discharge.	Open space	Dependent on runoff volumes and soils.	X
Wetland 	Wetlands are shallow vegetated water bodies with a varying water level. Specially selected plant species are used to filter water. Water flows horizontally and is gradually treated before being discharged. Wetlands can be integrated with a natural or hardscape environment.	Open space	Typically, 5–15% drainage area to provide good treatment.	X
Underground storage	Water can be stored in tanks, gravel or plastic crates beneath the ground to provide attenuation.	Open space	Dependent on runoff volumes and soils.	✓

3.7 Post-Development Surface Water Drainage

It is proposed that the new below ground surface water drainage system will positively drain the site via gravity and discharge at a restricted rate to the TW 225mm diameter surface water sewer in Garman Road via an existing 150mm diameter connection. On-site attenuation will be provided by a geocellular attenuation tank located beneath the proposed car park.

Where applicable, the surface water management strategy has incorporated the recommendations of the 'Non-Technical Standards for Sustainable Drainage' and general 'good practice' in terms of providing a Sustainable Drainage System (SuDS) which does not adversely impact on flood risk either within the site or beyond the development boundary.

3.8 Post-Development Surface Water Catchments

The table below indicates each catchment type area, post-development:

Table 3.5: Post-Development Catchment Areas

Post-Development Catchment	Area (m^2)
Building / Roof	1753*
Roads / Hardstanding - Impermeable	290
Roads / Hardstanding – Permeable	0000
Soft Landscaping	164
Total Area	2207

*As the roof is proposed as a green/brown roof, the drained impermeable area has had a reduction to 85% applied during design calculations. This reduction is not included here.

3.9 Post-Development Surface Water Run-Off

In order to determine the post-development surface water flows an assessment has been carried out to ensure that the flows from the new development will not adversely affect flood risk either within the site boundary, offsite adjacent properties, or the downstream network:

3.9.1 Run-Off Rates

The Greenfield runoff rate from the site has been identified as 0.35 l/s. In line with paragraph 3.4.10 of the London Plan Sustainable Design and Construction Supplementary Planning Guidance, three times this rate is 1.05 l/s. It is considered unfeasible to reduce to this rate as this rate would present a significant risk of blockage at the flow control unit. It is also considered that, due to the age of the existing development, that no flow restriction is currently implemented. Therefore, it is proposed that the site discharges at a restricted rate of 5.0 l/s in line with paragraph 3.4.9 of the Supplementary Planning Guidance.

3.10 Urban Creep

Urban Creep Factor (UCF) is defined as any increase in the impervious area that is drained to an existing drainage system without planning permission being required, such as the construction of patios, small extensions, etc.

As the footprint of the site will remain majority impervious, this factor is not applied.

3.11 Post-Development Surface Water Storage

For the purposes of design, it has been considered that the development's green roof will be used for treatment and conveyance only and any potential attenuation provided has not been included in the calculations. As such, flows within the site will be attenuated using a geocellular storage tank providing 90.8 m^3 of storage. This tank will be positioned within the proposed under croft car parking area.

The distribution of attenuation flood storage has been calculated for the development below:

Table 6 Attenuation Volume Required

Impermeable Area (m^2)	Discharge Rate (ltrs/sec)	Volume Provided (m^3)
1780	5.0	90.8

3.12 Post-Development Flood Exceedance Flows

In the event that flows from rainfall exceed the 1 in 100-year rainfall event plus allowance for climate change or system failure through lack of maintenance, surface water run-off will be directed via exceedance routes away buildings and/or critical infrastructure.

3.13 Water Quality Treatment

Pollution hazard indices for land use classifications (as identified in Table 26.2 of CIRIA C753 - The SuDS Manual) are as follows;

Table 3.7: Pollution hazard indices

Pollution hazard indices for different land use classifications in accordance with CIRIA C753 - The SuDS Manual. Table 26.2				
Land Usage	**Level**	**TSS**	**Metals**	**Hydrocarbons**
Other roofs (typically commercial / industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., <300 traffic movements/day	Low	0.5	0.4	0.4

The indicative SuDS mitigation indices for discharges to surface waters (as identified in Table 26.3 of The SuDS Manual), are as follows;

Table 3.8: SuDS pollution mitigation for discharge to surface waters

Indicative SuDS mitigation indices for discharge of surface water			
	Mitigation indices		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Green Roof	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately 1 in 1 year return period event, for inflow concentration relevant to the contributing drainage area		

It should be noted that the car park is covered by the development's green roof and as such will only be taking minimal runoff from outside the site. It is proposed that a Class-1 bypass separator is provided to treat these flows.

Consideration will be given to both during construction and post-development water quality treatment to ensure that water quality is not impacted during the construction works:

3.13.1 Quality of Surface Water Run-off: Post-Development

In accordance with Environment Agency Document PPG3 (now withdrawn but considered best practice guidance) as the car park is less than 50 spaces or 800m^2, the proposal considered to be 'low risk' in terms of pollution to the surface water network and as such an oil interceptor is deemed to be required. Additionally, it is proposed that the car parking area is located in an under croft space beneath the building and will not receive direct run-off.

Gullies and drainage channels will be specified with silt traps and catch pits will be incorporated in the drainage system to reduce the risk of silts / salts getting into the surface water network.

3.13.2 Quality of Surface Water Run-off: During Construction

It is anticipated that the during construction adequate provisions will be put in place to ensure the existing drainage is protected to prevent material which could have a negative impact on water quality entering the system.

3.14 Design Standards

All materials and products relating to the below ground drainage system shall be specified in accordance with their intended use and meet all relevant British Standards and BBA accreditations.

In accordance with best practice storm drainage will be designed to the following performance criteria:

Pipes running under full conditions with no surcharge	-	1 in 2-year storm return period
No flooding	-	1 in 30-year storm return period
Extreme flooding to be retained on site	-	1 in 100-year storm return period plus allowance for climate change (40%).

See **Appendix H** for Drainage Strategy.

4. FOUL WATER MANAGEMENT STRATEGY

4.1 Pre-Development Foul Water Drainage

Thames Water:

A foul water sewer of 150mm diameter flows across Sedge Road from east to west. At the junction of Sedge Road and Garman Road it increases to a 225mm diameter and flows southwards within Garman Road.

For the purpose of this report the drainage has been taken from the sewer asset map information only. It is recommended a full drainage CCTV survey is undertaken to determine accurate routes of the existing drainage so the proposed network can be suitably coordinated.

See **Appendix C** for a Sewer Asset Map.

Private:

The utilities survey identified that the site currently drains via gravity towards the west and has been taken that the this connects into the TW public sewer network in Garman Road via an existing 150m diameter pipe.

The private drainage serving the site will largely be removed and replaced to enable the re-development of the site. However, it is proposed that the existing connection into the TW public sewer is reused.

See **Appendix D** for the Utilities Survey.

4.2 Post-Development Foul Water Drainage

It is proposed that the new below ground foul water drainage system will positively drain the site via gravity and discharge into the TW 225mm diameter foul water sewer in Garman Road via an existing 150mm diameter connection.

It is considered that the site will be discharging only domestic waste into the system. Should it be decided to discharge trade effluent, permission must be sought from TW.

The design of all foul sewers and lateral drains must conform to BS EN 752, BS EN 16933, Building Regulations 2010 Part H, planning policy and best practice guidelines wherever applicable. Sanitary systems within the building should be designed in accordance with BS EN 12056-2.

4.3 Post-Development Foul Water Flow Rates

Using BS12056 and the proposed site plan, the foul water flows have been calculated based upon:

- 1 no. wash basin
- 2 no. sinks
- 1 no. WC with 6.0l cistern

Based upon the above, the peak flow rate from the development has been calculated as 1.50 l/s.

5. OWNERSHIP AND MAINTENANCE

The key elements of the foul and surface water drainage system will require periodic maintenance to prevent failure of the system and/or a reduction in capacity of the networks as a whole and the following matrix therefore sets out the various drainage items to be maintained, identifies who is responsible and the frequency of maintenance.

The proposed SuDS features will require maintenance including litter and debris removal, sediment removal, vegetation maintenance and remediation to any damaged structures.

The maintenance requirements will be the responsibility of a Shurgard UK Ltd.

Table 5.1: Proposed Schedule of Maintenance for Below Ground Drainage

Underground Cellular Tanks - Operation and maintenance requirements in accordance with CIRIA C753 - The SuDS Manual		
Maintenance Schedule	**Required Action**	**Frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly.
	For systems where rainfall infiltrates into the tank from above, check surface or filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually.
	Remove sediment from pre-treatment structures and / or internal forebays.	Annually, or as required.
Remedial actions	Repair / rehabilitate inlets, outlet, overflows and vents.	As required.
Monitoring	Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually.
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required.
Other Drainage Items - Ownership & Maintenance Responsibility Matrix		
Feature	**Maintenance**	**Frequency**
Private Drains	Inspection	CCTV survey every 5-10 years.
	Regular Maintenance	Jet clean system fully every 5-10 years. (Recommend prior to CCTV drainage survey is)
	Remedial / Occasional Maintenance	Carry out remedial works as identified in CCTV survey.
Discharge orifice manholes/flow control devices	Inspection	Quarterly
	Regular Maintenance	Remove silt and debris as necessary to prevent build up.
Gully / Drainage Channels	Inspection	Quarterly
	Regular Maintenance	Remove silt and debris as necessary to prevent build up.

The following information should be passed to the development operator to ensure that future maintenance is carried out in a safe and proper manner.

A formal review of the risks should be undertaken on an annual basis:

Table 5.2: Proposed Operational Schedule for Below Ground Drainage

Operation	Risks	Mitigating Measures
Access to manholes for Inspection and Maintenance.	1. Confined spaces	1. Entry to confined space to be minimised and, where unavoidable, to be carried out by appropriately trained personnel
Removal of silt from outfall	1. Risk to members of the public 2. Open Water	1. Access to hazardous areas by members of the public to be prohibited. 2. To be carried out by appropriately trained personnel
Removal of silt from drainage channel	1. Risk to members of the public	1. Access to hazardous areas by members of the public to be prohibited

All inspection and maintenance works should take into consideration the implications of 'lone working'. An assessment should be carried out and the risks mitigated accordingly.

6. CONSENT / PLANNING

Summary of expected consents required:

Any works within the easement of or to divert the existing 1350mm surface water sewer in the northern part of the site will require consent from Thames Water.

An initial pre-development enquiry to TW has confirmed that there is sufficient capacity within the foul water sewer in Garman Road to accommodate foul water discharge from the site. Consent to discharge surface water first requires approval from the LLFA before being considered by TW.

In addition to the above it is anticipated that details of the drainage scheme will need to be approved by Haringey Borough Council as Lead Local Flood Authority (LLFA) through a formal planning application. At the time of writing initial enquiries have been made to the LLFA but no response has been received.

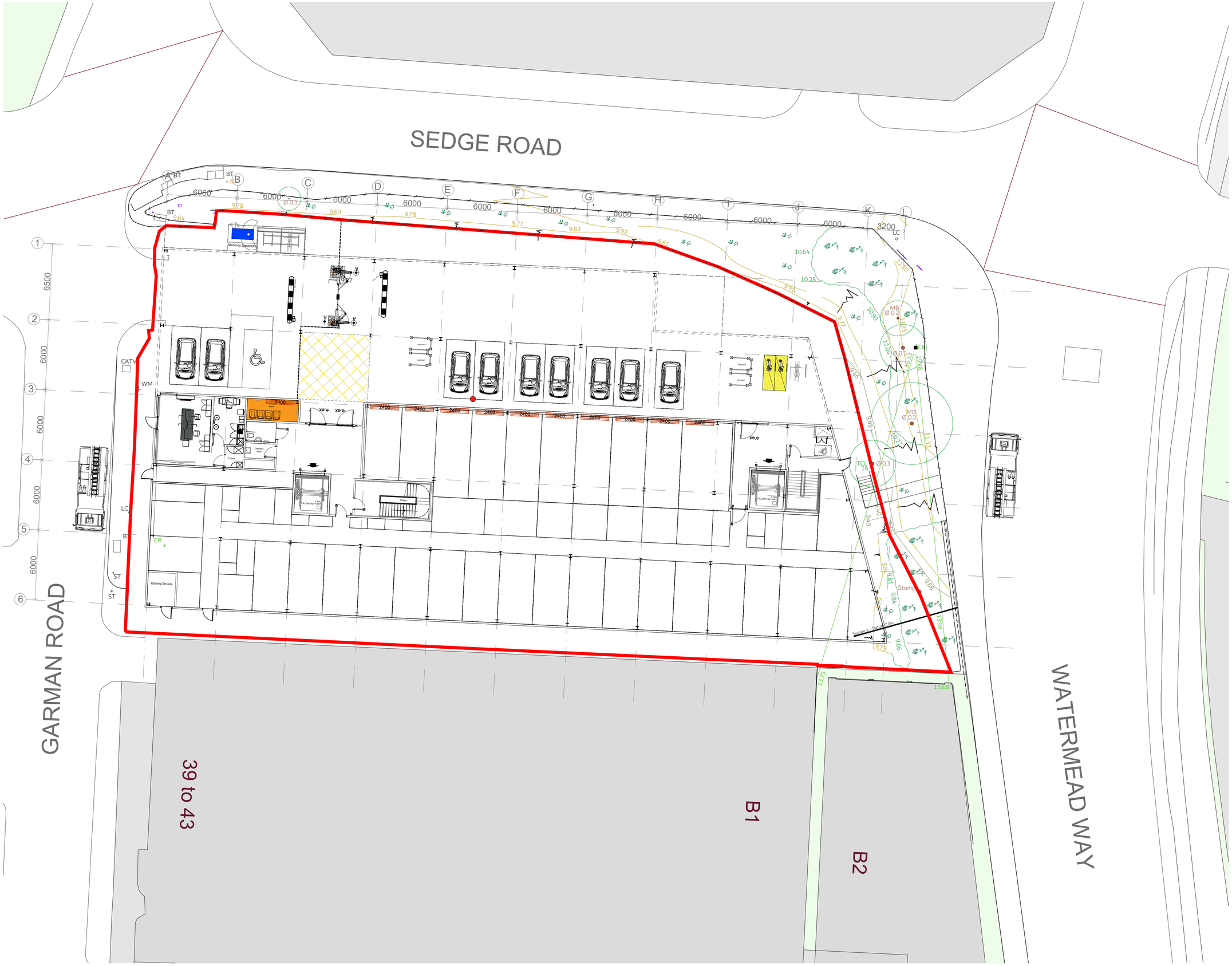
7. CONCLUSION

This report concludes that the foul and surface water drainage strategy for the development will be designed accordance with both national and local standards and best practice. The following key items have been summarised below:

- The foul and surface water drainage systems for the new development will be designed to accommodate the required flows for the lifetime of the development.
- It has been determined that the post-development surface water flow rates have been restricted to 5.0 l/s so as to not adversely impact downstream flooding of the site as a result of the new development.
- All surface water run-off from storm events up to and including the 100-year plus 40% climate change will be retained within the overall site.
- Ownership and maintenance liabilities for the foul and surface water drainage system will be clearly defined so that in the event of failure the drainage system appropriate action can be taken to ensure that the drainage system continues to work efficiently.
- In the event that flows from rainfall exceed the 1 in 100-year rainfall event or system failure through lack of maintenance, surface water run-off will be directed via exceedance routes away buildings and/or critical infrastructure.

Appendix A

Proposed Site Layout



NOTES

ORIGINAL A1

All levels and dimensions to be checked on site prior to construction / fabrication; report discrepancies immediately.
Do not scale dimensions from this drawings.
This drawing is copyright protected.

REVISION

- Visitor Parking: **3 x Car space** (1 of which is Accessible)
- Customer Parking: **7 x Car space** (2 of which are Electrical Charge points)
- Van Parking: **1 x space**
- Electrical Car "Twin" charging point
- Bicycle Parking: 4 long stay, 10 short stay, 2 Cargo Bikes

Refuse Requirement = 0.1 sqm

Actual Refuse Store = 8m2
Calculation: Total back of house/shop area = 57m2 Storage area Req @ 2 m2 / 1000m2
Sum: 57/1000 x 2 = 0.114m2

LEGEND: Surface Finishes

- Pavement (Highways Land)
- Existing Soft landscaping (Highways Land)
- Proposed Soft Landscaping Area Please refer to landscaping drawing for more details

N

Site Boundary - 2207 msq

SCALE 1:150

0 1 2 3 4 5m

PLANNING

SCALE	DATE	DRAWN	CHECKED
1:150	MAY'22	AF	DA

PROJECT
SHURGARD UK
45-47 GARMAN ROAD
TOTTENHAM: N17 0UR

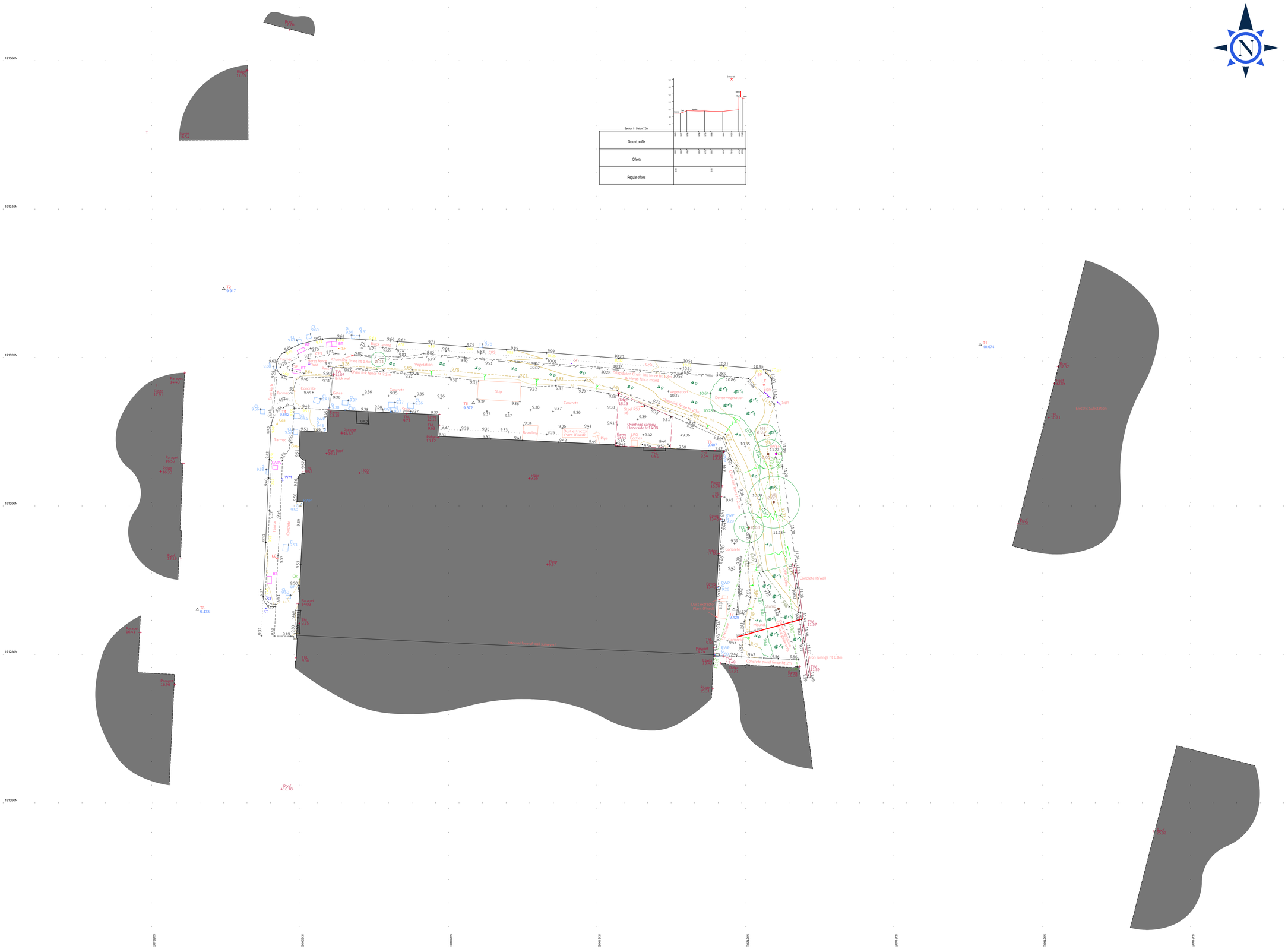
DRAWING
SITE PLAN
AS PROPOSED

Threesixty Architecture
10 MONTROSE STREET
GLASGOW
G1 1RE
t 0141 229 7575
www.360architecture.com

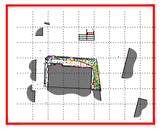
DRAWING No.
22007GA-D-002

Appendix B

Topographic Survey



Sheet Layout



Legend

Topographic

AV	Air Valve	MkE	Marker post electric
BB	Belisha beacon	MkG	Marker post gas
Bdy	Boundary post/peg	MkOF	Marker post oil/fuel
BH	Borehole	MkT	Marker post telecom
Bol	Bollard	MkU	Marker unidentified
BT	British telecom	MkW	Marker post water
Bus	Bus stop	Plnv	Pipe invert level
CATV	Cable TV	PR	Pipe riser
CCTV	Closed circuit tv	RA	Rodding access
CL	Cover level	RBol	Reflective bollard
Col	Column	RWP	Rainwater pipe
CP	Crossing point	Sag	Overhead sag level
CPS	Concrete paving	SBed	Soft/silt bed level
CR / DR	Cable riser/Duct riser	Sof	Soffit level
Elec	Electric feature	SP	Sign post
E Cab	Electricity cabinet	ST	Stop tap
EP	Electricity pole	SV	Stop valve
FH	Fire hydrant	SY	Stay
FS	Flag staff	Tap	Water tap
G	Gully	TCB	Telephone call box
Gas	Gas unidentified	TH	Trial hole
GL	Ground light	TL	Traffic light
GM	Gas meter	TP	Telecom pole
GP	Guide post	TS	Traffic signals
GV	Gas valve	TT	Tactile paving
HBed	Hard bed level	TW	Top of wall level
IBol	Illuminated bollard	UCab	Unidentified cabinet
Inv	Invert level	Vif	Vent pipe
ISign	Illuminated sign	WHead	Window head level
ISP	Illmunated sign post	WL	Water level
KI	Kerb inlet	WM	Water meter
LBx	Letter box	WO	Wash out
LC	Lighting column	WS	Window Sample
M&D	Marker post drainage	WSill	Window sill level

Bank top	Footpath or track
Breakline	Kerb or Rail line
Bank bottom	Kerb (dropped)
Bank bottom (water)	Kerb Inlet
Building overhead	Miscellaneous
Cable overhead	Roadmarkings
Concrete/Tarmac	Section position
Contour	Street furniture
Gate	Vegetated light/dense
Grass	Wall
Fence (labelled)	Waterline
Building / Minor building	OS Data © Crown copyright

Avg. tree spread
2030 Ground level
@1.5 Trunk Diam
MB Multi bole
1.2 Sapling level
15 (m AOD)

Hedge	
Bush	
Sapling	

Utility covers/cabinets etc. above ground

Drainage (general)	
Electric	(Overhead)
Gas	
Traffic signals	
Telecom	(Overhead)
Unidentified	(Overhead)
Water	

Survey Station	T2 100.000
3rd party station	
Viewpoint hold CTRL	

Station Table

Name	Easting	Northing	Level
RS1	535068.615	191315.775	11.051
T1	535151.642	191321.743	10.674
T2	535049.714	191329.269	9.917
T3	535046.159	191286.025	9.473
T4	535058.315	191313.591	9.602
T5	535083.361	191313.925	9.372
T6	535117.356	191307.468	9.407
T7	535118.455	191286.037	9.429

Drawing Notes

Utility depths and levels shown are in meters.

Pipe sizes and materials which cannot be obtained by visual survey are taken from record drawings or marker plates where available.

Cable routes shown as a single line may actually consist on many cables please refer to annotated configuration details where provided.

Drainage pipe sizes and invert levels have been determined without man entry into chambers. Every effort has been made to correctly obtain this information however accuracy is dependant on the visibility of the service.

Coordinates and Levels are derived from Ordnance Survey datum OSGB36 through a series of GNSS RTK Observations carried out at survey control station T3 and orientated through station T2.

Client Logo:

BROWNFIELD SOLUTIONS LTD

Project Address:
45 - 47 Garmen Road
London

Project Title
Topographical Survey

Surveyor	Drawn	Checked	Survey Date:	Scale:
TPO	TPO	DT	23/02/2022	1:200 @ A0

Project Number:	Sheet No:	Revision:
UM22-1202-BSL	1 OF 1	0

Revision	Revision Notes	Date

Scale
1:500 50m
1:200 20m
1:100 10m

Utility MAPPING
0800 024 UMAP (8627)
www.u-map.co.uk info@u-map.co.uk

Appendix C

Thames Water Sewer Records

CommercialDW
Drainage & Water Enquiry

Thames Water Property Searches

SearchFlow Limited
42
Kings Hill Avenue
Kings Hill
West Malling
ME19 4AJKent

Search address supplied	45-49, Garman Road, Tottenham, Haringey, LONDON, N17 0UL
Your reference	SHU001/0035
Our reference	CDWS/CDWS Standard/2022_4581880
Received date	3 February 2022
Search date	8 February 2022

Keeping you up-to-date

Commercial Drainage and Water Enquiry

The Commercial Drainage and Water Enquiry is specifically designed for those purchasing or leasing land or commercial property.

With comprehensive information regarding water and sewerage services and infrastructure assets, combined with an appropriate guarantee for commercial property and land transactions, the Commercial Drainage and Water Enquiry mitigates risk and provides peace of mind for commercial property professionals and their advisers.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

CON29DW COMMERCIAL DRAINAGE & WATER SEARCH

DRAINAGE + WATER SEARCHES NETWORK DWSN

CommercialDW
Drainage & Water Enquiry

Thames Water Property Searches

Question		Summary Answer
Maps		
1.1	Where relevant, please include a copy of an extract from the public sewer map.	Map Provided
1.2	Where relevant, please include a copy of an extract from the map of waterworks.	Map Provided
Drainage		
2.1	Does foul water from the property drain to a public sewer?	Connected
2.2	Does surface water from the property drain to a public sewer?	Connected
2.3	Is a surface water drainage charge payable?	See Details
2.4	Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundaries of the property?	Yes
2.4.1	Does the public sewer map indicate any public pumping station or any other ancillary apparatus within the boundaries of the property?	No
2.5	Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?	Yes
2.5.1	Does the public sewer map indicate any public pumping station or any other ancillary apparatus within the 50metres of any buildings within the property?	No
2.6	Are any sewers or lateral drains serving, or which are proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	No
2.7	Has a sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?	No
2.8	Is the building, which is or forms part of the property, at risk of internal flooding due to overloaded public sewers?	Not At Risk
2.9	Please state the distance from the property to the nearest boundary of the nearest sewage treatment works.	2.429 Kilometres
Water		
3.1	Is the property connected to mains water supply?	Connected
3.2	Are there any water mains, resource mains or discharge pipes within the boundaries of the property?	Yes
3.3	Is any water main or service pipe serving, or which is proposed to serve the property, the subject of an existing adoption agreement or an application for such an agreement?	No
3.4	Is the property at risk of receiving low water pressure or flow?	No
3.5	What is the classification of the water supply for the property?	Hard
3.6	Is there a meter installed at this property?	Yes
3.7	Please include details of the location of any water meter serving the property.	See Details

CommercialDW
Drainage & Water Enquiry

Thames Water Property Searches

Question		Summary Answer
Charging		
4.1.1	Who is responsible for providing the sewerage services for the property?	Thames Water
4.1.2	Who is responsible for providing the water services for the property?	Thames Water
4.2	Who bills the property for sewerage services?	See Details
4.3	Who bills the property for water services?	See Details
Trade Effluent		
5.1	Is there a consent, on this property, to discharge Trade Effluent under S118 of the Water Industry Act(1991) into the public sewerage system?	No
Wayleaves, Easements, Manhole Cover and Invert levels		
6.1	Is there a wayleave/easement agreement giving Thames Water the right to lay or maintain assets or right of access to pass through private land in order to reach the Company's assets?	No
6.2	On the copy extract from the public sewer map, please show manhole cover, depth and invert levels where the information is available.	See Details

Search address supplied: 45-49, Garman Road, Tottenham, Haringey, LONDON, N17 0UL

Any new owner or occupier will need to contact Thames Water on 0800 316 9800 or log onto our website www.thameswater.co.uk and complete our online form to change the water and drainage services bills to their name.

The following records were searched in compiling this report: - the map of public sewers, the map of waterworks, water and sewer billing records, adoption of public sewer records, building over public sewer records, the register of properties subject to internal foul flooding, the register of properties subject to poor water pressure and the drinking water register.
Thames Water Utilities Ltd (TWUL) holds all of these.

TWUL, trading as Property Searches, are responsible in respect of the following:-

(i) any negligent or incorrect entry in the records searched

(ii) any negligent or incorrect interpretation of the records searched

(iii) any negligent or incorrect recording of that interpretation in the search report

(iv) and compensation payments

Maps

1.1 Where relevant, please include a copy of an extract from the public sewer map.

A copy of an extract of the public sewer map is included, showing the public sewers, disposal mains and lateral drains in the vicinity of the property.

1.2 Where relevant, please include a copy of an extract from the map of waterworks.

A copy of an extract of the map of waterworks is included, showing water mains, resource mains or discharge pipes in the vicinity of the property.

Drainage

2.1 Does foul water from the property drain to a public sewer?

Records indicate that foul water from the property drains to a public sewer.

2.2 Does surface water from the property drain to a public sewer?

Records indicate that surface water from the property drains to a public sewer.

2.3 Is a surface water drainage charge payable?

Records indicate that a surface water charge is applicable at this property.

2.4 Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundary of the property?

The public sewer map included indicates that there is a public sewer, disposal main or lateral drain within the boundaries of the property. However, from the 1st October 2011 there may be additional public sewers, disposal mains or lateral drains which are not recorded on the public sewer map but which may further prevent or restrict development of the property.

2.4.1 Does the public sewer map indicate any public pumping station or any other ancillary apparatus within the boundaries of the property?

The public sewer map included indicates that there is no public pumping station within the boundaries of the property.

2.5 Does the public sewer map indicate any public sewer within 30.48 metres (100 feet) of any buildings within the property?

The public sewer map included indicates that there is a public sewer within 30.48 metres (100 feet) of a building within the property.

2.5.1 Does the public sewer map indicate any public pumping station or any other ancillary apparatus within 50 metres of any buildings within the property?

The public sewer map included indicates that there is no public pumping station within 50 metres of any buildings within the property.

2.6 Are any sewers or lateral drains serving, or which are proposed to serve, the property the subject of an existing adoption agreement or an application for such an agreement?

Records confirm that Foul sewers serving the development, of which the property forms part are not the subject of an existing adoption agreement or an application for such an agreement.

The Surface Water sewer(s) and/or Surface Water lateral drain(s) are not the subject of an adoption agreement.

2.7 Has a sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?

There are no records in relation to any approval or consultation about plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain. However, the sewerage undertaker might not be aware of a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain.

2.8 Is the building which is or forms part of the property, at risk of internal flooding due to overloaded public sewers?

The property is not recorded as being at risk of internal flooding due to overloaded public sewers.

From the 1st October 2011 most private sewers, disposal mains and lateral drains were transferred into public ownership It is therefore possible that a property may be at risk of internal flooding due to an overloaded public sewer which the sewerage undertaker is not aware of. For further information it is recommended that enquiries are made of the vendor.

2.9 Please state the distance from the property to the nearest boundary of the nearest sewage treatment works.

The nearest sewage treatment works is Deephams STW which is 2.429 kilometres to the north of the property.

Water

3.1 Is the property connected to mains water supply?

Records indicate that the property is connected to mains water supply.

3.2 Are there any water mains, resource mains or discharge pipes within the boundary of the property?

The map of waterworks indicates that there are water mains, resource mains or discharge pipes within the boundaries of the property.

3.3 Is any water main or service pipe serving, or which is proposed to serve, the property the subject of an existing adoption agreement or an application for such an agreement?

Records confirm that water mains or service pipes serving the property are not the subject of an existing adoption agreement or an application for such an agreement.

