

LAND AT PALK ROAD

PALK ROAD, BEDHAMPTON, HAVANT.

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

REPORT REF NO. 2108040-01B
PROJECT NO. 2108040
FEBRUARY 2024

HEAD OFFICE: 3rd Floor, The Hallmark Building, 52-56 Leadenhall Street, London, EC3M 5JE **T** | 020 7680 4088

EDINBURGH: Suite 35 4-5 Lochside Way Edinburgh EH12 9DT **T** | 0131 516 8111

ESSEX: 1 - 2 Crescent Court, Billericay, Essex, CM12 9AQ **T** | 01277 657 677

KENT: Suite 10, Building 40, Churchill Business Centre, Kings Hill, Kent, ME19 4YU **T** | 01732 752 155

MIDLANDS: Office 3, The Garage Studios, 41-43 St Mary's Gate, Nottingham, NG1 1PU **T** | 0115 697 0940

SOUTH WEST: City Point, Temple Gate, Bristol, BS1 6PL **T** | 0117 456 4994

SUFFOLK: Suite 110, Suffolk Enterprise Centre, 44 Felaw Street, Ipswich, IP2 8SJ **T** | 01473 407 321

Contents

1. INTRODUCTION	6
Consultee Responses	6
Site Location	6
Development Proposals	7
2. POLICY CONTEXT	9
National Planning Policy Framework	9
Havant Borough Council Core Strategy (2011)	10
Partnership for Urban South Hampshire Strategic Flood Risk Assessment (Updated 2016)	11
Climate Change	11
Sequential Test	12
Exception Test	13
3. BASELINE CONDITIONS	15
Hydrology	15
Topography	15
Ground Conditions	15
Existing Sewer Infrastructure	17
4. SOURCES OF FLOODING	19
Flood Zone Designation	19
Fluvial / Tidal Flooding	20
Pluvial Flooding	24
Groundwater Flooding	25
Sewer Flooding	26
Artificial Sources	27
5. FLOOD RISK MANAGEMENT	28
Finished Floor Levels	28
Safe Access and Egress	28

6. PROPOSED SURFACE WATER DRAINAGE STRATEGY.....	30
Proposed Sustainable Drainage Systems (SuDS).....	30
Long Term Storage and Urban Creep.....	35
Exceedance Flow Routes	35
Water Quality.....	35
Maintenance and Management of System	35
7. PROPOSED FOUL WATER DRAINAGE STRATEGY.....	37
8. CONCLUSIONS	38

Figures

Figure 1-1: Site Location Plan	7
Figure 1-2: Development Proposal	8
Figure 2-1: Extract from the PPG: Flood Risk Vulnerability.....	14
Figure 3-1: BGS Online Geology Mapping - Bedrock.....	16
Figure 3-2: BGS Online Geology Mapping – Superficial Deposits.....	17
Figure 3-3: Southern Water Asset Plans.....	18
Figure 4-1: Environment Agency Flood Map for Planning	21
Figure 4-2: Hydraulic Modelling Flood Outlines and Node Locations	22
Figure 4-3: Defended maximum flood extents at the 0.1% AEPfor climate change epochs.....	24
Figure 4-4: Environment Agency Flood Map for Surface Water	25
Figure 4-5: SFRA Ground Water Mapping	26

Tables

Table 2-1: East Hampshire Management Catchment Peak River Flow Allowances	11
Table 2-2: East Hampshire Management Catchment Peak Rainfall Allowances.....	12
Table 4-1: Predicted Flood Levels	22
Table 4-2: Tidal Flood Levels.....	23
Table 6-1: Existing and Proposed Areas	31
Table 6-2: Greenfield Discharge rates	33
Table 6-3: Existing and proposed hardstanding areas.....	33
Table 6-4: Existing and Proposed Surface Water Runoff Rates.....	34

Appendices

- Appendix A – 2108040-R04B LLFA Comments Letter Response
- Appendix B – Proposed Site Layout
- Appendix C – Topographic Survey
- Appendix D – Geoenvironmental Report
- Appendix E – Southern Water Data
- Appendix F – Utility Survey
- Appendix G – 2108040-001F Foul and Surface Water Drainage Strategy
- Appendix H – Greenfield Discharge rates
- Appendix I – Brownfield Discharge rates
- Appendix J – MicroDrainage calculations
- Appendix K – C753 Simple Index Method
- Appendix L – Maintenance and Management of System
- Appendix M – Foul Water calculations

LAND AT PALK ROAD

2108040-01B

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

FEBRUARY 2024

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	DRAFT	FH	CC	DRAFT	10/10/2022
-	FINAL	FH/LE	CC	BC	11/11/2022
A	FINAL	CC	CC	BC	07/12/2022
B	Final Layout Update	MG	MG	CC 	16/02/2024

This report has been prepared for the exclusive use of Bellway Homes Ltd (Wessex). It should not be reproduced in whole or in part, or relied upon by third parties, without the express written authority of Ardent Consulting Engineers.

1. INTRODUCTION

- 1.1. In December 2022 Ardent Consulting Engineers (hereafter referred to as "Ardent") has been commissioned by Bellway Homes Ltd (Wessex) to undertake a Flood Risk Assessment (FRA) for the proposed residential development at Palk Road, Havant, Hampshire (hereafter referred to as 'the site') (ref. 2108040-01 Rev A).
- 1.2. This FRA has been prepared as a revised version of the December 2022 FRA to facilitate the submission of a planning application to Havant Borough Council (HBC), as the Local Planning Authority.
- 1.3. The contents of this FRA evaluate the impact of flood risk on the proposed development. This FRA has been prepared with specific reference to the requirements of National Planning Policy Framework (NPPF) released in 2012 and revised in December 2023 and the Planning Practice Guidance (PPG), which superseded the Technical Guidance to the NPPF, in March 2014.
- 1.4. The report demonstrates to the Local Planning Authority and Statutory Consultees that the site can be suitably redeveloped whilst complying with the requirements of the NPPF in terms of flood risk.

Consultee Responses

- 1.5. In February 2023 Hampshire County Council (SWM/2023/0035), the Environment Agency (HA/2023/124806/01-L01) and Southern Water (DSA000019841) provided their comments in relation to the Land at Palk Road application. Ardent has responded to all of the aforementioned in June 2023 (2205270/LLFA/04RA). See **Appendix A** for details.
- 1.6. All comments have been included in this FRA document.

Site Location

- 1.7. The Site is located at Palk Road, Havant, to the southwest of West Street, centered on OS Grid Reference Mn470807, Me106483, NGR 470727,106435. The nearest postcode to the Site is PO9 1NL. The application site is approximately 1.3 ha in total and currently comprises commercial uses. Figure 1-1: Site Location Plan
- 1.8. below shows the Site location plan.

- 1.9. The Hermitage Stream is located along the southern boundary of the application site, and the remainder of the site surrounded by open green space to the east and commercial premises to the west. The surrounding settings are largely residential and commercial. Bedhampton Station is located to the north of the Site with the railway line running along the northern boundary of the Site.



Figure 1-1: Site Location Plan

Development Proposals

- 1.10. The full planning application is for the redevelopment of the current brownfield site to include the provision of 83 residential dwellings (C3 use), parking, public open space, landscaping and other associated works, including demolition of existing buildings on site, with access from Palk Road. A ground floor plan is included in Figure 1-2 below. Refer to Appendix B for the full development proposals.

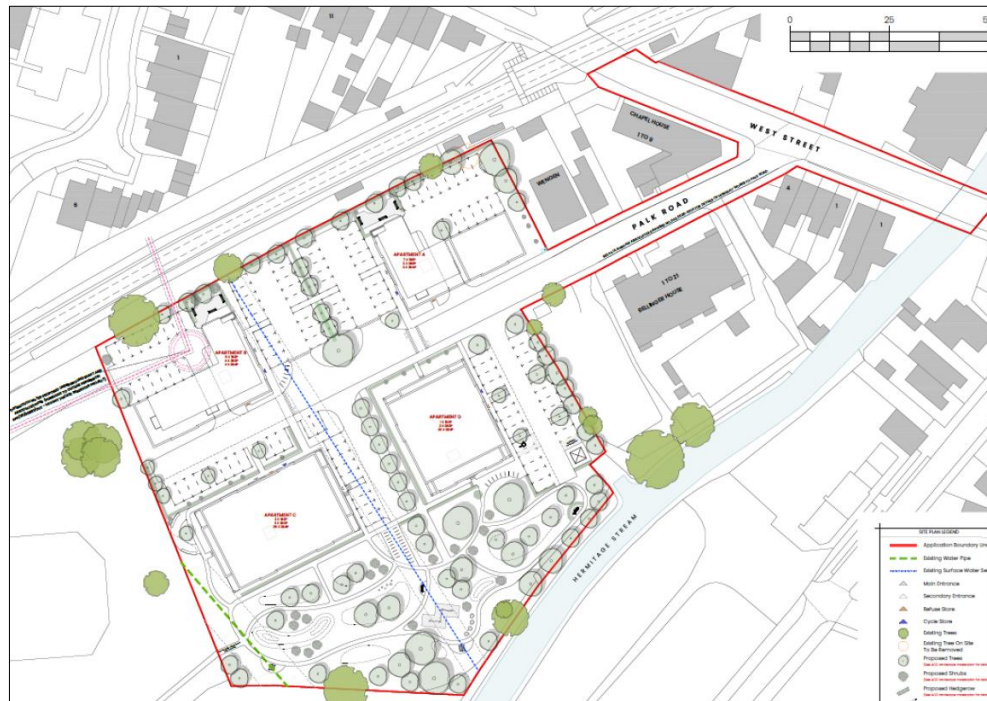


Figure 1-2: Development Proposal

2. POLICY CONTEXT

National Planning Policy Framework

- 2.1. The National Planning Policy Framework (NPPF) was introduced on 27 March 2012. This document was revised most recently in where paragraphs 165 to 175 inclusive establish the Planning Policy relating to flood risk management. The Technical Guide to the NPPF was superseded by the Planning Practice Guidance (PPG) in March 2014.
- 2.2. The PPG states that when planning or decision making in terms of flood risk, the process followed should be to avoid, control, mitigate and manage residual risk.
- 2.3. 'Avoiding' risk relates to the application of the Sequential and Exception tests. The PPG provides the methodology required to undertake the Sequential and Exception Tests and this should be applied to all sources of flooding.
- 2.4. 'Controlling' the risk relates to measures that will control the risk of flooding affecting the site. Early discussions with relevant flood risk management authorities, reference to Strategic Flood Risk Assessments and any programme of flood and coastal erosion risk management schemes will help to identify such opportunities.
- 2.5. 'Mitigating' the risk relates to the use of flood resistance and resilience measures to address any residual risks after the use of avoidance and control measures.
- 2.6. 'Managing' the risk relates to considering further management measures to deal with any residual risk remaining after avoidance, control and mitigation have been utilized such as providing safe access and escape routes and considering whether adequate flood warning would be available to people using the development. Residual risks will need to be safely managed to ensure people are not exposed to hazardous flooding.

Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems March 2015

- 2.7. The Non-statutory technical standards for sustainable drainage systems were published in March 2015. They should be used in conjunction with

the Planning Practice Guidance. In addition, the Best Practice Guidance for the Non-statutory technical standards was published in July 2015 by LASOO.

- 2.8. The Local Planning Authority (LPA) may set local requirements for planning permission that have the effect of more stringent requirements than these non-statutory technical standards.
- 2.9. In addition, SuDS should be designed in accordance with CIRIA 753 SuDS Manual, which represents current best practice.

Havant Borough Council Core Strategy (2011)

- 2.10. The Havant Borough Core Strategy is the principal document setting out the broad detail and direction of development in the borough upto 2026.
- 2.11. Policy CS15 relates to managing flood risk and coastal erosion risk in new development. It states development in areas at risk of flooding now and in the future will only be permitted where:
- a) It meets the sequential and exception test (where required) in relation to PPS25;
 - b) The site is located in a low hazard area as defined in the Strategic Flood Risk Assessment;
 - c) A site-specific flood risk assessment demonstrates that the development will be safe, including the access, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall;
 - d) The scheme incorporates flood protection, flood resilience and resistance measures appropriate to the character and biodiversity of the area and the specific requirements of the site;
 - e) Appropriate flood warning and evacuation plans are in place; and

- f) New site drainage systems are designed taking account of events which exceed the normal design standard.

Partnership for Urban South Hampshire Strategic Flood Risk Assessment (Updated 2016)

- 2.12. The Partnership for Urban South Hampshire Strategic Flood Risk Assessment (PUSH SFRA) was produced by Atkins in 2016 and is an update to the original Strategic Flood Risk Assessment Produced in 2007. PUSH is a partnership of Hampshire County Council, Isle of Wight, Portsmouth and Southampton and the district authorities of Eastleigh, East Hampshire, Fareham, Gosport, Havant, New Forest, Test Valley and Winchester.
- 2.13. The PUSH SFRA includes mapping of flood risk within the area.

Climate Change

- 2.14. The Planning Practice Guidance states that to allow for the predicted impacts of climate change on peak river flow within the East Hampshire Management Catchment, the following increases detailed in Table 2-1 below should be allowed for. For development with a lifetime beyond 2100, the central allowances should be used.

Table 2-1: East Hampshire Management Catchment Peak River Flow Allowances

	Central	Higher	Upper
2020s	19%	24%	37%
2050s	22%	30%	51%
2080s	37%	51%	88%

- 2.15. Therefore, under the NPPF an allowance of 37% for the effects of climate change would achieve the policy requirements for informing the development proposals.

- 2.16. The Planning Practice Guidance states that to allow for the predicted impacts of climate change on peak rainfall intensity within the East Hampshire Management Catchment, the following increases detailed in Table 2-2 below should be allowed for peak rainfall intensity. For development with a lifetime beyond 2100, the upper end allowances should be used.

Table 2-2: East Hampshire Management Catchment Peak Rainfall Allowances

	Central	Upper
3.3% annual exceedance rainfall event		
2050s	20%	35%
2070s	25%	40%
1% annual exceedance rainfall event		
2050s	20%	40%
2070s	25%	45%

Sequential Test

- 2.17. The objective of the Sequential Test is to steer new developments toward areas with the lowest probability of flooding. Where there are no reasonably available sites in lower flood risk areas, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in higher flood risk areas.
- 2.18. Annex 3 of the NPPF of the Planning Practice Guidance (PPG) classes the proposed residential use as 'more vulnerable'. As discussed in Section 4 most of the Site is shown to be in Flood Zone 1, however a small area in the southern part of the Site is located within Flood

Zone 3 in the Environment Agency's map for planning (where no development is proposed).

- 2.19. A sequential test has already been addressed through the Local Plan, through the allocation of the northern part of the site under Policy H19 of the adopted Site Allocations DPD. Therefore, as per NPPF paragraph 172, which states: *"Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again"*, it is not necessary to apply it again. Notwithstanding the above, a Sequential Test has been undertaken for the site and has been submitted to Havant District Council in support of the application. Additionally, an exception test has been submitted within this FRA which demonstrates that this site provides sustainable benefits and can be developed safely without increased flood risk elsewhere, reducing the flood risk overall and providing wider sustainability benefits to the community, in accordance with NPPF paragraph 170.

Exception Test

- 2.20. Table 2 of the PPG replicated below in Figure 2-1 confirms that the Exception Test is required for "More Vulnerable" uses in Flood Zone 3.
- 2.21. To pass the Exception Test it should be demonstrated that:
- *"the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
 - *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall."*
- 2.22. The first part of the exception test is addressed within the submitted Planning Statement which sets out the wider benefits to the community socially, environmentally and economically which would outweigh any flood risk to the development.
- 2.23. This FRA demonstrates that the proposed development, and the future residents would be safe from flooding for the lifetime of the development and would not increase flooding elsewhere. This therefore meets the

second part of the Exception Test.

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓ *
Key: ✓ Exception test is not required X Development should not be permitted					

Figure 2-1: Extract from the PPG: Flood Risk Vulnerability

3. BASELINE CONDITIONS

Hydrology

- 3.1. Hermitage Stream, a Main River, is located along the southern boundary of the site, as well as a culvert, classified as a main river located to the south of the site.

Topography

- 3.2. A topographical survey of the site was carried out in December 2021 by Dorset Land Surveying and is included in Appendix C. The site falls from northwest to southeast at a gradient of approximately 1:60 with elevations across the Site in the order of 7.96 m AOD – 5.93 m AOD.

Ground Conditions

- 3.3. A review of British Geological Survey (BGS) mapping indicates that the geology of the site consists of superficial deposits of River Terrace Deposits - Sand, silt and clay and Alluvium – Clay, silt, sand and gravel which are in turn underlain by Lambeth Group - Clay, silt and sand and Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk Formations. Refer to Figure 3-1 and Figure 3-2 below for BGS Bedrock and Superficial Deposits details respectively.



Figure 3-1: BGS Online Geology Mapping - Bedrock

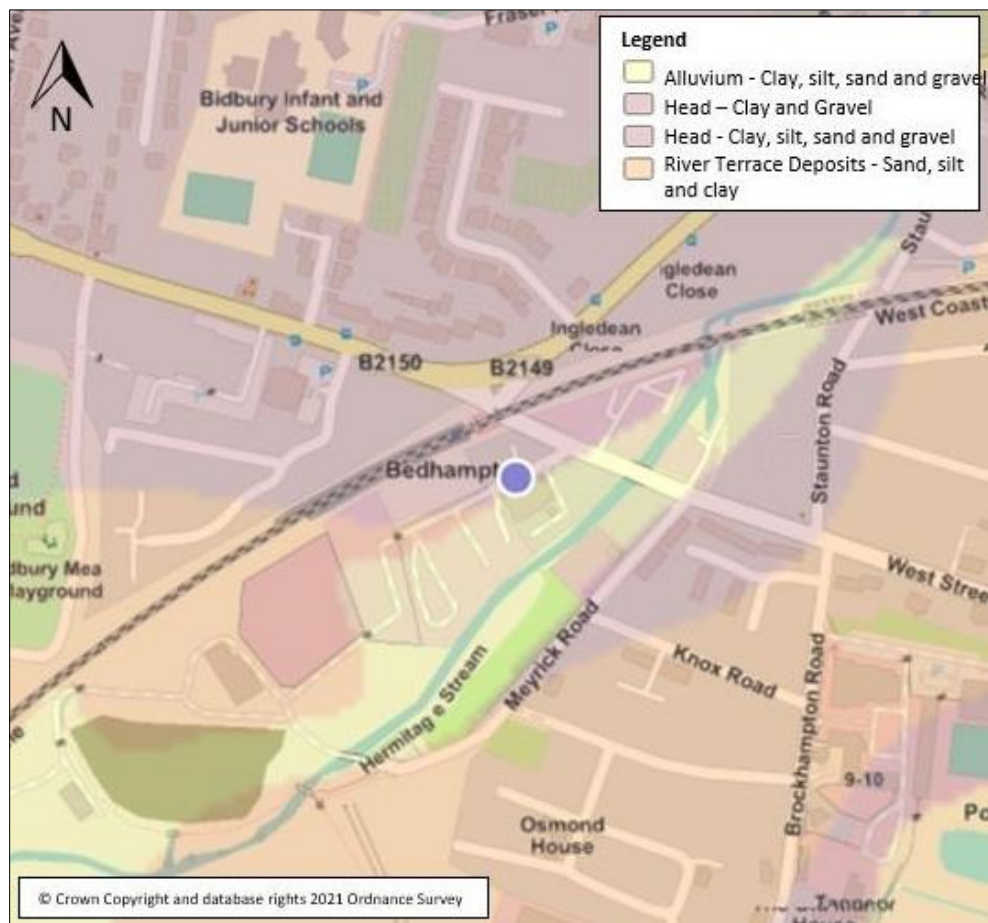


Figure 3-2: BGS Online Geology Mapping – Superficial Deposits

- 3.7. A ground Investigation was completed by Enzygo in December 2021 and site investigations detailed that made ground (pavement construction) was encountered to a thickness of 0.45m, underlain by further made ground (between 0.3m to 1.4m), underlain by drift deposits to depths greater than 2.9m. Groundwater was encountered during the site investigations with the highest groundwater level encountered over a 2 month period between December and January was 1.21m bgl. Refer to Appendix D for the Geo-environmental Report.

Existing Sewer Infrastructure

- 3.8. Both a public surface water sewer and a public foul sewer exist within the site boundary.

- 3.9. A surface water sewer exists though the site flowing north to south which eventually outfalls to the hermitage stream.
- 3.10. In addition, a foul sewer exists flowing west to east towards the north of the site. Refer to Figure 3-3 and Appendix E for the Southern Water Asset Plans.

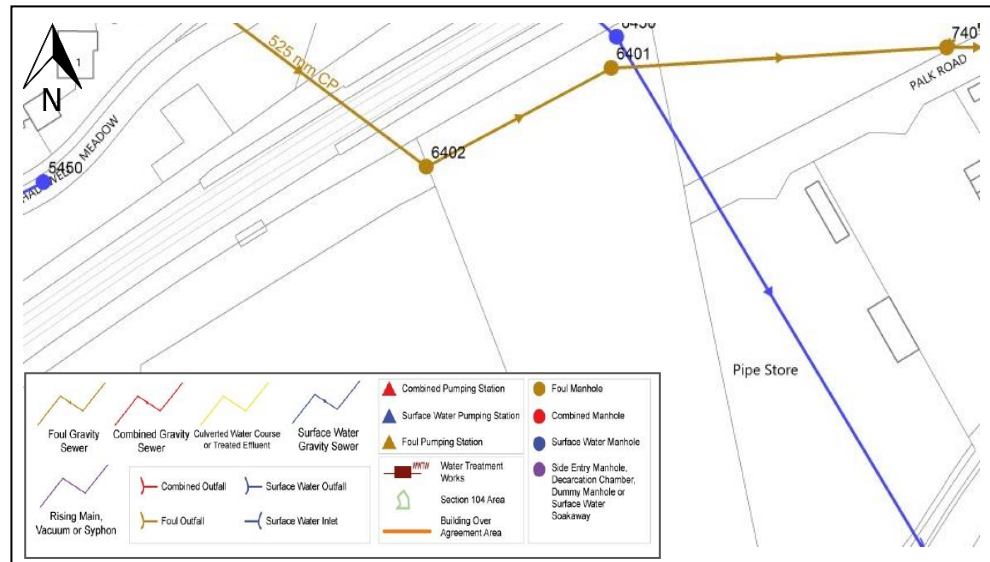


Figure 3-3: Southern Water Asset Plans

- 3.11. A GPR and drainage survey of the site has also been carried out to determine the exact location of the services on site. This has confirmed that a surface water sewer is located through the centre of the site flowing north to south which outfalls to the Hermitage Stream, and also confirms the location of the foul sewer. Refer to Appendix F for the GPR Survey.
- 3.12. A 3m offset from either side of the pipe to the proposed buildings has been allowed for within the design of the development.
- 3.13. It is proposed to divert the existing foul sewer within the site, and this will require a S185 agreement with Southern Water.

4. SOURCES OF FLOODING

4.1. The NPPF requires flood risk from the following sources to be assessed, each of which are assessed separately below:

- Fluvial sources (river flooding);
- Tidal sources (flooding from the sea);
- Sewer Flooding;
- Groundwater sources;
- Pluvial sources (flooding resulting from overland flows);
- Artificial sources, canals, reservoirs etc.; and,
- It also requires the risk from increases in surface water discharge to be assessed (surface water management).

Flood Zone Designation

4.2. Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. The NPPF Planning Practice Guidance defines Flood Zones as follows:

- **Flood Zone 1: Low Probability.** Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
- **Flood Zone 2: Medium Probability.** Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of seaflooding. (Land shown in light blue on the Flood Map)
- **Flood Zone 3a: High Probability.** Land having a 1% or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
- **Flood Zone 3b: The Functional Floodplain.** This zone comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional

floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. Functional floodplain will normally comprise:

- land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
- land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

Fluvial / Tidal Flooding

- 4.3. According to the Environment Agency's Flood Map for Planning, as illustrated below, indicates that a small area in the southern part of the Site is located within Flood Zone 3, defined as having a high risk of flooding respectively. This flood risk is associated with Hermitage Stream. Refer to Figure 4-1 below.

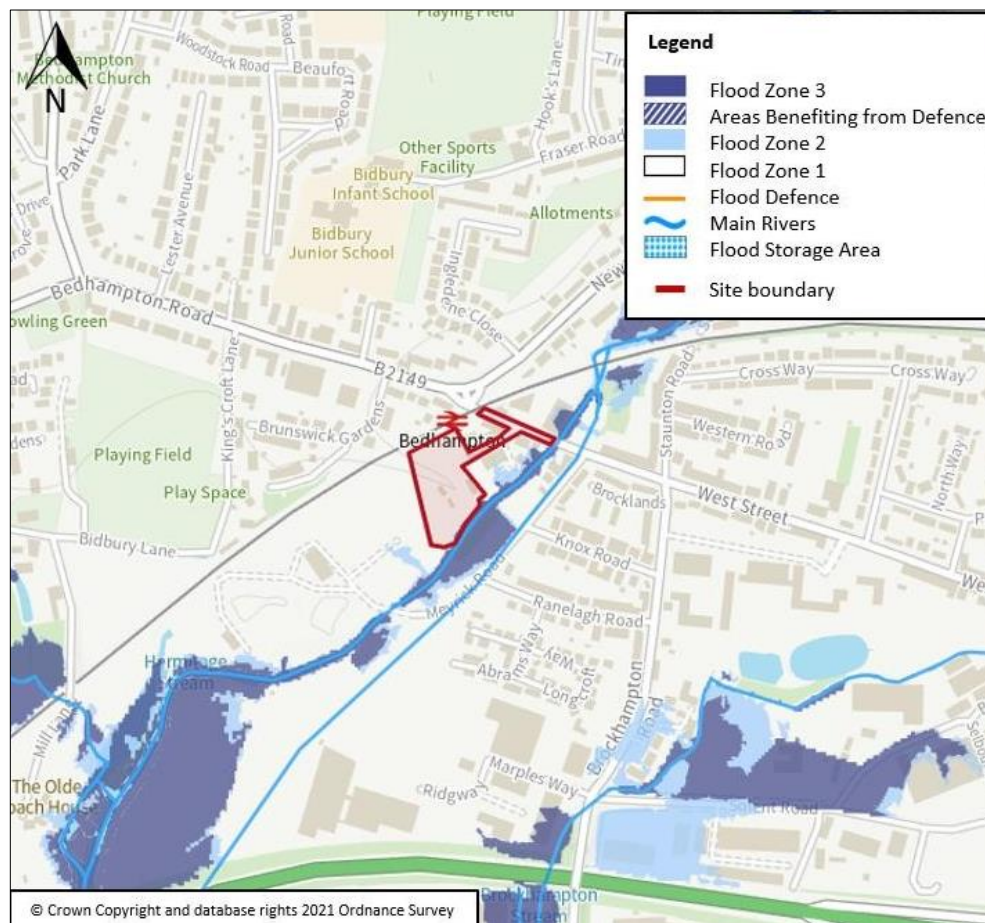


Figure 4-1: Environment Agency Flood Map for Planning

- 4.4. Hydraulic Modelling has also been carried out for this site. The model was developed by Atkins in 2008 as part of The Havant Flood Mapping Study and was updated by Ardent and reviewed and approved by the Environment Agency in March 2020. The model has been run for the 1 in 100 year plus 37% allowance for climate change event, in accordance with the latest requirements in the PPG.
- 4.5. The model results indicated that the maximum in channel predicted flood level for the 100 plus 37% Climate Change is 6.63m AOD within close proximity to the Site. Refer to Figure 4-2 below and Table 4-1 below.

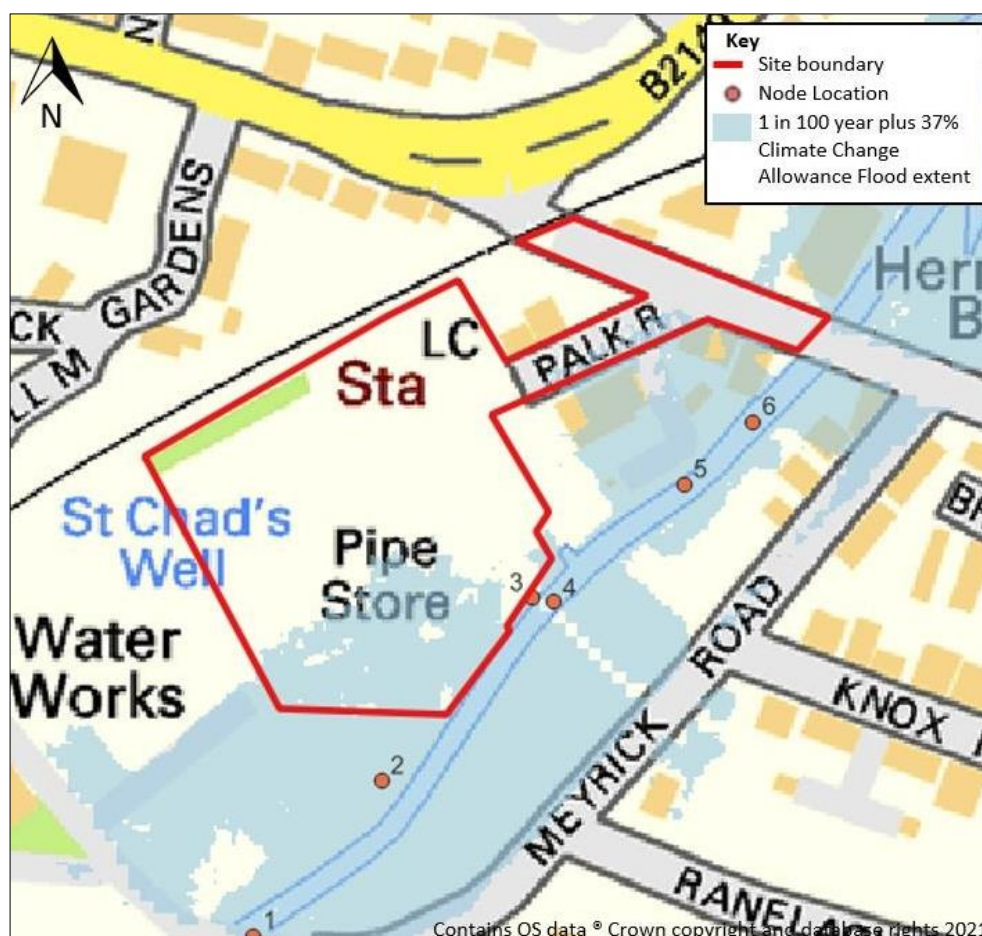


Figure 4-2: Hydraulic Modelling Flood Outlines and Node Locations

Table 4-1: Predicted Flood Levels

Node ID	1 in 100 year + 37%CC event (m AOD)
1	6.41
2	6.49
3	6.63
4	6.63
5	6.67
6	6.72

4.6. The predicted flood outlines are also shown on Figure 4-2. An area in the southwest of the Site is located within the considered to be at high risk of fluvial flooding. However, it should be noted that no development is proposed within the 1 in 100 plus 37% climate change allowance flood extents. As such the risk of fluvial flooding to the development is considered to be low.

- 4.7. As assessment of tidal flood risk has also been carried out for the proposed development. Peak tidal levels have been obtained from the East Solent Tidal model built in 2018. The model domain covering the area is the Hayling Island model with the closest model node at the site being BNDRY_5. In this location, the peak 200 year flood level is 3.39 m AOD and the peak 1000 year flood level is 3.56m AOD.
- 4.8. When considering climate change, Environment Agency guidance states that the anticipated rise in sea level for the southeast of England up to the year 2115 is expected to be 1.21 m. Therefore, the peak 200 year flood level plus climate change is 4.60 m AOD and the peak 1000 year flood level is 4.77 m AOD. The topographic survey indicates that ground levels at the site are all above 5.93m AOD therefore well above tidal influences. Refer to Table 4-2 below.

Table 4-2: Tidal Flood Levels

Tidal Flood Event	Flood level (m AOD)
200	3.39
1000	3.56
200 + CC (2115)	4.60
1000 + CC (2115)	4.77

- 4.9. Figure 4-3 below contains an extract taken from JBA's final modelling summary report which also demonstrates that the site is located outside of the tidal flood extents.

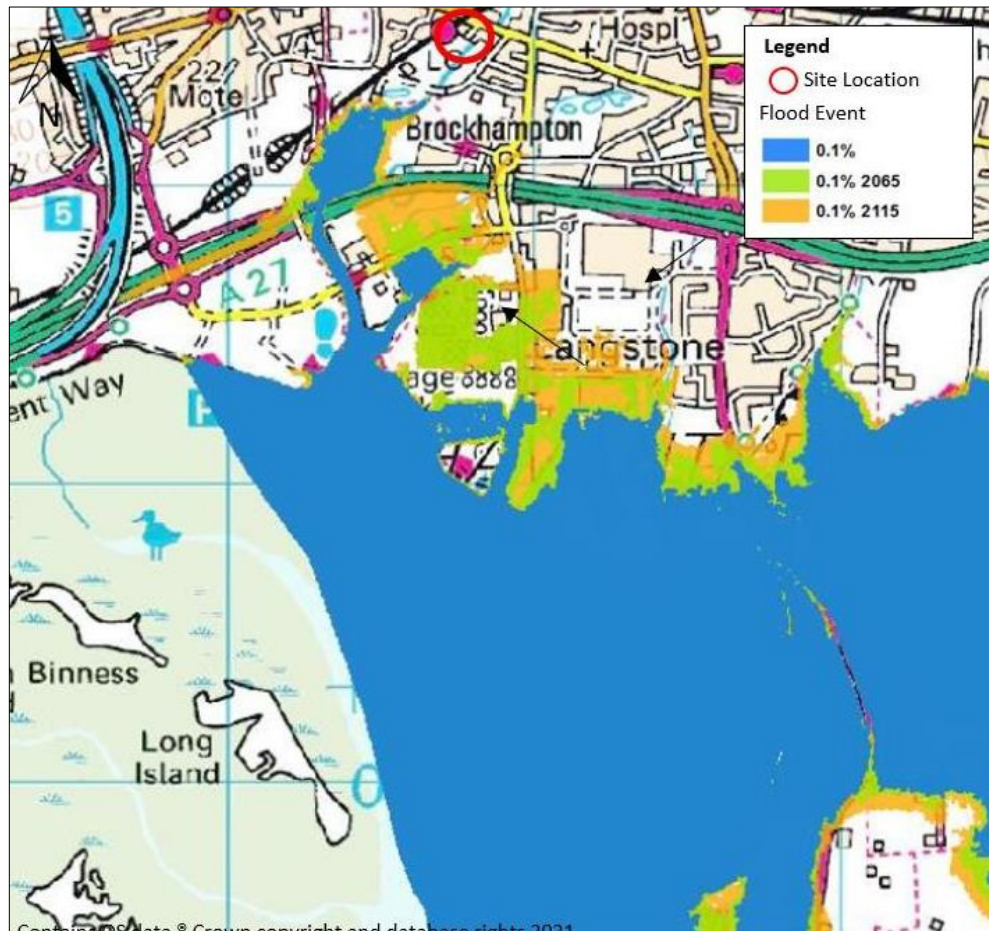


Figure 4-3: Defended maximum flood extents at the 0.1% AEP for climate change epochs

Pluvial Flooding

- 4.10. The Environment Agency surface water flood maps show that much of the development site is in an area that has a 'very low' risk of surface water flooding, meaning that there is less than a 0.1% chance of flooding from surface water flooding each year.
- 4.11. However, there are areas of 'low' to 'medium' risk of surface water flooding towards the southwest of the Site and along West Street and Palk Road. Refer to Figure 4-4 below. It is considered that this is largely associated with Hermitage Stream and therefore the mitigation measures required for fluvial flood risk would also mitigate against this flooding. In addition, the development will include a surface water management scheme, discussed in Section 6, which will mitigate against the increase in surface water flows as a result of the development.

