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DRAINAGE STRATEGY



QUEENS VIEW, NETLEY



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DRAINAGE STRATEGY

for

QUEENS VIEW
NETLEY

Client:
Eastleigh Borough Council
Eastleigh House
Upper Market Street
Eastleigh SO50 9YN

ISSUE		A	B	C
Issued By	C Hendry	C Hendry		
Date	12.07.2023	04.09.2023		
Purpose	Information	Information		
Approved By	CH	CH		

Project No. AAL307

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1.0 Executive Summary

Arch Associates Limited have been commissioned by Eastleigh Borough Council to prepare the Foul and Surface Water Drainage Strategy to accompany the planning application at Queens View, Netley. The proposed development includes demolition of the existing structures to make way for a new build residential scheme of 18 apartments.

Foul water is intended to connect to the existing public sewer to the west of the site. Surface water is intended to infiltration into the permeable River Terrace Deposits on site via a combination of permeable paving and buried crate soakaways. All surface water drainage features are designed to cater for the 1 in 100-year storm event plus 45% allowance for climate change.

2.0 The Site

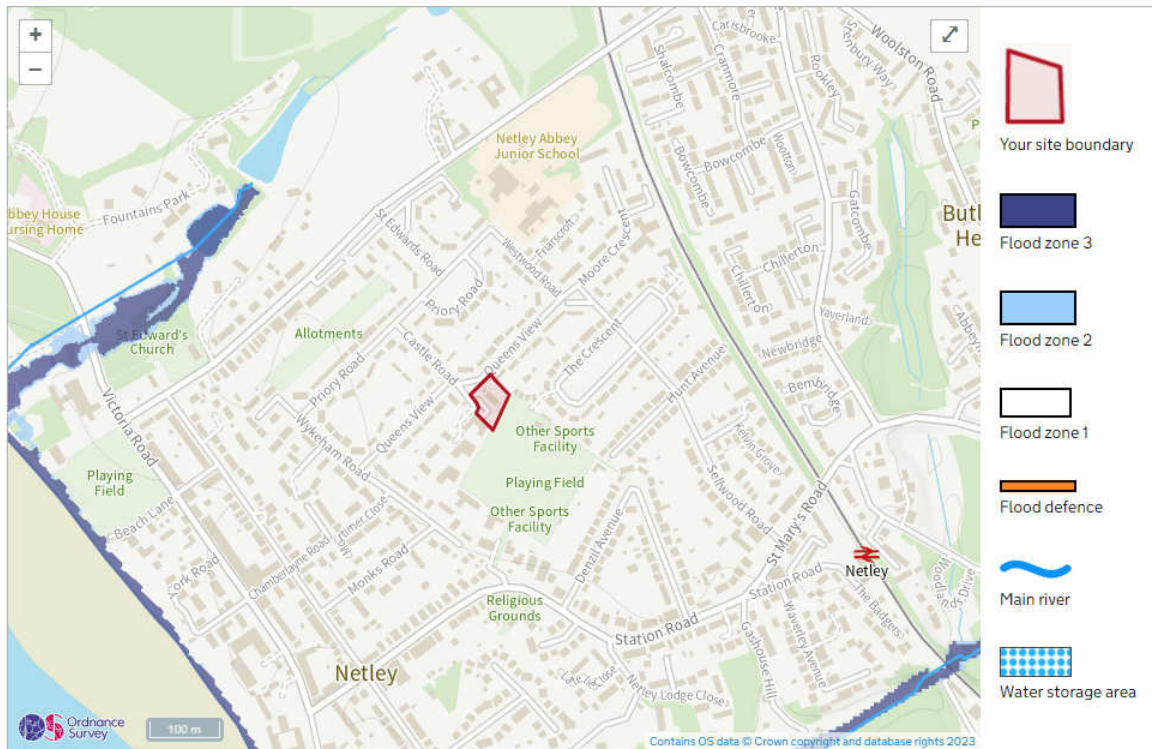
The existing site comprises two semi-detached, two storeyed, brick, mixed use buildings with commercial use on ground floor and flats on the first floor, including garages adjacent to their northern and eastern edge. The site surfacing includes a tarmacadam covered car park and turning circle to the west and south-west, along with concrete flooring present in front of the structures and to the rear of the northern site building. Domestic gardens relating to the flats, mainly grass covered, and a conservatory were noted to the rear of the eastern building. Grassed areas with tarmacadam and gravel paths crossing were noted in the north-west and in the eastern part of the site and a grass patch was spotted in the middle of the turning circle.

Semi mature and mature trees line the eastern and north-eastern fringe of the study area, forming the domestic gardens of the properties. A mature tree is noted in the northern side of the site, next to the lock up garages.

The subject area was sloping down gently to the south-west with a very gentle slope towards The Solent, located ~800m from the site.

The site surroundings include residential properties and recreational ground to the south and east, housing across Queens View Road to the north and west, and commercial developments with associated grounds to the south-west.



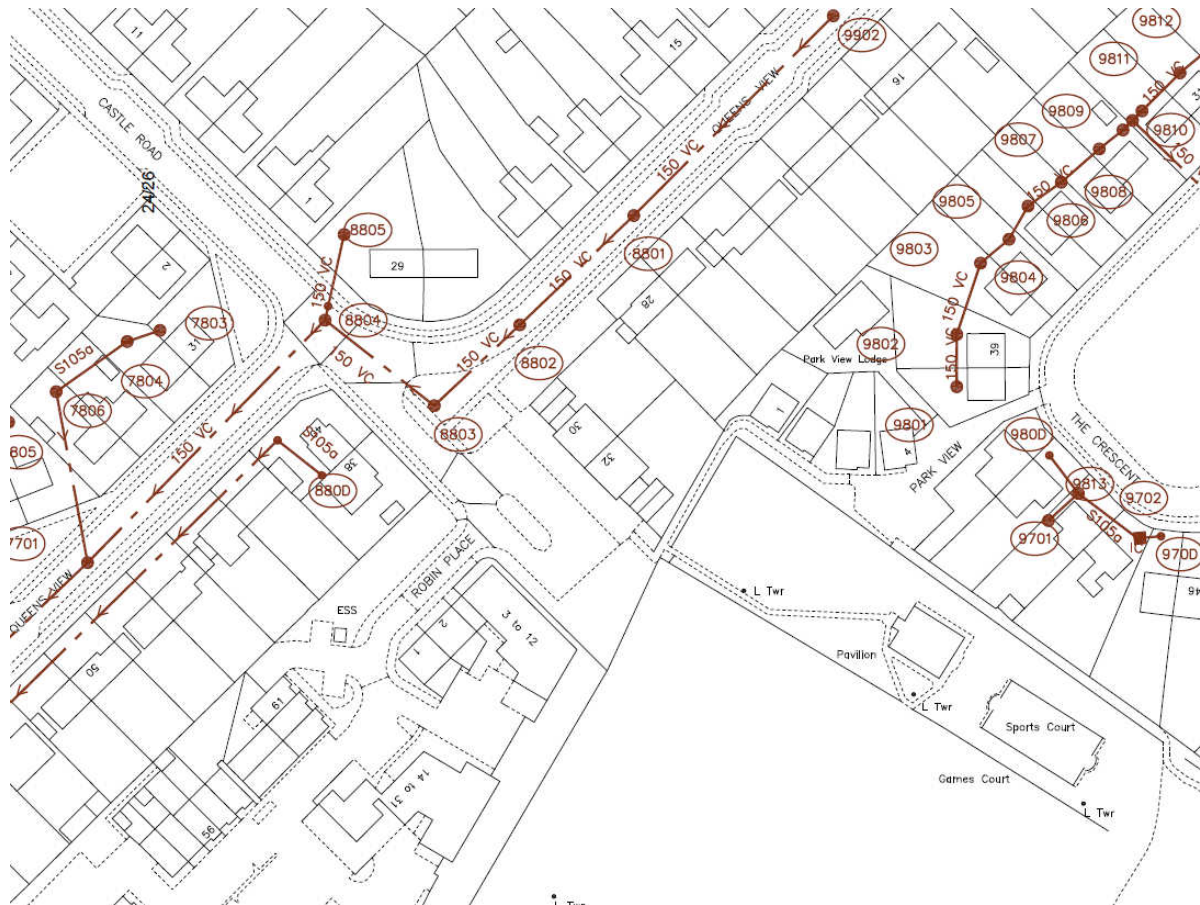


A review of the UK Government's Flood-Warning Information Services mapping online indicates that the site is located within Flood Zone 1, very low risk of flooding. No further flood risk assessment has therefore been completed apart from looking at on-site exceedance routes, which are discussed later in this report.

2.1 Existing Site Topography and Drainage

The site is generally flat with gentle gradient fall from north to south. The topographical survey shows the highest spot level within the site is circa 24.95mAOD in the north, and lowest point of 24.08mAOD in the south. Refer to the topographical survey in Appendix 2.

A review of the Southern Water asset plan confirms that there is an existing public foul sewer running within Queens View, into which we understand the existing structures drain their foul water.

Geology

BGS online mapping indicates the site to be underlain by the Selsey Sand Formation bedrock, with overlying River Terrace Deposits.

A site-specific site investigation was carried out by Soils Limited in May 2023, which confirmed the BGS mapping. The Selsay Sand formation was encountered in WSI at a depth of 6m below ground level. The River Terrace Deposits were generally found to be of gravelly sandy clay over clayey sandy Gravel.

Groundwater was not encountered during any of the investigations, which was expected in this location given the geology, elevation, and proximity to the coast.

BRE365 infiltration was conducted, and the results ranged from 1.78×10^{-5} m/s to 6.8×10^{-5} m/s.

3.0 Proposed Foul and Surface Water Drainage

3.1 Foul Water

Given the site topography and location of the existing foul sewer, it is proposed to discharge the foul water run-off from the site into the existing 150mm diameter foul main sewer to the west of the site. The proposed foul water drainage strategy has been designed in accordance with the Sewage Sector Guidance and Part H of the Building Regulations. Refer to Appendix 5 – Drainage Strategy Drawings for details.

A section 106 application to connect will need to be made with Southern Water should the scheme be granted planning permission.

The hydraulic design for the discharge rate for the foul wastewater design has been calculated based on a flow rate of 4000l/day per dwelling. Therefore, the discharge rate for the proposed residential development of 18 dwellings equates to a peak foul discharge rate of approximately 0.74 litres/second.

3.2 Surface Water

Consideration has been given to all possible forms of discharge for surface water and in accordance with the hierarchy with the NPPF 2021, which are as follows:

1. Collect surface water runoff for re-use
2. Infiltrate to ground
3. Discharge to a surface water body
4. Discharge to a surface water sewer, highway drain, or another drainage system

5. Discharge to a combined sewer

Collection and re-use of surface water should be considered but is likely to be of small volume in comparison to the proposed development and is therefore not considered as materially contributing to the management of surface water run-off during extreme events.

Infiltration to ground is considered achievable on this scheme due to the presence of permeable granular soils, which will provide adequate capacity for permeable paving and buried soakaway features.

Discharge to a surface water body is not viable at this site due to a lack of surface water bodies in the vicinity. It is also not required due to the viability of infiltration.

Discharge to a surface water sewer, highway drain, or another drainage system is not viable as there are no surface water sewers in the vicinity. It is also not required due to the viability of infiltration.

Based on available information, infiltration to ground is proposed for this development. Run-off from the roof areas and small parking area to the south of the site will be directed into buried crate soakaways, while external hard landscaping will infiltrate to ground via the use of permeable paving and porous subbase.

In accordance with Table 25.2 of the SuDS Manual, a factor of safety of 3 has been utilised in calculation of the subbase depth due to the area being drained being over 1000m² and the risk of damage being a minor inconvenience.

The crate soakaways and permeable paving have been designed in MicroDrainage and an infiltration rate of $1.78 \times 10^{-5} \text{ m/s}$ (0.064m/hr) has been used.

SuDS Treatment Train Components

Based on the guidance in CIRIA C753, the following analysis has been undertaken with the relative mitigation indices for the proposed levels of treatment taken from CIRIA C753 Tables 26.3 (surface waters) and Table 26.4. The resultant assessment is summarised within the Table below.

Element	Pollution Hazard Indices			
	Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Residential Parking	Low	0.5	0.4	0.4
	Pollution Mitigation Indices			
Permeable Pavign		0.7	0.6	0.7
Total		0.7	0.6	0.7
Sufficiency		Sufficient	Sufficient	Sufficient

4.0 Maintenance of SUDS features:

General Maintenance

In addition to the maintenance of specific SuDS features, such as soakaways, the following table outlines general maintenance requirements of the surface water system.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove sediment & debris from pre treatment devices & floor of inspection chambers	Annually
	Cleaning of any gutters & any filters on downpipes	Annually
	Trimming and roots that may be causing blockages	Annually (or as required)
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually

Permeable Block Paving

Permeable surfaces including permeable block paving, porous asphalt, gravel or free draining soils that allow rain to percolate through the surface into underlying drainage layers. They must be protected from silt, sand, compost, mulch, etc. Permeable block paving and porous asphalt can be cleaned by suction brushing.

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Twice a year, once after autumn leaf fall, and the second in spring pay particular attention to areas



		where water runs onto pervious surface from adjacent impermeable areas as this is most likely to collect sediment.
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into weeds by an applicator rather than spraying	As required once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, though vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace any lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	
	Inspect for evidence of poor operation and/or weed growth if required take	Three monthly, 48 h after large storms in first six months



	remedial action	
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Soakaways

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Inspect for sediment and debris in pre treatment components and floor of inspection chamber	Annually
Occasional Maintenance	Remove sediment and debris from pre treatment components and floor of inspection chamber	As required based on inspection
Remedial Actions	Reconstruct soakaway if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway).	As required
Monitoring	Inspect silt traps and note rate of sedimentation	Monthly in first year, then annually
	Check soakaways to ensure emptying is occurring	Annually

Foul Drainage Maintenance

The foul drainage system has been designed in accordance with the relevant codes of practice and should achieve self-cleansing velocity with the anticipated foul water flows. Maintenance of the system should therefore be minimal, but blockages may occur with improper use, such as inappropriate objects being flushed down toilets, in which case rodding or jetting may be required. This work should be carried out on an ad hoc basis by a specialist contractor.

SuDS Maintenance Responsibility

The maintenance of the SuDS features, and drainage generally, will be funded by the charity. The management company will formally appoint a drainage company (under a service agreement) to inspect and maintain the pumping station apparatus at the required frequency.