3.4 Is the property at risk of receiving low water pressure or flow?

Records confirm that the property is not recorded on a register kept by the water undertaker as being at risk of receiving low water pressure or flow.

3.5 What is the classification of the water supply for the property?

The water supplied to the property has an average water hardness of 108.9mg/l calcium which is defined as HARD by ThamesWater.

3.6 Is there a meter installed at this property?

Records indicate that there is a meter installed at this property.

3.7 Please include details of the location of any water meter serving the property.

Records indicate that the property is served by a water meter, which is located within the property.

Charging

4.1.1 – Who is responsible for providing the sewerage services for the property?

Thames Water Utilities Limited, Clearwater Court, Reading, RG1 8DB is the sewerage undertaker for the area.

4.1.2 – Who is responsible for providing the water services for the property?

Thames Water Utilities Limited, Clearwater Court, Reading, RG1 8DB is the water undertaker for the area.

4.2 Who bills the property for sewerage services?

If you wish to know who bills the sewerage services for this property then you will need to contact the current owner. For a list of all potential retailers of sewerage services for the property please visit www.open-water.org.uk

4.3 Who bills the property for water services?

If you wish to know who bills the water services for this property then you will need to contact the current owner. For a list of all potential retailers of water services for the property please visit www.open-water.org.uk

Trade Effluent

5.1 Is there a consent, on this property, to discharge Trade Effluent under S118 of the water Industry act (1991) into the public sewerage systems?

No.

Wayleaves, Easements, Manhole Cover and Invert levels

6.1 Is there a wayleave/easement agreement giving Thames water the right to lay or maintain assets or right of access to pass through private land in order to reach the Company's assets?

No.

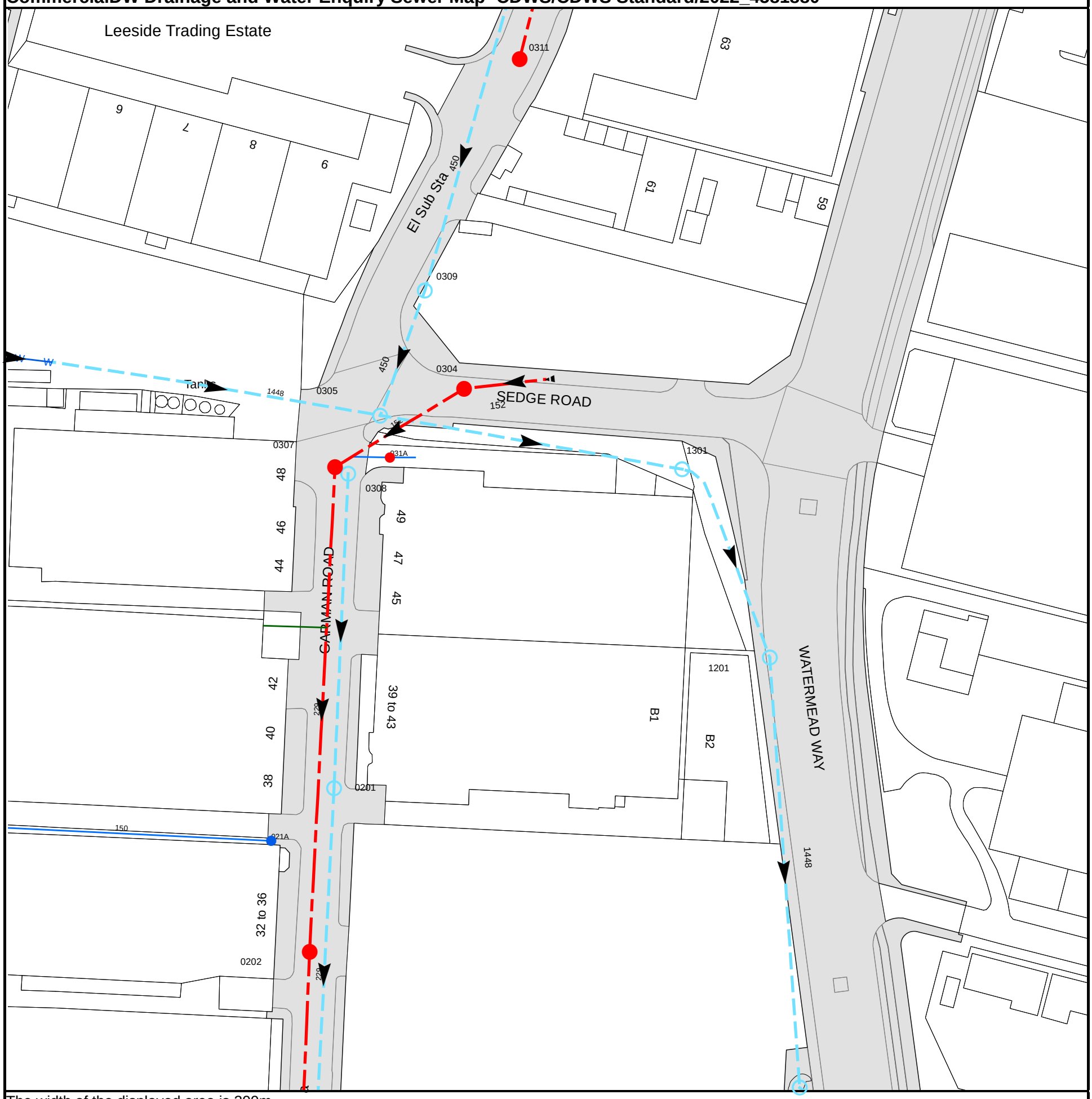
6.2 On the copy extract from the public sewer map, please show manhole cover, depth, and invert levels where the information is available.

Details of any manhole cover and invert levels applicable to this site are enclosed.

Payment for this Search

The charge will be added to the NLIS Account. This search was ordered through National Land Information Services, Russell Square House, 10-12 Russell Square, London WC1B 5LF.

CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2022_4581880



The width of the displayed area is 200m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map (2020) with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0307	9.5	7.98
0308	9.51	8.09
0305	9.26	7.16
031A	n/a	n/a
0309	9.7	7.88
0304	n/a	n/a
0311	10.75	9.26
1301	n/a	n/a
1105	8.54	7.04
0202	9.31	7.84
021A	n/a	n/a
0201	9.37	8.43
1201	8.51	7.08

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Con29DW Commercial Drainage and Water Search - Sewer Key

Public Sewer Types (Operated and maintained by Thames Water)

Foul Sewer: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water Sewer: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined Sewer: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Storm Sewer
- Sludge Sewer
- Foul Trunk Sewer
- Surface Trunk Sewer
- Combined Trunk Sewer
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Vacuum
- Thames Water Proposed
- Vent Pipe
- Gallery

Other Sewer Types (Not operated and maintained by Thames Water)

- Sewer
- Culverted Watercourse
- Proposed
- Decommissioned Sewer
- Content of this drainage network is currently unknown
- Ownership of this drainage network is currently unknown

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Meter
- Dam Chase
- Vent
- Fitting

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Ancillary
- Drop Pipe
- Control Valve
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Inlet
- Outfall
- Undefined End

Other Symbols

Symbols used on maps which do not fall under other general categories.

- Change of Characteristic Indicator
- Public / Private Pumping Station
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Chamber
- Operational Site

Ducts or Crossings

- Easement
- Conduit Bridge
- Subway
- Tunnel

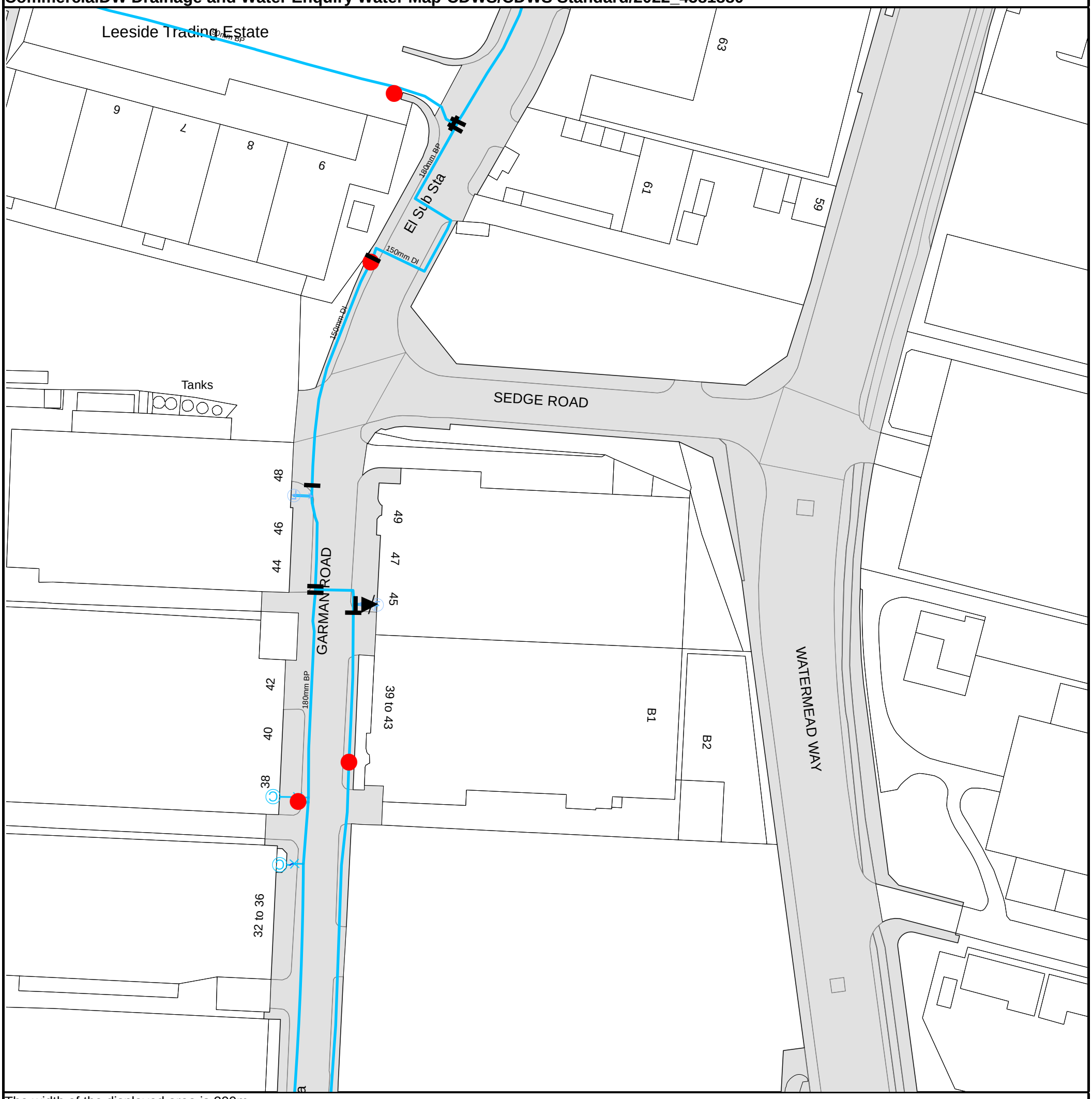
Ducts may contain high voltage cables. Please check with Thames Water.

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plan are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate the direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimeters.
Text next to a manhole indicates the manhole reference number and should not be taken as a measurement.
If you are unsure about any text or symbology, please contact Property Searches on 0800 009 4540.

Thames Water Utilities Ltd, Property Searches, PO Box 3189, Slough SL1 4W, DX 151280 Slough 13
T 0800 009 4540 **E** searches@thameswater.co.uk **I** www.thameswater-propertysearches.co.uk

CommercialDW Drainage and Water Enquiry Water Map-CDWS/CDWS Standard/2022_4581880



The width of the displayed area is 200m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

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Con29DW Commercial Drainage and Water Search - Water Key

Water Pipes (Operated & Maintained by Thames Water)

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Casement: Ducts may contain high voltage cables. Please check with Thames Water.

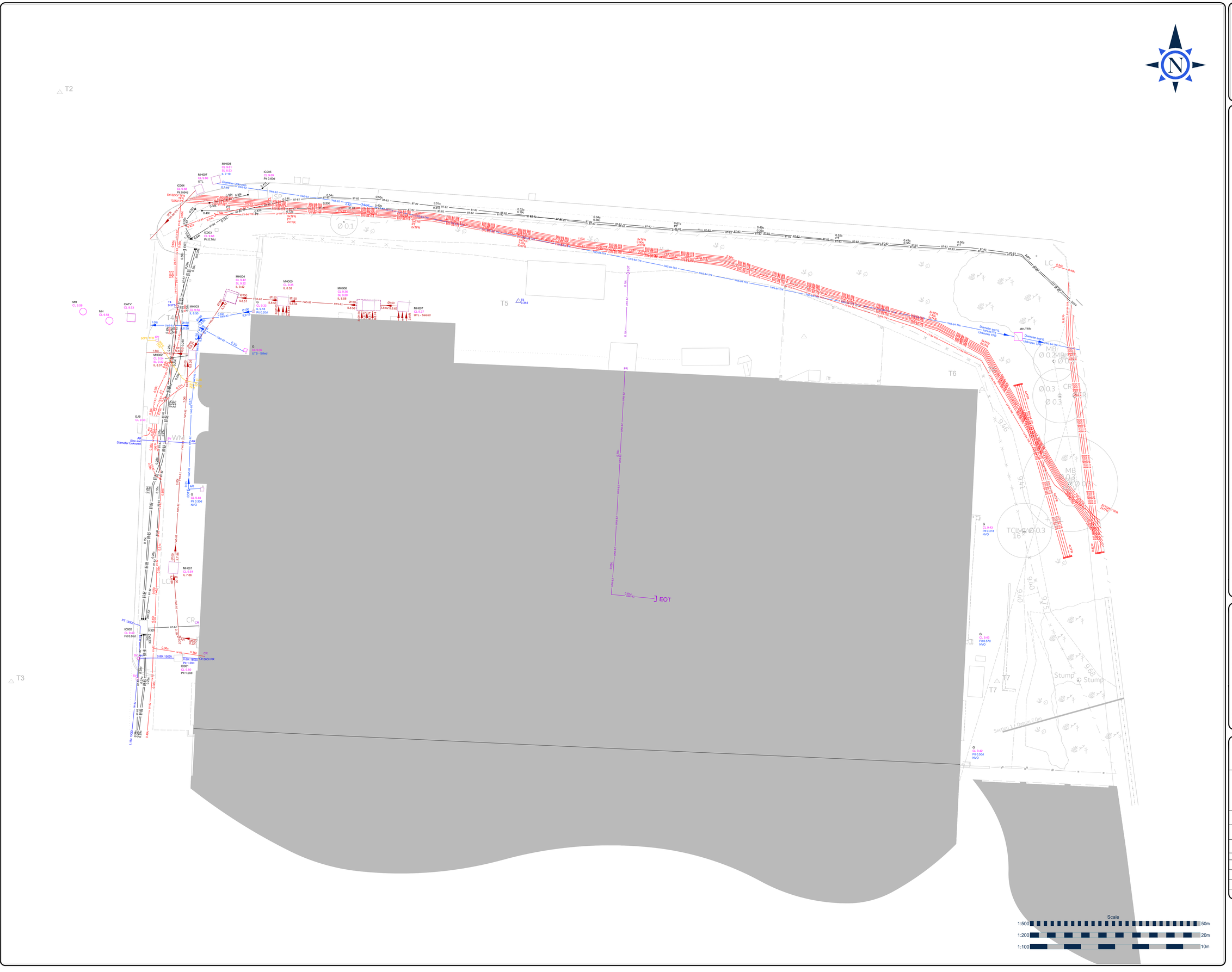
Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indicates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Appendix D

Existing Utilities Survey



Sheet Layout

Legend

AR	Assumed Route	MKR	Marker
AV	Air Valve	MTR	Meter
BD	Backdrop	MW	Monitoring Well
Bol.	Bollard	NVP	No Visible Pipe
BS	Bell Siphon	OH	Overhead
BTIC	BT Inspection Chamber	OA	Overhead Area
CBox	Control Box	OSBM	Ordnance Survey Benchmark
CP	Catchpit	PR	Pipe Riser
CL	Cover Level	PT	Poor Trace
Conc.	Concrete	RE	Rodding Eye
CP	Control Point	RGW	Retaining Wall
CTV	Cable TV	RS	Road Sign
D/Chan.	Drainage Channel	RWP	Rain Water Pipe
DL	Directly Laid	SA	Soakaway
DP	Down Pipe	SL	Soffit Level
DJB	Double Junction Box	SP	Spot Level
EOT	End of Trace	STN	Survey Control Station
EP	Electricity Pole	SV	Stop Valve
ER	Earth Rod	SVP	Soil Vent Pipe
FFL	Finished Floor Level	TBM	Temporary Benchmark
FH	Fire Hydrant	TFR	Taken From Records
FP	Flag Pole	THL	Threshold Level
FP	Flag Position	TK	Tank Vent
G	Gully	TP	Telegraph Pole
G/Run	Gully Run	U/S	Underside
GR	Gas Riser	UL	Uplight
GV	Gas Valve	UTF	Unable to Find
HL	Hand Hole	UTL	Unable to Lift
IB	Illuminous Bollard	UTR	Unable to Roof
IC	Inspection Chamber	UTS	Unable to Survey
IGP	Illuminated Guidepost	UTT	Unable to Trace
IL	Invert Level	VP	Vent Pipe
LBO	Lamp Bracket	VR	Vapour Recovery
LB	Lighting Bollard	WFC	Water Filled Chamber
LC	Lighting Column	WM	Water Meter
LH	Lamphole	WO	Wash Out
LP	Lamppost	WR	Water Riser
MH	Manhole	Ø	Diameter

Pipeline Material Abbreviations

AC	Asbestos Cement	PVC	Polyvinyl Chloride
CI	Cast Iron	RC	Reinforced Concrete
DI	Ductile Iron	S	Steel
HDPE	High Density Polyethylene	SS	Stainless Steel
MS	Mild Steel	VC	Vitrified Clay
PE	Polyethylene	WI	Wrought Iron

Utility Legend

EHV	Extra High Voltage Electricity	FWS	Foul Drainage
HV	High Voltage Electricity	SWS	Surface Drainage
LV	Low Voltage Electricity	CWS	Combined Drainage
SL	Street Lighting	EWS	Effluent Drainage
TS	Traffic Signals		
CATV	Cable Television	O	Offset Fill-Line
CCTV	Closed Circuit Television	V	Vent Line
COM	Communications	F	Fuel Line
BT	British Telecoms	VR	Vapour Recovery
FO	Fibre Optics	G	Gauge Line
GAS	Gas	OIL	Oil Pipe
HPG	High Pressure Gas	WBL	Heating Pipe
IPG	Intermediate Pressure Gas	ED	Empty Duct
W	Water		Chamber Extents
UNK	Unknown Asset		Approx. CE

Utility Location Depth Explanation

The located depth of a service obtained during a survey may be received to 3 different locations;

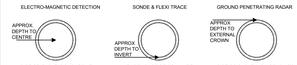
Center (c); EML Electromagnetic locating provides a depth to the center of the magnetic field received which is also the center of the pipe or cable.

Invert (i); Depths obtained during drainage surveys or using Flexi Trace or Sonde are taken at the invert of a pipe.

Top (t); GPR Ground Penetrating Radar provides depths to the top or crown of a pipe.

LV 0.30c SWS 0.30i UNK 0.30t

The letter following the depth indicates to where the depth has been measured to.



Utility Block Legend

EOT End of Trace

Capped Capped Ducts

TFR End of Service End of Record

PAS 128 Quality Level Classifications

Quality Level labeling of located utilities with a classification code allows the user of the information to understand clearly how it was obtained and then apply appropriate confidence and reliance upon it. Project risks relating to underground utilities can then be properly managed.

QL A Information is obtained by visually confirming the utility location, type, position and size. Services can be visually proven by way of Non destructive digging (NDD) using Vacuum Excavation or hand digging techniques to expose the buried service. Once accurately surveyed tolerances for a QL-A classification are: +/- 50mm of given depth and +/- 25mm horizontally.

QL B1 Information is obtained using Electromagnetic Pipe & Cable locators EML, Sonde or Flexi trace and Ground Penetrating Radar GPR equipment. In order to achieve a B1 classification at least two methods must accurately locate and agree on a buried service location. Once accurately surveyed tolerances for a QL-B1 classification are: +/- 15% of given depth and +/- 150mm horizontally.

QL B2 Information is obtained using Electromagnetic Pipe & Cable locators EML, Sonde or Flexi trace and Ground Penetrating Radar GPR equipment. In order to achieve a B2 classification one method must accurately locate a buried service location. Once accurately surveyed tolerances for a QL-B2 classification are: +/- 40% of given depth and +/- 250mm horizontally.

QL B3 Information is obtained using Electromagnetic Pipe & Cable locators EML, Sonde or Flexi trace and Ground Penetrating Radar GPR equipment. In order to achieve a B3 classification one method may indicate a possible position for a service location however due to possible interference or poor results no depth can be achieved. Once accurately surveyed tolerances for a QL-B3 classification are: no given depth and +/- 500mm horizontally.

QL B4 Information is has been unable to be located using Electromagnetic Pipe & Cable locators EML, Sonde or Flexi trace and Ground Penetrating Radar GPR equipment but is believed to exist until proven otherwise. This type of information could also be associated with assumed routes and Taken from records. There are no design tolerances associated with a B4 quality level and information should be treated with caution.

QL C Information is collected by correlating the survey of visible surface features such as marker plates, manholes or trench scars with existing drawing or record information to enable the approximate position of a utility to be determined. There are no design tolerances associated with a QL-C quality level.

QL D Information is the most basic level of Utility information derived from existing drawing and record information . This method should always be treated as an indication of the presence of a service and should not be used for design.

Drawing Notes

Utility depths and levels shown are in meters.

Pipe sizes and materials which cannot be obtained by visual survey are taken from record drawings or marker plates where available.

Cable routes shown as a single line may actually consist on many cables please refer to annotated configuration details where provided.

Drainage pipe sizes and invert levels have been determined without man entry into chambers. Every effort has been made to correctly obtain this information however accuracy is dependant on the visibility of the service.

For all equipment specifications, site procedures and limitations encountered on this project please see the survey report.

Coordinates and Levels are derived from Ordnance Survey datum OSGB36 through a series of GNSS RTK Observations carried out at survey control station T1 and orientated through station T2

Detection Disclaimer: Electromagnetic locating techniques as well as Ground Penetrating Radar have been utilized in the location of underground services. These results are non infallible and a NDD non destructive process should be carried out to confirm service identification positions and particularly depths where these are critical. Although all reasonable effort has been made in the locating and mapping of underground services the complete extents of this Utility survey information cannot be guaranteed.

Client Logo:

BROWNFIELD SOLUTIONS LTD

Project Address:
45 - 47 Garmen Road
London

Project Title:
PAS128 QL-B M2 Utility Mapping Survey

Surveyor	Drawn	Checked	Survey Date:	Scale:
ER	KF	DT	23/02/2022	1:100 @ A0

Project Number:	Sheet No:	Revision:
UM22-1202-BSL	1 OF 1	1

Revision	Revision Notes	Date
1	Drawing revised following removal of LV TFR through building as requested by Brownfield solutions	14-03-22

Utility MAPPING
0800 024 UMAP (8627)
www.u-map.co.uk info@u-map.co.uk

Appendix E

Greenfield Runoff Calculation

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Oliver Chard
Site name:	24318
Site location:	Shurgard Tottenham

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.60429° N
Longitude:	0.05073° W
Reference:	4281858536
Date:	Jun 07 2022 13:51

Runoff estimation approach IH124

Site characteristics

Total site area (ha): .22

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	617	617
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.35	0.35
1 in 1 year (l/s):	0.29	0.29
1 in 30 years (l/s):	0.8	0.8
1 in 100 year (l/s):	1.1	1.1
1 in 200 years (l/s):	1.29	1.29

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

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Appendix F

BGS Borehole Record

Project: [illegible]

Client: [redacted]

Engineer: [redacted]

Contractor: [illegible]

Ground Level: [illegible] m.D.

Drilling Method: [illegible]

Hole No: BH1

Sheet: [illegible]

Job No: 10967

WATER				STRATA				SAMPLES, DEPTH, SPT TEST				LAB TESTING						OTHER TESTS AND NOTES
Strike Water Depth	Water Level Elapsed Time	Water Level Elapsed	[illegible]	Description	Legend	[illegible]	Level m	Depth m	Type & No.	Blows/ Penetration	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

Abbreviations

Additional Info

Legend

Symbols / Abbreviations

Date: [illegible]

Logged: [illegible]

Checked: [illegible]

Page [illegible]

Appendix G

Geo-Environmental Assessment

BROWNFIELD SOLUTIONS LTD

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

SHURGARD UK

Garman Road, Tottenham

Phase II Geo-Environmental Assessment Report

SRP/M4993/10981

April 2022

EXECUTIVE SUMMARY	
Location and Brief Site Description	The site is located off Garman Road, Tottenham, N17 0UR. It is situated approximately 12 km north-east of London City Centre, centred on National Grid Reference 535091, 191308. The site is occupied by a factory unit and small yard area.
Ground Conditions	Generalised ground conditions from the ground investigation comprise (top down): • Made ground generally comprising gravelly clay from ground level to between 0.90m and 1.20m bgl. • Natural superficial deposits comprising clay and gravel proven to depths between 2.00m and 3.60m bgl. • Groundwater recorded in WS04 at 2.60m bgl.
Human Health - Soils Contamination	• No exceedances of heavy metals, PAHs, TPHs, BTEX or MTBE compounds. • Chrysotile fibres (loose fibres) detected in one sample of made ground. • Risk to human health is considered to be low.
Controlled Waters – Surface and Groundwater Contamination	• Risk to controlled waters is considered to be low.
Ground Gas	Ground gas monitoring is ongoing, and a full assessment will be undertaken on completion of the scheduled monitoring. This site is currently categorised as CS-1.
Outline Remedial Strategy	No specific remedial measures are considered necessary at the site at this stage.
Foundations and Floor Slabs	For the anticipated point loads from an assumed steel frame, shallow pad foundations are considered to be the most suitable foundation solution, with a 1m^2 pad at a depth of 2.0m within the gravel strata providing a safe bearing capacity of 500kN/m^2, keeping total and differential settlement within acceptable limits. Strip foundations may be utilised to support external masonry placed within the natural gravel strata at a minimum depth of 2.00m bgl, for a 0.6m wide foundation an allowable bearing capacity not exceeding 500kN/m2 should be assumed for the gravel. If the proposed loads are higher, or if the under croft parking is proposed at basement level, then deeper exploratory holes from further site investigation will be required to inform a deep foundation solution. Suspended floor slabs may be adopted however, ground bearing floor slabs may be considered more suitable.
Concrete Classification	DS-1 AC-1s conditions prevail in made ground and clay. DS-1 AC-2z conditions prevail in gravel.
Highways Design	Made Ground CBR – <2% Superficial Strata CBR – cohesive/fine soils– 2% Superficial Strata CBR – granular/coarse soils– 20-60% The above should be confirmed by in-situ testing at formation level by a specialist geotechnical engineer during construction.
Sustainable Drainage Systems (SUDS)	Drainage to soakaways is considered potentially suitable for this site. However, it is likely to require constructing within deeper more permeable strata or siting away from areas where the low permeability clays are present at shallow depth.
Further Work	The following further works will be required to progress to the construction phase: • Completion of ground gas monitoring programme. • Issue gas assessment / update gas assessment within this report. • If higher structural loads are anticipated than discussed in 7.3, or if basement excavation is considered, then deeper exploratory holes will be required to confirm foundation design. ○ Comprising: Cable Percussive boreholes to increase coverage, allow deeper piled foundation design and increase confidence of potential shallow design. • Demolition Asbestos survey. • Detailed foundation design by a structural engineer, including foundation zonation plan and depth schedule.

This executive summary should be read in conjunction with the full report, reference SRP/M4993/10981 and not as a standalone document.

PROJECT QUALITY CONTROL DATA SHEET

Site Name:	Garman Road, Tottenham		
Document Name:	Phase II Geo-Environmental Assessment Report		
Reference:	SRP/M4993/10981		
Status:	-	28/04/2022	Interim.

Issued By:	Client:	Engineer:
Brownfield Solutions Ltd Unit 5 Alfred Court Saxon Business Park Stoke Prior Bromsgrove Worcestershire B60 4AD Tel: 01215 729014 brownfield-solutions.com	Shurgard UK Ground Floor Egerton House Baker Street Weybridge KT7 0SR	
	Contact: Mr D Ross	Contact:

Written by:	Checked by:	Approved by:
S Piercy	J Wheaton	D M Gates
BSc (Hons) MSc	BSc (Hons) FGS	MGeoscience FGS
Graduate Project Engineer	Senior Project Engineer	Senior Project Engineer

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DRAWINGS

Drawing Number	Rev	Title
UK00- Tottenham Garman Road- UM Plan- SK02	-	Proposed Development Layout Plan
M4993/01	-	Site Location Plan
M4993/02	-	Site Features Plan
M4993/04	-	Exploratory Hole Location Plan

APPENDICIES

Appendix	Title
Photographs	Site Works Photographs
Appendix A	BSL Methodology and Guidance
Appendix B	Exploratory Hole Logs
Appendix C	Chemical Testing Results
Appendix D	Geotechnical Testing Results
Appendix E	Monitoring Results

1.0 INTRODUCTION

1.1 Context

This report describes a Phase II Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for Shurgard UK on a site off Garman Road, Tottenham and has been completed in general accordance with the following guidance:

- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
- BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.
- BS5930: 2015+A1:2020 Code of Practice for Ground Investigations.
- BS EN 1997-1 :2004+A1 :2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.
- BS EN 1997-2 :2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.

Definitions of terms and acronyms used within this report is presented in Section 10.0.

1.2 Proposed Development

The proposed development is for a commercial end use comprising a six-storey steel framed storage unit building and associated internal/covered car park areas as shown on the proposed development plan, drawing 'UK00-Tottenham Garman road-UM Plan-SK02' provided to BSL by the client.

1.3 Previous Reports

This report should be read in conjunction with the Brownfield Solutions Ltd Phase I Desk Study Assessment Report (SRP/M4993/10841) issued in March 2022.

1.4 Objectives and Scope

The objectives of this report are to determine the geo-environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime.

This report has been produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Following the Phase I Desk Study referenced above, an exploratory intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The exploratory investigation was undertaken using window sampling, gas and groundwater monitoring and laboratory chemical and geotechnical testing, with reporting on the findings.

1.5 Limitations

This assessment has been prepared in accordance with the relevant current legislative framework, guidance and risk assessment methodology as outlined in Appendix A. BSL is not liable for any subsequent changes in the guidance and legislation.

The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information upon which it has relied.

BSL have used reasonable skill, care, and diligence for the investigation of the site and the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been considered by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, Shurgard UK. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

The investigation carried out on the site has been conducted to provide the best information on the ground conditions within site access and budgetary constraints. The inherent variation of ground conditions allows only for definition of the actual conditions at the locations and depths of exploratory locations at the time of the investigation. Different ground conditions may exist that have not been identified within this investigation.

The recommendations in this report assume that ground levels will remain as existing, unless stated otherwise within the report. If there is to be any re-profiling (e.g., to create development platforms or flood defences) then the recommendations may not apply.

The groundwater results described are only representative of the dates on which they were recorded, and levels may vary seasonally (e.g., due to changes in weather).

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Although every effort has been made to position exploratory holes in the least sensitive areas of the site, exploratory hole positions were located approximately as part of this investigation and no guarantee can be given as to their accuracy. Consideration should be given to the possibility that exploratory holes excavated as part of this investigation and indeed any previous ground investigation work by others may be encountered beneath or within the influence of individual foundations. BSL cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Where it has not been possible to reasonably use an EC7 compliant investigation technique, a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

The chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required, unless otherwise stated.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g., Japanese knotweed), this report does not constitute a formal survey of these potential issues.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

2.0 THE SITE

2.1 Location

The site is located off Garman Road, Tottenham, N17 0UR. It is situated approximately 12 Km north-east of London City Centre, centred on National Grid Reference 535091, 191308 as shown on the Site Location Plan, Drawing No. M4993/01.

