

Downley Road, Havant

Flood Risk Assessment + Drainage Strategy



24-011-CAN Downley Road, Havant



Quality Control

Prepared by	Checked by	Approved by
Rishad Manil Senior Engineer	Ismail Laher Director	Grant Verster Consultant

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Final	08.07.2024	Submission for Full Planning	GV	Grant Verster	Consultant
P1	12.03.2024	Submission for Full Planning	GV	Grant Verster	Consultant

Prepared for:



Prepared by:

I&L Consulting Ltd.
29-31 Castle Street, High Wycombe, Buckinghamshire, HP13 6RU

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

Table of Contents

1.	Introduction.....	4
2.	Planning Policy and Evidence	6
3.	Site Description	9
4.	Existing Flood Risk.....	11
5.	Flood Risk from the Proposed Development.....	15
6.	Conclusion.....	25
Appendix A Proposed Site Plan		26
Appendix B Topographical Survey + Southern Water Utility Map		27
Appendix C Proposed Drainage Strategy Layout		28
Appendix D Hydraulic Calculation.....		29
Appendix E Infiltration Tests.....		30

1. Introduction

I&L Consulting Limited (I&L) was commissioned by the Applicant, Canmoor Developments Limited, to undertake a Flood Risk Assessment (FRA) and drainage strategy for a proposed industrial development located off Downley Road in Havant. The site lies within the authority of Havant Borough Council (HBC).

The relevant national planning guidance is set out by the National Planning Policy Framework (NPPF, updated in 2023). A FRA is required because the proposed development is greater than 1 hectare and located in Flood Zone 1 (low risk). The FRA therefore must assess aspects of flood risk specifically with regards to surface water flooding at the site and ensure that any proposed development allows for this existing flood envelope on site.

1.1 Study Aims and Objectives

The overall objective of this study was to carry out a FRA that meets the requirements of the NPPF and HBC flood risk policies. These consider surface water runoff management and the specific needs of the Environment Agency (EA), HBC and Local Water Authority. The study is required to assess all aspects of flood risk to the proposed development, the potential impacts of the development on people and property elsewhere within the catchment and identify possible mitigation measures to ensure that the development is safe in the event of a flood. To achieve this aim, the following key actions were undertaken:

- Obtain flood data from the EA and HBC;
- Review topographical and flood risk data to identify the existing flood risk posed to the site from all sources;
- Assess the residual flood risk post-development;
- Consider the vulnerability of the users and the development, taking account of the vulnerability classification;
- Assess the safety of the route of access/egress from the site in a flood event;
- Identify suitable mitigation measures to protect the development site against flooding; and
- The production of a conceptual surface water drainage strategy for the proposed development.

1.2 Scope of Works

In order to meet the above objectives, the following scope of work and tasks were undertaken:

- **Task 1: Data Collection.** I&L Consulting collected relevant available information on the nature of the flooding at the site. The Applicant and their consultant team have provided information about the site and proposed development layout and design.
- **Task 2: Identification of Current and Post-Development Flood Risk.** The existing and post-development flood risk posed to the site was assessed from the data that was collected in Task 1. The assessment identifies the flood risk from all potential sources of flooding and includes consideration of the impact of climate change on flood risk.
- **Task 3: Assessment of Site Safety.** I&L Consulting considered whether flood resilience measures needed to be undertaken and the safety of the route of access/egress from the site.

1.3 Data Collected

Table 1 lists the data that has been collected as part of this assessment. Comments on the source and the nature of the data are also provided.

Table 1: Collected Data

Purpose	Data and Source	Comments
Identification of site location	Ordnance Survey Map	Identifies the position of the site and local hydrological features
Identification of flood risk	Environment Agency Flood Map	Risk of flood from tidal and fluvial sources
	Topographical Survey	Existing site levels and topography
	Development details (drawings for existing site and proposed development)	Information on the layout of the proposed development
	Strategic Flood Risk Assessment (SFRA)	Reports that identify existing flood risk information within the area and considerations for development.
	Havant Borough Council Local Development Framework	Relevant Planning Policies
Identification of the existing drainage network	Sitewide Drainage Plan	Asset plans and drainage drawings identify public and private sewers nearest to the site.
Identification of ground conditions	British Geological Society (BGS) borehole logs.	Identifies the type of aquifer, groundwater level, permeability and geotechnical information
	Site specific intrusive testing.	

2. Planning Policy and Evidence

2.1 National Planning Policy Framework

The NPPF sets out what needs to be taken into account by developers to assess whether a proposed development is likely to be at risk of flooding or has the potential to increase flood risk elsewhere. Within the recently published updated NPPF (2023), the principles relating to flood risk management remain mostly unchanged from the 2021 version.

The overall objective of the NPPF is to steer development towards areas of lowest flood risk. NPPF policy aims to ensure flood risks have been taken into account and appropriate measures put in place to ensure that:

- The development is safe;
- Where possible, the flood risk overall is reduced;
- Increased flood risk does not occur elsewhere; and
- Appropriate mitigation measures are employed to deal with these effects and risks.

Paragraph 173 and footnote 59 of the NPPF outlines that a site-specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

The EA Flood Map shows the site to be located within Flood Zone 1, **low risk from fluvial flooding and surface water flooding**.

The NPPF considers the vulnerability of different forms of development to flooding; and classifies the proposed development as 'Less Vulnerable'.

2.2 Local Policy

The Local Plan (Core Strategy) was adopted by the Havant Borough Council in March 2011. An extract of the flood risk management policy is included below.

Policy CS15 Flood and Coastal Erosion Risk

Development in areas at risk of flooding now and in the future as identified on the latest Environment Agency flood risk maps and Strategic Flood Risk Assessment climate change maps will only be permitted where:

1. *It meets the sequential and exception test (where required) in relation to PPS25.*
2. *The site is located in a low hazard area as defined in the Strategic Flood Risk Assessment.*
3. *A site-specific flood risk assessment demonstrates that the development will be safe, including the access, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*
4. *The scheme incorporates flood protection, flood resilience and resistance measures appropriate to the character and biodiversity of the area and the specific requirements of the site.*
5. *Appropriate flood warning and evacuation plans are in place.*
6. *New site drainage systems are designed taking account of events which exceed the normal design standard.*

All development will be required to ensure that there is no net increase in surface water run off. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage,

unless it is proven that SuDS are not appropriate. Where SuDS are provided arrangements must be put in place for their whole life management and maintenance.

The council will work with partners to implement the Coastal Policy Zones in the North Solent Shoreline Management Plan to ensure that development avoids areas at risk from coastal erosion and coastal flooding and that areas required to offset coastal squeeze and prevent habitat fragmentation, to allow species to adapt to climate change, are identified and protected from development.

A pre- submission version of the Havant Borough Local Plan with changes was published in September

2020 and is expected to be submitted to the Secretary of State after consultation. Extracts of all relevant drainage and flood risk management policies are included below.

Policy E19 Managing flood risk in new development

Planning permission will only be granted where:

- a. The proposal meets the sequential and exception tests as set out in the NPPF and relevant local guidance;*
- b. The development will be safe over its lifetime without increasing flood risk elsewhere;*
- c. Any proposed flood protection, resilience and resistance measures address the specific requirements of the site, and are appropriate to the character and biodiversity of the area;*
- d. Opportunities have been explored to reduce flood risk;*
- e. Where necessary, appropriate flood warning and evacuation plans are in place; and*
- f. Where necessary, a contribution has been made towards any identified flood alleviation scheme(s).*

Policy E20 Drainage infrastructure in new development

Planning permission will only be granted where:

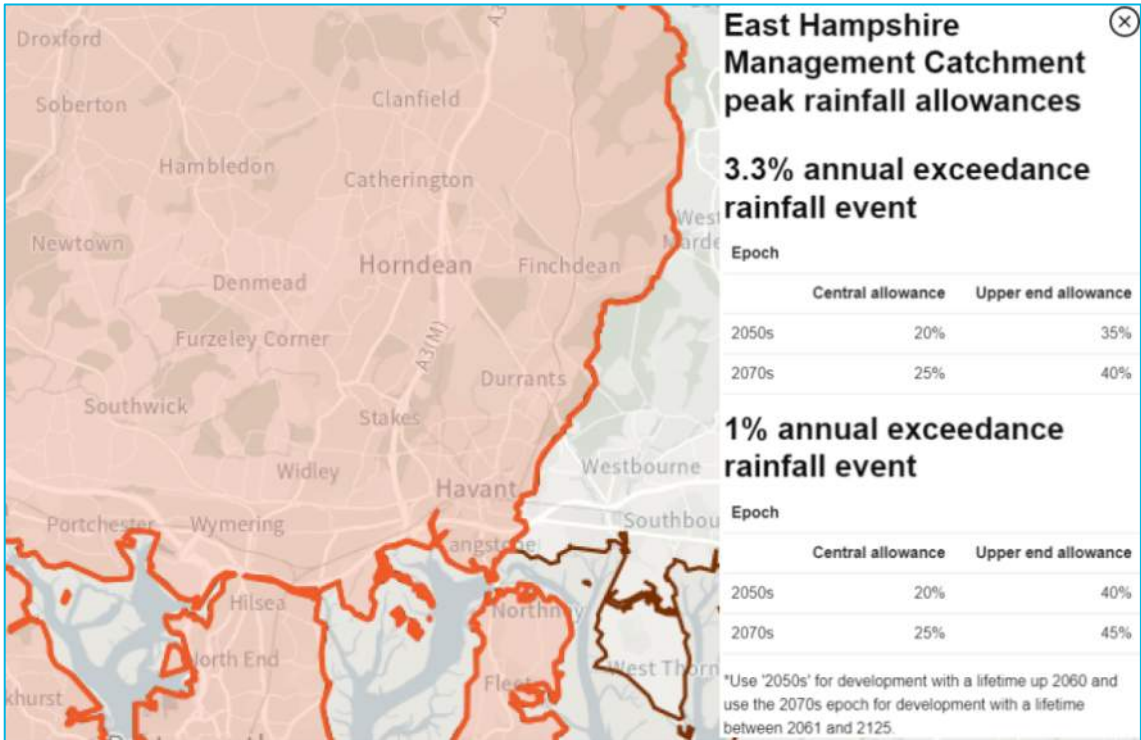
- a. Run-off rates have been reduced to below the pre-development rate, or, if this is not possible, there is no net increase in surface water run-off compared with the pre-development rate;*
- b. Drainage systems meet the drainage needs of the development in full over the lifetime of the*
- c. development and do not increase flood risk elsewhere;*
- d. The drainage strategy incorporates SuDS, unless there is clear evidence that this would be inappropriate;*
- e. Arrangements have been made between the applicant and the service provider for the timely delivery of sewerage network reinforcement; and*
- f. Any existing sewerage infrastructure is taken into account in site layout, to safeguard future access for maintenance and upsizing purposes.*

2.3 Climate Change

Predicted future change in peak river flows caused by climate change are provided by the EA within their online guidance¹. The UK has been split into a series of regionalised 'River Basin Districts'. These River Basin Districts are further split into Management Catchments, for which a range of climate change projections have been applied.

The development falls within the East Hampshire Management Catchment. The extract below identifies the relevant peak rainfall allowances from this Management Catchment.

¹ Environment Agency, Flood risk assessments: climate change allowances: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#table-1>



When determining the appropriate allowance for use in an FRA the anticipated lifespan of the development should be considered. This development is expected to have a design greater than 2060.

The EA guidance is to use the Upper End allowance for the 2070s epoch (2061 to 2125), which gives values of 40% for the 3.3% (30yr) and 45% for the 1% (100yr) rainfall events. The value of **45%** has been used in the surface water calculations appended to this report.

3. Site Description

The proposed development site which is the subject of this Flood Risk Assessment (FRA) is located off Downley Road, Havant. The site is located within a well-established industrial park. The existing site is currently extensively developed brownfield land with existing Industrial usage.

The proposal is to demolish the existing warehouse buildings and redevelopment to provide employment units for a flexible range of employment uses (Use Classes E(g)(iii), B2 and/or B8) erection of ancillary offices, together with the provision of yard areas, parking, landscaping and associated works. The total development has a slight fall from the northeast to the southwest.

The existing site is a Brownfield site with existing drainage serving the site. Southern Water utility map have been provided which shows both surface (375dia.) and foul (225dia.) water public sewers are located in Downley Road. The proposal would be to drain the redeveloped site at a restricted rate using a hydro brake flow control via the existing outfall pipes to the public sewers in Downley Road.

The site location plan is shown in Figure 1 below.



Figure 1: Site Location Plan

3.1 Topography and Hydrological Setting

There are no ordinary watercourses on or near the site. Therefore, ordinary watercourses are assessed to pose a low flood risk to the site.

The topographic survey (**Appendix B**) indicates that site levels across the site have fall from the northeast 19.25m AOD to southwest 18.05m AOD.

3.2 Geology and Hydrogeology

A phase 2 intrusive investigation has been completed by TRC at the site. Applicable sections from this report have been included below. This intrusive testing indicates ground conditions on site to comprise of Made Ground overlying the superficial geology, comprising River Terrace Deposits to at least 10m bgl. Bedrock geology was not encountered during the investigation.

Investigation Findings	
Ground Conditions	Made Ground was encountered between ground level and a maximum of 1.20m bgl.
	Superficial geology, comprising River Terrace Deposits, were encountered underlying Made Ground to at least 10m bgl, where the deepest borehole terminated. Bedrock geology was not encountered during the investigation.
Groundwater Conditions	During the ground investigation, groundwater was encountered within the deep borehole CP102 at 5.00m bgl and at 9.00m bgl rising to 7.50m bgl within the River Terrace Deposits. During subsequent monitoring, groundwater was encountered within CP102 at between 5.34m and 5.88m bgl within River Terrace Deposits. Dry conditions were encountered within the remaining shallower boreholes.
Soakaways	Soakaway testing did not form part of the scope of works, however given the predominantly granular nature of the superficial deposits, shallow soakaways may be viable for future developments. Suitability of ground conditions for shallow soakaways would be subject to confirmation of infiltration rates via in-situ testing in accordance with BRE 365.

Geology	Geological Description	Aquifer Status	Aquifer Description
Superficial Deposits: Head Deposits	Clay and Gravel	Secondary (Undifferentiated) Aquifer / Secondary (A) Aquifer	It is not possible to apply either an A or B definition because of the variable characteristics of the ground type.
Superficial Deposits: River Terrace Deposits	Sand and Gravel	Secondary (A) Aquifer	Permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers, lakes or wetlands.
Bedrock: London Clay Formation	Clay and Silt	Unproductive Strata	Geological strata with low permeability that have negligible significance for water supply or river base flow. They consist of deposits that naturally offer protection to any aquifers that may be present beneath.
The Site lies within a groundwater Source Protection Zone (SPZ) 1c (Inner Protection Zone), which relates to the superficial deposits. There are no active groundwater abstractions within 1km of the Site boundary. The Landmark Envirocheck report indicates the potential for groundwater flooding of property situated below ground level and potential for groundwater flooding to occur at ground surface. Historical BGS boreholes in the surrounding area indicate the presence of groundwater within the River Terrace Deposits between 1.40m and 6.00m bgl.			