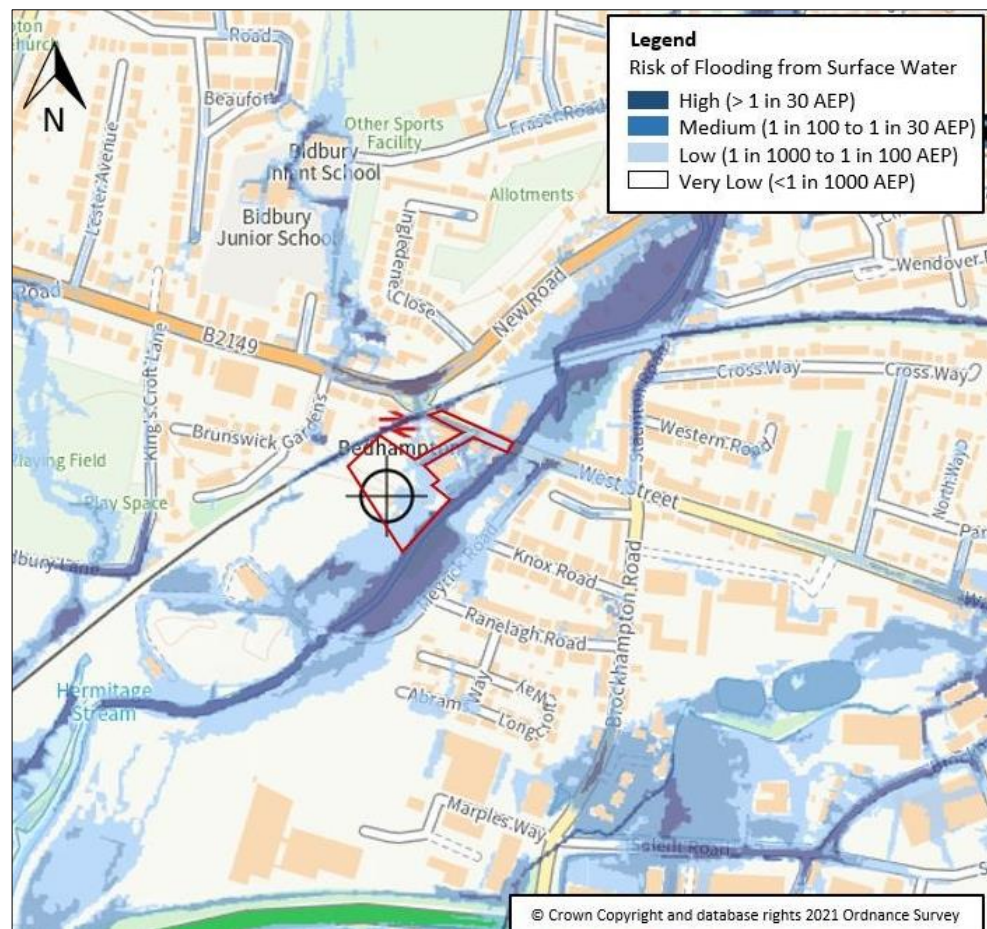


Figure 4-4: Environment Agency Flood Map for Surface Water

Groundwater Flooding

- 4.12. The PUSH SFRA mapping shows the site has not had any incidents of groundwater flooding, however, it is located in an area with high bedrock permeability as shown in Figure 4-5 below.

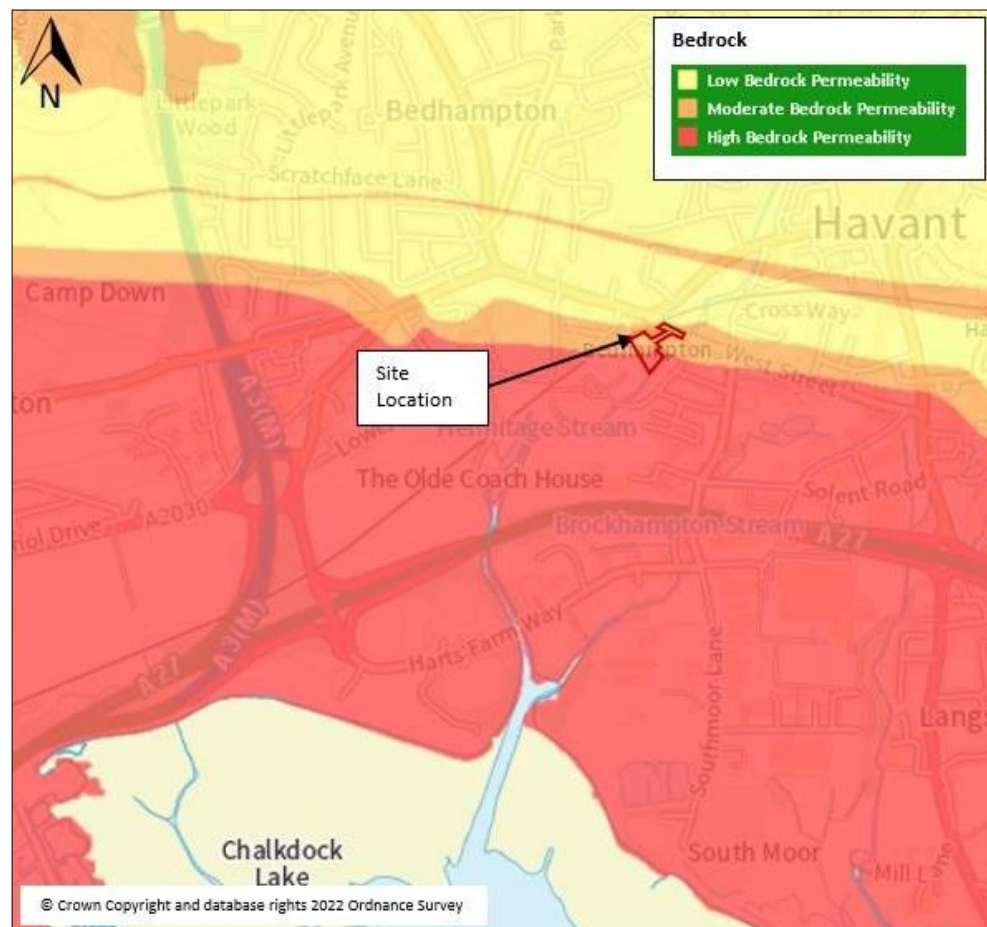


Figure 4-5: SFRA Ground Water Mapping

- 4.13. Monitoring undertaken between 2020 and 2021 demonstrated that groundwater was encountered at a highest level of 1.21m bgl. Groundwater would only pose a risk to sub ground level development. Since the development does not propose any belowground construction, groundwater is not seen as a flood risk to the development.
- 4.14. However, measures to manage the impact of high groundwater on the drainage system will be implemented such as impermeable liners.

Sewer Flooding

- 4.15. According to the PUSH SFRA, there is no record of sewer flooding within the vicinity of the Site.
- 4.16. The risk of sewer flooding is therefore assessed as very low.

Artificial Sources

- 4.17. According to the Environment Agency's Flood risk from reservoir map, the Site is not in an area at risk of flooding from artificial sources.
- 4.18. The site is therefore considered to be at a 'very low' risk of flooding from artificial sources.

5. FLOOD RISK MANAGEMENT

- 5.1. This site-specific flood risk assessment demonstrates that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
- 5.2. The site is partially at risk of fluvial flooding associated with the Hermitage Stream.

Finished Floor Levels

- 5.3. It should be noted that the proposed scheme has been designed to ensure that all residential development is located outside of the 100 year event plus 37% allowance for climate change flood outlines.
- 5.4. As a conservative approach, Finished Floor Levels for the residential properties would be set above the maximum flood level. It is recommended that a 300mm freeboard be provided above the 100 year + 37% flood level giving a minimum finished floor level of 6.93m AOD for any residential development.

Safe Access and Egress

- 5.5. As the Finished Floor Levels at the development will be raised to 6.93m AOD, 300mm above the highest recorded flood level on site for the 1 in 100 year + 37%CC event (6.63m AOD), safe refuge will be available throughout the development for all occupants in the event of a flood under this scenario.
- 5.6. Additionally, whilst a small extent of the modelled flood outline encroaches into the access road (Palk Road), the northern half of the road remains flood free and would therefore be accessible by vehicular transport and pedestrians, enabling safe access and egress to the wider area. Furthermore, the levels within the area of the access road covered by the 1 in 100 year + 37%CC event are shown to be largely similar to the flood level and therefore the flood depths at this area of the site are negligible.
- 5.7. Based on the EA surface water flood map and the topographic survey (Appendix C), the maximum predicted flood level for the 1 in 1000yr event is 6.85m AOD at the eastern part of the site falling to 6.54m AOD

at the south-western part. Therefore, predicted surface water flood levels are below the proposed FFLs for the residential development.

6. PROPOSED SURFACE WATER DRAINAGE STRATEGY

- 6.1. DEFRA's Non-statutory technical guidance for Sustainable Drainage Systems and CIRIA Guidance C753 "The SuDS Manual" have been used to determine the appropriate SuDS Strategy, which considers the spatial and environmental constraints of the Site.
- 6.2. Under the NPPF and its Planning Practice Guidance an allowance of 45% for the effects of climate change will achieve the policy requirements for the proposed development.

Proposed Sustainable Drainage Systems (SuDS)

- 6.3. In accordance with the NPPF Planning Practice Guidance, surface water runoff should be disposed of according to the following hierarchy:
1. into the ground (infiltration);
 2. to a surface water body;
 3. to a surface water sewer, highway drain, or another drainage system
 4. to a combined sewer.
- 6.4. As discussed in Section 3, BGS data indicates that part of the Site is underlain by Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation which may be compatible with the use of infiltration systems in these locations.
- 6.5. However, there is high groundwater present which would impede the functionality of infiltrating systems. It has also been found that Made Ground is present within the Site therefore infiltration would pose the risk of mobilising pollutants (present in the Made Ground) into the underlying aquifer.
- 6.6. BGS data also indicates that the remainder of the Site is underlain by the Lambeth Group, consisting of clay which would be incompatible with infiltration.

- 6.7. In addition, based on the topography of the Site, greenfield runoff generated onsite will currently flow overland into the existing Hermitage River running along the southern boundary.
- 6.8. The redline boundary/land ownership only extends to the top of bank of the Hermitage Stream and therefore it is not possible to construct a new connection directly to the watercourse. It is therefore proposed to discharge surface water runoff into the existing public sewer within the site boundary which almost immediately discharges to the Heritage Stream running along the southern boundary of the site. Surface water will be attenuated within SuDS features prior to being discharged to the Hermitage Stream at a controlled rate equivalent to the greenfield runoff rates for the developable area of the Site.
- 6.9. The constraints and opportunities for the use of SuDS techniques are appraised using the Management Train approach outlined in CIRIA C753 'The SuDS Manual' in Table 6-1 below.

Table 6-1: Existing and Proposed Areas

Type:	Infiltration Devices (Source Control)
Constraints:	Underlying geology and presence of made ground and high groundwater may be compatible with infiltration systems. Variable geology.
Opportunities:	Limited
Type:	Lined Permeable Paving (Source Control)
Constraints:	None
Opportunities:	Use of lined permeable paving implemented in strategy.
Type:	Rainwater Harvesting (Source Control)
Constraints:	The benefits of rainwater harvesting on a specific design storm event cannot be quantified, due to the seasonal availability of storage within the structure.
Opportunities:	Opportunities in amenity areas to provide harvesting features such as rain gardens, raised planters and water butts exist. However, it is difficult to quantify contribution, and therefore not included within calculations as part of this surface water management strategy.
Type:	Swales, etc. (Permeable Conveyance)
Constraints:	In order to provide practicable attenuation benefits 1:3 side-slope swales tend to require a significant land requirement. Additionally, the proposal to discharge to the public sewer network would limit the use of online open drainage systems.
Opportunities:	None due to spatial constraints.
Type:	Tree Pits/Rain gardens
Constraints:	Subject to Landscape Architect's design.
Opportunities:	There may be opportunities to use landscaped space to incorporate tree pits.
Type:	Green Roofs

Constraints:	Subject to Architect's design.
Opportunities:	Green roofs are not proposed as part of the development.
Type:	Attenuation Tanks (end of pipe treatment)
Constraints:	None
Opportunities:	Should additional attenuation be required this could be achieved by use of oversized sewers or geo-cellular storage attenuation.

- 6.10. After consideration of the CIRIA C753 SuDS Management Train approach, the most viable SuDS options for this site is a solution combining attenuation tanks and permeable paving. Refer to Drawing 2108040-001F in Appendix G for the proposed surface and foul water drainage strategy.
- 6.11. The inclusion of above ground SuDS features is limited by the flood risk to the site which prevents any features being located within the open space in the south of the site. The extent of permeable paving has been increased on site to ensure all runoff from roads is suitable treated prior to entering the attenuation tanks.
- 6.12. The permeable paving has remained outside of areas including the existing Southern Water surface water sewer, as well as the proposed private foul water sewers. Permeable paving has also been avoided in areas expected to be required for utility connections to the proposed development.
- 6.13. Flooding extents are shown on the Foul and Surface Water Drainage Strategy Drawing (Ref. 2108040-001E). This shows the extents to be confined mostly to the southwest of the site and outside the extent of all residential and commercial development and is therefore of negligible significance.

Existing and Proposed Surface Water Discharge Rates

Existing development

- 6.14.** The planning application boundary equates to 1.3 ha of which 0.2 ha is permeable. Existing brownfield runoff rates from the Site have been determined using the Wallingford Procedure Rational Method for an assumed critical 5-minute storm. Equivalent peak Greenfield Runoff rates for the Site were also calculated using the ICP SuDS Mean Annual Flow Method and are presented in Table 6-2 below. Full calculations can be found in Appendix I.

Table 6-2: Greenfield Discharge rates

Return Period Event	Brownfield (l/s)	Greenfield (l/s)
Q₁	155.35	3.1
Q₃₀	345.62	8.2
Q₁₀₀	440.05	11.5
Q_{bar}	-	3.6

Proposed development

6.15. The redevelopment will introduce permeable areas across the Site through the introduction of communal landscapes areas at groundlevel equating to approximately 3,000m².

6.16. Comparisons between the existing and proposed hardstanding areas excluding green roofs are shown in Table 6-3 below. The proposals therefore result in a reduction in impermeable area (45.4%).

Table 6-3: Existing and proposed hardstanding areas

Site	Area (ha)	Impermeable Area (ha)	Permeable Area (ha)	% Impermeable
Pre-Development	1.3	1.1	0.2	84.6%
Post-Development	1.3	0.627	0.673	46.0% (45.4% reduction)

Proposed surface water runoff rates

6.17. The Non-Statutory Technical Standards For Sustainable Drainage states that “for developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event”.

6.18. Due to the location of the existing pipe in the center of the site, to ensure the pipe is not crossed, it is proposed to allow for two new connections to the existing surface water sewer.

6.19. Southern Water were approached and have accepted the principles applied at the site for a new connection into the public network. The full response (Ref. DSA000019841) is provided in Appendix A where it is

stated 'The Flood Risk Assessment document indicates surface water flows no greater than existing levels being connected into the public system proving betterment of the surface water flows which would be satisfactory to Southern Water'.

- 6.20. A Section 106 application will be submitted in due course to Southern Water once the detailed design of the drainage connection has been completed. The proposals will be in accordance with the Code for Adoptions and are therefore considered appropriate.
- 6.21. It is proposed to limit the discharge rate from the site to the existing 1 in 100 year greenfield runoff rate which equates to 11.5 l/s. Discharge rates from Catchment A will therefore be limited to 4 l/s, and discharge rates from Catchment B will therefore be limited to 7.5 l/s for all storm events up to the 1 in 100-year plus a 45% allowance for climate change. This results in a minimum 92% betterment from the existing scenario.
- 6.22. Table 6-4 below highlights the existing and proposed surface water runoff discharge rates for the Site under various storm scenarios.

Table 6-4: Existing and Proposed Surface Water Runoff Rates

	Return Period			
	1 in 1 year Discharge Rate	1 in 30 Year Discharge Rate	1 in 100 year Discharge Rate	1 in 100 year + 45% Discharge Rate
Pre Development (l/s)	155.35	345.62	440.05	-
Calculated Greenfield runoff (l/s)	3.1	8.2	11.5	-
Proposed post Development (l/s)	11.5	11.5	11.5	11.5
% Reduction from pre development	92%	97%	97%	-

- 6.23. As displayed above in Table 6-4 there will be a significant reduction in surface water runoff in the post development scenario and therefore an improvement in the capacity of the public sewer network.
- 6.24. MicroDrainage Network module modelling results for all return periods including peak rainfall allowances for 1 in 30 year storm event show there is no flooding on the Site at any modelled rainfall event.

MicroDrainage modelling results are included in Appendix J.

Long Term Storage and Urban Creep

- 6.25. It is proposed to reduce the amount of impermeable area at the site. As such, the volume of runoff generated by the development site will not exceed the existing greenfield runoff volume during a 1 in 100year 6 hour event.
- 6.26. Urban creep allows for future urban expansion (i.e addition of patios, extensions and driveways) within the development which increases impermeability of developed areas, causing runoff rates and volume to rise. As the proposals are for an apartment scheme urban creep has not been allowed for as it is considered unlikely that the paved areas would increase without further planning approval.

Exceedance Flow Routes

- 6.27. The surface water drainage strategy has been designed to ensure no flooding occurs as a result of the 1 in 100-year rainfall event (including an allowance for climate change).
- 6.28. Site levels will be designed to ensure that exceedance flows will drain towards the paved areas and subsequently flow towards the Hermitage Stream beyond the site's southern boundary.
- 6.29. Should the capacity of the surface water system be exceeded during an extreme rainfall event, surface water would flow towards roads and to the Hermitage Stream to the south of the site.
- 6.30. Non return valves are proposed on the final discharge to the public sewer network to prevent flows backing up into the on-site drainage network.

Water Quality

- 6.31. Development proposals are for residential use. Based on Ciria753 Simple Index Treatment Method, the development would have an associated pollution hazard level of 'very low'. The recommended stages of treatment will be provided by the permeable paving. Refer to Appendix K for the simple Index Treatment Method calculations.

Maintenance and Management of System

- 6.32. The maintenance of all SuDS components will be in accord with the best practices and the CIRIA C753 The SuDS Manual. The recommended

Operation and Maintenance requirements for the proposed permeable paving and attenuation tanks are outlined in the Management Plan in Appendix L.

- 6.33. A management company will be appointed to maintain any parts of the network which are not to be offered for adoption to Southern Water.

7. PROPOSED FOUL WATER DRAINAGE STRATEGY

- 7.1. It is proposed to develop the site to comprise up to 83 new dwellings.
- 7.2. The peak foul flow rate for the proposed development has therefore been calculated to be 0.951l/s. Refer to Appendix M.
- 7.3. It is proposed that foul flows from the development will discharge into the existing Southern Water foul sewer that exists to the north of the site. Refer to the preliminary drainage strategy drawing no. 2108040-001F provided in Appendix G.
- 7.4. Southern Water confirmed in their consultation response to the planning application that they have capacity to accept flows from the proposed development.

8. CONCLUSIONS

- 8.1. This FRA has been produced to support a planning application for the proposed residential development at Palk Road.
- 8.2. The proposal comprise full planning application for the redevelopment of a brownfield site to include the provision of 83 residential dwellings (C3 use), parking, public open space, landscaping and other associated works, including demolition of existing buildings on site, with access from Palk Road.
- 8.3. A small part of the southern edge of the Site is marginally located in Flood Zone 2 and 3 however the residential blocks are wholly located in Flood Zone 1, and outside of the 100 year plus 37% allowance for climate change flood extents.
- 8.4. The Environment Agency's surface water flood maps show that the development site is in an area that has a 'Low' risk of surface water flooding and no other means of flooding identified as posing a risk to the site.
- 8.5. Based on the characteristics of the Site, it is proposed to discharge surface water runoff from the Site into the existing surface water sewer currently running through the centre of the site. Surface water will be attenuated within Sustainable Urban Drainage features prior to being discharged to existing ordinary watercourse at a controlled rate equivalent to the 1 in 100 year greenfield runoff rate for the developable area of the Site. This results in a 92% betterment from the existing scenario.
- 8.6. The drainage strategy is suitable to protect the site and surrounding areas from surface water flooding for all events up to and including the 1 in 100-year storm event including a 45% allowance for climate change.
- 8.7. The peak foul flow rate for the proposed development is calculated to be 0.951 /s. It is proposed that foul flows from the development will discharge into the existing Southern Water foul sewer within the

site. The foul sewer will also be diverted to accommodate the development.

- 8.8. In conclusion, this FRA demonstrates that the proposals are consistent with the aims of NPPF, PPG and Development Plan. The site would not be at risk of flooding or increase the flood risk to others. As such there are no reasons to withhold the grant of planning permission in relation to flood risk and or drainage related considerations subject to the inclusion of standard planning conditions.

Appendix A

Our Ref: 2205270/LLFA/04RA

Havant Borough Council
Development Control
Civic Offices
Civic Centre Road
Havant
Hampshire
PO9 2AX

16th June 2023

Dear Sir/Madam,

RESPONSE TO CONSULTEE COMMENTS – Land at Palk Road, Havant (REF: APP/22/01231)

Ardent Consulting Engineers (hereafter referred to as 'Ardent') have been commissioned by Bellway Homes Ltd. (Wessex) to address comments raised by the Lead Local Flood Authority (LLFA) and the Environment Agency (EA) with respect to the proposed development on Land at Palk Road, Havant, PO9 1NL (planning application ref: APP/22/01231). Refer to the enclosed responses from the relevant consultees in **Appendix A**.

This response letter aims to address the comments from the relevant consultees stated above. For ease of reference, the responses are detailed, in ***bold italics***, with the Ardent response immediately below. This letter should be read in conjunction with the Flood Risk Assessment produced by Ardent (Ref: 2108040-01A).

This information has been informally submitted to Hampshire County Council, as the LLFA, have they have confirmed that the additional information is acceptable, subject to formal submission.

Environment Agency

Recommend approval subject to condition to accord with FRA and set FFLs at or about 6.93mAOD.

No action. In line with Paragraph 5.3 of the Flood Risk Assessment produced by Ardent (Ref: 2108040-01A), the Finished Floor Levels at the development will be raised to 6.93m AOD, 300mm

above the highest recorded flood level on site for the 1 in 100 year + 37%CC event (6.63m AOD).

Where necessary, the advice of relevant experts should be sought:

- ***Details and adequacy of an emergency plan***

As the Finished Floor Levels at the development will be raised to 6.93m AOD, 300mm above the highest recorded flood level on site for the 1 in 100 year + 37%CC event (6.63m AOD), safe refuge will be available throughout the development for all occupants in the event of a flood under this scenario.

Additionally, whilst a small extent of the modelled flood outline encroaches into the access road (Palk Road), the northern half of the road remains flood free and would therefore be accessible by vehicular transport and pedestrians, enabling safe access and egress to the wider area. Furthermore, the levels within the area of the access road covered by the 1 in 100 year + 37%CC event are shown to be largely similar to the flood level and therefore the flood depths at this area of the site are negligible.

LLFA

In order for us to provide a substantive response, the following information is required:

Confirmation that floor levels for development in the low surface water flood risk area will be above modelled flood levels (this is in addition to the modelled Flood Zone area that considers climate change).

It is proposed that FFLs are set at 6.93m AOD for the residential development (300mm above the 100 year + 37% flood level). Based on the EA surface water flood map and the topographic survey (**Appendix B**), the maximum predicted flood level for the 1 in 1000yr event is 6.85m AOD at the eastern part of the site falling to 6.54m AOD at the south-western part.

Therefore, predicted surface water flood levels are below the proposed FFLs for the residential development. Additionally, the proposed development sets the road through the site at 300mm below the properties and the flow path route will be changed slightly through the site to follow the roads before connecting back into the Hermitage Stream.

Confirmation of whether there is an existing connection to the surface water sewer or whether approval has been sought from the water company for a connection into the

sewer. An alternative proposal for a new private surface water sewer serving the site and discharging to the watercourse could also be acceptable.

Southern Water were approached and have accepted the principles applied at the site for a new connection into the public network. The full response (Ref. DSA000019841) is provided in **Appendix A** where it is stated '*The Flood Risk Assessment document indicates surface water flows no greater than existing levels being connected into the public system proving betterment of the surface water flows which would be satisfactory to Southern Water*'.

A Section 106 application will be submitted in due course to Southern Water once the detailed design of the drainage connection has been completed. The proposals will be in accordance with the *Code for Adoptions* and are therefore considered appropriate.

Peak rainfall allowances should be included for the 1 in 30-year storm event in the calculations, and be shown to not cause flooding.

The Microdrainage model calculations have been re-run to include for the 1 in 30-year results, including an allowance for climate change, which show no flooding under this scenario. The updated MicroDrainage calculations are attached in **Appendix C**.

Permeable paving areas may need to be increased so that all runoff from roads is suitably treated prior to entering attenuation tanks.

The inclusion of above ground SuDS features is limited by the flood risk to the site which prevents any features being located within the open space in the south of the site. The extent of permeable paving has been increased on site to ensure all runoff from roads is suitable treated prior to entering the attenuation tanks. This is shown in the updated Drainage Strategy Drawing (2108040-001C) in **Appendix D**. The permeable paving has remained outside of areas including the existing Southern Water surface water sewer, as well as the proposed private foul water sewers. Permeable paving has also been avoided in areas expected to be required for utility connections to the proposed development.

Flooded extents should also be shown on the layout showing the flood exceedance flow routes.

The indicative extents of the minor flooding in the 1 in 100 year, including climate change, event have been included on the drainage strategy drawing (2108040-001D).

As stated in the FRA produced by Ardent (Ref. 2108040-01A), the surface water flood extents shown on site are largely associated with the Hermitage Stream. Flooding extents are shown on the Foul and Surface Water Drainage Strategy Drawing (Ref. 218040-001A). This shows the extents to be confined mostly to the southwest of the site and outside the extent of all residential and commercial development and is therefore of negligible significance.

Exceedance flow routes are identified on the Foul and Surface Water Drainage Strategy Drawing (Ref. 218040-001B), indicating flows will drain towards the highway network and subsequently flow towards the Hermitage Stream beyond the site's southern boundary.

We trust that the above addresses the queries raised by the Environment Agency and LLFA in relation to the proposed development. However, please do not hesitate to contact me if there are any further clarifications required.

Yours sincerely,

Charlie Cooper

Charlie Cooper
Associate Director

Encl: Appendix A – Environment Agency and LLFA Consultee Responses
Appendix B – Topographical Survey
Appendix C – Updated Microdrainage Calculations
Appendix D – 2108040-001D Surface and Foul Water Drainage Strategy

CC: Thomas Callaway – Hampshire County Council (LLFA)

Appendix A



Hampshire County Council

Universal Services
The Castle
Winchester, Hampshire SO23 8UD

Tel: 0300 555 1375
Fax 01962 847055
www.hants.gov.uk

Enquiries to	Thomas Callaway	My reference	SWM/2023/0035
Direct Line	03707 798982	Your reference	F/21/91183
Date	9 February 2023	Email	swm.consultee@hants.gov.uk

Dear Sir/Madam,

Redevelopment of a brownfield site to include the provision of 4No. Apartment blocks comprising of 90No. residential dwellings (including 27 affordable units) (Use class C3 residential), parking, public open space, landscaping and other associated works, including demolition of existing buildings on site, with access from Palk Road at Land at, Palk Road, Havant(Application No. APP/22/01231

Hampshire County Council as Lead Local Flood Authority has provided comments in relation to the above application in our role as statutory consultee on surface water drainage for major developments.

This response does not reflect the position of Hampshire County Council as the Highway Authority. If there is a potential for the drainage features to be offered for adoption, this will need to be discussed separately with Highways development planning as they might not be considered acceptable by the Highway Authority.

In order to assist applicants in providing the correct information to their Local Planning Authority for planning permission, Hampshire County Council has set out the information it requires to provide a substantive response at <https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/planning>

The County Council has reviewed the following documents relating to the above application:

- Flood Risk Assessment & Drainage Strategy 2108040-01 Rev. A (Arden, 7/12/22)

Director of Universal Services
Patrick Blogg

The site is brownfield and is within Flood Zone 1. Climate change modelling has been considered for the Flood Zone, and development is proposed outside of the area at risk. The site is predominantly within an area at very low risk of flooding from surface water, however a portion of the site is at low risk. Floor levels for development in this area should take account of modelled surface water flooded depths. Flood risk is increased adjacent to the site due to the proximity to a watercourse.

The site consists of a lot of made ground and groundwater levels are relatively high, meaning that infiltration will not work as a surface water drainage strategy. A watercourse is adjacent to the site and a surface water sewer passes through the site. The proposed development would result in a reduction in impermeable area.

The discharge rate from the site is to be reduced to the 1 in 100 year greenfield runoff rate, which would provide significant betterment for all storm events based on the existing brownfield runoff rate. Runoff is to be attenuated through permeable paving and attenuation tanks, with two restricted discharge connections into the surface water sewer which discharges to the adjacent watercourse.

If the site already drains to the surface water sewer, the water company may accept any reduction in flows. Otherwise an agreement must be made between the applicant and water company to connect to the sewer. Should this not be possible, a suitable alternative may be possible by way of constructing a private surface water sewer on-site to discharge to the watercourse.

Calculations have been provided for the storage and network, showing very minor flooding at the 1 in 100 year event. Climate change allowances have not been applied to the 1 in 30 year event, this is required to determine whether any flooding occurs in the network for this event. Flood exceedance flow routes have been shown on the layout.

Water treatment and runoff quality has been considered through the simple index approach. Not all roads will be draining through the permeable paving so consideration should be given to providing more permeable paving where road drainage is draining directly to an attenuation tank. Maintenance information has also been provided.

In order for us to provide a substantive response, the following information is required:

- Confirmation that floor levels for development in the low surface water flood risk area will be above modelled flood levels (this is in addition to the modelled Flood Zone area that considers climate change).
- Confirmation of whether there is an existing connection to the surface water sewer or whether approval has been sought from the water

company for a connection into the sewer. An alternative proposal for a new private surface water sewer serving the site and discharging to the watercourse could also be acceptable.

- Peak rainfall allowances should be included for the 1 in 30 year storm event in the calculations, and be shown to not cause flooding.
- Permeable paving areas may need to be increased so that all runoff from roads is suitably treated prior to entering attenuation tanks.
- Flooded extents should also be shown on the layout showing the flood exceedance flow routes.

We require this further information before we can make a decision on whether to recommend to the Local Planning Authority that planning permission is granted.

As a statutory consultee, the County Council has a duty to respond to consultations within **21 days**. The 21 day period will not begin until we have received sufficient information to enable us to provide a meaningful response.

Please ensure all data is sent to us via the relevant Local Planning Authority.

If you require additional guidance on providing the correct information, we recommend you use our **Surface Water Management Pre-application service** which will enable discussions with the reviewing engineer and scope out works that would address the points raised. For full details, please visit: <https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/planning> and click on [pre-application advice request form](#).

This response has been provided using the best knowledge and information submitted by the applicant as part of the planning application at the time of responding and is reliant on the accuracy of that information.

Yours faithfully,



Thomas Callaway
Senior FWM Project Officer

General guidance for the application

It is important to ensure that the long-term maintenance and responsibility for Sustainable Drainage Systems is agreed between the Local Planning Authority and the applicant before planning permission is granted. This should involve discussions with those adopting and/or maintaining the proposed systems, which could include the Highway Authority, Planning Authority, Parish Councils, Water Companies and private management companies.

For SuDS systems to be adopted by Hampshire Highways it is recommended that you visit the website at:

<https://www.hants.gov.uk/transport/developers/constructionstandards> for guidance on which drainage features would be suitable for adoption.

Where the proposals are connecting to an existing drainage system it is likely that the authorities responsible for maintaining those systems will have their own design requirements. These requirements will need to be reviewed and agreed as part of any surface water drainage scheme.

Works in relation to ordinary watercourses

PLEASE NOTE: If the proposals include works to an ordinary watercourse, under the Land Drainage Act 1991, as amended by the Flood and Water Management Act 2010, prior consent from the Lead Local Flood Authority is required. **This consent is required as a separate permission to planning.**

Information on ordinary watercourse consenting can be found at the following link

<https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/c/hangewatercourse>

It is strongly recommended that this information is reviewed before Land Drainage consent application is made.