2.2 Site Description

The main site features and potential issues identified are detailed below and are shown on the Site Features Plan, Drawing No. M4993/02.

Feature	Description
Site Area	Approximately 0.3 hectares.
Site Access	Access to the site is gained off Garman Road to the west of the site.
Current Land Use and Site Features	The site comprises an existing commercial unit with a yard, comprising concrete hardstanding. The building occupies the majority of the site and borders another unit to the south of the site. Within the building, the flooring is concrete. There are multiple manhole covers recorded in the yard area. The toilets and welfare facilities are near the front of the building bordering the road and it appears that the services associated with these run in through the front of the building. The building is no longer used as a furniture works; however, the equipment is still present. The majority of the equipment comprises large pieces of machinery e.g., edge bander, panel saw and CNC machines.
Potential Sources of Gross Contamination	No evidence of gross contamination was observed on site.
Vegetation	There are semi-mature trees with mixed vegetation on the eastern boundary of the site. There is a mix of vegetation along the north boundary. This includes nettles and ivy.
Topography	The site is generally flat. An embankment is present off site to the east and Sedge Road is elevated above current site levels.
Site Boundaries	Chain link fence bounds the site to the north and east. The south of the site is bound by a party wall inside the factory. Garman Road bounds the site to the west. Where the chain link fence has been broken, temporary fencing has been placed behind. Some gaps in these fences do exist.
Surrounding Area	The site is set within a commercial area, bordered by a vehicle repair yard to the north, a large electricity transformer station to the east, an additional commercial unit adjoined to the south and an alcohol works and laundry to the west.

3.0 SUMMARY OF PREVIOUS REPORTS

3.1 BSL Desk Study

A summary of the relevant points from the Desk Study completed by Brownfield Solutions Ltd (reference SRP/M4993/10841) is presented below:

- The site has had previous uses including a paper works and cardboard works.
- The site has been set within a wider industrial area over time. Nearby off-site sources include an alcohol works and laundry.
- Geology comprises superficial Enfield Silt Member (Unproductive) over London Clay (Unproductive). However, nearby deposits of alluvium recorded on BGS mapping may be present beneath the Enfield Silt Member, which are associated with the Secondary (A) Aquifer located 30m to the east of the site.
- No faults are present within an influencing distance of the site.
- The nearest watercourse is the Pymme's Brook circa 230m to the east of the site.
- The site is located in a Zone 2 floodplain.
- The site is indicated to lie within a Source Protection Zone, Zone II, Outer Catchment.
- The risk to human health is considered to be low to moderate. Due to the proposed development, there are not considered to be any pathways for direct contact or ingestion, and therefore only human health risks associated with gases and vapours were assessed.
- The risk from ground gas is considered to be moderate due to potential made ground on-site and the presence of alluvium in close proximity to the site. The site is not located in an area requiring radon protection measures.
- The risk to controlled waters is low.
- The site is located in the UXO high risk zone according to UXO screening mapping provided by Zetica. However, a detailed UXO assessment summarised below for the site concluded that the site is low risk.
- Recommendations were for an appropriate Phase II ground investigation to be carried out to confirm the identified risks and obtain information for preliminary design.

3.2 EOD Detailed UXO Desk Study

A summary of the relevant points from the detailed UXO Desk Study completed by EOD (reference EOD/22/22061/DTS) is presented below:

- The nearest recorded bomb strike is over 300m from the site.
- No bomb damage was recorded.
- No reconstruction was noted.
- No military usage was noted.
- The overall risk is low.
- Site Specific Unexploded Ordnance Awareness Briefings to all personnel conducting intrusive works was recommended.

4.0 METHOD OF INVESTIGATION

4.1 Objectives

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation was undertaken as per the recommendations of the Phase I Desk Study Assessment.

The aim of the fieldwork was to:

- Investigate ground conditions on the site and the potential need for detailed investigation.
- Install standpipes to allow future monitoring.
- Assess the potential contamination on the site and obtain samples for contamination screening.
- Assess the potential impact of any contamination on controlled waters.
- Obtain geotechnical information on the ground conditions at the site for preliminary foundation design purposes.
- Give an assessment of the geo-environmental risks associated with redevelopment of the site.

4.2 Site Works

The following site works have been undertaken as part of the intrusive investigation on 21st and 22nd March 2022.

Method	No.	Range Depths (m bgl)	Purpose
Window sample boreholes – Modular Tracked WS rig	5	2.00 – 3.60	Establish general ground conditions on site. Allow Standard Penetration Tests (SPTs) to be carried out and obtain samples for contamination testing. Installation of ground gas monitoring wells.
Hand Excavated Pit	1	1.00	Obtain samples for contamination and geotechnical testing.

The hand dug pit was due to be drilled by window sampling but could not be progressed due to an obstruction of the inspection pit at 1.00m bgl. Samples were obtained from the arisings and the pit was backfilled.

The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No. M4993/04, which is enclosed. The exploratory holes were positioned to gain the best coverage possible by the BSL engineer on site. Note that the slow concrete coring limited the positions of exploratory holes.

The exploratory hole logs are presented in Appendix B.

The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with the following guidance:

- BS 5930:2015+A1:2020 Code of Practice for Site Investigations.
- BS EN 14688-1:2018 Geotechnical Investigation and Testing – Identification and classification of soil.

4.3 Sampling

During the drilling of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing. They were stored and transported in general accordance with BS 10175:2011+A2:2017.

The type of sample was dependent upon the stratum and the purpose of analysis in accordance with current environmental guidance.

The distribution of samples taken across the site is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

Type	Number
Environmental (ES)	20

4.4 Laboratory Testing

As part of the initial assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

Potential contamination was found on site in the form of made ground and hydrocarbon odours therefore the following suite of determinands were chosen to screen for potential site impacts at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Soil Suite: Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter (SOM) and pH.	8
Petroleum Hydrocarbons (TPH CWG) up to C44 inc BTEX and MTBE.	4
Asbestos Screen.	8
Volatile Organic Compounds (VOCs) by GC-MS.	3

The Chemical Laboratory Testing Results are presented in Appendix C.

Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' and BS EN ISO 17892- Parts 1-12:2018 'Geotechnical investigation and testing. Laboratory testing of soil.'

The following tests were scheduled for geotechnical purposes:

Description	No of Samples
Atterberg Limits including Water Content.	4
SD1 BRE Full Suite.	4

The Geotechnical Laboratory Testing Results are presented in Appendix D.

4.5 Monitoring

Ground gas and ground water monitoring standpipes were installed in five boreholes and subsequently two monitoring visits have been undertaken out of three proposed as part of the current scope, in line with the recommendations of CIRIA C665. All gas monitoring was undertaken using GA 5000 infrared gas meter with integral electronic flow analyser and a Photo Ionisation Detector (PID). The Desk Study completed by Brownfield Solutions Ltd (reference SRP/M4993/10841) suggested six monitoring visits were to be carried out in accordance with CIRIA C665 guidance however monitoring may be concluded early if the dataset shows consistent data including across periods of falling pressure.

Flow measurements on each standpipe (l/hr) were taken. Measurements of the percentage volume in air (%v/v) of oxygen (O_2), carbon dioxide (CO_2) and methane (CH_4) were recorded in addition to the percentage Lower Explosive Limit (%LEL) of methane (Note: 100% LEL equates to 5% by volume), the atmospheric pressure (mb) and average temperature during the visit (°C).

Standpipes were constructed in general accordance with the relevant guidance. A summary of the installation construction is presented in the table below:

Location	Internal Diameter Pipe	Response Zone (m bgl)	Targeted Strata	Purpose
WS01	35mm PVC	1.00 – 3.00	MADE GROUND, CLAY, and GRAVEL	Ground Gas
WS02	35mm PVC	0.75 – 2.00	MADE GROUND and GRAVEL	Ground Gas
WS03	35mm PVC	0.75 – 2.00	MADE GROUND, CLAY, and GRAVEL	Ground Gas
WS04	35mm PVC	0.60 – 3.00	MADE GROUND, CLAY, and GRAVEL	Ground Gas
WS05	35mm PVC	0.60 – 3.00	MADE GROUND, CLAY, and GRAVEL	Ground Gas

The gas monitoring visits recorded peak and steady state conditions. Peak results are those that occur on opening the valve on the borehole tap. Steady state conditions are those that occur a period of time afterwards when the initial (accumulated) gases have been purged from the borehole.

Interim ground gas monitoring results are presented in Appendix F of this report.

5.0 GROUND CONDITIONS

5.1 Summary

A brief summary of the ground conditions encountered is presented in the table below:

Stratum	Range Depths - Top (m bgl)	Range Depths - Base (m bgl)	Range Thickness' (m)	Brief Description
Made Ground	GL	0.90 – 1.20	0..90 – 1.20	CONCRETE, MADE GROUND: Dark brown gravelly clay.
Natural Superficial Strata - Cohesive	0.90 – 1.20	1.70 – 2.00	0.60 – 0.90	Slightly gravelly CLAY.
Natural Superficial Strata - Granular	1.10 – 2.00	2.00 – 3.90	0.30 – 1.90	Sandy / clayey GRAVEL.

Details are provided in the logs in Appendix B and the individual strata are described in the sections below.

5.2 Made Ground

A concrete layer was present across the site. This concrete was cored inside the building and was observed from ground level to between 0.14m and 0.21m bgl. Small round single pieces of metal reinforcement were observed throughout the concrete cores. Concrete was also observed in the yard and was encountered from ground level to between 0.12m and 0.15m bgl in this area.

Made Ground – General
Made ground was encountered within all the exploratory holes across the site and was observed from ground level to depths between 0.90m and 1.20m bgl. The base of the made ground was not observed in HP01 as the hole was terminated due to a possible service.

The composition of the made ground was fairly consistent across the site. The majority comprised dark brown gravelly clay. The gravel generally consisted of brick, chert, concrete, pottery with occasional coal and rare slate.

In WS03, made ground of light brown and grey sandy gravel with medium cobble content was encountered between 0.12m and 0.32m bgl between the concrete and clay made ground.

5.3 Natural Superficial Strata

Two layers of natural superficial strata were encountered beneath the made ground. The first layer encountered was generally a firm clay with varying amounts of sand and gravel minor constituents. This layer was not encountered in WS02, and no natural strata was encountered in HP01.

Beneath the made ground and natural clay, where present, gravel was encountered from between 1.10m and 2.00m bgl to the base of each hole. The gravel had varying amounts of clay and sand within it. At the base of WS01 between 3.50m and 3.60m bgl was a band of black slightly clayey gravel with a slight hydrocarbon odour. The gravel was generally fine to coarse of chert.

5.4 Solid Geology

The solid geology of the London Clay is not thought to have been encountered in this investigation. Previous reports have discovered a BGS borehole (Ref: TQ39SW228) 230m south west of the site which encountered the London Clay at approximately 5.30m bgl.

5.5 Groundwater

The depths to groundwater and locations present are shown in the table below:

Location	Depth During Site Works (m)	Depth During Monitoring Period (range) (m)
WS01	-	2.09
WS02	-	1.97
WS03	-	1.91
WS04	2.60 - Small seepage	2.10
WS05	-	2.21

5.6 Observations

Contamination
During the works undertaken by BSL, observations for both visual and olfactory evidence of contamination were undertaken.

In WS01 a slight hydrocarbon odour was noted from 3.50m to the base of the hole at 3.60m.

Stability of Boreholes
The borehole sidewalls were generally stable and window sampling progressed without the need to install casing. However, a collapse occurred from 3.60m bgl up to 3.00m bgl in WS01.

6.0 TEST RESULTS

6.1 Geotechnical Laboratory Test Results

Plasticity Index Analysis
Plasticity index results ranged between 30% and 67% indicating the cohesive soils to be of low plasticity. Associated water contents ranged between 23.5% and 46.2%.

After modification of particle size in accordance with BRE 240 the modified plasticity indices are in the range 30% to 67% indicating the cohesive soils to be of medium to very high-volume change potential.

6.2 Aggressive Ground Conditions – Geotechnical Chemical Testing

The test results for the assessment of aggressive ground conditions are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

6.3 In Situ Geotechnical Testing

In Situ Standard Penetration Tests
Standard Penetration Tests (SPTs) were carried out within the window at regular 1.0m intervals. The results of the individual blows and the N-values are recorded on the Exploratory Hole Logs in Appendix B.

All SPT N values are uncorrected. Density and strength descriptors are reported in accordance with the guidelines stated in BS 5930:2015+A1:2020, incorporating requirements of BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and BS EN ISO 14689-1:2003.

6.4 Geo-Environmental Testing

Chemical Laboratory Testing
The chemical test results for soils are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

Photo-Ionisation Detection (PID) Monitoring - Soils
PID head space monitoring was undertaken on all environmental soil samples taken during the ground investigation at the site, the results are recorded on the exploratory hole logs.

All of the samples tested recorded PID results of between 0.0ppm and 0.1ppm, indicating that no significant volatile vapour contamination was present within the soils sampled.

Ground Gas Monitoring
Ground gas monitoring installations have been monitored on 2 occasions to date out of 3 visits scheduled. The results are presented in Appendix F and are summarised and assessed within Section 8.0 of this report.

7.0 GEOTECHNICAL ASSESSMENT

7.1 Ground Model Summary

The ground conditions can be summarised as below (top down):

- Made ground generally comprising concrete surfacing over gravelly clay from ground level to between 0.90m and 1.20m bgl.
- Natural superficial deposits comprising clay below the made ground proven to depths between 1.70m and 2.00m bgl, with the exception of HP01 and WS02, where no clay was recorded.
- Natural superficial deposits comprising gravel from between 1.10m and 2.00m bgl proven to depths between 2.00m and 3.90m bgl.
- Groundwater levels in WS04 at 2.60m bgl during site works.
- Post site works monitoring levels ranging between 1.91m and 2.21m bgl.

Made ground was encountered to depths of between 0.90m to 1.20m bgl and comprised predominantly gravelly clay with brick, concrete, occasional pottery. The natural geology at the site was considered likely to comprise the Enfield Silt Member, which according to information on the BGS website varies from a silt to a clay and is commonly yellow brown.

Deposits consistent with the Enfield Silt Member comprising firm clay were encountered to depths of between 1.70m and 2.00m bgl within all locations with the exception of WS02 where it was absent.

Gravels interpreted as the Kempton Park Gravel were encountered underlying the clay, with the exception of WS02 where the gravels were directly underlying the made ground, to depths of between 2.00m and 3.60m bgl. The gravels comprised an orange to brown sandy to clayey gravel.

The site appears to have been cut to form a level development at some point, as there is an embankment 2-3m above the current site levels on the eastern boundary of the site along Watermead Way. Levels also increase northwards as Sedge Road is elevated above current site level.

The absence of the deposits interpreted as the Enfield Silt Member within WS02 could potentially be due to the levelling of the site as discussed above or due to historic development on the site e.g., the construction of the buildings.

According to the Environment Agency the site is situated on unproductive deposits (Enfield Silt Member) however the Kempton Park Gravel formation outcrops 30m east of the site is also considered to be present beneath the site and is classified as a Secondary (A) Aquifer.

The encountered ground conditions indicate that there is a thin layer of low permeability deposits present beneath the made ground which is likely to offer some degree of protection to the possible water bearing deposits underlying the site.

London Clay has been encountered in a nearby BGS boreholes at around 5.30m bgl, beyond the maximum depth of this investigation.

The site lies within a Zone 2 floodplain. Specialist flood risk advice should be sought, and this will require consideration when setting the finished levels for the site.

7.2 Design Soil Parameters

The relevant test results from the prior section have been evaluated to derive geotechnical soil parameters for the site in the following section.

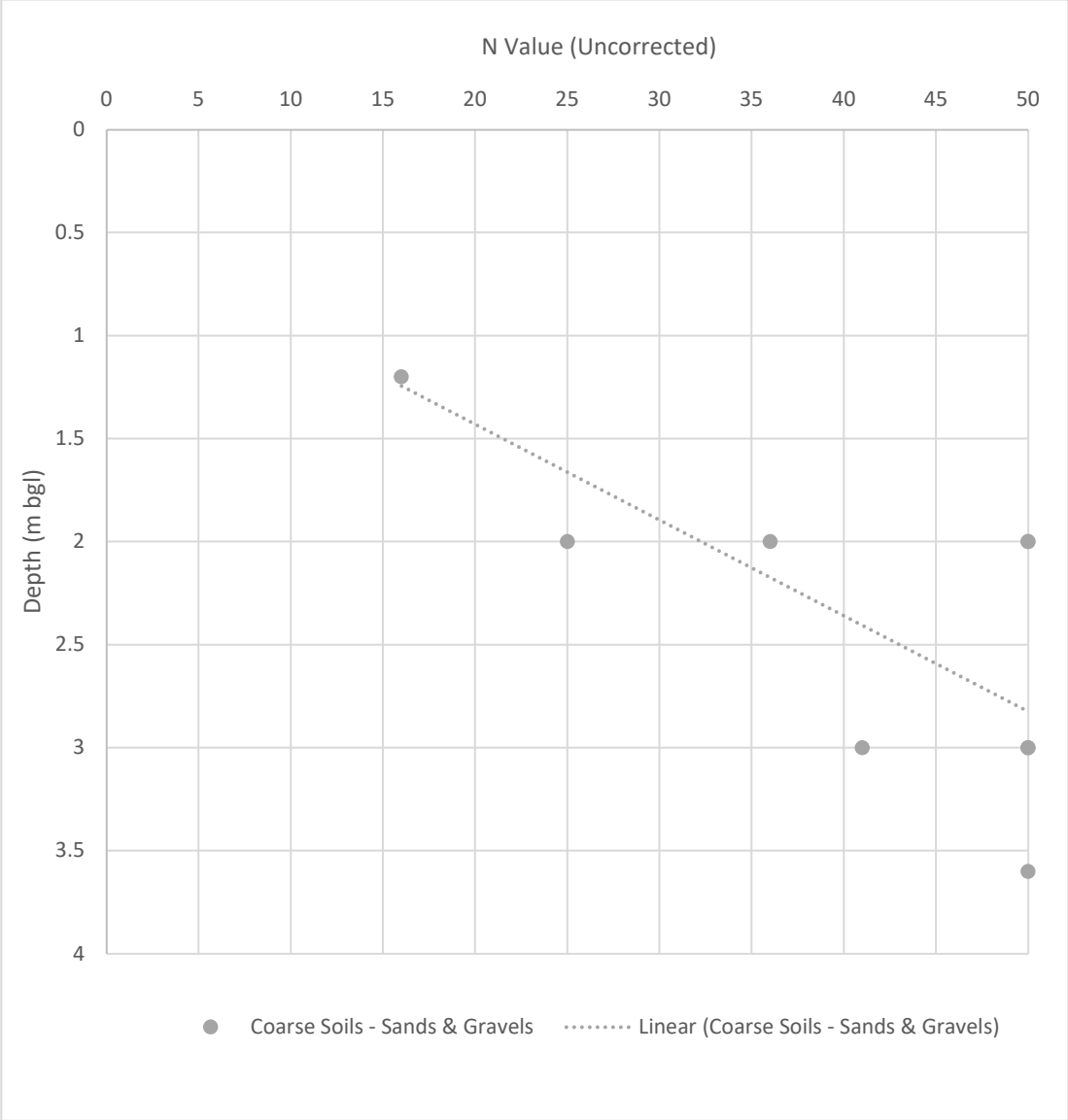
For cohesive (fine) soils, the equivalent approximate undrained shear strengths (Cu) and equivalent approximate coefficients of volume compressibility (mv) have been calculated from the recorded SPT N values, adopting f1 and f2 values respectively, based on the correlation of Stroud (1975) and the 'average' plasticity.

The f1 and f2 values of 4.3 and 0.45 respectively have been selected to provide a conservative assessment of the ground bearing capacity.

For granular (coarse) soils, the angle of shearing resistance (ϕ') has been derived from the uncorrected SPT N value data and the correlation of Peck (1967).

A depth (m bgl) vs derived shear strength (Cu) relationship has been calculated. There is limited data for the cohesive deposits as they were only observed in a thin layer and were not observed across the whole site, therefore a graph has not been produced. The SPT data for the cohesive deposits shows an undrained shear strength of 20kPa is achieved at 1.20m bgl. .

A depth (m bgl) vs SPT N value graph is provided below to provide a profile of the granular materials underlying the site.



The above graph shows a general increase in soil density as depth increases.

Characteristic Values

Characterisation of the geotechnical parameters above has been undertaken to obtain characteristic values, which are a cautious estimate of the values affecting the occurrence of the limit state.

The characteristic value for undrained shear strength (Cu) in cohesive deposits at 1.20mbgl is interpreted to be 20kN/m^2, however this is not recommended as a founding stratum due to its inconsistent presence.

The characteristic SPT N value in the granular deposits at 2.00m bgl is interpreted to be 30. Therefore, the characteristic ϕ' value at 2.00m bgl is interpreted to be 36° for Ultimate Limit State conditions. The characteristic SPT N value in the granular deposits at 3.00m bgl is interpreted to be 41, which is the lowest recorded N value, with the other two locations refusing at this depth (N value 50+). Therefore, the characteristic ϕ' value at 3.00m bgl is interpreted to be 38° for Ultimate Limit State conditions.

7.3 Foundations

The development will comprise a commercial end use comprising a six-storey steel framed storage unit building and associated internal/covered car park areas and is considered to be classed as Geotechnical Category 2 in accordance with Eurocode 7.

Preliminary design by calculation has been undertaken to determine the design resistance of the bearing strata in the following section. No proposed structural loads were available at the time of writing; therefore, the following recommendations are provisional and should be reviewed at the detailed design stage. However, for the purpose of this assessment a typical load of 50kN has been assumed per storey.

Shallow Foundations – Pad
No details of the foundation design have been provided, however assuming a steel frame it is assumed the majority of the load will be put through these point loads, making a pad type foundation applicable. As a guide the allowable bearing capacity for a Pad foundation with an area of 1m^2 has been calculated. This is assumed to have been placed within the natural gravel strata at a minimum depth of 2.00m bgl.

At this depth, an allowable bearing capacity not exceeding 500kN/m^2 should be assumed for the gravel. This adopts a factor of safety of 3 and limits settlements to within acceptable limits (<25mm).

If the pad foundation is placed at 3.00m bgl an allowable bearing capacity not exceeding 1000kN/m^2 should be assumed for the gravel. This adopts a factor of safety of 3 and limits settlements to within acceptable limits (<25mm).

The limiting factor for the safe bearing capacity is keeping settlement within 25mm. For foundations bearing within the gravels, the depth to the underlying London Clay is estimated to be circa 5m bgl based on BGS boreholes, and presence of shallow groundwater is a controlling factor. The current investigation has not encountered the London Clay; therefore, it is recommended for initial design purposes pending additional investigation to investigate the depth to the London Clay that a maximum bearing capacity of 500kN/m^2 for strip foundations is used.

Shallow Foundations – Strip
No details of the foundation design have been provided. However, it is envisaged that structural masonry skin of the building may be supported upon a strip foundation, as a guide the allowable bearing capacity for a shallow strip foundation, 0.6m wide has been calculated, founding within the natural gravel strata at a minimum depth of 2.00m bgl.

At this depth, an allowable bearing capacity not exceeding 500kN/m^2 should be assumed for the gravel. This adopts a factor of safety of 3 and limits settlements to within acceptable limits (<25mm).

If the strip foundation is placed at 3.00m bgl, an allowable bearing capacity of 1000kN/m^2 should be assumed. This adopts a factor of safety of 3 and limits settlements to within acceptable limits (<25mm).

The limiting factor for the safe bearing capacity is keeping settlement within 25mm. For foundations bearing within the gravels, the depth to the underlying London Clay is estimated to be circa 5m bgl based on BGS boreholes, and presence of shallow groundwater is a controlling factor. The current investigation has not encountered the London Clay; therefore, it is recommended for initial design purposes pending additional investigation to investigate the depth to the London Clay that a maximum bearing capacity of 500kN/m^2 for strip foundations is used.

Piles
According to the drawing provided by the client provides indicative drawings of the proposed development, the development will consist of a 6-story building. The indicative drawings also show under-

croft parking, therefore there is likely to be a requirement for columns to support the building above the carparking area.

The under-croft parking will comprise nearly 50% of the ground floor footprint and will need to be considered when designing foundations. These columns would provide a point load to any foundations and therefore the development may require piled foundations.

It may be suitable to utilise pad foundations to support column loads, however this is subject to detailed foundation design. If higher loads are envisaged, or if basement excavation is envisaged then deeper exploratory holes will be required.

7.4 Building Near Trees

Presently, a number of semi-mature trees are located along the eastern site boundary, however the proposed development indicates that these trees will be removed alongside all other vegetation, with no new planting undertaken. The volume change potential for the clay soils is medium to very high. Where foundation excavations (or piles if adopted) encounter cohesive strata in the vicinity of existing, proposed or recently removed trees, foundations should be adjusted in full accordance with BRE 298. All foundations should be deepened below roots of greater than 5mm diameter during excavations for footings.

A survey of all trees and hedges on the site and within influencing distance of the site boundary should be undertaken to identify tree species and heights by a qualified arboriculturist in accordance with BS 5837:2012. This information will be required in order to assess the effects of trees on the cohesive strata.

Where foundation depths due to trees already present or recently removed exceeds 1.50m, there is a possibility for heave to occur on removal of the tree and guidance states that compressible material or void former is required against the inside face of the foundation, unless it can be satisfied that the soil is not desiccated.

This section of the report will be updated with further recommendations once laboratory data has been received.

7.5 Floor Slabs

A suspended floor slab could be adopted at the site supported by a suitable foundation solution. Given the presence of cohesive (shrinkable) strata, the required void size for beneath floor slabs on this site is 300mm based on the medium to very high volume change potential clays.

For buildings where suspended construction is structurally inappropriate, a hardcore thickness in excess of 600 mm may be employed below a ground bearing slab providing it is designed and supervised by an appropriately qualified engineer.

Ground bearing slabs may be adopted providing the following criteria are satisfied:

- Any other compressible or unsuitable materials are excavated and either improved or removed and replaced with suitable materials.
- It is demonstrated that desiccation in cohesive soils is not present.
- Any fill beneath the slab is suitable, well-compacted granular material placed in an appropriate thickness in accordance with a suitable specification (e.g., SHW Series 600) designed and supervised by an appropriately qualified engineer, with the end performance validated.
- The slab is adequately reinforced.

- Regular construction joints and ties are provided to allow for differential settlement.

The final floor slab design should be of sufficient thickness and sufficiently reinforced to accept the envisaged applied loads, without unacceptable total or differential movement.

Vertical elements within the structure, such as columns and walls will need to be isolated from the ground bearing slab in order to allow for the slab to expand against them without resulting in cracking.

Prior to the placement of the founding materials and the construction of a ground bearing floor slab, the sub-formation and formation will need to be inspected and checked by a geotechnical engineer to ensure the ground conditions are as expected. If soft spots or hard spots are identified at the formation level, they should be reported to the Geotechnical Engineer immediately and remedial actions agreed.

Results to date do not indicate ground gas protection measures will be required at present, subject to ongoing monitoring and regulatory confirmation.

7.6 Site Preparation and Construction

Topsoil and subsoil should be removed from beneath all buildings and hardstanding areas.

There are a number of services crossing the site, an unknown service crosses through the centre of the factory and multiple service run to the front of the building from Garman Road. To allow construction, all services will need to be disconnected and any suspected dead services are confirmed as dead by testing. Extra care will be required when working near to the 132kv fluid filled cables present to the north and east of the site. Consultation with the operator(s) of the fluid filled cables may also be necessary.

Instability of excavations through natural soils is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. Instability of the made ground should be allowed for. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360° or similar) is recommended to maintain the build programme. Breaking equipment will also be required to penetrate concrete hardstanding associated with former construction.

7.7 Concrete Classification

The soluble sulphate and Ph test results have been assessed in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in the table below.

For the purposes of this assessment, the made ground and natural clay strata are considered to be relatively impermeable, therefore the groundwater has been classed as static. The natural gravel strata is permeable and classed as mobile.

Stratum	No. Samples	Characteristic SO_4 (mg/l)	Characteristic pH	DS Class	ACEC Class
Made Ground	6	355.50	7.5	DS1	AC-1s
Natural Superficial Strata-Clay	2	459.15	7.9	DS1	AC-1s
Natural Superficial Strata-Gravel	4	358.21	6.5	DS-1	AC-2z

Based on the above, the results of laboratory pH and sulphate content, alongside the BRE full suite tests, indicate that sulphate class DS-1 and ACEC Class AC-1s conditions prevail in made ground and clay whilst DS-1 and AC-2z conditions prevail in gravel in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

The site according to the published geology is situated on solid geology of the London Clay Formation, these were not encountered during the investigation, however the London Clay is likely to be pyritic.

The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

7.8 Highways

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of between 20 – 60 % are likely to be achieved in undisturbed natural granular soils and 2% for natural clay soils for pavement design purposes, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Equilibrium CBR values are likely to be 2% within the made ground.

Where the CBR is found to be less than 2%, the sub-grade is unlikely to be suitable for both the trafficking of site plant and as a permanent highway foundation without improvement of the soils.

To achieve the required design CBR value, improvement works may be required in accordance with DMRB IAN 73/06 Rev 1 Chapter 5 and may include proof rolling, excavation and re-engineering / replacement of weaker soils, the inclusion of a geogrid or use of stabilisation techniques such as the addition of hydraulic binders (e.g., cement/lime).

Based on the fines content of the soils, they are considered to be frost susceptible, therefore highway construction should be a minimum thickness of 450mm to mitigate against the risk.

Care should be taken to ensure the stratum at formation level is protected against inclement weather, as this is likely to lead to surface deterioration and a decrease in soils strengths.

7.9 Sustainable Drainage Systems (SUDS)

The use of sustainable drainage systems, such as traditional soakaways within the shallow soils is not likely to be feasible due to the presence of low permeability cohesive strata underlying the site at shallow depths.

However, should the soakaway be excavated into the underlying sands and gravels, the use of sustainable drainage systems maybe feasible.

If the use of sustainable drainage systems, such as traditional soakaways is anticipated, dependant on the location and depth proposed, this drainage system may be feasible. Low permeability, cohesive strata was generally encountered beneath the made ground to circa 2.0m bgl, and soakaway drainage would not be feasible in this zone, however if soakaways are deepened, to sit within the more permeable sand and gravel stratum, then it is possible that soakaways would be feasible. The soakaways should avoid any areas of contamination.

It is recommended that if soakaway drainage is proposed that on-site infiltration testing is undertaken.

8.0 GEO-ENVIRONMENTAL RISK ASSESSMENT

8.1 Introduction

The samples were tested for an assessment of the chemical contamination that may pose a risk to human health. The results were examined with reference to a selection of guidance documents as detailed in Appendix A. In this case the LQM S4ULs and DEFRA C4SLs for a commercial end use have been adopted as Tier 1 generic screening values.

The apparent exceedance of the relevant screening value is taken as indicating further detailed assessment or remedial action is required.

A summary assessment sheet is presented in Appendix C alongside the chemical test results. Results are discussed in detail in the sections below.

8.2 Soils Test Results and Risk Assessment – Human Health

Metals
No metals have been detected above the adopted screening criteria for commercial end use. As well as this, the majority of metals were found to be below the laboratory limits of detection (<LOD).

Asbestos
Chrysotile fibres have been detected in one sample from HP01 at 0.90m. Quantification analysis found the asbestos level to be <0.001% mass and is therefore classified as being trace levels.

Poly Aromatic Hydrocarbons (PAHs)
No PAHs have been detected above the adopted screening criteria. Generally, the PAHs were recorded below the laboratory LOD, with any other results being orders of magnitude below the screening criteria.

Total Petroleum Hydrocarbons (TPH CWG)
No petroleum hydrocarbons have been identified above the adopted screening criteria, including from the sample (WS01 at 3.50m) which was thought to have been identified as having a hydrocarbon odour during the site works.

BTEX and MTBE
No BTEX or MTBE compounds have been identified above the adopted screening criteria, all samples were below the limit of detection.

Volatile Organic Compounds (VOCs)
No VOCs have been identified above the laboratory limit of detection.

