Langstone Park

Masterplan

Flood Risk Assessment & Outline Drainage Strategy Report

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Appendix D –Other Supporting Information

D.1 Clancy Flood Risk Assessment (FRA) and SUDS Strategy, 02/07/2019 (Report Reference 8/1982)

D.2 Delta Simons Phase 1 Environmental Assessment, Nov 2020 (Report Reference 15-0754.07)

D.3 Clancy Consulting Geo-Environmental Appraisal Report, Oct 2029 (Report Reference 10/1425/001).

D.4 EA detailed advice ref ENVPAC.1.SSD.00216

Flood Risk Assessment and SUDS Strategy

Langstone Technology Park,
Langstone Road,
Havant,
PO9 1SA

2nd July 2019

Ref: 8/1982

Prepared on Behalf of:

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FLOOD RISK ASSESSMENT
Langstone Technology Park, Langstone Road, Havant, PO9 1SA

Report Reference: 8/1982

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1.0 INTRODUCTION

1.1 General

1.1.1 This report has been prepared on instructions received from AG Langstone BV and Trinity Investment Management.

1.1.2 This report relates to the proposed works at Langstone Technology Park, Havant to reconfigure the existing building '1000', add new areas of car parking along with construction of 12 No. units on the South West of the site.

1.1.3 This report sets out the results of a flood risk assessment required in support of a planning application for this development. The assessment has been carried out in accordance with the general principals set out in National Planning Policy Framework, Technical Guidance to the National Planning Policy Framework published in March 2012 and Planning Practice Guidance May 2019, Flood risk last updated in March 2014.

1.1.4 This report is prepared solely for the benefit of the Client. This report may not be assigned without prior written permission from Clancy Consulting.

1.2 Background Information

1.2.1 In 2001 the Department for Transport Local Government Regions (DTLR) published Planning Policy Guidance Note 25 (PPG25), which explains how flood risk should be taken into consideration during the planning and development process.

PPG25 was replaced by Planning Policy Statement 25: Development and Flood Risk published in March 2010. This latest Policy Statement has been introduced to place more emphasis on the increased flood risk from climate change.

PPS25 specifies a sequential test which local planning authorities should apply to all future proposed development sites. An exception test may also be applied to provide a method of managing flood risk while still allowing necessary development to occur.

In Feb 2019, the Government released a revised National Planning Policy Framework (NPPF) aiming to make the planning system less complex and more accessible, to protect the environment and promote sustainable growth.

NPPF accompanied with the Technical Guidance published also in March 2012 supersedes PPS25 although the principles set out in the new publication remain similar in terms of the flood risk aspect. The flood risk Practice Guide was published on-line in March 2014.

1.2.2 The following zones define the levels of flood risk:

Zone 1: Low Probability.
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any one year. (<0.1%)

Zone 2: Medium Probability
This zone comprises land assessed as having between 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.

Zone 3a: High Probability
This zone comprises land assessed as having between 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Zone 3b: Functional Flood Plain
This zone comprises land where water has to flow or be stored in times of flood. Strategic Flood Risk Assessments should identify this zone.

1.2.3 As part of its general obligations under the Water Resources Act 1991, The Environment Agency has carried out surveys of its existing defences against flooding and has published a series of nationwide 'Indicative Floodplain Maps' based upon information from historic flood events and basic hydraulic modelling. In general terms, these maps give a good indication of the areas likely to be affected by flooding. More recently, the Environment Agency have published the 'Flood Map' on their website which is based on improved hydraulic modelling and detailed local data. The map highlights Zones 2 and 3 on the map with all other areas being Flood Zone 1.

1.2.4 The EA Flood Map for the area of the proposed development indicates that there is a small strip of land within flood zone 3 on the site. However, the majority of the development lies in an area of flood risk **zone 1 – low probability of flooding.**

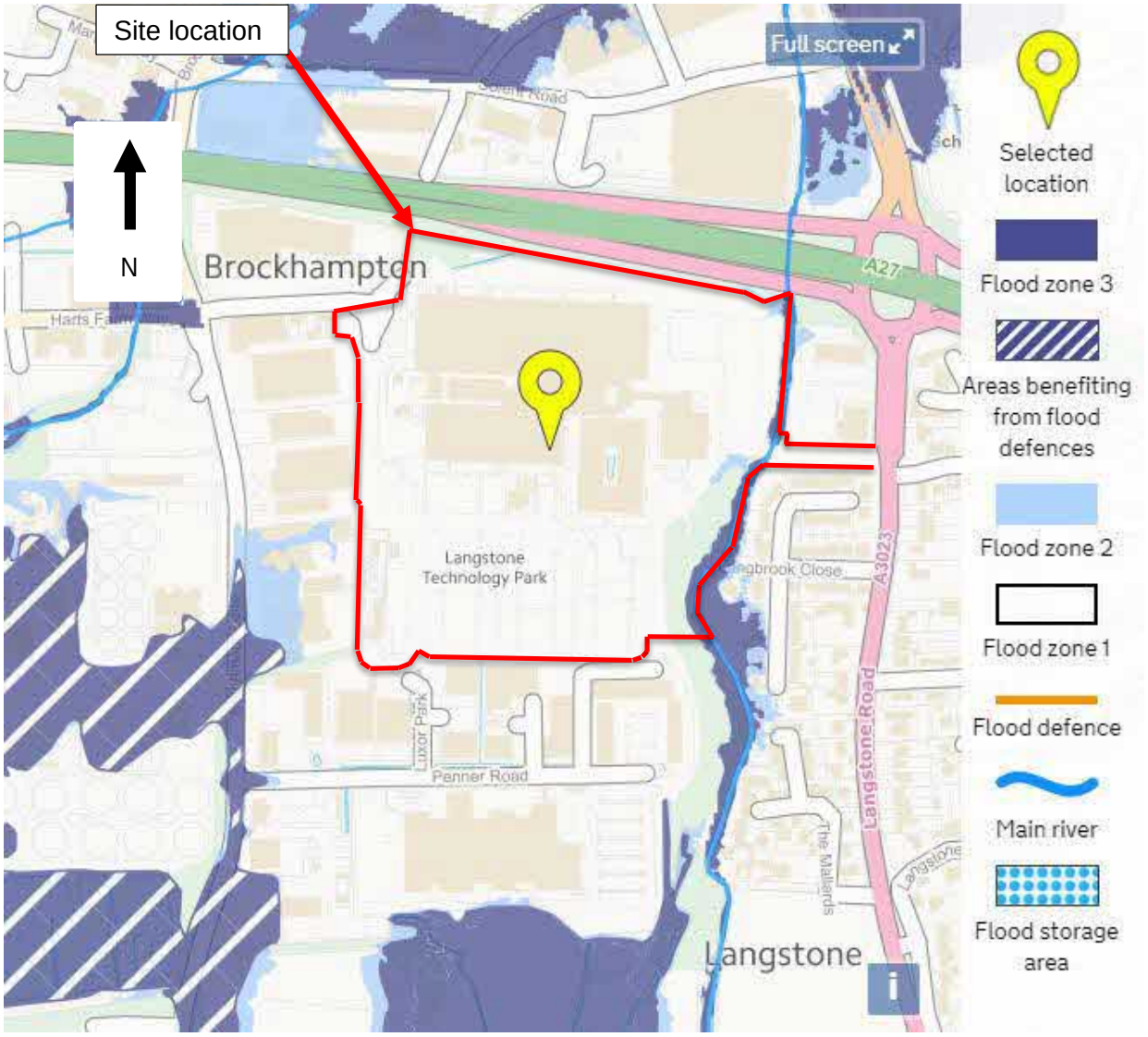


Figure 1 - Risk of Flooding from Rivers and Seas (EA)

2.0 STRUCTURE OF THE REPORT

2.1 The report has been structured to follow the general principals set out in the Technical Guidance published in March 2012.

2.2 The methodology for this FRA has comprised a desktop study and liaison with the Environment Agency (EA) and reference has also been made to relevant plans including plans showing the location of local sewers.

2.3 Sources of information

- Flood maps from the Environment Agency published online (EA)
- Havant Borough Council Strategic Flood Risk Assessment 2018
- British Geological Survey (BGS)
- Southern Water Asset Plan (SW)
- Preliminary Geo-environmental Risk Assessment (deltasimons May 2019)

3.0 SITE DESCRIPTION

3.1 Location

3.1.1 The site is located as detailed as below.

OS X (Eastings)	471279
OS Y (Northings)	105702
Nearest Post Code	PO9 1SA
Lat (WGS84)	N50:50:47 (50.846458)
Long (WGS84)	W0:59:20 (-0.988916)
LR	50.846458,-0.988916
National Grid	SU712057 / SU7127905702
mX	-110085
mY	6561024

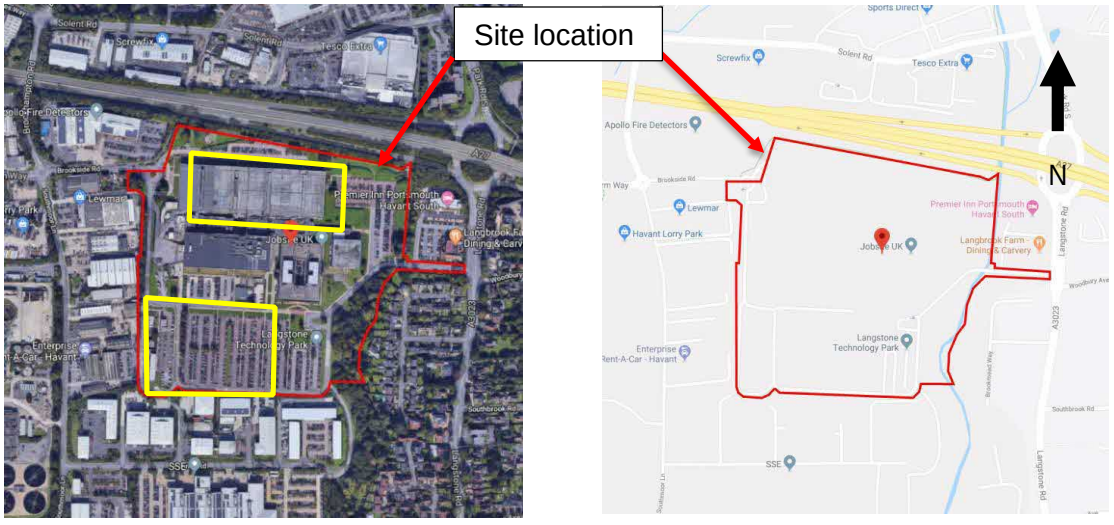


Figure 2 - Site Location Plan (Google Maps)

3.1.2 The overall site is approximately 425m long by 400m wide (17ha) and comprises of multiple large office and laboratory spaces hosting multiple businesses.