4. Existing Flood Risk

This section of the report identifies the existing risks from the different forms of flooding identified in NPPF.

4.1 Fluvial & Tidal Flooding

The EA has produced Flood Zone maps for much of England and Wales. The current displayed map is reproduced as Figure 2 below and shows the site to lie within Flood Zone 1 (low risk).

Figure 2 below has been extracted from the GOV.UK online map which shows the flood risk profile for the development site.

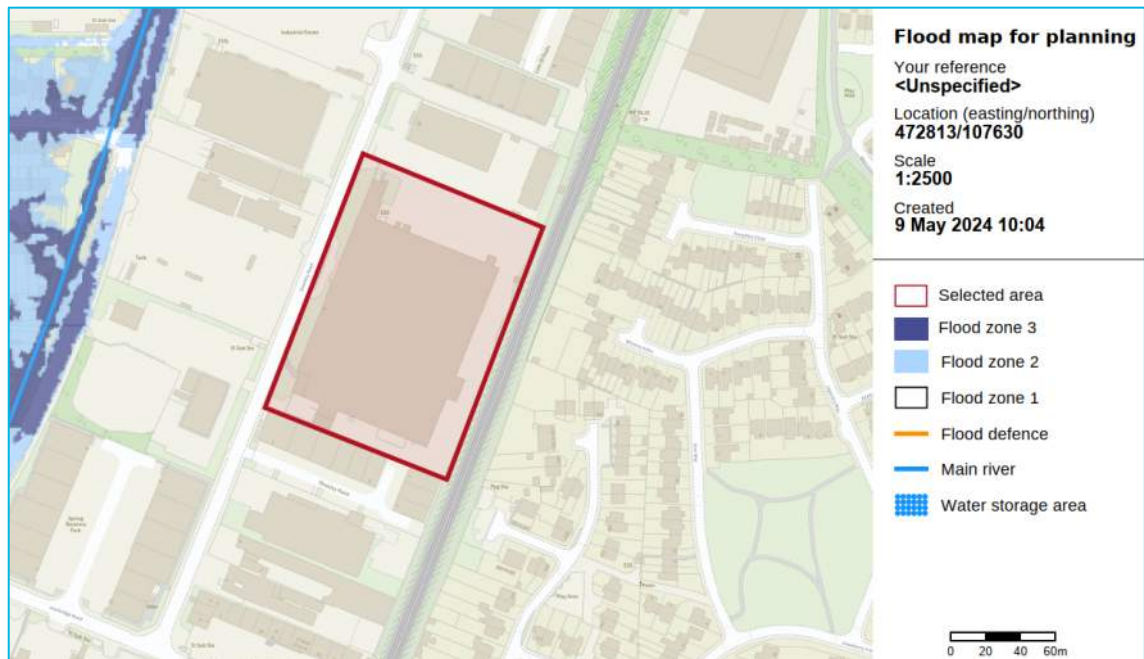


Figure 2: Fluvial Flood Risk Map (Source: <https://flood-warning-information.service.gov.uk>)

On the coast storm surges and high tides can threaten low lying coastal areas and can be sometimes large and rapid enough to overtop defence works, causing significantly more damage than river flooding. Tidal flooding is not considered a risk to the site due to the inland location of the development.

Therefore, flood risk from fluvial and tidal sources to the site is considered to be low.

4.2 Surface Water Flooding

Surface water flooding occurs when rainfall is unable to infiltrate into the ground and/or engineered drainage networks and accumulates on the surface.

The risk of flooding from surface water is presented in the GOV.UK online map at a strategic scale. It can be seen from the surface water flood map in Figure 3 that the site is at very low risk of surface water flooding. This represents a less than 0.1% annual probability of occurrence.

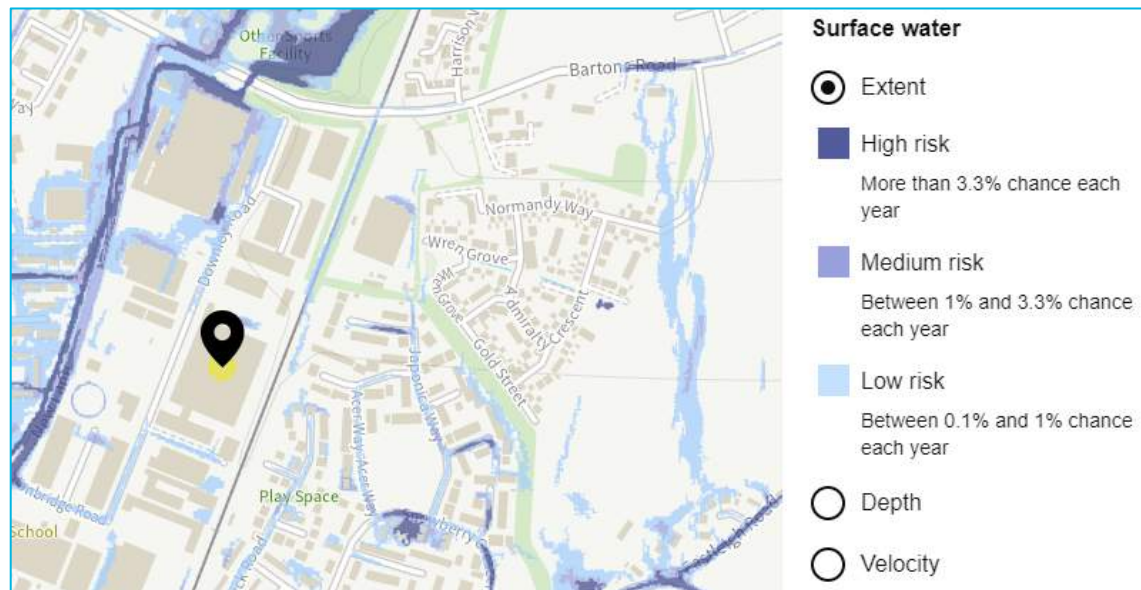


Figure 3: Surface Water Flood Risk Map (Source: <https://flood-warning-information.service.gov.uk>)

Given the topography, the proposed levels and the new drainage system with significant reduction to the runoff rate, the site will be at a low risk from surface water flooding.

4.3 Groundwater Flooding

Groundwater flooding typically occurs when water levels rise above surface elevations from underlying rocks or springs following prolonged rainfall. The two most common mechanisms of groundwater flooding are:

1. **Bedrock Flooding** – Occurs following extended periods of rainfall in areas underlain by a permeable bedrock outcrop. Typically, chalk aquifers pose the greater risk, where the large pore spaces in the rock allow the water table to rise rapidly. Settlements most at risk are those in low-lying areas and at the base of steep-sided valleys at the interface between permeable and impermeable strata (where the groundwater table is naturally closer to the ground surface).
2. **Superficial Deposit Flooding** – Occurs in permeable unconsolidated deposits (e.g., gravel) which lie on river floodplains following high in-bank river levels.

Due to a history of ground water flooding in Hampshire, Ground Water Management Plan (GWMP) was created in collaboration with other stakeholders in the county to identify areas at risk of ground water flooding and provide plans to mitigate the risks. The Areas Susceptible to Ground Water Flooding mapping provided in the Ground Water Management Plan GWMP (attached as Figure 4.4) indicates that there is a possibility of groundwater flooding within the vicinity of the proposed site.

A review of the results from intrusive testing on site by TRC, see point 3.2 above, have recorded groundwater within a range of 5.34m to 5.88m below the ground level at around 18.05 AOD; which is significantly lower than the proposed site's surface levels and therefore the risk of flooding on site due to ground water is considered low.

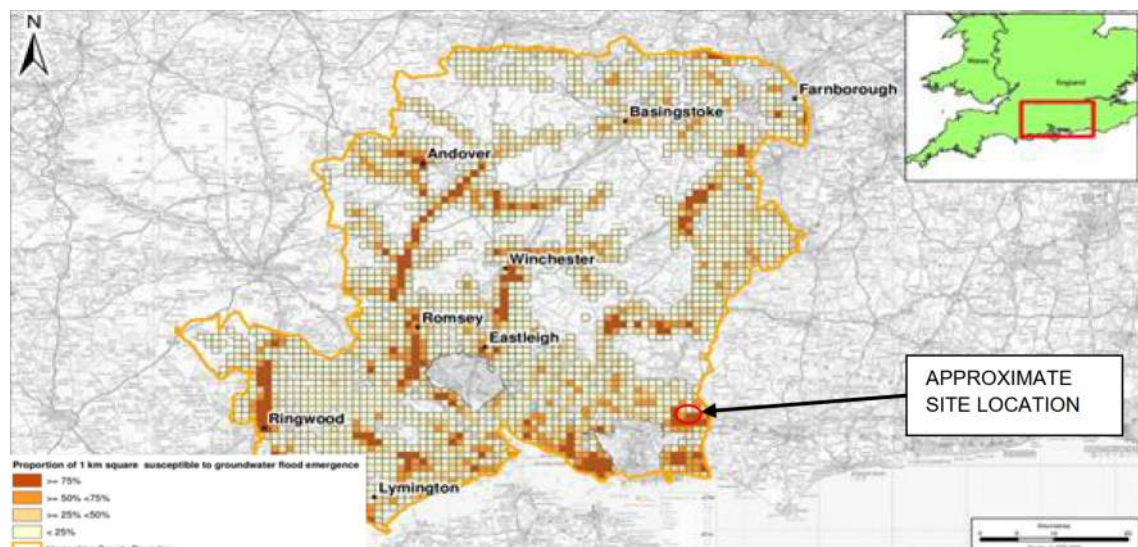


Figure 4: Areas Susceptible to Ground Water Flooding Mapping adapted from Hampshire Ground Water Management Plan. (Approximate Site shown in Red)

FFLs will be set 150mm above existing ground levels, we would expect the risk from groundwater flooding at this site to be low.

4.4 Sewer Flooding

A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes. Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30-year rainfall event. By definition a 1 in 100-year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area.

The discharge from the site will be via infiltration subject to planning approval. If this is not agreed as a viable option then discharge shall be restricted to Greenfield (urban) runoff rates. Flows from the site shall therefore not increase.

Therefore, the risk of sewer flooding to the site is considered low.

4.5 Artificial Sources of Flooding

The EA Flood Risk from Reservoirs mapping indicates that the site is located outside of an area of potential risk from flooding. There has been no loss of life in the UK from reservoir flooding since 1925.

Therefore, the risk from this type of flooding can be considered low.

4.6 Summary of Existing Flood Risk

The flood risk from fluvial & tidal flooding, surface water flooding, sewer flooding and groundwater is assessed to be low.

The flood risk to the site is summarised in Table 3.

Table 3: Summary of flood risk to the Site

Type of Flooding	Source of Flooding	Existing Flood Risk
Fluvial and Tidal	No Watercourses in close proximity.	Low (Flood Zone 1)
Surface Water	Runoff from the site and surrounding land	Low
Sewers	Surrounding public foul drainage systems	Low
Ground Water	Underlying geology and groundwater levels	Medium
Artificial Sources	none	n/a

5. Flood Risk from the Proposed Development

A full planning application is being submitted for the redevelopment of the site to provide employment units for a flexible range of employment uses (Use Classes E(g)(iii), B2 and/or B8) erection of ancillary offices, together with the provision of yard areas, parking, landscaping and associated works. Total development area of 1.70 ha. The proposed Site plan drawing is included in **Appendix A**.

5.1 Design Philosophy

The site is located within the Source Protection Zone 1c (SPZ1c) for an essential Public Water Supply Source. The SPZ1c relates to subsurface activity only, where the Chalk aquifer is confined and may be impacted by deep drilling activities. Subterranean activities such as deep drainage solutions and/or piling may pose a risk to groundwater quality at the local public water supply source. The groundwater area is of high sensitivity and consequently all measures to prevent pollution during and post construction are required in order to safeguard the local public water supply.

In conjunction with Building Regulations H3, the primary approach to the drainage of surface water runoff must be subject to the results of an infiltration test (conducted in accordance with BRE365 guidance) commissioned on the development site, winter ground water level monitoring and the availability of good infiltration media at the proposed soakaway locations. A site-specific infiltration test (conducted in accordance with BRE365 guidance) has been carried out on the development site. The test results have been included as **Appendix E** and confirms favourable infiltration rates within the subsoil. The proposal therefore is to discharge the surface water runoff from the development via a soakaway. However, the site is located within 'Zone 1- Subsurface Activity' Ground Water Source Protection Zone, which is designated as most at risk from contamination and development activities. This proposal will need to be approved through the planning consultation process.

The next method of discharge in conjunction to Building Regulation H3 would be to discharge into the nearest watercourse. No opportunity exists to discharge into watercourse as the nearest watercourse is located at approximately 60m away from the northwest site boundary; beyond New Lane road and residential properties.

As noted under section 3 above, the existing site is connected directly to the public sewer network with no infiltration or formal surface water runoff reduction in place. Should infiltration not be agreed as a viable option then the proposal would be to discharge the surface water runoff from the development into the existing public surface water network located under Downley Road at a reduced Greenfield (urban) rate.

The design approach ensures a sustainable, long-term solution for the Site, incorporating the following SuDS Mitigation measures:

- Permeable asphalt in carparks
- Underground restricted attenuation.

5.2 Fluvial and Tidal Flooding

The site is located within Flood Zone 1 (low risk) and therefore the proposed development would have no impact on the fluvial or tidal flooding. The risk from the proposed development would remain as low.