8.3 Summary – Human Health Risk Assessment

Based on the testing and assessment undertaken, there are no determinands above the relevant assessment criteria and mitigation measures will not be required in respect to soils.

Chrysotile asbestos fibres have been detected in one sample to date and was found to be at trace levels.

8.4 Controlled Waters Risk Assessment

Based on the lack of contaminants present within soils and the lack of significant on-site sources, there are not considered to be any significant risks with respect to controlled waters.

A slight hydrocarbon odour was noted between 3.50m and 3.60m bgl in WS01 within the gravel, however a sample taken from this location recorded no TPHs, BTEX or PAHs above the laboratory limit of detection.

During the monitoring visit, no sheen, odour, or product was observed on the water recovered.

Based on olfactory evidence of contamination the likelihood of any impact to controlled waters from on-site contamination is considered unlikely.

8.5 Permanent Ground Gas and Vapours Results

To date, two ground gas monitoring visits have been carried out on 7th April and 21st April 2022. A further 1 visit is scheduled. Results are summarised in the table below:

	CH_4 (%)		CO_2 (%)		O_2 (%)		CO (ppm)		H_2S (ppm)		TVOC (ppm)		Steady Flow (l/hr)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Peak	0.1	0.1	0.2	5.8	9.7	19.4	0.1	0.1	0.0	0.0	0.0	0.0	0.1	2.1
Steady	0.1	0.1	0.1	5.8	9.7	19.7							0.1	0.1

Notes: CH_4 = Methane; CO_2= Carbon dioxide; O_2= Oxygen; CO= Carbon Monoxide; H_2S= Hydrogen Sulphide; TVOC (PID)= Total Volatile Organic Compounds (as measured with Photo Ionisation Detector); ppm= Parts Per Million.

The highest carbon dioxide concentrations were recorded in WS02 (4.6% v/v) on the first visit and (5.8% v/v) on the second visit. The maximum flow of 2.1 l/hr was recorded in WS04 on the first visit.

The atmospheric pressure ranged between 981mb and 1009mb over the monitoring period, of which visits were conducted over falling pressure trends.

In addition to the above, PID head space monitoring was undertaken on all environmental soil samples taken during the ground investigation at the site, the results are recorded on the exploratory hole logs.

All of the samples tested recorded PID results of 0.0ppm, indicating that no significant volatile vapour contamination was present.

8.6 Ground Gas Risk Assessment

In order to assess the ground gas situation and the requirement for ground gas precautionary measures at the site, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' and BS8485:2015+A1:2019 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

As the proposed end-use a commercial development, guidance dictates that the gas monitoring results should be assessed in accordance with the Wilson and Card methodology.

The Wilson and Card methodology uses the concept of a Gas Screening Value (GSV) which is derived using the following equation: (max gas concentration / 100) x maximum flow.

A maximum positive steady flow of 0.1l/hr has been used to derive the GSVs. The GSV's for the site are presented below.

Gas	GSV (l/h)	Classification Based on GSV	Typical Threshold Concentration Exceeded
Methane	0.0001	CS-1	No
Carbon Dioxide	0.0058	CS-1	No

The GSV for carbon dioxide and methane place the site the site into Characteristic Situation 1 (CS1).

The concentration of carbon dioxide did exceed the typical threshold value of 5% v/v in WS02 (5.8% v/v) during the second monitoring visit. A value of 4.6% v/v for carbon dioxide was measured in WS02 during the previous monitoring visit. As there has only been on exceedance to date, the site is still considered as CS-1 based on the GSV.

Confirmation of the Characterisation Situation will be made following completion of the current monitoring period.

8.7 Qualitative Risk Assessment

The CSM has been revised based on the findings of the site investigation and laboratory testing results and these are presented overleaf. Unless stated otherwise, in respect to off-site sources, only risks that are assessed as moderate and above within the preliminary CSM have been carried forward to this section, or where a previously unidentified potential source, pathway and / or receptor has been identified from the recent site works.

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On-site Made Ground Metals and organic contamination	Migration into/chemical attack of water supply pipelines	Water Pipelines / End users	Unlikely	Mild	Very Low	Made ground is present across the site and was encountered to proven depths of between 0.90m 1.20m bgl. No contaminants were observed within the made ground. The risk is considered to be very low at this stage.
On-site Made ground Ground Gas (carbon dioxide and methane),	Migration into confined spaces, inhalation, and asphyxiation/ explosion	End-users / property / structures	Unlikely	Severe	CS1 (Very Low Risk)	Made ground is present across the site and was encountered to proven depths of between 0.90m 1.20m bgl. It is likely that due to the age of the made ground, the majority of degassing is likely to have ceased. Gas monitoring on-site to date places the site into Characteristic Situation 1 (CS1 – Very Low Risk) however monitoring is underway, and the gas assessment will be updated following completion of the monitoring programme.
On-site furniture works. Solvents, fuels, paints, oils	Inhalation of vapours	End-users / property / structures	Unlikely	Medium	Low	Solvents, fuels, paints, and varnishes may have been used on site in the manufacture of furniture, with vapours accumulating within buildings and being inhaled. However, these are likely to have been used in small volumes. There was no evidence of contamination around the site e.g. surface staining, all samples tested for VOCs and petroleum hydrocarbons were below relevant generic assessment criteria, with the majority also being below the laboratory limits of detection. Given this, it is unlikely that vapour contamination associated with the furniture works will affect end-users, property or structures and risks are considered to be low.
Off-site Natural Geology - Alluvium Ground Gas	Migration into confined spaces, inhalation, and asphyxiation/ explosion	End-users / property / structures	Implausible	Severe	No Linkage	It has been assumed that no alluvium was encountered beneath the site. The layer of clay has been interpreted as the Enfield Silt member and the gravel layer has been interpreted as the Kempton Park gravel member.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On site Works (Paper, Carboard and furniture manufacturing), including made ground **On site** PAH's, Metals, solvents, paints, varnishes	Leaching through unsaturated zone / Migration through saturated zone	Superficial Aquifers (Unproductive/ Secondary (A))	Unlikely	Medium	Low	The proposed development includes construction of a structure across the majority of the site. As well as this, site is currently surfaced in hardstanding and any open areas will remain so when developed. The combination of these two factors will significantly reduce the leaching potential of water falling on the site, which will reduce risks to controlled waters. The nearest active groundwater abstraction licence is 0.77km away. The site lies within a Zone II Source Protection Zone. There are several wells in the vicinity of the site, two of which are active and relate to potable drinking water abstraction, they are considered a sensitive receptor. However, two of the aquifers (bedrock and superficial Enfield Silt Member) are unproductive, comprising low permeability clays, limiting the migration and mobilisation of contaminants. Permeable deposits are present on-site underlying the unproductive aquifer. No significant on-site sources of contamination have been encountered, and no contaminants were recorded above their respective screening values within soils. As well as this, the majority of determinands were found to be below the laboratory limits of detection, and therefore it is not thought that any significant contamination is present on-site with respect to the on-site works. The risks to groundwater are considered to be low.
	Overland flow / migration along and within drainage	Pymme's Brook 230m away (Surface waters)	Unlikely	Medium	Low	No contaminants were identified above the commercial GAC, with the majority of determinands being below the laboratory limits of detection. As well as this, if present, any residual contamination would be unlikely to impact the river due to the low permeability of the clays underlying the area, which will inhibit lateral migration to drains. Any contamination reaching the drains is also likely to be diluted and attenuate prior to discharge into river. Risks to the river are considered to be low.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
	Migration through saturated zone	Pymme's Brook 230m away (Surface waters)	Unlikely	Medium	Low	No contaminants were identified above the commercial GAC, with the majority of determinands being below the laboratory limits of detection. The clays underlying the area are of low permeability, which will inhibit vertical migration to the water table. The risks to the river are considered to be low.

8.8 Outline Remedial Measures

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

No significant sources of contamination have been identified on site; therefore, no specific remedial measures are required for soils in respect to human health for the proposed end use.

Gas monitoring is ongoing, any remedial measures required will be discussed upon completion of the gas monitoring. At present, not gas protection measures are considered to be required.

8.9 Health and Safety Issues

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
Made Ground (heavy metals, PAHs, petroleum hydrocarbons)	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Low Likelihood	Mild	Low
Asbestos	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Likely	Medium	Moderate
Ground gas	Inhalation in confined spaces/trenches	Construction Workers	Low likelihood	Severe	Moderate

Trace levels of Chrysotile asbestos has been identified in one sample to date, however seven other samples were tested within the made ground across the site with no trace of asbestos. It is assumed that the asbestos was localised to the area surrounding HP01. Asbestos has previously been identified within the building which will require removal prior to demolition. The risk from asbestos should be highlighted in the method statements and site induction. If further evidence of asbestos is encountered in the soils, work should cease until asbestos control measures have been agreed and put in place. Asbestos is further discussed in Section 8.10 below.

The risk from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities.

General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land." In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear, and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Handwashing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.

- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety, and welfare of persons on the site.

8.10 Asbestos

The investigation of asbestos issues within structures was beyond the scope of this report. However, guidance from UK Government indicates that asbestos should be assumed to be present in buildings unless proven otherwise.

Asbestos was previously detected in the building within cement, flash guards, cement ceiling, floor tiles, cement guttering and cement corrugated profile sheets. These materials were observed externally and within the ladies toilet, lobby, canteen, welfare room, offices, men's toilets, and warehouse. Any asbestos within structures will require removal prior to re-development. This will need to be done by a suitably qualified experienced and licensed contractor, who ensures that adequate PPE is provided to operatives, and that all the relevant legislation is adhered to.

In addition, the presence of asbestos within the ground will require, a safe system of work to be set up on site to deal with the asbestos risk from the made ground. This may include but be not limited to:

- The use of qualified personnel where required.
- Cleaning down of machinery in designated areas.
- Decontamination unit for ground workers.
- Damping down of soils to prevent dust migration.

Asbestos fibres have been identified in one sample at the site with the asbestos level within the sample being quantified as <0.001% mass and classified as being trace levels. At these concentrations the liberation of fibres is considered to be unlikely and no specific precautionary measures with regards to asbestos are likely to be required at the site. The level of precautions required are at the discretion of the principal contactor on site however good site practices including minimising the generation of dusts should be adhered to and sufficient to mitigate against the risk from asbestos. In addition, site personnel should have the risk communicated at the induction stage. It is recommended that the asbestos in construction materials assessment tool is used at the site to inform asbestos licensing and control measures.

Excavations in soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CARSOIL) and CAR 2012. All such works will need to be agreed with the regulatory bodies (HSE and/or LA).

Additional guidance is provided within the BSL methodology Guidance Note in Appendix A.

9.0 CONCLUSIONS

9.1 Geo-Environmental

Geo-Environmental – Human Health
Testing of the made ground at the site did not reveal any exceedances of heavy metals, PAHs, petroleum hydrocarbons, BTEX or MTBE compounds.

Chrysotile fibres (loose fibres) have been detected in one sample of made ground across the site. On quantification analysis the asbestos level within the sample was <0.001% mass and classified as being trace levels.

Ground gas monitoring has revealed a maximum peak carbon dioxide concentration of 5.8%v/v and methane concentrations of 0.1%v/v. Based on the gas monitoring to date the site is classified as Characteristic Situation 1 and no ground gas protection measures are required.

Geo-Environmental – Controlled Waters
The overall risk to controlled waters is considered to be low.

9.2 Geotechnical

Foundations
It is understood the proposed building is steel framed and will provide point loads to the ground. Shallow pad foundations of may be placed within the natural gravel strata at a minimum depth of 2.00m bgl, for a 1m^2 pad an allowable bearing capacity not exceeding 500kN/ m^2 should be assumed for the gravel. If higher loads than this are envisaged, or if the under croft parking is proposed to be at a basement level then deeper site investigation would be required.

Strip foundations may be utilised to support external masonry placed within the natural gravel strata at a minimum depth of 2.00m bgl, for a 0.6m wide foundation an allowable bearing capacity not exceeding 500kN/m^2 should be assumed for the gravel.

Floor slabs
Given the design choice for under croft parking, a ground bearing floor slab is likely to be the preferred construction choice for the proposed development, provided the criteria described in Section 7.5 are met.

Concrete classification
Sulphate class DS-1 and ACEC Class AC-1s conditions prevail in the made ground and clay whilst DS-1 and ACEC Class AC-2z conditions prevail within the gravel. The solid geology underlying the site is the London Clay which can be pyritic additional precautions against aggressive ground conditions are likely to be required.

Highways
CBR values of 20-60% are likely to be achieved in undisturbed natural gravel soils and 2% for natural clay soils. Should be confirmed by on-site in-situ testing.

Drainage (SUDS)
Not likely to be feasible within the low permeability cohesive strata. However, these deposits maybe locally absent and soakaways could be excavated into the underlying more permeable strata which are likely to be affective.

9.3 Further Work

The following further work is considered necessary to progress the site to construction phase:

- Completion of ground gas monitoring programme.
- Issue gas assessment / update gas assessment within this report.
- If higher structural loads are anticipated than discussed in 7.3, or if basement excavation is considered, then deeper exploratory holes will be required to confirm foundation design.
  - Comprising: Cable Percussive boreholes to increase coverage, allow deeper piled foundation design and increase confidence of potential shallow design.
- Demolition Asbestos survey.
- Detailed foundation design by a structural engineer, including foundation zonation plan and depth schedule.

10.0 ABBREVIATIONS AND DEFINITIONS

GLOSSARY	
Term / Abbreviation	**Definition**
AST	Above Ground Storage Tank.
B(a)P	Benzo (a) Pyrene.
BGS	British Geological Survey.
BRE	Building Research Establishment.
BS	British Standard.
BSL	Brownfield Solutions Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes.
CBR	California Bearing Ratio (used in pavement/highways design).
CAR 2012	Control of Asbestos Regulations (2012).
CBCB	Cheshire Brine Compensation Board.
CBCD	Cheshire Brine Compensation District.
CBR	California Bearing Ratio.
CIEH	Chartered Institute of Environmental Health.
CIRIA	Construction Industry Research Association.
CL:AIRE	Contaminated Land: Applications in Real Environments.
CLEA	Contaminated Land Exposure Assessment.
CLO	Contaminated Land Officer.
COMAH	Control of Major Accident Hazards.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. There is no assumption in this definition that harm results from the presence of the contamination. Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. Contamination may relate to soils, surface water, groundwater, or ground gas.
Controlled Waters	Inland freshwater (any lake, pond, or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.
CPT	Cone Penetration Test.
CSM	Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e., the Phase I Desk Study). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model.
DCP	Dynamic Cone Penetrometer.
DNAPL	Dense Non-Aqueous Phase Liquid.
DoWCoP	Definition of Waste Code of Practice.
DWS	Drinking Water Standard.
EA	Environment Agency.
EHO	Environmental health Officer.
EQS	Environmental Quality Standard.
GAC	Generic Assessment Criteria.

GLOSSARY	
Term / Abbreviation	**Definition**
GDR	Geotechnical Design Report.
GFR	Geotechnical Feedback Report.
GIR	Ground Investigation Report.
GSV	Gas Screening Value.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines.
Hazard	Inherently dangerous quality of a substance, procedure, or event.
HDPE	High Density Polyethylene.
HSV	Hand Shear Vane.
K	Modulus of Subgrade Reaction.
LCRM	Land Contamination: Risk Management (EA guidance).
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene).
LOD	Limit of Detection (for particular method adopted).
MMP	Materials Management Plan.
Mv	Modulus of Volume of Compressibility.
ND	Not Detected.
NHBC	National House Building Council.
NR	Not Recorded.
OS	Ordnance Survey.
PAH	Polycyclic Aromatic Hydrocarbon.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
PCB	Poly-Chlorinated Biphenyl.
PCSM	Preliminary Conceptual Site Model.
pH	Scale used to specify how acidic or basic a water-based solution is.
PHC	Petroleum Hydrocarbons.
PID	Photo Ionisation Detector.
PNEC	Predicted No-Effect Concentration.
Precision	Level of agreement within a series of measurements of a parameter.
PSD	Particle Size Distribution.
PVC	Polyvinyl Chloride.
Receptor	Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s).
Risk	Probability of the occurrence, magnitude, and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature, and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
SOM	Soil Organic Matter.
Source	Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater, or gas concentration of the contaminant(s).
SPT	Standard Penetration Test.
SVOCs	Semi Volatile Organic Compounds.
TOC	Total Organic Carbon.
TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group).

GLOSSARY	
Term / Abbreviation	**Definition**
TVOCs	Total volatile organic compounds.
UCS	Unconfined Compressive Strength.
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.
UST	Underground Storage Tank.
UXO	Unexploded Ordnance.
VCCs	Vibro Concrete Columns.
VSCs	Vibro Stone Columns
VOCs	Volatile Organic Compounds.
WAC	Waste Assessment Criteria.
WFD (in waste context)	Waste Framework Directive.
WFD (in water context)	Water Framework Directive.
Units	**Definition**
°	Degrees
Φ	Phi angle (in degrees)
g/l	Grams per Litre
Km	Kilometres
kPa	Kilo Pascal (Equivalent to kN/m^2)
$KN/m^2/mm$	Kilo Newton per metered squared per millimeter
kN/m^2	Kilo Newtons per metre squared
kPa	Kilo Pascal (Equivalent to kN/m^2)
l/hr	Litres per hour
MJ/kg	Mega joule per kilogram
MN	Mega Newton
M^2/MN	Mega Newton per metre squared
M	Metres
m bgl	Metres Below Ground Level
m OD	Metres Ordnance Datum (sea level)
µg/l	Micrograms per Litre (parts per billion)
µm	Micrometre
mb	Millibars (atmospheric pressure)
mg/kg	Milligrams per kilogram (parts per million)
mg/m^3	Milligram per metre cubed
mm	Millimetre
ppb	Parts Per Billion
Ppm	Parts Per Million

11.0 REFERENCES

Association of Ground Investigation Specialists. 'Guidelines for Good Practice in Site Investigation.' Issue 2, March 2006.

BRE Special Digest 1: 'Concrete in Aggressive Ground' 3rd Ed 2005.

BRE Digest 365 'Soakaway Design'. 2016.

BRE Report 470 'Working platforms for tracked plant: good practice guide to the design, installation, maintenance, and repair of ground-supported working platforms'. 2004.

British Geological Survey Technical Report WD/00/04. 234pp. Environment Agency R&D Publication 68 'The physical properties of minor aquifers in England and Wales'.

British Geological Survey 'The advanced soil geochemical atlas of England and Wales.' 2012.

BS 1377 'Method of Test for Soils for Civil Engineering Purposes'. 1990.

BS EN 1997-1. 'Eurocode 7 – Geotechnical design - Part 1: General rules'. Plus, associated UK National Annex. 2004.

BS EN 1997-2. 'Eurocode 7 – Geotechnical design - Part 2: 'Geotechnical investigation and testing'. Plus, associated UK National Annex. 2007.

BS 5837: 'Trees in relation to design, demolition, and construction Recommendations'. 2012.

BS 5930+A1:2020: 'Code of Practice for Site Investigations'. 2020.

BS 8004: 'Code of practice for foundations'. 2015.

BS 8500-1 AMD 2. Concrete. Complementary BS to BS EN 206. Part 1. 'Method of specifying and guidance for the specifier.' 2018.

BS 8576 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'. 2013.

BS 10175:2011+A2 'Investigation of Potentially Contaminated sites - code of practice'. 2017.

BS 10176:2020 'Taking soil samples for determination of volatile organic compounds (VOCs).' 2020.

BS EN ISO 14688 'Geotechnical investigation and testing – Identification and classification of soil'. 2018.

BS EN ISO 17892 'Geotechnical investigation and testing. Laboratory testing of soil.' Parts 1-12 :2018.

CIRIA R143, 'The Standard Penetration Test (SPT): methods and use'. 1995.

CIRIA 151 'Interpreting Measurements of Gas in the Ground'. 1995.

CIRIA 152 'Risk assessment for Methane and Other Gases from the Ground'. 1995.

CIRIA 552 'Contaminated Land Risk Assessment – A guide to good practice'. 2001.

CIRIA C659 'Assessing risks posed by hazardous ground gases to buildings.' 2006.

CIRIA C665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings'. 2007.

CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry'. 2009.

CIRIA C733 'Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks'. 2014.

CIRIA C753 'The SuDS Manual'. 2015.

CL:AIRE and CIEH. 'Guidance on Comparing Soil Contamination Data with a Critical Concentration.' May 2008.

CL:AIRE RB17 'A Pragmatic Approach to Ground Gas Risk Assessment'. 2012.

CL:AIRE 'Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – CAR-SOILTM.' 2016.

DEFRA and the Environment Agency, CLR10 'Soil Guideline Value Reports for Individual Soil Contaminants'. 2002-2004.

Department of the Environment, CLR Report No 2 'Guidance on Preliminary Site Inspection of Contaminated Land'. 1994.

Department of the Environment, CLR Report No 3 'Documentary research on Industrial Sites'. 1994.

Department of the Environment, CLR Report No 4 'Sampling Strategies for Contaminated Land'. 1994.

Department of the Environment. 'Industry Profiles' - 48 separate publications available from The Stationery Office, London. 1995.

DETR. Circular: Contaminated Land. 2006.

EC Regulation 1272/2008 'The Classification, labelling and packaging of substances and mixtures (CLP)' 2008.

Environment Agency guidance - Land Contamination: Risk Management (LCRM). 2019.

Environment Agency 'Using Soil Guideline Values.' 2009.

Environment Agency, 'Updated Technical Background to the CLEA model.' 2009.

Environment Agency, 'Human health toxicological assessment of contaminants in soil.' 2009.

Environmental Quality Standards. 2008.

Ground Engineering. Wilson & Card 'Proposed method classifying gassing sites' /1999.

Health & Safety Executive (HSE). 'Protection of Workers & the General Public during the Development of Contaminated Land.' 1991.

Health and Safety Executive (HSE). Control of Asbestos Regulations (CAR). 2012.

Highways Agency. Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06. Rev 1. Highway Agency, London. 2009. [Withdrawn 30th May 2017].

Land Quality Press, Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R. C. and Nathanail, J.F. 'The LQM/CIEH S4ULs for Human Health Risk Assessment.' 2015.

Japanese Geotechnical Society. Hatanaka and Uchida 'Empirical correlation between penetration resistance and effective friction of sandy soil.' Soils & Foundations, 36 (4), 1-9. 1996.

Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1, Amendment August 2014. [Withdrawn 30th May 2017].

Manual of Contract Documents for Highway Works, Specification for Highways Works – Series 600 Earthworks November 2006. [Withdrawn 30th May 2017, Replacement unknown].

National Planning Policy Framework (NPPF). July 2018.

National Planning Policy Framework - Technical Guidance. March 2012.

Public Health England (PHE). Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs). September 2017.

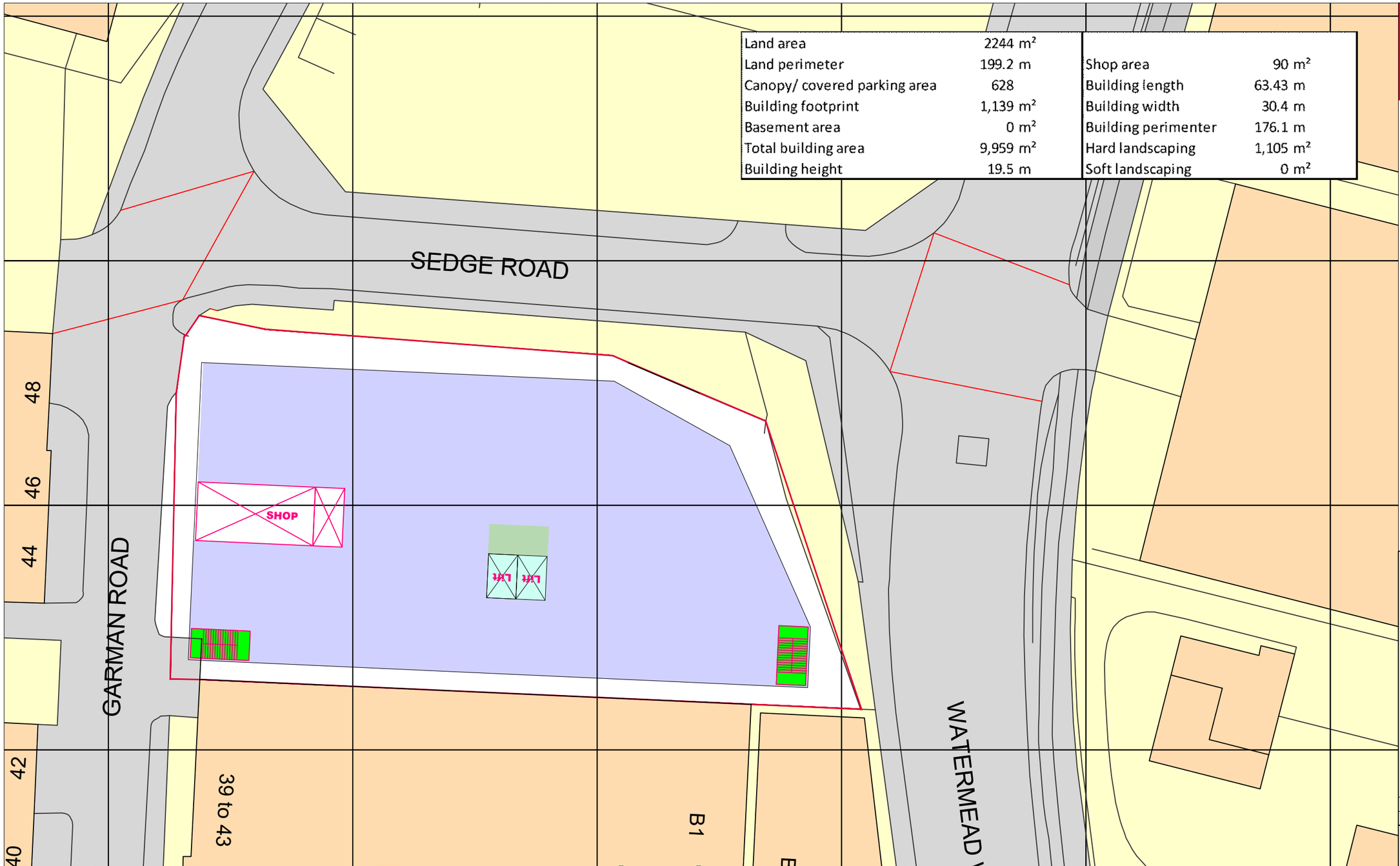
UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184).

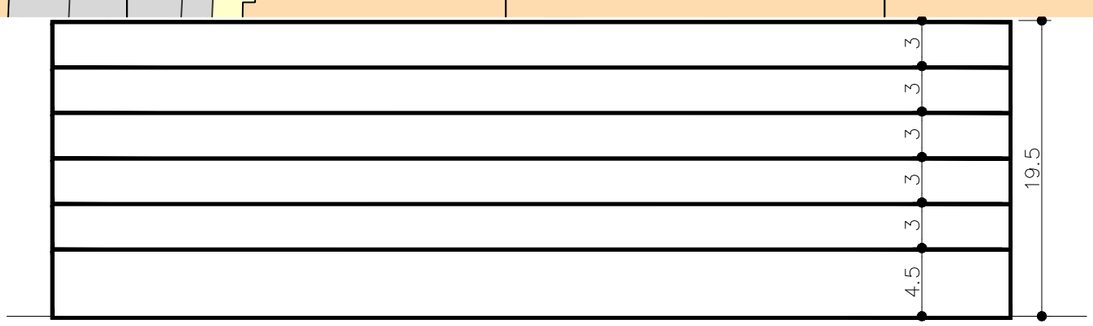
Water Framework Directive, 2000.

Water UK HBF. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation.