5.0 Exceedance Flow Routes

Exceedance flow routes may be caused by a flow rate higher than the design storm event, or potentially a blockage in the system. Consideration must therefore be given to the routes of overland exceedance flow routes.

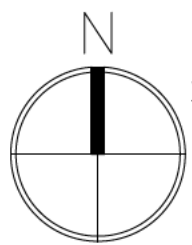
Given the topography of the site, exceedance flows would naturally flow downhill towards the southern boundary, at which point it will discharge onto Castle Road.



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Appendix 1

Proposed Masterplan



Notes
1. This drawing is the copyright of MH Architects Ltd
2. Do not scale this drawing except for Local Authority planning purposes
3. All dimensions must be checked on site by the contractor prior to commencement of the works.

Client Approval					
X	A - Approved				
X	B - Approved with comments				
X	C - Do not use				
Rev.	Revision Note/Purpose of Issue	Drawn By	Date	Chk By	Date

- site boundary
- proposed trees
- existing trees
- existing trees removed
- existing building footprint
- access points to homes
- block paving - shared surface
- paving - footpaths
- tarmac
- public landscape
- private landscape
- boundary landscape

Eastleigh Borough Council
Queens View
Netley Abbey
Residential proposals

Drawing Title
Site plan

Drawn	Date		Checked		Date		Scale at A1	
JDM	12/06/23		HJG		13/06/23		1:200	
Job No.	Pro.	Org.	Zone	Level	Type	Role	No.	Rev.
19-067	EBC	MHA	XX	XX	DR	AR	0019	A01
Purpose of Issue								

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Appendix 2

Topographical Survey



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Appendix 3

Southern Water Sewer Plan

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SEWER RECORDS PAGE 2 OF 2

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Drawn by: KumariM	
Title: 30 Queens View	
Date: 02/11/2021	



Appendix 4

Extracts of Site Investigation



Main Investigation Report

at

30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA

for

Eastleigh Borough Council

Reference: 20870/MIR

June 2023

Control Document

Project

30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA

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Main Investigation Report (MIR)

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.



Commission

This document comprises the Main Investigation Report (MIR) and incorporates the results, discussion, and conclusions to this intrusive works. General site data is recorded below:

Commission Record	
Client	Eastleigh Borough Council
Site Name	30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA
Grid Reference	SU 458 088
Soils Limited Quotation Ref	Q27498rev102, dated 16 th March 2023
Clients Purchase Order	000337277, dated 6 th April 2023

Documents associated with this development that must be referred to are given below.

Record Of Associated Documents			
Reference	Type	Date	Creator
LP3177/DS/1	Phase I Desk Study and Site Reconnaissance	4 th January 2023	Leap Environmental Ltd

Limitations and Disclaimers

The report was prepared solely for the brief described in Section 1.1 of this report.

The contents, recommendations and advice given in the report are subject to the Terms and Conditions given in Soils Limited's Quotation

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the Client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

If the term "competent person" is used in this report or any Soils Limited document, it means an engineering geologist or civil engineer with a minimum of three years post graduate experience in the understanding and application of the appropriate codes of practice.

Unless the site investigation works have been designed and specified in accordance with EC7, this report is a Geotechnical Investigation Report and is not necessarily a Ground Investigation Report as defined by EC7 (Eurocode 7 Part 1, §3.4, Part 2, §6.1) or a Geotechnical Design Report (Eurocode 7 Part 1, §2.8) as defined by Eurocode 7 and as such may not characterise the ground conditions and additional works may be required to comply with the requirements of EC7.

Within the report reference to ground level relates to the site level at the time of the investigation, unless otherwise stated.

Exploratory hole is a generic term used to describe a method of direct investigation. The term exploratory pit, borehole or window sample borehole implies the specific technique used to produce an exploratory hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The Client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice were adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by Derwentside Environmental Testing Services (DETS) in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 (as updated 2021) as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

It must be noted that a detailed survey of the possible presence or absence of invasive species, such as Japanese Knotweed, is outside of the scope of investigation.

Deleterious materials may be present in any Made Ground that pose a potential risk to site workers, end users and adjacent vulnerable receptors. These could include a range of contaminants, including asbestos, especially if the material includes large fractions of demolition derived materials.

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible

best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

All environmental works are undertaken in the context of, and in compliance with, BS10175+A2 2017 and LCRM (EA 2021) and all other pertinent planning, standards, documentation and guidance appropriate to the site at the time of production which may include, but are not necessarily limited to, documents provided by BS/CEN/ISO, NHBC, AGS, CIEH, CIRIA, SoBRA and CLAIRE.

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Section I Introduction

I.1 Objective of Investigation

The Client commissioned Soils Limited to undertake an intrusive ground investigation and to prepare a Main Investigation Report to supply the Client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the exploratory holes.

No Preliminary Investigation Report was undertaken by Soils Limited for the site that would allow a Conceptual Site Model (CSM) to be produced and potential contamination risks to be identified and assessed. To assist in delineating the scope of works described above, reliance was also placed on the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023, which was supplied to Soils Limited by the client.

Following liaison and agreement with the Client and as recommended in the above report:

- Two (2No.) standpipe monitoring wells were installed within the boreholes, to allow groundwater/ground-gas monitoring on three (3No.) occasions.
- Soil samples were to be taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified.

I.2 Site Description

The site of the proposed development comprised two semi-detached, two storeyed, brick, mixed use buildings with commercial use on ground floor and flats on the first floor, including garages adjacent to their northern and eastern edge.

The site surfacing included a tarmacadam covered car park and turning circle to the west and south-west, along with concrete flooring present in front of the structures and to the rear of the northern site building. Domestic gardens relating to the flats, mainly grass covered, and a conservatory were noted to the rear of the eastern building. Grassed areas with tarmacadam and gravel paths crossing were noted in the north-west and in the eastern part of the site and a grass patch was spotted in the middle of the turning circle.

Semi mature and mature trees were lining the eastern and north-eastern fringe of the study area, forming the domestic gardens of the properties. A mature tree was noted in the northern side of the site, next to the lock up garages and few scattered mature trees

were in the south-eastern side of the site within the grass covered area together with some shrubbery along the south-western boundary.

The subject area was sloping down gently to the south-west with a slope of $\sim 2^\circ$, towards 'The Solent' located $\sim 800\text{m}$ from the site.

The site surroundings included residential properties and recreational ground to the south and east, housing across 'Queens View Road' to the north and west and commercial developments with associated grounds to the south-west.

The location plan is given in Figure 1. An aerial photograph of the site and its close environs has been included in Figure 2.

1.3 Proposed Development

The proposals for the site comprised demolition of the existing structures to erect a three-storey building consisting of 20 No. residential flats. The proposed development was to include hard landscaping in the form of car park spaces and a parking court, footpaths and a bin storage area. Soft landscaping was to be included in the form of private gardens mainly to the rear of the flats along with low maintenance soft landscaped areas predominantly on the perimeter of the site and within the car park area to the front.

In compiling this report reliance was placed on drawing No.: 0019 Rev. P05, dated 8th August 2022 by MH Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the Client are presented in Appendix F.

1.4 Anticipated Geology

The 1:50,000 BGS Geology map showed the site to be underlain by the Selsey Sand Formation bedrock, with overlying River Terrace Deposits.

1.4.1 River Terrace Deposits

The rivers Test and Itchen have deposited extensive spreads of River Terrace Deposits in the Southampton area, representative of ancient floodplains. In total, eleven terraces have been recorded. The River Terrace Deposits consist predominantly of gravels made up of subangular to rounded flints with a significant sand component locally with lenses of silt, clay or peat.

The five highest terraces have appreciable clay content. Poorly sorted, clayey and sandy silts and silty clays overlie the 1st, 3rd, 5th and 6th terraces and locally at above terrace gravel.

I.4.2 Selsey Sand Formation

Silty sand, silty clay and sandy clayey silt, glauconitic, bioturbated, locally calcareous.

Rests on the Marsh Farm Formation at a sharp contact on a burrowed surface overlain by glauconitic sandy silt with a few pebbles. Overlain by Barton Clay Formation.

Boundary based a distinction of sand content from fine- to very fine-grained sandstone of the Tellina Bed (topmost Selsey Formation) to the olive grey glauconitic sandy clays of the Barton Clay Formation.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q27498rev102, dated 16th March 2023), was to comprise the following items:

- Service clearance of proposed test hole locations
- 4No. window sample boreholes and dynamic probes (DPSH) up to a depth of 4.00m bgl
- Installation of wells in two (2No.) of the boreholes, to allow groundwater/ground-gas monitoring on three (3No.) occasions, following liaison and agreement with the Client
- 2No. machine excavated trial pits to allow infiltration testing in accordance with BRE365
- Geotechnical laboratory testing
- Chemical laboratory analysis

2.1.1 Actual Project Works

The actual project works were undertaken on 9th, 10th and 15th May 2023, with subsequent sample logging, laboratory testing, monitoring, and reporting. The actual works comprised:

- Service clearance of proposed test hole locations
- 4No. window sample boreholes to a maximum depth of 3.00m bgl (WS1 to WS4)
- 4No. dynamic probes (DPSH) to a maximum depth of 6.00m bgl (DP1 to DP4), adjacent and prior to the drilling of the relevant window sample boreholes
- Installation of wells in two (2No.) of the boreholes (WS1 and WS4), to allow groundwater/ground-gas monitoring on three (3No.) occasions
- 3No. machine excavated trial pits (TPSK1, TPSK2 and TPSK2b) to 1.20m, 2.50m and 1.50m bgl respectively, to allow infiltration testing in accordance with BRE365
- Geotechnical laboratory testing
- Chemical laboratory analysis

Two window sample boreholes (WS1 and WS4) were backfilled with gravel and bentonite following the installation of monitoring wells; the remaining boreholes were backfilled with gravel; all trial pits (TPSK1, TPSK2 and TPSK2b) were backfilled with arisings and left slightly proud to accommodate future settlement.

The installation details are as follows:

- Ground level to 1.00m in WS1 and to 0.40m bgl in WS4 – plain 50mm pipework/bentonite backfill
- From 1.00m and 0.40m bgl to a depth of 2.70m and 1.40m bgl in WS1 and WS4 respectively, perforated 50mm pipework/gravel backfill with bentonite seal at depth.

The window samples WS2, WS3 and WS4 and dynamic probes DP2, DP3 and DP4, stopped at shallower depths than initially planned, due to the very competent material (dense soils) encountered, through which the equipment could not safely advance. The drilled depth in WS1 was limited to 3.00m bgl, due to the sides of the borehole continuously collapsing below that depth.

Trial pit TPSK1 stopped at a shallower depth than initially planned in order to reduce the risk of the excavator striking the overhead electrical cables running above the exploratory hole location. The depth of TPSK2 was also limited, due to the sides of the trial pit continuously collapsing. TPSK2b was subsequently undertaken at the same location of TPSK2, although at a shallower depth, to examine the infiltration potential of the ground within that depth.

All exploratory hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged and sub sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

On 9th May 2023, service clearance of proposed test hole locations was undertaken using a cable avoidance tool (RD8000) to trace low and high voltage electricity cables, BT, security cabling and metal pipes. To detect non-metallic services such as fibre optic, clay drainage, plastic gas, and water services, Ground Penetration Radar (Leica DS2000) was used.

Two trial pits were machine excavated to depths of 1.20m and 2.50m below ground level (bgl) and infiltration testing was undertaken in each of them, in accordance with BRE365, the results of which are presented in Section 3.2.

On 10th May 2023, four (4No.) window sample boreholes were drilled, using a Premier Compact Series 110 rig, to depths ranging between 1.00m and 3.00m bgl.

Four super heavy dynamic probes were driven prior and adjacent to their corresponding window sample borehole to depths ranging between 1.50m and 6.00m bgl.

A standpipe was installed within each of the window sample borehole locations WS1 and WS4, to allow for continued monitoring of both groundwater and ground gas on three (3No.) occasions, following liaison and agreement with the client and as recommended in the Phase I Desk Study and Site Reconnaissance, undertaken for the site by Leap Environmental Ltd (Report ref.: LP3177/DS/1, dated January 2023).

On 12th May 2023, an additional trial pit (TPSK2b) was machine excavated to a depth of 1.20m bgl and infiltration testing was undertaken within it, in accordance with BRE365, the results of which are presented in Section 3.2.

The maximum depths of exploratory holes have been included in Table 2.1.

Table 2.1 Final Depth of Exploratory Holes

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
WS1 ^w	3.00 ¹	DP1	6.00
WS2	1.00 ²	DP2	1.50 ²
WS3	1.50 ²	DP3	1.70 ²
WS4 ^w	1.50 ²	DP4	1.80 ²
TPSK1	1.20 ²		
TPSK2	2.50 ²		
TPSK2b	1.20		

Notes: ¹ Depth limited due to sides of the hole collapsing. ² Depth limited due to dense soils encountered, w - well installation. The depths given in this table are taken from the ground level on-site at the time of investigation.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the exploratory hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference must be made to the detailed records given within Appendix B, but for the purposes of discussion, the succession of conditions encountered in the exploratory holes in descending order can be summarised as:

Made Ground (MG)
River Terrace Deposits (RTD)
Selsey Sand Formation (SLSY)

The ground conditions encountered in the exploratory holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
	Top	Bottom		
MG	G.L.	0.40 – 0.45	0.40	Firm, dark brown, sandy, gravelly CLAY to sandy, gravelly SILT, with flint, tarmacadam, brick, concrete and clinker. Rare plastic found. Frequent rootlets noted.
RTD	0.40 – 0.45	2.70	2.30	Soft to firm, greyish brown, slightly sandy, very gravelly CLAY. Occasional rootlets noted. Becoming clayey, sandy, fine to coarse flint GRAVEL with depth. Becoming slightly sandy, very gravelly CLAY with depth.
SLSY	2.70	>3.00 ¹ ²	Not proven ²	Yellowish brown, mottled orange, slightly clayey SILT.

Note(s): ¹ Final depth of exploratory hole. ² Base of strata not encountered. The depths given in this table are taken from the ground level on-site at the time of investigation. G.L. = Ground Level

It must be noted that the Selsey Sand Formation bedrock was only encountered within WS1, therefore the full depth of the River Terrace Deposits could not be established within the remaining three window sample borehole locations, which were terminated within the superficial stratum.