5.3 Surface Water Flooding and Proposed Drainage Strategy

Policy E20 notes that planning *Planning permission will only be granted where:*

- Run-off rates have been reduced to below the pre-development rate, or, if this is not possible, there is no net increase in surface water run-off compared with the pre-development rate;*
- Drainage systems meet the drainage needs of the development in full over the lifetime of the*
- development and do not increase flood risk elsewhere;*

- d. The drainage strategy incorporates SuDS, unless there is clear evidence that this would be inappropriate;

Component Type	Description	Collection Mechanism	Design criteria					
			Water quantity			Water quality	Amenity	Biodiversity
			Peak runoff rate	Runoff volumes				
				Small events (interceptions)	Large events			
Rainwater harvesting	System that collects runoff from the roof of a building or other paved surface for use	P		●	●		●	
Green roofs	Planted soil layers on the roof of buildings that slow and store runoff	S	○	●		●	●	●
Infiltration systems	Systems that collect and store runoff, allowing it to infiltrate into the ground	P	○	●		●	●	●
Proprietary treatment systems	Subsurface structures designed to provide treatment of runoff	P				●		
Filter strips	Grass strips that promote sedimentation and filtration as runoff is conveyed over the surface	L		●		●	○	○
Filter drains	Shallow stone-filled trenches that provide attenuation, conveyance and treatment of runoff	L	●	○		●	○	○
Swales	Vegetated channels (sometimes planted) used to convey and treat runoff	L	●	●	●	●	●	●
Bioretention systems	Shallow landscaped depressions that allow runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils	P	○	●	○	●	●	●
Trees	Trees within soil-filled tree pits, tree planters or structural soils used to collect, store and treat runoff	P	●	●		●	●	●
Pervious pavements	Structural paving through which runoff can soak and subsequently be stored in the sub-base beneath, and/or allowed to infiltrate into the ground below	S	●	●	●	●	○	○
Attenuation storage tanks	Large, below-ground voided spaces used to temporarily store runoff before infiltration, controlled release or use	P	●					
Detention basins	Vegetated depressions that store and treat runoff	P	●	●	●	●	●	●
Ponds and wetlands	Permanent pools of water used to facilitate of runoff - runoff can also be stored in an attenuation zone above the pool	P	●			●	●	●
Key P-Point, L-Lateral, S-Surface, ● Likely valuable contribution to delivery of design criterion, ○ Some potential contribution to delivery of design criterion, if specifically included in the design								

Table 1: Table 7.1 SuDS component delivery of design criteria

5.3.1 Site Specific Strategy

The topographical survey and existing utility scan, see **Appendix B**, shows the site to be impermeable with existing drainage outfall points connecting to the public sewer. There is no record of there being any formal surface water restriction in place for the previous site.

As noted under point 5.1 above, the proposal is to discharge the surface water runoff from the development via a soakaway. But the site is located within 'Zone 1- Subsurface Activity' Ground Water Source Protection Zone, which is designated as most at risk from contamination and development activities. Therefore, this method of discharge will need approval via planning consultation.

The prevention of pollution during and post construction are required in order to safeguard the local public water supply given its location within the Source Protection Zone 1c (SPZ1c). Operation process will be required from the system: Sedimentation, Filtration, Chemical Separation and Oil Retention.

The surface water drainage network for the proposed development is in line with the principles of integrated Construction Industry Research and Information Association (CIRIA) Sustainable Drainage System SuDS and source control methods to convey surface water runoff flows from the site as well as national and local standard.

- The site is a Brownfield site with existing drainage in place and no formal restrictions on discharge rates.
- The in-situ ground is appropriate for infiltration drainage. The proposal is to discharge via soakaway.
- If discharge via infiltration is not agreed then the proposal would be to restrict the discharge to **the Greenfield (urban) rate** for all return periods, including climate change allowances;
- Appropriate attenuation to be provided onsite;
- The onsite surface water drainage design will follow the principles listed in the Approved Document Part H of the Building Regulations and Sewers for Adoption 7th Edition. The Building Regulations established a hierarchy for surface water disposal which encourages a SuDS approach;
- No surcharge for the 1:1year rainfall event except for the outfall pipe which may surcharge due to restriction.
- Onsite surface water sewers shall be designed to a 1 in 30 year no flooding standard in accordance with BS EN 752: 2017. There will be no flooding of buildings or off-site areas during a 1 in 100-year return period storm event including climate change allowance.
- Greenfield runoff rate (GRR) calculated using the ICP SUDS method confirms Qbar (urban) rate for the site of 16.5 litres/second.
- Any onsite flooding in the 1:100+45% event, will be directed into a safe place or mitigation measures to be provided on site for any flooding over 5m³.
- The drainage system to provided pollution prevention proprietary systems.

The proposed drainage network and attenuation requirements are modelled using industry standard hydraulic modelling software and included in **Appendix D**. The controlled discharge will be made via the existing outfall points for the site.

The proposed detailed drainage layout is included in **Appendix C**.

Therefore, based on designing to best practise and a betterment to the existing situation the risk of surface water flooding from the proposed development will remain low.

5.4 Water Quality

Table 26.2 of the CIRIA C753 SuDS Manual identifies that the pollution hazard level associated with the land uses within the Proposed Development as being 'Medium'. On a scale from 0 – 1, 'Commercial Yard & delivery areas' are deemed to have the following pollution hazard indices:

- Total suspended solids = 0.7
- Metals = 0.6
- Hydrocarbons = 0.7

The SuDS Manual confirms that in England and Wales, where the destination of runoff is to a watercourse then surface water indices should be used for the surface water discharge (Table 26.3 of The SuDS Manual).

The proposed surface water drainage strategy discharges to an existing sewer out falling into a watercourse. Therefore, the use of the surface water indices approach is deemed to be appropriate.

In terms of pollution control the site it is proposed that the commercial yard and delivery areas are to be protected by Class 1 bypass petrol interceptor. The pollution mitigation assessment is summarised in Tables 4 below. The pollution removal characteristics of the pollution control features are based on data in CIRIA C753 and data provided by the product manufacturers.

Table 4: Pollution Mitigation Assessment for the site

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydrocarbons
Class 1 Bypass Petrol Interceptor (Kingspan or similar)	0.4*	0.6*	0.8*
Total	0.4	0.6	0.8

*subject to manufactures details

The results in Table 4 show that there is a minor residual impact associated with the Total Suspended Solids. However, whilst Pollution Mitigation Index data is not provided in CIRIA C753 for gullies/catch pit manholes, it is anticipated that sumps at the base of the gullies and catch pits will provide a positive improvement that would mitigate the residual impact for the Total Suspended Solids.

Proprietary treatment systems are manufactured products that remove specified pollutants from surface water runoff. They can often be complementary to landscaped features, reducing pollutant levels in the runoff and protecting the amenity and/or biodiversity functionality of downstream SuDS components.

They can provide a valuable function in removing pollutants from runoff and may therefore be considered as an integral part of the Management Train in some situations.

5.4.1 Maintenance of Proprietary Systems

Maintenance schedule	Required action	Typical frequency
Routine maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables. A log should be kept detailing the depth of oil found, any oil volume and silt removed, or cleaning carried out. Alarm probes should be removed and cleaned at each inspection.	As necessary – indicated by system inspections or immediately following significant spill
Remedial actions	Replace malfunctioning parts or structures	As required
	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly

Monitoring	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months
------------	---	--

Table 5: Assessment of Suitability of SuDS at the site as the drainage hierarchy

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site
Retention	Balancing Pond		Provides both storm water attenuation and treatment. Run-off from each rain event is detained and treated in the pool. The retention time promotes pollutant removal through sedimentation.	Good removal of pollutants, can be used where groundwater is vulnerable, good community acceptability, high ecological, and amenity benefits.	No reduction in run-off volume, land take may limit use in high density sites.	✗ Not suitable for the type of development
	Sub-surface Storage		Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios), can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.	✓ Sub-surface storage is recommended.
Wetland	Shallow wetland		Wetlands provide storm water attenuation and treatment. They comprise shallow ponds and marshy areas, covered in aquatic vegetation. Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants. They can provide significant ecological benefits.	Good pollutant removal and if lined can be used where groundwater is vulnerable. Good community acceptability, ecological and amenity benefits.	Land take is high, requires base flow, little reduction in run-off volume, not suitable for steep sites.	✗ Wetlands are not possible due to the high land take required
	Extended detention wetland					
	Pond wetland					
	Pocket wetland					
	Submerged gravel wetland					
	Wetland channel					
Infiltration	Infiltration trench		Surface water run-off can be discharged directly to ground for infiltration by soakaways, basins, or trenches. A prerequisite is that both groundwater and ground conditions are appropriate to receive the quality and quantity of water generated.	Reduces the volume of run-off, effective at pollutant removal, contributes to groundwater recharge, simple and cost-effective, easy performance observation.	Requires appropriate pre-treatment, basins require a large flat area, offset from foundations.	✓ Soakaways are proposed subject to approval as site is located within 'Zone 1-Subsurface Activity' Ground Water Source Protection Zone.
	Infiltration basin					
	Soakaway					

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site
	Porous paving		Block or porous paving allows run-off to infiltrate through to subbase layer. Water can then be infiltrated into ground or conveyed into storage or drainage systems.	Reduces the volume of run-off and if designed for infiltration contributes towards groundwater recharge. Easy to install and retrofit. Simple to manage. If lined can be used where groundwater is sensitive.	Not suitable for heavily trafficked areas or adoptable roads. Requires regular sweeping to prevent clogging with dirt.	✓ Porous asphalt to the car parking areas could be used but limited parking areas.
	Permeable paving					
Filtration	Surface sand filter		Structures designed to treat surface water run-off through filtration using a sand bed filter medium. The filters can be designed with or without infiltration. Temporary storage of run-off is achieved through ponding above the filter layer. They are used where particularly high pollutant removal is required.	Flexibility of design, efficient in removing pollutants, suitable for retrofits and in tightly constrained urban locations.	Not for high sediment content, detention times can support algae growth, minimum hydraulic head of 1.2m required, possible odour problems, high capital and maintenance cost.	✗ There is no requirement for high pollution reduction at this site
	Sub-surface sand filter					
	Perimeter sand filter					
	Bioretention/filter swale		Vegetated strips of land designed to accept run-off as overland sheet flow between a hard-surfaced area and a receiving system.	Landscaping features, effective in removing pollutants, flexible layout to fit into landscape, suited for highly impervious areas, good retrofit, capability, effective pre-treatment option.	Requires landscaping and management, large land required, not suitable for steep sites; no significant attenuation or reduction of flows.	✗ No requirement for high pollution reduction; large land areas not available.
	Filter trench/drain		Shallow excavations filled with rubble or stone that create temporary subsurface storage for filtration of storm water run-off. Receive lateral inflow from an adjacent impermeable surface.	Hydraulic benefits achieved with filter trenches, trenches can be incorporated into site landscaping and fit well	High clogging potential without effective pre-treatment, limited to small catchments, high cost of	✗ Not feasible for the proposed development

SUDS Group	Technique	Image	Description	Advantages	Disadvantages	Suitable for Use at Site
				beside roads and car parks.	replacing filter material.	
Detention	Detention basin		Surface storage basins that provide flow control through attenuation. Normally dry and in certain situations the land may also function as a recreational facility	Cater for a wide range of rainfall events, can be used where groundwater is vulnerable, potential for dual land use, easy to maintain.	Land take, little reduction in run-off volume, detention depths constrained by levels.	✗ Not suitable and not required for this site
	Enhanced dry swale		Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate.	Incorporate into landscaping, good removal of pollutants, reduces run-off rates and volumes, low cost.	Not suitable for steep areas, significant land take, not suitable in areas with roadside parking.	✗ Not suitable and not required for this site
	Enhanced wet swale					
Conveyance	Conveyance swales		Formal linear drainage features in which surface water can be stored or conveyed. They can be incorporated with water features such as ponds or waterfalls where appropriate.	Negate the need for underground pipework. Can provide some attenuation. Possible reduction in run-off volume via plant uptake and infiltration.	Potential trip/wheel hazard, disable access issues.	✗ Not suitable and not required for this site
	Rills					
Source control	Green/brown roof		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation.	✗ Not suitable for long span portal framed buildings which is what will be proposed at this site.

5.4.2 Maintenance of SuDS

The on-site drainage will be managed by the site management company who will be responsible to maintain any on-site services including drainage.

Table 6: Management and Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional/Remedial Maintenance	Monitoring
Drainage channels/Gullies	- Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent surfacing. - Check for accumulation of debris and silt and cleaned as necessary - Gratings, frames and all associated locking parts to be checked for damage. - Exposed concrete and adjacent surfacing to be checked for cracking and general damage. - Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures	- Channel/Slot cleaning will be by flushing with water or high-pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted. - All channel surfaces and joints will be checked and repaired as necessary. - Repair/rehabilitation of inlets, outlet, as required.	Inspect every 4 months or after large storm.
Manholes/Inspection Chambers	- Check for accumulation of debris and silt and clean as necessary. - Covers and frames to be checked for damage. - Exposed concrete and adjacent surfacing to be checked for cracking and general damage. - Check condition of inlet and outlet pipes, flap valves, baffles etc.	- Clean as necessary. - All manhole and inspection chamber covers and frames to be replaced as necessary. - Repair exposed concrete and surfacing as necessary - Repair/rehabilitation of inlets, outlet, overflows and vents, as required.	Inspect every 6 months or after large storm.
Attenuation Tank	- Check for accumulation of debris and silt and clean as necessary. - Check condition of inlet and outlet pipes and ventilation structures	- Clean as necessary. - Repair/rehabilitation of inlets and outlet, as required.	Inspect every 6 months or after large storm.

5.5 Sewer Flooding

The site will reuse the existing outfall points. The peak discharge rate from the industrial development will be minimal and have limited impact on wider infrastructure.

Therefore, the risk of sewer flooding to the site post development work would remain unchanged as low risk.

5.6 Groundwater Flooding

The proposed development is unlikely to impact the groundwater.

Therefore, the risk from groundwater flooding will remain as low.

5.7 Artificial Sources of Flooding

The proposed development work will not have an impact on artificial sources of flood risk.

5.8 Summary of Flood Risk from the Proposed Development

The flood risk to and from the proposed development has been assessed to remain low from all sources.

The flood risk to the development is summarised in Table 8.

Table 8: Summary of flood risk to the development

Type of Flooding	Source of Flooding	Flood Risk	Proposed Mitigation
Fluvial and Tidal	No Watercourses in close proximity.	Low	Site is located in Flood Zone 1 (low risk).
Surface Water	Runoff from the site and surrounding land	Low risk	Discharge from the redeveloped site at a restricted Greenfield runoff rate and onsite infiltration attenuation.
Sewers	Surrounding public foul drainage systems	Low	Discharge into the existing drainage network
Ground Water	Underlying geology and groundwater levels	Low	Intrusive investigations identified depth of groundwater. Development levels raised.
Artificial Sources	none	Not applicable	

6. Conclusion

The existing flood risk to the development area from all sources has been assessed from a review of all available data. Future climate change has also been considered. Using the proposed development plan, the extent of the flood risk has been determined for the site as well as the effect that the development might have on flood risk elsewhere.

The assessment can be summarised as follows:

- The site is located in Flood Zone 1.
- The site is at low risk of flooding from all sources.
- The proposed development is classified as 'Less Vulnerable' and suitable for this location.
- The proposed development work would not increase the risk of flooding from any sources;
- A drainage strategy is proposed in consideration with the local and national standard and would not increase the flood risk.
- The site is a Brownfield site with existing drainage in place and no formal restrictions on discharge rates. The existing site is 100% impermeable.
- Infiltration testing has confirmed soakaways would be a viable method of discharging surface water runoff.
- The site is located within 'Zone 1- Subsurface Activity' Ground Water Source Protection Zone, which is designated as most at risk from contamination and development activities. Infiltration as a method of discharging surface water runoff will therefore require approval through planning consultation.
- If discharge via infiltration is not acceptable, the proposal would be to limit the discharge from the redeveloped site for from 1 in 1 year to 1 in 100-year return periods, including climate change allowance (45%) to the Qbar (urban) rate for the site of 16.5 L/seconds.
- The new drainage system will incorporate proprietary systems to removing pollutants from runoff from the site.
- The site lies in an area of potential groundwater vulnerability which has been considered in the drainage strategy proposed
- In conclusion, the proposed development work will not increase the risk of flooding to the site or surrounding areas in accordance with the provisions of relevant national and local planning policies.