3.2 Development Proposals

3.2.1 The applicant seeks full planning permission for the part-demolition of Building 1000, installation of a new flank elevation to the East, a new elevation to the North of Building 4000 as a result of the aforementioned part-demolition of Building 1000, the erection of new buildings in flexible B1c, B2 and B8 use in the South-West corner of the site with associated parking; and the creation of new car parking areas and the rationalisation of existing parking areas.

4.0 FLOOD POTENTIAL

4.1 Development Proposal

4.1.1 The NPPF classification of this development is 'less vulnerable'.

4.2 Potential for Flooding

4.2.1 The site is located within a zone 1 area in terms of flooding from rivers and the sea.

4.2.2 There are, therefore, four potential sources of flooding at the site which will be addressed in more detail in this report, i.e.

(i) From surface water overland flow off site.

(ii) From high groundwater levels.

(iii) From artificial sources such as reservoirs.

(iv) From the surcharging of drains or sewers on the site.

4.3 Existing Historical Flooding Information

4.3.1 No record of historical flooding history of the site has been found in the Havant Borough Council Strategic Flood Risk Assessment.

4.4 Flood Risk Probabilities

(i) Flooding from Surface Water – Overland flow

4.4.1 During extreme rainfall events or due to poor drainage gully maintenance there will be times when gully capacity is exceeded which will lead to surface flow within the surrounding roads. Mapping for this form of flooding is shown on the Environment Agency web site.

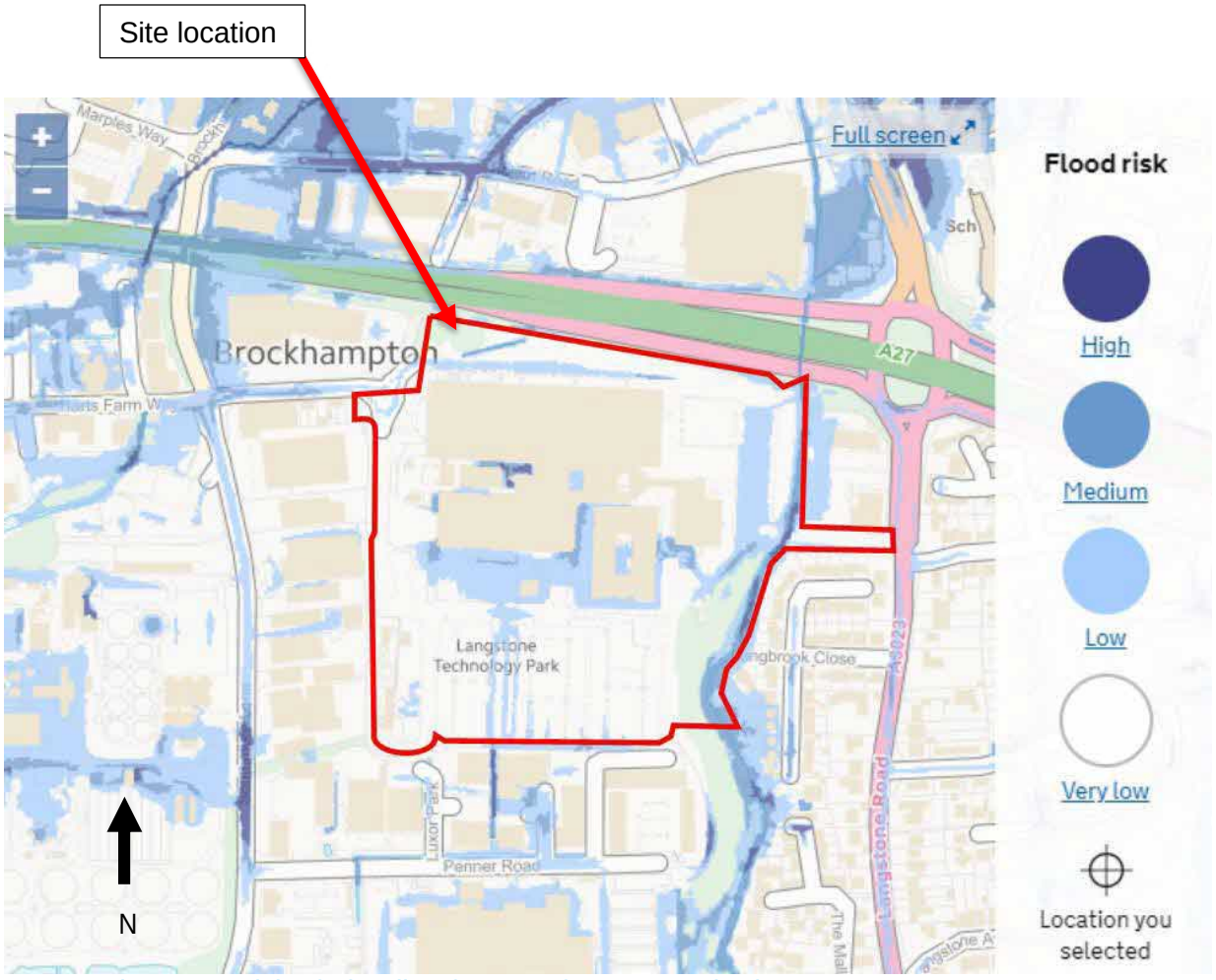


Figure 3 - Risk of Flooding from Surface Water (EA)

4.4.2 There is predicted to be various areas of low to medium risk of surface water flooding during extreme rainfall events on site, however the rest of the site is of very low risk up to the 0.1% probability event. **The Environment Agency classifies this site as low flood risk from surface water.**

4.4.3 As shown in Figure 3, the EA flood modelling anticipates that there is low potential for overland run off from the south of the development running north towards the existing buildings in the technology park. To mitigate this it is recommended that the new industrial units to be constructed on the car park have a minimal elevation raise. This elevation raise can be seen as provided on the architectural proposals.

(ii) Flooding from Groundwater

4.4.4 Geological records for this area indicate that the superficial geology consists of Alluvium (clay, sand, silt and gravel). The bedrock geology consists of Lewes Nodular Chalk, Seaford Chalk, Newhaven Chalk, Culver Chalk and Portsdown Chalk.

4.4.5 There are a number of historic borehole logs for the technology park. The boreholes indicate superficial deposits of clays and gravels overlaying firm chalk deposits. This is in line with expectations from British geological society maps. Ground water was encountered in the boreholes between approximately 1.35-2.25m. A summary of the boreholes can be found in Appendix F.

4.4.6 Based upon the desk study evidence above, **the risk of flooding due to ground water can be considered low for this proposed development.**

(iii) Flooding from Artificial Sources - Reservoirs

4.4.7 Artificial sources of flooding are potentially from man-made structures and infrastructure. The Environment Agency have modelled the potential effect of flooding from failures in retaining structures containing reservoirs.

4.4.8 It should be noted that reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs are inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the Environment Agency ensure that reservoirs are inspected regularly, and essential safety work is carried out. **The risk of flooding from reservoirs at this site is extremely low.**

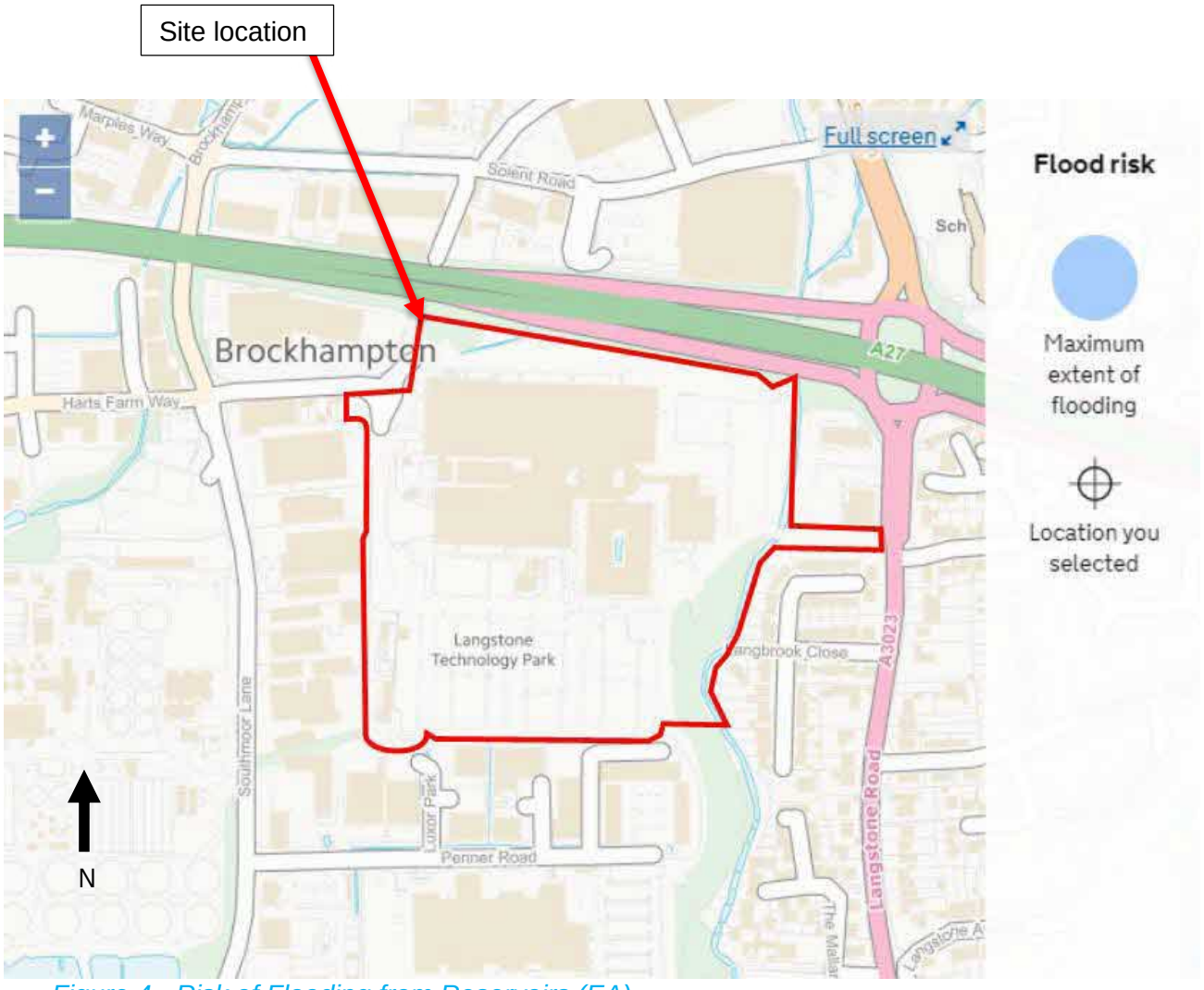


Figure 4 - Risk of Flooding from Reservoirs (EA)

(iv) Flooding from Drainage on site

4.4.9 Flooding could occur if the on-site drainage system becomes blocked or the rainfall event exceeds the design capacity. Details of the drainage system are discussed in Chapter 5.