2.3 Ground Conditions Encountered in Exploratory Holes

The ground conditions encountered in exploratory holes have been described below in descending order. The engineering logs are presented in Appendix B.1.

2.3.1 Made Ground

Soils described as Made Ground were encountered in all four window samples and all three trial pits from ground level to depths ranging between 0.40m and 0.45m bgl.

The Made Ground typically comprised firm, dark brown, slightly sandy, gravelly CLAY to slightly sandy, slightly gravelly SILT, becoming gravelly with depth. Gravel was angular to rounded, fine to coarse flint, tarmacadam, brick, concrete and clinker. Rare plastic was found. Frequent rootlets were noted. Odour of manure was identified in WS1. Odour of chlorinated solvents was noted in WS2, and very faint soapy/floral odour was noted in WS3.

The established depth of Made Ground found at each exploratory hole location has been included in Table 2.3.

Table 2.3 Established Depth of Made Ground

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
WS1	0.40	TPSK1	0.40
WS2	0.40	TPSK2	0.40
WS3	0.40	TPSK2b	0.40
WS4	0.45		

2.3.2 River Terrace Deposits

The superficial River Terrace Deposits were encountered directly below the Made Ground in all window sample boreholes (WS1 to WS4) and inferred within their corresponding dynamic probes (DP1 to DP4) and within all exploratory pits (TPSK1, TPSK2, TPSK2b), to depths ranging from 1.00m bgl (WS2) and 2.70m bgl. However, all exploratory holes except from the location of WS/DP1 were terminated within the soils of the River Terrace Deposits, so the full depth of the stratum could not be established in these locations.

The soils typically comprised soft to firm, greyish brown, slightly sandy, very gravelly CLAY. Gravel was angular to sub angular, fine to coarse flint. Occasional rootlets were noted. Becoming yellowish to orangish brown, clayey, sandy, fine to coarse flint GRAVEL with depth. Becoming yellowish brown and orangish brown mottled, slightly sandy, very gravelly CLAY with depth. Distinct floral soapy/solvent odour was noted from 2.00m bgl in WS1.

The established depth of River Terrace Deposits found at each exploratory hole location has been included in Table 2.4.

Table 2.4 Established Depth of River Terrace Deposits

Exploratory Hole	Depth (m bgl)	Probe Hole	Depth (m bgl)
WS1	2.70	DP1	2.70 ²
WS2	1.00 ¹	DP2	1.50 ^{1 2}
WS3	1.50 ¹	DP3	1.70 ^{1 2}
WS4	1.50 ¹	DP4	1.80 ^{1 2}
TPSK1	1.20 ¹		
TPSK2	2.50 ¹		
TPSK2b	1.20 ¹		

Note: ¹ Final depth of exploratory hole. ² Inferred from dynamic probes.

2.3.3 Selsey Sand Formation

The Selsey Sand Formation bedrock was only encountered in the location of WS1 and inferred within its corresponding dynamic probe (DP1), directly below the River Terrace Deposits to the final investigatory depth of 6.00m bgl.

The stratum comprised yellowish brown, mottled orange, slightly clayey SILT. Rare clay laminations were encountered at base.

The established depth of the Selsey Sand Formation found at each exploratory hole location has been included in Table 2.5.

Table 2.5 Established Depth of Selsey Sand Formation

Exploratory Hole	Depth (m bgl)	Probe Hole	Depth (m bgl)
WS1	3.00 ¹	DPI	6.00 ^{1,2}
WS2	N/E	DP2	N/E
WS3	N/E	DP3	N/E
WS4	N/E	DP4	N/E
TPSK1	N/E		
TPSK2	N/E		
TPSK2b	N/E		

Note: ¹ Final depth of exploratory hole. ² Inferred from dynamic probes. N/E = Not encountered

2.4 Roots

Roots were encountered in all window sample boreholes and trial pits to depths ranging between 0.40m and 0.90m bgl. The established depth of root penetration found at the exploratory hole locations has been included in Table 2.6.

Table 2.6 Established Depth of Root Penetration

Exploratory Hole	Depth (m bgl)
WS1	0.65
WS2	0.65
WS3	0.80
WS4	0.90
TPSK1	0.40
TPSK2	0.50
TPSK2b	0.50

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

Semi mature and mature trees were lining the eastern and north-eastern fringe of the study area, forming the domestic gardens of the properties. A mature tree was noted in the northern side of the site, next to the lock up garages and few scattered mature trees were in the south-eastern side of the site within the gras covered area together with some shrubbery along the south-western boundary. A search on Google Earth of an aerial photograph of the site and its environs dated 1999 (earliest available aerial photograph), showed the south-eastern site boundary as being covered by mature trees.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within an exploratory pit is necessary to gain a better indication of the maximum root depth.

2.5 Groundwater

Groundwater was not encountered in any of the exploratory hole locations at the time of the investigation. This could potentially be attributed to the depth of all exploratory holes being limited.

Wells were installed in two (2No.) window sample boreholes (WS1 and WS4) to allow for combined groundwater/soil-gas monitoring on three (3No.) occasions, following instructions from the Client.

Groundwater records taken during the intrusive investigation and during the groundwater/soil-gas monitoring to date, are shown in Table 2.7.

Table 2.7 Groundwater Records and Monitoring Data

Exploratory Hole	Well Depth (m bgl)	Depth to Water (m bgl)			
		10.05.23 ¹	16.05.23 ²	26.05.23 ²	14.06.23 ²
WS1	2.70	N/E	N/E	N/E	N/E
WS4	1.40	N/E	N/E	N/E	N/E

Note: ¹ Reading taken during drilling. ² Reading taken during monitoring N/E = Not encountered

Changes in groundwater level occur for reasons including seasonal effects, rainfall events and variations in drainage.

The investigation and groundwater monitoring were conducted in May 2023, when groundwater levels should be falling from their annual maximum (highest) elevation, which typically occurs around March to the annual minimum (lowest) which typically occurs around September.

Section 3 Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

The results were converted to equivalent SPT “N₆₀” values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix C.1, Table C.1.1 and C.1.2.

Table 3.1 SPT Hammer Efficiency

Rig Reference	Energy Ratio Er (%)
Premier 4	89.93

Table 3.2 Inferred SPT Interpretation

Strata	Depth Range (m bgl)	Inferred N ₆₀ Range	Cohesive Soils	
			Cohesive Strength	Inferred Cohesion
River Terrace Deposits	0.40 – 2.70	4 - 59	Very low to Very high	Cu=20 – 295kPa
Selsey Sand Formation	2.70 – >6.00 ¹	12 - 30	Medium to Very High	Cu=60 – 150kPa
Strata	Depth Range (m bgl)	Inferred N ₆₀ Range	Granular Soils	
			Relative Density	
River Terrace Deposits	0.40 – 1.50	8 - >50	Loose to Very dense	

Note(s): SPT “N₆₀” values presented have been corrected in accordance with BS EN 22476 Part 3 ¹ Base of strata not encountered.

A full interpretation of the DPSH tests, are outlined in Appendix C.2, Table C.2.1.

3.2 Infiltration Tests

Infiltration tests were performed in trial pits TPSK1, TPSK2 and TPSK2b in order to audit the infiltration potential of the ground for development that was appropriate to the settings present on the site.

The tests were undertaken within the granular soils of River Terrace Deposits within all the locations. The test within trial pit TPSK2 was abandoned due to minimal infiltration recorded over the course of the day.

The tests comprised piping water via a water tanker in TPSK1 and TPSK2 and via a water bowser in TPSK2b. The fall in water level over time was then recorded to give an indication of soakage potential.

BRE DG365:2023 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test is completed once 75% of the water present has drained away, in order to determine whether or not the underlying ground conditions may be suitable for surface water drainage.

Table 3.3 presents the infiltration test results performed within all three exploratory pits.

Table 3.3 Infiltration Test Results

Exploratory Hole	Test Cycle	Test Stratum	Test Depth (m bgl)	Infiltration Rate (m/sec)	Notes
TPSK1	1	RTD	1.16	6.70×10^{-5}	Gravel - natural soils
	2	RTD	1.08	6.80×10^{-5}	
	3	RTD	1.06	5.94×10^{-5}	
TPSK2	1	RTD	2.42	-	No infiltration rate was calculated due to the lack of infiltration recorded.
TPSK2b	1	RTD	1.20	2.80×10^{-5}	Gravel - natural soils
	2	RTD	1.20	3.05×10^{-5}	
	3	RTD	1.20	1.78×10^{-5}	

Notes: RTD = River Terrace Deposits

Infiltration rates of between 1.78×10^{-5} m/sec and 6.80×10^{-5} m/sec were calculated within the soils of the River Terrace Deposits.

For a soakaway to be viable it is required to empty by 50% in a 24-hour period in saturated ground conditions.

3.3 Atterberg Limit Tests

Atterberg Limit tests were performed on two samples, one obtained from the cohesive beds of River Terrace Deposits and one from the cohesive soils of Selsey Sand Formation bedrock. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

Table 3.4 Atterberg Limit Results Classification

Strata	Depth (m bgl)	Volume Change Potential	
		NHBC	BRE 240
River Terrace Deposits (cohesive)	2.40	Low	Low
Selsey Sand Formation (cohesive)	2.80	None	Low

A full interpretation of the Atterberg Limit tests, is outlined in Table C.2.2, Appendix C.2 and the laboratory report in Appendix C.3.

3.4 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on four samples from the granular beds of River Terrace Deposits and on one sample from the Selsey Sand Formation bedrock.

Table 3.5 Particle Size Distribution Classification

Strata	Depth (m bgl)	Volume Change Potential	
		NHBC	BRE 240
River Terrace Deposits (granular)	1.10, 1.0-1.50, 1.0-2.0, 2.80	No	No
Selsey Sand Formation (cohesive)	2.80	Yes	Yes

Note that a cohesive soil is only classified as having a volume change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

A full interpretation of the PSD tests, is outlined in Table C.2.3, Appendix C.2 and the laboratory report in Appendix C.3.

3.5 Sulphate and pH Tests

Water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

Table 3.6 Sulphate and pH Test Results

Strata	Depth (m bgl)	Sulphate Concentration (mg/l)	pH
River Terrace Deposits (cohesive)	0.60	23	7.2
River Terrace Deposits (granular)	0.90	<10	7.4

The significance of the sulphate and pH Test results is discussed in Section 5.2 and the laboratory report in Appendix C.3.

Section 4 Engineering Appraisal

4.1 Established Ground Conditions

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the exploratory holes.

4.1.1 Made Ground

Foundations must not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design. Foundations must be taken through any Topsoil and/or Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Soils described as Made Ground were encountered in all four window samples and all three exploratory pits from ground level to depths ranging between 0.40m and 0.45m bgl. The Made Ground typically comprised firm, dark brown, slightly sandy, gravelly CLAY to slightly sandy, slightly gravelly SILT, becoming gravelly with depth. Gravel was angular to rounded, fine to coarse flint, tarmacadam, brick, concrete and clinker. Rare plastic was found. Frequent rootlets were noted. Odour of manure was identified in WS1. Odour of chlorinated solvents was noted in WS2, and very faint soapy/floral odour was noted in WS3.

4.1.2 River Terrace Deposits

The superficial River Terrace Deposits were encountered directly below the Made Ground in all window sample boreholes (WS1 to WS4) and inferred within their corresponding dynamic probes (DP1 to DP4) and within all exploratory pits (TPSK1, TPSK2, TPSK2b), to depths ranging from 1.00m bgl (WS2) and 2.70m bgl. However, all exploratory holes except from the location of WS/DP1 were terminated within the soils of the River Terrace Deposits, so the full depth of the stratum could not be established in these locations.

The soils of the River Terrace Deposits are normally consolidated, predominantly granular soils, although in the subject site were locally cohesive as well. As such are expected to display low to moderate bearing capacities with moderate to high settlement characteristics. The granular beds of the River Terrace Deposits were considered suitable for the proposed development.

4.1.3 Selsey Sand Formation

The Selsey Sand Formation bedrock was only encountered in the location of WS1 and inferred within its corresponding dynamic probe (DP1), directly below the River Terrace Deposits to the final investigatory depth of 6.00m bgl.

Soils of the Selsey Sand Formation are overconsolidated cohesive soils in the present investigation and are expected to display moderate bearing capacities with moderate settlement characteristics. The soils of the Selsey Sand Formation were considered a suitable bearing stratum for the proposed development; however, their upper horizon

was encountered beyond the depth of traditional shallow foundations.

4.1.4 Guidance on Shrinkable Soils

The ground conditions were established as River Terrace Deposits with a thickness of 2.70m, overlying the bedrock of Selsey Sand Formation encountered only in the location of WS/DP1.

The volume change potential for each stratum was established and presented in Table 4.1.

Table 4.1 Established Volume Change Potential by Strata

Strata	Volume Change Potential		Established Lower Boundary (m bgl)
	BRE	NHBC	
RTD (cohesive)	Low ¹	Low ¹	0.80
RTD (granular)	No ²	No ²	2.70
SLSY (cohesive)	Low ¹	No ¹	Not determined

Notes: ¹ Atterberg Limit Testing ² PSD Testing

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The results from Atterberg Limits Tests classified the cohesive beds of River Terrace Deposits as **low volume change potential** in accordance with NHBC Standards Chapter 4.2.

The PSD tests indicated that all four samples tested from the granular beds of River Terrace Deposits had no volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Atterberg Testing indicated that the Selsey Sand Formation bedrock had **no volume change potential** in accordance with NHBC Standards Chapter 4.2.

Low volume change potential should therefore be adopted where foundations pass through the superficial cohesive soils of the River Terrace Deposits.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis to establish an appropriate founding depth prior to the construction of foundations. This must take account of trees, substantial bushes and hedgerows that are to remain, those that have already been removed or are to be removed or those that are to be planted as part of the site landscaping. When trees are felled, it can take up to twenty years for desiccation caused by roots to recover. Site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey and the foundation designer must investigate all sources, including local knowledge, aerial photographs and the like.

The BRE Digest 241 states: *“An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used”*.

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

The BRE Digest 240 suggests: “Two courses of action are open:

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage.”

The design of foundations suitable to withstand movements is presented in BRE Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2”.

4.1.5 Groundwater

Groundwater was not encountered in any of the exploratory hole locations at the time of the investigation and post site works monitoring. This could potentially be attributed to the depth of all exploratory holes being limited.

Groundwater monitoring was ongoing at the time of reporting and will be updated upon completion.