Appendix A Proposed Site Plan

Appendix B Topographical Survey + Southern Water Utility Map

107700N

107650N

107600N

47700E

107550N

47750E

47800E

47850E



OS Note:

This survey has been orientated to the Ordnance Survey (O.S.) National Grid OSG836(15) via Global Navigation Satellite Systems (GNSS) and the O.S. Active Network (OS Net).
A true OSG836 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.
The survey has been correlated to this point and a further one or more OSG836 (15) points established to create a true O.S. bearing for angle orientation.
No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.
Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Some services may have been omitted due to parked vehicles.

Legend:

Buildings	Overhead Cable	CVR	Cover (generic)	SDr	Drainage duct
Wall	Concrete edge	IC	Inspection chamber	Bu	Ballast
Kerb line	Tarmac edge	Plev	Pipe invert	Bu	Unmanned bollard
Line marking	Grass verge	Gy	Gully	Bu	Rubbish bin
Deep kerb	Canopy/Overhang	Bg	Back spill	Wp	Ward post
Centre line	Verge	Dp	Down pipe	Gd	Ground light
Top of bank	Bottom of bank	Pipe	Pipe above ground	Ubr	Latrine box
Station and Name	Front light	MH	Manhole	Stop	Tree stump
Station Level	Lamp post	WL	Water level	Sy	Site
Tree / Bush / Seeping	Telegraph post	Lp	Lamp post	TH	Threshold level
Area of Undergrowth	Electricity post	Ep	Electricity post	TH	Threshold level
Woodland	Bus stop	Bu	Bus stop	BT	British Telecom
Ridge Level	Stop valve	SV	Stop valve	BT	British Telecom
Eaves Level	Step lap	CL	Control box	BT	British Telecom
Flat Roof Level	Earth rod	ER	Earth rod	BT	British Telecom
Fence types:	Water meter	WM	Water meter	BT	British Telecom
Interwoven	Air valve	AV	Air valve	BT	British Telecom
Iron Railings	Underfloor inspection	UFI	Underfloor inspection	BT	British Telecom
Wire mesh	Wash out	WO	Wash out	BT	British Telecom
Post & Rail	Roading eye	RE	Roading eye	BT	British Telecom
Post & Wire	Beltline beacon	BL	Beltline beacon	BT	British Telecom
Cable Link	Cable tv	CTV	Cable tv	BT	British Telecom
Wooden Panels	Marker post	MP	Marker post	BT	British Telecom
Close Boarded	Gas marker post	GP	Gas marker post	BT	British Telecom
Steel Palisade	Softs	SO	Softs	BT	British Telecom
	Fire hydrant	PH	Fire hydrant	BT	British Telecom

Rev	Date	Description	Drawn	Ref
-----	------	-------------	-------	-----



- ☐ Topographical Surveys
- ☐ Site Engineering
- ☐ Utility / CCTV Surveys
- ☐ Measured Building Surveys
- ☐ 3D Laser Scanning
- ☐ Revit & BIM Models

Rowan House
Duffield Road
Little Eaton
Derby
DE21 5DR
Tel (01332) 830044
admin@greenhatch-group.co.uk
www.greenhatch-group.co.uk

St Albans Unit 8, The Courtyard Alban Park St Albans Hertfordshire AL4 0LA t. (01727) 854481	Newcastle 24 Riverside Studios Amethyst Road Newcastle Bus, Park Newcastle-U-Tyne NE4 7YL t. (01727) 854481	London 27, Cornwell Terrace Mews Regents Park London NW1 5LL t. (02072) 241806
--	---	---

CLIENT

Canmoor Projects
Limited

PROJECT

Dunham Bush
Downley Road, Havant
PO9 2JD

TITLE

Topographical
Survey

SCALE A2@ 1: 500	DATE SURVEYED 18.10.23
DRAWN SA	QUALITY REF GH18648

Level datum Grid orientation	See note See note
Job number	48721
Drawing No.	48721_T
Rev.	0

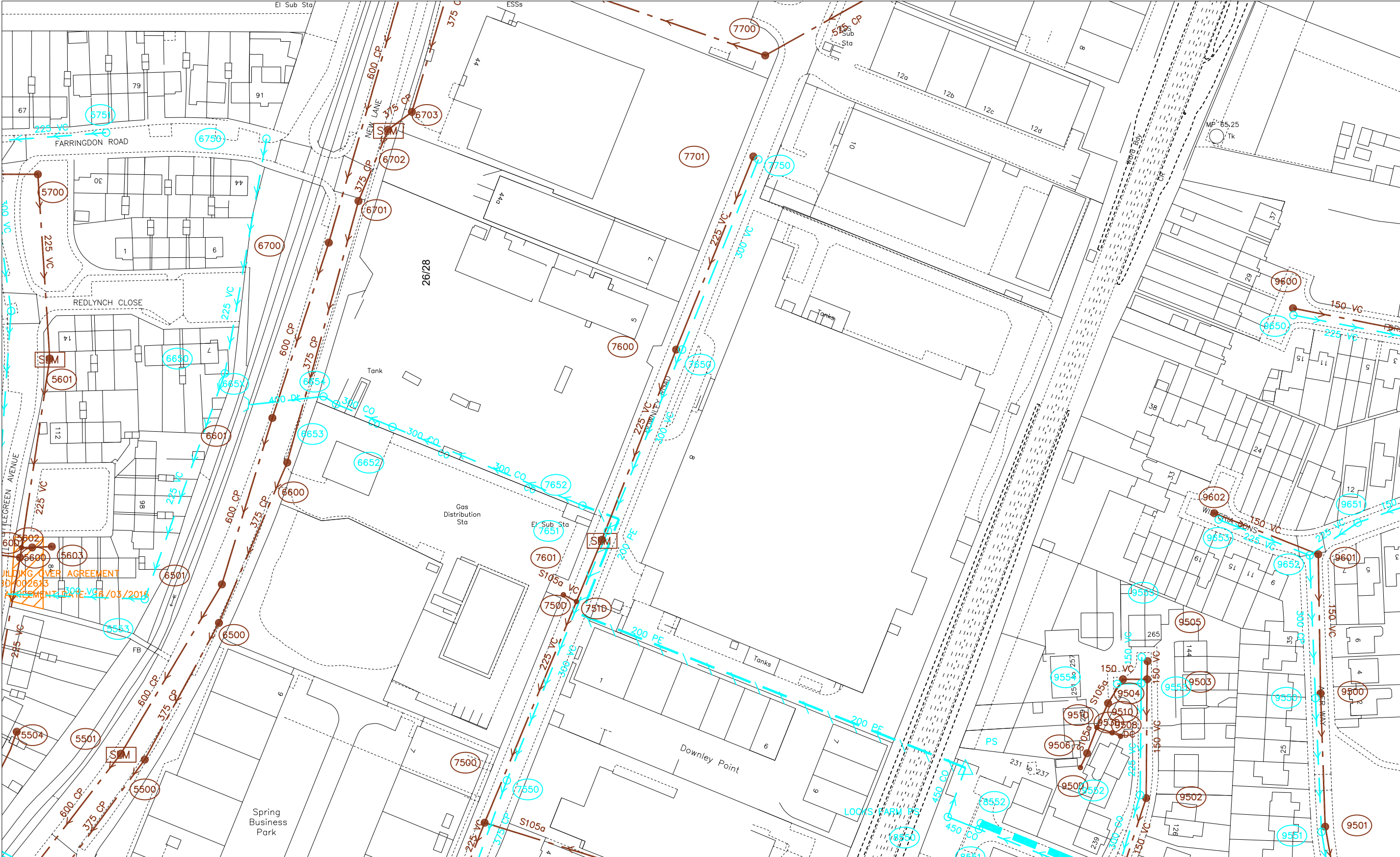
Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.
All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.
Notes:

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH1	472781.964	107723.005	18.157
GH2	472765.011	107659.079	18.186
GH3	472734.924	107581.117	18.037
GH4	472830.841	107546.299	18.395
GH5	472857.679	107606.300	19.316
GH6	472877.678	107662.073	19.234
GH7	472824.167	107708.043	19.089

SEWER RECORDS PAGE 1 OF 2

107788



107500

472537

O.S. REF.

SU7207NE

Title: 8 Downley Road

Drawn by: kumarshar

Scale: 1:1250

Date: 31/10/2023

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy.
The actual positions should be determined on site.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement
WARNING: Unknown (UNK) materials may include Bonded Asbestos Cemen

Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved
Licence No. WU 298530.



473008

Appendix C Proposed Drainage Strategy Layout

DRAINAGE

- REFER TO CIVIL AND STRUCTURAL SPECIFICATION REPORT - PART R.
- CONTRACTOR SHOULD ENSURE THE LOCAL PLANNING AUTHORITY HAVE APPROVED THE DRAINAGE PROPOSALS PRIOR TO ORDERING MATERIAL OR INSTALLATION.

HYDRAULIC DESIGN:
3. THE SURFACE WATER NETWORK, FLOW CONTROL AND ATTENUATION HAS BEEN DESIGNED USING DRAINAGE SOFTWARE WITH FSR RAINFALL DATA.

STRATEGY:
4. NEW DEVELOPMENT SHALL BE DISCHARGED INTO SOAKAWAY.
5. TOTAL ATTENUATION FOR 100YR+45% CLIMATE CHANGE BELOW GROUND = 858m³.

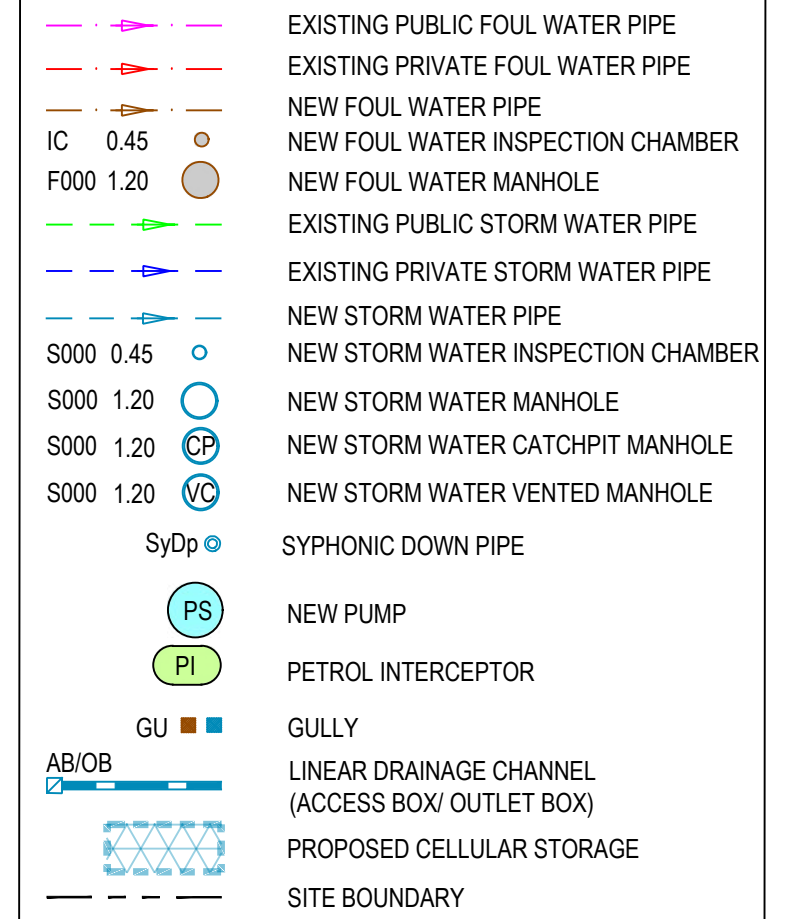
FINAL DRAINAGE CONNECTIONS:
6. WHERE THIRD PARTY APPROVAL IS REQUIRED THESE ARE NOTED AGAINST EACH DISCHARGE POINT ON THE DRAWING.
7. NO CONNECTION OR DISCHARGE SHOULD BE MADE UNTIL APPROVAL HAS BEEN RECEIVED. CHECK STATUS OF APPLICATION WITH ENGINEER.
8. CONTRACTOR SHOULD INVESTIGATE AND INSTALL FINAL DRAINAGE CONNECTIONS PRIOR TO INSTALLING ANY UPSTREAM DRAINAGE TO AVOID POTENTIAL LEVEL ISSUES.
9. EVERY EFFORT HAS BEEN MADE TO PROVIDE ACCURATE INFORMATION. HOWEVER, THE CONTRACTOR IS ADVISED TO CHECK ACTUAL CONDITIONS. I.E. THE LOCATION, ACCESSIBILITY, UNDERGROUND ROUTE, LEVELS, SIZES, CONDITION OF EXISTING SEWERS TO BE RE-USED AND/OR CONNECTED INTO.

GENERALLY:
10. DO NOT SCALE FROM THIS DRAWING. WORK TO DIMENSIONS OR CO-ORDINATES PROVIDED.
11. REPORT CONFLICTS TO ENGINEER IMMEDIATELY.
12. EVERY EFFORT HAS BEEN MADE TO ASCERTAIN TYPE, LOCATION AND DEPTH OF BURIED SERVICES AND/OR OBSTRUCTIONS. HOWEVER, THE CONTRACTOR IS ADVISED TO CARRY OUT OWN INVESTIGATIONS TO ENSURE THERE ARE NO CLASHES WITH THE PROPOSED WORKS.
13. CONTRACTOR IS RESPONSIBLE FOR PROTECTING RETAINED SERVICES AND MAKING CONTACT WITH OWNERS OF APPARATUS TO OBTAIN NECESSARY CONSENT FOR EXCAVATION, PROTECTION AND/OR DIVERTING.
14. BURIED OBSTRUCTIONS ENCOUNTERED DURING EXCAVATION THAT CONFLICT WITH PROPOSED WORKS SHOULD BE BROKEN OUT AND REMOVED. RESIDUAL VOIDS TO BE BACKFILLED AND COMPACTED AS PER SPECIFICATION.