5.0 DRAINAGE

5.1 EXISTING DRAINAGE

5.1.1 The Southern Water drainage mapping shows that there are adopted public drainage systems in the site. A large 600mm diameter foul sewer running from East to West through the centre of the site, 750mm diameter foul sewer running from East to West just north of the site and a 675mm diameter surface water sewer running from North to South along the western site boundary. Additional private drainage has been recorded in a CCTV survey.

5.1.2 The CCTV and Topographic survey undertaken at the site can be found in Appendix B.



Figure 5 - Existing Public Sewer Plan (Southern Water)

5.1.3 The CCTV survey located a number of private drainage systems within the site. These can be found in Appendix B and are summarised on the proposed drainage strategy drawing found in Appendix E.

5.1.4 Surface water on the site north of the road bisecting the site drains via a 450mm surface water pipe discharging to the Environment Agency (EA) main river to the east of the site. Surface water drainage for the existing car park on the south of the site exits the site via 375mm diameter pipes heading south. A sketch summary of the CCTV survey overlaid on the proposed scheme can be found in Appendix C.

5.1.5 Foul water from the site connects to the existing adopted Southern Water mains foul sewers running through the site.

5.1.6 Information from the EA main river map indicates the river running along the east side of the site is a main river.



Figure 6 – EA River map

5.2 PROPOSED DRAINAGE

5.2.1 Surface Water Disposal Hierarchy

The disposal of surface water should be considered in the following order of priority;

1. Infiltration into the subsoil via soakaways or permeable paving.
2. Discharge to a water course or the sea.
3. Discharge to a surface water sewer.
4. Discharge to a combined sewer.

If it is not possible to discharge to a soakaway, surface water should be controlled with the use of Sustainable Drainage Systems (SuDS) and considered using the SuDS Hierarchy.

5.2.2 SuDS Hierarchy

	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
Most Sustainable	Living roofs	✔	✔	✔
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✔	✔	✔
	Filter strips and swales	✔	✔	✔
	Infiltration devices - soakaways - infiltration trenches and basins	✔	✔	✔
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviors	✔	✔	
Least Sustainable	Tanked systems - over-sized pipes/tanks - storms cells	✔		

5.2.3 Disposal of Surface Water

Infiltration

At the time of writing infiltration test results are not available for the area. Infiltration via soakaways would be the primary discharge option for surface water if proven viable.

The current drainage does not discharge via infiltration, instead the northern area of the site discharges to a river east of the site while the south discharges via carrier pipe to an unknown location off site. Therefore it has been assumed, until proven otherwise, that infiltration is not viable.

Looking at historic borehole records available via the British Geological Society for the technology park, it is found that there is the potential for high groundwater. High groundwater levels are not preferable for soakaways as ground water fluctuates throughout the year and greatly reduce their efficiency if the soakaways are not at least 1m above the highest ground water level.

At detailed design stage a full ground investigation should be carried out including infiltration testing to establish if infiltration is viable.

Watercourse

As identified in Section 5.1, there is a main river located East of the developed site. If soakaways are found to not be viable then discharge into the watercourse is the next preferred option. Discussions have been undertaken with the Environment Agency (EA) via a phone conversation on 14/6/2019. The EA have stated that so long as the discharged surface water is ‘clean’ then there will not be a permit required for discharge to the main river.

Existing Sewer Connections

If permission for additional discharge into the main river is not granted then a connection to the existing adopted surface water sewers will be required.

5.2.4 SuDS Strategy - Control at Source.

One of the most effective means of reducing surface water flows and run-off is to control the rainfall at source with the use of increased soft landscaping, green roofs, and permeable paving.

Permeable paving has been proposed as an option in areas of low trafficked hardstanding. Permeable paving can be used to filter and improve water quality as well as provide a storage reservoir for storm water during extreme rainfall events. The main areas that permeable paving would be utilised in this development is the car parks. As a precautionary measure it would be advisable to only utilise permeable paving in the parking bays to avoid excessive wear on the surface. Permeable paving will not be viable in the heavy trafficked areas of the south-west of the site due to the proposed vehicle loading in the area.

It would not be advisable to utilise green roofs on this type of development due to the style and function of the proposed buildings.

Generally, the smaller, more isolated footpaths may drain directly into adjacent soft landscaping if permeable paving is not utilised.

5.2.5 Proposed Drainage

Any new drainage should be designed in accordance with the building regulations to allow for easy access for maintenance and blockage clearance.

Runoff Rates (See Appendix D for calculations)

The drainage areas have been split into four distinct areas as shown in Figure 7. The Havant Local Plan stipulates in section 3.5.b that run off rates should be below the pre-development rate, or, if not possible show no increase compared to predevelopment rates.

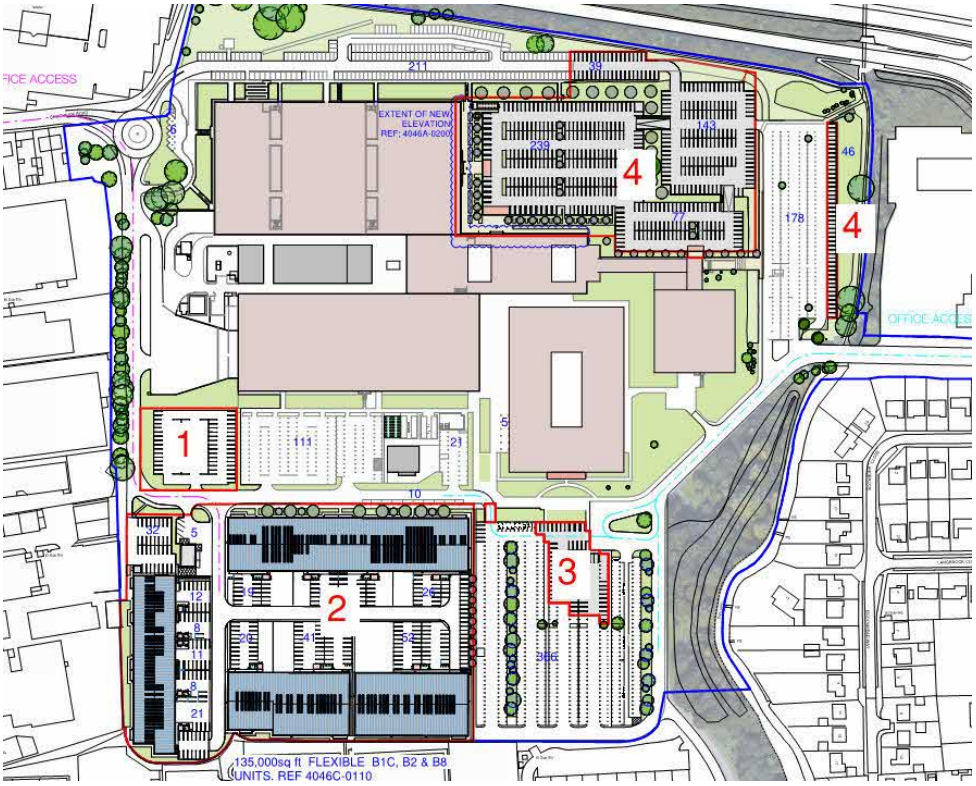


Figure 7 – Development areas, 1 to 4

Area 1 – Impermeable area = 2,044m^2
Current run-off rates
1 in 1 year (l/s) = 7.5
1 in 30 year (l/s) = 18.4
1 in 100 year (l/s) = 23.7

Area 2 – Impermeable area = 25,439 m^2
Current run-off rates
1 in 1 year (l/s) = 203.2
1 in 30 year (l/s) = 497.6
1 in 100 year (l/s) = 641.6

Area 3 – Impermeable area = 1,822 m^2
Current run-off rates
Current area is soft landscaping, see greenfield rates

1 in 1 year (l/s) = 0.46
1 in 30 year (l/s) = 1.24
1 in 100 year (l/s) = 1.72

Obar (l/s) = 0.54

Area 4
Car park in footprint of Building 1000 area = 5212.5m^2
1 in 1 year (l/s) = 41.6
1 in 30 year (l/s) = 102.6
1 in 100 year (l/s) = 131.5

New car parking in north of area 4 = 1693.5m^2
1 in 1 year (l/s) = 13.5
1 in 30 year (l/s) = 33.1
1 in 100 year (l/s) = 42.7

Additional car parking area = 2655.6m^2
1 in 1 year (l/s) = 21.2
1 in 30 year (l/s) = 51.9
1 in 100 year (l/s) = 67.0

Eastern proposed parking area = 530.71m^2
1 in 1 year (l/s) = 4.2
1 in 30 year (l/s) = 10.4
1 in 100 year (l/s) = 13.4

Proposed Runoff Rate

The proposed runoff rate for the site have been chosen to match the current discharge and are therefore as follows:

Area 1 – 7.5 l/s
Area 2 – 132.0 l/s
Area 3 – 5.0 l/s
Area 4 – See Drainage Strategy Drawing

5 l/s has been chosen for area 3 as a flow control device will be used to limit the flow for higher storm events. The impermeable area in area 1 is also increasing. 5 l/s is the minimum recommended flow rate to reduce the likelihood of debris build up in the network.

For Area 2 see the calculations provided in Appendix 4. The discharge rate from this area has been lowered from the current run off rate as the hydraulic capacity of the discharge pipe is not expected to be able to meet the proposed flow. This is a betterment of the existing drainage.