Section 5 Foundation Scheme

5.1 Foundation Recommendations

Foundations **must not** be constructed within any Made Ground and cohesive beds of River Terrace Deposits due to the likely variability and potential for large load induced settlements both total and differential.

Roots were encountered in all window sample boreholes and exploratory pits to depths ranging between 0.40m and 0.90m bgl. If roots are encountered during the construction phase foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a shallow foundation solution, in the granular River Terrace Deposits was considered the most suitable.

The proposed development is likely to be both light and brittle. It is therefore considered that foundation design is undertaken using NHBC Standards Chapter 4.2.

5.1.1 Shallow Foundations into the River Terrace Deposits (granular beds)

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 5.1 shows the calculated bearing values and anticipated settlement characteristics. The maximum encountered depth of Made Ground and unsuitable soils was 0.80m bgl, bearing capacities were calculated below this depth.

Given the limitations of only a single test location with adequate depth, an allowable bearing capacity of no more than 180kPa should be adopted for foundations formed within the granular soils of River Terrace Deposits underlying the site. Foundations formed onto soils in greater depths, is possible to be placed within the cohesive beds of River Terrace Deposits found underlying the granular beds in the location of WS1, which would result in significantly lower bearing capacity values.

Table 5.1 Allowable Bearing Capacities in the River Terrace Deposits

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.00	5.00 x 0.75	180	25

All foundation formations must be examined, recorded, and signed off by a competent person.

The use of reinforced trench fill foundations reduces the potential for differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the

presented values, provided that excavation bases are carefully bottomed out and blinded or concreted as soon after excavation as possible and kept dry.

Foundations must not be constructed over former structures and other hard spots. The foundations design must be suitable for the conditions present at the site.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

It has been assumed that the foundations to any existing structures have been grubbed out. Where foundations have been grubbed out the new foundation must be taken through any backfill material into suitable natural ground as outlined in this report.

5.1.2 Ground Floor Slab

NHBC Standards 2023 states ground floors should be constructed as suspended floors where:

- *“the foundation depth dictated by the NHBC Standards 2023, Chapter 4.2.10 would exceed 1.5m bgl;”*
- *“ground floor construction is undertaken when the surface soils are seasonally desiccated;”*
- *“the depth of fill exceeds 600mm;”*
- *“there is shrinkable soil that could be subject to movement, expansive material or other unstable soils;”*
- *“the ground has been subject to vibratory improvement;” or*
- *“ground or fill is not suitable to support ground-bearing slabs.”*

It is considered that a ground bearing floor slab construction could be suitable for the development providing that any near surface cohesive soils are removed and replaced with suitably rolled and compacted granular fill.

5.2 Subsurface Concrete

The sulphate and pH tests carried out in accordance with BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground', established the site concrete classifications for each stratum as presented in Table 5.2. The classification given was determined using the mobile groundwater case, in the view of groundwater being encountered within the underlying granular beds.

Table 5.2 Concrete Classification

Stratum	Design Sulphate Class	ACEC Class
RTD (granular)	DS-I	AC-I
RTD (cohesive)		

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, '*Concrete in Aggressive Ground*' taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

5.3 Excavations

Shallow excavations in the Made Ground and River Terrace Deposits are likely to be marginally stable in the short term at best.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary.

Section 6 Site Drainage

6.1 Soakaways

Given the observed infiltration over the test period, it is considered that the site would be suitable for the adoption of a surface water soakaway system located within the granular beds of River Terrace Deposits. In accordance with BRE DG365:2023 a rate of 1.78×10^{-5} m/sec should be used in the design of the soakaway system (i.e. the slowest rate recorded during all infiltration tests). Note that the above infiltration rate was calculated after extrapolation of the available data.

It is recommended that the results of the in-situ permeability testing are passed to a drainage engineer for commentary and design.

Section 7 Determination of Chemical Analysis

7.1 Site Characterisation and Revised Conceptual Site Model

No Preliminary Investigation Report was undertaken by Soils Limited for the site that would allow a Conceptual Site Model (CSM) to be produced and potential contamination risks to be identified and assessed.

Reliance was therefore, placed in the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd, which was supplied to Soils Limited by the client and according to which potential on-site and off-site sources of soil and groundwater contamination comprised the following:

- Made Ground on-site (i.e. fill material associated with current site structures) potentially including asbestos, metals, polycyclic aromatic hydrocarbons (PAHs), and being a plausible source of ground-gas
- Historic allotment gardens on-site (potentially being a source of pesticides, heavy metals and polycyclic aromatic hydrocarbons (PAHs))
- Allotment gardens and historic farmland – off site sources (potentially being a source of pesticides, heavy metals and polycyclic aromatic hydrocarbons (PAHs))
- Electrical substation – off site sources (potentially being a source of polychlorinated biphenyl, heavy metals and petroleum hydrocarbons)

As discussed in the above report:

- The site is underlain by Secondary A aquifers of High Vulnerability relating to the superficial River Terrace Deposits and Selsey Sand Formation bedrock underlying the site.
- Shallow groundwater is anticipated on-site. Perched water may be present in any Made Ground deposits underlying the site.
- There are no surface water features within the site or adjoining the site boundary. There are also no surface water features within 500m of the site. The closest is Southampton Water which is located ~570m southwest of the site. The site is situated within the Itchen coastal catchment.
- There are no active abstraction licences within 1000m of the subject site.
- The site does not lie within a currently designated groundwater Source Protection Zone (SPZ).

This Main Investigation Report established:

- The presence of Made Ground in each of the exploratory holes to depths ranging between 0.40m and 0.45m bgl. The Made Ground typically comprised firm, dark brown, slightly sandy, gravelly CLAY to slightly sandy, slightly gravelly SILT, becoming gravelly with depth. Gravel was angular to rounded, fine to coarse flint, tarmacadam, brick, concrete and clinker. Rare plastic was found. Frequent

rootlets were noted. Odour of manure was identified in WS1. Odour of chlorinated solvents was noted in WS2, and very faint solvent odour was noted in WS3.

- No significant visual or olfactory indicators of hydrocarbon contamination was present within the Made Ground.
- The presence of River Terrace Deposits in each of the exploratory holes directly beneath the Made Ground to a maximum depth of 2.70m bgl in the location of WS/DP1. The soils generally comprised soft to firm, greyish brown, slightly sandy, very gravelly CLAY. Gravel was angular to sub angular, fine to coarse flint. Occasional rootlets were noted. Becoming yellowish to orangish brown, clayey, sandy, fine to coarse flint GRAVEL with depth. Becoming yellowish brown and orangish brown mottled, slightly sandy, very gravelly CLAY with depth. Distinct floral soapy/solvent odour was noted from 2.00m bgl in WS1. Note that all exploratory holes except from the location of WS/DP1 were terminated within the soils of the River Terrace Deposits, so the full depth of the stratum could not be established in these locations.
- Shallow groundwater was not encountered in any of the exploratory hole locations within the Made Ground and/or River Terrace Deposits during the investigation and the 1st groundwater monitoring visit. However, this can be attributed to the limited depth of all exploratory holes undertaken on site.

Therefore, the Preliminary Qualitative Risk Assessment of the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, by Leap Environmental Ltd, did not require significant revision and is presented in Appendix D.1.

7.2 Soil Sampling

Exploratory hole locations were established to provide an overview of ground conditions across the site in relation to the proposed construction, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

Representative samples for potential environmental testing were obtained from the exploratory holes at depths of between 0.10m and 0.50m to allow appropriate representation of the materials encountered, with additional samples to be obtained, if necessary, where there was visual or olfactory evidence of contamination.

Unless otherwise stated, analytical testing was based initially on a screening suite of commonly identified inorganic and organic contaminants, taking into account the prevailing site conditions and the findings of the initial conceptual site model.

7.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, by Leap Environmental Ltd and the Main Investigation Report intrusive investigation.

The chemical analyses were carried out on 4No. samples of Made Ground and 1No. sample of the granular River Terrace Deposits. The nature of the analyses is detailed in Table 7.1.

Table 7.1 Chemical Analyses Suites - Soil

No. of Tests	Determinants	Soil Tested	
		MG	RTD
5	Metal suites: Arsenic, Boron (Water Soluble), Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc	✓	✓
5	Organic Matter	✓	✓
5	pH	✓	✓
5	Sulphate contents – water soluble	✓	✓
5	Asbestos screening	✓	✓
5	Phenols – total monohydric	✓	✓
1	Organochlorine Pesticides	✓	
1	Organophosphorus Pesticides	✓	
5	Polycyclic aromatic hydrocarbons (PAH) – (EPA 16)	✓	✓
5	Extractable Petroleum Hydrocarbons – (EPH) Texas Banded	✓	✓

The soil testing was carried out in compliance with the MCERTS performance standard, and the results are shown in Appendix D.2, test reports 23-06330 and 23-06541.

Section 8 Qualitative Risk Assessment

8.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix D.3.

8.2 Representative Contamination Criteria - Soil

In compiling this report reliance was placed on drawing No.: 0019 Rev. P05, dated 8th August 2022 by MH Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic assessment criteria (GAC) for a '**Residential with home grown produce**' end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, GACs derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity of organic determinants (Petroleum Hydrocarbons and Polyaromatic Hydrocarbons) to the human health, soils samples were analysed for Soil Organic Matter (SOM). The selected samples analysed recorded, SOM values of between **0.5%** and **4.2%**. For each soil sample tested, the resultant SOM allowed for the correct comparison to be made with the appropriate guideline value for each organic determinants analysed.

8.3 Risk Assessment – Made Ground

Table 8.1 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix D.2.

Table 8.1 Summary of GAC Exceedances – Made Ground

Location	Depth (m bgl)	Contaminant	Concentration	Guidance Level (S4UL)	SOM (%)
WS2	0.10	Dibenz(a,h)anthracene	0.40	0.30	4.2

Note(s): Units mg/kg, SOM – Organic Matter

The risk assessment has established a potential pollutant linkage in relation to human health from a single elevated Polyaromatic Hydrocarbons (PAHs) concentration within the Made Ground, in WS2 at 0.10m bgl.

8.4 Risk Assessment – River Terrace Deposits

Table 8.2 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix D.2.

Table 8.2 Summary of GAC Exceedances – River Terrace Deposits

Location	Depth (m bgl)	Contaminant	Concentration	Guidance Level
None				

The risk assessment has established no potential chemical pollutant linkage in relation to human health receptors within the sample tested from the River Terrace Deposits.

8.5 Asbestos

The test certificate for each sample submitted for contamination analysis during this investigation includes the results of an Asbestos Screen.

In each case 'Not detected' was reported.

This finding does not obviate the risk of asbestos being present on the site and the Client must seek advice from qualified and competent asbestos specialist during and prior to undertaking works to ensure compliance with appropriate legislation and guidance.

8.6 Risk to Groundwater

From information provided by the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd, the Groundsure Maps stated, that the superficial River Terrace Deposits and the Selsey Sand Formation bedrock had a Secondary A Aquifer designation, indicating that the units maintain the potential to sustain large volumes of water. The overall groundwater vulnerability was soils of Medium Vulnerability, soils with moderate ability to attenuate diffuse source pollutants or in which it is possible that some non-adsorbed diffuse source pollutants and liquid discharges could penetrate the soils layer.

The soils of River Terrace Deposits underlying the Made Ground reaching to a proven depth of 2.70m bgl, were assessed by the intrusive investigation as predominantly granular, permeable soils, and therefore could be considered a sensitive receptor; however, shallow groundwater was not encountered within the superficial soils during the intrusive investigation. The predominantly cohesive soils of the Selsey Sand Formation underlying the River Terrace Deposits are impermeable subject to soil composition (presence of clayey lenses), therefore, are not considered a sensitive receptor.

A quantitative Groundwater Risk Assessment was not commissioned as part of the site investigation report. However, it is considered that the elevated PAHs recorded in WS2 at a depth of 0.10m bgl, presumably resulted from a tarmacadam inclusion present in the Made Ground, which is going to be removed as part of the development works and/or remediation of the site and therefore, represent a **very low to negligible risk** to

groundwater quality.

If considered appropriate by the Local Planning Authority, leachate tests could be undertaken, in the absence of groundwater, as part of any additional ground investigation.

8.7 Risk from Ground Gas Ingression

The Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd, suggested that there was a moderate risk of ground gas generation associated with the Made Ground underlying the site.

The intrusive investigation recorded Made Ground at a thickness of up to 0.45m bgl; no putrescible material was observed within the Made Ground. PAHs were recorded in concentrations in excess of the relevant S4UL for a '*Residential with Home Grown Produce*' land-use scenario in one location within the site boundaries but are not significant contributors to the creation of ground gases or vapours.

Therefore, as the ground investigation recorded Made Ground at a thickness less than 0.50m and no putrescible material was encountered, the overall risk from ground gas to the proposed development is considered to be very low. Taking into consideration the likely potential source of ground gases, limited to the presence of Made Ground, three monitoring visits have been undertaken over a period of a month, in accordance with current guidance, the results of which are presented in Table 8.3 and provided in Appendix E.

Table 8.3 Ground Gas Results

Date (Baro Trend)	TH	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	H ₂ S (ppm)	CO (ppm)	LEL (%)	aP (mb)	Flow (l/h)	Dp	H ₂ O (m bgl)	Hole (m)	VOC (ppm)
16/05/23 (Steady)	ATM	<1.0	0.0	20.6	<1.0	<1.0	<0.1	1023	0.0	<1.0	-	-	<1.0
	WS1	<1.0	0.5	20.1	<1.0	<1.0	<0.1	1023	0.0	<1.0	Dry	2.64	10.0
	WS4	<1.0	1.8	18.6	<1.0	<1.0	<0.1	1023	0.0	<1.0	Dry	1.37	2.0
26/05/23 (Rising)	ATM	<1.0	0.0	20.8	<1.0	<1.0	<0.1	1030	0.3	1.0	-	-	<1.0
	WS1	<1.0	0.6	19.9	<1.0	<1.0	<0.1	1030	0.3	1.0	Dry	2.40	<1.0
	WS4	<1.0	2.2	19.0	<1.0	2.0	<0.1	1030	0.1	1.0	Dry	1.35	<1.0
14/06/23 (Rising)	ATM	<1.0	0.0	20.9	<1.0	<1.0	<0.1	1015	0.0	<1.0	-	-	<1.0
	WS1	<1.0	0.5	20.5	<1.0	1.0	<0.1	1016	0.0	<1.0	Dry	2.62	<1.0
	WS4	<1.0	2.0	19.2	<1.0	1.0	<0.1	1015	0.0	<1.0	Dry	1.35	<1.0
Maximum		<0.1	2.2	20.5	<1.0	2.0	<0.1	1030	0.3	1.0	-	-	10.0
Minimum		<0.1	0.5	18.6	<1.0	<1.0	<0.1	1015	<0.1	<1.0	Dry	-	<1.0
Note: Zero reading = below the equipment detection limit.													