NEW DRAINAGE:
15. INTERNAL FOUL POINTS ARE LOCATED AND SET OUT BY THE ARCHITECT.
16. TRADITIONAL RAINWATER DOWNPIPES ARE PROVIDED BY THE CLADDING CONTRACTOR AND COORDINATED WITH THE ARCHITECT.
17. DESIGN ASSUMES THAT ALL WORKS ARE NOT TO BE ADOPTED.
18. GRADIENTS OF PIPES ARE AVERAGED. PIPE CONNECTIONS SHOULD BE INSTALLED TO THE STATED INVERT LEVELS.
19. COVER LEVELS OF THE MANHOLES ARE AVERAGED. COVER AND FRAME SHOULD BE SET TO SUIT FINISHED GROUND LEVELS.
20. ALL PIPEWORK WITHIN MANHOLES ARE TO BE LAID SOFFIT TO SOFFIT (U.O.), INCLUDING BACKDROP PIPEWORK, WHERE THE RODDING ACCESS LEVEL IS SPECIFIED.
21. FLAT LATERAL CONNECTION TO BE 135° Y JUNCTIONS (IE 45° OBLIQUE JUNCTIONS) RELATIVE TO MAIN RUN. TO BE USED ON FOUL OR SURFACE WATER RUNS. 90° OR 67° SQUARE JUNCTIONS SUITABLE FOR SURFACE WATER CONNECTIONS ONLY.
22. SADDLE CONNECTIONS TO LARGER PIPES SHOULD BE MADE SO THAT THE INVERT LEVEL OF THE SMALLER PIPE DOES NOT ADJOIN BELOW MID HEIGHT OF THE LARGER PIPE.
23. PIPES CROSSING WITHIN 200MM OF EACH OTHER ARE TO BE ISOLATED BY CONCRETE FOR A MINIMUM DISTANCE OF 1M BEYOND CROSSING POINT IN ALL DIRECTIONS.
24. A CCTV DRAINAGE SURVEY TO BE CARRIED OUT ON COMPLETION TO PROVE THE INTEGRITY OF THE AS-BUILT DRAINAGE SYSTEMS.

ANCILLARY ITEMS:
25. WHERE PROPOSED CONTRACTOR MUST PROVIDE PROPOSALS FOR SUPPLY OF LINEAR DRAINAGE CHANNELS, KERB DRAINS, INTERCEPTORS, ATTENUATION, PUMPS, HYDROBRAKE, FILTER UNITS.
26. WHERE PROPOSED ALLOWANCE SHOULD BE MADE FOR POWER SUPPLY TO INTERCEPTORS AND PUMPS AND FOR INSTALLING CONTROL PANELS.

LEGEND



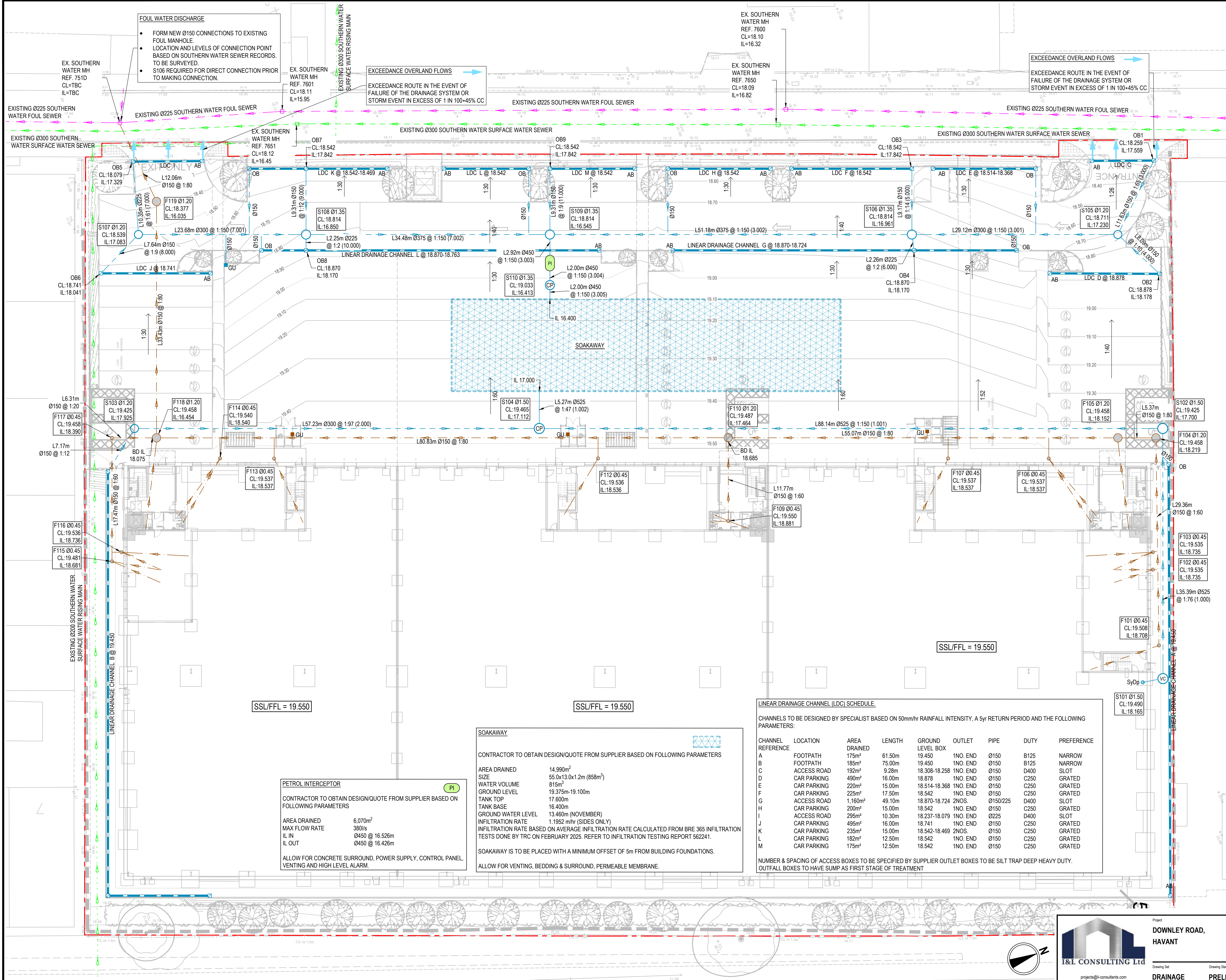
P2	12.02.25	REVISED WITH INFILTRATION TEST	RM	IL
P1	03.06.24	PRELIMINARY ISSUE	SH	IL
Rev.	Date	Description	Technician	Reviewer

DRAINAGE PLANNING STRATEGY



Project
DOWNLEY ROAD,
HAVANT

Drawing Set	Drawing Status	Scale	Project Number	Drawing Number	Revision
DRAINAGE	PRELIMINARY	1:250 @ A1 1:500 @ A3	24-011-I&L	D00	P2



SOAKAWAY

CONTRACTOR TO OBTAIN DESIGN/QUOTE FROM SUPPLIER BASED ON FOLLOWING PARAMETERS

AREA DRAINED	14,990m²
SIZE	55.0x13.0x1.2m (858m³)
WATER VOLUME	815m³
GROUND LEVEL	19.375m-19.100m
TANK TOP	17.600m
TANK BASE	16.400m
GROUND WATER LEVEL	13.460m (NOVEMBER)
INFILTRATION RATE	1.1952 m/hr (SIDES ONLY)
INFILTRATION RATE BASED ON AVERAGE INFILTRATION RATE CALCULATED FROM BRE 365 INFILTRATION TESTS DONE BY TRC ON FEBRUARY 2025. REFER TO INFILTRATION TESTING REPORT 562241.	

SOAKAWAY IS TO BE PLACED WITH A MINIMUM OFFSET OF 5m FROM BUILDING FOUNDATIONS.

ALLOW FOR VENTING, BEDDING & SURROUND, PERMEABLE MEMBRANE.

PETROL INTERCEPTOR

CONTRACTOR TO OBTAIN DESIGN/QUOTE FROM SUPPLIER BASED ON FOLLOWING PARAMETERS

AREA DRAINED	6,070m²
MAX FLOW RATE	380/s
IL IN	Ø450 @ 16.526m
IL OUT	Ø450 @ 16.426m

ALLOW FOR CONCRETE SURROUND, POWER SUPPLY, CONTROL PANEL, VENTING AND HIGH LEVEL ALARM.

LINEAR DRAINAGE CHANNEL (LDC) SCHEDULE

CHANNELS TO BE DESIGNED BY SPECIALIST BASED ON 50mm/hr RAINFALL INTENSITY, A 5yr RETURN PERIOD AND THE FOLLOWING PARAMETERS:

CHANNEL REFERENCE	LOCATION	AREA DRAINED	LENGTH	GROUND LEVEL BOX	OUTLET	PIPE	DUTY	PREFERENCE
A	FOOTPATH	175m²	61.50m	19.450	1NO. END	Ø150	B125	NARROW
B	FOOTPATH	185m²	75.00m	19.450	1NO. END	Ø150	B125	NARROW
C	ACCESS ROAD	192m²	9.28m	18.308-18.258	1NO. END	Ø150	D400	SLOT
D	CAR PARKING	490m²	16.00m	18.878	1NO. END	Ø150	C250	GRATED
E	CAR PARKING	220m²	15.00m	18.514-18.368	1NO. END	Ø150	C250	GRATED
F	CAR PARKING	225m²	17.50m	18.542	1NO. END	Ø150	C250	GRATED
G	ACCESS ROAD	1,160m²	49.10m	18.870-18.724	2NOS.	Ø150/Ø225	D400	GRATED
H	CAR PARKING	200m²	15.00m	18.542	1NO. END	Ø150	C250	GRATED
I	ACCESS ROAD	295m²	10.30m	18.237-18.079	1NO. END	Ø225	D400	SLOT
J	CAR PARKING	495m²	16.00m	18.741	1NO. END	Ø150	C250	GRATED
K	CAR PARKING	235m²	15.00m	18.542-18.469	2NOS.	Ø150	C250	GRATED
L	CAR PARKING	182m²	12.50m	18.542	1NO. END	Ø150	C250	GRATED
M	CAR PARKING	175m²	12.50m	18.542	1NO. END	Ø150	C250	GRATED

NUMBER & SPACING OF ACCESS BOXES TO BE SPECIFIED BY SUPPLIER OUTLET BOXES TO BE SILT TRAP DEEP HEAVY DUTY. OUTFALL BOXES TO HAVE SUMP AS FIRST STAGE OF TREATMENT

Appendix D Hydraulic Calculation

Nodes

Name	Area (ha)	Cover Level (m)	Diameter (mm)	Depth (m)
S101	0.613	19.497	1500	1.350
S102	0.123	19.425	1500	1.725
S103	0.156	19.425	1200	1.500
S104	0.000	19.465	1500	2.341
OB1	0.019	18.271	600	0.712
OB2	0.049	18.872	600	0.694
S105	0.070	18.711	1200	1.481
OB3	0.022	18.546	600	0.704
OB4	0.116	18.864	600	0.694
S106	0.020	18.814	1350	1.853
OB5	0.029	18.094	600	0.765
OB6	0.049	18.732	600	0.691
S107	0.041	18.539	1200	1.456
OB7	0.016	18.550	600	0.708
OB8	0.140	18.870	600	0.700
S108	0.018	18.814	1350	1.964
OB9	0.018	18.550	600	0.708
S109		18.814	1350	2.269
PI		18.893	1	2.467
S110		19.033	1350	2.620
TANK		19.100	1	2.700
PS		18.965	1500	2.592
Dummy		18.741	1200	1.298

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S101	S102	35.389	0.600	18.147	17.700	0.447	79.2	525	5.23	50.0
1.001	S102	S104	86.400	0.600	17.700	17.124	0.576	150.0	525	6.02	50.0
2.000	S103	S104	58.729	0.600	17.925	17.349	0.576	102.0	300	5.63	50.0
1.002	S104	TANK	5.270	0.600	17.124	17.000	0.124	42.5	525	6.05	50.0
3.000	OB1	S105	11.350	0.600	17.559	17.380	0.179	63.4	150	5.15	50.0
4.000	OB2	S105	7.751	0.600	18.178	17.380	0.798	9.7	150	5.04	50.0
3.001	S105	S106	29.115	0.600	17.230	17.036	0.194	150.1	300	5.53	50.0
5.000	OB3	S106	9.167	0.600	17.842	17.186	0.656	14.0	150	5.06	50.0
6.000	OB4	S106	2.012	0.600	18.170	17.111	1.059	1.9	225	5.00	50.0
3.002	S106	S109	51.175	0.600	16.961	16.620	0.341	150.1	375	6.11	50.0
7.000	OB5	S107	10.096	0.600	17.329	17.158	0.171	59.0	225	5.10	50.0
8.000	OB6	S107	7.291	0.600	18.041	17.233	0.808	9.0	150	5.04	50.0
7.001	S107	S108	23.684	0.600	17.083	16.925	0.158	149.9	300	5.41	50.0
9.000	OB7	S108	9.059	0.600	17.842	17.075	0.767	11.8	150	5.05	50.0
10.000	OB8	S108	2.245	0.600	18.170	17.000	1.170	1.9	225	5.00	50.0
7.002	S108	S109	34.484	0.600	16.850	16.620	0.230	149.9	375	5.80	50.0
11.000	OB9	S109	9.056	0.600	17.842	16.845	0.997	9.1	150	5.04	50.0
3.003	S109	PI	2.922	0.600	16.545	16.526	0.019	153.8	450	6.14	50.0
3.004	PI	S110	2.000	0.600	16.426	16.413	0.013	153.8	450	6.16	50.0
3.005	S110	TANK	2.000	0.600	16.413	16.400	0.013	153.8	450	6.18	50.0
1.003	TANK	PS	4.066	0.600	16.400	16.373	0.027	150.6	300	6.23	50.0
1.004	PS	Dummy	8.000	0.600	16.373	17.443	-1.070	-7.5	225	6.36	50.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	35.389	79.2	525	Circular	19.497	18.147	0.825	19.425	17.700	1.200
1.001	86.400	150.0	525	Circular	19.425	17.700	1.200	19.465	17.124	1.816
2.000	58.729	102.0	300	Circular	19.425	17.925	1.200	19.465	17.349	1.816
1.002	5.270	42.5	525	Circular	19.465	17.124	1.816	19.100	17.000	1.575
3.000	11.350	63.4	150	Circular	18.271	17.559	0.562	18.711	17.380	1.181
4.000	7.751	9.7	150	Circular	18.872	18.178	0.544	18.711	17.380	1.181
3.001	29.115	150.1	300	Circular	18.711	17.230	1.181	18.814	17.036	1.478
5.000	9.167	14.0	150	Circular	18.546	17.842	0.554	18.814	17.186	1.478
6.000	2.012	1.9	225	Circular	18.864	18.170	0.469	18.814	17.111	1.478
3.002	51.175	150.1	375	Circular	18.814	16.961	1.478	18.814	16.620	1.819
7.000	10.096	59.0	225	Circular	18.094	17.329	0.540	18.539	17.158	1.156
8.000	7.291	9.0	150	Circular	18.732	18.041	0.541	18.539	17.233	1.156
7.001	23.684	149.9	300	Circular	18.539	17.083	1.156	18.814	16.925	1.589
9.000	9.059	11.8	150	Circular	18.550	17.842	0.558	18.814	17.075	1.589
10.000	2.245	1.9	225	Circular	18.870	18.170	0.475	18.814	17.000	1.589