Drainage Strategy

The proposal for this site is to attenuate all flows from impermeable areas to current run off rates with the use of below ground geocellular tanks, oversized pipes, permeable paving and flow control devices.

See Appendix D for drainage calculations including current and greenfield run off rates alongside storage tank size calculations.

See Appendix E for the proposed drainage drawings and typical details.

Water Quality

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 8 – SuDS Manual extract

In accordance with the SuDS Manual, we will need to mitigate the above pollution hazard indices via the use of SuDS devices and features.

Car Parks;

The SuDS Manual identifies car parks of this use as a low pollution hazard level. It is therefore proposed that permeable pavement will be used to help mitigate this risk.

The hazard indices for car parks are;
Total Suspended Solids – 0.5
Metals – 0.4
Hydrocarbons – 0.4

Permeable Paving provides the following mitigation indices;
Total Suspended Solids – 0.7
Metals – 0.6
Hydrocarbons – 0.7

Permeable Paving is therefore suitable for SuDS mitigation in car park areas.

Area 2 (Industrial area)

The hazard indices for Industrial areas are;
Total Suspended Solids – 0.7
Metals – 0.6
Hydrocarbons – 0.7

It will not be suitable to use permeable paving for the area due to the potential for heavy vehicle loading.

Hydro International Downstream Defenders provide the following mitigation indices;

Total Suspended Solids – 0.5
Metals – 0.4
Hydrocarbons – 0.8

Therefore two downstream defenders will provide cleaning of:
Total Suspended Solids – 0.75
Metals – 0.6
Hydrocarbons – 1.2

As per SuDS manual mitigation the second item in a treatment chain will have an effectiveness of 50% This is adequate to meet the required mitigation measures as suggested by the CIRIA SuDS manual.

Roof areas of new units on the South west of the site:

As roof areas are a very low risk, the mitigation provided by the Downstream Defenders will be more than adequate.

5.2.6 Drainage and SuDS Maintenance Strategy

All of the measures described in this document will form part of the building O&M manual. All of the measures and designs will need to be adhered to in order to maintain the design life and design capacity of the surface and foul water drainage systems. Health and Safety risks have been communicated on design drawings. All responsibility for the on-site surface, foul water drainage and maintenance will lie with the site owner, this is to include all aspects of the surface water drainage system, including piped drains.

The below ground drainage network is designed in accordance with Building Regulations Part H 2015, BSEN 752-2008, LASOO Non-Statutory Technical Standards for Sustainable Drainage 2015 and CIRIA C753 – The SUDS Manual.

General Maintenance

Inspection chambers and access points are provided at regular intervals which can be jetted / cleaned. General checking of the below ground drainage systems should be every three (3) months. General maintenance / cleaning of the below ground systems should be after each major storm event and on an annual basis. This applies to all pipes, inspection chambers, manholes, rodding eyes, gullies, channels and headwalls etc.

Drainage Channels & Slot Drains

To be maintained in accordance with the manufacturer's recommendations and the "General" Section above.

Foul Systems

To be maintained in accordance with the "General" Section above.

Attenuation tank

The attenuation tank is to be inspected after every major storm event as will the catch pit prior to the tank. Catch pits should be emptied regularly to prevent them becoming full and causing inefficiency within the surface water drainage system.

Permeable paving

All permeable paving should be inspected monthly for the first three months after use. After this period the paving should be inspected three-monthly for operation and 48h after large storm events in the first six months.

Downstream Defender and Up-flow Filter

To be maintained in accordance with the manufacturer recommendations.

Flow Controls

Flow control device recommended to be inspected monthly for first three months and thereafter at six monthly intervals with hose dose down if required. Flow control device to be maintained in accordance with manufacturers recommendations.

Please refer to Appendix E and G for operation and maintenance requirement information.

6.0 NPPF AND LOCAL POLICY

6.1 Planning Policy Requirements

The proposal site has been classified as being within Flood Zone 1.

NPPF considers the development use as "less vulnerable" development in respect of flood risk.

The NPPF (Technical Guide) Table 3, Flood Risk Vulnerability and Flood Zone Compatibility matrix indicates that "less vulnerable" development proposals in Flood Zone 1 are appropriate.

6.2 Exception test and Policy check.

The site is in an area of flood zone 1, therefore no exception test is required.

6.3 Residual Risks, Flood Mitigation, Resistance and Resilience of Proposed Building

6.3.1 The site has been shown to be at low to very low risk from all forms of flooding.

6.3.2 The residual risk will be from failure of drainage systems on site. A detailed maintenance strategy and regime should be developed during the detailed design stage.

6.3.3 The proposed drainage system will improve upon the existing drainage. The existing drainage for the areas of development have unattenuated flows and therefore have the potential to increase flood risk in lower lying areas, or areas downstream of the adjacent river. The proposed drainage will control flow rates with the use of attenuation devices such as permeable paving, storage tanks and vortex flow devices to mitigate this potential.

7.0 CONCLUSIONS AND RECOMMENDATIONS

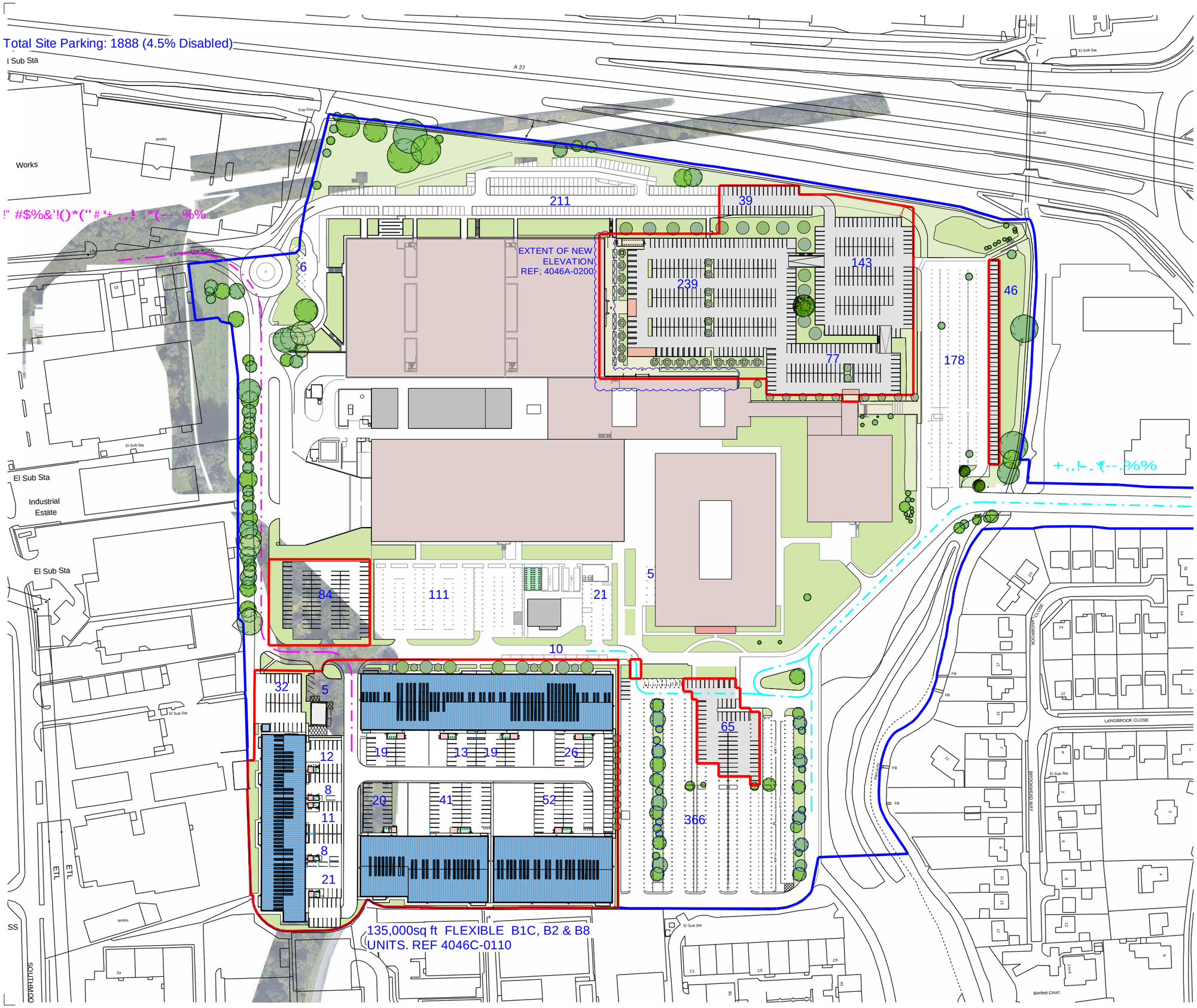
7.1 This report gives details of the flood risk assessment, which has been carried out in relation to the proposed redevelopment at Langstone Technology Park, Havant for commercial use.

7.2 The site is in flood zone 1. The development is at low risk from all sources of flooding.

7.3 It has been shown that improvements can be made to the existing drainage to better manage surface water flow rates and reduce the risk of flooding off site.