For guidance on providing the correct information, we recommend you use our **Ordinary Watercourse Consents Pre-application service** and help avoid delays occurring at the formal application stage. A Pre-application service for Ordinary Watercourse Consents is available, allowing consents to go through in a smoother, often more timely manner. For full information please visit:

<https://www.hants.gov.uk/landplanningandenvironment/environment/flooding/c/hangewatercourse>

Havant Borough Council
Development Control
Civic Offices
Civic Centre Road
Havant
Hampshire
PO9 2AX

Our ref: HA/2023/124806/01-L01
Your ref: APP/22/01231
Date: 07 February 2023

Dear Planning,

REDEVELOPMENT OF A BROWNFIELD SITE TO INCLUDE THE PROVISION OF 4NO. APARTMENT BLOCKS COMPRISING OF 90NO. RESIDENTIAL DWELLINGS (INCLUDING 27 AFFORDABLE UNITS) (USE CLASS C3 RESIDENTIAL), PARKING, PUBLIC OPEN SPACE, LANDSCAPING AND OTHER ASSOCIATED WORKS, INCLUDING DEMOLITION OF EXISTING BUILDINGS ON SITE, WITH ACCESS FROM PALK ROAD LAND AT, PALK ROAD, HAVANT

Thank you for the consulting the Environment Agency on the above application.

We have reviewed the information as submitted and set out our position and comments below.

Environment Agency Position

The proposed development will only meet the National Planning Policy Framework's requirements in relation to flood risk if the following **planning condition** is included on any planning permission granted.

Condition

The development shall be carried out in accordance with the submitted flood risk assessment (Flood Risk Assessment for Land at Palk Road, Bedhampton, Havant dated December 2022 carried out by: Ardent Consulting Engineers) and the following mitigation measures it details

- [5.4] Finished floor levels of the resident aspect of this proposal shall be set no lower than 6.93 metres above Ordnance Datum (AOD)

These mitigation measures shall be fully implemented prior to occupation and subsequently in accordance with the scheme's timing/phasing arrangements. The

Environment Agency
Guildbourne House Chatsworth Road, Worthing, West Sussex, BN11 1LD.
Customer services line: 03708 506 506
www.gov.uk/environment-agency

Cont/d..

measures detailed above shall be retained and maintained thereafter throughout the lifetime of the development.

Reason

To reduce the risk of flooding to the proposed development and future occupants

Advice to LPA/Applicant

Flood resistance and resilience

We strongly recommend the use of flood resistance and resilience measures. Physical barriers, raised electrical fittings and special construction materials are just some of the ways you can help reduce flood damage.

To find out which measures will be effective for this development, please contact your building control department. In the meantime, if you'd like to find out more about reducing flood damage, visit the Flood Risk and Coastal Change pages of the planning practice guidance. The following documents may also be useful:

Department for Communities and Local Government: Preparing for floods

<http://www.planningportal.gov.uk/uploads/odpm/4000000009282.pdf>

Department for Communities and Local Government: Improving the flood performance of new buildings: <https://www.gov.uk/government/publications/flood-resilient-construction-of-new-buildings>

The following issues are not within our direct remit or expertise, but nevertheless are important considerations for managing flood risk for this development. Prior to deciding this application we recommend that consideration is given to the issues below. Where necessary, the advice of relevant experts should be sought.

- Adequacy of rescue or evacuation arrangements
- Details and adequacy of an emergency plan
- Provision of and adequacy of a temporary refuge
- Details and adequacy of flood proofing and other building level resistance and resilience measures
- Details and calculations relating to the structural stability of buildings during a flood
- Whether insurance can be gained or not
- Provision of an adequate means of surface water disposal such that flood risk on and off-site isn't increased

Although the majority of the site will likely remain dry in a 100 year return period plus 37% climate change event, the flood risk assessment states Palk Road will be used to vacate the site. As demonstrated in the flood risk assessment, Palk Road will be partially affected by flooding from a 100 year return period plus 37% climate change event, which could restrict access and egress for emergency services.

The Environment Agency does not normally comment on or approve the adequacy of flood emergency response procedures, as we do not carry out these roles during a flood. Our involvement with this development during an emergency will be limited to delivering flood warnings to occupants. In all circumstances where warning and emergency response are fundamental to managing flood risk, we advise local planning authorities to formally consider the emergency planning and rescue implications of new development in making their decisions.

Environmental Permit

The Environmental Permitting (England and Wales) Regulations 2016 require a permit or exemption to be obtained for any activities which will take place:

- on or within 8 metres of a main river (16 metres if tidal)
- on or within 8 metres of a flood defence structure or culverted main river (16 metres if tidal)
- on or within 16 metres of a sea defence
- involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
- in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission

For further guidance please visit <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits> or contact our National Customer Contact Centre on 03708 506 506 (Monday to Friday, 8am to 6pm) or by emailing enquiries@environment-agency.gov.uk.

The applicant should not assume that a permit will automatically be forthcoming once planning permission has been granted, and we advise them to consult with us at the earliest opportunity.

Signing up for flood warnings

The applicant/occupants should phone Floodline on 0345 988 1188 to register for a flood warning, or visit <https://www.gov.uk/sign-up-for-flood-warnings>. It's a free service that provides warnings of flooding from rivers, the sea and groundwater, direct by telephone, email or text message. Anyone can sign up.

Flood warnings can give people valuable time to prepare for flooding – time that allows them to move themselves, their families and precious items to safety. Flood warnings can also save lives and enable the emergency services to prepare and help communities.

For practical advice on preparing for a flood, visit <https://www.gov.uk/prepare-for-flooding>.

To get help during a flood, visit <https://www.gov.uk/help-during-flood>.

For advice on what to do after a flood, visit <https://www.gov.uk/after-flood>.

Yours faithfully

Mrs Sophie Brown
Sustainable Places Planning Advisor

Direct dial 0203 0257 250

Direct e-mail planningSSD@environment-agency.gov.uk



Department of Planning and Development
Havant Borough Council
Public Service Plaza
Civic Centre Road
Havant
Hampshire
PO9 2AX

Your ref
APP/22/01231

Our ref
DSA000019841

Date
13/02/2023

Contact
Tel 0330 303 0119

Dear Sir/Madam,

Proposal: Redevelopment of a brownfield site to include the provision of 4No. Apartment blocks comprising of 90No. residential dwellings (including 27 affordable units) (Use class C3 residential), parking, public open space, landscaping and other associated works, including demolition of existing buildings on site, with access from Palk Road.

Site: APP/22/01231: - Land at Palk Road, Havant.

Thank you for your letter dated 23/01/2023.

Please see the attached extract from Southern Water records showing the approximate position of our existing public foul and surface water sewers within the development site. The exact position of the public assets must be determined on site by the applicant in consultation with Southern Water before the layout of the proposed development is finalised.

It appears that the applicant is proposing to abandon/divert a public foul sewer. Any public sewer diversion proposals shall be approved by Southern Water under Section 185 of the Water Industry Act. An application should be made using Southern Water's Get Connected Service at developerservices.southernwater.co.uk

- The public foul sewers requires a clearance of 3 metres on either side of the gravity sewer to protect it from construction works and to allow for future access for maintenance.
- The 750 mm public surface water sewer requires a clearance of 4 metres on either side of the gravity sewer to protect it from construction works and to allow for future access for maintenance.
- No development or tree planting should be carried out within 3 metres of the external edge of the public gravity sewer without consent from Southern Water.
- No soakaways, swales, ponds, watercourses or any other surface water retaining or conveying features should be located within 5 metres of public or adoptable gravity sewers.

- All existing infrastructure should be protected during the course of construction works.

Please refer to: southernwater.co.uk/media/3011/stand-off-distances.pdf

It is possible that a sewer now deemed to be public could be crossing the development site. Therefore, should any sewer be found during construction works, an investigation of the sewer will be required to ascertain its ownership before any further works commence on site.

In order to protect drainage apparatus, Southern Water requests that if consent is granted, a condition is attached to the planning permission; for example, the developer must advise the local authority (in consultation with Southern Water) of the measures which will be undertaken to divert the public sewers, prior to the commencement of the development.

Our investigations indicate that Southern Water can facilitate foul sewerage disposal to service the proposed development. Southern Water requires a formal application for a connection to the public sewer to be made by the applicant or developer.

To make an application visit Southern Water's Get Connected service: developerservices.southernwater.co.uk and please read our New Connections Charging Arrangements documents which are available on our website via the following link: southernwater.co.uk/developing-building/connection-charging-arrangements

The Flood Risk Assessment document indicates surface water flows no greater than existing levels being connected into the public system proving betterment of the surface water flows which would be satisfactory to Southern Water.

The supporting documents make reference to drainage using Sustainable Drainage Systems (SuDS).

Under certain circumstances SuDS will be adopted by Southern Water should this be requested by the developer. Where SuDS form part of a continuous sewer system, and are not an isolated end of pipe SuDS component, adoption will be considered if such systems comply with the latest Design and Construction Guidance (Appendix C) and CIRIA guidance available here:

water.org.uk/sewerage-sector-guidance-approved-documents/

ciria.org/Memberships/The_SuDS_Manual_C753_Chapters.aspx

Where SuDS rely upon facilities which are not adoptable by sewerage undertakers the applicant will need to ensure that arrangements exist for the long-term maintenance of the SuDS facilities. It is critical that the effectiveness of these systems is maintained in perpetuity. Good management will avoid flooding from the proposed surface water system, which may result in the inundation of the foul sewerage system.

Thus, where a SuDS scheme is to be implemented, the drainage details submitted to the Local Planning Authority should:

- Specify the responsibilities of each party for the implementation of the SuDS scheme.
- Specify a timetable for implementation.



- Provide a management and maintenance plan for the lifetime of the development.

This should include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime.

The Council's technical staff and the relevant authority for land drainage consent should comment on the adequacy of the proposals to discharge surface water to the local watercourse.

Land uses such as general hard standing that may be subject to oil/petrol spillages should be drained by means of appropriate oil trap gullies or petrol/oil interceptors.

We request that should this planning application receive planning approval, the following informative is attached to the consent: Construction of the development shall not commence until details of the proposed means of foul sewerage and surface water disposal have been submitted to, and approved in writing by, the Local Planning Authority in consultation with Southern Water.

This initial assessment does not prejudice any future assessment or commit to any adoption agreements under Section 104 of the Water Industry Act 1991. Please note that non-compliance with the Design and Construction Guidance will preclude future adoption of the foul and surface water sewerage network on site. The design of drainage should ensure that no groundwater or land drainage is to enter public sewers.

For further advice, please contact Southern Water, Southern House, Yeoman Road, Worthing, West Sussex, BN13 3NX (Tel: 0330 303 0119).

Website: southernwater.co.uk or by email at: SouthernWaterPlanning@southernwater.co.uk

Yours faithfully,

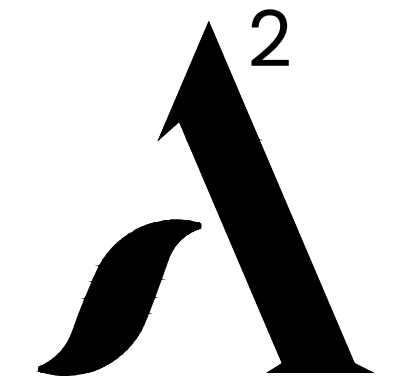
Future Growth Planning Team
Developer Services

southernwater.co.uk/developing-building/planning-your-development

Requested By:



Appendix B



ARCHITECTURE & DEVELOPMENT

WEBSITE: www.A2AD.co.uk
EMAIL: info@A2AD.co.uk
TELEPHONE: 01489 290035
ADDRESS: Elan House
5a Little Park Farm Road
Fareham PO15 5SJ

CLIENT:



PROJECT:

Land Off Palk Road
Bedhampton, Havant
PO9 1NL

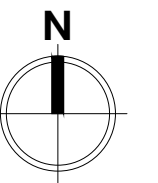
DRAWING:

Proposed Site Layout

STATUS:

Planning

Do not scale for any other purpose than stated in title, use annotated dimensions only. All dimensions to be checked on site & any discrepancies/errors to be reported to A2 before work commences. This drawing is to be read in conjunction with all other relevant materials.
Copyright exists on this plan and information displayed on this drawing. Reproduction of plan is not permitted without written consent. Company registration no 1287357



REV: DATE:

SCALE: DATE: DRAWN BY:

1:500@A2 FEB | 2024 WS/SA

REFERENCE: SHEET NO: REVISION:

21085 201 -

Appendix C

Appendix D



Geoenvironmental

Palk Road, Havant PO9 1NL

For Bellway Homes

CRM.1668.023.GE.R.001.B



Contact Details:

Enzygo Geoenvironmental Ltd. (Bristol Office)
The Byre
Woodend Lane
Cromhall
Gloucestershire
GL12 8AA

tel: 01454 269237
email: steve.rhodes@enzygo.com
www: enzygo.com

Geoenvironmental Report

Project:	Palk Road, Havant PO9 1NL
For:	Bellway Homes
Ref:	CRM.1668.023.GE.R.001.B
Status:	Revision B
Date:	December 2021
Author:	Steve Rhodes BSc (hon) MSc DIC CEng CGeol MIMMM MI EnvSc FGS Director
Reviewer:	Richard Hamilton BSc (Hons.) MSc Director of Geo-Environmental

Disclaimer:

This report has been produced by Enzygo Limited within the terms of the contract with the client and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

Executive Summary

Proposed Development

The proposed development comprises residential use at Palk Road, Havant PO9 1NL.

Investigation

Site works were undertaken by Enzygo Geoenvironmental Ltd. in November and December 2021.

Ground Conditions

Ground conditions comprise Made Ground over soft becoming firm and stiff with depth silty clay varying to medium dense clayey sand. Soft clays were encountered locally to over 3m bgl. Groundwater was encountered at depths of between 1.5m 2.9m bgl.

Contamination

Contamination has been identified and clean cover soils are recommended.

Foundations

Piled foundations re recommended due to deep soft soils. It maybe possible to zone the extent of piling if additional investigation is undertaken once site possession has been taken.

Waste Classification

Two part WAC tests indicate soils should be classified as stable non reactive waste.

Pavement Construction

An equilibrium CBR value of 4% is recommended.

Ground Gas

Radon and ground gas risks have been identified. Gas protection measures are recommended.

Contents

1.0	INTRODUCTION	1
1.1	Background	1
1.2	Proposed Development	1
1.3	Objectives	1
1.4	Risk Classification	1
2.0	SITE SETTING	3
2.1	Current Site Description	3
2.2	Surrounding Area	3
3.0	DESK STUDY	4
3.1	Historical Maps	4
3.2	Historical Maps	4
4.0	Environmental Setting	6
4.2	Groundwater	6
4.3	Coal Mining	6
4.4	Non Coal Mining and Cavities	6
4.5	Ground Workings	6
4.6	Natural Cavities	6
4.7	Hydrology	7
4.8	Radon Risk Potential	7
4.9	Natural Hazards Finding	7
4.10	Sensitive Land Uses	7
4.11	Environmental Sensitivity	7
4.12	Industrial Land Uses	8
4.13	Regulatory Database	8
4.14	Landfill Sites	8

4.15	Planning Information	8
5.0	PRELIMINARY ASSESSMENT	9
5.1	Preliminary Conceptual Model	9
6.0	SITE INVESTIGATION	11
6.1	General	11
6.2	Site Works.....	11
6.3	Laboratory Testing.....	11
7.0	GROUND AND GROUNDWATER CONDITIONS.....	12
7.1	Summary of Ground and Groundwater Conditions	12
7.2	Made Ground.....	12
7.3	Drift Deposits	12
7.4	Soil Strength.....	12
7.5	Visual and Olfactory Evidence of Contamination	12
7.6	Groundwater	13
7.7	Ground Gas.....	13
8.0	CONTAMINATION ASSESSMENT	14
8.1	General	14
8.2	Human Health.....	14
8.3	Controlled Waters.....	14
8.4	Ground Gas.....	14
8.5	Conceptual Model	15
8.6	Remediation and Verification Strategy	16
8.7	Waste Classification	17
9.0	GEOTECHNICAL ASSESSMENT	18
9.1	Proposed Development	18
9.2	Ground Conditions.....	18

9.3	Preparation	18
9.4	Foundations	18
9.5	Floor Slab	18
9.6	Pavement Construction	19
9.7	Drainage.....	19
9.8	Aggressive Soils	19
9.9	Excavation.....	19

Tables and Figures

Table 1.4.1	Risk Classification	2
Table 2.0	Site Description	3
Table 2.2.1	Land Use Surrounding the Area	3
. Table 3.1.1	Historical Maps	4
Table 4.9.1	Natural Hazards	7
Table 4.13.1	Regulatory Database	8
Table 5.1.1	Preliminary Conceptual Model	9
Table 7.1.1	Ground and groundwater conditions.....	12
Table 7.6.1	Groundwater Depths	13
Table 7.7.1	Gas Monitoring Results	13
Table 8.2.4	GAC Exceedances.....	14
Table 8.5.1	Conceptual Model	16

Drawings and Appendices

Drawings.....	20
---------------	----

Appendix 1 – Desk Study Information	21
Appendix 2 – Exploratory Hole Logs	22
Appendix 3 – Chemical Testing.....	23
Appendix 4 – Geotechnical Testing	24
Appendix 5 - Human Health Assessment Reference Values	25

1.0 INTRODUCTION

1.1 Background

1.1.1 Enzygo Geoenvironmental Limited has been commissioned to prepare a Geo-Environmental Report for a proposed development at Palk Road, Havant PO9 1NL.

1.2 Proposed Development

1.2.1 The proposed development comprises residential properties with domestic gardens and associated infrastructure.

1.3 Objectives

1.3.1 The objectives of the study are to:

- Obtain a desk study, a copy of which is included in Appendix 1;
- Undertake a targeted ground investigation;
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;
- Provide a factual and interpretative report relating to the desk study and site investigations. Provide a revised conceptual model and recommendations on any potential development issues and mitigation measures, where appropriate; and.

1.4 Risk Classification

1.4.1 Enzygo Geoenvironmental has utilised the available information, together with our experience to assess the likely risks to development from land quality issues. Definitions of the risk terms used are provided on the following table.

Table 1.4.1 Risk Classification

Risk	Description
Negligible	No contamination risk has been identified which is likely to affect development.
Low	No significant contaminated land risks have been encountered affecting development and a low risk that remediation will be required.
Low-Moderate	There are unlikely to be significant contaminated land issue associated with the site which will adversely affect its re-development. However, minor or localised contamination may be present requiring remediation. Remediation should be possible under a discovery strategy and with a call out service.
Moderate	Some potential contaminated land risks have been encountered or identified which may affect re- development. The risks identified are unlikely to affect the entire site or preclude development. Remediation is considered feasible as part of the development process and no further investigation is considered necessary.
Moderate-High	Some potentially significant contaminated land risks have been identified at the property that requires remediation. It is recommended that a separate remedial methodology is prepared supported by a site-specific risk assessment
High	Significant potential contaminated land risks have been identified and remediation is required supported by further intrusive ground investigation, risk assessment and remedial design.

1.4.2 Where adverse risks from ground instability are identified these are discussed within the report.

2.0 SITE SETTING

Table 2.0 Site Description

Item	Description
Site Address	Palk Road, Havant PO9 1NL
National Grid Reference	1.2 Ha

2.1 Current Site Description

- 2.1.1 The following site description has been compiled from the site inspection undertaken by Enzygo Geoenvironmental Ltd, together with current maps and aerial photographs.
- 2.1.2 The site comprises a rectangular parcel of land used for storage. Palk Road is present extending in to the eastern area of the site.
- 2.1.3 The site is predominantly covered by tarmac hardstanding and is used for storage. The south east the site is used for the storage of pallets. Within the southern area is a builders merchants with the storage of pipes and bagged aggregate. The western area of the site is used by Portsmouth Water for storage of pipes.
- 2.1.4 Small temporary office buildings and containers are present.
- 2.1.5 Within the north east of the site is an area of scrub land with over grown vegetation.
- 2.1.6 No evidence of fuel storage, leakage or spillage was noted.

2.2 Surrounding Area

- 2.2.1 Land uses surrounding the site are summarised as follows:

Table 2.2.1 Land Use Surrounding the Area

Direction	Land Use
North East	Residential use
North West	Railway line with residential use beyond
South West	Field with solar panels
South East	Watercourse with residential use, public open space and a substation beyond

- 2.2.2 No significant contamination sources are identified on or adjacent to the site.

3.0 DESK STUDY

3.1 Historical Maps

3.1.1 A review of historical Ordnance Survey maps and information pertinent to the site and within a 250m radius is summarised below:

. Table 3.1.1 Historical Maps

Potentially Contaminative Historical Land Use		
Map Edition	Site	Surrounding Area
1868	Field. Bedhampton Stream within SE of site. Mill Pond in SW corner.	Railway line 10m NW. Bedhampton Stream 0m SE. Mill Pond 0m SW. Fields 0m NW, 20m SW 0m NE & 20m SE. Fields 20m Spring 100m W feeding mill pond. Pond 30m NW. Residential development 50m N.
1897	Palk Road shown.	Water works 100m SW. Residential development 50m NE & 100m SW.
1909	Bedhampton Stream no longer shown. Palk Road extended along NE boundary	Residential development 70m SE.
1932	Mill Pond no longer shown.	Mill pond 0m SW partly infilled. Station 0m NE.
1940	No significant change.	No significant change.
1951	Earthworks in NW corner of site	Bedhampton Stream re-aligned along SE boundary. Pump house 40m E. Residential development 20m NW. Pond 30m NW no longer shown.
1959	Allotments in NE. Pond in N.	No significant change.
1961	No significant change.	Office 0m NE.
1969	Pond no longer shown.	No significant change.
1973	No significant change.	No significant change.
1987	Building in E on former Palk Road. Allotments no longer shown. Remainder of site is a pipe store.	No significant change.
1993	No significant change.	No significant change.
2001	No significant change.	No significant change.
2003	No significant change.	No significant change.
2010	No significant change.	Residential development 0m E.
2021	No significant change.	No significant change.

3.2 Historical Maps

3.2.1 The Bedhampton Stream appears to have been infilled and culverted between 1909 and 1951 and then re-engineered along the south eastern boundary.

3.2.2 Potential Made Ground is identified on site from infilled Bedhampton Stream, Mill Pond, pond and earthworks. These potential sources will be assessed during the investigation.

3.2.3 There is a very low risk of metals associated with the former allotments.

3.2.4 No other significant risks are identified.

4.0 Environmental Setting

4.1 Ground Conditions

4.1.1 The British Geological Survey (BGS) indicates that the site is underlain by the following geological sequence:

Table 4.3.1 Geological Sequence

Geological	Type	Descriptions	Aquifer Classification
Drift	Alluvium (south)	Clay, Silt, Sand and Gravel	Secondary A
	River Terrace Deposits (centre)	Clay, Silt, Sand and Gravel	Secondary A
	Head (north)	Clay, Silt, Sand and Gravel	Secondary Undifferentiated
Solid	Lambeth Beds (north)	Silty and Sandy Clay,	Secondary A
	Lewes Formation (south)	Chalk	Principal

4.1.2 BGS records indicate no Made Ground on or adjacent to the site.

4.1.3 There are no records of landslips on or near the site.

4.1.4 Published records of background soil chemistry for the site show no exceedances of residential GAC values.

4.1.5 BGS boreholes present close to the site show soft becoming stiff with depth clay.

4.2 Groundwater

4.2.1 The permeability of the drift geology is recorded as high to very low. The permeability of the solid geology is recorded as very high to very low.

4.2.2 The Ground Sure Report shows the site is not located within a Source Protection Zone.

4.2.3 Groundwater abstraction licences for potable water supply are identified 108m west and 230m east. Abstractions are from the Chalk Aquifer.

4.3 Coal Mining

4.3.1 The groundsure report has identified that the site is not within an area of potential coal mining.

4.4 Non Coal Mining and Cavities

4.4.1 No cavities are identified close to the site.

4.4.2 No significant risks have been identified.

4.5 Ground Workings

4.5.1 Ground workings identified within 250m of the site are limited to the infilled ponds and identified in Section 3 and a railway cutting.

4.5.2 No new risks are identified from the ground workings.

4.6 Natural Cavities

4.6.1 No natural cavities are identified within 250m of the site.

4.7 Hydrology

4.7.1 There are no surface water courses on the site but the Bedhampton Stream is present along the south eastern boundary.

4.7.2 The site south east boundary of the site is shown to be within Flood Risk Zone 3.

4.7.3 There is a moderate to high risk of groundwater flooding at the site.

4.8 Radon Risk Potential

4.8.1 The Groundsure GeoInsight Report indicates that the site is situated within an area where basic radon protection measures are required.

4.9 Natural Hazards Finding

4.9.1 BGS information presented within the Groundsure report identified the following ground conditions:

Table 4.9.1 Natural Hazards

Hazard	Risk Designation (Groundsure)
Collapsible Ground	Negligible/Low.
Compressible Ground	Moderate/Negligible.
Ground Dissolution	Moderate/Negligible.
Landslide	Very Low.
Running Sand	Low/Very Low.
Swelling / Shrinking Clay	Moderate/Low.

4.9.2 A moderate risk of clay heave is identified from the Lambeth Beds Formation, a moderate risk of compressible ground from the Alluvium and a moderate risk from the Chalk solution features is identified. These risks will be assessed as part of the site investigation. No other significant geotechnical risks are identified

4.10 Sensitive Land Uses

4.10.1 The site comprises a storage area and so is considered to be of low sensitivity.

4.10.2 No historical features are identified on the site.

4.11 Environmental Sensitivity

4.11.1 Overall the site is currently considered to be of High environmental sensitivity due to the following:

- The underlying stratum are designated as a Secondary A Aquifer over a Principal Aquifer;
- There are surface water features adjacent to the site;
- The site is located within a source protection zone.
- There are potable groundwater abstractions within 250m of the site.

4.11.2 The proposed end use of the site is residential and as such future sensitivity will be high for end users.

4.12 Industrial Land Uses

4.12.1 No significant Industrial uses are identified within 250m of the site. No significant risks are identified.

4.12.2 The Groundsure Report indicates that there is one fuel stations within 250m of the site. This is an obsolete fuel filling station and is identified 120m north west and the risk is dismissed based on distance.

4.12.3 Records indicate no high pressure underground oil or gas pipelines within 250m of the site.

4.12.4 No new risks are identified from the register of industrial land uses.

4.13 Regulatory Database

4.13.1 The following information has been obtained from a commercially available environmental database.

Table 4.13.1 Regulatory Database

Environmental Permits, Incidents and Registers	0-250m	250-500m	Details
Site determined as contaminated land	0	0	Not applicable.
Authorised industrial processes	0	2	Landfill 82m W.
Registered radioactive substances	0	0	Not applicable.
Enforcements, prohibitions or prosecutions	0	0	Not applicable.
Pollution Incidents	2	2	Nearest is Category 2 (Significant) impact to water from soil 21m NW. Not considered a risk to the site.
Consents issued under the Planning (Hazardous Substances) Act 1990	0	0	Not applicable.
Control of Major Accident Hazard (COMAH)/ Notification of Installations Handling Hazardous Substances (NIHHS) sites	0	0	Not applicable.
Records of Licensed Discharge Consents	3	14	Treated sewage discharges. Nearest is 97m W and not considered a risk.

4.13.2 The risk from landfill operations will be assessed later in the report. No other significant risks are identified from the regulatory data base.

4.14 Landfill Sites

4.14.1 A recently closed landfill is identified 2m west of the site associated with the water works. The landfill was licenced to accept Inert Waste.

4.14.2 No other significant waste activities are identified within 250m of the site.

4.14.3 Ground gas monitoring will be undertaken as part of the investigation.

4.15 Planning Information

4.15.1 A review of Havant District Council planning portal shows redevelopment of the training centre to residential apartments in 2002. No other relevant information or ground investigation information is provided pertaining to the site.

5.0 PRELIMINARY ASSESSMENT

5.1 Preliminary Conceptual Model

5.1.1 Based on the information obtained the following Preliminary Conceptual Model has been prepared:

Table 5.1.1 Preliminary Conceptual Model

Source	Location	Exposure Pathway	Potential Receptor	Probability of Exposure	Details
Human Health					
Asbestos, metals and hydrocarbons.	Made Ground	Ingestion dermal and inhalation.	Construction Workers.	Low.	Management practices to be implemented.
			Site users.	Low.	Likely Made Ground and if present remediation can easily be incorporated in to the proposed development.
Asbestos, metals and hydrocarbons.	Unforeseen Contamination.	Ingestion dermal and inhalation.	Construction Workers.	Dismissed.	Normal construction PPE will address risk under CDM.
			Site users.	Very Low.	No significant source identified.
Hydrocarbon and metals.	Migration from off-site sources.	Ingestion dermal and inhalation.	Construction Workers.	Dismissed.	No significant sources identified.
			Site users.		
Ground Gas.	Landfill.	Inhalation & Explosive.	Construction Workers.	Dismissed	No confined space access anticipated.
			Site users.	Very Low	Off-site landfill which was licensed for Inert Waste.
	Made Ground	Inhalation & Explosive.	Construction Workers.	Dismissed	No confined space access anticipated.
			Site users.	Very Low	No significant putrescible material likely.
Radon	Natural	Inhalation	Site users.	Very Low	Basic Radon measures required.
Groundwater					
Hydrocarbon and metals.	Unforeseen Contamination.	Vertical Migration.	Groundwater.	Moderate	Low permeability clay soils over Principal Aquifer.
Surface Water					
Hydrocarbon and metals.	Unforeseen Contamination.	Horizontal Migration.	River Network.	Moderate.	Water course adjacent to the site.
Environmental Receptors					
On site contaminants		Ingestion dermal and inhalation.	Ecology.	Dismissed.	No source identified.
		Direct.	Archaeology.	Dismissed.	None present.
		Direct.	Geology.	Dismissed.	None present.
		Phytotoxic.	Woodland.	Dismissed.	None present.
		Phytotoxic.	Crops.	Dismissed.	None present.
		Ingestion dermal and inhalation.	Livestock.	Dismissed.	No receptor.
Building Services					
On site contaminants		Direct.	Historic Buildings.	Dismissed.	No receptors.
		Direct.	Proposed Buildings.	Dismissed.	No receptor.
		Permeate into pipework.	Water Pipes.	Very Low.	Requirements of Water Authority to be followed.

5.1.2 The ground investigation will include a standard suite of contamination tests including hydrocarbons and will include ground gas monitoring.

6.0 SITE INVESTIGATION

6.1 General

- 6.1.1 A site investigation was undertaken by Enzygo Geoenvironmental Limited on 25th and 26th November 2021 and comprised eight window sampler boreholes.
- 6.1.2 Locations of exploratory holes advanced by Enzygo Geoenvironmental Limited are presented on Drawing CRM.1668.023.GE.D.001 and were located to target potential contamination sources identified from the desk study and also to provide coverage.
- 6.1.3 Some of the locations were restricted on site due to storage of pallets and also time constraints imposed on site works by the tenants who provided access.

6.2 Site Works

- 6.2.1 Representative soil samples were collected for chemical and geotechnical testing. Soil samples destined for chemical analysis were collected in appropriate containers provided by the analytical laboratory. Samples were stored in cool boxes prior to dispatch to the laboratory for analysis. All samples were collected using appropriate sampling equipment that was cleaned at each sampling location.
- 6.2.2 Generally samples were collected from Made Ground, which may contain potential inclusions of contaminating materials and also materials displaying evidence of potential contamination.
- 6.2.3 In the absence of any evidence of contamination samples were collected near surface as this material is more likely to be contaminated by surface spillages and also will potentially be in contact with future residents.
- 6.2.4 Selected samples were also collected from underlying natural soils.

6.3 Laboratory Testing

- 6.3.1 Samples for geotechnical testing were sent to the laboratories of I2 Ltd, which is UKAS accredited, for the following analysis:
- Laboratory CBR tests;
 - Moisture Content;
 - Atterberg Limits Determinations; and
 - Soluble sulphate and pH.
- 6.3.2 Soil samples for chemical analysis were sent to I2 Ltd who are UKAS and MCERTS accredited. Samples were tested for the CLEA metal suite, pH, sulphate, cyanide, phenols, speciated Polycyclic Aromatic Hydrocarbons (PAH), organic carbon, Total Petroleum Hydrocarbon (TPH:CWG), and asbestos screen.
- 6.3.3 Two stage Waste Acceptance Criteria (WAC) tests were undertaken to assist with waste classification.

7.0 GROUND AND GROUNDWATER CONDITIONS

7.1 Summary of Ground and Groundwater Conditions

7.1.1 Ground and groundwater conditions have been assessed by Enzygo Geoenvironmental Limited investigation. The investigation undertaken identify the following strata:

Table 7.1.1 Ground and groundwater conditions

Strata	Summary Description	Thickness (m)
Made Ground (Pavement Construction)	Tarmac over sub base.	0.45
Made Ground (General)	Brown sandy gravelly clay with fragments of brick, concrete and flint.	0.3 to 1.4
Drift Deposits	Soft becoming firm and stiff with depth sandy gravelly clay varying to clayey sand and flint gravel.	>2.9
Groundwater.	Seepages WS7 only.	2.25m bgl

7.1.2 Details of the ground and groundwater conditions encountered are given on the exploratory hole records included in Appendix 2 and are summarised in the sections below:

7.2 Made Ground

7.2.1 Within areas of hardstanding Made Ground was encountered comprising tarmac over sub base consistent with pavement construction.

7.2.2 Below the pavement construction and also within the area of soft landscaping Made Ground was noted to comprise brown sandy gravelly clay with fragments of brick, concrete and flint. Deeper Made Ground was encountered in Borehole WS1 associated with the area of earthworks and Borehole WS7 associated with the historic infilled Bedhampton Stream.

7.2.3 Groundwater seepage was also only encountered in Borehole WS7 and is likely to be associated with the infilled Bedhampton Stream.

7.3 Drift Deposits

7.3.1 Natural Soils encountered below the Made Ground were noted to comprise soft becoming firm and stiff with depth sandy gravelly clay varying to clayey sand and flint gravel. Within Borehole WS1 and WS8 the soils were noted to be soft to depths of 3m below ground level (bgl).

7.3.2 It is not feasible to differentiate between the Alluvium, River Terrace Deposits and Head as the material are similar.

7.4 Soil Strength

7.4.1 Undrained shear strength of cohesive soils were calculated using the correlations of Stroud and Butler. These show the undrained shear strength values to generally increase from 30kN/m² at 1m bgl to 75kN/m² at 4m bgl.