Based on the documentation presented in the "BS 8485:2015+A1:2019", Code of practice for the design of protective measures for Methane and Carbon Dioxide ground gases for new buildings" the hazardous gas flow rate (Q_{hg}) was calculated using Equation 1:

$$Q_{hg} = \left(\frac{C_{hg}}{100} \right) \times q \quad \text{Equation 1}$$

Where:

C_{hg} is the measured hazardous gas concentration in percentage volume-by-volume

q is the flow rate in litres per hour of combined gases found by direct measurement – where the flow rate is zero or below the detection level of the instrument, this must default to the detection limit, in this case 0.1 ltr/hr.

The highest concentration of carbon dioxide (CO₂) was recorded at 2.2% by volume, in WS4 on 26th May 2023. Consequently, the values used in Equation 1 were 2.2 and 0.3l/hr for the hazardous ground gas concentration and flow rate respectively, and therefore Equation 1 gives the below results:

$$Q_{hg} = \left(\frac{2.2}{100} \right) \times 0.3 = 0.0066 \text{ l/hr}$$

The results derive a Gas Screening Value of 0.0066, which is significantly below the CS1/CS2 threshold of 0.07.

VOC (Volatile Organic Compounds) screening undertaken during the monitoring has recorded a maximum of 10.0ppm in WS1 on 16th May 2023; this is potentially linked to the elevated Polyaromatic Hydrocarbons (PAHs) concentration found within the Made Ground in WS2 at 0.10m bgl. However, the maximum VOCs being significantly above the average for the dataset (average of 2.6ppm vs maximum of 10.0ppm), is not considered significant in context and was recorded on only one date at a single location, so this peak value may be an outlier or artefact. In addition, the remainder of the results do not indicate VOCs in excess of a worst case of 2.0ppm and an average of 1.2ppm. As such, it is considered that this potentially is an anomaly and is not considered representative of the gas conditions prevalent onsite.

CIRIA C665 and BS8485:2015+A1:2019 both state that where concentrations of carbon dioxide are consistently recorded over 5% v/v and/or methane in excess of 1%, consideration should be given to increasing the Characteristic Situation to 2 on a precautionary basis.

Where such situations prevail, consideration should also be given to the gas and conceptual site models as to which is the more appropriate situation to consider in light of the potential and actuality for active generation both on and off-site. Reviewing the dataset, site model and quality of data, no methane was recorded above instrument detection limit (0.1%), and carbon dioxide concentration was not recorded above 2.2% on all monitoring occasions. As such no precautionary rise to CS2 is indicated from the dataset.

The technical results of the initial characterisation of the ground gas regime, classifies the site as Characteristic Situation 1 (CS1), where no ground gas protection is necessary within new properties. Therefore, the results of the precautionary monitoring showed that the moderate risk initially identified in the Phase I Desk Study and Site Reconnaissance, ref.: LP3177/DS/1, dated January 2023 by Leap Environmental Ltd was not appropriate

for the site.

The precautionary monitoring identified no anomalous or unexpected results or indications of active gas generation and/or significant flow. As such, no protection measures are either indicated or considered necessary.

8.7.1 Radon

The site **was not situated** within an area where protection or risk assessment against the ingress of radon was required. Radon protection measures **will not be required** within the proposed new development.

8.8 Generic Quantitative Risk Assessment

Quantitative risk assessments are undertaken for the soil and ground gas. The full laboratory chemical report is presented in Appendix D.2.

8.8.1 Soils

One of the samples tested showed concentrations in excess of the relevant S4UL for a residential land-use scenario. In WS2 at 0.10m bgl, Dibenz(a,h)anthracene was recorded at a concentration of 0.40mg/kg against the residential end-use S4UL of 0.30mg/kg.

The Tier 1 risk assessment therefore established that there was a potential risk to construction workers and other vulnerable receptors on exposure which will have to be considered in relation to the site works by the H&S advisors and is beyond the scope of this report.

8.8.2 Groundwater

The Groundwater Risk Assessment established that there is a **very low** residual risk to the groundwater receptor as discussed in Section 8.6.

8.8.3 Ground Gas

The Preliminary Investigation Report identified a moderate risk of ground gas associated with Made Ground underlying the site.

Monitoring of the wells installed within WS1 and WS4 has been undertaken on three occasions, including targeting periods of steady and rising pressure. In accordance with BS8485:2015, a **very low risk** was identified, which does not require gas protection measures.

8.9 Recommendations

Soil chemical analysis recorded one sample (WS2:0.10m bgl) with substance levels over their representative guideline values. WS2 was located beneath proposed residential gardens.

Therefore, there was a risk to the Human Health, Building Structures and Services and Groundwater receptor, which would require a remediation strategy.

The remedial objective for the site is to ensure site clean-up removes any unacceptable risk to the identified receptors of Human Health, Building Structures and Services and Groundwater receptor. The risk is likely to be further mitigated by the placement of a building and hard cover significantly reducing the potential infiltration to the ground and hence the passage and volume of available groundwater. In the areas of proposed soft landscaping (private gardens), any potential contamination linkages will be broken by emplacement of appropriate depth of clean soils imported to provide a suitable growing medium.

In essence the remedial objective must sever any source-pathway-receptor pollutant linkages that have been established. Once this has been achieved, by whatever means, there can theoretically be no risk.

8.10 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

8.11 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered, and competent advice must always be sought.

8.12 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

8.13 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

8.14 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction

phases for the redevelopment of the site.

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Appendix F Information Provided by the Client

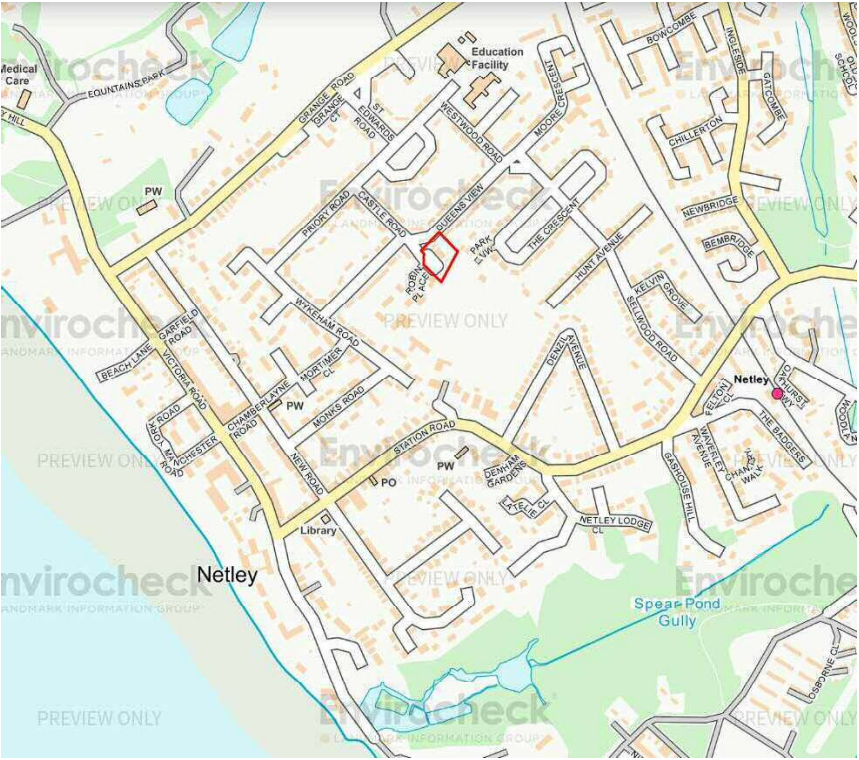


Figure I – Site Location Map

Job Number 20870	Project 30-32 Queens View, Netley, Southampton, Hampshire SO31 5EA
Client Eastleigh Borough Council	Date June 2023



Figure 2 – Aerial Photograph



Project

30-32 Queens View, Netley,
Southampton, Hampshire
SO31 5EA

Client

Eastleigh Borough Council

Date

June 2023

Job Number

20870



Figure 3 – Exploratory Hole Plan

Project

30-32 Queens View, Netley,
Southampton, Hampshire
SO31 5EA

Client

Eastleigh Borough Council

Date

June 2023

Job Number

20870

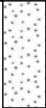


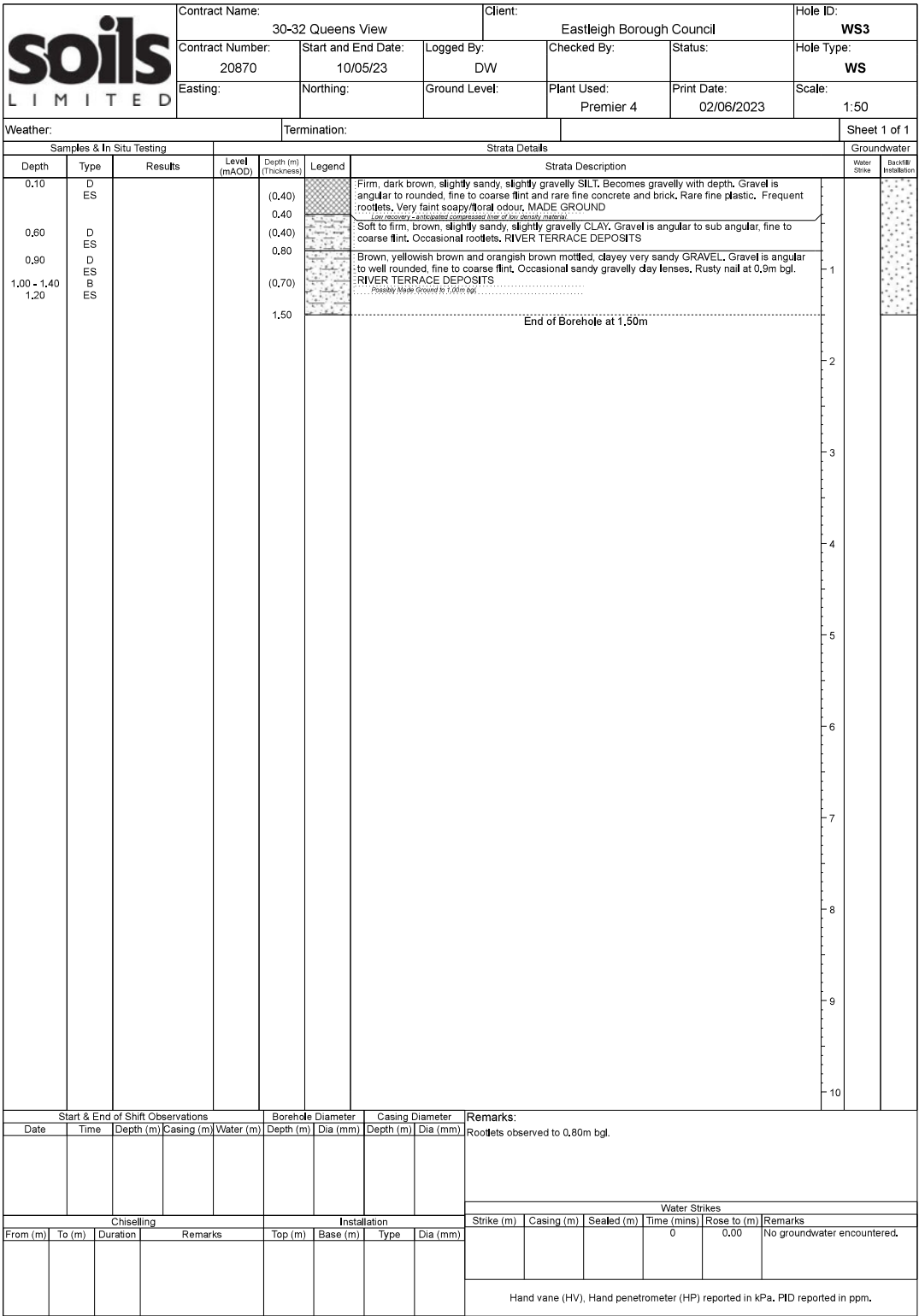
Appendix B Field Work

Appendix B.1 Engineers Logs



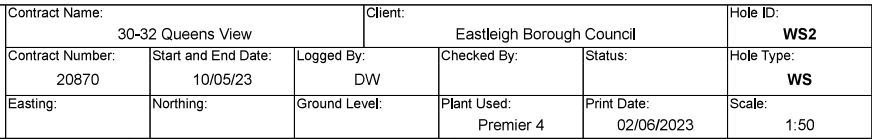
Contract Name: 30-32 Queens View		Client: Eastleigh Borough Council		Hole ID: WS1					
Contract Number: 20870		Start and End Date: 10/05/23		Logged By: DW					
Checked By:		Status:		Hole Type: WS					
Easting:		Northing:		Ground Level:					
Plant Used: Premier 4		Print Date: 02/06/2023		Scale: 1:50					
Weather:				Termination:					
Sheet 1 of 1									
Samples & In Situ Testing			Strata Details						
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Strata Description				
0,20	D			(0,40)	Firm, dark brown, slightly sandy, gravelly CLAY, Gravel is angular to rounded, fine to coarse flint, rare brick and linker, Frequent rootlets, Odour of manure, MADE GROUND				
0,50	D			0,40	Soft to firm, greyish brown, slightly sandy, very gravelly CLAY, Gravel is angular to sub angular, fine to coarse flint, Occasional rootlets, RIVER TERRACE DEPOSITS				
0,80	D			0,65	Brown, yellowish brown and orangish brown mottled, sandy, clayey GRAVEL, Gravel is angular to well rounded, fine to coarse flint, Distinct floral soapy/solvent odour from 2,00m bgl. Occasional sand and gravel lenses, RIVER TERRACE DEPOSITS				
1,10	D			(1,20)					
1,40	ES								
1,90	D			1,85	Stiff brown, yellowish brown and orangish brown mottled, slightly sandy, very gravelly CLAY, Gravel is angular to well rounded, fine to coarse flint, Distinct floral soapy/solvent odour, RIVER TERRACE DEPOSITS				
2,10	ES			(0,40)					
2,25				2,25	Orangish brown, slightly sandy, very gravelly CLAY, Gravel is angular to well rounded, fine to coarse flint, RIVER TERRACE DEPOSITS				
2,40	D			(0,45)					
2,60	D			2,70	Yellowish brown, mottled orange, slightly clayey SILT, Rare clay laminations at base, SELSEY SAND FORMATION				
2,80	D			(0,30)					
				3,00	End of Borehole at 3,00m				
Start & End of Shift Observations			Borehole Diameter		Casing Diameter				
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Remarks:
									Rootlets observed to 0,65m bgl.
Water Strikes									
Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks									
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)		
				0,00	1,00	PLAIN	30		
				1,00	2,70	SLOTTED	30		
Hand vane (HV), Hand penetrometer (HP) reported in kPa, PID reported in ppm.									