APPENDIX A

Proposed Development Plans



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(6$2*81&18*0/*&4:781"*'4# 1324/32;*(<<"*4# 1324/32*681*0/*%1*? 1?!1"* /3*2401;*#42?81'63?412*63")/8*6# %4:740412*%109113*0 42*"869 43:*63"* 436/8# 6049 3*:4513*1?219 181*# !20*%1*81 / 601 *4# # 1 4601<$'0/*0* &/ 8*? <&4&4? 6 0# 3 *%1 & 81 *' 8/ ? 1 1 * 43: ;*(<<* 86 9 43: 2*6 81 *0/ *%1 *81 6 * *43 * ?/3>73?04/3*9 40 *0 1*2' 1?4&4?604/3*63"*6<<*9 /8!2*0/*%1*?68841"*/?70*43* 6??/8"63?1*940 *<60120"*84042 *%063"68"2*)*- /"12*/&*=86?04?1;

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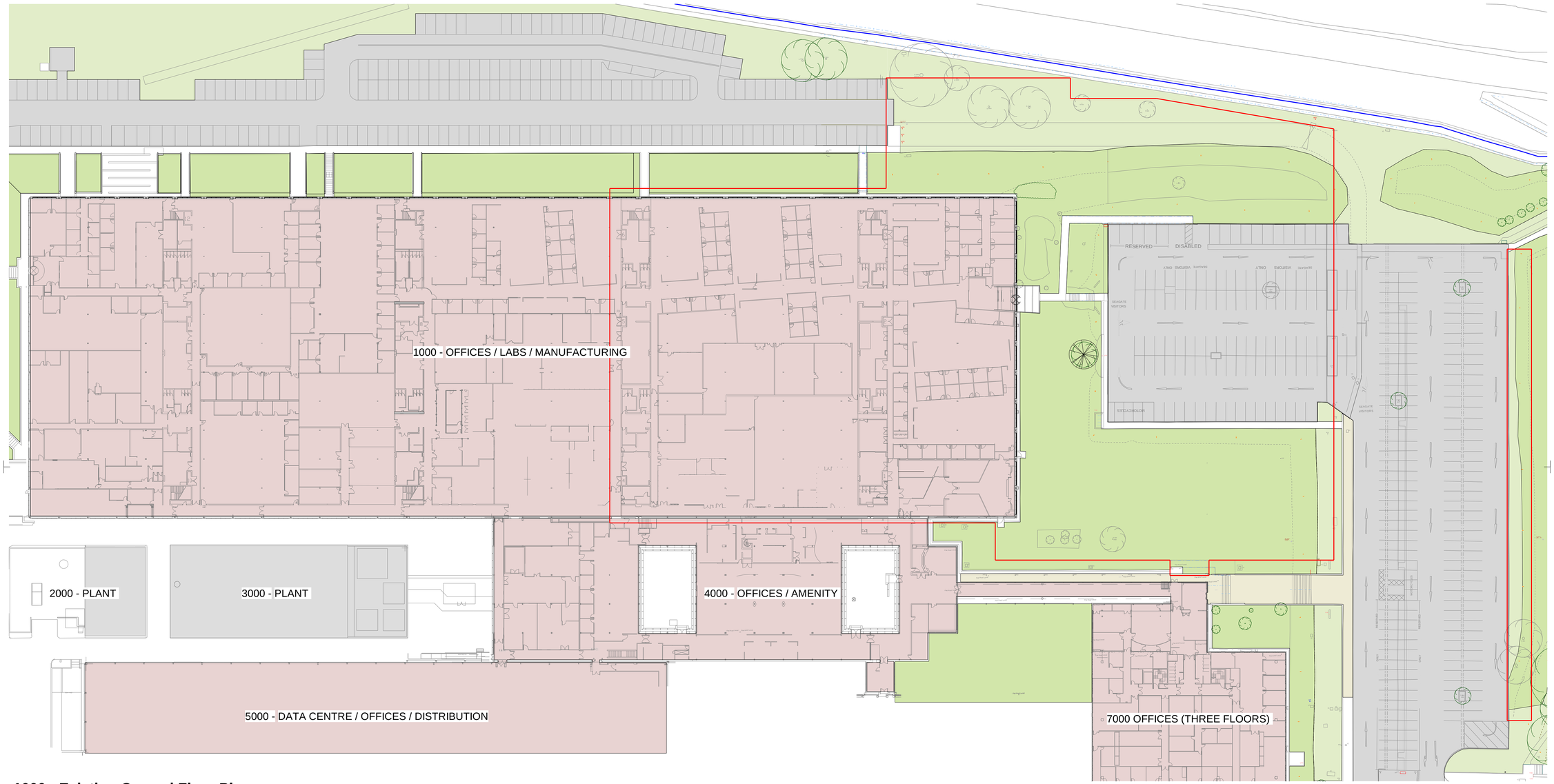
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1000 - Existing Ground Floor Plan

1 : 500

- APPLICATION AREA
- APPLICANT OWNERSHIP BOUNDARY
- EXISTING GIA
- EXISTING CAR PARKING

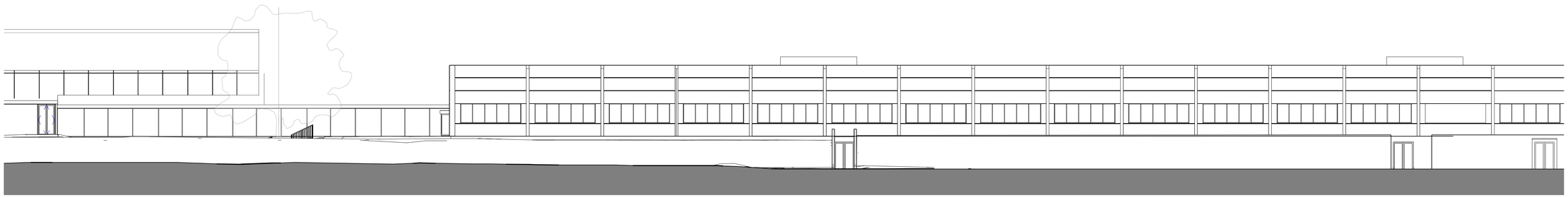
Notes

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SCALE 1:500
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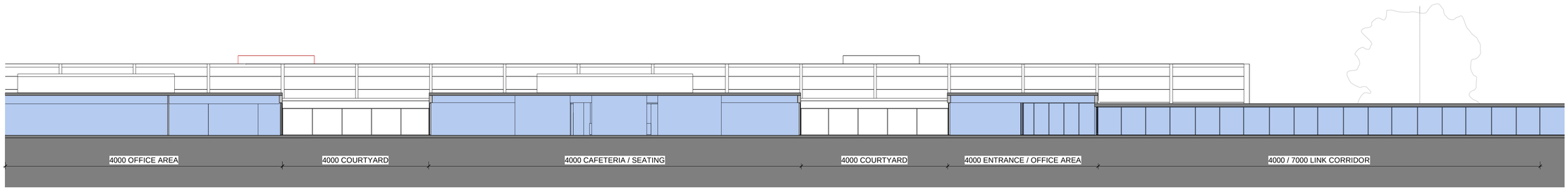
AWW

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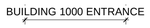
Existing North Elevation 1.200
1 : 200



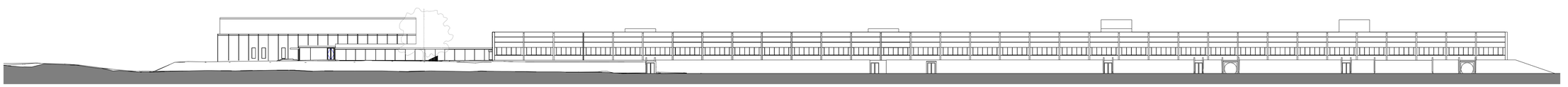


Existing Site Section - Building 1000 South Elevation 1.200
1 : 200

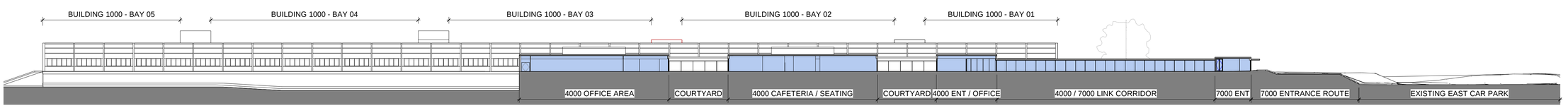
Existing East Elevation 1.200
1 : 200



Existing East Elevation 1.500
1 : 500



Existing North Elevation 1.500
1 : 500



Existing Site Section - Building 1000 South Elevation 1.500
1 : 500

Notes

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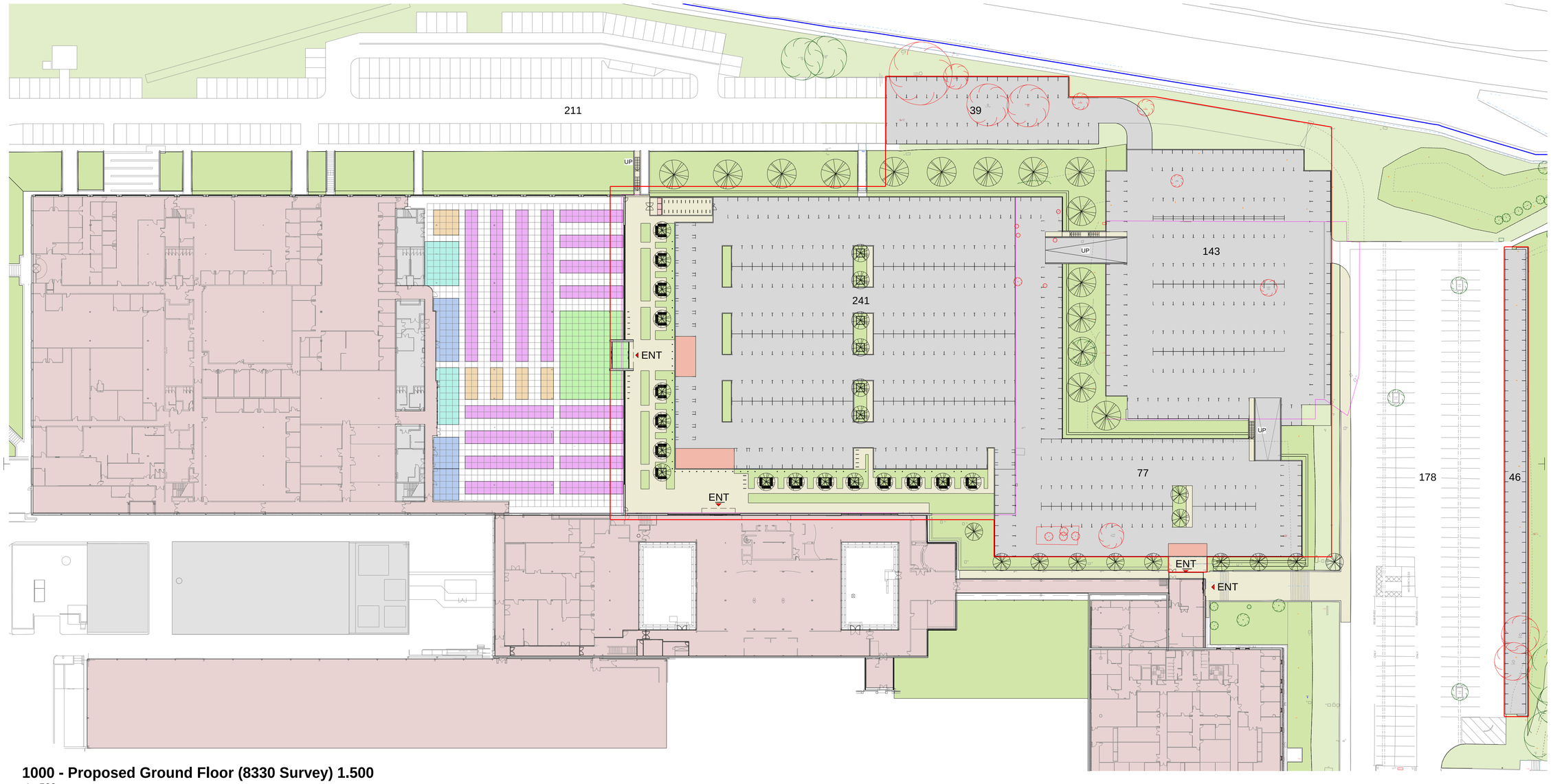
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1000 - Proposed Ground Floor (8330 Survey) 1.500