DRAWINGS

Land area	2244 m²	Shop area	90 m²
Land perimeter	199.2 m	Building length	63.43 m
Canopy/ covered parking area	628	Building width	30.4 m
Building footprint	1,139 m²	Building perimenter	176.1 m
Basement area	0 m²	Hard landscaping	1,105 m²
Total building area	9,959 m²	Soft landscaping	0 m²
Building height	19.5 m		





Tottenham Garmanroad			SK02			09/12/2021
	Gross m²	Footprint				
Zone			Efficiency	Net m²	AUS	# units
A5	1,764		68.3%	1,205	4.94	244
A4	1,764		66.3%	1,169	3.19	367
A3	1,764		70.2%	1,239	5.63	220
A2	1,764		72.6%	1,280	8.31	154
A1	1,764		73.8%	1,302	10.5	124
A0	1,139	1,139	68.7%	782	17.8	44
Total	9,959	1,139	***70.1%***	***6,977***	**6.05**	***1,153***

SHURGARD SELF-STORAGE

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GARMAN ROAD 45-47

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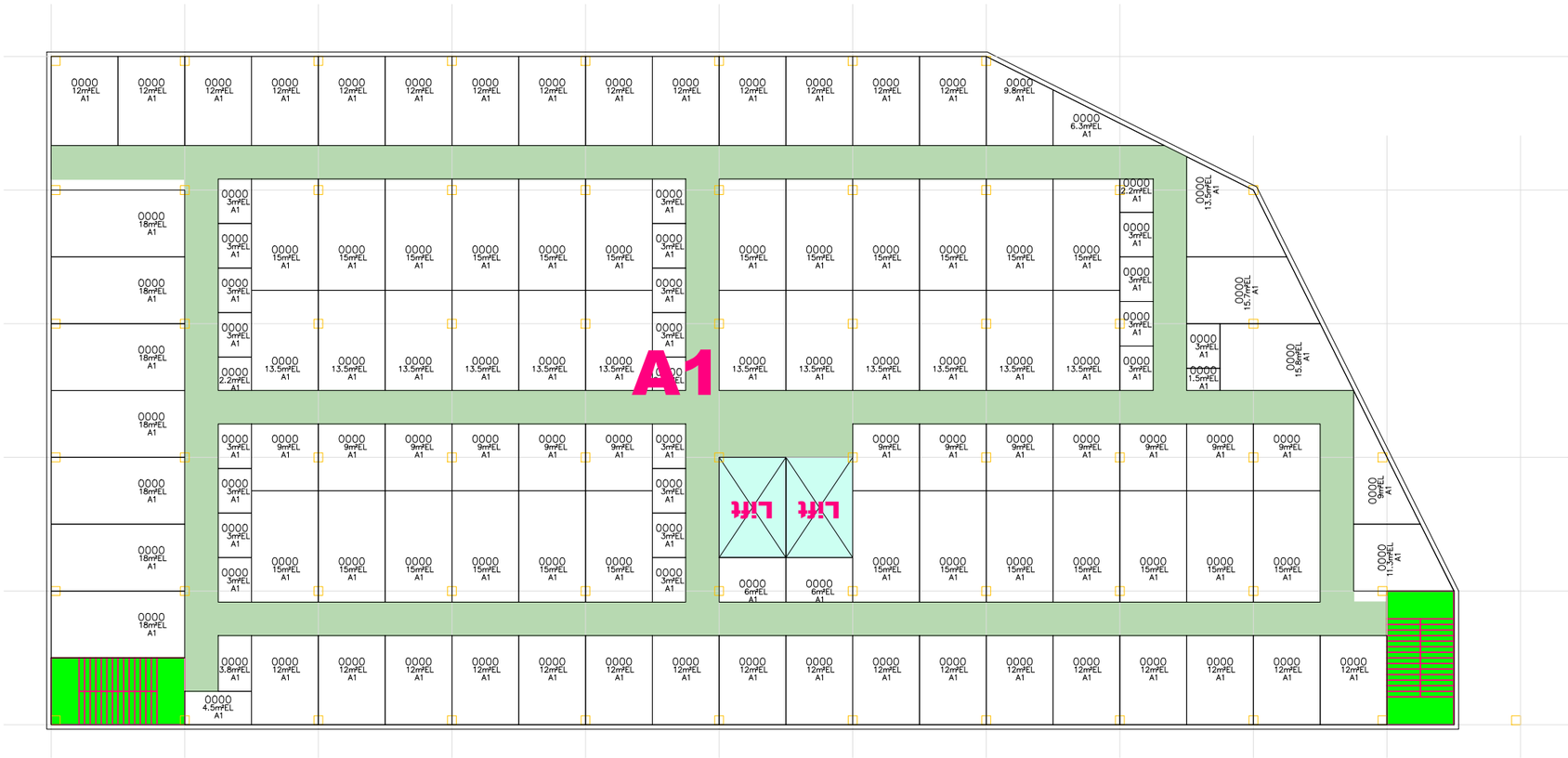

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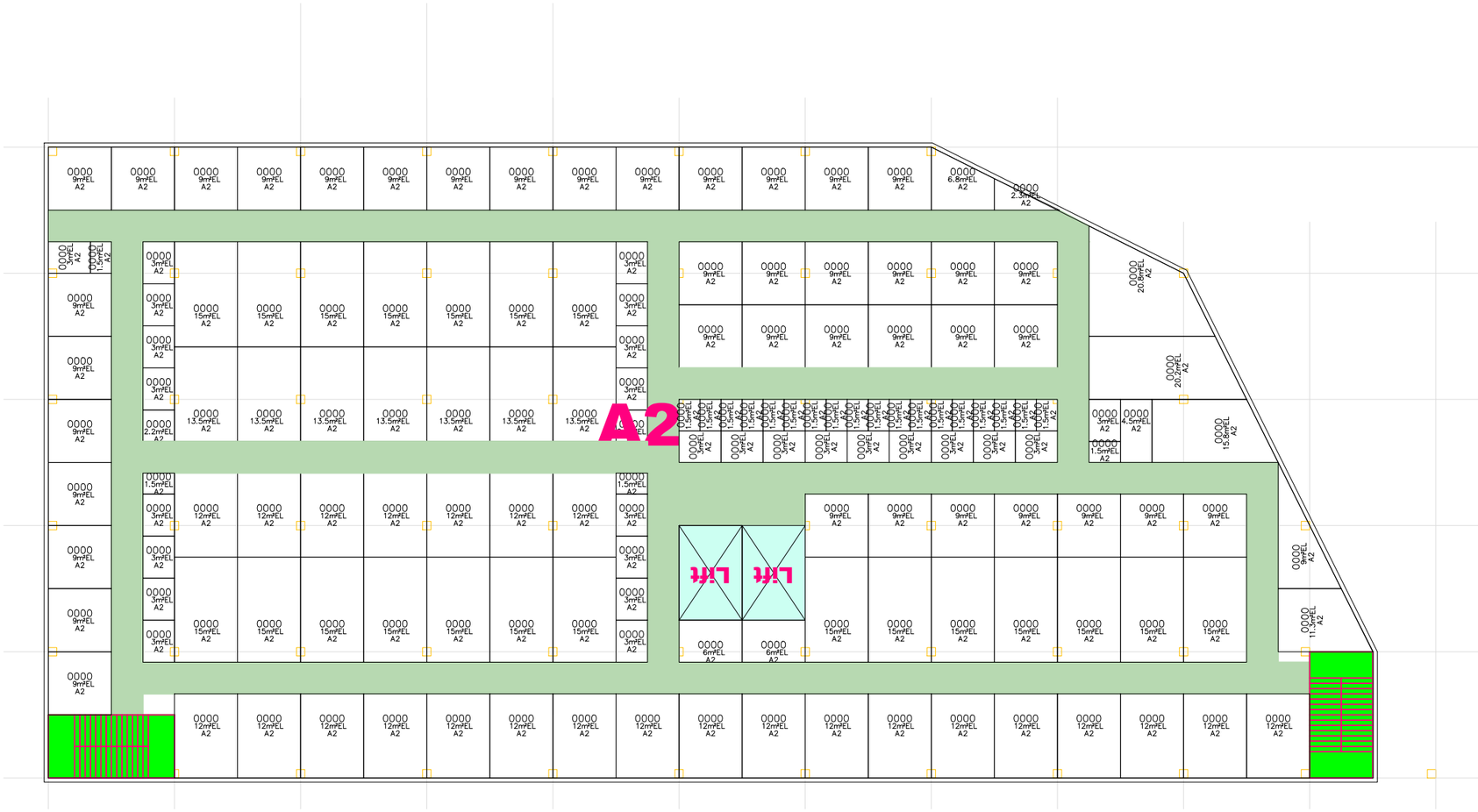

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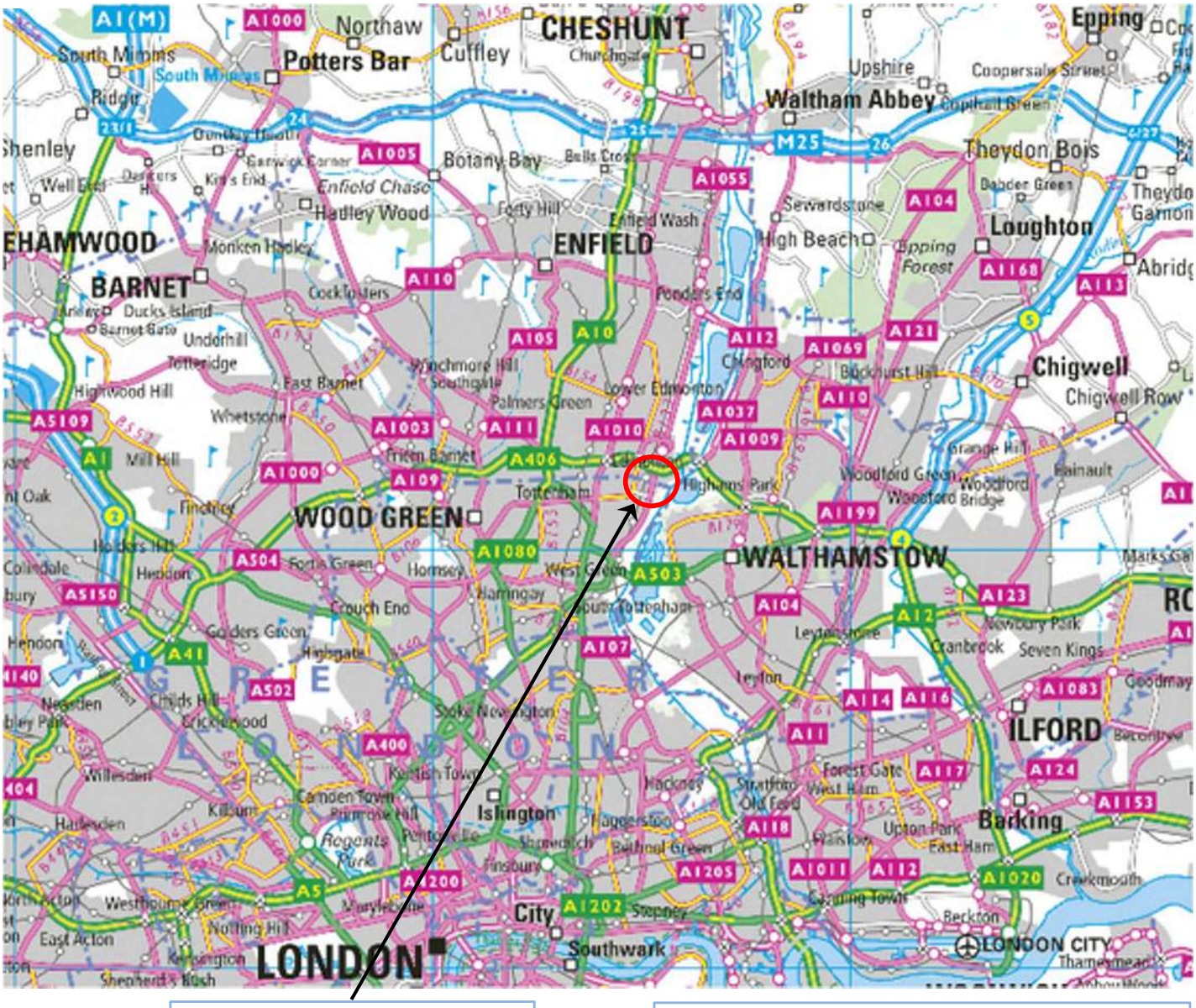

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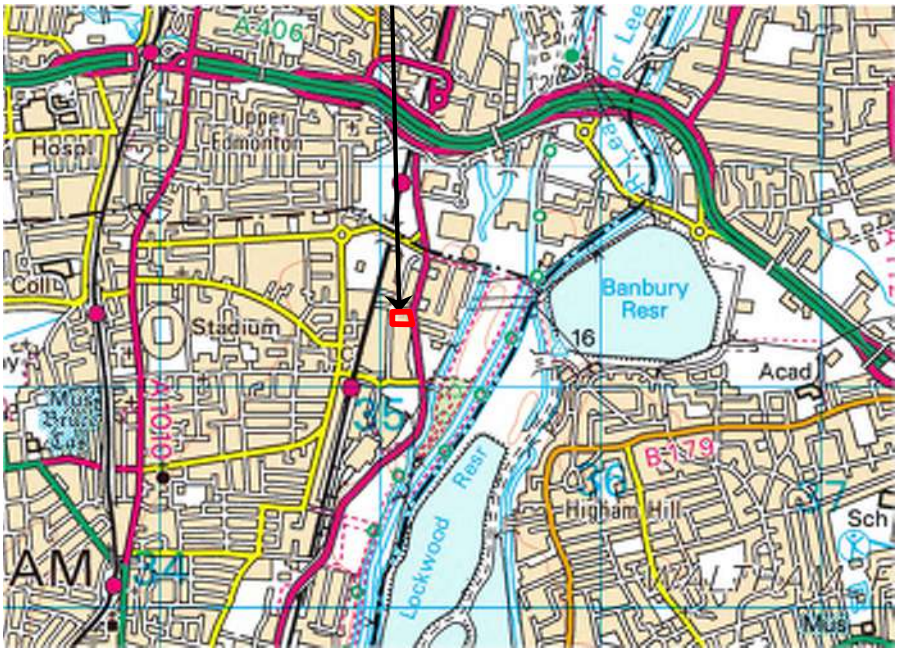
NEAREST POSTCODE: N17 0UR



REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
SHURGARD UK

PROJECT TITLE
GARMAN ROAD, TOTTENHAM

DRAWING TITLE
SITE LOCATION PLAN

DRAWING No.	REVISION	SCALE	DATE
C4993/01	-	NTS	04/03/22

DRAWN BY	CHECKED BY
SRP	JW

KEY

APPROXIMATE SITE BOUNDARY

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
SHURGARD UK

PROJECT TITLE
GARMAN ROAD, TOTTENHAM

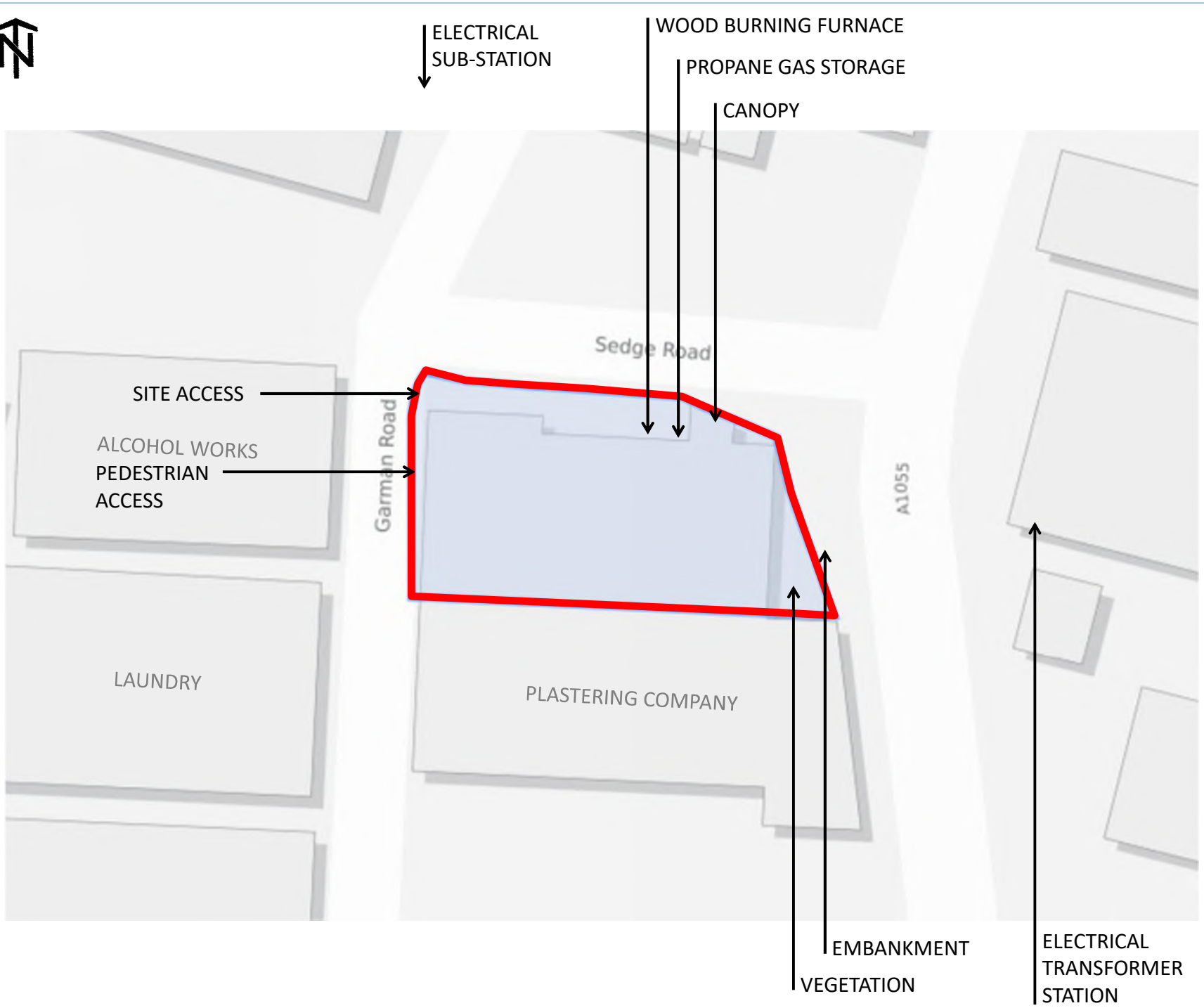
DRAWING TITLE
MH0 SITE FEATURES PLAN

DRAWING No.	REVISION	SCALE	DATE
M4993/02	-	NTS	04/03/22

DRAWN BY	CHECKED BY
SRP	JW

Slide 1

MH0 The electrical substation on drawing is not clear where it is
Mark Holland, 2022-03-03T12:40:20.762



KEY

APPROXIMATE SITE BOUNDARY

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
SHURGARD UK

PROJECT TITLE
GARMAN ROAD, TOTTENHAM

DRAWING TITLE
SITE FEATURES PLAN

DRAWING No.	REVISION	SCALE	DATE
M4993/02	-	NTS	04/03/22

DRAWN BY	CHECKED BY
SRP	JW

KEY

- APPROXIMATE SITE BOUNDARY
- WSXX WINDOW SAMPLE BOREHOLE
- HP01 HAND EXCAVATED TRIAL PIT
- BOREHOLE INSTALLATION
- BUILDING OUTLINE
- OFFICE AND SHOWROOM OUTLINE

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
SHURGARD UK

PROJECT TITLE
GARMAN ROAD, TOTTENHAM

DRAWING TITLE
EXPLORATORY HOLE LOCATION PLAN

DRAWING No.	REVISION	SCALE	DATE
M4993/04	-	NTS	23/03/22

DRAWN BY	CHECKED BY
SRP	JW

PHOTOGRAPHS

PHOTO 1

PHOTO 2

PHOTO 3

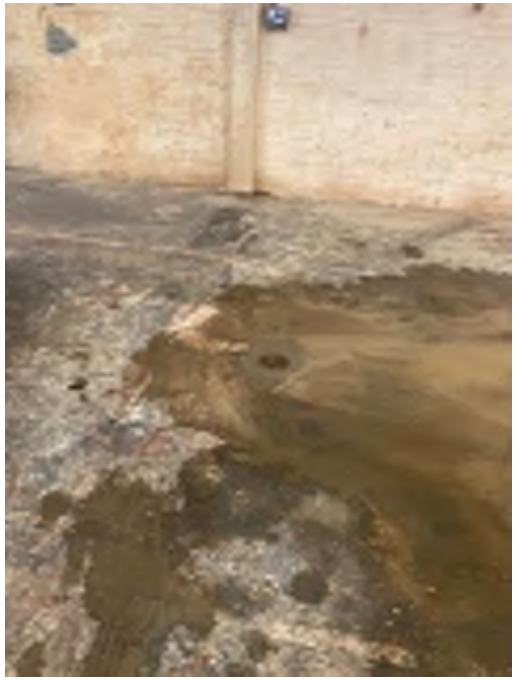


PHOTO 4

Photo Descriptions

PHOTO NO.	DETAILS
1	Completed WS01.
2	Completed WS02.
3	Completed WS03.
4	Completed WS04.

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
SHURGARD UK

PROJECT TITLE
GARMAN ROAD, TOTTENHAM

TITLE
SITE WORKS PHOTOGRAPHS

Associated Document Ref No.
SRP/M4993/10981

PAGE
1 of 2

COMPLIED BY
SRP

CHECKED BY
MH

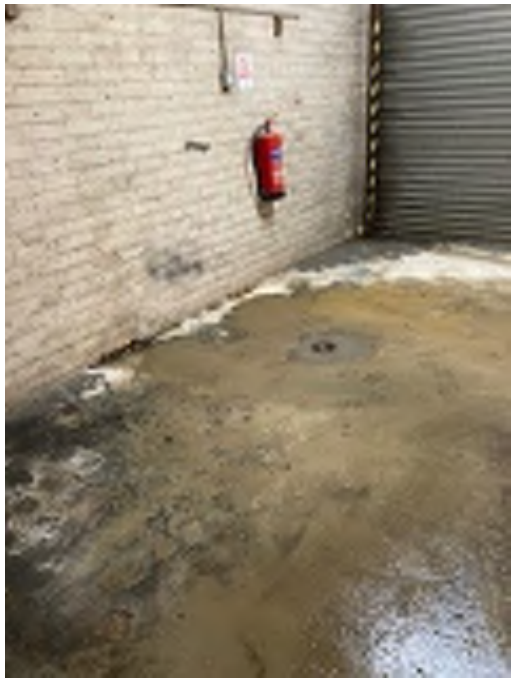


PHOTO 5

PHOTO 6

PHOTO 7

Photo Descriptions

PHOTO NO.	DETAILS
5	Completed WS05.
6	Completed HP01.
7	Concrete Cores.

REV	DATE	DESCRIPTION	BY	CKD

BROWNFIELD SOLUTIONS LTD

CLIENT
SHURGARD UK

PROJECT TITLE
GARMAN ROAD, TOTTENHAM

TITLE
SITE WORKS PHOTOGRAPHS

Associated Document Ref No.
SRP/M4993/10981

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APPENDIX A

BSL Methodology and Guidance

BSL Methodology and Guidance – Geo-Environmental Assessment Reports

This Appendix provides information on the approaches, methods and guidance used by Brownfield Solutions Ltd in the preparation of this report.

The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential soils and groundwater contamination). The term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). It should be noted that this is an integrated investigation and these two main aspects are related, unless otherwise specified within the report (i.e. as a standalone environmental or geotechnical assessment).

Desk Studies are written in broad agreement with BS 10175:2011+A2:2017. The first stage of a two-staged investigation and assessment of a site is the Preliminary Investigation (BS 10175:2011+A2:2017), often referred to as a Phase 1 Desk Study Assessment, comprising a desk study and walk-over survey, which culminates in the Preliminary Risk Assessment. A preliminary conceptual site model (CSM) is developed. From this are identified any geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them.

From the geo-environmental perspective, the hazard Identification process uses professional judgement to evaluate all the hazards in terms of possible contaminant linkages (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include an exploratory, a detailed or/and supplementary Investigations as described in BS 10175:2011+A2:2017. Phase II Assessments are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance and are also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Legislative Background

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act;
- The Contaminated Land (England) Regulations 2000;
- The DETR circular 02/2000 Environmental Protection Act 1990: Part IIA Contaminated Land.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

1) Significant harm is being caused or there is a significant possibility of such harm being caused;
2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

- **Source** - substances that are potential contaminants or pollutants that may cause harm;
- **Pathway** - a potential route by which contaminants can move from the source to the receptor;
- **Receptor** - a receptor that may be harmed, for example the water environment, humans and water.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the SPR approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents
This report has been prepared in accordance with the list of guidance below however the list is not exhaustive:

- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990.
- CLR11 – Model Procedures.
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002.
- DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002.
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
- Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003).
- BS 10175:2011+A2:2017.

Relevant Legislative Documents
The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012).
- The Environment Protection Act (1990).
- The Water Resources Act (1991).
- The Environment Act (1995).
- The Contaminated Land (England) Act (2000).
- The Pollution Prevention and Control (England and Wales) Regulations (2000).
- The Landfill Regulations (England and Wales) Regulations (2002).
- The Landfill (England and Wales) (Amendment) Regulations (2004).
- Contaminated Land (England) Regulations (2012).
- Health and Safety at Work Act.

Contaminated Land Risk Assessment

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:

Hazard Identification → Hazard Assessment → Risk Estimation → Risk Evaluation

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process. Under CLR11, three tiers of risk assessment exist - Preliminary, Generic Quantitative and Detailed Quantitative.

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552:

- **High likelihood**: There is a pollution linkage and an event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution;

- **Likely**: There is a pollution linkage and all the elements are present and in the right place, which means it is probable that an event will occur. Circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term;

- **Low likelihood**: There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain even over a longer period such event would take place, and is less likely in the short term;

- **Unlikely**: There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.

The severity is also classified using a system based on CIRIA C552. The terms and definitions are:

- **Severe**: Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
  Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse;

- **Medium**: Chronic damage to human health ('significant harm' as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
  Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of species within a designated nature reserve;

- **Mild**: Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment;
  Examples – Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.

- **Minor**: harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Examples – Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very Low	Very low
	No Linkage	No risk			

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

- **Very high**: There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required;

- **High**: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term;

- **Moderate**: It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term;

- **Low**: It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild;

- **Very Low**: There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Some linkages may be identified which constitutes a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled 'no linkage' in the summary table and no further action is required.

Ground Gas Guidance

Redevelopment on brownfield sites is an ever increasing occurrence, including those sites where a potential ground gas issue is present.

BS8485:2015+A1:2019 and CIRIA C665 is the current guidance which gives up-to-date advice on all aspects of ground gas. It outlines good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to gas contaminated land. Two semi-quantitative methods are set out for the assessment of risk:

1. For low rise housing with a ventilated under floor void at minimum 150 mm (Boyle and Witherington);
2. For all other development types (Wilson and Card).

Both methods use the concept of Gas Screening Values (GSVs) to identify levels of risk. The mitigation and management of potentially unacceptable risk is described with reference to both passive and active systems of gas. Source removal is also discussed as an option.

CIRIA C665 and the advice it contains has been prepared to be generally consistent with CLR11 *Model Procedures for the management of land contamination* (Defra and Environment Agency, 2004a). The aim of CIRIA C665 is a consistent approach to decision making, particularly relating to the scope of protective design measures on a site specific basis.

Legislative Framework
CIRIA C665 provides technical guidance however also recognises the context into which the guidance has to be employed. Government policy is based upon a "suitable for use approach", which is relevant to both the current and proposed future use of land. When considering the current use of land, Part IIA of the Environment Protection Act 1990 provides the regulatory regime. The presence of hazardous ground gases could provide the "source" in a "pollutant linkage" which could lead the regulator to determine that considerable harm or there is a significant possibility of such harm being caused. Under such circumstances, the regulator would determine the land to be "contaminated land" under the provisions of the Act, setting out the process of remediation as described in the DETR Circular 02/2000 *Statutory guidance on contaminated land* (DETR, 2000a).

Frequency and Duration of Monitoring
The monitoring period for a specific site covers the "worst case" scenario. A "worst case" scenario will occur during falling atmospheric pressure and, in particular, weather conditions such as rainfall, frost and dry weather.

The benefits of the additional information and whether it is likely to change the scope of gas protection should be considered, as are the consequences of failing to characterise adequately pollutant linkages. Investigations concerned with soil gas are required to provide monitoring data sufficient to allow prediction of worst case conditions enabling the confident assessment of risk and subsequent design of appropriate gas protection schemes. Monitoring programmes should not be an academic exercise in data collection.

Below are matrices that will aid in determining an appropriate number of gas monitoring visits and the length of monitoring period.

Typical/idealised periods of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	1 month	2 months	3 months	6 months	12 months
	Moderate (Flats)	2 months	3 months	6 months	12 months	24 months
	High (Residential with Gardens)	3 months	6 months	6 months	12 months	24 months

Typical/idealised frequency of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4	6	6	12	12
	Moderate (Flats)	6	6	9	12	24
	High (Residential with Gardens)	6	9	12	24	24

Note

1 NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).
2 There is no industry consent over "high", "medium" or "low" generation potential of source.
3 At least two sets of readings should be at low and falling atmospheric pressure (but not restricted to periods below <1000 mb) known as worst case conditions. Historical data can be used as part of the data set (Table 5.5b).

It is recommended that newly installed monitoring wells are left for 24 hours to allow the soil gas to reach equilibrium. It should be recognised, however, that some soil gas regimes could take considerably longer (up to seven days). Interpretation of any initial readings should take this equilibrium process into account.

Contaminated Land Screening Values

In assessing the potential for contamination Brownfield Solutions Limited (BSL) follows UK guidance and current best practice.

General
The current recommended method for assessing contamination is on the basis of:

Source-Pathway-Receptor

Where any one of these "pollution linkages" is absent there is deemed to be no risk.

Fundamentally receptors can be considered as humans and controlled waters (surface and ground waters).

The purpose of using Tier 1 screening levels is to have a simple means of assessing the potential contamination of a site and to inform decisions on whether further investigation is warranted or whether an option to undertake clean up based on the data to hand is cost effective.

Human Health
Current UK guidance is provided by DEFRA and the Environment Agency (EA). Publications forming part of the guidance include; CLEA Model, toxicological reports and soil guideline values (SGV), collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values for soil contamination based on standard land uses and soil assumptions.

CLEA guidance has gone through a number of revisions, all of the original SGV's that were published have been withdrawn and publication of new SGV's commenced in 2009.

For determinands where no SGVs are available, S4UL values have been published using the CLEA 1.06 Model. These are the third set of generic assessment criteria generated by CIEH, and replace the previous two sets of GACs. The revised S4UL values are based on greater knowledge of relevant toxicology and further consideration of exposure frequencies.

No SGV or S4UL is available for lead as this is derived based on blood lead levels. C4SL values for six determinands including lead was published by DEFRA/CL:AIRE in December 2014 and they represent a low risk as opposed to minimal risk. The C4SL values are based on a sandy loam with 6% Soil Organic Matter. These screening values were published by DEFRA for Part 2A use, although with the dual purpose for use under planning. However these have not been officially accepted by Local Government for use under planning. S4ULs remain the first reference due to the broader range of end uses and soil organic content.

The preference from the EA is that site specific screening levels are used wherever possible. Due to numerous factors it is not always possible to utilise site specific values. In these instances the following data sources are used in the order of preference given below:

- CIEH S4UL values (derived by CIEH/LQM)
- DEFRA/CL:AIRE C4SL's
- CL:AIRE GAC values
- Current UK SGV's
- Guidance from other European countries
- Guidance from the outside Europe

Controlled Waters
The European Water Framework Directive (WFD) became UK law in December 2003. It was created to ensure that European countries manage their rivers, groundwater and lakes so that they stay healthy for people and for wildlife.

This is achieved by the use of chemical standards for surface waters and groundwater. These values describe concentrations of chemicals that are not expected to cause harm to environmental organisms or human health, provided they are not exceeded. The same chemical may have several standards for different environmental regimes, and for different protection objectives.

Statutory Standards are set in legislation and if exceeded, this constitutes non-compliance with statutory obligations. European Directives are implemented in England and Wales by corresponding statutory instruments (i.e. regulations). The statutory instruments can be the exact same standards as they appear in the Directive or be more stringent.

A number of non-statutory standards also exist, these are set by various organisations (including the EA) for chemicals that are considered to be of concern, but are not covered by any specific legislation.

The chemical standards used in the UK to control impaction of contamination on controlled waters are Environmental Quality Standards (EQS). The EQS's cover a large number of compounds.

Where certain compounds are not covered by the EQS these are commonly compared to the UK Drinking Water Standards (DWS).

Further Assessment

When screening values are exceeded then further consideration is required. This could include the use of simple measures to break the pollution pathway and mitigate the risk, further more detailed investigation, including the deriving of site specific values to better define the risk and to design appropriate remedial measures.

Re-Use Of Waste - Guidance Note

Definition of Waste
The Environment Agency considers waste to be *"...any material that is discarded, or intended to be discarded..."* This includes any soil from trenches, footing, site strip etc. It is no longer required in its original location, therefore it is considered to be waste.

CL:AIRE: Code of Practice
Where materials are excavated for construction purposes, wherever possible these should be retained on site for engineering purposes if they are suitable for use. This can be implemented under the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE DoWCoP), also commonly referred to as a "Materials Management Plan".

The developer/contractor is advised to complete all works under the DoWCoP.

Potential scenarios where soils may be able to be re-used:

- Material capable of being used in another place on the same site without treatment.
- Material capable of being used in another place on the same site following ex-situ treatment on site.
- Material capable of being used in another development site without treatment (Direct Transfer).
- Material capable of being used in another development site following ex-situ treatment on another site eg Hub site.

The Code of Practice requires 4 No. Factors to be addressed:

1. Protection of human health and protection of the environment.
2. Suitability of use, without further treatment.
3. Certainty of use.
4. Quantity of material.

In order to satisfy these requirements the following are required:

i) Consultation/approval with Local Authority & Environment Agency to confirm they have no objections to the proposed re-use of waste soils, or the risk assessments for the site.
ii) Risk Assessments to demonstrate that the site does not present an Environmental Hazard.
iii) Remediation Strategy for contaminated sites (or Design Statement for non-contaminated sites).
iv) Materials Management Plan (MMP) which details material generated stockpiles and the end use.
v) Volume calculations.
vi) Planning permission for the development.
vii) Contractual details to be clear, regarding who steps in is a contractor goes into administration/liquidation.

The use of the CoP is effectively industry regulated, there is a requirement to appoint an independent Qualified Person (QP) who checks all the requirements have been met and registers the documentation with the Environment Agency. This person must not have had any involvement with the preparing of the risk assessments or remedial strategy on the site.
Soils which require treatment on site (eg bioremediation, stabilisation) will require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use.
Site management procedures need to be in place to ensure that material is tracked through from excavation stockpiling, treatment and remediation processes. Should the process of material tracking be considered non-robust, or not adhered to, this may fail the test whether excavated materials may be considered non-waste.

Waste Classification For Soils

Introduction
Waste producers have a duty of care to classify the waste they are producing:

- before it is collected, disposed of or recovered.
- to identify the controls that apply to the movement of the waste.
- to complete waste documents and records.
- to identify suitably authorised waste management options.
- to prevent harm to people and the environment.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. Where this is not possible there are three main options for the disposal of soils:

1. Disposal to a permitted waste recycling facility.
2. Re-use on another site (subject to the suitability).
3. Disposal to a landfill site.

The disposal to a permitted facility will be subject to the **specific conditions of the permits for each individual facility** and will vary dependent on location and environmental sensitivity of the receiving site. Re-use on another site will also be subject to the acceptability criteria of that site.

The guidance below relates to disposal to **landfill sites only**.

Background for Landfill Disposal
In July 2005 the United Kingdom implemented the European Directive 1999/31/EC (The Landfill Directive), this introduced the current regime for waste and waste disposal to landfill. The Landfill Directive places controls on waste disposal. These controls include requirements to follow the waste acceptance procedures and criteria that have been agreed by the Council of the European Union and are laid out in Council Decision 2003/33/EC.

Before a waste can be accepted at a landfill site, the landfill **operator** must be satisfied that the waste meets his permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

If disposal to landfill is the best management option for the waste soils, these procedures **must** be followed or the operator may refuse to accept the waste.