	Contract Name: 30-32 Queens View			Client: Eastleigh Borough Council			Hole ID: WS2							
	Contract Number: 20870		Start and End Date: 10/05/23		Logged By: DW		Checked By:		Status:		Hole Type: WS			
	Easting:		Northing:		Ground Level:		Plant Used: Premier 4		Print Date: 02/06/2023		Scale: 1:50			
Weather:				Termination:						Sheet 1 of 1				
Samples & In Situ Testing				Strata Details								Groundwater		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description						Water Strike	Backfill Installation	
0.10	D ES			(0,40)		Firm, dark brown, slightly sandy, slightly gravelly CLAY. Becomes gravelly with depth. Gravel is angular to rounded, fine to coarse flint, brick, and unbound black stained potential tarmac gravel. Frequent rootlets, Odour of chlorinated solvents, MADE GROUND <i>Band with gravel with black staining and strong chlorinated solvents odour</i> Greyish brown, sandy, clayey GRAVEL. Gravel is angular to sub-angular, fine to coarse flint. Frequent rootlets, Fines reducing with depth. Very faint soapy odour, RIVER TERRACE DEPOSITS Orangish brown, yellowish brown and dark brown mottled, silty becoming clayey sandy, slightly GRAVEL. Gravel is angular to well rounded, fine to coarse flint, RIVER TERRACE DEPOSITS <i>Dark brown soapy band</i>								
0.50	D ES			0.40										
	D ES			0.65										
0.80	D ES			(0,35) 1.00										
						End of Borehole at 1,00m						1		
												2		
												3		
												4		
												5		
												6		
												7		
												8		
												9		
												10		
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 0,65m bgl.					
									Water Strikes					
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)				0	0,00	No groundwater encountered.
									Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.					





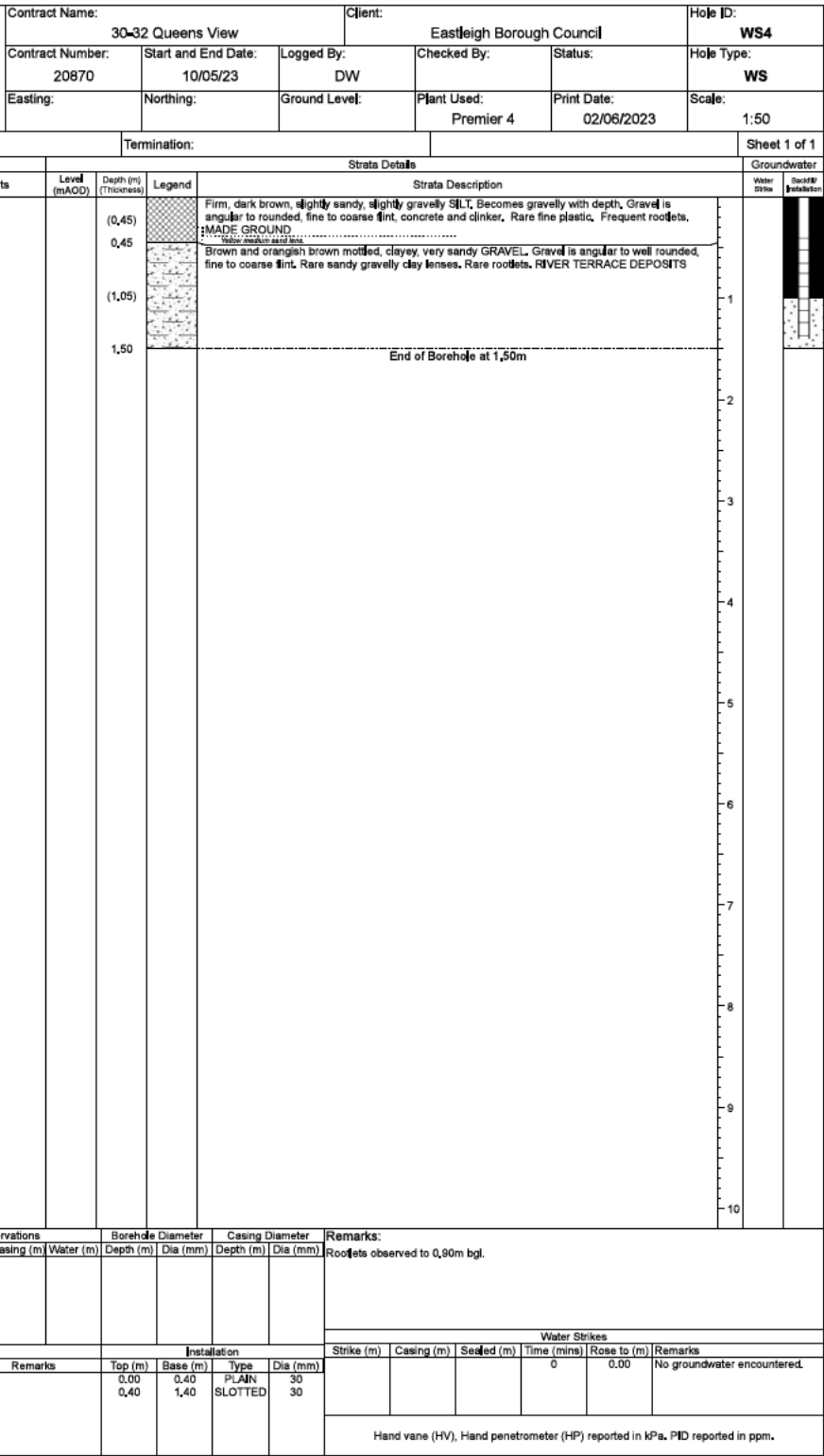
Contract Name: 30-32 Queens View		Client: Eastleigh Borough Council		Hole ID: WS4									
Contract Number: 20870		Start and End Date: 10/05/23		Logged By: DW									
Checked By:		Status:		Hole Type: WS									
Easting:		Northing:		Ground Level:									
Plant Used: Premier 4		Print Date: 02/06/2023		Scale: 1:50									
Weather:				Termination:									
				Sheet 1 of 1									
Samples & In Situ Testing			Strata Details										
Results			Groundwater										
Depth	Type	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description								
0,20	ES		(0,45)		Firm, dark brown, slightly sandy, slightly gravelly SILT. Becomes gravelly with depth. Gravel is angular to rounded, fine to coarse flint, concrete and clinker. Rare fine plastic. Frequent rootlets.								
0,30	D		0,45		MADE GROUND								
0,50	D				Brown and orangish brown mottled, clayey, very sandy GRAVEL. Gravel is angular to well rounded, fine to coarse flint. Rare sandy gravelly clay lenses. Rare rootlets. RIVER TERRACE DEPOSITS								
0,90	D		(1,05)										
1,00 - 1,50	ES B		1,50		End of Borehole at 1,50m								
Start & End of Shift Observations			Borehole Diameter		Casing Diameter								
Date	Time	Depth (m)	Casing (m)	Water (m)	Remarks:								
					Rootlets observed to 0,90m bgl.								
Chiselling			Installation		Water Strikes								
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
				0,00	0,40	PLAIN	30				0	0,00	No groundwater encountered.
				0,40	1,40	SLOTTED	30						
Hand vane (HV), Hand penetrometer (HP) reported in kPa, PID reported in ppm.													



Termination:

Sheet 1 of 1

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks: Rootlets observed to 0,65m bgl.	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)		
Chiselling					Installation					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)		



Soakaway Calculations

Soakaway Test No.	TPSK1 Test 1
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

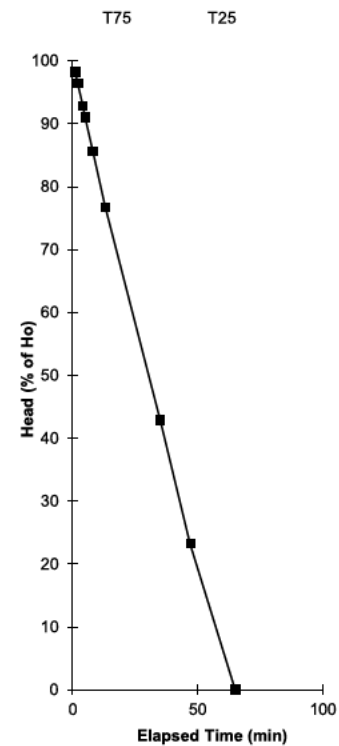
Depth of Pit	1.16 m
Width of Pit	0.65 m
Length of Pit	1.70 m
Depth of Pit Soaked	0.56 m
np50	2.421 m2
Vp75-25	0.3094 m3
c75-25	31.8 min
water used	0.6188 m3
f	6.708E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.60	0	100	0.56
0.61	1	98	0.55
0.62	2	96	0.54
0.64	4	93	0.52
0.65	5	91	0.51
0.68	8	86	0.48
0.73	13	77	0.43
0.92	35	43	0.24
1.03	47	23	0.13
1.16	65	0	0.00

T75	14.158	75
T25	45.909	25
T75-25	31.751	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK1 Test 2
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.08 m
Width of Pit	0.65 m
Length of Pit	1.70 m
Depth of Pit Soaked	0.58 m

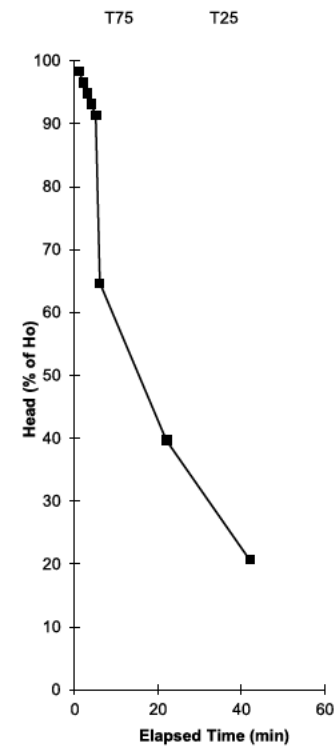
ap50	2.468 m2
Vp75-25	0.32045 m3
t75-25	31.8 min
water used	0.6409 m3
f	6.796E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.50	0	100	0.58
0.51	1	98	0.57
0.52	2	97	0.56
0.53	3	95	0.55
0.54	4	93	0.54
0.55	5	91	0.53
0.71	6	65	0.38
0.85	22	40	0.23
0.96	42	21	0.12

T75	5.613	75
T25	37.455	25
T75-25	31.842	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK1 Test 3
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.06 m
Width of Pit	0.65 m
Length of Pit	1.70 m
Depth of Pit Soaked	0.65 m

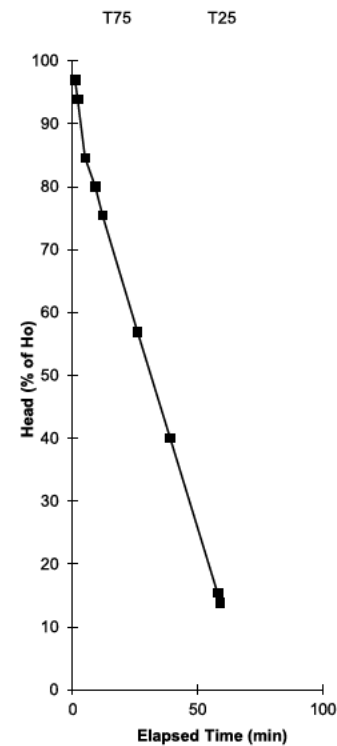
ap50	2.6325 m2
Vp75-25	0.359125 m3
t75-25	38.3 min
water used	0.7183 m3
f	5.939E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.41	0	100	0.65
0.43	1	97	0.63
0.45	2	94	0.61
0.51	5	85	0.55
0.54	9	80	0.52
0.57	12	75	0.49
0.69	26	57	0.37
0.80	39	40	0.26
0.96	58	15	0.10
0.97	59	14	0.09

T75	12.292	75
T25	50.578	25
T75-25	38.286	Derived from Best Fit

Comments



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Soakaway Test No.	TPSK2 Test 1
Contract:	30-32 Queens View
Contract No.	20870

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	2.42 m
Width of Pit	0.65 m
Length of Pit	2.10 m
Depth of Pit Soaked	0.74 m
ap50	3.4 m2
Vp75-25	0.50505 m3
c75-25	0.0 min
water used	1.0101 m3
r	N/A m/sec.