1 : 500

- APPLICATION AREA
- APPLICANT OWNERSHIP BOUNDARY
- EDGE OF EXISTING SLAB / PARKING AREA
- 1500x1500mm OFFICE GRID
- ELEMENTS REMOVED
- EXISTING GIA
- RECEPTION / ENTRANCE
- OPEN PLAN WORK STATION
- BREAKOUT / INFORMAL
- CONFERENCE / MEETING / FORMAL
- KITCHEN / WC / SERVICES
- EXISTING CORE (PLANT / WC / ST)

Notes

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SCALE 1:500 m

AWW

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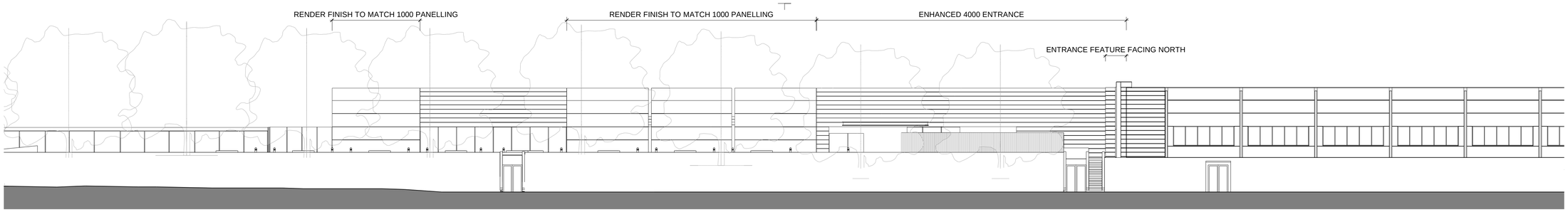
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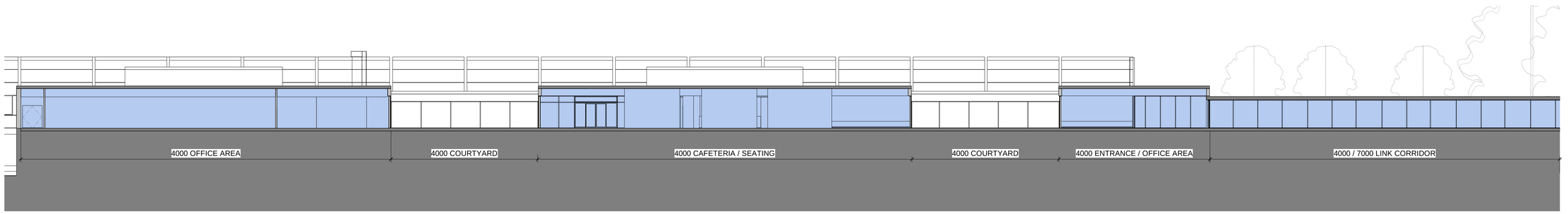
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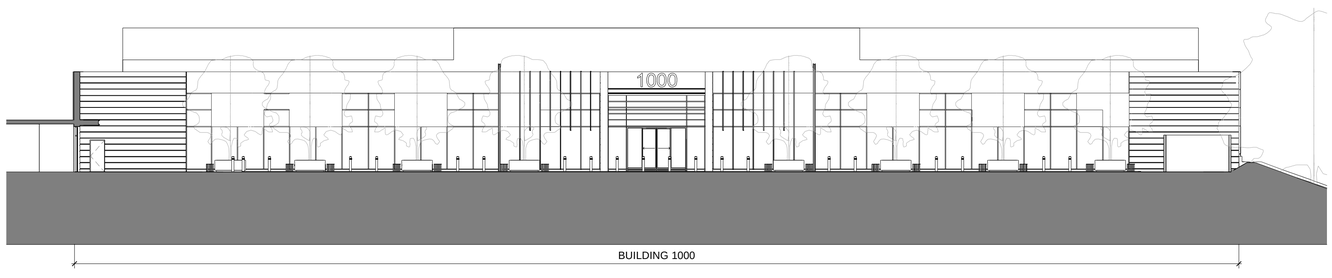
North Elevation Proposed 1.200

1 : 200



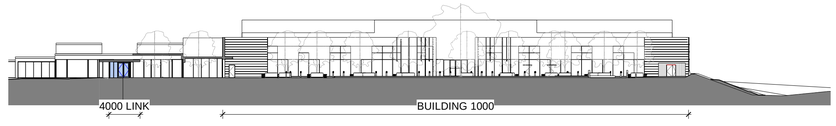
Propsoed Site Section - Building 1000 South Elevation 1.200

1 : 200



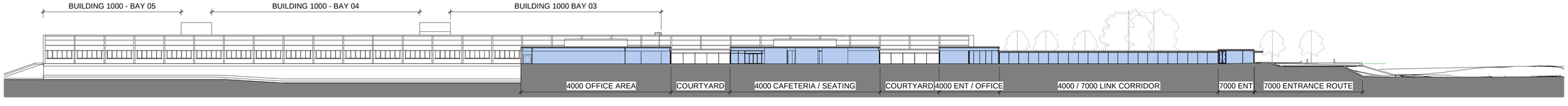
Proposed East Elevation 1.200

1 : 200



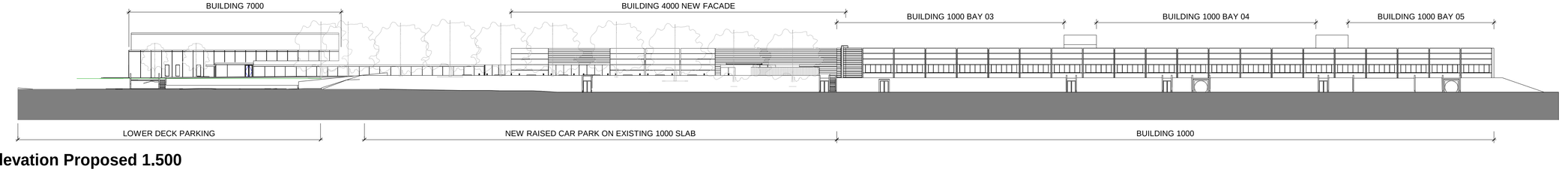
Proposed East Elevation 1.500

1 : 500



Proposed Site Section - Building 1000 South Elevation 1.500

1 : 500



North Elevation Proposed 1.500

1 : 500

Notes

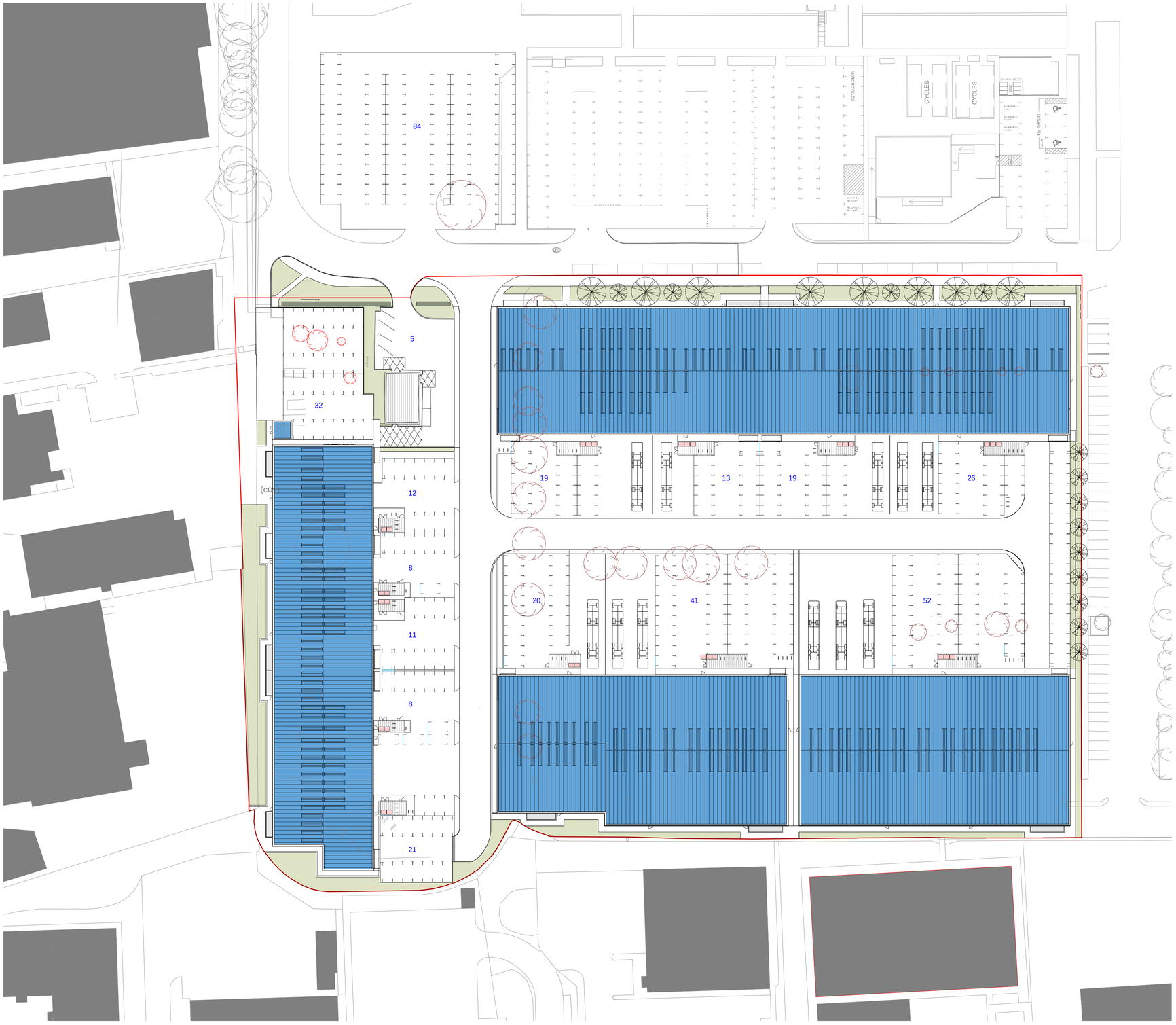
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SCALE 1:200 m