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
1.000	S101	1500		Manhole	Adoptable	S102	1500		Manhole	Adoptable
1.001	S102	1500		Manhole	Adoptable	S104	1500		Manhole	Adoptable
2.000	S103	1200		Manhole	Adoptable	S104	1500		Manhole	Adoptable
1.002	S104	1500		Manhole	Adoptable	TANK	1	1	Manhole	Adoptable
3.000	OB1	600	600	Manhole	Adoptable	S105	1200		Manhole	Adoptable
4.000	OB2	600	600	Manhole	Adoptable	S105	1200		Manhole	Adoptable
3.001	S105	1200		Manhole	Adoptable	S106	1350		Manhole	Adoptable
5.000	OB3	600	600	Manhole	Adoptable	S106	1350		Manhole	Adoptable
6.000	OB4	600	600	Manhole	Adoptable	S106	1350		Manhole	Adoptable
3.002	S106	1350		Manhole	Adoptable	S109	1350		Manhole	Adoptable
7.000	OB5	600	600	Manhole	Adoptable	S107	1200		Manhole	Adoptable
8.000	OB6	600	600	Manhole	Adoptable	S107	1200		Manhole	Adoptable
7.001	S107	1200		Manhole	Adoptable	S108	1350		Manhole	Adoptable
9.000	OB7	600	600	Manhole	Adoptable	S108	1350		Manhole	Adoptable
10.000	OB8	600	600	Manhole	Adoptable	S108	1350		Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
7.002	34.484	149.9	375	Circular	18.814	16.850	1.589	18.814	16.620	1.819
11.000	9.056	9.1	150	Circular	18.550	17.842	0.558	18.814	16.845	1.819
3.003	2.922	153.8	450	Circular	18.814	16.545	1.819	18.893	16.526	1.917
3.004	2.000	153.8	450	Circular	18.893	16.426	2.017	19.033	16.413	2.170
3.005	2.000	153.8	450	Circular	19.033	16.413	2.170	19.100	16.400	2.250
1.003	4.066	150.6	300	Circular	19.100	16.400	2.400	18.965	16.373	2.292
1.004	8.000	-7.5	225	Circular	18.965	16.373	2.367	18.741	17.443	1.073

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Width (mm)	Node Type	MH Type
7.002	S108	1350		Manhole	Adoptable	S109	1350		Manhole	Adoptable
11.000	OB9	600	600	Manhole	Adoptable	S109	1350		Manhole	Adoptable
3.003	S109	1350		Manhole	Adoptable	PI	1	1	Manhole	Adoptable
3.004	PI	1	1	Manhole	Adoptable	S110	1350		Manhole	Adoptable
3.005	S110	1350		Manhole	Adoptable	TANK	1	1	Manhole	Adoptable
1.003	TANK	1	1	Manhole	Adoptable	PS	1500		Manhole	Adoptable
1.004	PS	1500		Manhole	Adoptable	Dummy	1200		Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
S101	472860.039	107693.344	19.497	1.350	1500					
							0	1.000	18.147	525
S102	472827.194	107706.518	19.425	1.725	1500					
							1	1.000	17.700	525
							0	1.001	17.700	525

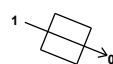
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)	
S103	472773.045	107571.869	19.425	1.500	1200			0	2.000	17.925	300
S104	472794.957	107626.357	19.465	2.341	1500			1 2 0	2.000 1.001 1.002	17.349 17.124 17.124	300 525 525
OB1	472791.848	107719.497	18.271	0.712	600	600		0	3.000	17.559	150
OB2	472806.508	107714.321	18.872	0.694	600	600		0	4.000	18.178	150
S105	472799.466	107711.083	18.711	1.481	1200			1 2 0	4.000 3.000 3.001	17.380 17.380 17.230	150 150 300
OB3	472780.098	107687.491	18.546	0.704	600	600		0	5.000	17.842	150
OB4	472790.554	107683.579	18.864	0.694	600	600		0	6.000	18.170	225
S106	472788.603	107684.070	18.814	1.853	1350			1 2 3 0	6.000 5.000 3.001 3.002	17.111 17.186 17.036 16.961	225 150 300 375

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)
OB5	472738.183	107585.677	18.094	0.765	600	600	 0	7.000	17.329	225
OB6	472750.777	107575.965	18.732	0.691	600	600	 0	8.000	18.041	150
S107	472747.806	107582.623	18.539	1.456	1200	 1 2 0	8.000	17.233	150	
							7.000	17.158	225	
							7.001	17.083	300	
OB7	472748.238	107607.977	18.550	0.708	600	600	 0	9.000	17.842	150
OB8	472758.726	107603.760	18.870	0.700	600	600	 0	10.000	18.170	225
S108	472756.643	107604.597	18.814	1.964	1350	 1 2 3 0	10.000	17.000	225	
							9.000	17.075	150	
							7.001	16.925	300	
							7.002	16.850	375	
OB9	472761.107	107639.970	18.550	0.708	600	600	 0	11.000	17.842	150
S109	472769.509	107636.591	18.814	2.269	1350	 1 2 3 0	11.000	16.845	150	
							7.002	16.620	375	
							3.002	16.620	375	
							3.003	16.545	450	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)	
PI	472772.220	107635.500	18.893	2.467	1	1		1	3.003	16.526	450
								0	3.004	16.426	450
S110	472776.146	107633.922	19.033	2.620	1350			1	3.004	16.413	450
								0	3.005	16.413	450
TANK	472791.692	107667.218	19.100	2.700	1	1		1	3.005	16.400	450
								2	1.002	17.000	525
								0	1.003	16.400	300
PS	472787.920	107668.735	18.965	2.592	1500			1	1.003	16.373	300
								0	1.004	16.373	225
Dummy	472780.498	107671.720	18.741	1.298	1200			1	1.004	17.443	225

Simulation Settings

Rainfall Methodology	FSR	Summer CV	0.750	Additional Storage (m³/ha)	0.0
Rainfall Events	Singular	Winter CV	0.840	Starting Level (m)	
FSR Region	England and Wales	Analysis Speed	Detailed	Check Discharge Rate(s)	x
M5-60 (mm)	20.000	Skip Steady State	✓	Check Discharge Volume	x
Ratio-R	0.400	Drain Down Time (mins)	10080		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160	2880
----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	100	45	0	0
30	0	0	0				

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	16.400
Side Inf Coefficient (m/hr)	1.19520	Porosity	0.95	Time to half empty (mins)	440

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	715.0	0.0	1.200	715.0	163.2	1.201	0.0	163.2

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S101	10	18.289	0.142	86.4	0.2514	0.0000	OK
15 minute winter	S102	10	17.884	0.184	102.9	0.3247	0.0000	OK
15 minute winter	S103	11	18.015	0.090	22.0	0.1019	0.0000	OK
15 minute winter	S104	11	17.305	0.181	123.3	0.3205	0.0000	OK
15 minute winter	OB1	10	17.595	0.036	2.7	0.0129	0.0000	OK
15 minute winter	OB2	10	18.215	0.037	6.9	0.0132	0.0000	OK
15 minute winter	S105	10	17.326	0.096	19.4	0.1086	0.0000	OK
15 minute winter	OB3	10	17.869	0.027	3.1	0.0096	0.0000	OK
15 minute winter	OB4	10	18.207	0.037	16.4	0.0134	0.0000	OK
15 minute winter	S106	10	17.091	0.130	41.1	0.1863	0.0000	OK
15 minute winter	OB5	10	17.368	0.039	4.1	0.0139	0.0000	OK
15 minute winter	OB6	10	18.077	0.036	6.9	0.0130	0.0000	OK
15 minute winter	S107	10	17.172	0.089	16.7	0.1009	0.0000	OK
15 minute winter	OB7	10	17.864	0.022	2.3	0.0079	0.0000	OK
15 minute winter	OB8	10	18.211	0.041	19.7	0.0147	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S101	1.000	S102	85.6	1.500	0.157	2.0257	
15 minute winter	S102	1.001	S104	102.0	1.537	0.258	5.7345	
15 minute winter	S103	2.000	S104	21.3	1.211	0.193	1.0316	
15 minute winter	S104	1.002	TANK	123.5	2.191	0.166	0.2981	
15 minute winter	OB1	3.000	S105	2.6	0.835	0.118	0.0359	
15 minute winter	OB2	4.000	S105	6.9	2.124	0.119	0.0251	
15 minute winter	S105	3.001	S106	18.9	1.008	0.208	0.5489	
15 minute winter	OB3	5.000	S106	3.1	1.494	0.064	0.0188	
15 minute winter	OB4	6.000	S106	16.4	4.370	0.043	0.0076	
15 minute winter	S106	3.002	S109	40.7	1.213	0.250	1.7279	
15 minute winter	OB5	7.000	S107	4.0	0.919	0.060	0.0443	
15 minute winter	OB6	8.000	S107	6.9	2.177	0.115	0.0230	
15 minute winter	S107	7.001	S108	16.3	0.963	0.180	0.4025	
15 minute winter	OB7	9.000	S108	2.3	1.454	0.044	0.0141	
15 minute winter	OB8	10.000	S108	19.7	4.594	0.052	0.0096	

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S108	10	16.981	0.131	40.7	0.1880	0.0000	OK
15 minute winter	OB9	10	17.863	0.021	2.5	0.0077	0.0000	OK
15 minute winter	S109	11	16.750	0.205	83.1	0.2937	0.0000	OK
15 minute winter	PI	7	16.728	0.302	83.8	0.0000	0.0000	OK
15 minute winter	S110	7	16.726	0.313	84.1	0.4476	0.0000	OK
600 minute winter	TANK	450	16.719	0.319	21.8	216.6069	0.0000	SURCHARGED
600 minute winter	PS	450	16.719	0.346	0.1	0.6111	0.0000	SURCHARGED
15 minute summer	Dummy	1	17.443	0.000	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S108	7.002	S109	40.0	1.199	0.245	1.1669	
15 minute winter	OB9	11.000	S109	2.5	1.640	0.042	0.0137	
15 minute winter	S109	3.003	PI	83.8	1.329	0.322	0.1917	
15 minute winter	PI	3.004	S110	84.1	1.220	0.323	0.2305	
15 minute winter	S110	3.005	TANK	84.6	2.278	0.325	0.1184	
15 minute winter	TANK	1.003	PS	2.8	0.465	0.031	0.1478	
600 minute winter	TANK	Infiltration		6.3				
15 minute summer	PS	Pump	Dummy	0.0				0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S101	10	18.391	0.244	212.0	0.4305	0.0000	OK
15 minute winter	S102	10	18.013	0.313	252.8	0.5522	0.0000	OK
15 minute winter	S103	10	18.075	0.150	54.0	0.1693	0.0000	OK
15 minute winter	S104	11	17.440	0.316	302.1	0.5577	0.0000	OK
15 minute winter	OB1	10	17.617	0.058	6.6	0.0210	0.0000	OK
15 minute winter	OB2	10	18.239	0.061	17.0	0.0218	0.0000	OK
15 minute winter	S105	10	17.391	0.161	47.6	0.1824	0.0000	OK
15 minute winter	OB3	10	17.884	0.042	7.6	0.0152	0.0000	OK
15 minute winter	OB4	10	18.228	0.058	40.1	0.0208	0.0000	OK
15 minute winter	S106	10	17.180	0.219	101.2	0.3141	0.0000	OK
15 minute winter	OB5	10	17.389	0.060	10.0	0.0217	0.0000	OK
15 minute winter	OB6	10	18.101	0.060	17.0	0.0214	0.0000	OK
15 minute winter	S107	10	17.233	0.150	41.1	0.1700	0.0000	OK
15 minute winter	OB7	10	17.876	0.034	5.5	0.0123	0.0000	OK
15 minute winter	OB8	10	18.234	0.064	48.4	0.0229	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S101	1.000	S102	210.2	1.811	0.386	4.1051	
15 minute winter	S102	1.001	S104	249.8	1.869	0.632	11.5486	
15 minute winter	S103	2.000	S104	52.3	1.535	0.475	2.0087	
15 minute winter	S104	1.002	TANK	304.3	2.694	0.408	0.5950	
15 minute winter	OB1	3.000	S105	6.5	1.065	0.291	0.0694	
15 minute winter	OB2	4.000	S105	16.9	2.683	0.295	0.0489	
15 minute winter	S105	3.001	S106	46.7	1.267	0.516	1.0777	
15 minute winter	OB3	5.000	S106	7.6	1.918	0.158	0.0361	
15 minute winter	OB4	6.000	S106	40.1	5.020	0.105	0.0186	
15 minute winter	S106	3.002	S109	100.3	1.303	0.615	3.9484	
15 minute winter	OB5	7.000	S107	9.9	1.084	0.147	0.1017	
15 minute winter	OB6	8.000	S107	16.9	2.750	0.284	0.0449	
15 minute winter	S107	7.001	S108	40.6	1.176	0.448	0.8457	
15 minute winter	OB7	9.000	S108	5.5	1.867	0.105	0.0265	
15 minute winter	OB8	10.000	S108	48.4	5.282	0.128	0.0240	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S108	10	17.078	0.228	100.6	0.3263	0.0000	OK
15 minute winter	OB9	9	17.875	0.033	6.2	0.0118	0.0000	OK
480 minute winter	S109	368	17.056	0.511	22.8	0.7316	0.0000	SURCHARGED
480 minute winter	PI	368	17.056	0.630	21.6	0.0000	0.0000	SURCHARGED
480 minute winter	S110	368	17.056	0.643	21.5	0.9204	0.0000	SURCHARGED
480 minute winter	TANK	368	17.056	0.656	55.0	445.7232	0.0000	SURCHARGED
480 minute winter	PS	368	17.056	0.683	0.2	1.2072	0.0000	SURCHARGED
15 minute summer	Dummy	1	17.443	0.000	0.0	0.0000	0.0000	OK
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S108	7.002	S109	99.7	1.277	0.611	2.7102	
15 minute winter	OB9	11.000	S109	6.2	2.086	0.104	0.0413	
15 minute winter	S109	3.003	PI	205.9	1.671	0.791	0.3585	
15 minute winter	PI	3.004	S110	205.9	1.620	0.791	0.2656	
15 minute winter	S110	3.005	TANK	205.8	2.732	0.791	0.2512	
15 minute winter	TANK	1.003	PS	4.7	0.474	0.052	0.2863	
480 minute winter	TANK	Infiltration		14.3				
15 minute summer	PS	Pump	Dummy	0.0				0.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S101	11	18.751	0.604	399.0	1.0670	0.0000	SURCHARGED
15 minute winter	S102	11	18.461	0.761	454.8	1.3452	0.0000	SURCHARGED
15 minute winter	S103	10	18.161	0.236	101.6	0.2668	0.0000	OK
15 minute winter	S104	11	17.617	0.493	558.4	0.8719	0.0000	OK
15 minute winter	OB1	11	18.025	0.466	12.4	0.1676	0.0000	FLOOD RISK
15 minute winter	OB2	11	18.290	0.112	31.9	0.0402	0.0000	OK
15 minute winter	S105	11	17.963	0.733	85.2	0.8285	0.0000	SURCHARGED
15 minute winter	OB3	11	17.907	0.065	14.3	0.0234	0.0000	OK
15 minute winter	OB4	11	18.263	0.093	75.5	0.0334	0.0000	OK
15 minute winter	S106	11	17.751	0.790	183.2	1.1304	0.0000	SURCHARGED
15 minute winter	OB5	11	17.756	0.427	18.9	0.1536	0.0000	SURCHARGED
15 minute winter	OB6	11	18.138	0.097	31.9	0.0351	0.0000	OK
15 minute winter	S107	11	17.738	0.655	73.1	0.7413	0.0000	SURCHARGED
15 minute winter	OB7	10	17.887	0.045	10.4	0.0164	0.0000	OK
15 minute winter	OB8	10	18.270	0.100	91.1	0.0360	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S101	1.000	S102	379.4	1.953	0.696	7.6452	
15 minute winter	S102	1.001	S104	460.4	2.132	1.165	18.4349	
15 minute winter	S103	2.000	S104	100.2	1.678	0.910	3.6187	
15 minute winter	S104	1.002	TANK	559.6	3.078	0.751	0.9326	
15 minute winter	OB1	3.000	S105	13.1	1.152	0.588	0.1998	
15 minute winter	OB2	4.000	S105	31.2	2.915	0.543	0.1227	
15 minute winter	S105	3.001	S106	84.4	1.277	0.932	2.0503	
15 minute winter	OB3	5.000	S106	13.9	2.057	0.290	0.1141	
15 minute winter	OB4	6.000	S106	75.1	4.977	0.197	0.0556	
15 minute winter	S106	3.002	S109	181.2	1.643	1.111	5.6445	
15 minute winter	OB5	7.000	S107	19.7	1.068	0.290	0.4015	
15 minute winter	OB6	8.000	S107	31.5	2.989	0.529	0.1083	
15 minute winter	S107	7.001	S108	73.2	1.107	0.808	1.6678	
15 minute winter	OB7	9.000	S108	10.4	1.892	0.199	0.1001	
15 minute winter	OB8	10.000	S108	90.8	5.235	0.240	0.0638	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.81%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S108	11	17.604	0.754	183.1	1.0795	0.0000	SURCHARGED
15 minute winter	OB9	10	17.887	0.045	11.7	0.0162	0.0000	OK
360 minute winter	S109	288	17.596	1.051	50.2	1.5036	0.0000	SURCHARGED
360 minute winter	PI	288	17.596	1.170	49.0	0.0000	0.0000	SURCHARGED
360 minute winter	S110	288	17.595	1.182	48.9	1.6920	0.0000	SURCHARGED
360 minute winter	TANK	288	17.595	1.195	127.6	811.8591	0.0000	SURCHARGED
360 minute winter	PS	288	17.595	1.222	0.4	2.1597	0.0000	SURCHARGED
15 minute summer	Dummy	1	17.443	0.000	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S108	7.002	S109	179.7	1.629	1.101	3.8035	
15 minute winter	OB9	11.000	S109	11.7	2.150	0.196	0.0999	
15 minute winter	S109	3.003	PI	371.0	2.342	1.425	0.4630	
15 minute winter	PI	3.004	S110	370.3	2.337	1.423	0.3169	
15 minute winter	S110	3.005	TANK	369.1	2.963	1.418	0.3169	
15 minute winter	TANK	1.003	PS	7.9	0.491	0.087	0.2863	
360 minute winter	TANK	Infiltration		27.0				
15 minute summer	PS	Pump	Dummy	0.0				0.0