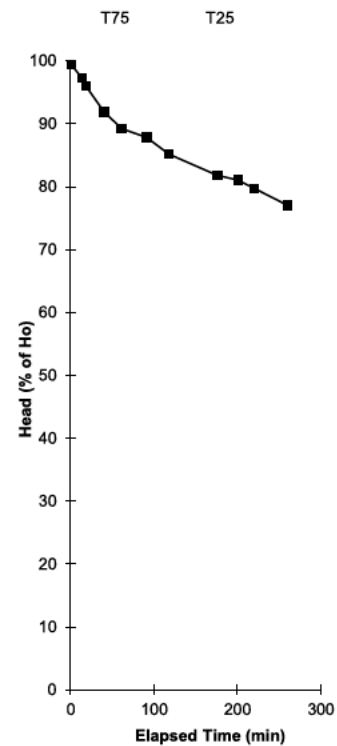
Field Data

Depth to Water (m)	Elapsed Time (min)	Head of Water (% of Ho)	Head of Water (m)
1.68	0	100	0.74
1.69	1	99	0.74
1.70	13	97	0.72
1.71	18	96	0.71
1.74	40	92	0.68
1.76	61	89	0.66
1.77	91	88	0.65
1.79	118	85	0.63
1.82	176	82	0.61
1.82	200	81	0.60
1.83	220	80	0.59
1.85	260	77	0.57

T75	0.000	75
T25	0.000	25
T75-25	0.000	Derived from Best Fit

Comments

Infiltration stopped - unable to calculate infiltration rate



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Soakaway Calculations

Soakaway Test No.	TPSK2b Test 1
Contract:	30-32 Queens View
Contract No.	20870

Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

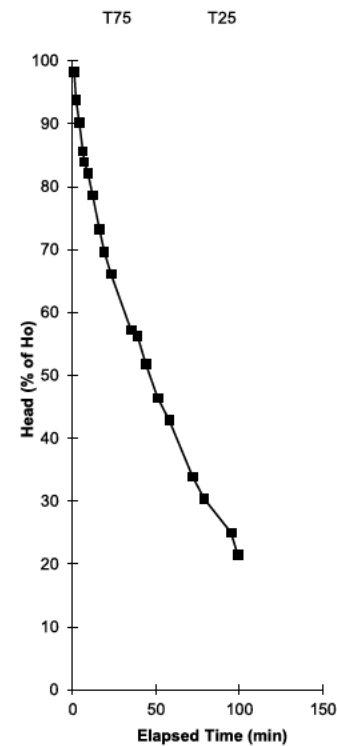
Depth of Pit	1.20 m
Width of Pit	0.70 m
Length of Pit	2.00 m
Depth of Pit Soaked	0.56 m
np50	2.912 m2
Vp75-25	0.392 m3
c75-25	80.3 min
water used	0.7840 m3
f	2.793E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.64	0	100	0.56
0.65	1	98	0.55
0.675	2	94	0.53
0.695	4	90	0.51
0.72	6	86	0.48
0.73	7	84	0.47
0.74	9	82	0.46
0.76	12	79	0.44
0.79	16	73	0.41
0.81	19	70	0.39
0.83	23	66	0.37
0.88	35	57	0.32
0.885	39	56	0.32
0.91	44	52	0.29
0.94	51	46	0.26
0.96	58	43	0.24
1.01	72	34	0.19
1.03	79	30	0.17
1.06	95	25	0.14
1.08	99	21	0.12

T75	14.667	75
T25	95.000	25
T75-25	80.333	Derived from Best Fit

Comments



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Soakaway Calculations

Soakaway Test No.	TPSK2b Test 2
Contract:	30-32 Queens View
Contract No.	20870

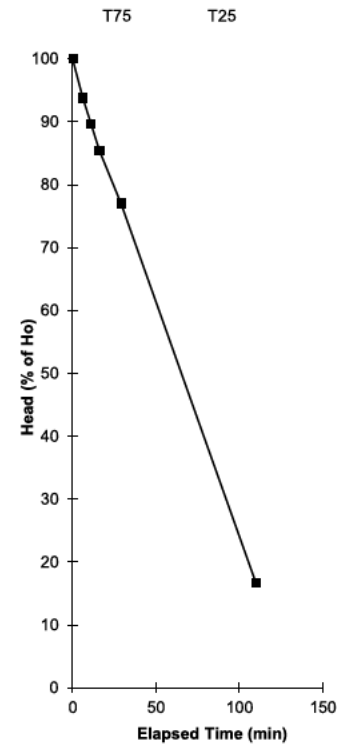
Field Test

Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.20 m
Width of Pit	0.70 m
Length of Pit	2.00 m
Depth of Pit Soaked	0.48 m
ap50	2.696 m2
Vp75-25	0.336 m3
c75-25	68.2 min
water used	0.6720 m3
f	3.045E-05 m/sec.

Field Data

[illegible]

Comments

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Soakaway Calculations

Soakaway Test No.	TPSK2b Test 3
Contract:	30-32 Queens View
Contract No.	20870

Field Test

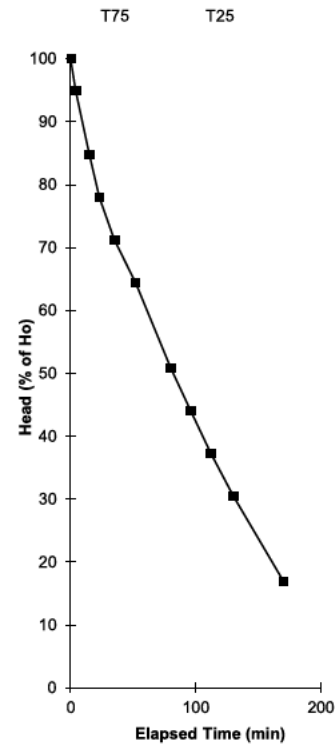
Trial Pit Log (include details of groundwater):

See trial Pit record

Depth of Pit	1.20 m
Width of Pit	0.70 m
Length of Pit	2.00 m
Depth of Pit Soaked	0.59 m
ap50	2.993 m2
Vp75-25	0.413 m3
t75-25	121.8 min
water used	0.8260 m3
f	1.889E-05 m/sec.

Field Data

Depth to	Elapsed	Head of	Head of
Water	Time	Water	Water
(m)	(min)	(% of Ho)	(m)
0.61	0	100	0.59
0.64	4	95	0.56
0.7	15	85	0.50
0.74	23	78	0.46
0.78	35	71	0.42
0.82	52	64	0.38
0.9	80	51	0.30
0.94	96	44	0.26
0.98	112	37	0.22
1.02	130	31	0.18
1.1	170	17	0.10



T75	28.250	75
T25	150.000	25
T75-25	121.750	Derived from Best Fit

Comments

Data extrapolated to calculate an infiltration rate.

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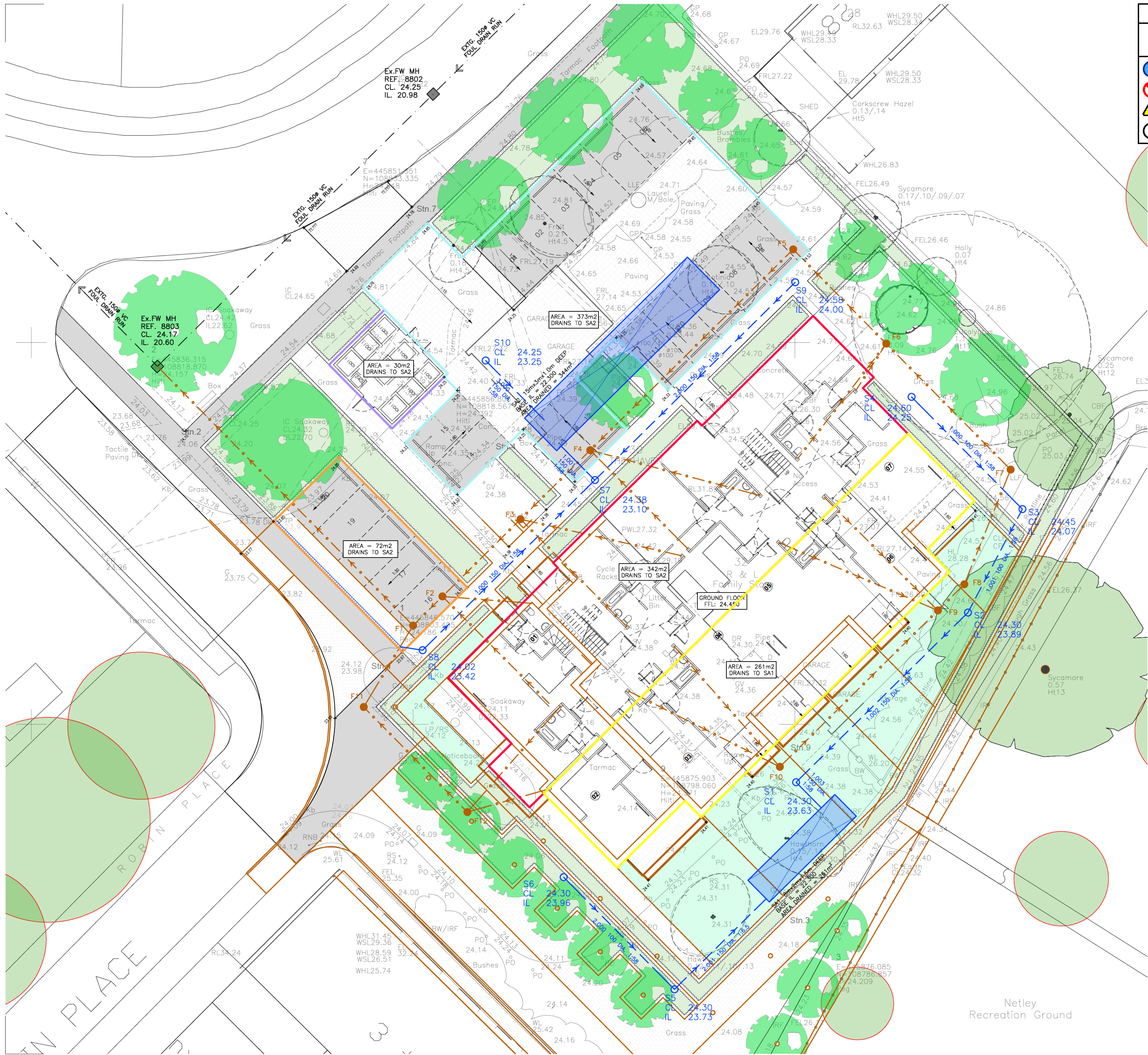
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Appendix 5

Drainage Strategy Drawings



KEY TO HEALTH AND SAFETY SYMBOLS

THESE NOTES ARE BASED ON THE USE OF EXPERIENCED AND COMPETENT CONTRACTORS CARRYING OUT THE WORK USING AN APPROVED SAFE METHOD OF WORKING

INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION

INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION

INDICATES A RESIDUAL RISK AS A WARNING

INDICATES A RESIDUAL RISK FOR INFORMATION

COLOURED DRAWING

REQUEST A COLOURED COPY IF THIS STAMP IS NOT RED

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWING AAL307-5051 FOR DRAINAGE DETAILS

DRAINAGE LEGEND

EXISTING SURFACE / STORM WATER SEWER / MANHOLE

EXISTING FOUL WATER SEWER / MANHOLE

S1 SURFACE WATER MAN-HOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).

100mm Dia. PVCu. SN4 STORM WATER DRAIN (U.N.O.)

ATTENUATION TANK / SOAKAWAY OUT OF PROPRIETARY CRATE SYSTEM (SEE SCHEDULE FOR DETAILS).

ACO DRAIN / SUMP.

F1 FOUL WATER MANHOLE / INSPECTION CHAMBER / ACCESS CHAMBER (SEE SCHEDULE FOR DETAILS).

100mm Dia. PVCu. SN4 FOUL WATER DRAIN (U.N.O.)

- NOTES**
- © This drawing is the copyright of ARCH Associates Limited. It may not be copied, altered or reproduced without their written authority. This drawing must not be scaled. IF IN DOUBT ASK.
- GENERAL NOTES**
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND DETAILS.
 - ALL FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED DIMENSIONS.
 - ANY DISCREPANCIES BETWEEN THIS DRAWING AND OTHER INFORMATION IS TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO THE COMMENCEMENT OF THE WORKS ON SITE.
 - THE MAIN CONTRACTOR SHALL BE RESPONSIBLE FOR THE SETTING OUT AND ACCURACY OF ALL DIMENSIONS.
 - THE CONTRACTOR IS TO ENSURE THE STABILITY AND STRUCTURAL INTEGRITY OF THE EXISTING PROPERTY AT ALL TIMES DURING WORKS AND IS TO BE RESPONSIBLE FOR ALL PROPPING AND SHORING AS REQUIRED.
 - MAIN CONTRACTOR TO PROVIDE AND FIX SUITABLE BRACING AND PROPPING FOR ALL ELEMENTS IN THE TEMPORARY CONDITION DURING CONSTRUCTION STAGE, SUCH AS TO ENSURE STRUCTURE STABILITY AT ALL TIMES.
 - IT IS THE CONTRACTORS SOLE RESPONSIBILITY FOR ASCERTAINING SAFE DISPOSAL OF ANY OFF-SITE EXCAVATED SPOIL. NO CLAIM RESULTING FROM ABNORMAL TIP REQUIREMENTS WILL BE ENTERTAINED.
- DRAINAGE**
- ALL MATERIALS AND WORKMANSHIP TO SEWERAGE SECTOR DESIGN AND CONSTRUCTION GUIDANCE DOCUMENT APPENDIX C APPROVED VERSION 2.2.
 - ALL MATERIALS AND WORKMANSHIP TO COMPLY WITH BS EN 752-1: 2008
 - WHEN USING VITRIFIED CLAY PIPEWORK WITH FLEXIBLE JOINTS, SUPERSTRENGTH SHALL BE USED. ALL ADAPTABLE WORKS SHALL USE V.C PIPEWORK. FOR NON-ADOPTED SYSTEM PVCU-SN4 CLASS PIPEWORK AND FITTINGS MAY BE SUBSTITUTED.
 - CONCRETE ENCASEMENT, MINIMUM 150 BED AND HAUNCH, TO BE USED ON PIPEWORK UNDER ROADS WITH LESS THAN 1200 COVER TO GROUND.
 - UNLESS OTHERWISE STATED, ALL PIPEWORK TO BE BEDDED AND SURROUNDED IN 10mm SINGLE SIZE AGGREGATE UP TO 450mm DIAMETER. FOR LARGER PIPEWORK, 20mm SHALL BE USED.
 - REFER TO MANHOLE SCHEDULE FOR SIZES, COVERS ETC.
 - ALL MATERIALS TO COMPLY WITH THE RELEVANT BS-EN, LATEST EDITION, FOR PIPEWORK AND FITTINGS.
 - UPON COMPLETION, ALL WORKS TO BE THOROUGHLY CLEANED BY FLUSHING.

P1	12.07.2023	PRELIMINARY ISSUE FOR COMMENT	JH
Rev.	Date	Description	By

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Client
EASTLEIGH BOROUGH COUNCIL

Architect
MH ARCHITECTS

Project title
RE-DEVELOPMENT OF 30-32 QUEENS VIEW, NETLEY.