7.4.2 Within Borehole WS1 and WS8 the soils were noted to be soft to depths of 3m below ground level (bgl).

7.5 Visual and Olfactory Evidence of Contamination

7.5.1 No visual or olfactory evidence of contamination was encountered during the site works

7.6 Groundwater

7.6.1 Groundwater was encountered as a seepage in Borehole WS7 at 2.25m bgl only during the site works. The depth to groundwater measured during the monitoring visit is summarised on the table below:

Table 7.6.1 Groundwater Depths

Exploratory Hole	Depth m(bgl)					
	3.12.21	10.12.21	17.12.21	21.12.21	6.1.22	13.1.22
WS1	3.1	2.95	2.18	3.01	2.57	2.66
WS3	Dry	Dry	1.79	1.81	1.44	1.21
WS8	1.9	1.55	1.25	1.92	Dry	1.97

7.7 Ground Gas

7.7.1 Ground gas was monitored during the return visit to monitor groundwater levels and the results are summarised on the table below:

Table 7.7.1 Gas Monitoring Results

Exploratory Hole	Atmos pressure (Mb)	Flow (l/hr)	CH4		CO2		O2
			Concentration (%)	GSV (l/hr)	Concentration (%)	GSV (l/hr)	Concentration (%)
3.12.21							
WS1	1013	<0.1	7.6	<0.0076	6.8	<0.0068	4.1
WS3	1009	<0.1	<0.1	<0.0001	1.4	<0.0014	19.7
WS8	1009	<0.1	<0.1	<0.0001	2.2	<0.0022	18.7
10.12.21							
WS1	999	<0.1	9.9	<0.0099	8.4	<0.0006	0.1
WS3	999	<0.1	<0.1	<0.0001	2.0	<0.0020	18.9
WS8	999	<0.1	<0.1	<0.0001	0.9	<0.0009	18.4
17.12.21							
WS1	1027	<0.1	1.0	<0.0010	8.4	<0.0084	4.4
WS3	1027	<0.1	<0.1	<0.0001	2.3	<0.0023	19.3
WS8	1027	<0.1	<0.1	<0.0001	2.1	<0.0021	18.2
21.12.21							
WS1	1024	<0.1	1.1	<0.0011	8.8	<0.0088	4.1
WS3	1024	<0.1	<0.1	<0.0001	1.5	<0.0015	19.4
WS8	1024	<0.1	<0.1	<0.0001	2.4	<0.0024	17.9
6.1.22							
WS1	1015	<0.1	1.0	<0.0010	9.4	<0.0094	3.3
WS3	1015	<0.1	<0.1	<0.0001	1.1	<0.0011	20.4
WS8	1015	<0.1	<0.1	<0.0001	3.2	<0.0032	15.7
13.1.22							
WS1	1010	<0.1	1.0	<0.0010	8.7	<0.0087	3.9
WS3	1010	<0.1	<0.1	<0.0001	1.3	<0.0013	19.8
WS8	1010	<0.1	<0.1	<0.0001	2.7	<0.0027	16.2

8.0 CONTAMINATION ASSESSMENT

8.1 General

8.1.1 A Tier I risk assessment has been undertaken using available and current screening values for a residential end use. The risk assessment is undertaken based on the findings of the ground investigation. Based on the contamination testing and Tier I assessment a Conceptual Model has been prepared, which is presented later in this section.

8.1.2 Where significant risks are identified remedial measures are recommended.

8.2 Human Health

8.2.1 Assessment of the risks to human health has been undertaken by comparing the soil quality data with reference values obtained from the Contaminated Land Exposure Assessment (CLEA), Soil Guideline Values (SGV) and General Acceptance Criteria (GAC) published by LQM/CIEH. The LQM/CIEH S4ULs values are used and summary tables of the reference values are included in Appendix 5.

8.2.2 Where an exceedance is identified the risk is assessed by considering the sensitivity of the proposed development and the potential pathway. The proposed development is for residential comprising including domestic houses and therefore the GAC values for Residential Use with plant uptake are considered suitable.

8.2.3 Results of the chemical testing from the investigation is included in Appendix 3.

8.2.4 The soil quality analysis shows exceedances of the GAC values in the following samples only:

Table 8.2.4 GAC Exceedances

Exploratory Hole	Determinant	Concentration (mg/kg)	
		Soil	GAC
WS10 @ 0.9m	Dibenz(a,h)anthracene	0.81	0.24
	Benzo(a)Pyrene	6.0	2.2
	Benzo(b)Flouranthene	5.7	2.6
	Chrysotile	<0.001%	Absent
	Dibenz(a,h)anthracene	0.43	0.24
WS9 @ 1.0m	Lead	440	200

8.2.5 It is considered that the PAH and Lead is associated with ash material within the Made Ground which is present in a vitrified form.

8.3 Controlled Waters

8.3.1 No significant concentrations of potentially mobile contaminants were identified. The underlying soils are identified as low permeability clay and clayey sand and gravel.

8.3.2 In the absence of a significant mobile source the risks to controlled waters is dismissed.

8.4 Ground Gas

8.4.1 Following the guidance provided in Section 3 of CIRIA C665 an initial assessment is undertaken to determine if there are any significant sources of potential ground gas. Such sources include landfills, organic clays and made ground incorporating putrescible materials such as rags, paper and wood. Where no significant source is identified no further assessment is necessary.

- 8.4.2 This approach is further supported by supplementary guidance given in RB17, published by CL:AIRE which confirms that gas monitoring is not generally required on sites where Made Ground is less than 5m thick and with low organic matter content or on natural soils such as alluvial clays and Chalk as the ground gas sources are not considered significant. The supplementary guidance given in RB17 also takes account of the current requirements for sealing of floor slabs and substructures to meet air tightness requirements under Part L of the Building Regulations which were not considered in CIRIA C665. The advice given in RB17 is consistent with CIRIA C665 and the Local Authority Guide to Ground Gas published by CIEH.
- 8.4.3 Where significant potential risk from ground gas is identified from the Initial Conceptual Model and the intrusive ground investigation works ground gas monitoring is undertaken and the results of the monitoring are compared against the Gas Screening Values given in CIRIA Report 665. From this the Characteristic Situation is identified and remedial measures proposed.
- 8.4.4 When assessing the risk and type of remedial measures appropriate consideration is given to the likely construction of the development, the nature of the gas posing a risk and the nature of the likely source. The use of engineering judgement when determining risk from ground gas is consistent with the recommendations given in CIRIA C665 using a pollutant linkage model.
- 8.4.5 Gas monitoring was undertaken during return visits which has recorded elevated concentrations of Methane which are likely to be arising from the off-site landfill. As Methane is explosive it is recommended that the ground gas regime is increased to Characteristic Situation 2 (CS2).
- 8.4.6 It maybe possible to zone the site and identify areas where no ground gas protection is required if further investigation and monitoring were undertaken once site possession has been taken.
- 8.4.7 Additional ground gas monitoring is being undertaken.

8.5 Conceptual Model

- 8.5.1 A Conceptual Model is presented below based on the findings of the ground investigation.

Table 8.5.1 Conceptual Model

Source	Location	Exposure Pathway	Potential Receptor	Probability of Exposure	Details
Human Health					
PAH, Asbestos and Lead.	Made Ground.	Ingestion dermal and inhalation.	Construction Workers.	Low.	Management practices to be implemented.
			Site users.	Low.	Exceedances of GAC identified and remediation recommended.
Hydrocarbon and metals.	Migration from off-site sources.	Ingestion dermal and inhalation.	Construction Workers.	Dismissed.	No significant sources identified.
			Site users.		
Ground Gas.	Landfill.	Inhalation & Explosive.	Construction Workers.	Dismissed	No confined space access anticipated.
			Site users	Very Low	Minimum gas protection measures to CS2 recommended.
Radon	Natural	Inhalation	Site users.	Very Low	Basic Radon measures required.
Groundwater					
Hydrocarbon and metals.	Potential spillage on site.	Vertical Migration.	Groundwater.	Dismissed.	No mobile source identified and soils are low permeability soils.
Surface Water					
Hydrocarbon and metals.	Potential spillage on site.	Horizontal Migration.	River Network.	Dismissed.	No mobile source identified and soils are low permeability soils.
Environmental Receptors					
On site contaminants.		Ingestion dermal and inhalation.	Ecology.	Dismissed.	No receptor.
		Direct.	Archaeology.	Dismissed.	No receptor.
		Direct.	Geology.	Dismissed.	No receptor.
		Phytotoxic.	Woodland.	Dismissed.	No receptor.
		Phytotoxic.	Crops.	Dismissed.	No receptor.
		Ingestion dermal and inhalation.	Livestock.	Dismissed.	No receptor.
Building Services					
On site contaminants.		Direct.	Historic Buildings.	Dismissed.	No receptor.
		Direct.	Proposed Buildings.	Dismissed.	No receptor.
		Permeate into pipework.	Water Pipes.	Low.	Requirements of Water Authority to be followed.

8.6 Remediation and Verification Strategy

8.6.1 Made Ground identified across the site is not considered to be suitable to be retained within soft landscape areas as it will not provide a suitable rooting material. It is therefore recommended that the risks to future site users is mitigated through the use of clean cover soils to soft landscape areas.

8.6.2 This should comprise 400mm in communal areas and 600mm in domestic gardens placed over a geotextile no dig barrier. Appropriate verification of the cover soils and presence of the geotextile should be validated with hand pits and appropriate testing to be agreed with the Local Planning Authority.

8.6.3 Gas protection measures are recommended which are discussed in Section 9.

8.6.4 If unforeseen contamination is encountered during construction works such as localised spillage outside the areas investigated an Environmental consultant will be available on a 'call out' basis to undertake an assessment of risk. If 'unforeseen contamination' is encountered the discovery strategy will be to remove the source as it is likely to be very limited in extent and the Local Planning Authority advised.

8.6.5 Asbestos contaminated material has been identified during the ground investigation and it is possible that further material could be encountered during construction works. Measures should to be incorporated in to the Contractors Construction Stage Health and Safety Plan as required under the Construction Design and Management (CDM) Regulations to mitigate risk to construction works. Measures may include

- Designing temporary works to minimise disturbance of the Back fill material;
- Separating material and disposal of soils containing asbestos;
- Wetting down during excavation;
- Sheeting of stockpiles where asbestos is suspected;
- Testing of soils and off-site disposal of any soils found or suspected of containing asbestos;
- Preventing access to the construction site by members of the public;
- Use of good hygiene measures, including washing down of plant; and

8.6.6 Use of appropriate PPE, including face masks

8.7 Waste Classification

8.7.1 Two part WAC tests undertaken from the site identified exceedance of leachable Fluoride concentrations above the Inert threshold. No elevated PAH, TOC or TPH concentrations were recorded above the Inert Waste thresholds. Asbestos speciation has been scheduled and will be reported once the results have been received.

8.7.2 It is considered that the soils will generally be classified as Stable Non Reactive Waste.

8.7.3 The Waste Management paper 3 requires the landfill to make an appropriate assessment of the waste classification. As such final assessment will be undertaken by the receiving landfill based on the requirements of their permit.

9.0 GEOTECHNICAL ASSESSMENT

9.1 Proposed Development

9.1.1 The proposed development comprises residential houses. Structural loads are not known and so typical wall load of 75kN/m has been used for preliminary assessment purposes.

9.1.2 It is considered that the scheme meets the criteria of Geotechnical Category 1 of Eurocode 7.

9.2 Ground Conditions

9.2.1 Ground conditions comprise Made Ground over soft becoming firm and stiff with depth silty clay varying to medium dense clayey sand. Soft clays were encountered locally to over 3m bgl.

9.2.2 Groundwater was encountered at depths of between 1.5m 2.9m bgl.

9.3 Preparation

9.3.1 The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the Specification for Highway Works. This should include:

- Any redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill;
- All buried structures and old foundations should be excavated from below the proposed structures with the resulting void backfilled prior to foundation works; and
- Any root balls associated with existing trees should be grubbed out.

9.4 Foundations

9.4.1 Due to the presence of soft and very soft clays to depths of greater than 3m bgl it is considered that piled foundations will be required. As an alternative consideration maybe given to controlled modulus columns. Vibro granular columns are not generally considered suitable due to the soft nature of the Alluvial soils.

9.4.2 It may be possible to zone the site and identify areas where conventional strip foundations may be used if further investigation is undertaken once site possession has been taken.

9.4.3 Final foundation depths should also take account of NHBC requirements for building near trees. An assessment of the soils modified plasticity index confirms that the shallow soils are of high volume change potential in accordance with Chapter 4.2 of NHBC Standards.

9.4.4 The risk of potential Chalk solution features has been re-assessed based on the ground investigation information. Solution features generally form where granular soils overly Chalk adjacent to a clay soil, which allows the concentration of surface water flow into the chalk, thereby creating dissolution of fissures. At this site the Alluvium has been shown to be clay of significant thickness. In addition, shallow groundwater was encountered. This will mitigate the potential for the creation of Chalk solution features and as such the risk is no longer considered significant.

9.5 Floor Slab

9.5.1 Given the depth of Made Ground it is recommended that suspended floor slabs are used.

9.5.2 Gas protection measures are recommended to meet the requirement of Characteristic Situation 2 is incorporated into ground floor slabs. This should also address the risks from Radon. Measures are likely to comprise:

- Use of a vented under slab void; and
- Use of a gas membrane on the ground floor slab and below the screed. The membrane should be jointed, sealed to the cavity tray and sealed around service entry points.

9.5.3 Validation of the ground gas measures should be undertaken.

9.6 Pavement Construction

9.6.1 An assessment of the likely California Bearing Ratio (CBR) has been assessed from the following sources:

- Laboratory CBR tests;
- Description of the materials encountered in the exploratory holes;
- Guidance given in HD25/94 and 73/06; and

9.6.2 Based on this it is recommended that an equilibrium CBR of 4% is used.

9.6.3 If roadways are to be adopted by Hampshire Highways they may require soaked CBR testing to be undertaken.

9.7 Drainage

9.7.1 Soakaway drainage is not considered feasible.

9.7.2 The report should be submitted to the Water Authority.

9.8 Aggressive Soils

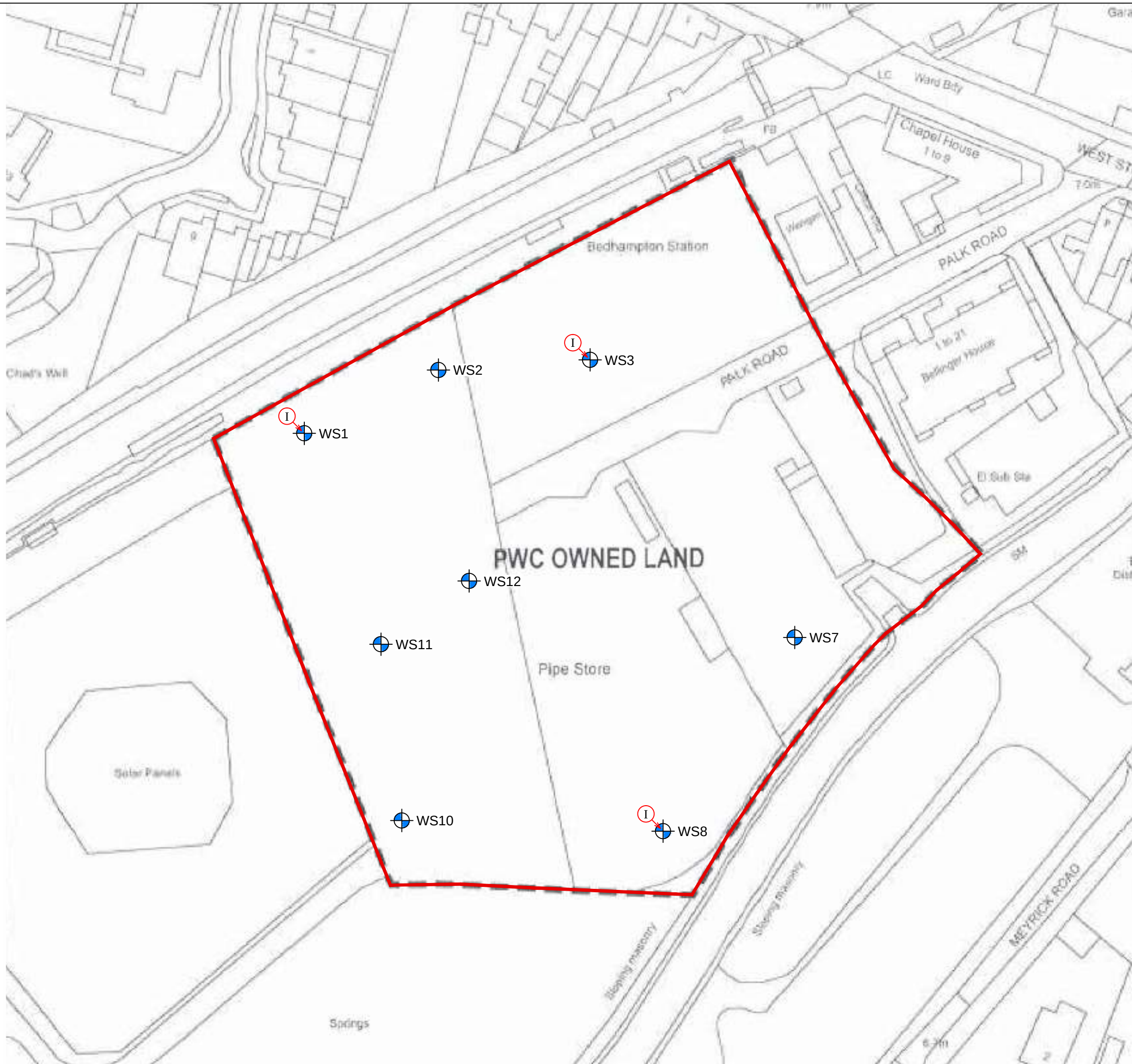
9.8.1 It is considered that buried concrete may be designed in accordance with ACEC Class AC-1s.

9.9 Excavation

9.9.1 Based on the various site observations it is considered that excavations should be feasible with normal plant. Assistance from a breaker will be required for excavation of hardstanding.

9.9.2 Excavations where access is required should be supported in accordance with CIRIA RR97.

9.9.3 Significant dewatering is not anticipated.



Key

Site Boundary

Window Sampler Boreholes (WS)
(WS1 - WS3, WS7, WS8, WS10 - WS12)

Borehole Installation (I)



Samuel House, 5 Fox Valley Way, Stocksbridge, Sheffield, S36 2AA

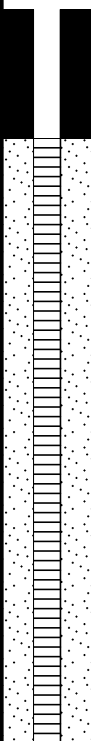
CLIENT:		Bellway Homes	
SCALE:	NTS / A3	PROJECT REF:	CRM.1668.023
DRAWN:	MG	CHECKED:	SR
		DATE:	Dec 2021
PROJECT:		Park Road, Havant	
TITLE:		Site Plan	
FIGURE NO:		CRM.1668.023.GE.D.001	

Appendix 1 – Desk Study Information

Appendix 2 – Exploratory Hole Logs



Site Park Road, Havant PO91NL				WS1
Job No CRM.1668.023	Dates Start 25-11-21 Finish 25-11-21	Ground Level (m)	Co-Ordinates	
Client Bellway Homes				Sheet 1 of 1

Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
					0.10		MADE GROUND: TARMACADAM.	0	
		0.60	ES	N 8	0.45		MADE GROUND: Type 1 subbase of sandy GRAVEL.		
					0.70		MADE GROUND: (Soft) green sandy gravelly CLAY. Gravel is angular to rounded fine to coarse brick, chert, and concrete.		
					1.00		MADE GROUND: (Firm) brown gravelly slightly sandy CLAY. Gravel is angular yo subangular fine to coarse brick.	1	
		1.20 - 1.65	SPTLS	1.30	1.20 - 1.65 Soft to firm, low strength.				
		1.60	ES	1.70	MADE GROUND: (Soft) black sandy gravelly CLAY. Gravel is angular to rounded fine to coarse brick, concrete and chert.				
		2.00	D ES SPTLS	N 6	2.00 - 2.45		(Firm) brown mottled light greenish grey slightly sandy CLAY.	2	
		2.00 - 2.45					2.00 - 2.45 Soft, low strength.		
		3.00	D SPTLS	N 6	3.00 - 3.45		3.00 - 3.45 Soft, low strength.	3	
		3.00 - 3.45					3.50 - 5.45 Becoming red and light greenish grey.		
		4.00	D SPTLS	N 15	4.00 - 4.45		4.00 - 4.45 Firm to stiff, medium strength.	4	
		4.00 - 4.45					5.00 - 5.45 Stiff, medium strength.	5	
5.00	D SPTLS	N 17	5.00 - 5.45	5.00 - 5.45 Stiff, medium strength.					
5.00 - 5.45				Borehole completed at 5.45m.	6				
								7	
					{8.00}			8	

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.20m begl. Dynamic sampled 1.20m-5.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, a slotted pipe (50mm) was installed to 5.00m begl, granular response zone (5.00m-1.00m), bentonite seal 1.00m-0.15m, 0.15m-0.00m flush steel cover.

Groundwater	Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
All dimensions in metres Scale 1:50				Logged By ES

1.0ENZYGO WS LOG CRM.1668.023 HAVANT.GPJ GINT STD AGS 3_1 ENZYGO.GPJ 3/12/21



Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site Park Road, Havant PO91NL				WS2
Job No CRM.1668.023	Dates Start 25-11-21 Finish 25-11-21	Ground Level (m)	Co-Ordinates	
Client Bellway Homes				Sheet 1 of 1

Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
					0.15			MADE GROUND: TARMACADAM.	0
					0.40			MADE GROUND: Type 1 subbase of sandy GRAVEL.	
		0.50	ES		0.60			MADE GROUND: Green very clayey gravelly coarse SAND. Gravel us angular to rounded fine to coarse flint and brick.	
		1.00	D		1.00			(Firm) brown mottled light greenish grey slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse flint.	1
		1.20 - 1.65	SPTLS	N 23				(Firm) brown mottled light greenish grey slightly sandy CLAY. 1.20 - 1.65 Stiff, high strength.	
		2.00	D	N 24					2
		2.00 - 2.45	SPTLS					2.00 - 2.45 Stiff, high strength.	
								2.50 - 3.00 Becoming (very stiff).	
		3.00	D	N 50					3
		3.00 - 3.44	SPTLS		3.44			3.00 - 3.44 Very stiff, very high strength. Refused at 3.435m begl.	
					{8.00}			Borehole completed at 3.44m.	4
									5
									6
									7
									8

General Remarks

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.20m begl. Dynamic sampled 1.20m-3.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, the borehole was backfilled with arisings.

Groundwater	Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
All dimensions in metres Scale 1:50				Logged By ES

1.0 ENZYGO.WS LOG CRM 1668.023 HAVANT.GPJ GINT STD AGS 3_1 ENZYGO.GPJ 3/12/21



Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site Park Road, Havant PO91NL							WS3		
Job No CRM.1668.023		Dates Start 25-11-21 Finish 25-11-21		Ground Level (m)		Co-Ordinates			
Client Bellway Homes							Sheet 1 of 1		
Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
		0.30	ES		0.50			MADE GROUND: Wild growth over dark brown slightly clayey gravelly medium SAND with a low cobble content of angular concrete. Gravel is angular to rounded fine to coarse brick concrete and chert.	0
		0.90	D					(Firm) brown mottled light greenish grey slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse flint.	1
		1.00	ES						
		1.20 - 1.65	SPTLS	N 7	1.40			1.20 - 1.65 Soft, low strength.	
		2.00	D	N 10				(Firm) brown mottled light greenish grey slightly sandy CLAY.	2
		2.00 - 2.45	SPTLS		2.50			2.00 - 2.45 Firm, medium strength.	
	3.00	D	N 50				(Very) stiff red and light gret slightly sandy CLAY.	3	
	3.00 - 3.45	SPTLS		3.45			3.00 - 3.45 Very stiff, very high strength. Refused at 3.445m begl.		
								Borehole completed at 3.45m.	4
									5
									6
									7
									8
					{8.00}				

General Remarks
EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.20m begl. Dynamic sampled 1.20m-3.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, a slotted pipe (50mm) was installed to 3.00m begl, granular response zone (3.00m-1.00m), bentonite seal 1.00m-0.00m, plain pipe 0.00m-1.00m agl (above ground level).

Groundwater	Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
All dimensions in metres Scale 1:50				
Logged By ES				

1.0 ENZYGO.WS LOG CRM 1668.023 HAVANT.GPJ GINT STD AGS 3_1 ENZYGO.GPJ 3/12/21



Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site Park Road, Havant PO91NL				WS7
Job No CRM.1668.023	Dates Start 26-11-21 Finish 26-11-21	Ground Level (m)	Co-Ordinates	
Client Bellway Homes				Sheet 1 of 1

Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
					0.30			MADE GROUND: Black slightly gravelly slightly sandy CLAY. Gravel is angular to subangular fine to coarse brick and concrete	0
		0.80	D					MADE GROUND: (Soft) green slightly sandy slightly gravelly CLAY. Gravel is angular to subangular brick and concrete.	
		1.00	ES		1.00				
		1.20 - 1.65	SPT	N 14				1.00 Plywood sheets encountered.	1
		1.40	ES		1.50			MADE GROUND: (Stiff) red and brown slightly sandy gravelly CLAY. Gravel is angular fine to coarse chert and concrete.	
								1.20 - 1.65 Firm, medium strength.	
		1.90	ES					1.50 Cobble encountered.	
		2.00	D	N 5				(Soft) green slightly gravelly CLAY. Gravel is angular coarse flint.	2
		2.00 - 2.45	SPT					2.00 - 2.45 Soft, low strength.	
		3.00	D	N 6				3.00 - 3.45 Soft, low strength.	3
		3.00 - 3.45	SPT						
		3.80 - 4.00	D		3.80			3.60 - 4.00 Borehole collapsed.	
		4.00 - 4.30	D	N 4				Brown clayey sandy GRAVEL of angular to subangular flint.	4
		4.00 - 4.45	SPT		4.30				
		4.30 - 4.45	D		4.45			Brown mottled light greenish grey and red slightly sandy CLAY.	
								Borehole completed at 4.45m.	
									5
									6
									7
					{8.00}				8

General Remarks

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.20m begl. Dynamic sampled 1.20m-4.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater encountered at 2.25m begl after completion.
BACKFILL: On completion, the borehole was backfilled with arisings.

Groundwater

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
26/11/21	2.25		

All dimensions in metres
Scale 1:50

Logged By
ES

Park Road, Havant PO91NL

CRM.1668.023

Start 26-11-21
Finish 26-11-21

Co-Ordinates

Bellway Homes

1 of 1

1.0 ENZYGO WS LOG CRM.1668.023 HAVANT.GPJ GINT STD AGS 3_1 ENZYGO.GPJ 3/12/21

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.00m begl. Dynamic sampled 1.00m-4.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, a slotted pipe (50mm) was installed to 4.00m begl, granular response zone (4.00m-1.00m), bentonite seal 1.00m-0.15m, 0.15m-0.00m flush steel cover.

Groundwater	Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
All dimensions in metres Scale 1:50				Logged By ES



Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site Park Road, Havant PO91NL				WS10
Job No CRM.1668.023	Dates Start 26-11-21 Finish 26-11-21	Ground Level (m)	Co-Ordinates	
Client Bellway Homes				Sheet 1 of 1

Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
					0.15			MADE GROUND: TARMACADAM.	0
					0.40			MADE GROUND: Type 1 subbase of sandy GRAVEL.	
		0.80	ES					MADE GROUND: Black sandy gravelly CLAY. Gavel is angular fine to coarse brick, concrete, chalk and flint.	
		1.00	D	N 3	1.00			1.00 - 1.45 Very soft, very low strength. (Soft) green and brown slightly sandy slightly gravelly CLAY. Gravel is angular fine to coarse chert.	1
		1.00 - 1.45	SPTLS						
		2.00	D	N 7				2.00 - 2.45 Soft, low strength.	2
		2.00 - 2.45	SPTLS						
					2.70			2.50 - 3.00 Borehole collapsed.	
		3.00	D	N 7				Brown clayey sandy GRAVEL of angular to subangular flint.	3
		3.00 - 3.45	SPTLS					3.00 - 3.45 Loose.	
					3.50			Soft light brown slightly sandy gravelly CLAY. Gravel is subangular fine to coarse chalk.	
		4.00	D	N 13				4.00 - 4.45 Firm, medium strength.	4
		4.00 - 4.45	SPTLS						
					4.45			Borehole completed at 4.45m.	5
									6
									7
									8
					{8.00}				

General Remarks

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.00m begl. Dynamic sampled 1.00m-4.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, the borehole was backfilled with arisings.

Groundwater

Date

Strike Depth
(m)

Casing Depth
(m)

Depth After
Observation
(m)

All dimensions in metres
Scale 1:50

Logged By
ES



Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site Park Road, Havant PO91NL				WS11
Job No CRM.1668.023	Dates Start 26-11-21 Finish 26-11-21	Ground Level (m)	Co-Ordinates	
Client Bellway Homes				Sheet 1 of 1

Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
					0.10			MADE GROUND: TARMACADAM.	0
					0.40			MADE GROUND: Type 1 subbase of sandy GRAVEL.	
		0.50	ES					MADE GROUND: Black sandy gravelly CLAY. Gavel is angular fine to coarse brick, concrete, chalk and flint.	
		1.20	D	N 4	1.10			1.00 Brick cobble encountered.	1
		1.20 - 1.65	SPTLS					(Soft) green and brown slightly sandy gravelly CLAY. Gravel is angular fine to coarse chert.	
								1.20 - 1.65 Soft, very low strength.	
		2.00	D	N 6				2.00 - 2.45 Soft, low strength.	2
		2.00 - 2.45	SPTLS						
					2.50			Brown clayey sandy GRAVEL of angular to subangular flint.	
		3.00	D	N 7				3.00 - 3.45 Loose.	3
		3.00 - 3.45	SPTLS						
									
		4.00	D	N 11	4.00			(Soft) light brown slightly sandy gravelly CLAY. Gravel is subangular fine to coarse chalk.	4
		4.00 - 4.45	SPTLS					4.00 - 4.45 Firm, medium strength.	
					4.45			Borehole completed at 4.45m.	
									5
									6
									7
									8
					{8.00}				

General Remarks

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.20m begl. Dynamic sampled 1.20m-4.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, the borehole was backfilled with arisings.

Groundwater

Date

Strike Depth
(m)

Casing Depth
(m)

Depth After
Observation
(m)

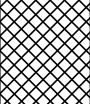
All dimensions in metres
Scale 1:50

Logged By
ES



Enzygo Ltd
Tel: 01454 269237
Fax: 01454 269760
Web: www.enzygo.com

Site Park Road, Havant PO91NL				WS12
Job No CRM.1668.023	Dates Start 25-11-21 Finish 25-11-21	Ground Level (m)	Co-Ordinates	
Client Bellway Homes				Sheet 1 of 1

Well	Water Levels	Samples & In Situ Testing			Depth (m)	Level (mAD)	Legend	Stratum Description	
		Depth (m)	No/Type	Results					
		1.00 1.20 - 1.65	ES SPTLS	N 13	0.15			MADE GROUND: TARMACADAM.	0
					0.45			MADE GROUND: Type 1 subbase of sandy GRAVEL.	
					1.20			MADE GROUND: Green very clayey gravelly coarse SAND. Gravel us angular to rounded fine to coarse flint and brick	1
		2.00 2.00 - 2.45	D SPTLS	N 27	1.90			1.20 - 1.65 Firm, medium strength. (Firm) brown mottled light greenish grey slightly sandy gravelly CLAY. Gravel is subrounded to rounded fine to coarse flint.	
					2.00			Brown clayey sandy GRAVEL of angular to subangular flint.	2
								2.00 - 2.45 Stiff, high strength. (Firm) brown mottled light greenish grey and red slightly sandy CLAY.	
		3.00 3.00 - 3.45	D SPT	N 23	3.00			2.50 - 3.00 Borehole collapsed.	
					3.45			2.90 Subrounded cobble of flint. (Firm) brown mottled light greenish grey and red slightly sandy CLAY.	3
								3.00 - 3.45 Stiff, high strength.	
								Borehole completed at 3.45m.	4
					{8.00}				8

General Remarks

EQUIPMENT: Premier 110 compact window sampling tracked rig.
METHOD: Hand dug inspection pit 0.00m-1.20m begl. Dynamic sampled 1.20m-3.00m begl.
CASING: Not used.
GROUNDWATER: Groundwater not encountered.
BACKFILL: On completion, the borehole was backfilled with arisings.