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Notes

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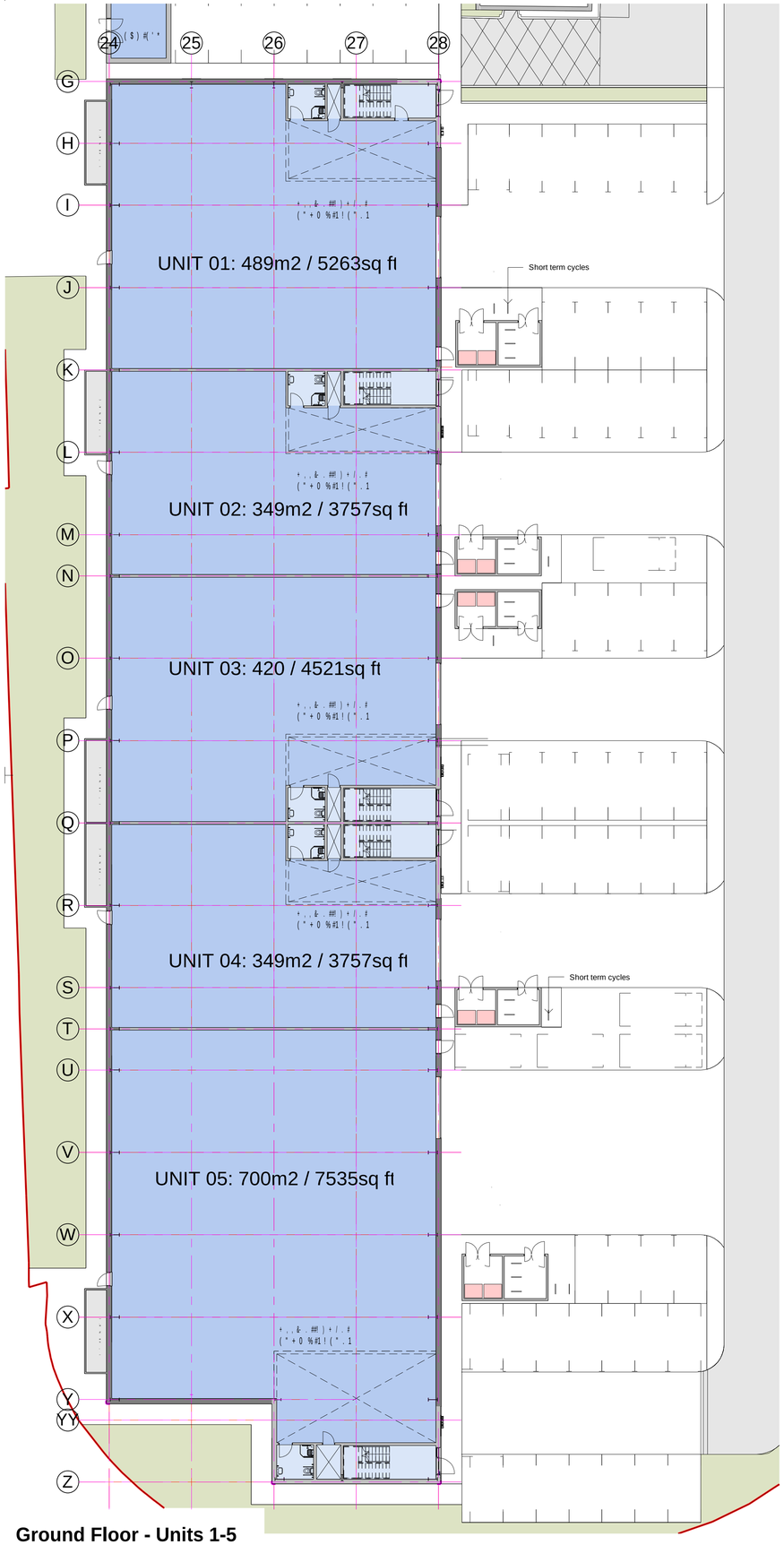
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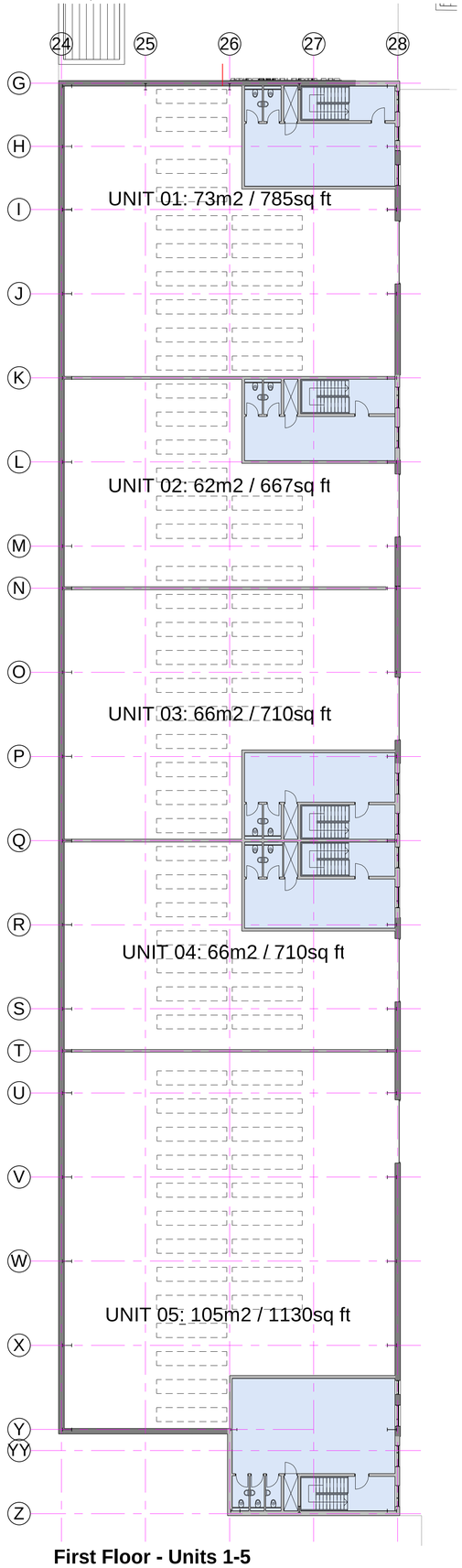
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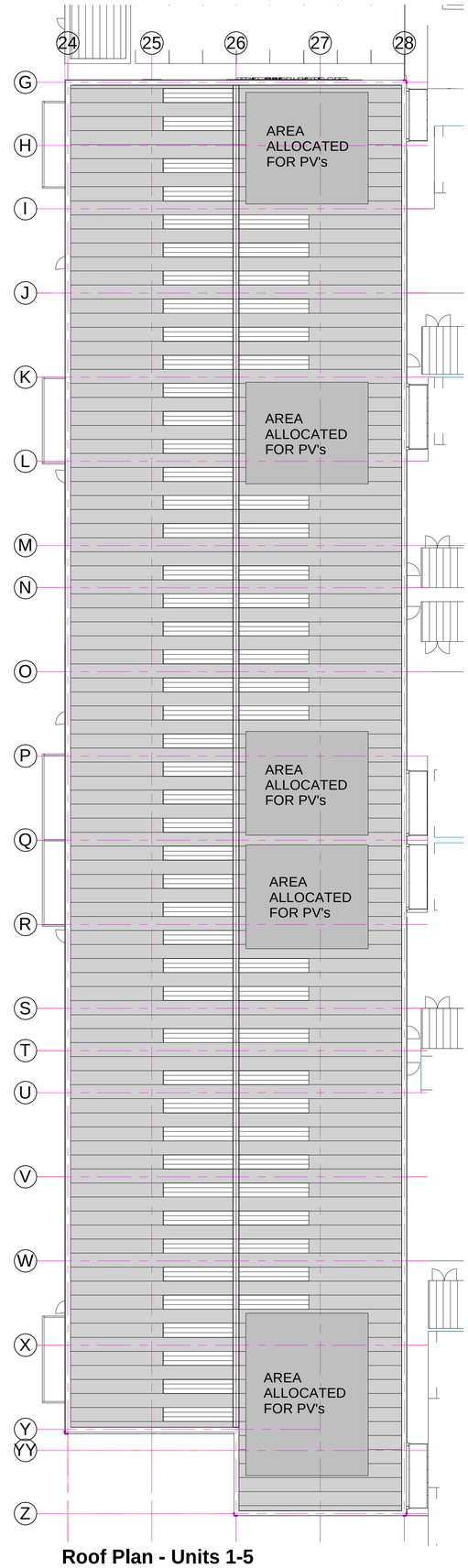
Ground Floor - Units 1-5

1 : 200



First Floor - Units 1-5

1 : 200



Roof Plan - Units 1-5

1 : 200

Notes

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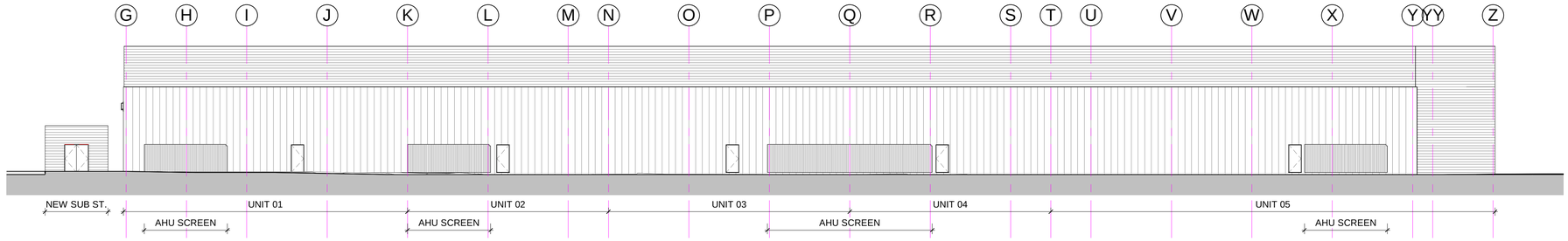
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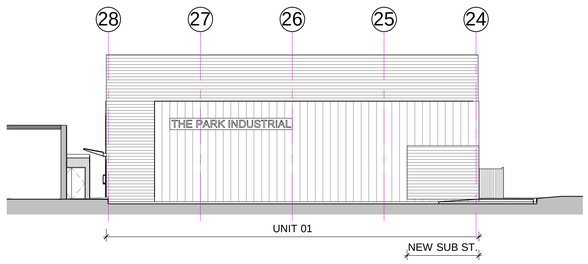
Units 01-05 East Elevation