Drawing title

DRAINAGE STRATEGY

Scale	Paper size	Date	Drawn by	Checked by	Status
1:125	A1	FEB.2023	JH	CH	SO

Name

Project code / No. | Originator | Zone | Level | Type | Role | Number | Revision

AAL307 - AAL-00-XX-DR-S-5001-P01



Appendix 6

Surface Water Drainage Calculations

Arch Associates Limited		Page 1
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
Date 10/07/2023 18:24 File Drainage.MDX	Designed by ARCH ASSOCIATES Checked by CH	
XP Solutions	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	10.300	0.176	58.5	0.007	4.00	0.0	0.600	0	100	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)
1.000	50.00	4.17	24.254	0.007	0.0	0.0	0.0	1.01	7.9	1.3

Arch Associates Limited		Page 2
Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	QUEENS VIEW NETLEY	
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XP Solutions	Network 2020.1.3	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.001	7.650	0.131	58.4	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	15.820	0.270	58.6	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	2.400	0.041	58.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	10.310	0.176	58.6	0.007	4.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	8.440	0.148	57.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	2.000	0.035	57.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.001	50.00	4.30	24.078	0.007	0.0	0.0	0.0	1.01	7.9	1.3
1.002	50.00	4.50	23.897	0.020	0.0	0.0	0.0	1.32	23.3	3.6
1.003	50.00	4.53	23.627	0.020	0.0	0.0	0.0	1.32	23.3	3.6
2.000	50.00	4.17	23.960	0.007	0.0	0.0	0.0	1.01	7.9	1.3
2.001	50.00	4.28	23.734	0.007	0.0	0.0	0.0	1.33	23.6	1.3
1.004	50.00	4.55	22.300	0.027	0.0	0.0	0.0	1.33	23.6	4.9

Arch Associates Limited		Page 3
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S4	24.600	0.346	Open Manhole	450	1.000	24.254	100				
S3	24.600	0.522	Open Manhole	450	1.001	24.078	100	1.000	24.078	100	
S2	24.300	0.403	Open Manhole	450	1.002	23.897	150	1.001	23.947	100	
S1	24.300	0.673	Open Manhole	450	1.003	23.627	150	1.002	23.627	150	
S6	24.100	0.140	Open Manhole	450	2.000	23.960	100				
S5	24.300	0.566	Open Manhole	450	2.001	23.734	150	2.000	23.784	100	
SOAKAWAY	24.300	2.000	Open Manhole	1200	1.004	22.300	150	1.003	23.586	150	1286
								2.001	23.586	150	1286
SOAKAWAY	24.350	2.085	Open Manhole	0		OUTFALL		1.004	22.265	150	

No coordinates have been specified, layout information cannot be produced.

Arch Associates Limited		Page 4
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
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XP Solutions	Network 2020.1.3	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	S4	24.600	24.254	0.246	Open Manhole	450
1.001	o	100	S3	24.600	24.078	0.422	Open Manhole	450
1.002	o	150	S2	24.300	23.897	0.253	Open Manhole	450
1.003	o	150	S1	24.300	23.627	0.523	Open Manhole	450
2.000	o	100	S6	24.100	23.960	0.040	Open Manhole	450
2.001	o	150	S5	24.300	23.734	0.416	Open Manhole	450
1.004	o	150	SOAKAWAY	24.300	22.300	1.850	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	10.300	58.5	S3	24.600	24.078	0.422	Open Manhole	450
1.001	7.650	58.4	S2	24.300	23.947	0.253	Open Manhole	450
1.002	15.820	58.6	S1	24.300	23.627	0.523	Open Manhole	450
1.003	2.400	58.5	SOAKAWAY	24.300	23.586	0.564	Open Manhole	1200
2.000	10.310	58.6	S5	24.300	23.784	0.416	Open Manhole	450
2.001	8.440	57.0	SOAKAWAY	24.300	23.586	0.564	Open Manhole	1200
1.004	2.000	57.1	SOAKAWAY	24.350	22.265	1.935	Open Manhole	0

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
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XP Solutions	Network 2020.1.3	

Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S4	100	0.246	0.422	Unclassified	450	0	0.246	Unclassified
1.001	S3	100	0.253	0.422	Unclassified	450	0	0.422	Unclassified
1.002	S2	150	0.253	0.523	Unclassified	450	0	0.253	Unclassified
1.003	S1	150	0.523	0.564	Unclassified	450	0	0.523	Unclassified
2.000	S6	100	0.040	0.416	Unclassified	450	0	0.040	Unclassified
2.001	S5	150	0.416	0.564	Unclassified	450	0	0.416	Unclassified
1.004	SOAKAWAY	150	1.850	1.935	Unclassified	1200	0	1.850	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.004	SOAKAWAY	24.350	22.265	22.300	0	0

Arch Associates Limited		Page 6
Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY	
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XP Solutions Network 2020.1.3		

Simulation Criteria for Storm

Volumetric Runoff Coeff 1.000	Manhole Headloss Coeff (Global) 0.500	Inlet Coeffiecient 0.800
Areal Reduction Factor 1.000	Foul Sewage per hectare (l/s) 0.000	Flow per Person per Day (l/per/day) 0.000
Hot Start (mins) 0	Additional Flow - % of Total Flow 0.000	Run Time (mins) 60
Hot Start Level (mm) 0	MADD Factor * 10m ³ /ha Storage 2.000	Output Interval (mins) 1

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) 19.200	Cv (Summer) 1.000
Return Period (years)	100	Ratio R 0.350	Cv (Winter) 0.840
Region England and Wales		Profile Type Summer Storm	Duration (mins) 30

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY																			
Date 10/07/2023 18:24 File Drainage.MDX	Designed by ARCH ASSOCIATES Checked by CH																			
XP Solutions	Network 2020.1.3																			
<u>Storage Structures for Storm</u>																				
<u>Cellular Storage Manhole: SOAKAWAY, DS/PN: 1.004</u>																				
Invert Level (m) 22.300 Infiltration Coefficient Side (m/hr) 0.06408 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.06408 Safety Factor 3.0																				
<table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td><td>Inf. Area (m²)</td></tr><tr><td>0.000</td><td>16.0</td><td>16.0</td><td>1.500</td><td>16.0</td><td>46.0</td><td>1.501</td><td>0.0</td><td>46.0</td></tr></table>			Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	0.000	16.0	16.0	1.500	16.0	46.0	1.501	0.0	46.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	16.0	16.0	1.500	16.0	46.0	1.501	0.0	46.0												
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

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

Synthetic Rainfall Details

```
Margin for Flood Risk Warning (mm) 300.0 DTS Status   ON Inertia Status OFF
Analysis Timestep      Fine DVD Status OFF
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe
									Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)
1.000	S4 15	Summer	100	+45%					24.322	-0.032	0.000	0.79			5.9
1.001	S3 15	Summer	100	+45%					24.147	-0.031	0.000	0.81			5.9

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XP Solutions	Network 2020.1.3														
Summary of Critical Results by Maximum Level (Rank 1) for Storm <table><thead><tr><th>PN</th><th>US/MH Name</th><th>Status</th><th>Level Exceeded</th></tr></thead><tbody><tr><td>1.000</td><td>S4</td><td>FLOOD RISK</td><td></td></tr><tr><td>1.001</td><td>S3</td><td>OK</td><td></td></tr></tbody></table>				PN	US/MH Name	Status	Level Exceeded	1.000	S4	FLOOD RISK		1.001	S3	OK	
PN	US/MH Name	Status	Level Exceeded												
1.000	S4	FLOOD RISK													
1.001	S3	OK													
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
1.002	S2	15 Summer	100	+45%					23.997	-0.050	0.000	0.78		
1.003	S1	15 Summer	100	+45%	100/15 Summer				23.800	0.023	0.000	1.32		
2.000	S6	15 Summer	100	+45%					24.028	-0.032	0.000	0.80		
2.001	S5	15 Summer	100	+45%					23.789	-0.095	0.000	0.29		
1.004	SOAKAWAY	720 Winter	100	+45%	1/60 Summer				23.649	1.199	0.000	0.00		900

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
1.002	S2	16.8	OK	
1.003	S1	16.7	SURCHARGED	
2.000	S6	5.9	FLOOD RISK	
2.001	S5	5.9	OK	
1.004	SOAKAWAY	0.0	SURCHARGED	

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Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
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STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	15.860	0.271	58.5	0.024	4.00	0.0	0.600	0	150	Pipe/Conduit	

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	18.430	0.315	58.5	0.017	4.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	5.500	0.094	58.5	0.003	4.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	2.000	0.020	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	4.23	24.000	0.017	0.0	0.0	0.0	1.32	23.3	3.1
3.000	50.00	4.09	23.250	0.003	0.0	0.0	0.0	1.01	7.9	0.5
1.001	50.00	4.32	23.106	0.044	0.0	0.0	0.0	1.00	17.8	7.9
1.002	50.00	4.35	22.300	0.044	0.0	0.0	0.0	1.00	17.8	7.9

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S8	24.000	0.580	Open Manhole	450	1.000	23.420	150				
S9	24.580	0.580	Open Manhole	450	2.000	24.000	150				
S10	24.250	1.000	Open Manhole	450	3.000	23.250	100				
S9	24.250	1.144	Open Manhole	450	1.001	23.106	150	1.000	23.149	150	43
								2.000	23.685	150	579
								3.000	23.156	100	
SOAKAWAY 2	24.250	1.950	Open Manhole	450	1.002	22.300	150	1.001	23.056	150	756
	24.250	1.970	Open Manhole	0		OUTFALL		1.002	22.280	150	

No coordinates have been specified, layout information cannot be produced.

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Town House St Geroge's Square Bishops Waltham Southampton SO32 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
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PIPELINE SCHEDULES for Storm

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
1.000	o	150	S8	24.000	23.420	0.430	Open Manhole		450
2.000	o	150	S9	24.580	24.000	0.430	Open Manhole		450
3.000	o	100	S10	24.250	23.250	0.900	Open Manhole		450
1.001	o	150	S9	24.250	23.106	0.994	Open Manhole		450
1.002	o	150	SOAKAWAY 2	24.250	22.300	1.800	Open Manhole		450

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
1.000	15.860	58.5	S9	24.250	23.149	0.951	Open Manhole		450
2.000	18.430	58.5	S9	24.250	23.685	0.415	Open Manhole		450
3.000	5.500	58.5	S9	24.250	23.156	0.994	Open Manhole		450
1.001	5.000	100.0	SOAKAWAY 2	24.250	23.056	1.044	Open Manhole		450
1.002	2.000	100.0		24.250	22.280	1.820	Open Manhole		0

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Network Classifications for Storm

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
1.000	S8	150	0.430	0.951	Unclassified	450	0	0.430	Unclassified
2.000	S9	150	0.415	0.430	Unclassified	450	0	0.430	Unclassified
3.000	S10	100	0.900	0.994	Unclassified	450	0	0.900	Unclassified
1.001	S9	150	0.994	1.044	Unclassified	450	0	0.994	Unclassified
1.002	SOAKAWAY 2	150	1.800	1.820	Unclassified	450	0	1.800	Unclassified

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002		24.250	22.280	0.000	0	0

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Town House St Geroge's Square Bishops Waltham Southampton S032 1AF	QUEENS VIEW NETLEY SOAKAWAY 2 NETWORK	
Date 12/07/2023 13:10 File Drainage SA2.MDX	Designed by ARCH ASSOCIATES Checked by CH	
XP Solutions	Network 2020.1.3	
<u>Simulation Criteria for Storm</u>		
Volumetric Runoff Coeff 1.000 Manhole Headloss Coeff (Global) 0.500 Inlet Coeffiecient 0.800 Areal Reduction Factor 1.000 Foul Sewage per hectare (l/s) 0.000 Flow per Person per Day (l/per/day) 0.000 Hot Start (mins) 0 Additional Flow - % of Total Flow 0.000 Run Time (mins) 60 Hot Start Level (mm) 0 MADD Factor * 10m³/ha Storage 2.000 Output Interval (mins) 1		
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		
<u>Synthetic Rainfall Details</u>		
Rainfall Model FSR M5-60 (mm) 19.300 Cv (Summer) 1.000 Return Period (years) 100 Ratio R 0.350 Cv (Winter) 0.840 Region England and Wales Profile Type Summer Storm Duration (mins) 30		
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Town House St Geroge's Square	QUEENS VIEW																			
Bishops Waltham	NETLEY																			
Southampton S032 1AF	SOAKAWAY 2 NETWORK																			
Date 12/07/2023 13:10	Designed by ARCH ASSOCIATES																			
File Drainage SA2.MDX	Checked by CH																			
XP Solutions	Network 2020.1.3																			
Storage Structures for Storm Cellular Storage Manhole: S9, DS/PN: 1.001 Invert Level (m) 22.300 Infiltration Coefficient Side (m/hr) 0.06400 Porosity 0.95 Infiltration Coefficient Base (m/hr) 0.06400 Safety Factor 3.0 <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>45.0</td><td>45.0</td><td>1.000</td><td>45.0</td><td>81.0</td><td>1.001</td><td>0.0</td><td>81.0</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	45.0	45.0	1.000	45.0	81.0	1.001	0.0	81.0
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)												
0.000	45.0	45.0	1.000	45.0	81.0	1.001	0.0	81.0												
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

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

Synthetic Rainfall Details

```
Margin for Flood Risk Warning (mm) 300.0 DTS Status   ON Inertia Status OFF
Analysis Timestep      Fine DVD Status OFF
```

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Flow / Cap.	Overflow (l/s)	Half Drain	Pipe
									Level (m)	Depth (m)	Volume (m³)			Time (mins)	Flow (l/s)
1.000	S8	15 Summer	100	+45%					23.534	-0.036	0.000	0.94			20.2
2.000	S9	15 Summer	100	+45%					24.089	-0.061	0.000	0.66			14.3

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<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>																			
<table><thead><tr><th></th><th>US/MH</th><th></th><th>Level</th></tr><tr><th>PN</th><th>Name</th><th>Status</th><th>Exceeded</th></tr></thead><tbody><tr><td>1.000</td><td>S8</td><td>OK</td><td></td></tr><tr><td>2.000</td><td>S9</td><td>OK</td><td></td></tr></tbody></table>					US/MH		Level	PN	Name	Status	Exceeded	1.000	S8	OK		2.000	S9	OK	
	US/MH		Level																
PN	Name	Status	Exceeded																
1.000	S8	OK																	
2.000	S9	OK																	
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
3.000	S10	15 Summer	100	+45%					23.291	-0.059	0.000	0.36		
1.001	S9	600 Winter	100	+45%					23.102	-0.154	0.000	0.00		760
1.002	SOAKAWAY 2	15 Summer	1	+0%					22.300	-0.150	0.000	0.00		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
3.000	S10	2.5	OK	
1.001	S9	0.0	OK	
1.002	SOAKAWAY 2	0.0	OK	