Groundwater	Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
All dimensions in metres Scale 1:50				Logged By ES

Appendix 3 – Chemical Testing

Analytical Report Number: 21-26456
Project / Site name: Park Road Havant
Your Order No: CRM 1668 022

Lab Sample Number				2102416	2102417	2102418	2102419	2102420
Sample Reference				WS1	WS1	WS1	WS1	WS3
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.90	1.00	1.60	2.00	0.30
Date Sampled				25/11/2021	25/11/2021	25/11/2021	25/11/2021	25/11/2021
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	33
Moisture Content	%	0.01	NONE	12	19	21	17	16
Total mass of sample received	kg	0.001	NONE	0.50	1.0	1.1	1.0	1.5

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	SFS				SFS

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	-	-	-	8.2
Organic Matter (automated)	%	0.1	MCERTS	2.4	-	-	-	5.2
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.4	-	-	-	3.0

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	-	-
----------------------------	-------	---	--------	---	-------	---	---	---

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	1.4	-	-	-	0.18
Anthracene	mg/kg	0.05	MCERTS	0.28	-	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.0	-	-	-	0.39
Pyrene	mg/kg	0.05	MCERTS	1.7	-	-	-	0.38
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.96	-	-	-	0.23
Chrysene	mg/kg	0.05	MCERTS	0.93	-	-	-	0.23
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.1	-	-	-	0.23
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.53	-	-	-	0.27
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.95	-	-	-	0.27
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.61	-	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.19	-	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.67	-	-	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	11.4	-	-	-	2.18
-----------------------------	-------	-----	--------	------	---	---	---	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	-	-	-	11
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	-	-	-	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	-	-	5.5
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	-	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	-	-	-	51
Copper (aqua regia extractable)	mg/kg	1	MCERTS	31	-	-	-	54
Lead (aqua regia extractable)	mg/kg	1	MCERTS	120	-	-	-	120
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	-	1.4
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	-	-	-	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	100	-	-	-	180

Analytical Report Number: 21-26456
 Project / Site name: Park Road Havant
 Your Order No: CRM 1668 022

Lab Sample Number	2102416	2102417	2102418	2102419	2102420
Sample Reference	WS1	WS1	WS1	WS1	WS3
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.90	1.00	1.60	2.00	0.30
Date Sampled	25/11/2021	25/11/2021	25/11/2021	25/11/2021	25/11/2021
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
Toluene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
p & m-xylene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
o-xylene	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
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	< 10	< 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	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	3.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	< 10	11	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	< 10	24	< 10	< 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	11	< 10	35	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	11	-	-	-	< 10

TPH (>C5 - C7) HS_1D_TOTAL	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH (>C7 - C8) HS_1D_TOTAL	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH (C8 - C10) HS_1D_TOTAL	mg/kg	0.1	MCERTS	< 0.1	-	-	-	< 0.1
TPH (C10 - C12) EH_CU_1D_TOTAL	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPH (C12 - C16) EH_CU_1D_TOTAL	mg/kg	4	MCERTS	< 4.0	-	-	-	< 4.0
TPH (C16 - C21) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	4.0	-	-	-	< 1.0
TPH (C21 - C35) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	4.0	-	-	-	< 1.0
TPH (C35 - C44) EH_CU_1D_TOTAL	mg/kg	10	NONE	< 10	-	-	-	< 10
TPH Total C5 - C44 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	11	-	-	-	< 10

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

Analytical Report Number: 21-26456
Project / Site name: Park Road Havant
Your Order No: CRM 1668 022

Lab Sample Number				2102421	2102422	2102423	2102424	2102425
Sample Reference				WS3	WS2	WS12	WS9	WS9
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.50	1.00	1.00	1.40
Date Sampled				25/11/2021	25/11/2021	25/11/2021	25/11/2021	25/11/2021
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	< 0.1
Moisture Content	%	0.01	NONE	13	14	12	28	22
Total mass of sample received	kg	0.001	NONE	1.5	1.0	1.0	1.5	1.5

Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A		SFS	SFS	SFS	

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	7.9	8.0	7.6	-
Organic Matter (automated)	%	0.1	MCERTS	-	2.7	2.5	1.8	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-	1.6	1.4	1.0	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	-	-	-
----------------------------	-------	---	--------	-------	---	---	---	---

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	0.60	< 0.05	-
Anthracene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	-	0.39	1.3	< 0.05	-
Pyrene	mg/kg	0.05	MCERTS	-	0.38	1.1	< 0.05	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.21	0.80	< 0.05	-
Chrysene	mg/kg	0.05	MCERTS	-	0.23	0.62	< 0.05	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	0.28	0.79	< 0.05	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	0.18	0.47	< 0.05	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.27	0.68	< 0.05	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	< 0.05	0.41	< 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	0.47	< 0.05	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	1.94	7.24	< 0.80	-
-----------------------------	-------	-----	--------	---	------	------	--------	---

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	13	9.8	6.9	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	0.2	0.6	0.4	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	< 0.2	-
Chromium (hexavalent)	mg/kg	4	MCERTS	-	< 4.0	< 4.0	< 4.0	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	21	23	19	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	22	25	13	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	39	61	440	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	< 0.3	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	14	19	14	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	60	73	66	-

Analytical Report Number: 21-26456
 Project / Site name: Park Road Havant
 Your Order No: CRM 1668 022

Lab Sample Number				2102421	2102422	2102423	2102424	2102425
Sample Reference				WS3	WS2	WS12	WS9	WS9
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.50	1.00	1.00	1.40
Date Sampled				25/11/2021	25/11/2021	25/11/2021	25/11/2021	25/11/2021
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Toluene	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
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS,1D,AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH,CU,1D,AL}	mg/kg	1	MCERTS	3.0	3.1	< 1.0	2.7	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH,CU,1D,AL}	mg/kg	2	MCERTS	2.9	2.9	< 2.0	2.1	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH,CU,1D,AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 _{EH,CU,1D,AL}	mg/kg	8.4	NONE	-	< 8.4	< 8.4	< 8.4	-
TPH-CWG - Aliphatic (EC5 - EC35) _{EH,CU+HS,1D,AL}	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) _{EH,CU+HS,1D,AL}	mg/kg	10	NONE	-	< 10	< 10	< 10	-

TPH-CWG - Aromatic >EC5 - EC7 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS,1D,AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH,CU,1D,AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH,CU,1D,AR}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 _{EH,CU,1D,AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic > EC35 - EC44 _{EH,CU,1D,AR}	mg/kg	8.4	NONE	-	< 8.4	< 8.4	< 8.4	-
TPH-CWG - Aromatic (EC5 - EC35) _{EH,CU+HS,1D,AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44) _{EH,CU+HS,1D,AR}	mg/kg	10	NONE	-	< 10	< 10	< 10	-

TPH (>C5 - C7) _{HS,1D,TOTAL}	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
TPH (>C7 - C8) _{HS,1D,TOTAL}	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
TPH (C8 - C10) _{HS,1D,TOTAL}	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	< 0.1	-
TPH (C10 - C12) _{EH,CU,1D,TOTAL}	mg/kg	2	MCERTS	-	3.1	< 2.0	2.7	-
TPH (C12 - C16) _{EH,CU,1D,TOTAL}	mg/kg	4	MCERTS	-	< 4.0	< 4.0	< 4.0	-
TPH (C16 - C21) _{EH,CU,1D,TOTAL}	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
TPH (C21 - C35) _{EH,CU,1D,TOTAL}	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
TPH (C35 - C44) _{EH,CU,1D,TOTAL}	mg/kg	10	NONE	-	< 10	< 10	< 10	-
TPH Total C5 - C44 _{EH,CU+HS,1D,TOTAL}	mg/kg	10	NONE	-	< 10	< 10	< 10	-

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

Analytical Report Number: 21-26456
Project / Site name: Park Road Havant
Your Order No: CRM 1668 022

Lab Sample Number				2102426
Sample Reference				WS9
Sample Number				None Supplied
Depth (m)				1.90
Date Sampled				25/11/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	20
Total mass of sample received	kg	0.001	NONE	1.5

Asbestos in Soil	Type	N/A	ISO 17025	-
Asbestos Analyst ID	N/A	N/A	N/A	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-
Organic Matter (automated)	%	0.1	MCERTS	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-
----------------------------	-------	---	--------	---

Speciated PAHs

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

Total PAH

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

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-
Chromium (hexavalent)	mg/kg	4	MCERTS	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-

Analytical Report Number: 21-26456
Project / Site name: Park Road Havant
Your Order No: CRM 1668 022

Lab Sample Number				2102426
Sample Reference				WS9
Sample Number				None Supplied
Depth (m)				1.90
Date Sampled				25/11/2021
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Monoaromatics & Oxygenates				
Benzene	µg/kg	1	MCERTS	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0

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 > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	-
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	-

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	-
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	-

TPH (>C5 - C7) HS_1D_TOTAL	mg/kg	1	MCERTS	-
TPH (>C7 - C8) HS_1D_TOTAL	mg/kg	1	MCERTS	-
TPH (C8 - C10) HS_1D_TOTAL	mg/kg	0.1	MCERTS	-
TPH (C10 - C12) EH_CU_1D_TOTAL	mg/kg	2	MCERTS	-
TPH (C12 - C16) EH_CU_1D_TOTAL	mg/kg	4	MCERTS	-
TPH (C16 - C21) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	-
TPH (C21 - C35) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	-
TPH (C35 - C44) EH_CU_1D_TOTAL	mg/kg	10	NONE	-
TPH Total C5 - C44 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	-

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

Analytical Report Number : 21-26456

Project / Site name: Park Road Havant

* 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 *
2102416	WS1	None Supplied	0.9	Brown loam and clay with gravel.
2102417	WS1	None Supplied	1	Brown clay and sand.
2102418	WS1	None Supplied	1.6	Brown clay and loam with gravel.
2102419	WS1	None Supplied	2	Brown clay.
2102420	WS3	None Supplied	0.3	Brown loam and clay with gravel and vegetation.
2102421	WS3	None Supplied	1	Brown clay and sand with gravel.
2102422	WS2	None Supplied	0.5	Brown loam and clay with gravel and vegetation.
2102423	WS12	None Supplied	1	Brown loam and clay with gravel and vegetation.
2102424	WS9	None Supplied	1	Brown clay and loam with gravel and vegetation.
2102425	WS9	None Supplied	1.4	Brown clay and loam with gravel.
2102426	WS9	None Supplied	1.9	Brown clay and sand.

Analytical Report Number : 21-26456
Project / Site name: Park Road Havant

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
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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
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
Total organic carbon (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
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
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	NONE
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

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.

Analytical Report Number : 21-26456
Project / Site name: Park Road Havant

Water matrix abbreviations:

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

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

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

**Steve Rhodes**

Enzygo Geoenvironmental Ltd
The Byre
Woodend Lane
Cromhall
Gloucestershire
GL12 8AA

e: steve.rhodes@enzygo.com

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 21-26717

Project / Site name:	Park Road Havant	Samples received on:	01/12/2021
Your job number:	CRM.1668,023	Samples instructed on/ Analysis started on:	02/12/2021
Your order number:	CRM.1688.022	Analysis completed by:	14/12/2021
Report Issue Number:	1	Report issued on:	14/12/2021
Samples Analysed:	4 soil samples		

Signed:

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

Analytical Report Number: 21-26717
Project / Site name: Park Road Havant
Your Order No: CRM.1668.022

Lab Sample Number				2103884	2103885	2103886	2103887
Sample Reference				WS8	WS1	WS9	WS10
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.60	0.90	0.90
Date Sampled				25/11/2021	25/11/2021	25/11/2021	25/11/2021
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	< 0.1	32
Moisture Content	%	0.01	NONE	15	13	19	8.7
Total mass of sample received	kg	0.001	NONE	0.40	1.5	1.5	1.5

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			DSA	DSA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	7.5	8.3
Organic Matter (automated)	%	0.1	MCERTS	-	-	0.9	0.8
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-	-	0.5	0.4

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	-	-
----------------------------	-------	---	--------	-------	---	---	---

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	0.52
Fluorene	mg/kg	0.05	MCERTS	-	-	< 0.05	0.75
Phenanthrene	mg/kg	0.05	MCERTS	-	-	< 0.05	5.3
Anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	1.3
Fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	8.9
Pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	8.2
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	5.3
Chrysene	mg/kg	0.05	MCERTS	-	-	< 0.05	3.6
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	5.7
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	2.9
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	6.0
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	2.9
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	0.81
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	< 0.05	3.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	< 0.80	55.6
-----------------------------	-------	-----	--------	---	---	--------	------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	5.9	10
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	0.5	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	< 0.2	0.4
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	18	24
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	10	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	48	110
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	12	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	35	79

Analytical Report Number: 21-26717
Project / Site name: Park Road Havant
Your Order No: CRM.1668.022

Lab Sample Number	2103884	2103885	2103886	2103887
Sample Reference	WS8	WS1	WS9	WS10
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.50	0.60	0.90	0.90
Date Sampled	25/11/2021	25/11/2021	25/11/2021	25/11/2021
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	-
Toluene	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	-	-
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
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	< 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	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	14
TPH-CWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	39
TPH-CWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	110
TPH-CWG - Aromatic > EC35 - EC44 _{EH_CU_1D_AR}	mg/kg	8.4	NONE	-	-	< 8.4	83
TPH-CWG - Aromatic (EC5 - EC35) _{EH_CU+HS_1D_AR}	mg/kg	10	MCERTS	< 10	< 10	< 10	160
TPH-CWG - Aromatic (EC5 - EC44) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	-	-	< 10	240

TPH (>C5 - C7) _{HS_1D_TOTAL}	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0
TPH (>C7 - C8) _{HS_1D_TOTAL}	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0
TPH (C8 - C10) _{HS_1D_TOTAL}	mg/kg	0.1	MCERTS	-	-	< 0.1	< 0.1
TPH (C10 - C12) _{EH_CU_1D_TOTAL}	mg/kg	2	MCERTS	-	-	< 2.0	< 2.0
TPH (C12 - C16) _{EH_CU_1D_TOTAL}	mg/kg	4	MCERTS	-	-	< 4.0	14
TPH (C16 - C21) _{EH_CU_1D_TOTAL}	mg/kg	1	MCERTS	-	-	< 1.0	39
TPH (C21 - C35) _{EH_CU_1D_TOTAL}	mg/kg	1	MCERTS	-	-	< 1.0	110
TPH (C35 - C44) _{EH_CU_1D_TOTAL}	mg/kg	10	NONE	-	-	< 10	83
TPH Total C5 - C44 _{EH_CU+HS_1D_TOTAL}	mg/kg	10	NONE	-	-	< 10	240

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



Analytical Report Number: 21-26717
Project / Site name: Park Road Havant
Your Order No: CRM.1688.022

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
2103887	WS10	0.90	136	Loose Fibres	Chrysotile	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number : 21-26717
Project / Site name: Park Road Havant

* 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 *
2103884	WS8	None Supplied	0.5	Brown clay and sand with gravel.
2103885	WS1	None Supplied	0.6	Brown clay and sand with gravel.
2103886	WS9	None Supplied	0.9	Brown clay and sand.
2103887	WS10	None Supplied	0.9	Brown loam and clay with stones.

Analytical Report Number : 21-26717
Project / Site name: Park Road Havant

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
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
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
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
Total organic carbon (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
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
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	NONE
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

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.

Analytical Report Number : 21-26717
Project / Site name: Park Road Havant

Water matrix abbreviations:

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

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

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

**Steve Rhodes**

Enzygo Geoenvironmental Ltd
The Byre
Woodend Lane
Cromhall
Gloucestershire
GL12 8AA

e: steve.rhodes@enzygo.com

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

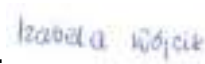
t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 21-26457

Project / Site name:	Park Road Havant	Samples received on:	01/12/2021
Your job number:	CRM 1668 023	Samples instructed on/ Analysis started on:	01/12/2021
Your order number:	CRM 1668 022	Analysis completed by:	10/12/2021
Report Issue Number:	1	Report issued on:	10/12/2021
Samples Analysed:	2 wac multi samples		


Signed:

Izabela Wójcik
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.

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	21-26457						
					Client: ENZYGO GEO		
Location	Park Road Havant						
Lab Reference (Sample Number)	2102525				Landfill Waste Acceptance Criteria		
					Limits		
Sampling Date	25/11/2021				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS1						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	0.2				3%	5%	6%
Loss on Ignition (%) **	4.1				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.30				1	--	--
Mineral Oil (mg/kg) BH, LD, CU, AL, #	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	8.1				--	>6	--
Acid Neutralisation Capacity (mol / kg)	4.3				--	To be evaluated	To be evaluated
Eluate Analysis							
	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test		
(BS EN 12457 - 3 preparation utilising end over end leaching procedure)					using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l	mg/l		mg/kg			
Arsenic *	< 0.010	< 0.010		< 0.050	0.5	2	25
Barium *	0.032	0.025		0.25	20	100	300
Cadmium *	< 0.0005	< 0.0005		< 0.0020	0.04	1	5
Chromium *	< 0.0010	0.0029		0.026	0.5	10	70
Copper *	0.019	0.011		0.12	2	50	100
Mercury *	< 0.0015	< 0.0015		< 0.010	0.01	0.2	2
Molybdenum *	< 0.0030	< 0.0030		0.025	0.5	10	30
Nickel *	0.0033	0.0061		0.058	0.4	10	40
Lead *	< 0.0050	0.0056		0.053	0.5	10	50
Antimony *	< 0.0050	< 0.0050		< 0.020	0.06	0.7	5
Selenium *	< 0.010	< 0.010		< 0.040	0.1	0.5	7
Zinc *	0.018	0.0087		0.097	4	50	200
Chloride *	7.0	< 4.0		33	800	15000	25000
Fluoride	1.3	1.2		12	10	150	500
Sulphate *	3.0	2.3		24	1000	20000	50000
TDS*	110	66		700	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.13	< 0.13		< 0.50	1	-	-
DOC	19	10		110	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.0						
Dry Matter (%)	81						
Moisture (%)	19						
Stage 1							
Volume Eluate L2 (litres)	0.29						
Filtered Eluate VE1 (litres)	0.18						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = MCERTS accredited							

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

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email: reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	21-26457						
				Client: ENZYGO GEO			
Location	Park Road Havant						
Lab Reference (Sample Number)	2102526			Landfill Waste Acceptance Criteria			
Sampling Date	25/11/2021			Limits			
Sample ID	WS11			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	1.3			3%	5%	6%	
Loss on Ignition (%) **	3.7			--	--	10%	
BTEX (µg/kg) **	< 10			6000	--	--	
Sum of PCBs (mg/kg) **	< 0.30			1	--	--	
Mineral Oil (mg/kg) BH, ID, CU, AL, #	< 10			500	--	--	
Total PAH (WAC-17) (mg/kg)	5.78			100	--	--	
pH (units)**	7.8			--	>6	--	
Acid Neutralisation Capacity (mol / kg)	6.5			--	To be evaluated	To be evaluated	
Eluate Analysis							
(BS EN 12457 - 3 preparation utilising end over end leaching procedure)	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test		
	mg/l	mg/l		mg/kg	using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.010	< 0.010		< 0.050	0.5	2	25
Barium *	0.046	0.029		0.31	20	100	300
Cadmium *	< 0.0005	< 0.0005		< 0.0020	0.04	1	5
Chromium *	< 0.0010	< 0.0010		0.0053	0.5	10	70
Copper *	0.021	0.012		0.13	2	50	100
Mercury *	< 0.0015	< 0.0015		< 0.010	0.01	0.2	2
Molybdenum *	0.043	0.017		0.20	0.5	10	30
Nickel *	0.0040	0.0043		0.043	0.4	10	40
Lead *	< 0.0050	< 0.0050		0.020	0.5	10	50
Antimony *	< 0.0050	< 0.0050		< 0.020	0.06	0.7	5
Selenium *	< 0.010	< 0.010		< 0.040	0.1	0.5	7
Zinc *	0.022	0.0111		0.12	4	50	200
Chloride *	7.0	< 4.0		40	800	15000	25000
Fluoride	0.24	0.19		2.0	10	150	500
Sulphate *	29	19		200	1000	20000	50000
TDS*	170	110		1200	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.13	< 0.13		< 0.50	1	-	-
DOC	33	33		330	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.0						
Dry Matter (%)	83						
Moisture (%)	17						
Stage 1							
Volume Eluate L2 (litres)	0.32						
Filtered Eluate VE1 (litres)	0.20						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
				* = UKAS accredited (liquid eluate analysis only)			
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation				** = MCERTS accredited			

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



Analytical Report Number : 21-26457

Project / Site Name: Park Road, Havant

* 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 *
2102525	WS1	None Supplied	1	Brown clay and sand.
2102526	WS11	None Supplied	0.5	Brown clay and loam with gravel and vegetation.



Environmental Science

Analytical Report Number : 21-26457

Project / Site name: Park Road, Havant

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
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W
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
Preparation WAC leachate		In-house method	L043-PL	W
Speciated WAC-17 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. MCERTS accredited except Coronene.	L064-PL	D
Chloride in WAC leachate (BS EN 12457-3 Prep)	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W
Fluoride in WAC leachate (BS EN 12457-3 Prep)	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L033-PL	W
Phenol Index in WAC leachate (BS EN 12457-3 Prep)	Determination of monohydric phenols in leachate by continuous flow analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W
Sulphate in WAC leachate (BS EN 12457-3 Prep)	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W
TDS in WAC leachate (BS EN 12457-3 Prep)	Determination of total dissolved solids in leachate by electrometric measurement.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L031-PL	W
DOC in WAC leachate (BS EN 12457-3 Prep)	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR analyser.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L037-PL	W
PCB's by GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D
BTEX (Sum of BTEX compounds) in soil	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046-PL	W
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D
Mineral Oil in Soil C10 - C40	Determination of dichloromethane/hexane extractable hydrocarbons in soil by GC-MS.	In-house method based on USEPA 8270	L076-PL	D
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L023-PL	D

Iss No 21-26457-1 Park Road Havant CRM 1668 023

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

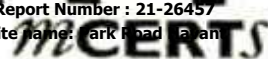
The results included within the report are representative of the samples submitted for analysis.

Page 5 of 8



Analytical Report Number : 21-26457

Project / Site name: Park Road, Havant



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
Metals in WAC leachate (BS EN 12457-3 Prep)	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W

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 correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

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.

Appendix 4 – Geotechnical Testing

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 16/12/2021

Sampled By: Client

Test Results:

Laboratory Reference: 2104837

Hole No.: WS1

Sample Reference: Not Given

Sample Description: Orangish brown slightly sandy CLAY with fragments of rootlet

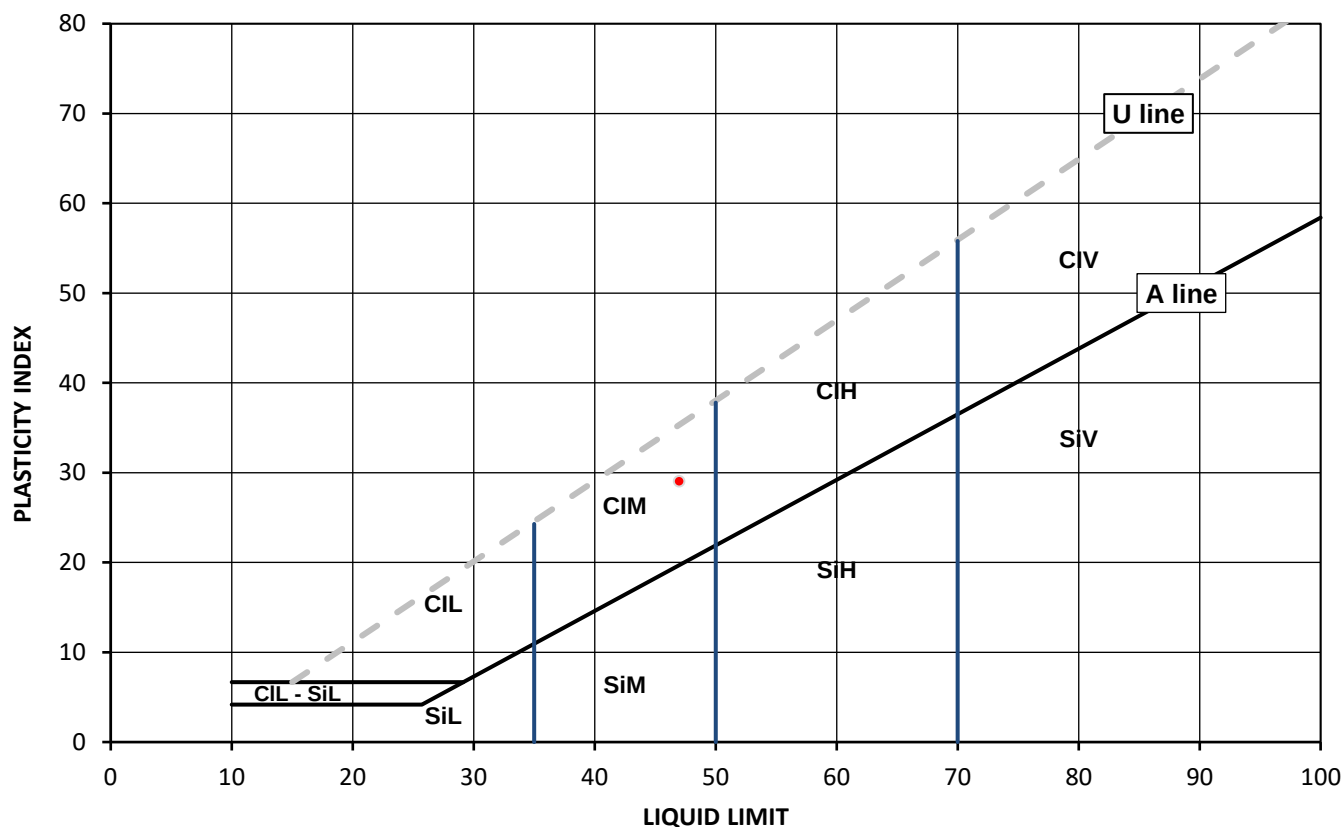
Depth Top [m]: 2.00

Depth Base [m]: Not Given

Sample Type: D

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
20	47	18	29	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 CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Page 1 of 1

Date Reported: 22/12/2021

GF 232.12

Client: Enzygo Geoenvironmental Ltd
Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA
Contact: Steve Rhodes
Site Address: Havant

Client Reference: CRM.1668.022
Job Number: 21-26908
Date Sampled: 25/11/2021
Date Received: 01/12/2021
Date Tested: 16/12/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2104838

Hole No.: WS3

Sample Reference: Not Given

Sample Description: Multicolour CLAY

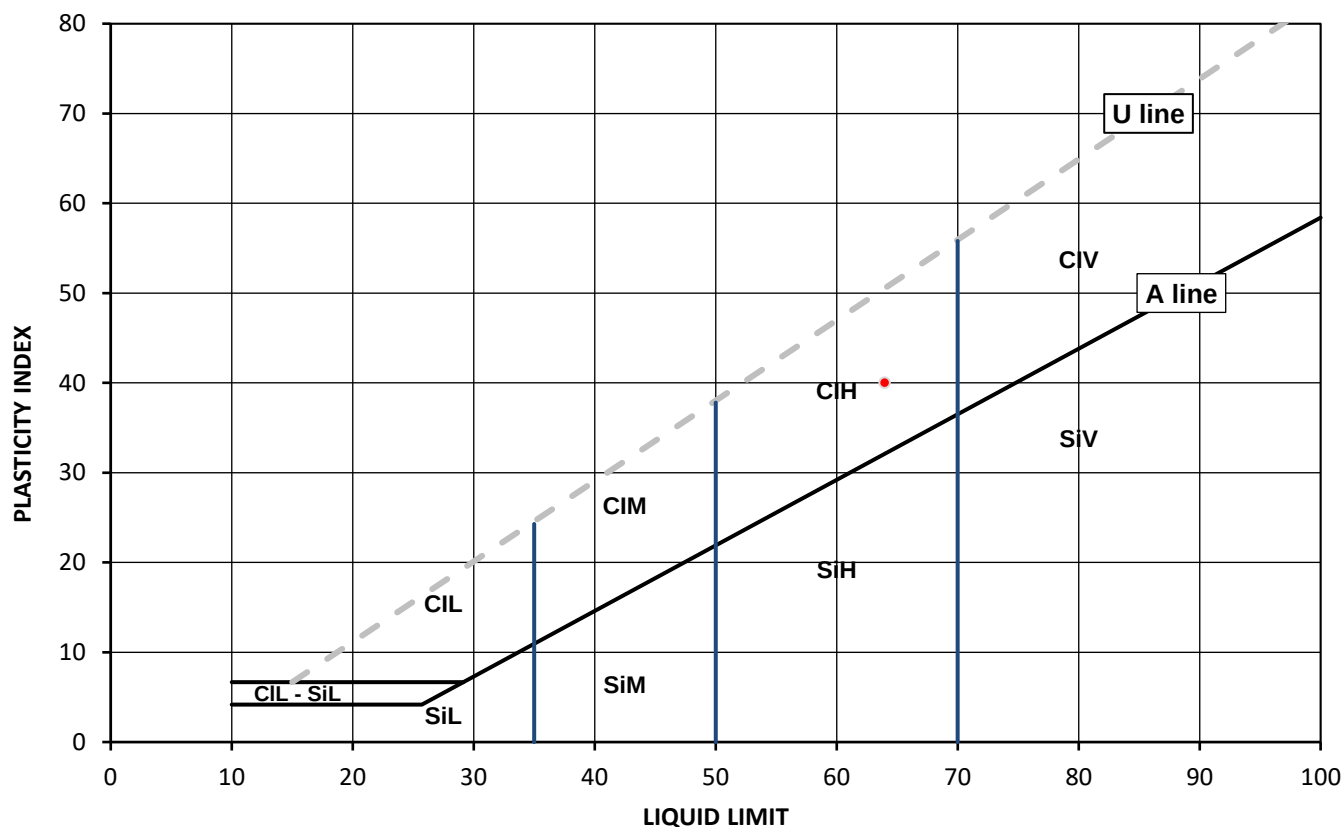
Depth Top [m]: 2.00

Depth Base [m]: Not Given

Sample Type: D

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
25	64	24	40	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 CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd
Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA
Contact: Steve Rhodes
Site Address: Havant

Client Reference: CRM.1668.022
Job Number: 21-26908
Date Sampled: 25/11/2021
Date Received: 01/12/2021
Date Tested: 16/12/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

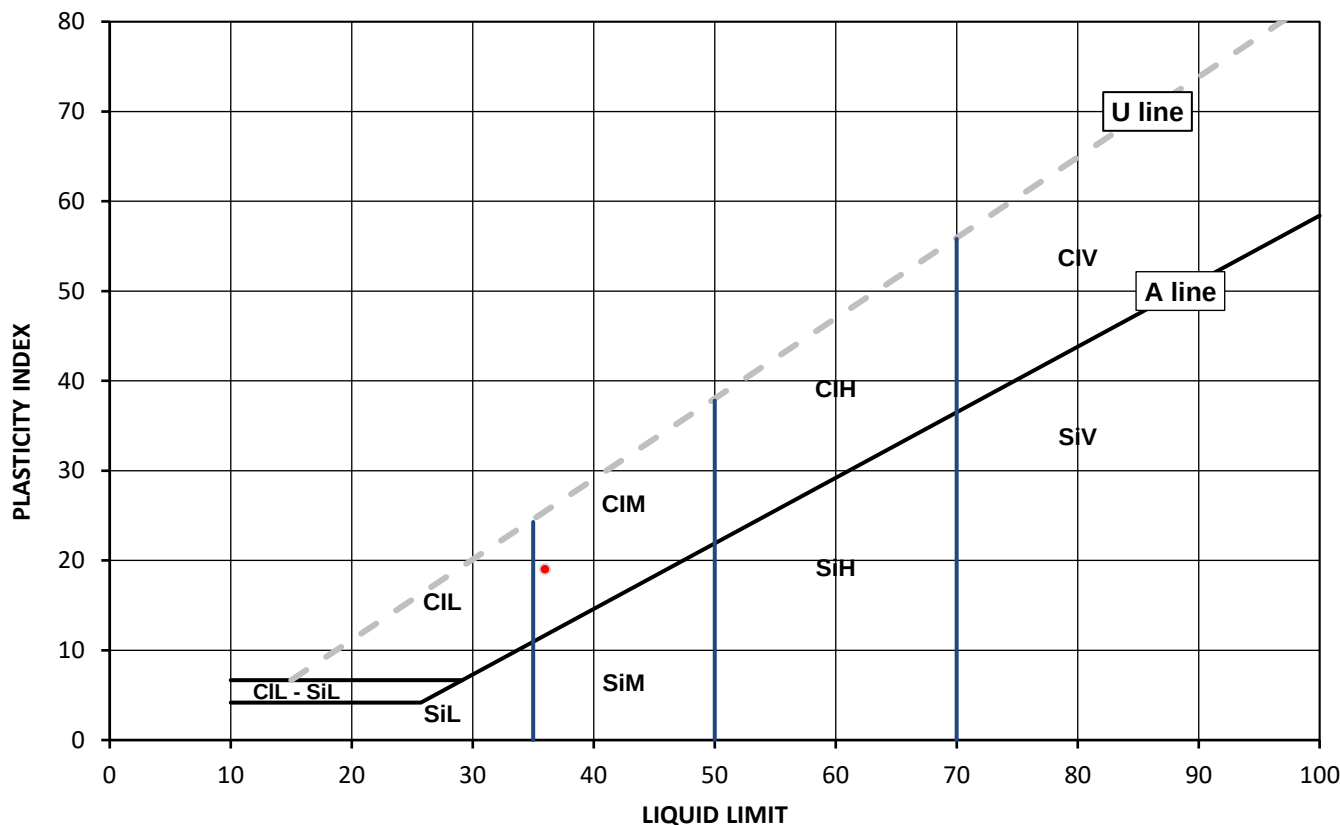
Test Results:

Laboratory Reference: 2104839
Hole No.: WS2
Sample Reference: Not Given
Sample Description: Multicolour sandy CLAY

Depth Top [m]: 1.00
Depth Base [m]: Not Given
Sample Type: D

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
19	36	17	19	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd
Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA
Contact: Steve Rhodes
Site Address: Havant

Client Reference: CRM.1668.022
Job Number: 21-26908
Date Sampled: 25/11/2021
Date Received: 01/12/2021
Date Tested: 16/12/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

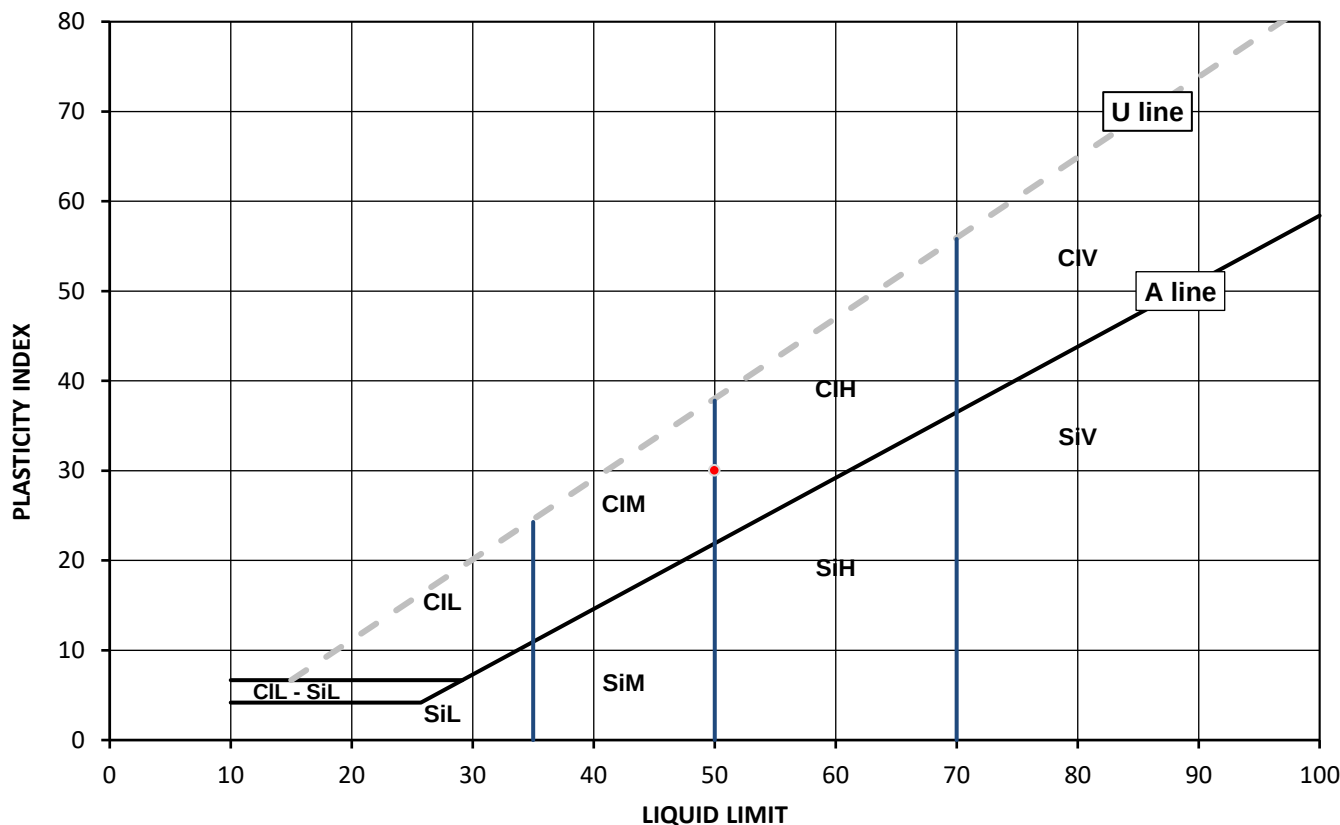
Test Results:

Laboratory Reference: 2104840
Hole No.: WS2
Sample Reference: Not Given
Sample Description: Multicolour slightly sandy CLAY

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D

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
19	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 CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 13/12/2021

Sampled By: Client

Test Results:

Laboratory Reference: 2104841

Hole No.: WS9

Sample Reference: Not Given

Sample Description: Brown sandy CLAY

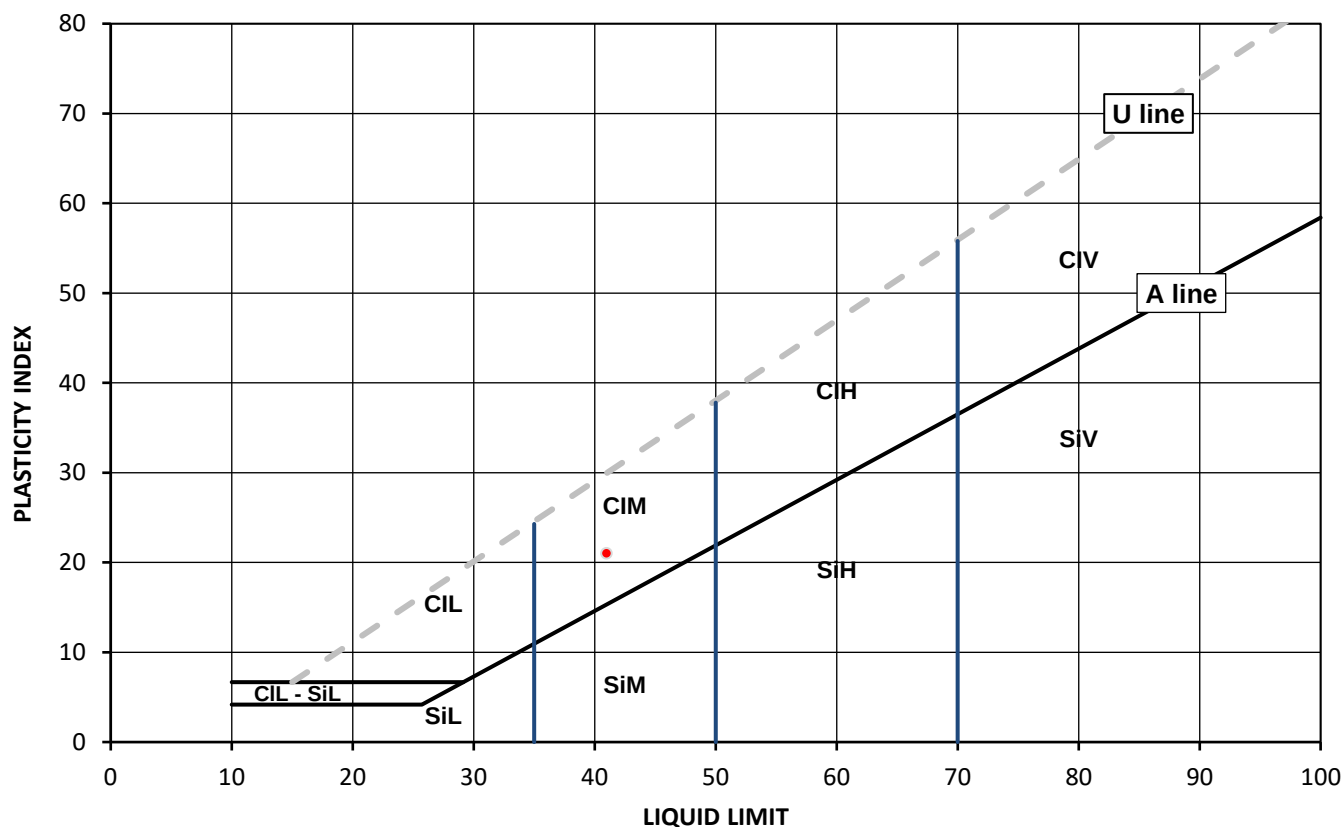
Depth Top [m]: 0.90

Depth Base [m]: Not Given

Sample Type: D

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
24	41	20	21	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 17/12/2021

Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2104842

Hole No.: WS9

Sample Reference: Not Given

Sample Description: Brown slightly gravelly sandy CLAY

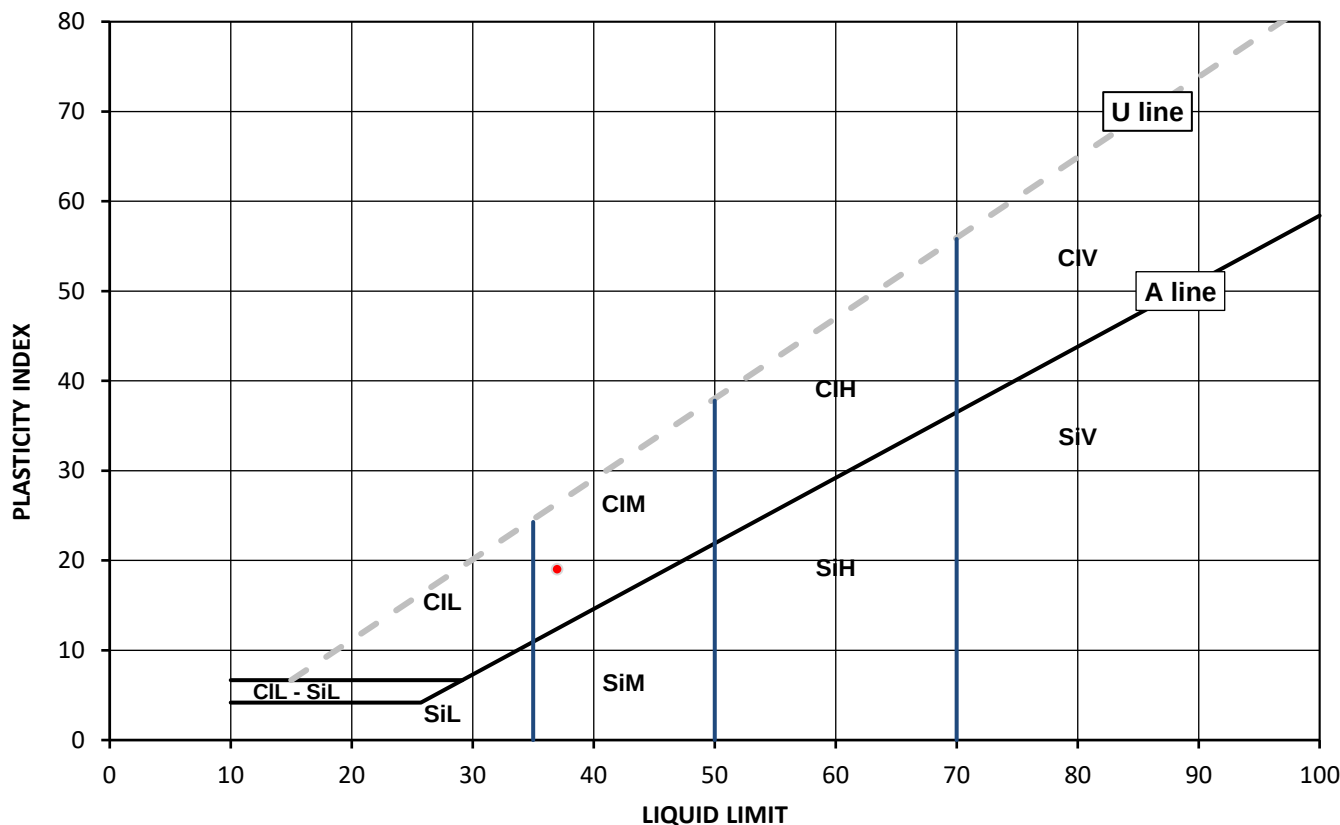
Depth Top [m]: 2.00

Depth Base [m]: Not Given

Sample Type: D

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
28	37	18	19	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 16/12/2021

Sampled By: Client

Test Results:

Laboratory Reference: 2104843

Hole No.: WS8

Sample Reference: Not Given

Sample Description: Brown slightly gravelly slightly sandy CLAY

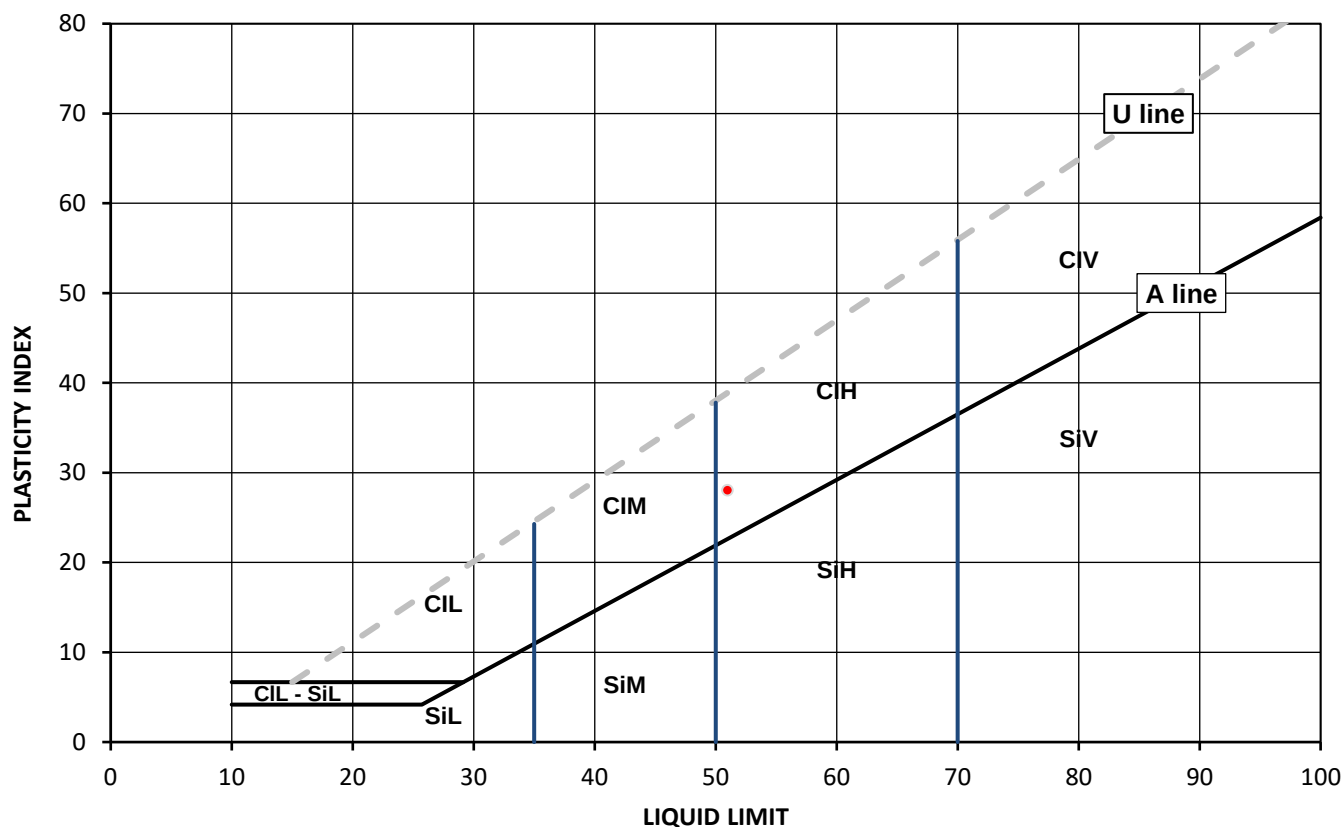
Depth Top [m]: 1.00

Depth Base [m]: Not Given

Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
30	51	23	28	75



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L	Low
	M	Medium
	H	High
	V	Very high
	O	Organic
		append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 16/12/2021

Sampled By: Client

Test Results:

Laboratory Reference: 2104844

Hole No.: WS8

Sample Reference: Not Given

Sample Description: Brownish grey slightly gravelly slightly sandy CLAY

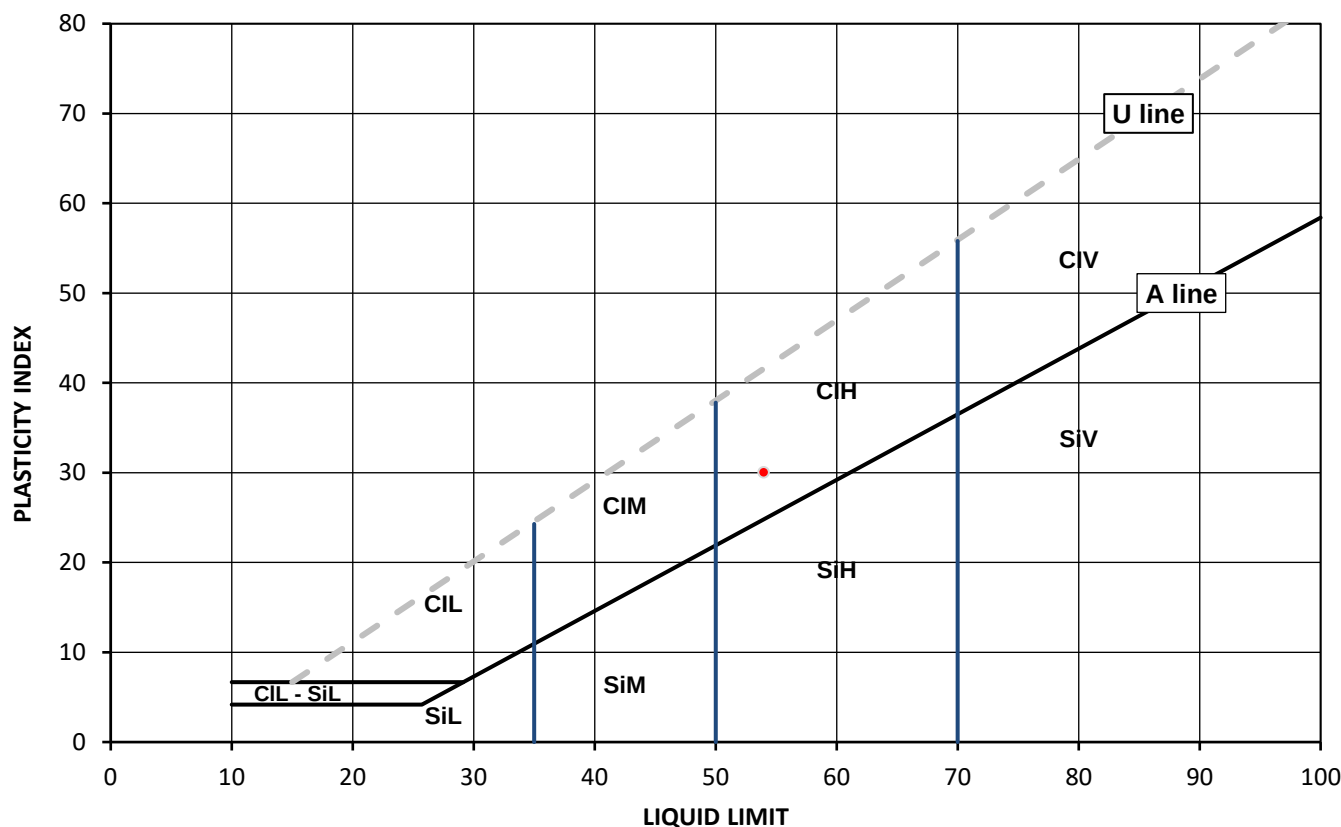
Depth Top [m]: 2.00

Depth Base [m]: Not Given

Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
50	54	24	30	96



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	append to classification for organic material (eg CIHO)
	V Very high	
	O Organic	

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 16/12/2021

Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2104845

Hole No.: WS10

Sample Reference: Not Given

Sample Description: Multicolour slightly gravelly slightly sandy CLAY

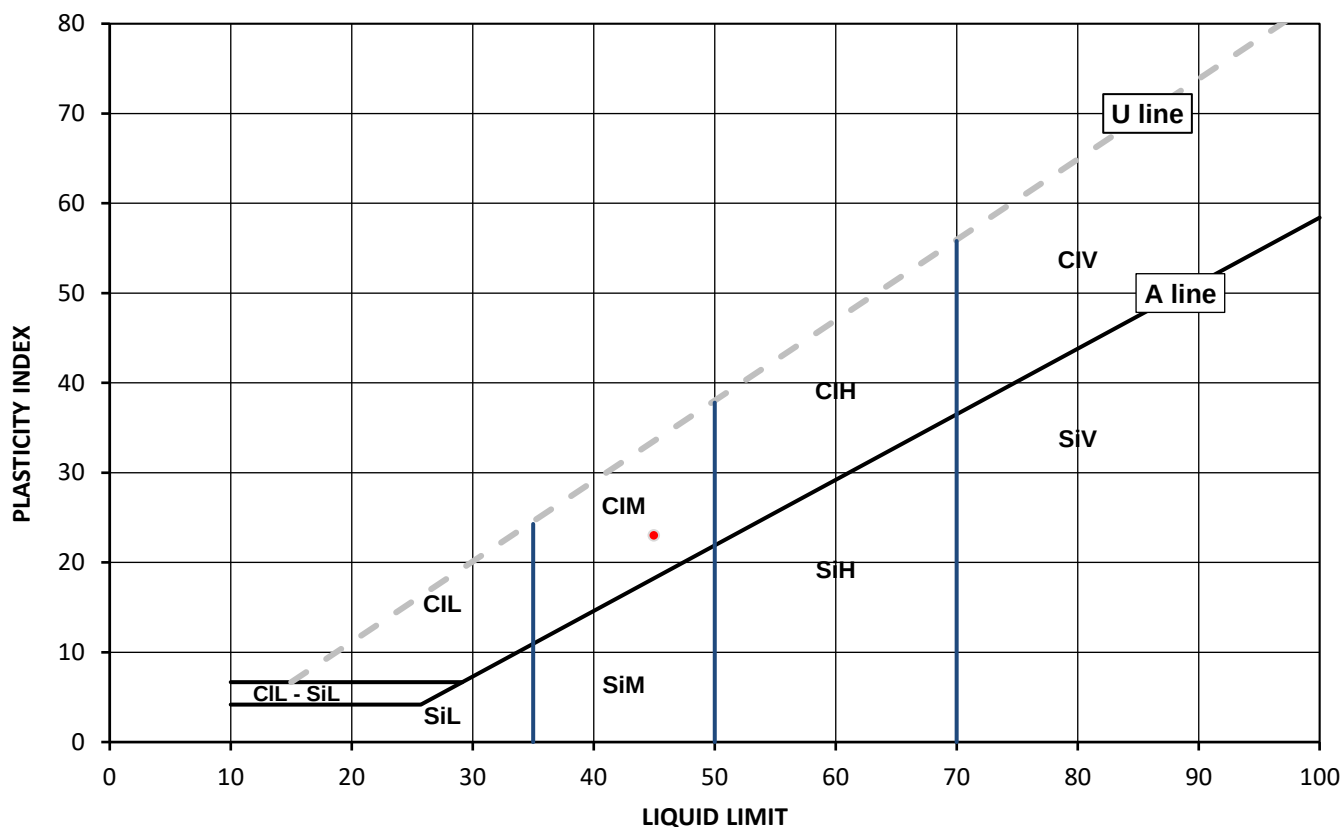
Depth Top [m]: 1.00

Depth Base [m]: Not Given

Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
9.0	45	22	23	69



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	below 35
Si	Silt	35 to 50
	L Low	50 to 70
	M Medium	exceeding 70
	H High	
	V Very high	
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 17/12/2021

Sampled By: Client

Test Results:

Laboratory Reference: 2104846

Hole No.: WS10

Sample Reference: Not Given

Sample Description: Brown slightly gravelly slightly organic CLAY

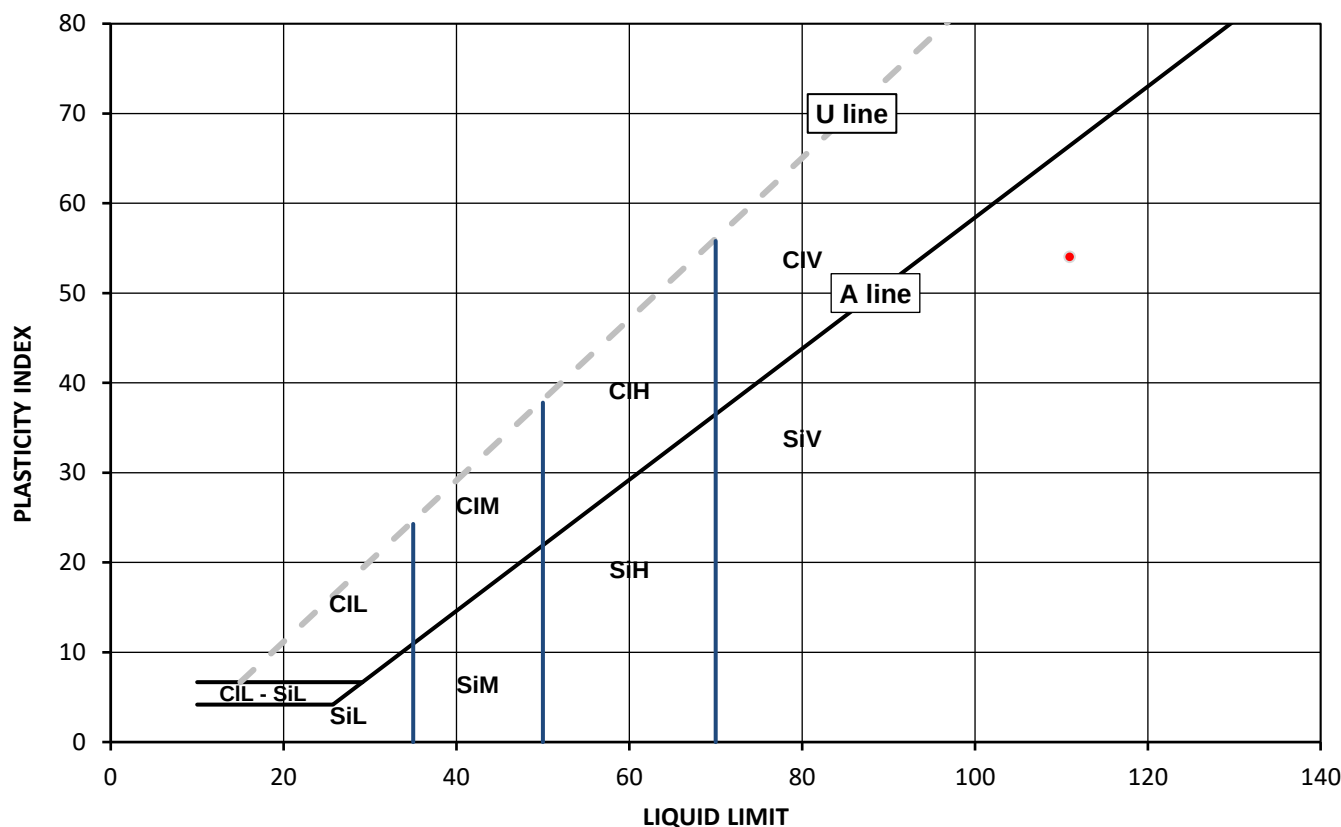
Depth Top [m]: 2.00

Depth Base [m]: Not Given

Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
65	111	57	54	96



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

Cl	Clay	Plasticity	L	Low	Liquid Limit	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 CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.



4041

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

Water Content by BS 1377-2:1990: Clause 3.2; 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 8.2i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 13/12 - 17/12/2021

Sampled By: Client

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 m	Depth Base m	Type					% Passing 425um	WL %	Wp %	Ip %	bulk Mg/m3	dry Mg/m3	PD Mg/m3			
2104837	WS1	Not Given	2.00	Not Given	D	Orangish brown slightly sandy CLAY with fragments of rootlet	Atterberg 1 Point	20		100	47	18	29						
2104845	WS10	Not Given	1.00	Not Given	D	Multicolour slightly gravelly slightly sandy CLAY	Atterberg 1 Point	9.0		69	45	22	23						
2104846	WS10	Not Given	2.00	Not Given	D	Brown slightly gravelly slightly organic CLAY	Atterberg 1 Point	65		96	111	57	54						
2104839	WS2	Not Given	1.00	Not Given	D	Multicolour sandy CLAY	Atterberg 1 Point	19		100	36	17	19						
2104840	WS2	Not Given	2.00	Not Given	D	Multicolour slightly sandy CLAY	Atterberg 1 Point	19		100	50	20	30						
2104838	WS3	Not Given	2.00	Not Given	D	Multicolour CLAY	Atterberg 1 Point	25		100	64	24	40						
2104843	WS8	Not Given	1.00	Not Given	D	Brown slightly gravelly slightly sandy CLAY	Atterberg 1 Point	30		75	51	23	28						
2104844	WS8	Not Given	2.00	Not Given	D	Brownish grey slightly gravelly slightly sandy CLAY	Atterberg 1 Point	50		96	54	24	30						
2104841	WS9	Not Given	0.90	Not Given	D	Brown sandy CLAY	Atterberg 1 Point	24		100	41	20	21						
2104842	WS9	Not Given	2.00	Not Given	D	Brown slightly gravelly sandy CLAY	Atterberg 1 Point	28		99	37	18	19						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.



4041

Client: Enzygo Geoenvironmental Ltd

Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes

Site Address: Havant

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT**DETERMINATION OF WATER CONTENT**

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 13/12 - 17/12/2021

Sampled By: Client

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2104837	WS1	Not Given	2.00	Not Given	D	Orangish brown slightly sandy CLAY with fragments of rootlet		20	Sample was quartered, oven dried at 106.9 °C			
2104845	WS10	Not Given	1.00	Not Given	D	Multicolour slightly gravelly slightly sandy CLAY		9.0	Sample was quartered, oven dried at 108.9 °C			
2104846	WS10	Not Given	2.00	Not Given	D	Brown slightly gravelly slightly organic CLAY		65	Sample was quartered, oven dried at 108.9 °C			
2104839	WS2	Not Given	1.00	Not Given	D	Multicolour sandy CLAY		19	Sample was quartered, oven dried at 106.9 °C			
2104840	WS2	Not Given	2.00	Not Given	D	Multicolour slightly sandy CLAY		19	Sample was quartered, oven dried at 106.9 °C			
2104838	WS3	Not Given	2.00	Not Given	D	Multicolour CLAY		25	Sample was quartered, oven dried at 106.9 °C			
2104843	WS8	Not Given	1.00	Not Given	D	Brown slightly gravelly slightly sandy CLAY		30	Sample was quartered, oven dried at 106.9 °C			
2104844	WS8	Not Given	2.00	Not Given	D	Brownish grey slightly gravelly slightly sandy CLAY		50	Sample was quartered, oven dried at 106.9 °C			
2104841	WS9	Not Given	0.90	Not Given	D	Brown sandy CLAY		24	Sample was quartered, oven dried at 106.3 °C			
2104842	WS9	Not Given	2.00	Not Given	D	Brown slightly gravelly sandy CLAY		28	Sample was quartered, oven dried at 108.9 °C			

Comments:

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.

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd



TEST CERTIFICATE

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



California Bearing Ratio Top Only

4041

Tested in Accordance with: BS 1377-4: 1990: Clause 7

Client: Enzygo Geoenvironmental Ltd
Client Address: The Byre, Woodend Lane,
Cromhall, Gloucestershire,
GL12 8AA

Contact: Steve Rhodes
Site Address: Havant

Client Reference: CRM.1668.022

Job Number: 21-26908

Date Sampled: 25/11/2021

Date Received: 01/12/2021

Date Tested: 20/12/2021

Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2104841
Hole No.: WS9
Sample Reference: Not Given
Sample Description: Brown sandy CLAY

Depth Top [m]: 0.90
Depth Base [m]: Not Given
Sample Type: D

Specimen Preparation:

Condition Remoulded
Details Recompacted with specified standard effort using 2.5kg rammer

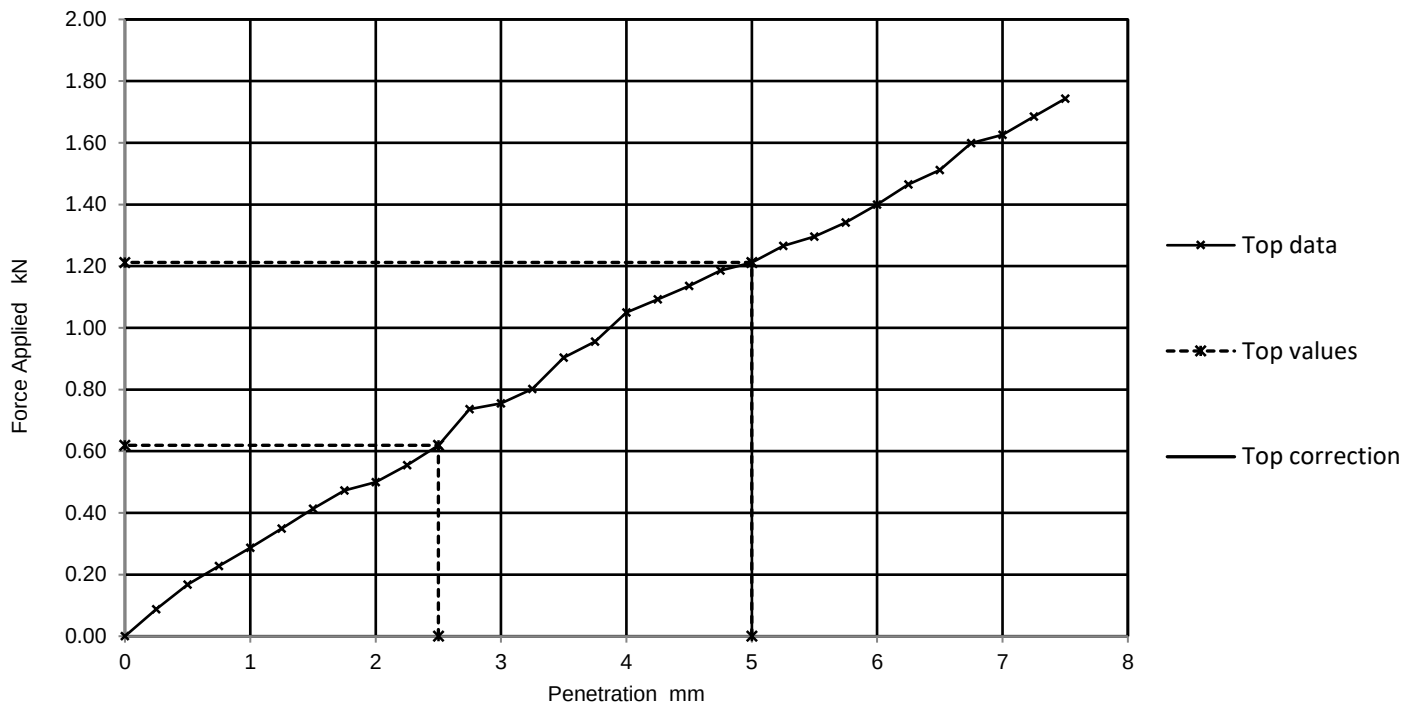
Soaking details Not soaked
Period of soaking days
Time to surface days
Amount of swell recorded mm
Dry density after soaking Mg/m3

Material retained on 20mm sieve removed 9 %

Initial Specimen details Bulk density 1.96 Mg/m3
Dry density 1.59 Mg/m3
Moisture content 23 %

Surcharge applied 8 kg
4.8 kPa

Force v Penetration Plots



Results

TOP

Curve correction applied	CBR Values, %			
	2.5mm	5mm	Highest	Average
No	4.7	6.1	6.1	N/A

Moisture Content %
25

Remarks:

Test/ Specimen
specific remarks:

Signed:

Monika Janoszek
PL Deputy Geotechnical Laboratory Manager
for and on behalf of i2 Analytical Ltd

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.

Page 1 of 1

Date Reported: 22/12/2021

GF 277.8



Steve Rhodes

Enzygo Geoenvironmental Ltd
The Byre
Woodend Lane
Cromhall
Gloucestershire
GL12 8AA

e: steve.rhodes@enzygo.com

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 21-26910

Project / Site name:	Havant	Samples received on:	01/12/2021
Your job number:	CRM.1668.022	Samples instructed on/ Analysis started on:	01/12/2021
Your order number:		Analysis completed by:	15/12/2021
Report Issue Number:	1	Report issued on:	21/12/2021
Samples Analysed:	6 soil samples		

Signed: 

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

Analytical Report Number: 21-26910
Project / Site name: Havant

Lab Sample Number				2104850	2104851	2104852	2104853	2104854
Sample Reference				WS3	WS8	WS8	WS8	WS11
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	1.00	2.00	3.00	2.00
Date Sampled				25/11/2021	25/11/2021	25/11/2021	25/11/2021	25/11/2021
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	35	< 0.1
Moisture Content	%	0.01	NONE	18	20	26	29	19
Total mass of sample received	kg	0.001	NONE	0.50	0.50	0.50	1.1	1.1

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5	7.9	7.3	6.8	8.1
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	610	240	91	87	320
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.31	0.12	0.046	0.044	0.16
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	306	121	45.5	43.6	160

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

Analytical Report Number: 21-26910
Project / Site name: Havant

Lab Sample Number				2105598
Sample Reference				WS11
Sample Number				None Supplied
Depth (m)				1.20
Date Sampled				Deviating
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	11
Total mass of sample received	kg	0.001	NONE	1.1

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-

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

Analytical Report Number : 21-26910

Project / Site name: Havant

* 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 *
2104850	WS3	None Supplied	2	Brown clay.
2104851	WS8	None Supplied	1	Brown clay and sand with gravel.
2104852	WS8	None Supplied	2	Brown clay and loam with gravel and vegetation.
2104853	WS8	None Supplied	3	Brown clay and loam with gravel and stones.
2104854	WS11	None Supplied	2	Brown clay and loam with gravel.
2105598	WS11	None Supplied	1.2	Brown loam and clay with gravel and vegetation.