Key Points

- Not all waste can be landfilled
- Landfills are classified according to whether they can accept **hazardous**, **non-hazardous** or **inert** wastes.
- Wastes can only be accepted at a landfill if they meet the waste acceptance criteria (WAC) for that class of landfill.
- Most wastes must be treated before you can send them to landfill.
- There are formal processes for identifying and checking wastes that must be followed before wastes can be accepted at a landfill site.

Classification
Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste types. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not i.e the hazard assessment. The most common EWC waste codes related to soil are:

17 05	**soil (including excavated soil from contaminated sites), stones and dredging spoil**
17 05 03*	soil and stones containing dangerous substances
17 05 04	soil and stones other than those mentioned in 17 05 03

Soils may contain certain contaminants (eg asbestos, oil,) which have prescribed concentration thresholds, that if breached will render the material hazardous waste. These are based on specific "hazardous properties" which include hazards such as carcinogenicity, flammability and toxicity.

In the first instance the concentrations of plausible contaminants within the soil should be identified and wastes should be **classified based on their total concentrations**.

Waste Definitions

Inert	• Will not undergo any significant physical, chemical or biological transformations. • Will not dissolve. • Will not burn. • Will not physically or chemically react. • Will not biodegrade. • Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. • Has insignificant total leachability and pollutant content. • Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate).
Non-Hazardous	Is not inert (see above) Is not hazardous (see below)
Hazardous	Soil has hazardous properties as defined in WM3 (Guidance on the classification and assessment of waste (1st edition 2015)- Technical Guidance)
Stable Non-reactive hazardous waste#	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents either: in the waste alone (for example, by biodegradation), under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) or by the impact of other wastes (including waste products such as leachate and gas).

This option allows hazardous waste that is stable and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes.

WAC Testing

The purpose of WAC analysis is to confirm that the waste complies with the relevant WAC for the receiving landfill. If the waste has any disposal route other than a landfill site (e.g. recycling facility, incineration etc) the **WAC is not relevant.** Furthermore the WAC limits **cannot be used to make an assessment of whether a waste is hazardous**. WAC testing does however define if a non-hazardous waste is suitable for an inert landfill.

Classification based on Total Concentrations[1]	Non-Hazardous Waste		Hazardous Waste	
WAC testing	Below inert WAC limit values:	Above inert WAC limit values:	Below hazardous WAC limit values	Above hazardous WAC limit values
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill[2]	HAZARDOUS landfill	PRE-TREATMENT[3]

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).
2 Individual sites may have certain limit values pre-determined in their licence.
3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

Hydrocarbons in Soils

WM3 uses the term Oil or Waste Oil to cover hydrocarbons products such as fuel oil, petrol or diesel. These are defined by WM3 as hazardous under an absolute entry in the List of Wastes. However hydrocarbons in soils are a mixture rather than a pure product and are therefore not absolute entries.

Known Oils

The simplest scenario is where the identity of the contaminating oil is known or can be identified. If the oil is known the manufacturer's or supplier's REACH compliant safety data sheet for the specific oil can be obtained and the hazard statement codes on that Safety Data Sheet can be used for the hazardous waste assessment.

Where the identity of the oil can only be identified down to a petroleum group level (i.e. the contaminating oil is known to be diesel, but the specific type/brand is unknown), then the classification of that petroleum group should be used in the assessment. The marker compounds associated with that petroleum group may be used to confirm carcinogenicity.

Oils may contain a range of hydrocarbons, so the presence of for instance Diesel Range Organics (DRO) does not enable the assessor to conclude that diesel is present. These hydrocarbons may have arisen from other oils, the laboratory needs

to provide an interpretation of the chromatograph to determine if it is consistent with diesel or weathered diesel as a whole.

The concentration of known oils should be determined using a method that as a minimum spans the range in which the carbon numbers for that known oil fall.

Unknown Oils
Where hydrocarbons are contaminating soils it is likely that the oil will be unknown or cannot be determined.

WM3 states that:

For contaminated land specific consideration must be given to the following before proceeding;

- The presence of other organic contaminants, for example solvents or coal tar that could be detected as hydrocarbons. Coal Tar is not an oil and is considered separately in WM3 example 2. Where the site history or investigation indicates the presence of hydrocarbons from oil and other sources (e.g. coal tar), and the origin of the hydrocarbons cannot reliably be assigned to either, then a worst case approach of considering the hydrocarbons both as waste oil (in accordance with this example) and from other sources, for example coal tar should be taken.
- The presence of diesel, or weathered diesel, should be specifically considered by the laboratory and where this is confirmed by the hydrocarbon profile the oil should be assessed as a known or identified oil (diesel).

The use of **marker compounds** is optional; however it is recommended that where possible the marker compounds should be used. WM3 states:

If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:

- The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.1 of the CLP for BaP)
- This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3, and
- The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

For example:

TPH Concentration (mg/kg)	Petrol or Diesel	BaP (mg/kg)	Classification
10,000	No	0.9	Non- Hazardous
1,000	No	Not available	Hazardous
1,000	Yes	Not relevant	Hazardous

References

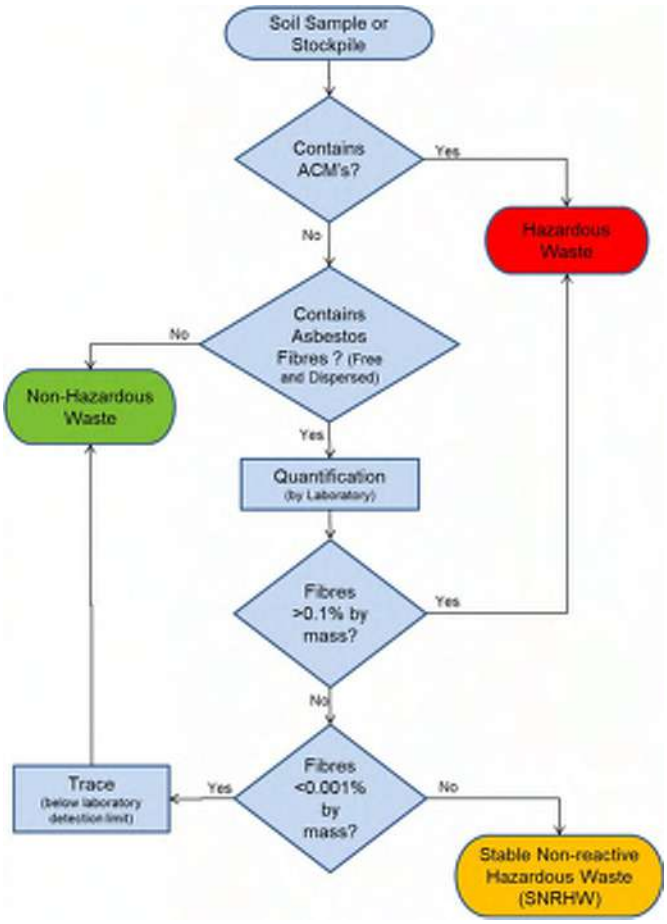
1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert Waste on Land" 2009.
3. Environment Agency "Waste acceptance at landfills - Guidance on waste acceptance procedures and criteria" Nov 2010.
4. Environment Agency "Guidance on the classification and assessment of waste (Technical Guidance WM3)".
5. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).
6. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
7. 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament
8. Environmental Permitting Guidance The Landfill Directive For the Environmental Permitting (England and Wales) Regulations 2010 Updated March 2010 Version 3.1
9. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).

Additional Asbestos Guidance Notes

Disposal
The 1st Edition of WM3 "Guidance on the classification and assessment of waste", details the way in which Asbestos is assessed within soils.

The assessment of asbestos containing waste is dependent on whether the asbestos is present as:

- Fibres that are free and dispersed, or
- Identifiable pieces of asbestos containing materials (ACM's)



Identifiable pieces of asbestos are any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. The result is that commonly soils with visible ACM's are sorted and the ACM's removed by hand picking and separate disposal.
Asbestos concentrations below 0.001% by mass are below standard laboratory detection limits and are not currently regarded as containing asbestos for the purposes of disposal and may be disposed of to an inert landfill site[1]. These levels are often termed "trace" by laboratories.
Asbestos concentrations between 0.001% and 0.1% are stable non-reactive hazardous waste (SNRHW)[1]. Waste transfer stations where soil recycling takes place may be able to take SNRHW, but are unlikely to take soils containing asbestos above trace concentrations.
The following codes should be assigned to the asbestos waste as appropriate:

17 06	**Insulation materials and asbestos-containing construction materials**
17 06 01	Insulation materials containing asbestos
17 06 03	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05	Construction material containing asbestos

WM3 indicates that 17 06 05 would normally be used in preference to 17 06 01 for the asbestos in asbestos contaminated soil and stones.

Construction materials containing asbestos and "*other suitable materials*" may be landfilled at landfills for non-hazardous waste in accordance with the Landfill Directive without testing.

This means that wastes that are only hazardous because of their asbestos content can be disposed of at landfills for non-hazardous waste in separate landfill cells that only accept asbestos wastes and other suitable materials. The Landfill Directive requires that stable non-reactive hazardous waste shall not be deposited with biodegradable waste (for example organic material, household waste, paper etc..) and must meet the waste acceptance criteria set out in accordance with Annex II.

Construction

Health and Safety Executive (HSE) guidance on asbestos is not directly related to soil and much of the guidance focuses on the removal of asbestos from buildings. The overarching legislation is the Control of Asbestos Regulation (CAR 2012). However where work involves (or is likely to involve) contact with asbestos then CAR 2012 requires a risk assessment including whether or not the work is licensed or notifiable non-licensed work and may require an Asbestos Management Plan. Work becomes notifiable if it is considered that the control limit could be exceeded.

Brownfield sites frequently have soils that contain asbestos and the presence of asbestos needs to be considered within the context of construction, particularly in relation to groundworks. The exposure of soils and the use of excavators and plant to move soil around increases the possibility of fibres becoming airborne. However it is good site practice to not generate dusts and to employ dust suppression on all sites regardless of the presence of asbestos.

The legal control limit for asbestos is 0.1f/ml over a continuous four hour period. The control limit is not a '*safe*' level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

Clearly the higher the concentrations in the soil the greater potential there is for fibres to be released, however IOM publication TM/88/14 "the release of dispersed asbestos fibres from soil" 1988 concludes that:

- Mixtures of asbestos in dry soils with asbestos content as low as 0.001% can produce airborne respirable asbestos concentrations greater than 0.1f/ml in dust clouds where the respirable dust concentrations are less than 5mg/m^3.
- An action limit is recommended of no higher than 0.001% asbestos in soils above which steps should be taken to minimise exposure to airborne fibres (eg by wetting).
- The addition of relatively small quantities (10%) of water can reduce the airborne fibre concentrations by an order of magnitude.

Where asbestos has been identified at concentrations above 0.001% as free and dispersed fibres in the soil precautions need to be adopted. Concentrations below this are considered to be normal background, although good site practice dictates that the generation of dusts should be avoided and therefore any fugitive fibre release from minor concentrations should be kept to a practical minimum.

End Use

The use of materials containing asbestos and material containing asbestos is prohibited under EU legislation. There is currently a Joint Industry Working Group (JIWG) tasked with producing a Code of Practice for Asbestos in Soil, Made Ground and Construction & Demolition Material that will clarify in due course the position of the various government agencies.

Asbestos containing materials can remain in situ under a suitable cover system which may be hardsurfacing or soft landscaping (with or without hard dig layers and markers).

There is a risk that future maintenance may compromise such systems and details of the presence of asbestos should be kept in the Health and Safety File.

Preliminary publications from JIWG (April 2015) provide guides for decision making in relation to construction. These are at a "Beta" test stage and further publications will be provided in due course.

The re-use of waste soils should be undertaken in accordance with the CL:AIRE Code of Practice and is subject to suitable risk assessments demonstrating low risk . There is nothing that specifically excludes the re-use of soils containing asbestos as fill to raise levels. However the movement of materials increases the risk of fibres becoming airborne and suitable precautions will be required.

The re-use of soils containing asbestos at concentrations above hazardous waste levels is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be feasible where there is a long program for implementation.

APPENDIX B

Exploratory Hole Logs

Borehole Log

BROWNFIELD SOLUTIONS LTD		No.	HP01
			Sheet 1 of 1
PROJECT NO:	M4993	**CO-ORDS:**	**Hole Type** BH
PROJECT NAME:	GARMAN ROAD, TOTTENHAM	**LEVEL:**	**Scale** 1:50
CLIENT:	SHURGARD UK	**DATES:** 21/03/22	**Logged** SRP / **Checked** JW

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
					0.12			MADE GROUND: CONCRETE.
		0.50	ES PID	0.0PPM	0.60			MADE GROUND: Firm light brown gravelly clay. Gravel is sub-angular fine to coarse of chert and occasional brick.
		0.90	ES PID	0.0PPM	1.00			MADE GROUND: Firm dark brown slightly gravelly clay. Gravel is sub-angular fine to coarse of chert, brick and concrete. *Concrete with power signal detected on CAT and Genny at 1.00m bgl.* End of Borehole at 1.00m

1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0

Remarks

1. Location scanned and cleared with CAT and Genny.
2. Hand-dug inspection pit excavated to 1.00m bgl.
3. No groundwater encountered.
4. Borehole terminated due to concrete and suspect service at 1.00m bgl.
4. Borehole backfilled with arisings.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

BROWNFIELD SOLUTIONS LTD

PROJECT NO:	M4993	**CO-ORDS:**	
PROJECT NAME:	GARMAN ROAD, TOTTENHAM	**LEVEL:**	
CLIENT:	SHURGARD UK	**DATES:**	21/03/22

Window Sampler No.		
WS01		
Sheet 1 of 1		
Hole Type		
WS		
Scale		
1:30		
Logged	**Checked**	
SRP	JW	

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description	
					0.21			MADE GROUND: CONCRETE.	
		0.40	ES PID	0.0PPM				MADE GROUND: Firm to stiff dark brown slightly sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse of brick, limestone and chert with occasional pottery and slate.	
		1.00	ES PID	0.0PPM					1.0
		1.20	SPT	N=4 (1,1/1,1,1,1)	1.20			*Occasional coal gravel between 1.10m and 1.20m bgl.*	
		1.50	ES PID	0.0PPM				Firm brown slightly sandy CLAY. Sand is fine to coarse.	
		2.00	SPT	N=34 (3,4/6,8,10,10)	2.00				2.0
					2.30			Brown slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to medium of chert and siltstone.	
		2.60	ES PID	0.0PPM				Brown sandy GRAVEL. Sand is medium to coarse. Gravel is sub-angular to rounded fine to coarse of chert.	
		3.00	SPT	N=41 (8,10/11,11,11,8)				*Collapse from 3.60m bgl up to 3.00m bgl.*	3.0
		3.50 3.60	ES PID SPT	0.0PPM N≥50 (25 for 120mm/50 for 165mm)				*Black slightly clayey gravel with slight hydrocarbon odour between 3.50m and 3.60m bgl.*	
					3.90			End of Borehole at 3.90m	4.0
									5.0
									6.0

Remarks

1. Location scanned and cleared with CAT and Genny.
2. Hand-dug inspection pit excavated to 1.20m bgl.
3. No groundwater encountered.
4. Borehole installed; GL to 1.00m bgl plain, 1.00m to 3.00m bgl slotted.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

BROWNFIELD SOLUTIONS LTD

PROJECT NO:	M4993	**CO-ORDS:**	
PROJECT NAME:	GARMAN ROAD, TOTTENHAM	**LEVEL:**	
CLIENT:	SHURGARD UK	**DATES:**	21/03/22 - 22/03/22

Window Sampler No.	
WS02	
Sheet 1 of 1	
Hole Type	
WS	
Scale	
1:30	
Logged	**Checked**
SRP	JW

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description	
					0.15			MADE GROUND: CONCRETE.	
		0.30	ES PID	0.0PPM				MADE GROUND: Firm dark brown gravelly clay. Gravel is angular to sub-angular fine to coarse of concrete, brick, chert and siltstone.	
					0.90			MADE GROUND: Firm brown gravelly clay. Gravel is sub-angular fine to coarse of brick and chert with rare pottery.	1.0
		1.00	ES PID	0.0PPM	1.10			Orange and brown clayey GRAVEL. Gravel is sub-angular fine to coarse of chert.	
		1.20	SPT	N=16 (1,1/4,4,4,4)					
		1.60	ES PID	0.0PPM					
		2.00	SPT	N≥50 (6,9/50 for 250mm)	2.00			End of Borehole at 2.00m	2.0
									3.0
									4.0
									5.0
									6.0

Remarks

1. Location scanned and cleared with CAT and Genny.
2. Hand-dug inspection pit excavated to 1.20m bgl.
3. No groundwater encountered.
4. Borehole installed; GL to 0.75m bgl plain, 0.75m to 2.00m bgl slotted.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

BROWNFIELD SOLUTIONS LTD

PROJECT NO:	M4993	**CO-ORDS:**	
PROJECT NAME:	GARMAN ROAD, TOTTENHAM	**LEVEL:**	
CLIENT:	SHURGARD UK	**DATES:**	21/03/22 - 22/03/22

Window Sampler No.		
WS03		
Sheet 1 of 1		
Hole Type		
WS		
Scale		
1:30		
Logged	**Checked**	
SRP	JW	

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description	
					0.12			MADE GROUND: CONCRETE.	
		0.20	ES PID	0.0PPM	0.32			MADE GROUND: Light brown and grey sandy gravel with medium cobble content. Gravel is angular to sub-angular fine to coarse of brick, concrete, pottery and chert. Cobble are angular of brick and concrete.	
		0.80	ES PID	0.0PPM	0.95			MADE GROUND: Firm dark brown gravelly clay. Gravel is sub-angular fine to coarse of brick and chert.	
		1.20	SPT	N=4 (0,0/1,1,1,1)				Firm brown CLAY.	1.0
		1.30	ES PID	0.0PPM	1.70			Brown clayey GRAVEL. Gravel is sub-rounded fine to coarse of chert.	
		1.90	ES PID	0.0PPM	2.00			End of Borehole at 2.00m	2.0
		2.00	SPT	N≥50 (5,7/50 for 290mm)					
									3.0
									4.0
									5.0
									6.0

Remarks

1. Location scanned and cleared with CAT and Genny.
2. Hand-dug inspection pit excavated to 1.20m bgl.
3. No groundwater encountered.
4. Borehole installed; GL to 0.75m bgl plain, 0.75m to 2.00m bgl slotted.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

BROWNFIELD SOLUTIONS LTD		Window Sampler No.	WS04
			Sheet 1 of 1
PROJECT NO:	M4993	**CO-ORDS:**	**Hole Type** WS
PROJECT NAME:	GARMAN ROAD, TOTTENHAM	**LEVEL:**	**Scale** 1:30
CLIENT:	SHURGARD UK	**DATES:** 22/03/22	**Logged** SRP / **Checked** JW

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description	
					0.14			MADE GROUND: CONCRETE.	
		0.60	ES PID	0.0PPM				MADE GROUND: Firm dark brown gravelly clay. Gravel is sub-angular fine to coarse of brick, pottery and chert.	1.0
		1.20	SPT	N=7 (1,2/2,2,1,2)	1.10			Firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is sub-angular fine to medium of chert.	
		1.60	ES PID	0.0PPM	1.70			Orange and brown GRAVEL. Gravel is sub-rounded fine to coarse of chert.	2.0
		2.00	SPT	N=36 (5,7/8,9,9,10)					
	▼							*Slow seepage of groundwater below 2.60m bgl.*	
		2.80	ES PID	0.0PPM					
		3.00	SPT	N≥50 (8,11/50 for 215mm)	3.00			End of Borehole at 3.00m	3.0
									4.0
									5.0
									6.0

Remarks

1. Location scanned and cleared with CAT and Genny.
2. Hand-dug inspection pit excavated to 1.20m bgl.
3. Groundwater encountered at 2.60m bgl.
4. Borehole installed; GL to 1.00m bgl plain, 1.00m to 3.00m bgl slotted.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

Borehole Log

BROWNFIELD SOLUTIONS LTD

PROJECT NO:	M4993	**CO-ORDS:**	
PROJECT NAME:	GARMAN ROAD, TOTTENHAM	**LEVEL:**	
CLIENT:	SHURGARD UK	**DATES:**	22/03/22

Window Sampler No.	
WS05	
Sheet 1 of 1	
Hole Type	
WS	
Scale	
1:30	
Logged	**Checked**
SRP	

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description	
					0.18			MADE GROUND: CONCRETE.	
		0.40	ES PID	0.0PPM				MADE GROUND: Firm dark brown gravelly clay. Gravel is angular fine to coarse of chert, siltstone, brick and concrete with occasional pottery.	
					0.90			Firm brown slightly gravelly CLAY. Gravel is sub-angular fine to coarse of chert.	1.0
		1.20	SPT	N=5 (1,1/1,1,1,2)					
		1.30	ES PID	0.0PPM					
					1.80			Brown sandy GRAVEL. Sand is medium to coarse. Gravel is sub-rounded fine to medium of chert and siltstone.	2.0
		2.00	SPT	N=25 (7,7/5,5,6,9)					
		2.90	ES PID	0.0PPM					
		3.00	SPT	N≥50 (7,8/50 for 280mm)	3.00			End of Borehole at 3.00m	3.0
									4.0
									5.0
									6.0

Remarks

1. Location scanned and cleared with CAT and Genny.
2. Hand-dug inspection pit excavated to 1.20m bgl.
3. No groundwater encountered.
4. Borehole installed; GL to 0.60m bgl plain, 0.60m to 3.00m bgl slotted.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

APPENDIX C

Chemical Testing Results

S. Piercy
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e: s.piercy@brownfield-solutions.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
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Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-47831

Project / Site name:	Garman Road	**Samples received on:**	24/03/2022
Your job number:	M4993	**Samples instructed on/ Analysis started on:**	24/03/2022
Your order number:	M4993-2969-SRP	**Analysis completed by:**	31/03/2022
Report Issue Number:	1	**Report issued on:**	31/03/2022
Samples Analysed:	14 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	-	< 0.1	< 0.1	40	< 0.1
Moisture Content	%	0.01	NONE	-	19	24	7.5	17
Total mass of sample received	kg	0.001	NONE	-	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	GFI	GFI			GFI

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	8.7	8.3	8.6	7.6
Total Sulphate as SO4	%	0.005	MCERTS	-	-	0.16	-	-
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	710	-	130	90
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.35	0.4	0.063	0.045
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	353	400	63.1	45.1
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	21	-	-
Total Sulphur	%	0.005	MCERTS	-	-	0.066	-	-
Ammoniacal Nitrogen as NH4	mg/kg	0.5	MCERTS	-	-	1	-	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	0.1	-	-
Organic Matter (automated)	%	0.1	MCERTS	-	3.9	-	0.4	1.1
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	40	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	0.94	-	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	1.9	-	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	1.9	-	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	1.1	-	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	1.1	-	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	1.1	-	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.78	-	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	1	-	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.64	-	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.69	-	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	11.2	-	< 0.80	< 0.80

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	20	-	7.1	9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	-	< 0.2	< 0.2
Chromium (III)	mg/kg	1	NONE	-	43	-	13	47
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	43	-	13	47
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	66	-	8.8	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	310	-	9.2	55
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	0.9	-	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	31	-	15	34
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	180	-	22	80
Magnesium (water soluble)	mg/kg	5	NONE	-	-	40	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	20	-	-
Monoaromatics & Oxygenates								
Benzene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
Toluene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
Ethylbenzene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
p & m-xylene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
o-xylene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic >EC16 - EC35 $_{EH_CU_1D_AL}$	mg/kg	10	MCERTS	-	< 10	-	< 10	-
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH_CU_1D_AL}$	mg/kg	8.4	NONE	-	< 8.4	-	< 8.4	-
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH_CU+HS_1D_AL}$	mg/kg	10	MCERTS	-	< 10	-	< 10	-
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	-	< 10	-	< 10	-
TPH-CWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	12	-	< 10	-
TPH-CWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	31	-	< 10	-
TPH-CWG - Aromatic > EC35 - EC44 $_{EH_CU_1D_AR}$	mg/kg	8.4	NONE	-	< 8.4	-	< 8.4	-
TPH-CWG - Aromatic (EC5 - EC35) $_{EH_CU+HS_1D_AR}$	mg/kg	10	MCERTS	-	43	-	< 10	-
TPH-CWG - Aromatic (EC5 - EC44) $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	-	43	-	< 10	-
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Chloroethane	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
Bromomethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Vinyl Chloride	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
Trichlorofluoromethane	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
1,1-Dichloroethene	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Trichloromethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
Benzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Tetrachloromethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Trichloroethene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Dibromomethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Bromodichloromethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Tetrachloroethene	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Chlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
p & m-Xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Styrene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Tribromomethane	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
o-Xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Isopropylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Bromobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	-	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.1	-	22	24	8.4
Total mass of sample received	kg	0.001	NONE	0.8	-	0.8	0.4	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A		GFI	ASE		ASE

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.5	-	8.2	7.9	8.2
Total Sulphate as SO4	%	0.005	MCERTS	-	-	-	0.037	-
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	20	-	150	-	21
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.01	-	0.075	0.074	0.011
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	10.1	-	75.4	73.9	10.5
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	2.7	-
Total Sulphur	%	0.005	MCERTS	-	-	-	0.016	-
Ammoniacal Nitrogen as NH4	mg/kg	0.5	MCERTS	-	-	-	< 0.5	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	-	< 0.05	-
Organic Matter (automated)	%	0.1	MCERTS	0.3	-	3.2	-	0.3
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	2.5	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	0.43	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	0.95	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	0.84	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	0.8	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	0.55	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	0.66	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	0.5	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	0.73	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	0.37	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	0.42	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	-	6.25	-	< 0.80

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids	%	0.1	NONE					
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	-	19	-	5.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	-	< 0.2
Chromium (III)	mg/kg	1	NONE	18	-	43	-	10
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	-	43	-	10
Copper (aqua regia extractable)	mg/kg	1	MCERTS	11	-	92	-	13
Lead (aqua regia extractable)	mg/kg	1	MCERTS	9	-	240	-	8.3
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	1.2	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	-	29	-	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	28	-	170	-	20

Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	15	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	7.3	-

Monoaromatics & Oxygenates

Benzene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
Toluene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
Ethylbenzene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
p & m-xylene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
o-xylene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	-	-	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC16 - EC35 $_{EH_CU_1D_AL}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH_CU_1D_AL}$	mg/kg	8.4	NONE	-	-	-	-	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH_CU+HS_1D_AL}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	-	-	-	-	< 10

TPH-CWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	-	-	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic > EC35 - EC44 $_{EH_CU_1D_AR}$	mg/kg	8.4	NONE	-	-	-	-	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) $_{EH_CU+HS_1D_AR}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC44) $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	-	-	-	-	< 10

VOCs

Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chloroethane	µg/kg	1	NONE	-	-	-	-	< 1.0
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	0.1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Styrene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tribromomethane	µg/kg	1	NONE	-	-	-	-	< 1.0
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	70	< 0.1
Moisture Content	%	0.01	NONE	16	16	4.4	17
Total mass of sample received	kg	0.001	NONE	0.8	0.4	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	Chrysotile- Loose Fibres
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Detected
Asbestos Analyst ID	N/A	N/A	N/A		ASE		ASE

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	7.4	8.3	8.1
Total Sulphate as SO4	%	0.005	MCERTS	0.176	-	0.022	-
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	720	-	65
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.3	0.36	0.028	0.032
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	301	358	28.4	32.3
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	15	-	5.1	-
Total Sulphur	%	0.005	MCERTS	0.075	-	0.008	-
Ammoniacal Nitrogen as NH4	mg/kg	0.5	MCERTS	< 0.5	-	< 0.5	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	< 0.05	-	< 0.05	-
Organic Matter (automated)	%	0.1	MCERTS	-	4.4	-	5.6
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	48	-	3.6	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	0.73	-	1.4
Anthracene	mg/kg	0.05	MCERTS	-	0.19	-	0.3
Fluoranthene	mg/kg	0.05	MCERTS	-	1.4	-	2.8
Pyrene	mg/kg	0.05	MCERTS	-	1.3	-	2.8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.91	-	1.6
Chrysene	mg/kg	0.05	MCERTS	-	0.91	-	1.4
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	0.95	-	1.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.71	-	0.9
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	1	-	1.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.57	-	0.86
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	0.17
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.72	-	1.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	9.4	-	16.7

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Heavy Metals / Metalloids	%	0.1	NONE				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	26	-	99
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	-	< 0.2
Chromium (III)	mg/kg	1	NONE	-	40	-	45
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	40	-	45
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	70	-	280
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	460	-	270
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	1.6	-	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	30	-	56
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	210	-	560

Magnesium (water soluble)	mg/kg	5	NONE	63	-	7.1	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	32	-	3.6	-

Monoaromatics & Oxygenates

Benzene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
Toluene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
Ethylbenzene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
p & m-xylene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
o-xylene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	< 0.001	-	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	< 2.0	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	< 8.0	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	< 8.0	-	-	-
TPH-CWG - Aliphatic >EC16 - EC35 $_{EH_CU_1D_AL}$	mg/kg	10	MCERTS	< 10	-	-	-
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH_CU_1D_AL}$	mg/kg	8.4	NONE	< 8.4	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH_CU+HS_1D_AL}$	mg/kg	10	MCERTS	< 10	-	-	-
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	< 10	-	-	-

TPH-CWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	< 1.0	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	< 2.0	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	11	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	26	-	-	-
TPH-CWG - Aromatic > EC35 - EC44 $_{EH_CU_1D_AR}$	mg/kg	8.4	NONE	< 8.4	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) $_{EH_CU+HS_1D_AR}$	mg/kg	10	MCERTS	37	-	-	-
TPH-CWG - Aromatic (EC5 - EC44) $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	37	-	-	-

VOCs

Chloromethane	µg/kg	1	ISO 17025	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-
Benzene	µg/kg	1	MCERTS	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-
Styrene	µg/kg	1	MCERTS	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-47831
Project / Site name: Garman Road

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2216769	WS01	None Supplied	1	Brown clay and sand with gravel and vegetation.
2216770	WS01	None Supplied	1.5	Light brown clay and sand with gravel.
2216771	WS01	None Supplied	3.5	Light grey sand with gravel and stones.
2216772	WS02	None Supplied	1	Light brown clay and sand with gravel.
2216773	WS02	None Supplied	1.6	Light brown sand with gravel.
2216775	WS03	None Supplied	0.8	Brown clay and loam with gravel.
2216776	WS03	None Supplied	1.3	Light brown clay.
2216777	WS04	None Supplied	0.6	Light brown sand with gravel.
2216778	WS04	None Supplied	2.8	Brown loam and clay with gravel.
2216779	WS05	None Supplied	0.4	Brown loam and clay with gravel and brick.
2216780	WS05	None Supplied	2.9	Light brown sand with stones and gravel
2216781	HP01	None Supplied	0.9	Brown loam and clay with gravel and coal.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 22-47831
Project / Site name: Garman Road

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS

Analytical Report Number : 22-47831
Project / Site name: Garman Road

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

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Analytical Report Number : 22-47831

Replaces Analytical Report Number: 22-47831, issue no. 1
Additional analysis undertaken.