Appendix E Infiltration Tests



NOTES	COPYRIGHT NOTES Google imagery June 2018				REVISIONS				 Work.Life 20 Red Lion Street, London, WC1R 4PS		TITLE EXPLORATORY HOLE LOCATION PLAN		
											TRC PROJECT NO. 562241	SCALE 1:850 @ A3	
					P01		FIRST ISSUE		CLIENT ROYAL LONDON PROPERTY FUND		PURPOSE OF ISSUE		STATUS
							Initials	TS			TS	08/07/24	
									REV.		REVISION NOTES/COMMENTS		PROJECT DOWNLEY ROAD, HAVANT
Initials				FIGURE 04									



Trial Pit Log

Project Name: Downley Road, Havant		Client: Canmoor Projects		Date: 18/02/2025	
Location: Downley Road, Havant, PO9 2JD		Subcontractor: Mill Hill Plant Ltd		Co-ords: E472803.95 N107660.06	
Project No. : 562241.0000.0004		Crew Name: DO		Equipment: 8-tonne tracked excavator	
Location Number SOAK01	Location Type TP	Level 18.97m AoD	Logged By Martin Dorfling	Scale 1:20	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		1.00	17.97		MADE GROUND: Light brown sandy slightly gravelly CLAY. Sand is fine to coarse grained. Gravel is angular to well rounded fine to coarse of brick and flint. Medium cobble content of brick.	1
		1.30	ES						
		2.00	B		2.50	16.47		End of Pit at 2.500m	2
									3
									4

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks
2.00	0.40	Stable throughout					

Remarks

1. Trial Pit scanned for utilities prior to excavation.
2. Groundwater not encountered.
3. Trial Pit terminated at target depth.
4. Location backfilled with arisings.





Trial Pit Log

Project Name: Downley Road, Havant		Client: Canmoor Projects		Date: 18/02/2025	
Location: Downley Road, Havant, PO9 2JD		Subcontractor: Mill Hill Plant Ltd		Co-ords: E472790.61 N107628.37	
Project No. : 562241.0000.0004		Crew Name: DO		Equipment: 8-tonne tracked excavator	
Location Number SOAK02	Location Type TP	Level 18.86m AoD	Logged By Martin Dorfling	Scale 1:20	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D					MADE GROUND: Light brown sandy slightly gravelly CLAY. Sand is fine to coarse grained. Gravel is angular to sub-angular fine to coarse grained of brick.	1
		0.70	ES						
		1.50	ES		1.30	17.56		Reddish brown clayey very sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to rounded fine to coarse of flint. Medium cobble content of flint. [RIVER TERRACE DEPOSITS]	2
		2.00	B		2.50	16.36		End of Pit at 2.500m	3
									4

Dimensions		Trench Support and Comment				Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks		Date	Rate	Remarks
1.80	0.50	Stable throughout						

Remarks

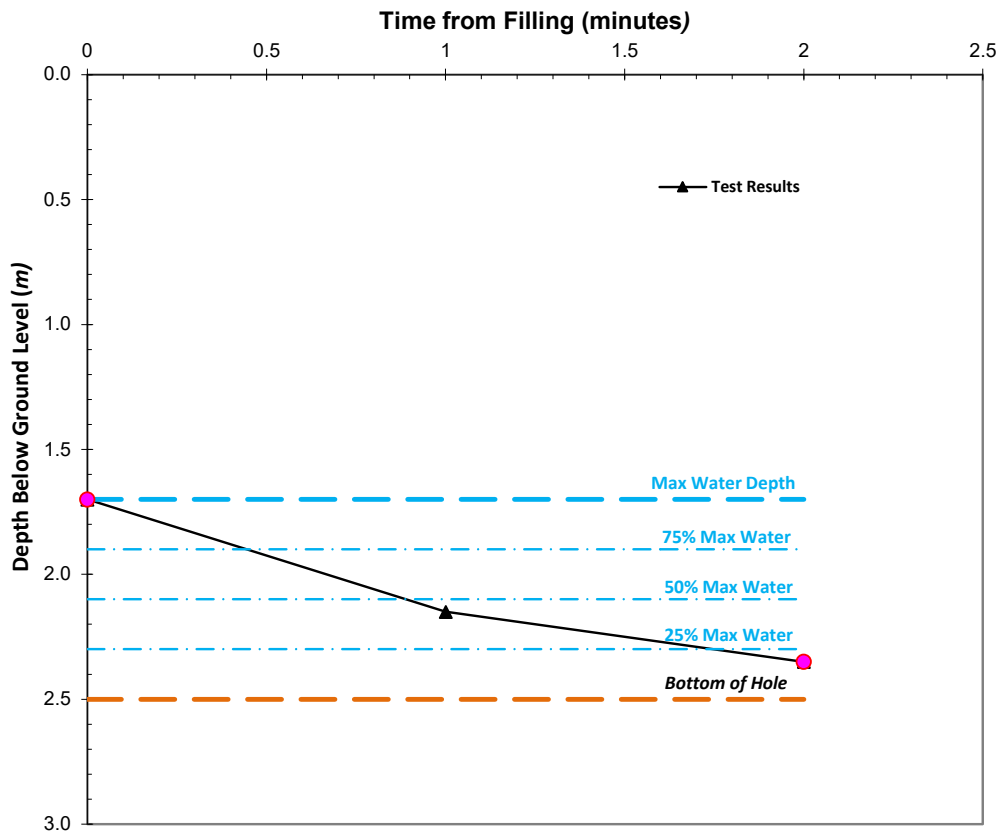
1. Trial Pit scanned for utilities prior to excavation.
2. Groundwater not encountered.
3. Trial Pit terminated at target depth.
4. Location backfilled with arisings.



BRE Digest 365 Soakage Test



Test Hole No: SOAK01
Test No: Test No 1 (Initial)



Pit Length (m)	2.00	Depth to Water at Start of Test (m)	1.70
Pit Width (m)	0.40	Max Water Dropdown during Test (m)	0.65
Depth to Pit Base (m)	2.50	Total Soakage Test Time (min)	2.0
Depth to Top of Permeable Soils (m)	1.00	Mean Internal Discharge Area (m ²)	3.080
Depth to Groundwater Surface (m)		Discharge Rate (litre/min)	260.000
Depth to Top of Granular Fill (m)		Soakage Rate (litre/m ² /min)	84.42
Voids Assumed for Granular Fill (%)	100%	BRE Soil Infiltration Rate (m/sec)	1.41E-03

Comments:

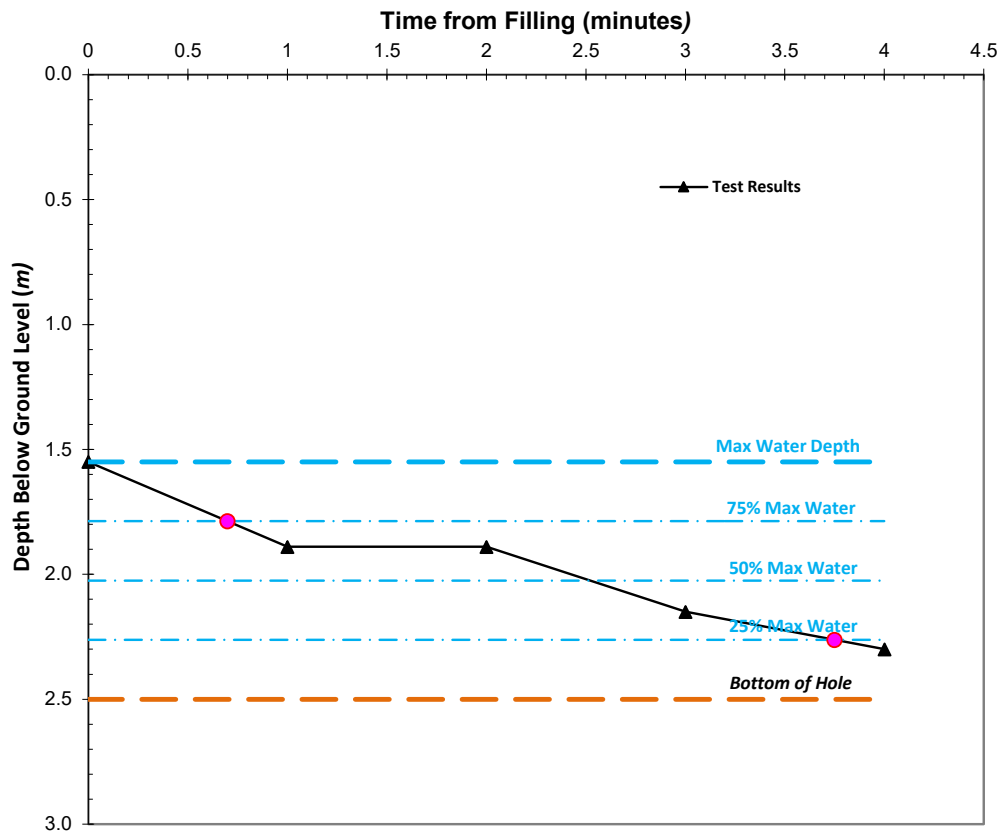
Pit was nearly emptied at finish of test.

Client: Royal London Property Group	Job No: 562241	Test Date: 18/Feb/2025
Project: Downley Road, Havant	Tested By: MD	Engineer: MD
		Fig. S1

BRE Digest 365 Soakage Test



Test Hole No: SOAK01
Test No: Test No 2 (Repeated)



Pit Length (m)	2.00	Depth to Water at Start of Test (m)	1.55
Pit Width (m)	0.40	Max Water Dropdown during Test (m)	0.75
Depth to Pit Base (m)	2.50	Total Soakage Test Time (min)	4.0
Depth to Top of Permeable Soils (m)	1.00	Mean Internal Discharge Area (m ²)	3.080
Depth to Groundwater Surface (m)		Discharge Rate (litre/min)	95.000
Depth to Top of Granular Fill (m)		Soakage Rate (litre/m ² /min)	30.84
Voids Assumed for Granular Fill (%)	100%	BRE Soil Infiltration Rate (m/sec)	5.14E-04

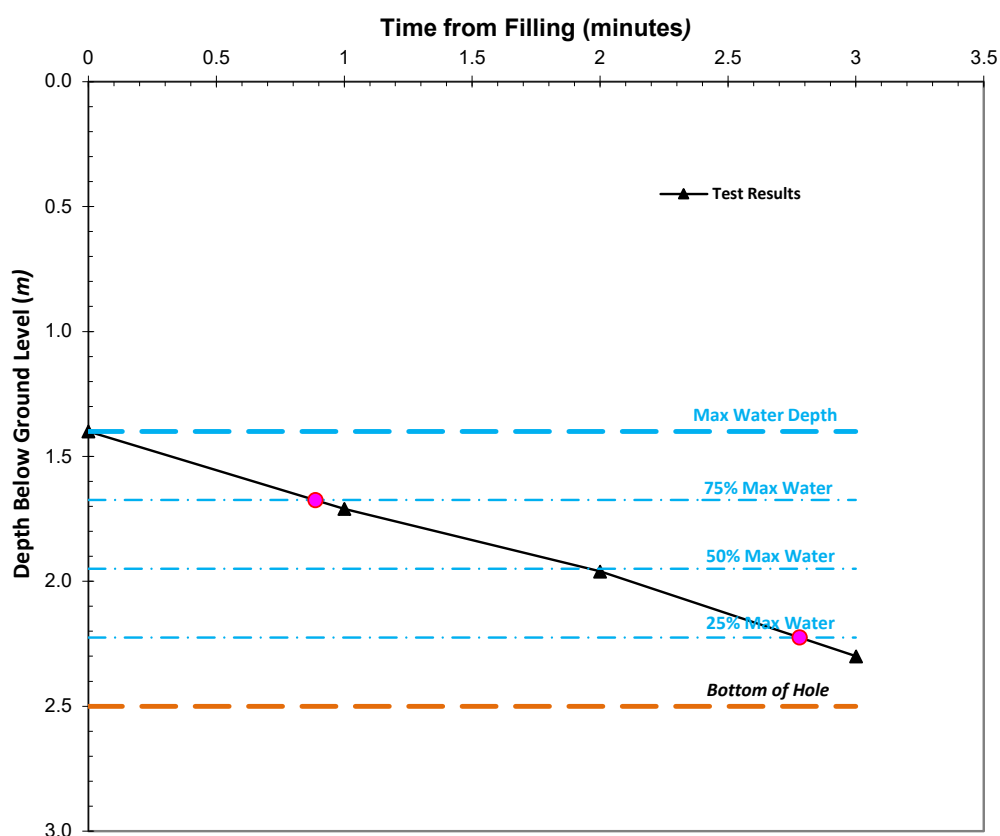
Comments:
Pit was nearly emptied at finish of test.