Analytical Report Number : 21-26910
Project / Site name: Havant

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
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
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
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.

Analytical Report Number : 21-26910
Project / Site name: Havant

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS11	None Supplied	S	2105598	a	None Supplied	None Supplied	None Supplied

Appendix 5 - Human Health Assessment Reference Values

Determinant	Units	GAC Value Residential					
		With Plant Uptake			Without Plant Uptake		
Arsenic	mg/kg	37			40		
Cadmium	mg/kg	11			85		
Chromium	mg/kg	910			910		
Chromium VI	mg/kg	6			6		
Lead	mg/kg	200			310		
Mercury	mg/kg	40			56		
Nickel	mg/kg	130			180		
Selenium	mg/kg	250			430		
Copper	mg/kg	2400			7100		
Zinc	mg/kg	3700			40000		
Cyanide	mg/kg	791			800		
SOM	%	1	2.5	6	1	2.5	6
Phenol	mg/kg	120	200	380	440	690	1200
Napthalene	mg/kg	2.3	5.6	13	2.3	5.6	13
Acenaphtylene	mg/kg	170	420	920	2900	4600	6000
Acenaphthene	mg/kg	210	510	1100	3000	4700	6000
Flourene	mg/kg	170	400	860	2800	3800	4500
Phenanthrene	mg/kg	95	220	440	1300	1500	1500
Anthracene	mg/kg	2400	5400	11000	31000	35000	37000
Fluoranthene	mg/kg	280	560	890	1500	1600	1600
Pyrene	mg/kg	620	1200	2000	3700	3800	3800
Benzo(a)Anthracene	mg/kg	7.2	11	13	11	14	15
Chrysene	mg/kg	15	22	27	30	31	32
Benzo(b)Flouranthene	mg/kg	2.6	3.3	3.7	3.9	4.0	4.0
Benzo(k)Flouranthene	mg/kg	77	93	100	110	110	110
Benzo(a)Pyrene	mg/kg	2.2	2.7	3.0	3.2	3.2	3.2
Indeno(123-cd)Pyrene	mg/kg	27	36	41	45	46	46
Dibenzo(a,h)Anthracene	mg/kg	0.24	0.28	0.3	0.31	0.32	0.32
Benzo(ghi)Perylene	mg/kg	320	340	350	360	360	360
TPH C ₅ -C ₆ Aliphatic	mg/kg	42	78	160	42	78	160
TPH C ₆ -C ₈ Aliphatic	mg/kg	100	230	530	100	230	530
TPH C ₈ -C ₁₀ Aliphatic	mg/kg	27	65	150	27	65	150
TPH C ₁₀ -C ₁₂ Aliphatic	mg/kg	130	330	760	130	330	770
TPH C ₁₂ -C ₁₆ Aliphatic	mg/kg	1100	2400	4300	1100	2400	4400
TPH C ₁₆ -C ₃₅ Aliphatic	mg/kg	65000	92000	110000	65000	92000	110000
TPH C ₃₅ -C ₄₄ Aliphatic	mg/kg	65000	92000	110000	65000	92000	110000
TPH C ₅ -C ₇ Aromatic	mg/kg	70	140	300	370	690	1400
TPH C ₇ -C ₈ Aromatic	mg/kg	130	290	660	860	1800	3900
TPH C ₈ -C ₁₀ Aromatic	mg/kg	34	83	190	47	110	270
TPH C ₁₀ -C ₁₂ Aromatic	mg/kg	74	180	380	250	590	1200
TPH C ₁₂ -C ₁₆ Aromatic	mg/kg	140	330	660	1800	2300	2500
TPH C ₁₆ -C ₂₁ Aromatic	mg/kg	260	540	930	1900	1900	1900
TPH C ₂₁ -C ₃₅ Aromatic	mg/kg	1100	1500	1700	1900	1900	1900
TPH C ₃₅ -C ₄₄ Aromatic	mg/kg	1100	1500	1700	1900	1900	1900
Benzene	mg/kg	0.087	0.17	0.37	0.38	0.70	1.4
Toluene	mg/kg	130	290	660	880	1900	3900
Ethylbenzene	mg/kg	47	110	260	83	190	440
Xylene	mg/kg	56	130	310	79	180	430

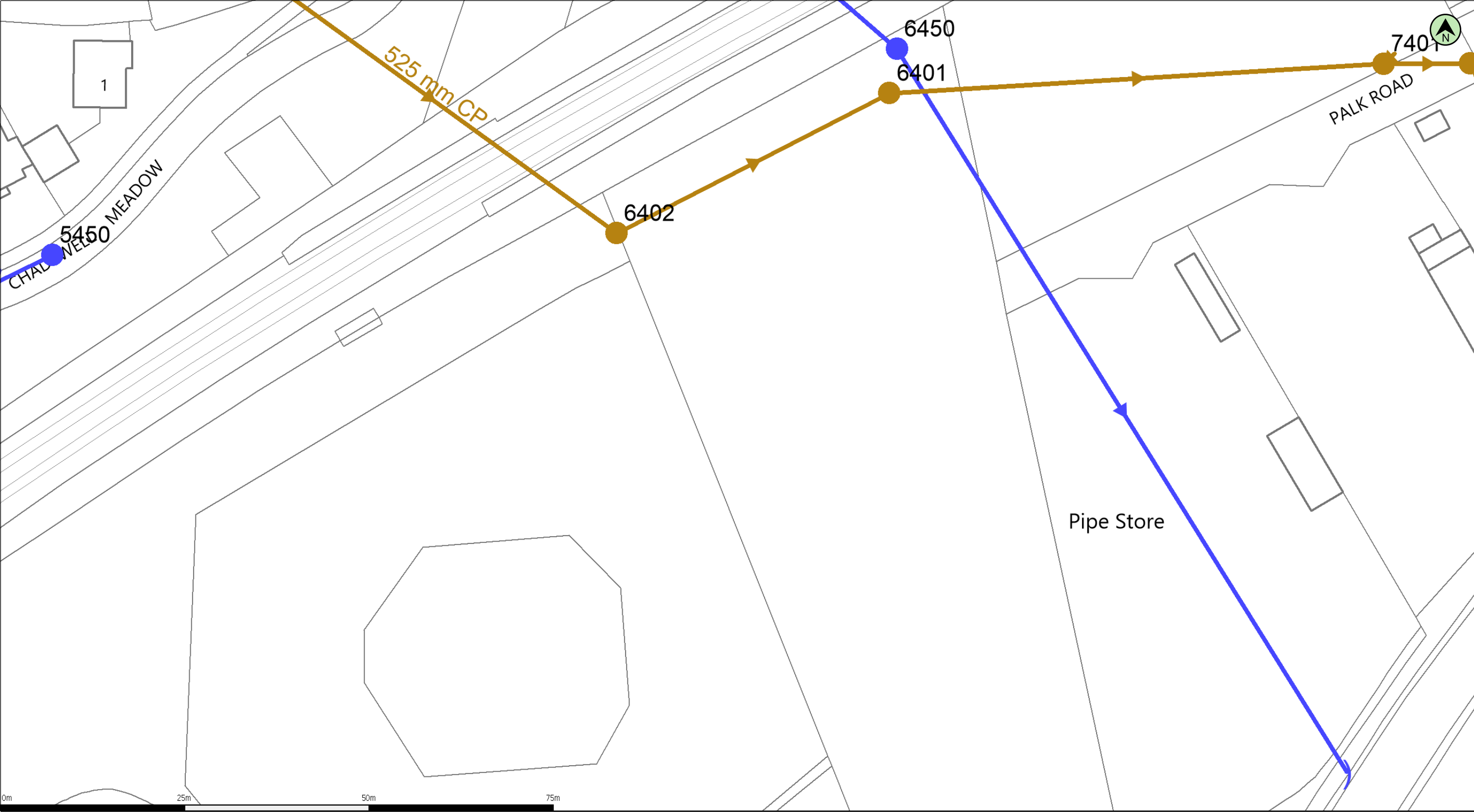
Determinant	Units	GAC Value					
		Residential POS			Commercial		
Arsenic	mg/kg	79			640		
Cadmium	mg/kg	120			190		
Chromium	mg/kg	1500			8600		
Chromium VI	mg/kg	7.7			33		
Lead	mg/kg	630			2330		
Mercury	mg/kg	120			1100		
Nickel	mg/kg	230			980		
Selenium	mg/kg	1100			12000		
Copper	mg/kg	12000			68000		
Zinc	mg/kg	81000			730000		
Cyanide	mg/kg	N/A			16200		
SOM	%	1	2.5	6	1	2.5	6
Phenol	mg/kg	440	690	1300	440	690	1300
Napthalene	mg/kg	4900	4900	4900	190	460	1100
Acenaphtylene	mg/kg	15000	15000	15000	83000	97000	100000
Acenaphthene	mg/kg	15000	15000	15000	84000	97000	100000
Flourene	mg/kg	9900	9900	9900	63000	68000	71000
Phenanthrene	mg/kg	3100	3100	3100	22000	22000	23000
Anthracene	mg/kg	74000	74000	74000	520000	540000	540000
Fluoranthene	mg/kg	3100	3100	3100	23000	23000	23000
Pyrene	mg/kg	7400	7400	7400	54000	54000	54000
Benzo(a)Anthracene	mg/kg	29	29	29	170	170	180
Chrysene	mg/kg	57	57	57	350	350	350
Benzo(b)Flouranthene	mg/kg	7.1	7.2	7.2	44	44	45
Benzo(k)Flouranthene	mg/kg	190	190	190	1200	1200	1200
Benzo(a)Pyrene	mg/kg	5.7	5.7	5.7	35	35	36
Indeno(123-cd)Pyrene	mg/kg	82	82	82	500	510	510
Dibenzo(a,h)Anthracene	mg/kg	0.57	0.57	0.58	3.5	3.6	3.6
Benzo(ghi)Perylene	mg/kg	640	640	640	3900	4000	4000
TPH C ₅ -C ₆ Aliphatic	mg/kg	570000	590000	600000	3200	5900	12000
TPH C ₆ -C ₈ Aliphatic	mg/kg	600000	610000	620000	7800	17000	40000
TPH C ₈ -C ₁₀ Aliphatic	mg/kg	13000	13000	13000	2000	4800	11000
TPH C ₁₀ -C ₁₂ Aliphatic	mg/kg	13000	13000	13000	9700	23000	47000
TPH C ₁₂ -C ₁₆ Aliphatic	mg/kg	13000	13000	13000	59000	82000	90000
TPH C ₁₆ -C ₃₅ Aliphatic	mg/kg	250000	250000	250000	1600000	1700000	1800000
TPH C ₃₅ -C ₄₄ Aliphatic	mg/kg	250000	250000	250000	1600000	1700000	1800000
TPH C ₅ -C ₇ Aromatic	mg/kg	56000	56000	56000	26000	46000	86000
TPH C ₇ -C ₈ Aromatic	mg/kg	56000	56000	56000	56000	110000	180000
TPH C ₈ -C ₁₀ Aromatic	mg/kg	5000	5000	5000	3500	8100	17000
TPH C ₁₀ -C ₁₂ Aromatic	mg/kg	5000	5000	5000	16000	28000	34000
TPH C ₁₂ -C ₁₆ Aromatic	mg/kg	5100	5100	5000	36000	37000	38000
TPH C ₁₆ -C ₂₁ Aromatic	mg/kg	3800	3800	3800	28000	28000	28000
TPH C ₂₁ -C ₃₅ Aromatic	mg/kg	3800	3800	3800	28000	28000	28000
TPH C ₃₅ -C ₄₄ Aromatic	mg/kg	3800	3800	3800	28000	28000	28000
Benzene	mg/kg	72	72	73	27	47	90
Toluene	mg/kg	56000	56000	56000	56000	110000	180000
Ethylebenzene	mg/kg	24000	24000	25000	5700	13000	27000
Xylene	mg/kg	41000	42000	43000	5900	14000	30000

Copyright Land Quality Management Ltd reproduced with permission Publication No S4UL3250. All rights reserved

Determinant	Units	GAC Value					
		Park POS			Allotments		
Arsenic	mg/kg	170			43		
Cadmium	mg/kg	532			1.9		
Chromium	mg/kg	33000			18000		
Chromium VI	mg/kg	220			1.8		
Lead	mg/kg	1300			80		
Mercury	mg/kg	240			19		
Nickel	mg/kg	3400			230		
Selenium	mg/kg	1800			88		
Copper	mg/kg	44000			520		
Zinc	mg/kg	170000			620		
Cyanide	mg/kg						
SOM	%	1	2.5	6	1	2.5	6
Phenol	mg/kg	440	690	1300	23	42	83
Napthalene	mg/kg	1200	1900	3000	4.1	10	24
Acenaphtylene	mg/kg	29000	30000	30000	28	69	160
Acenaphthene	mg/kg	29000	30000	30000	34	85	200
Flourene	mg/kg	20000	20000	20000	27	67	160
Phenanthrene	mg/kg	6200	6200	6300	15	38	90
Anthracene	mg/kg	150000	150000	150000	380	950	2200
Fluoranthene	mg/kg	6300	6300	6400	52	130	290
Pyrene	mg/kg	15000	15000	15000	110	270	620
Benzo(a)Anthracene	mg/kg	49	56	62	2.9	6.5	13
Chrysene	mg/kg	93	110	120	4.1	9.4	19
Benzo(b)Flouranthene	mg/kg	13	15	16	0.99	2.1	3.9
Benzo(k)Flouranthene	mg/kg	370	410	440	37	75	130
Benzo(a)Pyrene	mg/kg	11	12	13	0.97	2.0	3.5
Indeno(123-cd)Pyrene	mg/kg	150	170	180	9.5	21	39
Dibenzo(a,h)Anthracene	mg/kg	1.1	1.3	1.4	0.14	0.27	0.43
Benzo(ghi)Perylene	mg/kg	1400	1500	1600	290	470	640
TPH C ₅ -C ₆ Aliphatic	mg/kg	95000	130000	180000	730	1700	3900
TPH C ₆ -C ₈ Aliphatic	mg/kg	150000	220000	320000	2300	5600	13000
TPH C ₈ -C ₁₀ Aliphatic	mg/kg	14000	18000	21000	320	770	1700
TPH C ₁₀ -C ₁₂ Aliphatic	mg/kg	21000	23000	24000	2200	4400	7300
TPH C ₁₂ -C ₁₆ Aliphatic	mg/kg	25000	25000	26000	11000	13000	13000
TPH C ₁₆ -C ₃₅ Aliphatic	mg/kg	450000	480000	490000	260000	270000	270000
TPH C ₃₅ -C ₄₄ Aliphatic	mg/kg	450000	480000	490000	260000	270000	270000
TPH C ₅ -C ₇ Aromatic	mg/kg	76000	84000	92000	13	27	57
TPH C ₇ -C ₈ Aromatic	mg/kg	87000	95000	100000	22	51	120
TPH C ₈ -C ₁₀ Aromatic	mg/kg	7200	8500	9300	8.6	21	51
TPH C ₁₀ -C ₁₂ Aromatic	mg/kg	9200	9700	10000	13	31	74
TPH C ₁₂ -C ₁₆ Aromatic	mg/kg	10000	10000	10000	23	57	130
TPH C ₁₆ -C ₂₁ Aromatic	mg/kg	7600	7700	7800	46	110	260
TPH C ₂₁ -C ₃₅ Aromatic	mg/kg	7800	7800	7900	370	820	1600
TPH C ₃₅ -C ₄₄ Aromatic	mg/kg	7800	7800	7900	370	820	1600
Benzene	mg/kg	90	100	110	0.017	0.034	0.075
Toluene	mg/kg	87000	95000	100000	22	51	120
Ethylebenzene	mg/kg	17000	22000	27000	16	39	91
Xylene	mg/kg	17000	23000	31000	28	67	160

Copyright Land Quality Management Ltd reproduced with permission Publication No S4UL3250. All rights reserved

Appendix E



(c) Crown copyright and database rights 2021 Ordnance Survey 100031673 Date: 24/11/21 Scale: 1:500 Map Centre: 470674,106444 Data updated: 20/10/21 Our Ref: 710884 - 1 Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2021 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

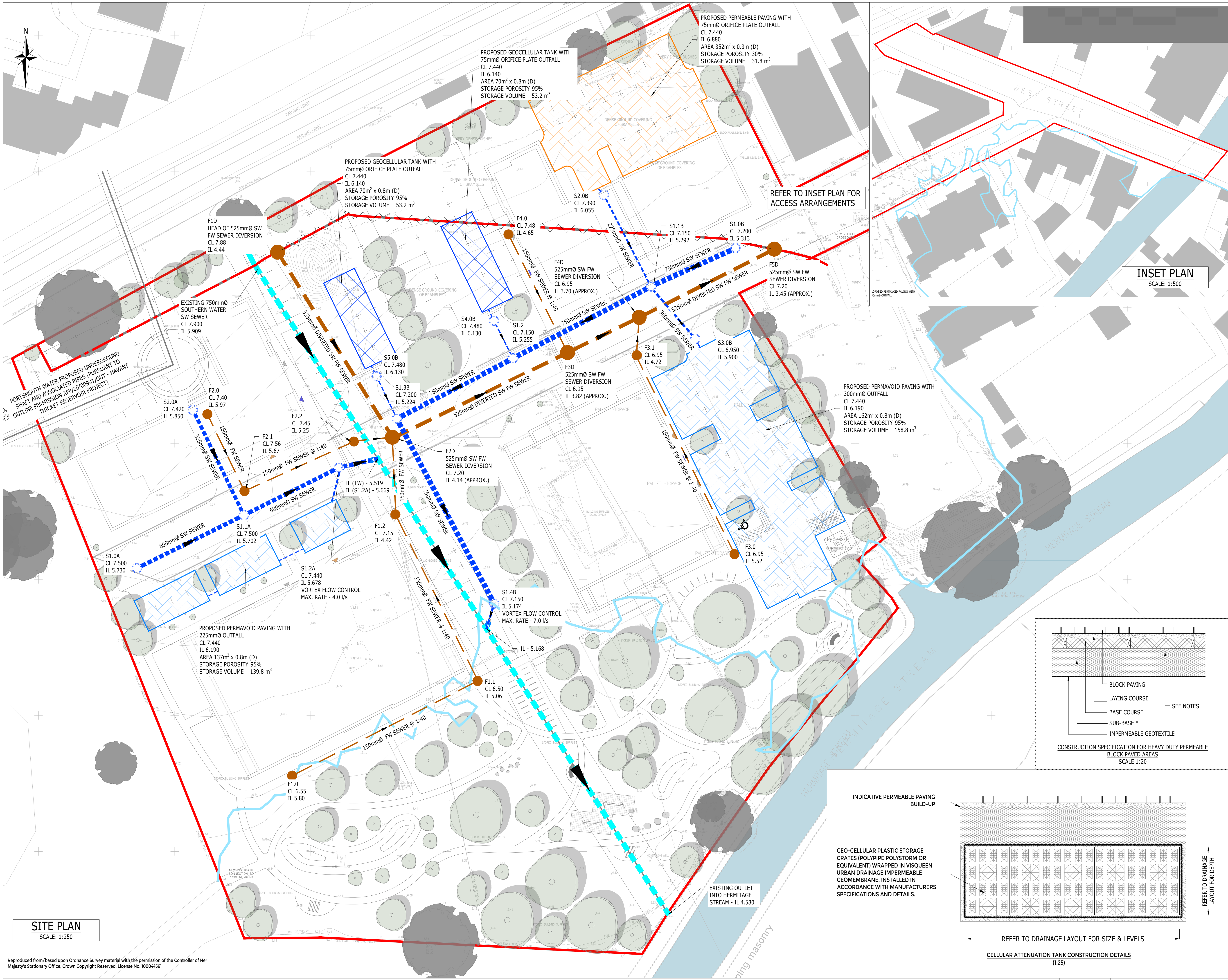
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

wendy.turner@t-d-s.com
TDSSW 400



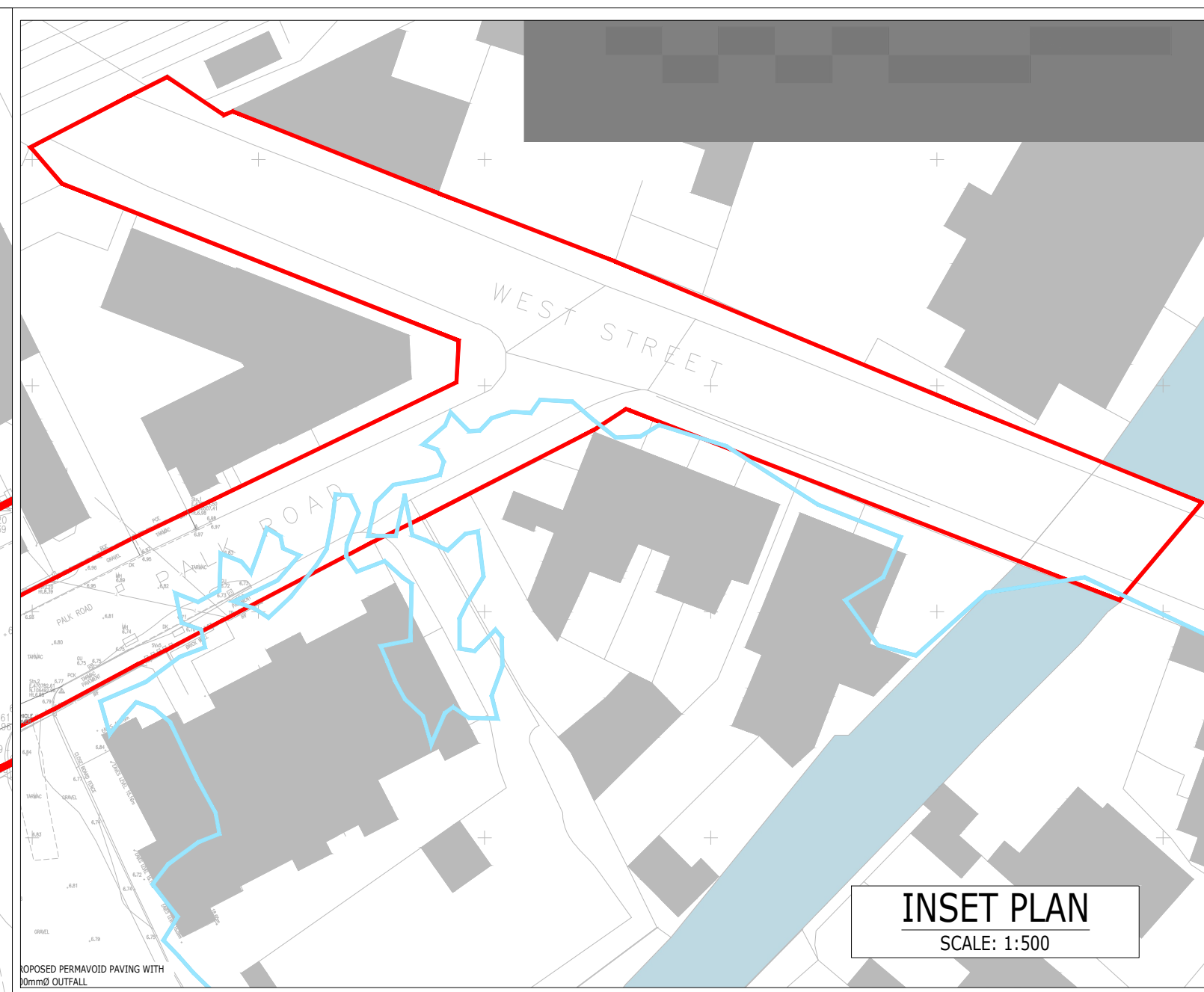
Appendix F

Appendix G



SITE PLAN
SCALE: 1:250

Reproduced from/based upon Ordnance Survey material with the permission of the Controller of Her Majesty's Stationary Office, Crown Copyright Reserved. License No. 100044561



INSET PLAN
SCALE: 1:500

- NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE RELEVANT SPECIFICATION AND ALL OTHER RELATED DRAWINGS ISSUED BY THE ENGINEER.
 - DO NOT SCALE FROM THIS DRAWING. WORK FROM FIGURED DIMENSIONS ONLY.
 - ALL DIMENSIONS SHOWN ON THIS DRAWING ARE IN METRES, UNLESS OTHERWISE STATED.
 - DRAWING BASED ON PROPOSED SITE LAYOUT PLAN, DRAWING NUMBER 21085 - X01 - PROPOSED SITE LAYOUT (CONCEPT) BY AZAD, DATED NOV 2023
 - TOPOGRAPHICAL SURVEY BY DORSET LAND SURVEYING, DRAWING NUMBER 7726, DATED 10.21.2021.
 - PREDICTED FLOOD EXTENTS WERE MODELLED BY ARDENT CONSULTING ENGINEERS. THE FLOOD MODELLED WAS A 1 IN 100 YR EVENT WITH A 37% ACCOUNTING FOR CLIMATE CHANGE.
 - THE MINIMUM FINISHED FLOOR LEVEL SHOULD BE SET AT 6.93m AOD.
 - AREAS WITHIN THE PREDICTED FLOOD EXTENTS AND THE PROPOSED DEVELOPMENT BOUNDARY TO REMAIN AT EXISTING LEVELS.

PERMEABLE PAVING NOTES
HEAVY DUTY: TO BE USED FOR ALL SHARED DRIVES, PARKING COURTS AND PRIVATE ACCESS ROADS

* THE FORMATION OF THE PERMEABLE PAVING SUB-BASE MUST NOT EXCEED A GRADIENT OF 1/40.

FOR STEEPER GRADIENTS, USE MAXIMUM GRADIENT OF 1/40 FOR FORMATION, APPLYING VERTICAL STEPS AS NECESSARY, BUT ENSURING MINIMUM SUB-BASE THICKNESS IS ALWAYS ACHIEVED.

PERMEABLE PAVING CONSTRUCTION SPECIFIED ABOVE IS SUITABLE FOR CBR VALUES OF BETWEEN 2% & 5%. FOR CBR VALUES OUTSIDE OF THIS RANGE, REFER BACK TO THE ENGINEER FOR CLARIFICATION.

ALL MATERIAL SPECIFICATION AND WORKMANSHIP OF PERMEABLE PAVING CONSTRUCTION TO BE STRICTLY IN ACCORDANCE WITH RECOMMENDATIONS BY MARSHALLS.

- KEY
- SITE BOUNDARY
 - INDICATIVE FOUL WATER SEWER
 - INDICATIVE SURFACE WATER SEWER
 - INDICATIVE PERMEABLE PAVING (30% VOIDS)
 - INDICATIVE PERMAVOID PAVING (95% VOIDS)
 - INDICATIVE GEOCELLULAR TANK (95% VOIDS)
 - EXISTING 750mm SOUTHERN WATER SURFACE WATER SEWER
 - EXISTING SOUTHERN WATER FOUL SEWER
 - EXISTING SOUTHERN WATER FOUL SEWER TO BE ABANDONED
 - HYDROBRAKE FLOW CONTROL STRUCTURE
 - NON-RETURN VALVE

FOR INFORMATION ONLY

NOT FOR CONSTRUCTION

F	LAYOUT UPDATED (FEB. 2024)	LB	CC	BC	15.02.24
E	DESIGN FOR UPDATED LAYOUT (A1) - DRAFT	LB	CC	BC	10.01.24
D	FLOOD VOLUME ADDED	TA	CC	BC	09.06.23
C	MINOR UPDATES	TA	CC	BC	24.05.23
B	UPDATED FOR LLFA COMMENTS	TA	CC	BC	16.05.23
A	PLANNING ISSUE	TD	CC	BC	11.11.22
Rev	Description	Drn	Chk	App	Date

ARDENT CONSULTING ENGINEERS

Third Floor
The Hallmark Building
52-56 Leadenhall Street
London
EC3M 5JE

Tel: 020 7680 4088
Web: www.ardent-ce.co.uk
E-mail: enquiries@ardent-ce.co.uk



Client

BELLWAY HOMES (WESSEX)

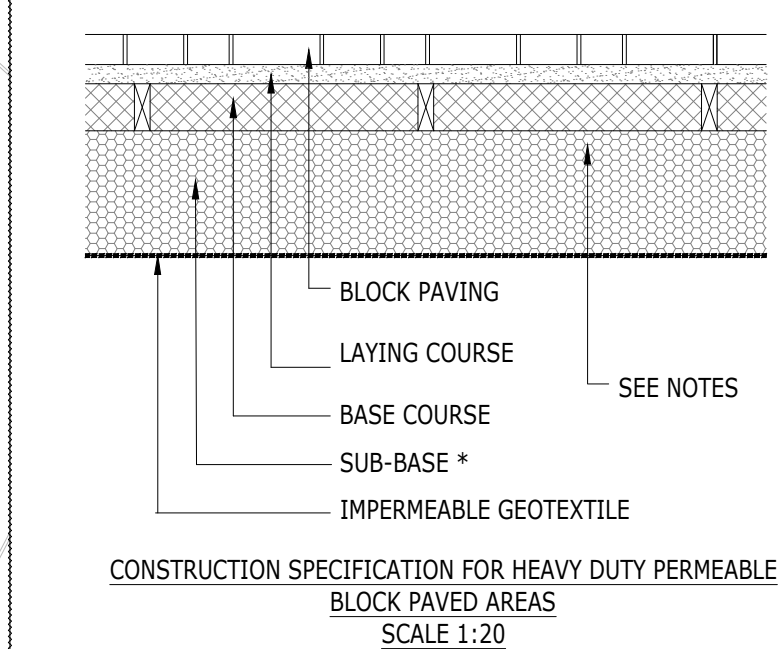
Project Title:

LAND AT PALK ROAD, HAVANT

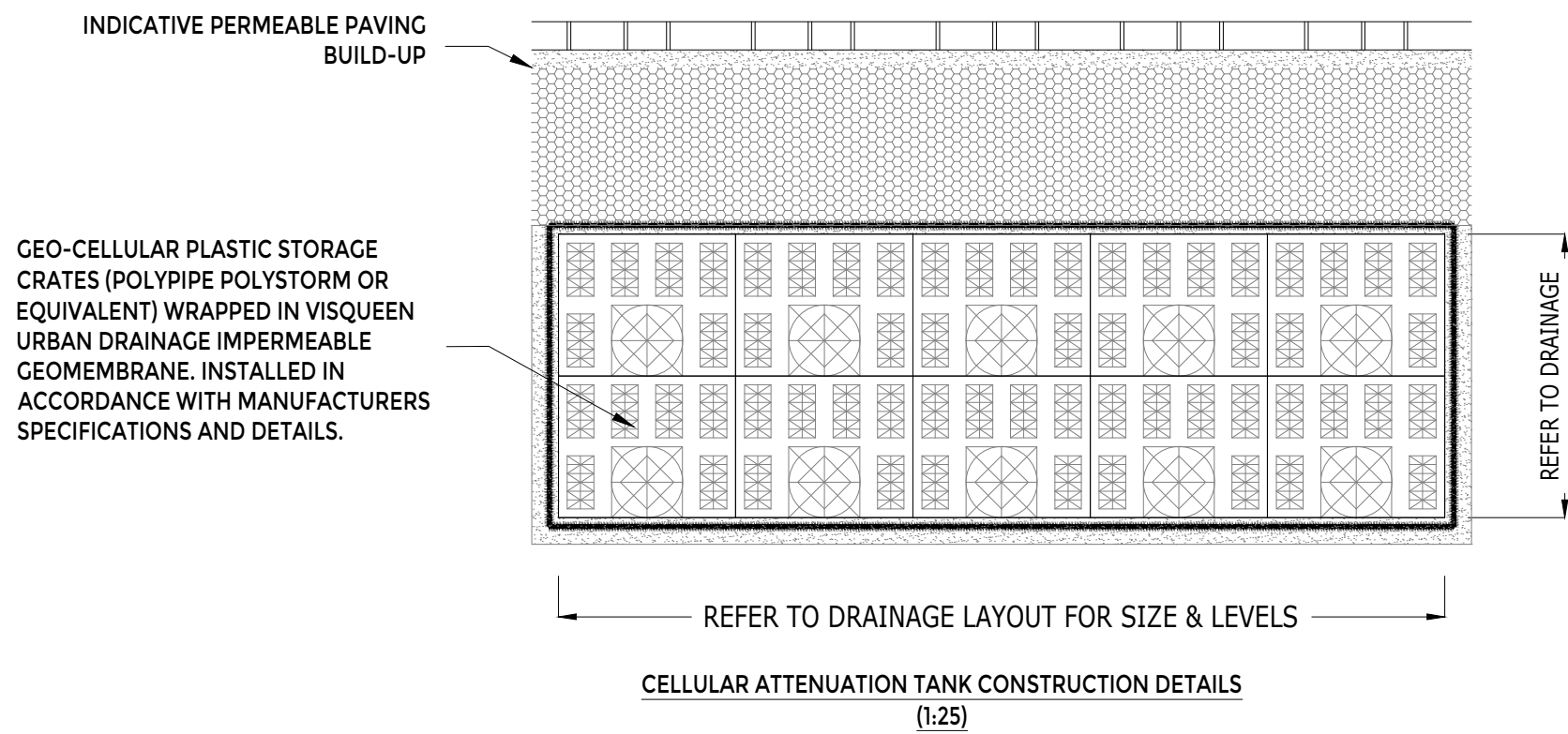
Drawing Title:

FOUL AND SURFACE WATER DRAINAGE STRATEGY

A1 Scale	Date	Designed by
AS SHOWN	MAY 23	TD
Drawn by	Checked by	Approved by
FH	CC	BC
Drawing Number	2108040-001	Rev F



CONSTRUCTION SPECIFICATION FOR HEAVY DUTY PERMEABLE BLOCK PAVED AREAS
SCALE 1:20



CELLULAR ATTENUATION TANK CONSTRUCTION DETAILS
(1:25)

Appendix H

Ardent		Page 1
3rd Floor, The Hallmark Building 52-56 LeadenHall Street London, EC3M 5JE		
Date 17/10/2022 16:54 File	Designed by fhammer Checked by	
Innovyze Source Control 2020.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years) 100 SAAR (mm) 736 Urban 0.000
Area (ha) 1.000 Soil 0.400 Region Number Region 7

Results 1/s

QBAR Rural 3.6
QBAR Urban 3.6

Q100 years 11.5

Q1 year 3.1
Q30 years 8.2
Q100 years 11.5

©1982-2020 Innovyze

Appendix I

EXISTING SURFACE WATER

Existing site information:

Site Boundary Area	13000	m ²
Developable Area	1.3	ha
Impermeable Area	1.1000	ha

Modified Rational Method Equation:

$$Q_n = 2.78 CiA$$

where:

C	Runoff Coeffic =	1 (in this case 1 as using impermeable area)
i_n	Rainfall Intensity for n return period (mm/hr)	
A	Impermeable Area (Ha)	
Q_n	Runoff for n return period (l/s)	

Rainfall Intensity:

The rainfall intensities for various return periods were extracted from Table 1(a) of the Transport and Road Research Laboratory Report - Estimated rainfall for drainage calculations in the United Kingdom (TRRL Report LR 595) by C. P. Young. For the 5 min duration.

i_1	50.8 mm/hr
i_{30}	113.02 mm/hr
i_{100}	143.9 mm/hr

Existing Surface Water Runoff:

Therefore:

			C		i_n		A		Q_n
Q_1	2.78	x	1	x	50.8	x	1.1	=	155.35 l/s
Q_{30}	2.78	x	1	x	113.0	x	1.1	=	345.62 l/s
Q_{100}	2.78	x	1	x	143.9	x	1.1	=	440.05 l/s

Appendix J

2108040 Palk Road Planning Catchment A
--

Designed by LB
Checked by CC

Network 2020.1



Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.002	A	7.440	5.669	5.519	750	0

Ardent Consulting Engineers			Page 3																																																																										
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment A																																																																											
Date 01/01/2024		Designed by LB																																																																											
File 2108040 - Palk Road 2024 - Tanks.MDX		Checked by CC																																																																											
Innovyze		Network 2020.1																																																																											
Online Controls for Catchment A																																																																													
Hydro-Brake® Optimum Manhole: AS 1.2A, DS/PN: 1.002, Volume (m³): 6.7																																																																													
Unit Reference MD-SHE-0090-4000-1300-4000 Design Head (m) 1.300 Design Flow (l/s) 4.0 Flush-Flo™ Objective Minimise upstream storage Application Surface Sump Available Yes Diameter (mm) 90 Invert Level (m) 5.678 Calculated Minimum Outlet Pipe Diameter (mm) 150 Suggested Manhole Diameter (mm) 1200																																																																													
<table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.300</td><td>4.0</td><td>Kick-Flo®</td><td>0.796</td><td>3.2</td></tr><tr><td>Flush-Flo™</td><td>0.388</td><td>4.0</td><td>Mean Flow over Head Range</td><td>-</td><td>3.5</td></tr></table>						Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.300	4.0	Kick-Flo®	0.796	3.2	Flush-Flo™	0.388	4.0	Mean Flow over Head Range	-	3.5																																																						
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																								
Design Point (Calculated)	1.300	4.0	Kick-Flo®	0.796	3.2																																																																								
Flush-Flo™	0.388	4.0	Mean Flow over Head Range	-	3.5																																																																								
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																																																																													
<table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>2.8</td><td>0.600</td><td>3.8</td><td>1.600</td><td>4.4</td><td>2.600</td><td>5.5</td><td>5.000</td><td>7.5</td><td>7.500</td><td>9.1</td></tr><tr><td>0.200</td><td>3.7</td><td>0.800</td><td>3.2</td><td>1.800</td><td>4.7</td><td>3.000</td><td>5.9</td><td>5.500</td><td>7.9</td><td>8.000</td><td>9.4</td></tr><tr><td>0.300</td><td>3.9</td><td>1.000</td><td>3.5</td><td>2.000</td><td>4.9</td><td>3.500</td><td>6.3</td><td>6.000</td><td>8.2</td><td>8.500</td><td>9.7</td></tr><tr><td>0.400</td><td>4.0</td><td>1.200</td><td>3.9</td><td>2.200</td><td>5.1</td><td>4.000</td><td>6.8</td><td>6.500</td><td>8.5</td><td>9.000</td><td>9.9</td></tr><tr><td>0.500</td><td>3.9</td><td>1.400</td><td>4.1</td><td>2.400</td><td>5.3</td><td>4.500</td><td>7.1</td><td>7.000</td><td>8.8</td><td>9.500</td><td>10.2</td></tr></table>						Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	2.8	0.600	3.8	1.600	4.4	2.600	5.5	5.000	7.5	7.500	9.1	0.200	3.7	0.800	3.2	1.800	4.7	3.000	5.9	5.500	7.9	8.000	9.4	0.300	3.9	1.000	3.5	2.000	4.9	3.500	6.3	6.000	8.2	8.500	9.7	0.400	4.0	1.200	3.9	2.200	5.1	4.000	6.8	6.500	8.5	9.000	9.9	0.500	3.9	1.400	4.1	2.400	5.3	4.500	7.1	7.000	8.8	9.500	10.2
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																		
0.100	2.8	0.600	3.8	1.600	4.4	2.600	5.5	5.000	7.5	7.500	9.1																																																																		
0.200	3.7	0.800	3.2	1.800	4.7	3.000	5.9	5.500	7.9	8.000	9.4																																																																		
0.300	3.9	1.000	3.5	2.000	4.9	3.500	6.3	6.000	8.2	8.500	9.7																																																																		
0.400	4.0	1.200	3.9	2.200	5.1	4.000	6.8	6.500	8.5	9.000	9.9																																																																		
0.500	3.9	1.400	4.1	2.400	5.3	4.500	7.1	7.000	8.8	9.500	10.2																																																																		
©1982-2020 Innovyze																																																																													

Ardent Consulting Engineers		Page 4																												
Suite 207 One Alie Street London E1 8DE	2108040 Palk Road Planning Catchment A																													
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX	Designed by LB Checked by CC																													
Innovyze Network 2020.1																														
Storage Structures for Catchment A Porous Car Park Pipe: 3.000 <table><tr><td>Manning's N</td><td>0.075</td><td>Width (m)</td><td>3.8</td></tr><tr><td>Infiltration Coefficient Base (m/hr)</td><td>0.00000</td><td>Length (m)</td><td>36.1</td></tr><tr><td>Membrane Percolation (mm/hr)</td><td>1000</td><td>Slope (1:X)</td><td>707.8</td></tr><tr><td>Max Percolation (l/s)</td><td>38.1</td><td>Depression Storage (mm)</td><td>5</td></tr><tr><td>Safety Factor</td><td>1.0</td><td>Evaporation (mm/day)</td><td>3</td></tr><tr><td>Porosity</td><td>0.95</td><td>Membrane Depth (mm)</td><td>300</td></tr><tr><td>Invert Level (m)</td><td>6.190</td><td></td><td></td></tr></table>			Manning's N	0.075	Width (m)	3.8	Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	36.1	Membrane Percolation (mm/hr)	1000	Slope (1:X)	707.8	Max Percolation (l/s)	38.1	Depression Storage (mm)	5	Safety Factor	1.0	Evaporation (mm/day)	3	Porosity	0.95	Membrane Depth (mm)	300	Invert Level (m)	6.190		
Manning's N	0.075	Width (m)	3.8																											
Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	36.1																											
Membrane Percolation (mm/hr)	1000	Slope (1:X)	707.8																											
Max Percolation (l/s)	38.1	Depression Storage (mm)	5																											
Safety Factor	1.0	Evaporation (mm/day)	3																											
Porosity	0.95	Membrane Depth (mm)	300																											
Invert Level (m)	6.190																													
©1982-2020 Innovyze																														

Suite 207
One Alie Street
London E1 8DE

2108040 Palk Road Planning Catchment B
--

Date	01/01/2024
------	------------

Designed by LB

File 2108040 - Palk Road 2024 - Tanks.MDX

Checked by CC

Innovyze

Network 2020.1



Summary of Critical Results by Maximum Level (Rank 1) for Catchment A

PN	US/MH Name	Duration (mins)	US/CL (m)	Water	Surcharged	Flooded	Pipe		Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	
2.000	AS 2.0A	120	7.420	6.603	0.228	0.000	0.09	12.1	SURCHARGED
1.001	AS 1.1A	120	7.500	6.603	0.301	0.000	0.12	16.0	SURCHARGED
3.000	AP. Paving	120	7.440	6.603	-0.537	0.000	0.01	8.7	OK
3.001	AOutfall	120	7.440	6.603	0.264	0.000	0.21	5.4	SURCHARGED
1.002	AS 1.2A	120	7.440	6.602	0.324	0.000	0.02	4.0	SURCHARGED

Suite 207
One Alie Street
London E1 8DE

2108040 Palk Road Planning Catchment A
--

Date	01/01/2024
------	------------

Designed by LB

File 2108040 - Palk Road 2024 - Tanks.MDX

Checked by CC

Innovyze

Network 2020.1



Summary of Critical Results by Maximum Level (Rank 1) for Catchment A

PN	US/MH Name	Duration (mins)	US/CL (m)	Water	Surcharged	Flooded	Pipe		Status
				Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	
2.000	AS 2.0A	120	7.420	6.406	0.031	0.000	0.06	7.9	SURCHARGED
1.001	AS 1.1A	120	7.500	6.406	0.104	0.000	0.08	10.6	SURCHARGED
3.000	AP. Paving	120	7.440	6.407	-0.733	0.000	0.01	8.4	OK
3.001	AOutfall	120	7.440	6.407	0.068	0.000	0.22	5.8	SURCHARGED
1.002	AS 1.2A	120	7.440	6.406	0.128	0.000	0.02	4.0	SURCHARGED

Ardent Consulting Engineers		Page 1
Suite 207 One Alie Street London E1 8DE	2108040 Palk Road Planning Catchment A	
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX	Designed by LB Checked by CC	
Innovyze	Network 2020.1	

Summary of Critical Results by Maximum Level (Rank 1) for Catchment A

Simulation Criteria

Areal Reduction Factor 1.000	Manhole Headloss Coeff (Global) 0.500	MADD Factor * 10m³/ha Storage 2.000
Hot Start (mins) 0	Foul Sewage per hectare (l/s) 0.000	Inlet Coefficient 0.800
Hot Start Level (mm) 0	Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000	

Number of Input Hydrographs 0	Number of Offline Controls 0	Number of Time/Area Diagrams 0
Number of Online Controls 1	Number of Storage Structures 1	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR M5-60 (mm) 19.400 Cv (Summer) 0.750
Region England and Wales	Ratio R 0.350 Cv (Winter) 0.840

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, 240, 360, 480, 960, 1440	
Return Period(s) (years) 100	
Climate Change (%) 0	

PN	US/MH Name	Duration (mins)	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Cap. (l/s)	Status
1.000	AS 1.0A	120	7.500	6.562	0.232	0.000	0.01 2.0	SURCHARGED

©1982-2020 Innovyze

Ardent Consulting Engineers		Page 2
Suite 207	2108040 Palk Road	
One Alie Street	Planning	
London E1 8DE	Catchment B	
Date 01/01/2024	Designed by LB	
File 2108040 - Palk Road 2024 - Tanks.MDX	Checked by CC	
Innovyze	Network 2020.1	

STORM SEWER DESIGN by the Modified Rational Method

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	24.900	0.010	2490.0	0.039	5.00	0.0		0.050	→[↓]		Cellular Storage	🚒
4.001	4.774	0.048	99.5	0.000	0.00	0.0	0.600		○	150	Pipe/Conduit	🚰
1.002	17.799	0.031	580.0	0.034	0.00	0.0	0.600		○	750	Pipe/Conduit	🚰
5.000	25.000	0.010	2500.0	0.038	5.00	0.0		0.050	→[↓]		Cellular Storage	🚒
5.001	5.469	0.055	99.4	0.000	0.00	0.0	0.600		○	150	Pipe/Conduit	🚰
1.003	29.310	0.051	580.0	0.000	0.00	0.0	0.600		○	750	Pipe/Conduit	🚰
1.004	3.175	0.005	580.0	0.040	0.00	0.0	0.600		○	750	Pipe/Conduit	🚰

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)
4.000	50.00	7.33	6.140	0.039	0.0	0.0	0.0	0.18	380.6	5.3
4.001	50.00	7.41	6.130	0.039	0.0	0.0	0.0	1.01	17.8	5.3
1.002	50.00	11.17	5.255	0.317	0.0	0.0	0.0	1.15	510.1	42.9
5.000	50.00	7.35	6.140	0.038	0.0	0.0	0.0	0.18	378.1	5.1
5.001	50.00	7.44	6.130	0.038	0.0	0.0	0.0	1.01	17.8	5.1
1.003	50.00	11.60	5.224	0.355	0.0	0.0	0.0	1.15	510.1	48.1
1.004	50.00	11.64	5.174	0.395	0.0	0.0	0.0	1.15	510.1	53.5

2108040 Palk Road Planning Catchment B
--

Designed by LB

Checked by CC

Network 2020.1



Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.004		7.150	5.168	5.168	750	0

Ardent Consulting Engineers		Page 4																								
Suite 207 One Alie Street London E1 8DE	2108040 Palk Road Planning Catchment B																									
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX	Designed by LB Checked by CC																									
Innovyze	Network 2020.1																									
Online Controls for Catchment B Orifice Manhole: S 2.0B, DS/PN: 2.001, Volume (m³): 37.9 Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 6.055 Orifice Manhole: S 3.0B, DS/PN: 3.001, Volume (m³): 141.6 Diameter (m) 0.300 Discharge Coefficient 0.600 Invert Level (m) 5.900 Orifice Manhole: S 4.0B, DS/PN: 4.001, Volume (m³): 56.4 Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 6.130 Orifice Manhole: S 5.0B, DS/PN: 5.001, Volume (m³): 56.4 Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 6.130 Hydro-Brake® Optimum Manhole: S 1.4B, DS/PN: 1.004, Volume (m³): 17.2 <table><tr><td>Unit Reference</td><td>MD-SHE-0115-7000-1550-7000</td><td>Sump Available</td><td>Yes</td></tr><tr><td>Design Head (m)</td><td>1.550</td><td>Diameter (mm)</td><td>115</td></tr><tr><td>Design Flow (l/s)</td><td>7.0</td><td>Invert Level (m)</td><td>5.174</td></tr><tr><td>Flush-Flo™</td><td>Calculated</td><td>Minimum Outlet Pipe Diameter (mm)</td><td>150</td></tr><tr><td>Objective</td><td>Minimise upstream storage</td><td>Suggested Manhole Diameter (mm)</td><td>1200</td></tr><tr><td>Application</td><td>Surface</td><td></td><td></td></tr></table>			Unit Reference	MD-SHE-0115-7000-1550-7000	Sump Available	Yes	Design Head (m)	1.550	Diameter (mm)	115	Design Flow (l/s)	7.0	Invert Level (m)	5.174	Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150	Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200	Application	Surface		
Unit Reference	MD-SHE-0115-7000-1550-7000	Sump Available	Yes																							
Design Head (m)	1.550	Diameter (mm)	115																							
Design Flow (l/s)	7.0	Invert Level (m)	5.174																							
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	150																							
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200																							
Application	Surface																									
©1982-2020 Innovyze																										

Ardent Consulting Engineers		Page 6
Suite 207 One Alie Street London E1 8DE	2108040 Palk Road Planning Catchment B	
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX	Designed by LB Checked by CC	
Innovyze	Network 2020.1	
Storage Structures for Catchment B Porous Car Park Pipe: 2.000 Manning's N0.075Width (m)14.4 Infiltration Coefficient Base (m/hr)0.00000Length (m)24.5 Membrane Percolation (mm/hr)1000Slope (1:X)490.0 Max Percolation (l/s)98.0Depression Storage (mm)5 Safety Factor2.0Evaporation (mm/day)3 Porosity0.30Membrane Depth (mm)300 Invert Level (m)6.880 Porous Car Park Pipe: 3.000 Manning's N0.075Width (m)17.1 Infiltration Coefficient Base (m/hr)0.00000Length (m)30.5 Membrane Percolation (mm/hr)1000Slope (1:X)598.8 Max Percolation (l/s)145.1Depression Storage (mm)5 Safety Factor2.0Evaporation (mm/day)3 Porosity0.95Membrane Depth (mm)300 Invert Level (m)6.250 Cellular Storage Pipe: 4.000 Manning's N0.050Infiltration Coefficient Side (m/hr)0.00000 Invert Level (m)6.140Safety Factor2.0 Infiltration Coefficient Base (m/hr)0.00000Porosity0.95		
©1982-2020 Innovyze		

Ardent Consulting Engineers			Page 7																																						
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment B																																							
Date 01/01/2024		Designed by LB																																							
File 2108040 - Palk Road 2024 - Tanks.MDX		Checked by CC																																							
Innovyze		Network 2020.1																																							
Cellular Storage Pipe: 4.000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>70.0</td><td>0.0</td><td>0.800</td><td>70.0</td><td>0.0</td><td>0.801</td><td>0.0</td><td>0.0</td></tr></tbody></table> Cellular Storage Pipe: 5.000 Manning's N 0.050 Infiltration Coefficient Side (m/hr) 0.00000 Invert Level (m) 6.140 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>70.0</td><td>0.0</td><td>0.800</td><td>70.0</td><td>0.0</td><td>0.801</td><td>0.0</td><td>0.0</td></tr></tbody></table>						Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	70.0	0.0	0.800	70.0	0.0	0.801	0.0	0.0	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	70.0	0.0	0.800	70.0	0.0	0.801	0.0	0.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																	
0.000	70.0	0.0	0.800	70.0	0.0	0.801	0.0	0.0																																	
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)																																	
0.000	70.0	0.0	0.800	70.0	0.0	0.801	0.0	0.0																																	
©1982-2020 Innovyze																																									

Ardent Consulting Engineers			Page 8																												
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment B																													
Date 01/01/2024		Designed by LB																													
File 2108040 - Palk Road 2024 - Tanks.MDX		Checked by CC																													
Innovyze		Network 2020.1																													
Summary of Critical Results by Maximum Level (Rank 1) for Catchment B																															
Simulation Criteria Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0																															
Synthetic Rainfall Details Rainfall Model FSR M5-60 (mm) 19.400 Cv (Summer) 0.750 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840 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, 240, 360, 480, 960, 1440 Return Period(s) (years) 1 Climate Change (%) 0																															
<table><tr><th colspan="3"></th><th colspan="3">Water Surcharged Flooded</th><th colspan="2">Pipe</th></tr><tr><th>PN</th><th>US/MH Name</th><th>Duration (mins)</th><th>US/CL (m)</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Pipe Flow (l/s) Status</th></tr><tr><td>1.000</td><td>S 1.0B</td><td>120</td><td>7.200</td><td>5.585</td><td>-0.478</td><td>0.000</td><td>0.00 0.5</td><td>OK</td></tr></table>									Water Surcharged Flooded			Pipe		PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Pipe Flow (l/s) Status	1.000	S 1.0B	120	7.200	5.585	-0.478	0.000	0.00 0.5	OK
			Water Surcharged Flooded			Pipe																									
PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Pipe Flow (l/s) Status																							
1.000	S 1.0B	120	7.200	5.585	-0.478	0.000	0.00 0.5	OK																							
©1982-2020 Innovyze																															

Suite 207
One Alie Street
London E1 8DE

2108040 Palk Road Planning Catchment B
--

Date	01/01/2024
------	------------

Designed by LB

File 2108040 - Palk Road 2024 - Tanks.MDX

Checked by CC

Innovyze

Network 2020.1



Summary of Critical Results by Maximum Level (Rank 1) for Catchment B

				Water	Surcharged	Flooded	Pipe		
	US/MH	Duration	US/CL	Level	Depth	Volume	Flow /	Flow	
PN	Name	(mins)	(m)	(m)	(m)	(m³)	Cap.	(l/s)	Status
2.000	P Paving	2.0	15 7.480	6.916	-0.264	0.000	0.02	1.8	OK
2.001	S 2.0B	15	7.480	6.202	-0.078	0.000	0.09	3.9	OK
3.000	P Paving	3.0	15 6.850	6.265	-0.285	0.000	0.00	2.9	OK
3.001	S 3.0B	15	6.950	5.997	-0.203	0.000	0.09	7.6	OK
1.001	S 1.1B	120	7.150	5.585	-0.457	0.000	0.03	8.6	OK
4.000	Tank 4.0	240	7.480	6.166	-0.775	0.000	0.00	0.7	OK
4.001	S 4.0B	240	7.480	6.166	-0.114	0.000	0.04	0.5	OK
1.002	S 1.2B	120	7.150	5.585	-0.420	0.000	0.03	8.6	OK
5.000	Tank 5.0	240	7.480	6.166	-0.775	0.000	0.00	0.7	OK
5.001	S 5.0B	240	7.480	6.166	-0.114	0.000	0.03	0.5	OK
1.003	S 1.3B	120	7.200	5.584	-0.390	0.000	0.02	7.5	OK
1.004	S 1.4B	120	7.150	5.582	-0.341	0.000	0.02	6.8	OK

Ardent Consulting Engineers			Page 1																																		
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment B																																			
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX		Designed by LB Checked by CC																																			
Innovyze		Network 2020.1																																			
Summary of Critical Results by Maximum Level (Rank 1) for Catchment B																																					
Simulation Criteria Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0																																					
Synthetic Rainfall Details Rainfall Model FSR M5-60 (mm) 19.400 Cv (Summer) 0.750 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840 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, 240, 360, 480, 960, 1440 Return Period(s) (years) 30 Climate Change (%) 40																																					
<table><tr><th colspan="2"></th><th colspan="2">Water</th><th colspan="2">Surcharged</th><th colspan="2">Flooded</th><th colspan="2">Pipe</th><th></th></tr><tr><th>PN</th><th>US/MH Name</th><th>Duration (mins)</th><th>US/CL (m)</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Flow (l/s)</th><th>Status</th><th></th></tr><tr><td>1.000</td><td>S 1.0B</td><td>120</td><td>7.200</td><td>6.444</td><td>0.381</td><td>0.000</td><td>0.04</td><td>10.1</td><td>SURCHARGED</td><td></td></tr></table>							Water		Surcharged		Flooded		Pipe			PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status		1.000	S 1.0B	120	7.200	6.444	0.381	0.000	0.04	10.1	SURCHARGED	
		Water		Surcharged		Flooded		Pipe																													
PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status																												
1.000	S 1.0B	120	7.200	6.444	0.381	0.000	0.04	10.1	SURCHARGED																												
©1982-2020 Innovyze																																					

Ardent Consulting Engineers			Page 1																																		
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment B																																			
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX		Designed by LB Checked by CC																																			
Innovyze		Network 2020.1																																			
Summary of Critical Results by Maximum Level (Rank 1) for Catchment B																																					
Simulation Criteria Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0																																					
Synthetic Rainfall Details Rainfall Model FSR M5-60 (mm) 19.400 Cv (Summer) 0.750 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840 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, 240, 360, 480, 960, 1440 Return Period(s) (years) 30 Climate Change (%) 0																																					
<table><tr><th colspan="2"></th><th colspan="2">Water</th><th colspan="2">Surcharged</th><th colspan="2">Flooded</th><th colspan="2">Pipe</th><th></th></tr><tr><th>PN</th><th>US/MH Name</th><th>Duration (mins)</th><th>US/CL (m)</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Flow (l/s)</th><th>Status</th><th></th></tr><tr><td>1.000</td><td>S 1.0B</td><td>120</td><td>7.200</td><td>6.327</td><td>0.264</td><td>0.000</td><td>0.03</td><td>6.3</td><td>SURCHARGED</td><td></td></tr></table>							Water		Surcharged		Flooded		Pipe			PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status		1.000	S 1.0B	120	7.200	6.327	0.264	0.000	0.03	6.3	SURCHARGED	
		Water		Surcharged		Flooded		Pipe																													
PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status																												
1.000	S 1.0B	120	7.200	6.327	0.264	0.000	0.03	6.3	SURCHARGED																												
©1982-2020 Innovyze																																					

Ardent Consulting Engineers		Page 1																																		
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment B																																		
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX		Designed by LB Checked by CC																																		
Innovyze		Network 2020.1																																		
Summary of Critical Results by Maximum Level (Rank 1) for Catchment B																																				
Simulation Criteria Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0																																				
Synthetic Rainfall Details Rainfall Model FSR M5-60 (mm) 19.400 Cv (Summer) 0.750 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840 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, 240, 360, 480, 960, 1440 Return Period(s) (years) 100 Climate Change (%) 45																																				
<table><tr><th colspan="2"></th><th colspan="2">Water</th><th colspan="2">Surcharged</th><th colspan="2">Flooded</th><th colspan="2">Pipe</th><th></th></tr><tr><th>PN</th><th>US/MH Name</th><th>Duration (mins)</th><th>US/CL (m)</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Flow (l/s)</th><th>Status</th><th></th></tr><tr><td>1.000</td><td>S 1.0B</td><td>240</td><td>7.200</td><td>6.567</td><td>0.504</td><td>0.000</td><td>0.06</td><td>12.9</td><td>SURCHARGED</td><td></td></tr></table>						Water		Surcharged		Flooded		Pipe			PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status		1.000	S 1.0B	240	7.200	6.567	0.504	0.000	0.06	12.9	SURCHARGED	
		Water		Surcharged		Flooded		Pipe																												
PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status																											
1.000	S 1.0B	240	7.200	6.567	0.504	0.000	0.06	12.9	SURCHARGED																											
©1982-2020 Innovyze																																				

Ardent Consulting Engineers			Page 1																																		
Suite 207 One Alie Street London E1 8DE		2108040 Palk Road Planning Catchment B																																			
Date 01/01/2024 File 2108040 - Palk Road 2024 - Tanks.MDX		Designed by LB Checked by CC																																			
Innovyze		Network 2020.1																																			
Summary of Critical Results by Maximum Level (Rank 1) for Catchment B																																					
Simulation Criteria Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0																																					
Synthetic Rainfall Details Rainfall Model FSR M5-60 (mm) 19.400 Cv (Summer) 0.750 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840 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, 240, 360, 480, 960, 1440 Return Period(s) (years) 100 Climate Change (%) 0																																					
<table><tr><th colspan="2"></th><th colspan="2">Water</th><th colspan="2">Surcharged</th><th colspan="2">Flooded</th><th colspan="2">Pipe</th><th></th></tr><tr><th>PN</th><th>US/MH Name</th><th>Duration (mins)</th><th>US/CL (m)</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Flow (l/s)</th><th>Status</th><th></th></tr><tr><td>1.000</td><td>S 1.0B</td><td>120</td><td>7.200</td><td>6.419</td><td>0.356</td><td>0.000</td><td>0.04</td><td>9.7</td><td>SURCHARGED</td><td></td></tr></table>							Water		Surcharged		Flooded		Pipe			PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status		1.000	S 1.0B	120	7.200	6.419	0.356	0.000	0.04	9.7	SURCHARGED	
		Water		Surcharged		Flooded		Pipe																													
PN	US/MH Name	Duration (mins)	US/CL (m)	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Flow (l/s)	Status																												
1.000	S 1.0B	120	7.200	6.419	0.356	0.000	0.04	9.7	SURCHARGED																												
©1982-2020 Innovyze																																					

Appendix K

**C753 SIMPLE INDEX TREATMENT
METHOD**
OCTOBER 2022

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Table 1: Pollution hazard indices for different land use classifications

(land use in bold applicable for the development).

	Mitigation indices		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bio retention system (Green roof)	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	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 the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Table 2: Indicative SuDS mitigation indices for discharges to surface waters

(bold text is applicable to this development).

For surface water discharge from Residential Parking Areas and Low Traffic Roads <300 traffic movements/day			
	Required mitigation indices		
Source	TSS	Metals	Hydrocarbons
Low	0.2	0.2	0.05
Type of SuDS component provided			
Permeable pavement	0.7	0.6	0.7
Total	0.7	0.6	0.7
Check	+0.5	+0.4	+0.65

Table 3: SuDS mitigation indices provided

Appendix L

1.0 INTRODUCTION

- 1.1 The development at Palk Road includes a number of Sustainable Drainage Systems (SuDS) as part of the surface water drainage system including permeable paving and geocellular tanks. This Technical Note sets out an outline management plan for the aforementioned SuDS components.
- 1.2 The proposed SuDS components in addition to addressing climate change will bring a number of benefits in terms of water quality, environmental, and social amenity.
- 1.3 The maintenance of all SuDS components will be in accord with the best practices and CIRIA document C753 "The SuDS Manual". Typical maintenance activities for the proposed SuDS components have been reproduced from Table 32.1 of "The SuDS Manual" in **Table 1** below. A private management company will be set up to maintain the surface water drainage network, including on-site SuDS. .

Table 1: Typical SuDS Maintenance Activities

Operation and maintenance activity	SuDS component	
	Geo-cellular Tank	Permeable paving Green roof
Regular maintenance		
Inspection	■	■
Litter and debris removal	□	■
Grass cutting		
Weed and invasive plant control		□
Shrub management		□
Shoreline vegetation		
Aquatic vegetation management		
Occasional maintenance		
Sediment management	■	■
Vegetation replacement		
Vacuum sweeping and brushing		■
Remedial maintenance		
Structure rehabilitation / repair	□	□
■ will be required □ may be required		

2.0 SuDS MANAGEMENT PLAN

- 2.1 This plan is intended to cover all on-site drainage structures. The Site Management Team should oversee and implement the SuDS Management Plan and designate a qualified person who will be responsible for the proper operation and maintenance of the surface water drainage structures.

Water Quality Management

- 2.2 In line with Tables 26.2 and 26.3 of the CIRIA C753 The SuDS Manual, it can be seen that the proposed permeable paving would provide sufficient treatment for the surface water runoff from the Site.
- 2.3 The surface drainage network would also be designed to protect and enhance the quality of surface water runoff through the removal of sediment and pollutants. Catchpit manholes and silt trapped gullies will reduce the amount of pollutants entering the system. Preventive maintenance of the system will include a comprehensive source reduction program of regular sweeping and litter removal, prohibitions on the use of pesticides, and maintenance of bin areas.

Maintenance Program

- 2.4 The Site Management Team will conduct the SuDS Management Plan set forth in this document. The Site Management will ensure that inspections and record keeping are timely and accurate. Inspection & Maintenance Log Forms should include the date and physical conditions of the structures, depth of sediment in structures, evidence of overtopping or debris blockage and maintenance required of each structure. Records of maintenance will be kept on file on-site and copies of Inspection & Maintenance Log sheets indicating all work and inspections will be available to the Council upon request. A model Maintenance log is appended for reference.
- 2.5 Regular maintenance should include:
- Inspect channel and gully inlet grates and remove any debris every 6 months or as determined to be reasonable based on experience with the installed

systems to ensure that the gullies are working in their intended fashion and that they are free of debris;

- Inspect gully sumps and bottom of drain manholes quarterly; if depth of sediment in sumps exceeds 50% capacity, sediment must be removed. Excessive sediment shall be removed and properly disposed by a licensed drainage cleaning company.
- All litter shall be picked up and removed from the parking areas, external bin stores and soft landscaping.
- Inspect external bin stores for spillage and scattered litter must be performed on a regular basis to prevent the spread of pollutants into the surface water drainage network.
- The inlets, outlet and vents and overflows of SuDS components should be checked annually and after large storms to ensure that they are in good condition and operating as designed. Regular maintenance includes inspection and identification of any areas that are not operating correctly monthly for the first 3 months and then every 6 months after.

Winter Maintenance Program

- 2.6 Ensure that drainage structures are not blocked by ice, snow, debris or rubbish during winter months.

Operation and Maintenance requirements

- 2.7 Recommendations for the operation and maintenance including typical frequencies are included in **Tables 2** and **3** below.

Table 22: SuDS Operation and Maintenance Requirements- Permeable paving

SUDS Element	Permeable Paving	
Maintenance Period	Maintenance Task	Frequency
Regular Maintenance	Brushing and vacuuming	Once a year or as required
Occasional Maintenance	Stabilise and mow contributing adjacent area	As required
	Removal of weed or management using glyphosate applied directly	As required

	into weeds by an applicator rather than spraying	
Remedial Work	Remediate any landscaping which has been raised to within 50mm of the level of the paving	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to structural performance or a hazard to users.	As required.
Monitoring	Rehabilitation of surface or upper structure by remedial sweeping	Every 10 to 15 years, or as required
	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	3 monthly, 48hrs after large storms in first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 3: SuDS Operation and Maintenance Requirements- Attenuation tank

SUDS Element	Attenuation Tank	
Maintenance Period	Maintenance Task	Frequency
Maintenance Work	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 risk to performance)	Monthly

	Remove sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial Work	Repair/rehabilitate inlets, outlets, 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.

Suds Management Plan- Appendix A
Drainage Operation and Maintenance Log

Site Maintenance Supervisor: _____ Date: _____

☐ Routine ☐ Response to rainfall event _ in ☐ Other: _____

BMP	Frequency	Date Performed	Comments
Gullies and Manholes	Monthly Inspections		
	Maintenance Quarterly and as necessary		
Pavement Areas (parking, driveways, service areas)	Quarterly Sweeping		
	Rubbish & Litter Removal as Necessary		
Geocellular attenuation (permavoid)	Bi-annual maintenance as necessary		
	Inspect and identify areas not operating property every 3 months (for the first 3 months) and every 6 months after		
Geocellular attenuation (permavoid)	Full bi-annual inspection		

Appendix M

PROPOSED FOUL WATER



Unit Type	Proposed Area/Units		Hours (hrs)	Foul Water Flow Rate l/day		Peak Factor	Peaked Loading l/s		Loading (l/s)
General Housing p	83	units	24	150	per person	6.6	0.0114583	per person	0.951

TOTAL PROPOSED FOUL LOADING

=

0.951