Project / Site name:	Garman Road	**Samples received on:**	24/03/2022
Your job number:	M4993	**Samples instructed on/ Analysis started on:**	24/03/2022
Your order number:	M4993-2969-SRP	**Analysis completed by:**	07/04/2022
Report Issue Number:	2	**Report issued on:**	08/04/2022
Samples Analysed:	14 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	-	< 0.1	< 0.1	40	< 0.1
Moisture Content	%	0.01	NONE	-	19	24	7.5	17
Total mass of sample received	kg	0.001	NONE	-	0.8	0.8	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	GFI	GFI	N/A	N/A	GFI

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	8.7	8.3	8.6	7.6
Total Sulphate as SO4	%	0.005	MCERTS	-	-	0.16	-	-
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	710	-	130	90
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.35	0.4	0.063	0.045
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	353	400	63.1	45.1
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	21	-	-
Total Sulphur	%	0.005	MCERTS	-	-	0.066	-	-
Ammoniacal Nitrogen as NH4	mg/kg	0.5	MCERTS	-	-	1	-	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	0.1	-	-
Organic Matter (automated)	%	0.1	MCERTS	-	3.9	-	0.4	1.1
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	40	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	0.94	-	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	1.9	-	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	1.9	-	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	1.1	-	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	1.1	-	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	1.1	-	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.78	-	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	1	-	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.64	-	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.69	-	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	11.2	-	< 0.80	< 0.80

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	20	-	7.1	9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	-	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	-	< 1.2	-	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	-	43	-	13	47
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	43	-	13	47
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	66	-	8.8	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	310	-	9.2	55
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	0.9	-	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	31	-	15	34
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	180	-	22	80
Magnesium (water soluble)	mg/kg	5	NONE	-	-	40	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	20	-	-
Monoaromatics & Oxygenates								
Benzene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
Toluene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
Ethylbenzene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
p & m-xylene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
o-xylene	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic >EC16 - EC35 $_{EH_CU_1D_AL}$	mg/kg	10	MCERTS	-	< 10	-	< 10	-
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH_CU_1D_AL}$	mg/kg	8.4	NONE	-	< 8.4	-	< 8.4	-
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH_CU+HS_1D_AL}$	mg/kg	10	MCERTS	-	< 10	-	< 10	-
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	-	< 10	-	< 10	-
TPH-CWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	< 0.001	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	-	< 2.0	-	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	12	-	< 10	-
TPH-CWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	31	-	< 10	-
TPH-CWG - Aromatic > EC35 - EC44 $_{EH_CU_1D_AR}$	mg/kg	8.4	NONE	-	< 8.4	-	< 8.4	-
TPH-CWG - Aromatic (EC5 - EC35) $_{EH_CU+HS_1D_AR}$	mg/kg	10	MCERTS	-	43	-	< 10	-
TPH-CWG - Aromatic (EC5 - EC44) $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	-	43	-	< 10	-

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Chloroethane	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
Bromomethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Vinyl Chloride	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
Trichlorofluoromethane	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
1,1-Dichloroethene	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Trichloromethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
Benzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Tetrachloromethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Trichloroethene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Dibromomethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Bromodichloromethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Tetrachloroethene	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
Chlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
p & m-Xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Styrene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Tribromomethane	µg/kg	1	NONE	-	< 1.0	-	< 1.0	-
o-Xylene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Isopropylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Bromobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Butylbenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	< 1.0	-	< 1.0	-

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216768	2216769	2216770	2216771	2216772
Sample Reference				WS01	WS01	WS01	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.00	1.50	3.50	1.00
Date Sampled				21/03/2022	21/03/2022	21/03/2022	21/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	< 1.0	-	< 1.0	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	-	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.1	-	22	24	8.4
Total mass of sample received	kg	0.001	NONE	0.8	-	0.8	0.4	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	GFI	ASE	N/A	ASE

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.5	-	8.2	7.9	8.2
Total Sulphate as SO4	%	0.005	MCERTS	-	-	-	0.037	-
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	20	-	150	-	21
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.01	-	0.075	0.074	0.011
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	10.1	-	75.4	73.9	10.5
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	2.7	-
Total Sulphur	%	0.005	MCERTS	-	-	-	0.016	-
Ammoniacal Nitrogen as NH4	mg/kg	0.5	MCERTS	-	-	-	< 0.5	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	-	< 0.05	-
Organic Matter (automated)	%	0.1	MCERTS	0.3	-	3.2	-	0.3
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	2.5	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	0.43	-	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	0.95	-	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	-	0.84	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	0.8	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	-	0.55	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	0.66	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	-	0.5	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	0.73	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	0.37	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	0.42	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	-	6.25	-	< 0.80

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	-	19	-	5.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	-	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	-	< 1.2	-	< 1.2
Chromium (III)	mg/kg	1	NONE	18	-	43	-	10
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	-	43	-	10
Copper (aqua regia extractable)	mg/kg	1	MCERTS	11	-	92	-	13
Lead (aqua regia extractable)	mg/kg	1	MCERTS	9	-	240	-	8.3
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	1.2	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	-	29	-	12
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	28	-	170	-	20
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	15	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	7.3	-
Monoaromatics & Oxygenates								
Benzene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
Toluene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
Ethylbenzene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
p & m-xylene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
o-xylene	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	-	-	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	-	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC16 - EC35 $_{EH_CU_1D_AL}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH_CU_1D_AL}$	mg/kg	8.4	NONE	-	-	-	-	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH_CU+HS_1D_AL}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	-	-	-	-	< 10
TPH-CWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	-	-	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic > EC35 - EC44 $_{EH_CU_1D_AR}$	mg/kg	8.4	NONE	-	-	-	-	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) $_{EH_CU+HS_1D_AR}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC44) $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	-	-	-	-	< 10

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chloroethane	µg/kg	1	NONE	-	-	-	-	< 1.0
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Styrene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tribromomethane	µg/kg	1	NONE	-	-	-	-	< 1.0
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	< 1.0

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216773	2216774	2216775	2216776	2216777
Sample Reference				WS02	WS03	WS03	WS03	WS04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.20	0.80	1.30	0.60
Date Sampled				22/03/2022	22/03/2022	22/03/2022	22/03/2022	22/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	70	< 0.1
Moisture Content	%	0.01	NONE	16	16	4.4	17
Total mass of sample received	kg	0.001	NONE	0.8	0.4	0.8	0.8

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	< 0.001
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	< 0.001
Asbestos Analyst ID	N/A	N/A	N/A	N/A	ASE	N/A	EC

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	7.4	8.3	8.1
Total Sulphate as SO4	%	0.005	MCERTS	0.176	-	0.022	-
Water Soluble Sulphate as SO4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	720	-	65
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.3	0.36	0.028	0.032
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	301	358	28.4	32.3
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	15	-	5.1	-
Total Sulphur	%	0.005	MCERTS	0.075	-	0.008	-
Ammoniacal Nitrogen as NH4	mg/kg	0.5	MCERTS	< 0.5	-	< 0.5	-
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	< 0.05	-	< 0.05	-
Organic Matter (automated)	%	0.1	MCERTS	-	4.4	-	5.6
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	48	-	3.6	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	0.73	-	1.4
Anthracene	mg/kg	0.05	MCERTS	-	0.19	-	0.3
Fluoranthene	mg/kg	0.05	MCERTS	-	1.4	-	2.8
Pyrene	mg/kg	0.05	MCERTS	-	1.3	-	2.8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.91	-	1.6
Chrysene	mg/kg	0.05	MCERTS	-	0.91	-	1.4
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	0.95	-	1.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.71	-	0.9
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	1	-	1.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.57	-	0.86
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	-	0.17
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.72	-	1.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	9.4	-	16.7

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	26	-	99
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	-	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	-	< 1.2	-	< 1.2
Chromium (III)	mg/kg	1	NONE	-	40	-	45
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	40	-	45
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	70	-	280
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	460	-	270
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	1.6	-	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	30	-	56
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	210	-	560
Magnesium (water soluble)	mg/kg	5	NONE	63	-	7.1	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	32	-	3.6	-
Monoaromatics & Oxygenates							
Benzene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
Toluene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
Ethylbenzene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
p & m-xylene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
o-xylene	mg/kg	0.001	MCERTS	< 0.001	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	< 0.001	-	-	-
Petroleum Hydrocarbons							
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS_1D_AL}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH_CU_1D_AL}$	mg/kg	1	MCERTS	< 1.0	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH_CU_1D_AL}$	mg/kg	2	MCERTS	< 2.0	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	< 8.0	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH_CU_1D_AL}$	mg/kg	8	MCERTS	< 8.0	-	-	-
TPH-CWG - Aliphatic >EC16 - EC35 $_{EH_CU_1D_AL}$	mg/kg	10	MCERTS	< 10	-	-	-
TPH-CWG - Aliphatic > EC35 - EC44 $_{EH_CU_1D_AL}$	mg/kg	8.4	NONE	< 8.4	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH_CU+HS_1D_AL}$	mg/kg	10	MCERTS	< 10	-	-	-
TPH-CWG - Aliphatic (EC5 - EC44) $_{EH_CU+HS_1D_AL}$	mg/kg	10	NONE	< 10	-	-	-
TPH-CWG - Aromatic >EC5 - EC7 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 $_{HS_1D_AR}$	mg/kg	0.001	MCERTS	< 0.001	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 $_{EH_CU_1D_AR}$	mg/kg	1	MCERTS	< 1.0	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 $_{EH_CU_1D_AR}$	mg/kg	2	MCERTS	< 2.0	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	11	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 $_{EH_CU_1D_AR}$	mg/kg	10	MCERTS	26	-	-	-
TPH-CWG - Aromatic > EC35 - EC44 $_{EH_CU_1D_AR}$	mg/kg	8.4	NONE	< 8.4	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) $_{EH_CU+HS_1D_AR}$	mg/kg	10	MCERTS	37	-	-	-
TPH-CWG - Aromatic (EC5 - EC44) $_{EH_CU+HS_1D_AR}$	mg/kg	10	NONE	37	-	-	-

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
VOCs							
Chloromethane	µg/kg	1	ISO 17025	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-
Benzene	µg/kg	1	MCERTS	-	-	-	-
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-
Styrene	µg/kg	1	MCERTS	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-
o-Xylene	µg/kg	1	MCERTS	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 22-47831
Project / Site name: Garman Road
Your Order No: M4993-2969-SRP

Lab Sample Number				2216778	2216779	2216780	2216781
Sample Reference				WS04	WS05	WS05	HP01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.80	0.40	2.90	0.90
Date Sampled				22/03/2022	22/03/2022	22/03/2022	21/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: **22-47831**
Project / Site name: **Garman Road**
Your Order No:

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2216781	HP01	0.90	159	Loose Fibres	**Chrysotile**	< 0.001	**< 0.001**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 22-47831
Project / Site name: Garman Road

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2216769	WS01	None Supplied	1	Brown clay and sand with gravel and vegetation.
2216770	WS01	None Supplied	1.5	Light brown clay and sand with gravel.
2216771	WS01	None Supplied	3.5	Light grey sand with gravel and stones.
2216772	WS02	None Supplied	1	Light brown clay and sand with gravel.
2216773	WS02	None Supplied	1.6	Light brown sand with gravel.
2216775	WS03	None Supplied	0.8	Brown clay and loam with gravel.
2216776	WS03	None Supplied	1.3	Light brown clay.
2216777	WS04	None Supplied	0.6	Light brown sand with gravel.
2216778	WS04	None Supplied	2.8	Brown loam and clay with gravel.
2216779	WS05	None Supplied	0.4	Brown loam and clay with gravel and brick.
2216780	WS05	None Supplied	2.9	Light brown sand with stones and gravel
2216781	HP01	None Supplied	0.9	Brown loam and clay with gravel and coal.

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 22-47831
Project / Site name: Garman Road

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS

Analytical Report Number : 22-47831
Project / Site name: Garman Road

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

APPENDIX D

Geotechnical Testing Results

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

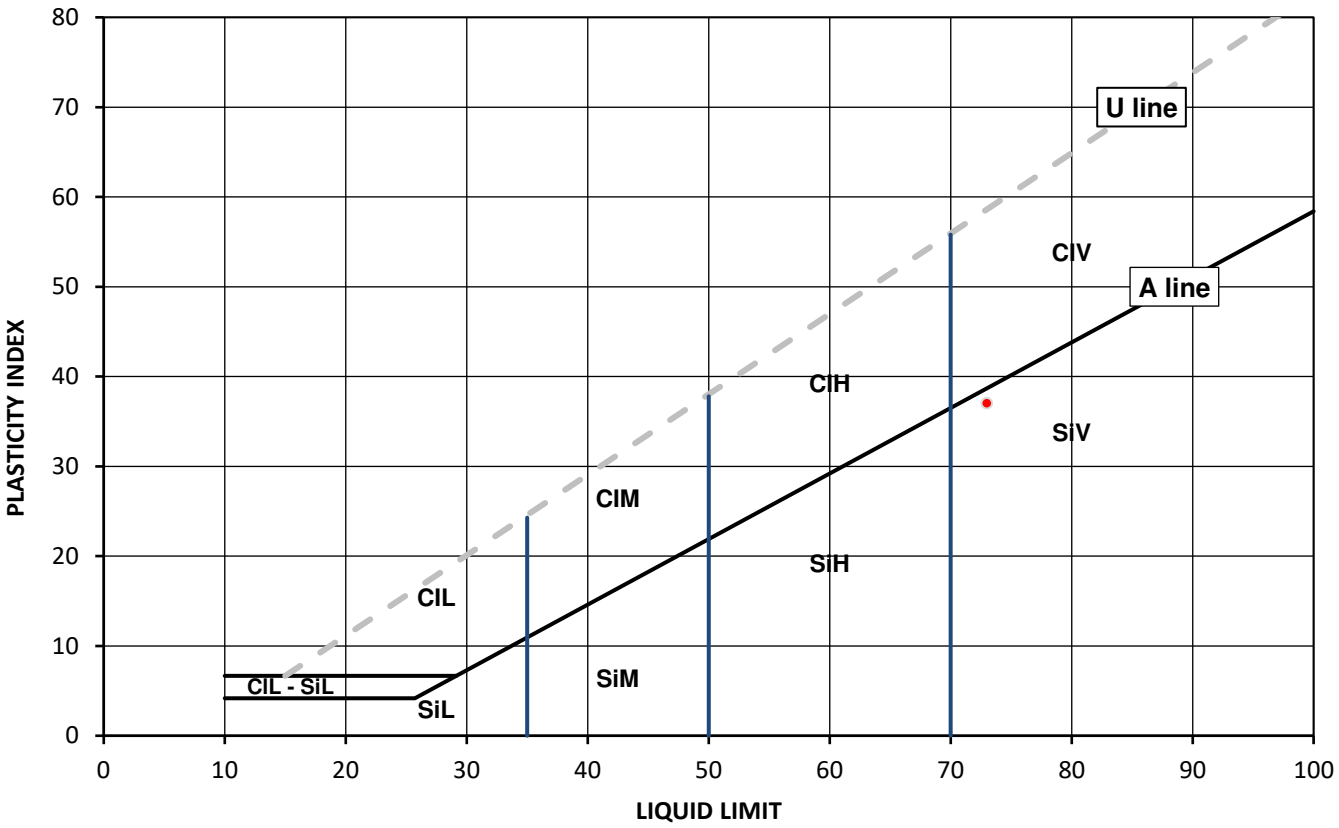
Client:	Brownfield Solutions Ltd	Client Reference:	M4993
Client Address:	William Smith House, 173 - 183 Witton Street, Northwich, Cheshire, CW9 5LP	Job Number:	22-47846
		Date Sampled:	21/03/2022
		Date Received:	24/03/2022
Contact:	S. Piercy	Date Tested:	06/04/2022
Site Address:	Garman Road	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2216878	Depth Top [m]:	1.50
Hole No.:	WS01	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brownish grey slightly gravelly CLAY		
Sample Preparation:	Tested after >425um removed by hand		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
44.6	73	36	37	98



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014

Remarks:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed: [redacted]

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 12/04/2022

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

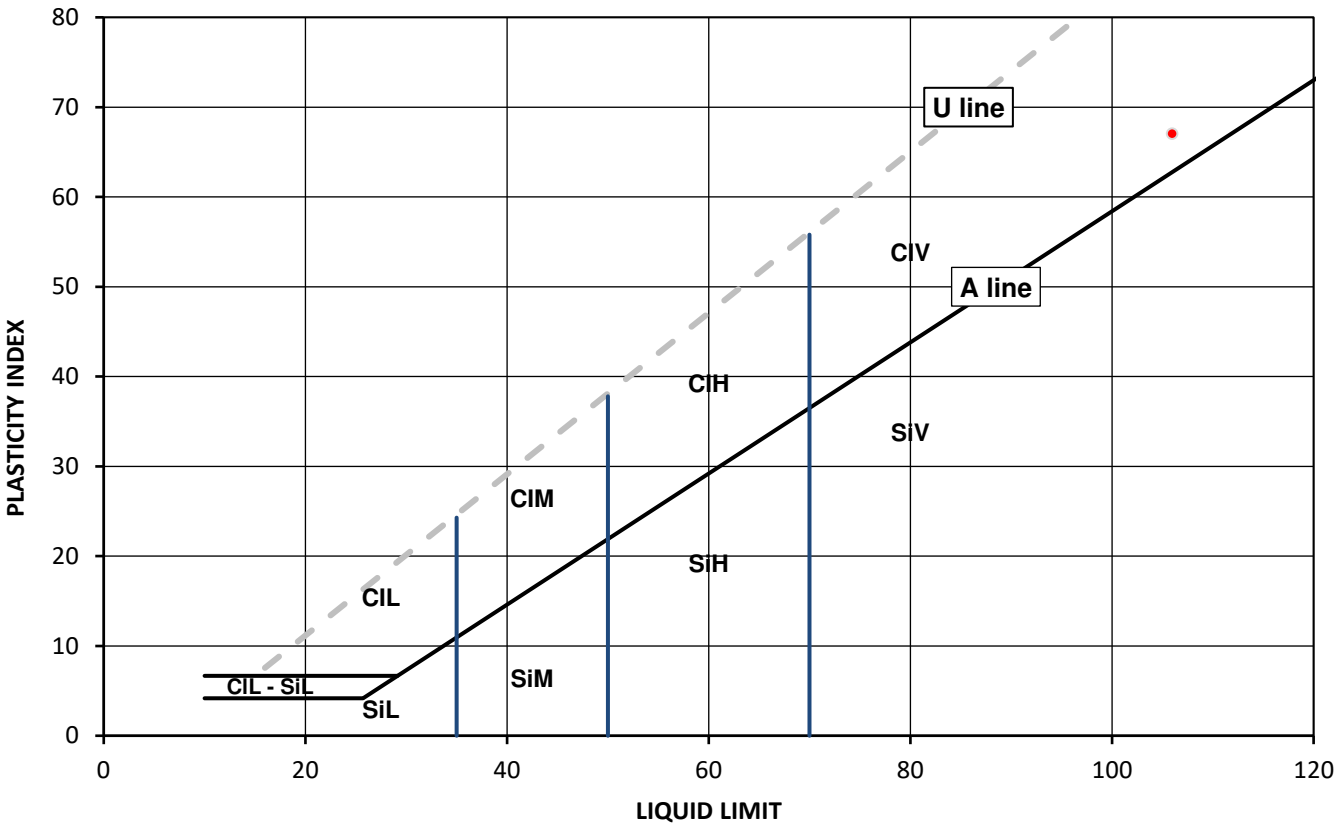
Client:	Brownfield Solutions Ltd	Client Reference:	M4993
Client Address:	William Smith House, 173 - 183 Witton Street, Northwich, Cheshire, CW9 5LP	Job Number:	22-47846
		Date Sampled:	22/03/2022
		Date Received:	24/03/2022
Contact:	S. Piercy	Date Tested:	06/04/2022
Site Address:	Garman Road	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2216879	Depth Top [m]:	1.30
Hole No.:	WS03	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brownish grey CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
45.4	106	39	67	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014

Remarks:

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Signed: [redacted]

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Date Reported: 12/04/2022

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

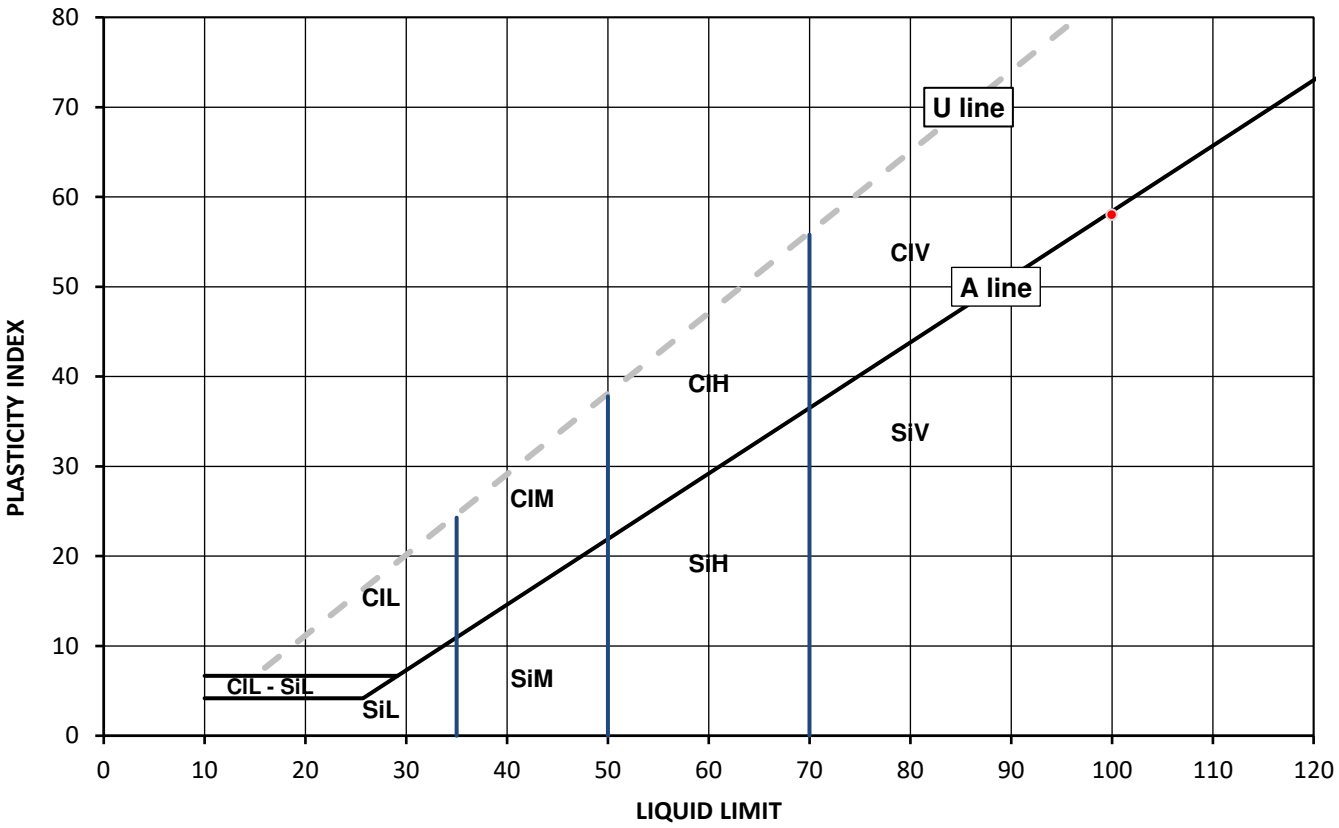
Client:	Brownfield Solutions Ltd	Client Reference:	M4993
Client Address:	William Smith House, 173 - 183 Witton Street, Northwich, Cheshire, CW9 5LP	Job Number:	22-47846
		Date Sampled:	22/03/2022
		Date Received:	24/03/2022
Contact:	S. Piercy	Date Tested:	06/04/2022
Site Address:	Garman Road	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2216880	Depth Top [m]:	1.60
Hole No.:	WS04	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brownish grey CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
46.2	100	42	58	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014

Remarks:

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Signed: [redacted]

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 12/04/2022

GF 232.12

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with:BS 1377-2:1990:Clause 4.4 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

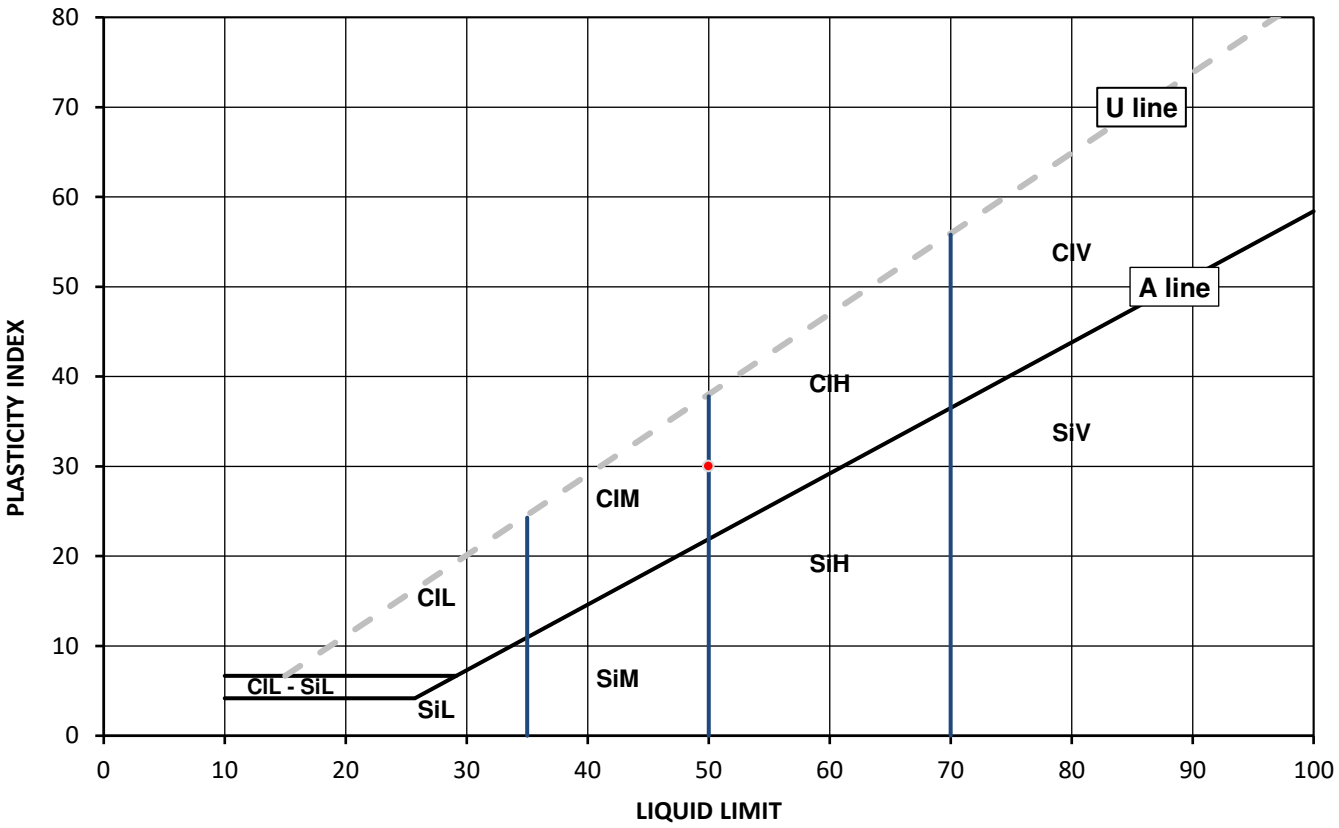
Client:	Brownfield Solutions Ltd	Client Reference:	M4993
Client Address:	William Smith House, 173 - 183 Witton Street, Northwich, Cheshire, CW9 5LP	Job Number:	22-47846
		Date Sampled:	22/03/2022
		Date Received:	24/03/2022
Contact:	S. Piercy	Date Tested:	06/04/2022
Site Address:	Garman Road	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	2216881	Depth Top [m]:	1.30
Hole No.:	WS05	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Sample Description:	Brownish grey slightly sandy CLAY		
Sample Preparation:	Tested in natural condition		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
23.5	50	20	30	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014

Remarks:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed: [redacted]

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 12/04/2022

GF 232.12

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

Water Content by BS EN ISO 17892-1:2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Client: Brownfield Solutions Ltd
Client Address: William Smith House, 173 - 183 Witton Street, Northwich, Cheshire, CW9 5LP
Contact: S. Piercy
Site Address: Garman Road

Client Reference: M4993
Job Number: 22-47846
Date Sampled: 21/03 - 22/03/2022
Date Received: 24/03/2022
Date Tested: 06/04/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W]	Water Content BS EN ISO 17892-1 [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m				%	%	%	%	%	%	Mg/m3	Mg/m3	Mg/m3	%		
2216878	WS01	Not Given	1.50	Not Given	D	Brownish grey slightly gravelly CLAY	Atterberg 1 Point		44.6	98	73	36	37						
2216879	WS03	Not Given	1.30	Not Given	D	Brownish grey CLAY	Atterberg 1 Point		45.4	100	106	39	67						
2216880	WS04	Not Given	1.60	Not Given	D	Brownish grey CLAY	Atterberg 1 Point		46.2	100	100	42	58						
2216881	WS05	Not Given	1.30	Not Given	D	Brownish grey slightly sandy CLAY	Atterberg 1 Point		23.5	100	50	20	30						

Note: # Non accredited; NP - Non plastic

Comments:

Signed: [redacted]

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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Date Reported: 12/04/2022

GF 234.14

APPENDIX E

Monitoring Results

Ground Gas Monitoring Results

CLIENT:	Date	Operator	Analsyer	Weather Observations			Temp (°C)	Pressure Trend	Min Barometric Pressure (mb)	Notes
SHURGARD UK	07/04/2022	PG	GFM	Intermittent cloud	Windy	Cool	11	Falling	981	
JOB NO.	21/04/2022	PG	GFM	Sunny	No wind	Warm	14	Falling	1009	
M4993										
SITE:										
GARMAN ROAD TOTTENHAM										

Notes: mb = milibars; CH_4 = methane; LEL = lower explosive limit = 5%v/v; CO_2 = carbon dioxide; O_2 = oxygen; CO=carbon monoxide; H_2S = hydrogen sulphide; TVOC= Total volatile organic compounds; PPM = parts per million. Where the flow is less than the limit of detection of the instrument, the detection limit is reported (Highlighted in green). Gas Screening Values (GSVs) are rounded to 3 decimal places. Calibration Records for analysers used availble on request.

Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH_4 (%v/v)		CH_4 (%LEL)		CO_2 (%v/v)		O_2 (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH_4) (l/hr)	Gas Screening Value (CO_2) (l/hr)	Notes
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H_2S	TVOC (PID)					
				Summary Statistcs																			
			Max. values:	1009	0.0	2.1	0.1	0.1	0.1	2.0	2.0	5.8	5.8	19.7	19.7	0.0	0.0	0.0	2.3	2.7	0.000	0.006	
			Min. values:	982	0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	9.7	9.7	0.0	0.0	0.0	1.9	2.0	0.000	0.000	
				Worst-case GSVs based on maximum recorded steady flow and maximum individual peak concentrations:																	0.000	0.006	
07/04/2022	AM	Ambient	X.00 - X.00	982				0.1		2.0		0.1		19.7		0.0	0.0	0.0					
		WS03	0.75-2.00	982.00	0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.2	0.1	19.4	19.7	0.0	0.0	0.0	1.91	2.03	0.000	0.000	
		WS02	0.75-2.00	982.00	0.0	0.1	0.1	0.1	0.1	2.0	2.0	4.6	4.6	13.9	13.2	0.0	0.0	0.0	1.97	2.05	0.000	0.005	
		WS01	1.00-3.00	982.00	0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.0	1.1	18.2	18.5	0.0	0.0	0.0	2.09	2.61	0.000	0.001	
		WS04	0.60-3.00	982.00	0.0	2.1	0.1	0.1	0.1	2.0	2.0	3.1	3.3	16.9	17.0	0.0	0.0	0.0	2.10	2.57	0.000	0.003	
		WS05	0.60-3.00	982.00	0.0	0.1	0.1	0.1	0.1	2.0	2.0	2.0	0.2	17.9	19.4	0.0	0.0	0.0	2.21	2.71	0.000	0.002	
07/04/2022	AM	Ambient	X.00 - X.00	981				0.1		2.0		0.1		19.7		0.0	0.0	0.0					
21/04/2022	AM	Ambient	X.00 - X.00	1009		0.1		0.1		2.0		0.1		19.4		0.0	0.0	0.0					
		WS03	0.75-2.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.5	0.2	19.3	19.4	0.0	0.0	0.0	NGW	2.08	0.000	0.001	
		WS02	0.75-2.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	5.8	5.8	9.7	9.7	0.0	0.0	0.0	NGW	2.05	0.000	0.006	
		WS01	1.00-3.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	2.0	0.9	17.8	18.9	0.0	0.0	0.0	2.25	2.53	0.000	0.002	
		WS04	0.60-3.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	2.2	1.8	18.0	18.4	0.0	0.0	0.0	2.26	2.60	0.000	0.002	
		WS05	0.60-3.00		0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.9	1.9	18.6	18.7	0.0	0.0	0.0	2.34	2.65	0.000	0.002	
21/04/2022				1009		0.1		0.1		2.0		0.1		19.4		0.0	0.0	0.0					
07/04/2022	AM	Ambient	X.00 - X.00	981																			

North West

William Smith House
173 – 183 Witton Street
Northwich
Cheshire
CW9 5LP

Tel: 01606 334 844

Midlands

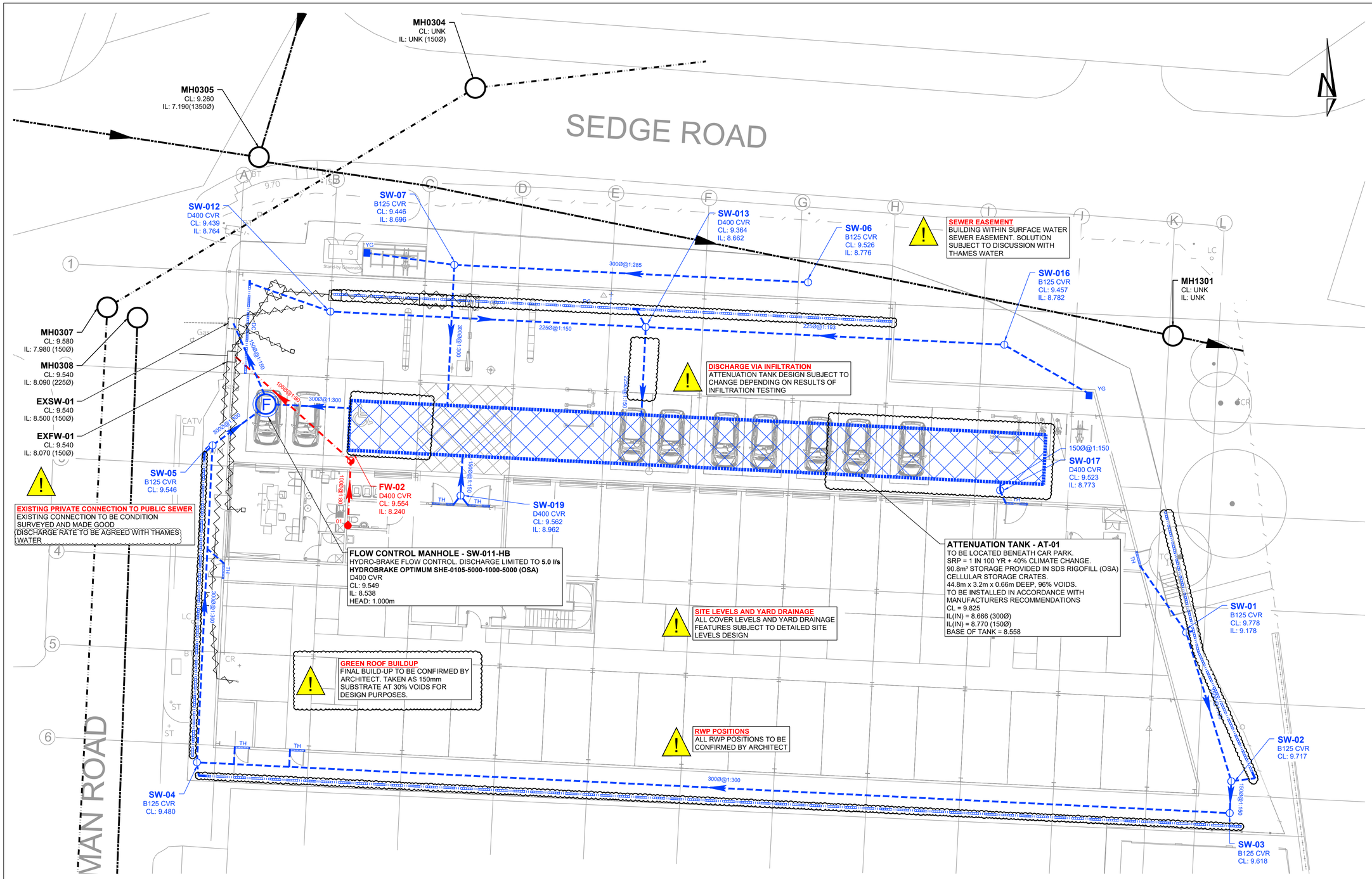
Unit 5, Alfred Court
Saxon Business Park
Stoke Prior
Bromsgrove
Worcestershire
B60 4AD

Tel: 01215 729 014

www.brownfield-solutions.com

Appendix H

Proposed Drainage Strategy



THIS DRAWING IS SUBJECT TO ADDITIONAL DETAILED DESIGN AND COORDINATION

PROPOSED DRAINAGE - FOUL

- FOUL WATER DRAIN
- FOUL WATER MANHOLE
- FOUL WATER INSPECTION CHAMBER
- 01 FOUL OUTLET / STACK POSITION (Refer to Service Engineer / Architect for Details) (Shown indicative)

PROPOSED DRAINAGE - STORM

- STORM WATER DRAIN
- STORM WATER MANHOLE
- STORM WATER INSPECTION CHAMBER
- YG YARD GULLY
- RWO RAIN WATER DOWNPIPE
- DC DRAINAGE CHANNEL
- TH THRESHOLD DRAINAGE CHANNEL (Refer to architect for details / specification)

NOTE: DRAINAGE HAS ONLY BEEN SHOWN INDICATIVELY TO DEMONSTRATE THE PRINCIPLES OF THE DRAINAGE STRATEGY AND SHOULD NOT BE USED FOR PRICING

PUBLIC AND PRIVATE EXISTING/PROPOSED DRAINAGE

- 150Ø@1:100 EXISTING PUBLIC FOUL SEWER
- 150Ø@1:100 EXISTING PUBLIC STORM SEWER
- 150Ø@1:100 EXISTING PRIVATE FOUL DRAIN
- 150Ø@1:100 EXISTING PRIVATE STORM DRAIN
- DRAIN TO BE ABANDONED

KEY PLAN

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
4. Levels shown in metres above Ordnance Datum (mAOD).
5. All dimensions shown in millimetres unless otherwise stated.
6. All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
7. All external drainage within trafficked areas with less than 1.2m cover to have type Z concrete bed and surround. All external drainage within landscaped areas with cover less than 0.6m to have type Z concrete bed and surround. All drainage with greater cover than the minimum required to have type S bed and surround.
8. All drainage to be laid soffit to soffit unless otherwise shown.
9. The Contractor is to verify the line, level and diameter of existing sewers before commencing drainage works.
10. All foul drainage to be minimum 100mm diameter, all surface water drainage to be minimum 150mm diameter unless otherwise shown.
11. Cover levels shown on this drawing refer to approximate surface levels. It is the contractors responsibility to ensure that access covers and frames are set at the final surface levels.
12. Where possible the contractor is to orientate manhole biscuits and covers to locate them parallel to kerbs and paving.
13. The Contractor should comply with hs(g) 47 "Avoiding Danger from Underground Services" when excavating around existing services.
14. It is the contractors responsibility to determine the location and depth of all existing services, mains and cables prior to construction.
15. Contractor to provide temporary screens in each of the down stream manholes during the construction period of the development in accordance with Design Construction Guidance Cl. B5.2.23 and the local sewerage undertakers requirements.
16. All in-situ concrete and precast concrete components to be manufactured using Sulphate Resisting Portland Cement, (SRPC) to BS 4027, if required, subject to soil conditions. Manhole components to be to BS EN 1917:2002.
17. All ironwork to be kite marked by BSI or certified by equal inspection authority.
18. All redundant connections to be capped off and grouted from the down stream manhole.
19. All new drainage pipes to be jetted, CCTV surveyed with DVD recording and any defects highlighted to the supervising officer. Following the rectification of any defects, the drain is to be re-surveyed with CCTV and the recordings made available to the project manager/engineer.
20. Prior to commencing the works the contractor is to confirm details of the existing drainage system as noted on the drawing.
21. Prior to commencing the works the contractor is to undertake the drainage investigation work as noted on the drawing.
22. All existing drainage other than demarcation chambers and connections to Thames Water public sewers to be abandoned unless otherwise noted.
23. Rainwater Downpipe positions to be confirmed by the architect.
24. Public sewer information taking from Utility Mapping Survey, PAS 128 QL-B M2 Rev 1, dated 14 March 2022, by Utility Mapping.
25. Site Plan and red line boundary from Site Plan As Proposed , 2207GA-D-002, dated May 2022, by Three Sixty Architecture.

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P02	UPDATED DRAINAGE CHANNEL POSITION, REVISED ATTENUATION TANK SIZE, ADDED CHANNEL DRAINAGE TO PERIMETER PATH					
	J.NEAL-LONG	27/01/23	O.CHARD	27/01/23	T.KING	27/01/23
P01	PRELIMINARY ISSUE					
	O.CHARD	13/06/22	J.MAGEE	13/06/22	T.KING	13/06/22

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e: bristolcentral@hydrock.com

CLIENT

SHURGARD SELF-STORAGE

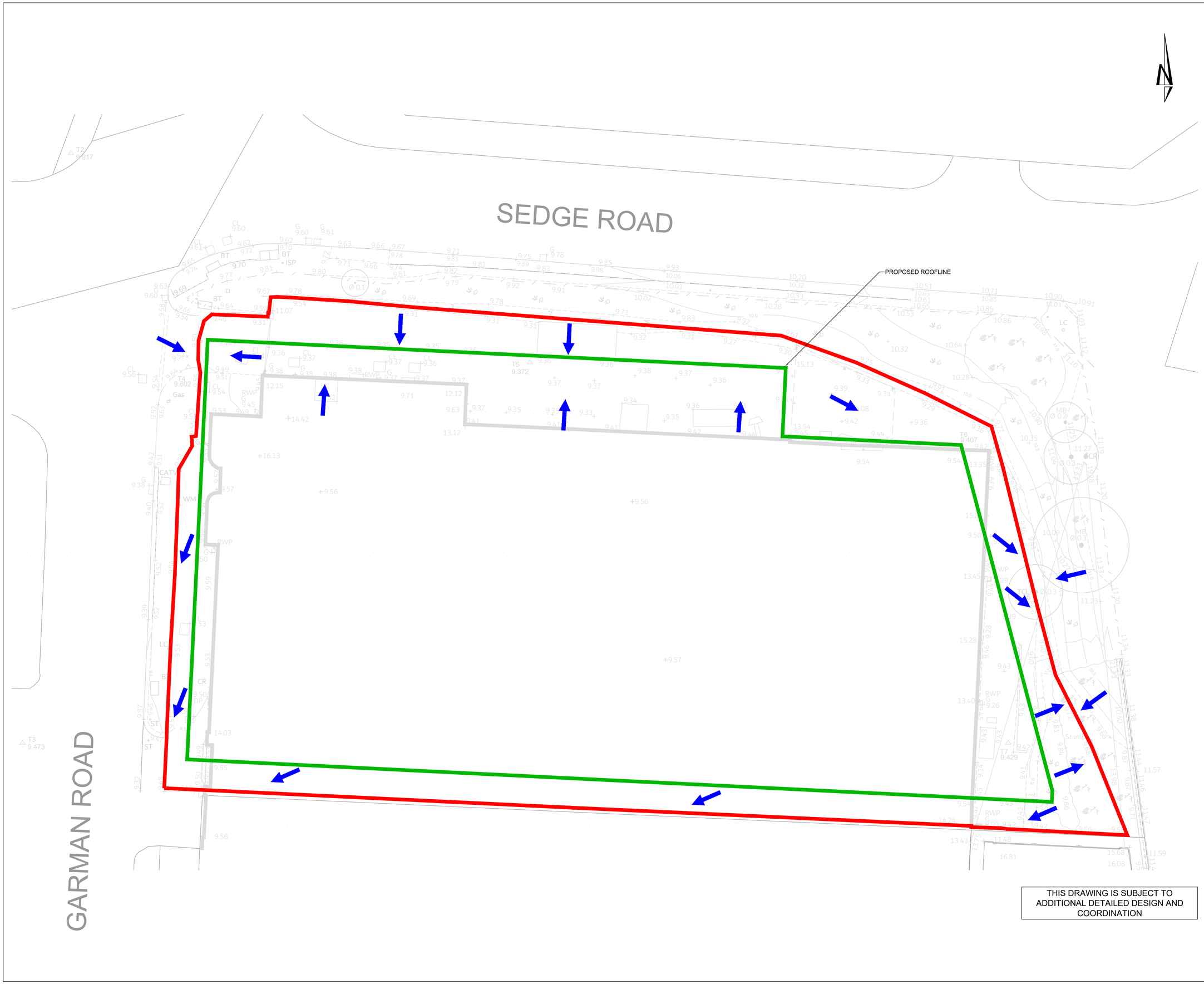
PROJECT

SHURGARD TOTTENHAM

TITLE

DRAINAGE LAYOUT

HYDROCK PROJECT NO.	SCALE @ A1	
C-24318-C	1:125	
STATUS DESCRIPTION		STATUS
ISSUED FOR INFORMATION		S2
DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)		REVISION
24318-HYD-XX-XX-DR-C-7010		P02



KEY PLAN

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
2. The DWG file is issued for the purposes of coordination only and do not represent formal drawing issue and are not to be reprinted in any form. Formal issue of drawings is via DWF, Adobe PDF files and/or hard copies and their associated information issue sheets.
3. Note that all care has been taken with the export of DWG files and their content, but we recommend that you make due dimensional checks before using any DWG file information. Any errors found are to be reported to Hydrock immediately.
4. Levels shown in metres above Ordnance Datum (mAOD).
5. Site Plan and red line boundary from Site Plan As Proposed , 2207GA-D-002, dated May 2022, by Three Sixty Architecture.

REV	REVISION NOTES/COMMENTS					
	DRAWN BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
P01	PRELIMINARY ISSUE					
	O.CHARD	27/01/23	C.MACHUGH	27/01/23	T.KING	27/01/23

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CLIENT
SHURGARD SELF-STORAGE

PROJECT
SHURGARD TOTTENHAM

TITLE
SURFACE WATER OVERLAND FLOW PATHS

HYDROCK PROJECT NO.	SCALE @ A1
C-24318-C	1:125

STATUS DESCRIPTION	STATUS
ISSUED FOR INFORMATION	S2

DRAWING NO. (PROJECT CODE-ORGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
24318-HYD-XX-XX-DR-C-7011	P01

Appendix I

Supporting Calculations

Project Title:	Shurgard Tottenham		**Designer:**	OC	**Revision:**	P01
Project Number:	24318	**Date:** 10/06/2022	**Checked:**	JM		

Hydrock

Frequency Factor 0.7 (From Table 3)
System Type 3 (From 4.2)

	INPUT NUMBER OF APPLIANCES FOR EACH PIPE/NETWORK																				
	Pipe/Network number																				
Appliance	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**total**
Drawnet Number	**1.000**																				
Wash basin, bidet	1																				1
Shower without plug																					0
Shower with plug																					0
Single urinal with cistern																					0
Urinal with flushing valve																					0
Slab urinal																					0
Bath																					0
Kitchen Sink	2																				2
Dishwasher (household)																					0
Washing machine up to 6kg																					0
Washing machine up to 12kg																					0
WC with 4,0 l cistern																					0
WC with 6,0 l cistern	1																				1
WC with 7,5 l cistern																					0
WC with 9,0 l cistern																					0
Floor gully DN 50																					0
Floor gully DN 70																					0
Floor gully DN 100																					0
Total Discharge Units (DU)	4.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.60
Total Flow Rate (l/s)	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50 l/s

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	20.500	Add Flow / Climate Change (%)	0
Ratio R	0.436	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.950	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SW-1.000	10.008	0.067	150.0	0.005	5.00	0.0	0.600	o	150	Pipe/Conduit	🔒
SW-1.001	2.053	0.014	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
SW-1.002	66.557	0.222	300.0	0.049	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
SW-1.003	20.434	0.068	300.0	0.034	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
SW-1.004	4.481	0.015	300.0	0.001	0.00	0.0	0.600	o	375	Pipe/Conduit	🔒
SW-2.000	22.801	0.080	285.0	0.037	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒
SW-2.001	9.049	0.030	300.0	0.049	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
SW-2.002	6.224	0.138	45.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
SW-3.000	20.326	0.075	271.0	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SW-1.000	50.00	5.20	9.149	0.005	0.0	0.0	0.0	0.82	14.5	0.8
SW-1.001	50.00	5.25	9.082	0.005	0.0	0.0	0.0	0.82	14.5	0.8
SW-1.002	50.00	6.31	8.843	0.054	0.0	0.0	0.0	1.04	115.0	9.2
SW-1.003	50.00	6.64	8.621	0.088	0.0	0.0	0.0	1.04	115.0	15.1
SW-1.004	50.00	6.71	8.553	0.089	0.0	0.0	0.0	1.04	115.0	15.3
SW-2.000	50.00	5.41	8.776	0.037	0.0	0.0	0.0	0.93	65.5	6.4
SW-2.001	50.00	5.58	8.696	0.087	0.0	0.0	0.0	0.90	63.8	14.8
SW-2.002	50.00	5.62	8.696	0.087	0.0	0.0	0.0	2.35	165.9	14.8
SW-3.000	50.00	5.36	8.689	0.000	0.0	0.0	0.0	0.95	67.2	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SW-4.000	23.106	0.093	248.5	0.000	5.00	0.0	0.600	o	300	Pipe/Conduit	
SW-3.001	5.653	0.019	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-3.002	18.720	0.037	506.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-5.000	0.519	0.003	150.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
SW-5.001	42.096	0.212	198.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
SW-2.003	5.287	0.020	261.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SW-1.005	5.660	0.038	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SW-4.000	50.00	5.39	8.707	0.000	0.0	0.0	0.0	0.99	70.2	0.0
SW-3.001	50.00	5.49	8.614	0.000	0.0	0.0	0.0	0.90	63.8	0.0
SW-3.002	50.00	5.94	8.595	0.000	0.0	0.0	0.0	0.69	48.9	0.0
SW-5.000	50.00	5.01	8.773	0.000	0.0	0.0	0.0	0.82	14.5	0.0
SW-5.001	50.00	6.00	8.770	0.000	0.0	0.0	0.0	0.71	12.5	0.0
SW-2.003	50.00	6.09	8.558	0.087	0.0	0.0	0.0	0.97	68.4	14.8
SW-1.005	50.00	6.83	8.538	0.176	0.0	0.0	0.0	0.82	14.5«	30.1

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SW-1.000	o	150	SW-01	9.778	9.149	0.479	Open Manhole	450
SW-1.001	o	150	SW-02	9.717	9.082	0.485	Open Manhole	450
SW-1.002	o	375	SW-03	9.618	8.843	0.400	Open Manhole	900
SW-1.003	o	375	SW-04	9.480	8.621	0.484	Open Manhole	900
SW-1.004	o	375	SW-05	9.546	8.553	0.618	Open Manhole	900
SW-2.000	o	300	SW-06	9.526	8.776	0.450	Open Manhole	450
SW-2.001	o	300	SW-07	9.446	8.696	0.450	Open Manhole	450
SW-2.002	o	300	SW-08	9.825	8.696	0.829	Junction	
SW-3.000	o	300	SW-012	9.439	8.689	0.450	Open Manhole	450
SW-4.000	o	300	SW-016	9.457	8.707	0.450	Open Manhole	450
SW-3.001	o	300	SW-013	9.364	8.614	0.450	Open Manhole	600
SW-3.002	o	300	SW-015	9.492	8.595	0.597	Junction	
SW-5.000	o	150	SW-017	9.515	8.773	0.592	Open Manhole	450
SW-5.001	o	150	SW-018	9.516	8.770	0.596	Junction	
SW-2.003	o	300	SW-09-TANK	9.825	8.558	0.967	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SW-1.000	10.008	150.0	SW-02	9.717	9.082	0.485	Open Manhole	450
SW-1.001	2.053	150.0	SW-03	9.618	9.068	0.400	Open Manhole	900
SW-1.002	66.557	300.0	SW-04	9.480	8.621	0.483	Open Manhole	900
SW-1.003	20.434	300.0	SW-05	9.546	8.553	0.618	Open Manhole	900
SW-1.004	4.481	300.0	SW-011-HB	9.549	8.538	0.636	Open Manhole	1200
SW-2.000	22.801	285.0	SW-07	9.446	8.696	0.450	Open Manhole	450
SW-2.001	9.049	300.0	SW-08	9.825	8.666	0.859	Junction	
SW-2.002	6.224	45.1	SW-09-TANK	9.825	8.558	0.967	Junction	
SW-3.000	20.326	271.0	SW-013	9.364	8.614	0.450	Open Manhole	600
SW-4.000	23.106	248.5	SW-013	9.364	8.614	0.450	Open Manhole	600
SW-3.001	5.653	300.0	SW-015	9.492	8.595	0.596	Junction	
SW-3.002	18.720	506.0	SW-09-TANK	9.825	8.558	0.967	Junction	
SW-5.000	0.519	150.0	SW-018	9.516	8.770	0.596	Junction	
SW-5.001	42.096	198.6	SW-09-TANK	9.825	8.558	1.117	Junction	
SW-2.003	5.287	261.7	SW-011-HB	9.549	8.538	0.711	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SW-1.005	o	150	SW-011-HB	9.549	8.538	0.861	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SW-1.005	5.660	150.0	SW-0	9.547	8.500	0.897	Open Manhole	450

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SW-1.005	SW-0	9.547	8.500	0.000	450	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 535085 191299 TQ 35085 91299
Data Type	Point
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SW-011-HB, DS/PN: SW-1.005, Volume (m³): 1.9

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	8.538
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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Storage Structures for Storm

Cellular Storage Manhole: SW-09-TANK, DS/PN: SW-2.003

Invert Level (m) 8.558 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.96
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	143.3	143.3	0.661	0.0	174.9
0.660	143.3	174.9			

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
FEH Rainfall Version 2013
Site Location GB 535085 191299 TQ 35085 91299
Data Type Point
Cv (Summer) 0.950
Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
SW-1.000	SW-01	15 Summer	2	+0%	100/180 Summer			
SW-1.001	SW-02	15 Summer	2	+0%	100/180 Summer			
SW-1.002	SW-03	15 Summer	2	+0%	100/180 Summer			
SW-1.003	SW-04	15 Summer	2	+0%	100/15 Summer			
SW-1.004	SW-05	15 Summer	2	+0%	100/15 Summer			
SW-2.000	SW-06	15 Summer	2	+0%	100/15 Summer			
SW-2.001	SW-07	15 Summer	2	+0%	100/15 Summer			
SW-2.002	SW-08	15 Summer	2	+0%				
SW-3.000	SW-012	15 Summer	2	+0%	100/30 Summer			
SW-4.000	SW-016	15 Summer	2	+0%	100/60 Summer			
SW-3.001	SW-013	240 Summer	2	+0%	100/30 Summer			
SW-3.002	SW-015	240 Summer	2	+0%				
SW-5.000	SW-017	15 Summer	2	+0%	100/30 Summer			
SW-5.001	SW-018	15 Summer	2	+0%				

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
SW-1.000	SW-01	9.176	-0.123	0.000	0.07			1.0	OK
SW-1.001	SW-02	9.112	-0.120	0.000	0.09			1.0	OK
SW-1.002	SW-03	8.915	-0.303	0.000	0.08			8.5	OK
SW-1.003	SW-04	8.730	-0.266	0.000	0.13			12.9	OK
SW-1.004	SW-05	8.698	-0.230	0.000	0.16			12.4	OK
SW-2.000	SW-06	8.853	-0.223	0.000	0.12			7.1	OK
SW-2.001	SW-07	8.810	-0.186	0.000	0.31			15.1	OK
SW-2.002	SW-08	8.776	-0.220	0.000	0.16			15.0	OK*
SW-3.000	SW-012	8.689	-0.300	0.000	0.00			0.0	OK
SW-4.000	SW-016	8.707	-0.300	0.000	0.00			0.0	OK
SW-3.001	SW-013	8.678	-0.236	0.000	0.00			0.1	OK
SW-3.002	SW-015	8.678	-0.217	0.000	0.00			0.1	OK*
SW-5.000	SW-017	8.773	-0.150	0.000	0.00			0.0	OK
SW-5.001	SW-018	8.770	-0.150	0.000	0.00			0.0	OK*

PN	US/MH Name	Level Exceeded
SW-1.000	SW-01	
SW-1.001	SW-02	
SW-1.002	SW-03	
SW-1.003	SW-04	
SW-1.004	SW-05	
SW-2.000	SW-06	
SW-2.001	SW-07	
SW-2.002	SW-08	
SW-3.000	SW-012	
SW-4.000	SW-016	
SW-3.001	SW-013	
SW-3.002	SW-015	
SW-5.000	SW-017	
SW-5.001	SW-018	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
SW-2.003	SW-09-TANK	240 Summer	2	+0%	100/15 Summer			
SW-1.005	SW-011-HB	15 Summer	2	+0%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
SW-2.003	SW-09-TANK	8.678	-0.180	0.000	0.05		83	3.1	OK*
SW-1.005	SW-011-HB	8.694	0.006	0.000	0.38			4.6	SURCHARGED

PN	US/MH Name	Level Exceeded
SW-2.003	SW-09-TANK	
SW-1.005	SW-011-HB	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
FEH Rainfall Version 2013
Site Location GB 535085 191299 TQ 35085 91299
Data Type Point
Cv (Summer) 0.950
Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
SW-1.000	SW-01	15 Summer	30	+0%	100/180 Summer			
SW-1.001	SW-02	15 Summer	30	+0%	100/180 Summer			
SW-1.002	SW-03	15 Summer	30	+0%	100/180 Summer			
SW-1.003	SW-04	15 Summer	30	+0%	100/15 Summer			
SW-1.004	SW-05	15 Summer	30	+0%	100/15 Summer			
SW-2.000	SW-06	15 Summer	30	+0%	100/15 Summer			
SW-2.001	SW-07	15 Summer	30	+0%	100/15 Summer			
SW-2.002	SW-08	180 Summer	30	+0%				
SW-3.000	SW-012	180 Summer	30	+0%	100/30 Summer			
SW-4.000	SW-016	180 Summer	30	+0%	100/60 Summer			
SW-3.001	SW-013	180 Summer	30	+0%	100/30 Summer			
SW-3.002	SW-015	180 Summer	30	+0%				
SW-5.000	SW-017	180 Summer	30	+0%	100/30 Summer			
SW-5.001	SW-018	180 Summer	30	+0%				

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
SW-1.000	SW-01	9.193	-0.106	0.000	0.19			2.4	OK
SW-1.001	SW-02	9.130	-0.102	0.000	0.22			2.4	OK
SW-1.002	SW-03	8.974	-0.244	0.000	0.24			26.5	OK
SW-1.003	SW-04	8.878	-0.118	0.000	0.34			33.2	OK
SW-1.004	SW-05	8.841	-0.087	0.000	0.39			30.8	OK
SW-2.000	SW-06	8.939	-0.137	0.000	0.31			17.8	OK
SW-2.001	SW-07	8.919	-0.077	0.000	0.87			42.7	OK
SW-2.002	SW-08	8.842	-0.154	0.000	0.16			14.6	OK*
SW-3.000	SW-012	8.841	-0.148	0.000	0.00			0.0	OK
SW-4.000	SW-016	8.841	-0.166	0.000	0.00			0.0	OK
SW-3.001	SW-013	8.841	-0.073	0.000	0.01			0.3	OK
SW-3.002	SW-015	8.841	-0.054	0.000	0.01			0.4	OK*
SW-5.000	SW-017	8.841	-0.082	0.000	0.00			0.0	OK
SW-5.001	SW-018	8.841	-0.079	0.000	0.00			0.0	OK*

PN	US/MH Name	Level Exceeded
SW-1.000	SW-01	
SW-1.001	SW-02	
SW-1.002	SW-03	
SW-1.003	SW-04	
SW-1.004	SW-05	
SW-2.000	SW-06	
SW-2.001	SW-07	
SW-2.002	SW-08	
SW-3.000	SW-012	
SW-4.000	SW-016	
SW-3.001	SW-013	
SW-3.002	SW-015	
SW-5.000	SW-017	
SW-5.001	SW-018	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
SW-2.003	SW-09-TANK	180 Summer	30	+0%	100/15 Summer			
SW-1.005	SW-011-HB	180 Summer	30	+0%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
SW-2.003	SW-09-TANK	8.841	-0.017	0.000	0.07		130	4.4	OK*
SW-1.005	SW-011-HB	8.840	0.152	0.000	0.42			5.0	SURCHARGED

PN	US/MH Name	Level Exceeded
SW-2.003	SW-09-TANK	
SW-1.005	SW-011-HB	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH
FEH Rainfall Version 2013
Site Location GB 535085 191299 TQ 35085 91299
Data Type Point
Cv (Summer) 0.950
Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
SW-1.000	SW-01	240 Winter	100	+40%	100/180 Summer			
SW-1.001	SW-02	240 Winter	100	+40%	100/180 Summer			
SW-1.002	SW-03	240 Winter	100	+40%	100/180 Summer			
SW-1.003	SW-04	240 Winter	100	+40%	100/15 Summer			
SW-1.004	SW-05	240 Winter	100	+40%	100/15 Summer			
SW-2.000	SW-06	240 Winter	100	+40%	100/15 Summer			
SW-2.001	SW-07	240 Winter	100	+40%	100/15 Summer			
SW-2.002	SW-08	720 Summer	100	+40%				
SW-3.000	SW-012	240 Winter	100	+40%	100/30 Summer			
SW-4.000	SW-016	240 Winter	100	+40%	100/60 Summer			
SW-3.001	SW-013	240 Winter	100	+40%	100/30 Summer			
SW-3.002	SW-015	15 Summer	100	+40%				
SW-5.000	SW-017	240 Winter	100	+40%	100/30 Summer			
SW-5.001	SW-018	720 Winter	100	+40%				

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
SW-1.000	SW-01	9.351	0.052	0.000	0.07			0.8	SURCHARGED
SW-1.001	SW-02	9.351	0.119	0.000	0.08			0.8	SURCHARGED
SW-1.002	SW-03	9.351	0.133	0.000	0.08			9.1	FLOOD RISK
SW-1.003	SW-04	9.349	0.353	0.000	0.15			14.1	FLOOD RISK
SW-1.004	SW-05	9.348	0.420	0.000	0.18			14.0	FLOOD RISK
SW-2.000	SW-06	9.351	0.275	0.000	0.11			6.2	FLOOD RISK
SW-2.001	SW-07	9.350	0.354	0.000	0.28			13.8	FLOOD RISK
SW-2.002	SW-08	8.996	0.000	0.000	0.09			8.7	SURCHARGED*
SW-3.000	SW-012	9.348	0.359	0.000	0.00			0.0	FLOOD RISK
SW-4.000	SW-016	9.348	0.341	0.000	0.00			0.0	FLOOD RISK
SW-3.001	SW-013	9.348	0.434	0.000	0.01			0.3	FLOOD RISK
SW-3.002	SW-015	8.895	0.000	0.000	0.01			0.4	SURCHARGED*
SW-5.000	SW-017	9.348	0.425	0.000	0.00			0.0	FLOOD RISK
SW-5.001	SW-018	8.920	0.000	0.000	0.00			0.0	SURCHARGED*

PN	US/MH Name	Level Exceeded
SW-1.000	SW-01	
SW-1.001	SW-02	
SW-1.002	SW-03	
SW-1.003	SW-04	
SW-1.004	SW-05	
SW-2.000	SW-06	
SW-2.001	SW-07	
SW-2.002	SW-08	
SW-3.000	SW-012	
SW-4.000	SW-016	
SW-3.001	SW-013	
SW-3.002	SW-015	
SW-5.000	SW-017	
SW-5.001	SW-018	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
SW-2.003	SW-09-TANK	240 Winter	100	+40%	100/15 Summer			
SW-1.005	SW-011-HB	240 Winter	100	+40%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)
SW-2.003	SW-09-TANK	9.219	0.361	0.000	0.11		227	6.8
SW-1.005	SW-011-HB	9.347	0.659	0.000	0.42			5.0

PN	US/MH Name	Status	Level Exceeded
SW-2.003	SW-09-TANK	SURCHARGED*	
SW-1.005	SW-011-HB	FLOOD RISK	

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