Client: Royal London Property Group	Job No: 562241	Test Date: 18/Feb/2025
Project: Downley Road, Havant	Tested By: MD	Engineer: MD
		Fig. S2

BRE Digest 365 Soakage Test



Test Hole No: SOAK01
Test No: Test No 3 (Repeated)



Pit Length (m)	2.00	Depth to Water at Start of Test (m)	1.40
Pit Width (m)	0.40	Max Water Dropdown during Test (m)	0.90
Depth to Pit Base (m)	2.50	Total Soakage Test Time (min)	3.0
Depth to Top of Permeable Soils (m)	1.00	Mean Internal Discharge Area (m ²)	3.440
Depth to Groundwater Surface (m)		Discharge Rate (litre/min)	110.000
Depth to Top of Granular Fill (m)		Soakage Rate (litre/m ² /min)	31.98
Voids Assumed for Granular Fill (%)	100%	BRE Soil Infiltration Rate (m/sec)	5.33E-04

Comments:

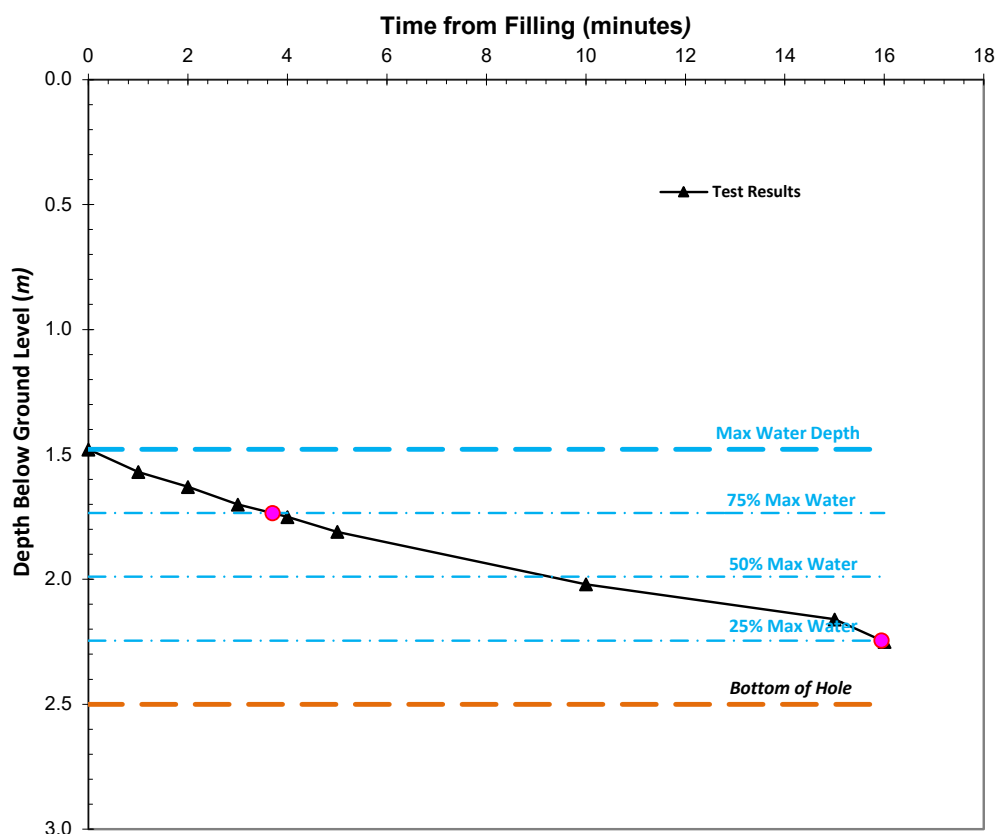
Pit was nearly emptied at finish of test.

Client: Royal London Property Group	Job No: 562241	Test Date: 18/Feb/2025
Project: Downley Road, Havant	Tested By: MD	Engineer: MD
		Fig. S3

BRE Digest 365 Soakage Test



Test Hole No: SOAK02
Test No: Test No 1 (Initial)



Pit Length (m)	1.80	Depth to Water at Start of Test (m)	1.48
Pit Width (m)	0.50	Max Water Dropdown during Test (m)	0.77
Depth to Pit Base (m)	2.50	Total Soakage Test Time (min)	16.0
Depth to Top of Permeable Soils (m)	1.30	Mean Internal Discharge Area (m ²)	3.246
Depth to Groundwater Surface (m)		Discharge Rate (litre/min)	37.486
Depth to Top of Granular Fill (m)		Soakage Rate (litre/m ² /min)	11.55
Voids Assumed for Granular Fill (%)	100%	BRE Soil Infiltration Rate (m/sec)	1.92E-04

Comments:

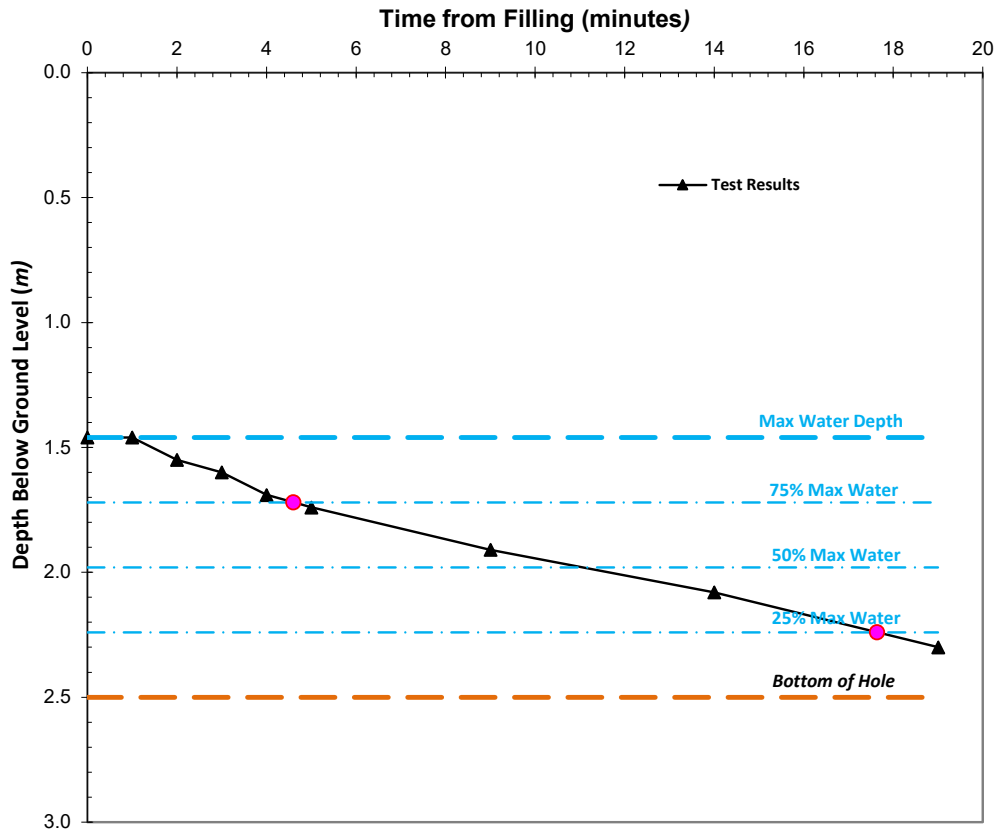
Pit was nearly emptied at finish of test.

Client: Royal London Property Group	Job No: 562241	Test Date: 18/Feb/2025
Project: Downley Road, Havant	Tested By: MD	Engineer: MD
		Fig. S4

BRE Digest 365 Soakage Test



Test Hole No: SOAK02
Test No: Test No 2 (Repeated)



Pit Length (m)	1.80	Depth to Water at Start of Test (m)	1.46
Pit Width (m)	0.50	Max Water Dropdown during Test (m)	0.84
Depth to Pit Base (m)	2.50	Total Soakage Test Time (min)	19.0
Depth to Top of Permeable Soils (m)	1.30	Mean Internal Discharge Area (m ²)	3.292
Depth to Groundwater Surface (m)		Discharge Rate (litre/min)	35.900
Depth to Top of Granular Fill (m)		Soakage Rate (litre/m ² /min)	10.91
Voids Assumed for Granular Fill (%)	100%	BRE Soil Infiltration Rate (m/sec)	1.82E-04

Comments:

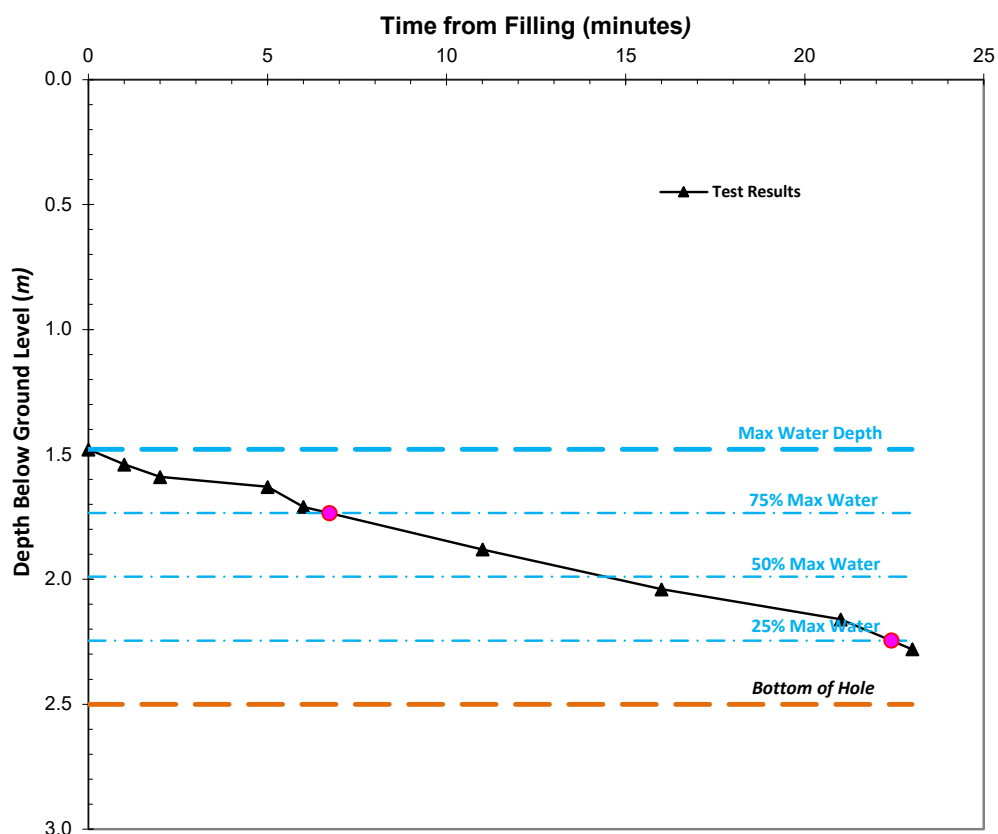
Pit was nearly emptied at finish of test.

Client: Royal London Property Group	Job No: 562241	Test Date: 18/Feb/2025
Project: Downley Road, Havant	Tested By: MD	Engineer: MD
		Fig. S5

BRE Digest 365 Soakage Test



Test Hole No: SOAK02
Test No: Test No 3 (Repeated)



Pit Length (m)	1.80	Depth to Water at Start of Test (m)	1.48
Pit Width (m)	0.50	Max Water Dropdown during Test (m)	0.80
Depth to Pit Base (m)	2.50	Total Soakage Test Time (min)	23.0
Depth to Top of Permeable Soils (m)	1.30	Mean Internal Discharge Area (m ²)	3.246
Depth to Groundwater Surface (m)		Discharge Rate (litre/min)	29.270
Depth to Top of Granular Fill (m)		Soakage Rate (litre/m ² /min)	9.02
Voids Assumed for Granular Fill (%)	100%	BRE Soil Infiltration Rate (m/sec)	1.50E-04

Comments:

Pit was nearly emptied at finish of test.

Client: Royal London Property Group	Job No: 562241	Test Date: 18/Feb/2025
Project: Downley Road, Havant	Tested By: MD	Engineer: MD
		Fig. S6



Summary
Results of BRE Digest 365 Soakage Tests

Project : Downley Road, Havant					Job No : 562241		
Client : Royal London Property Group					Grid Reference : E 472809, N 107616		
Tested By : MD				Engineer: MD		Test Date : 18/Feb/2025	
Hole No	Test No	Hole Depth (m)	Soakage Rate for Each Test (litre/m ² /min)	Soakage Rate for Each Hole (litre/m ² /min) (m/sec)		Water Level at Finish of Test	Remarks
SOAK01	No 1	2.50	84.42	30.84	5.14E-4	Nearly empty pit.	Depth to top of permeable soils was 1m.
SOAK01	No 2	2.50	30.84			Nearly empty pit.	
SOAK01	No 3	2.50	31.98			Nearly empty pit.	
SOAK02	No 1	2.50	11.55	9.02	1.50E-4	Nearly empty pit.	Depth to top of permeable soils was 1.3m.
SOAK02	No 2	2.50	10.91			Nearly empty pit.	
SOAK02	No 3	2.50	9.02			Nearly empty pit.	
Mean Value of All Calculated Soakage Rates :				19.93 litre/m ² /min	3.32E-4 m/sec		