1 : 200



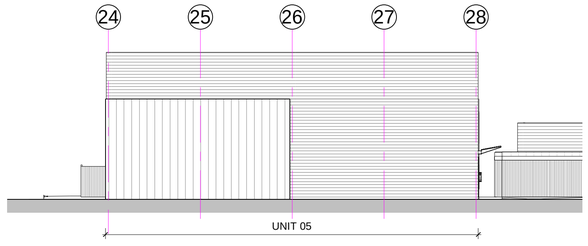
Units 01-05 West Elevation

1 : 200



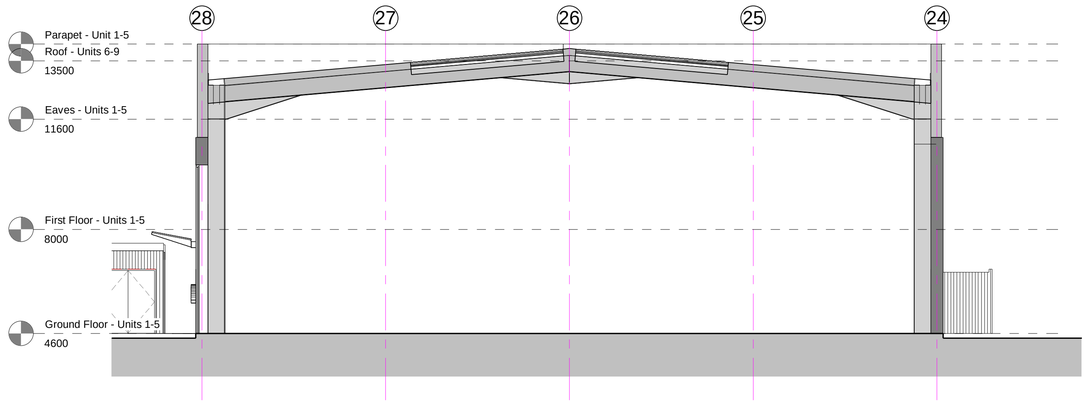
Units 01-05 North Elevation

1 : 200



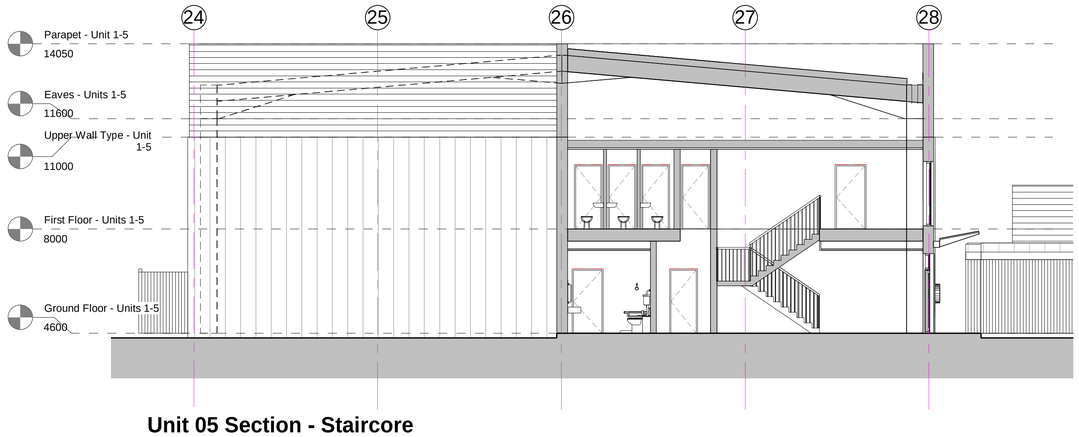
Units 01-05 South Elevation

1 : 200



Units 1-5 Warehouse Section

1 : 100



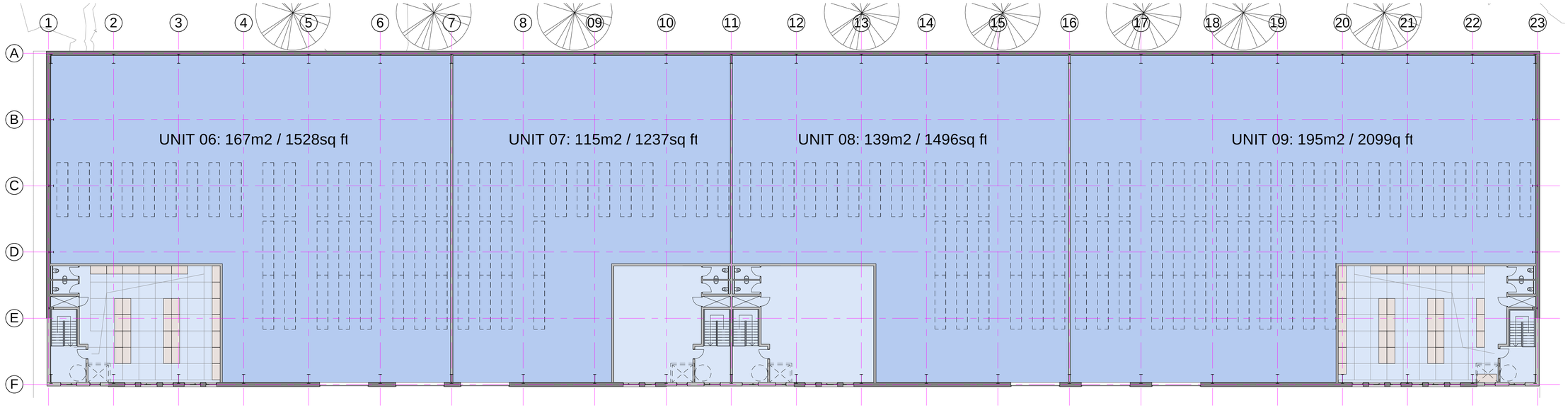
Unit 05 Section - Staircore

1 : 100

Notes

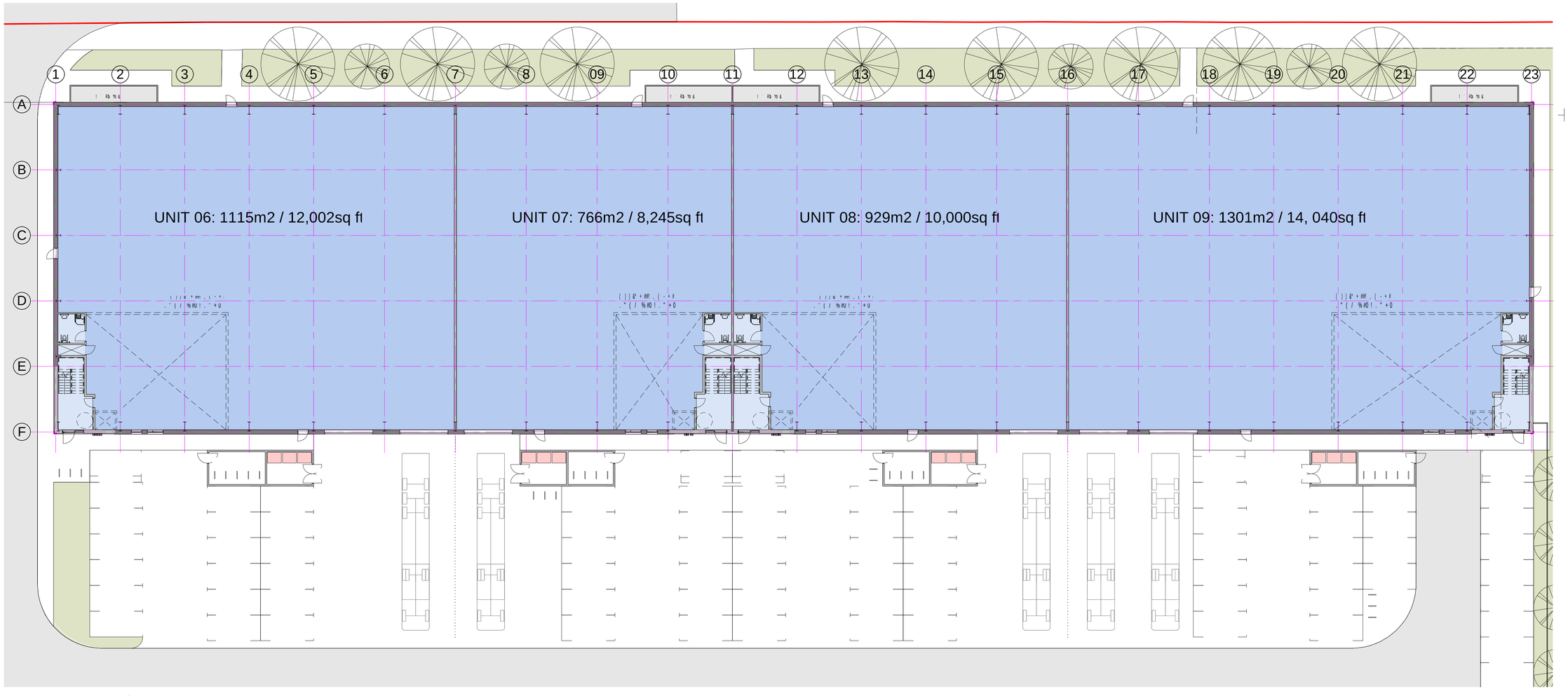
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2 0 2 4 6 8 10
SCALE 1:200 m



First Floor - Units 6-9

1 : 200



GF - Units 6-9

1 : 200

Notes

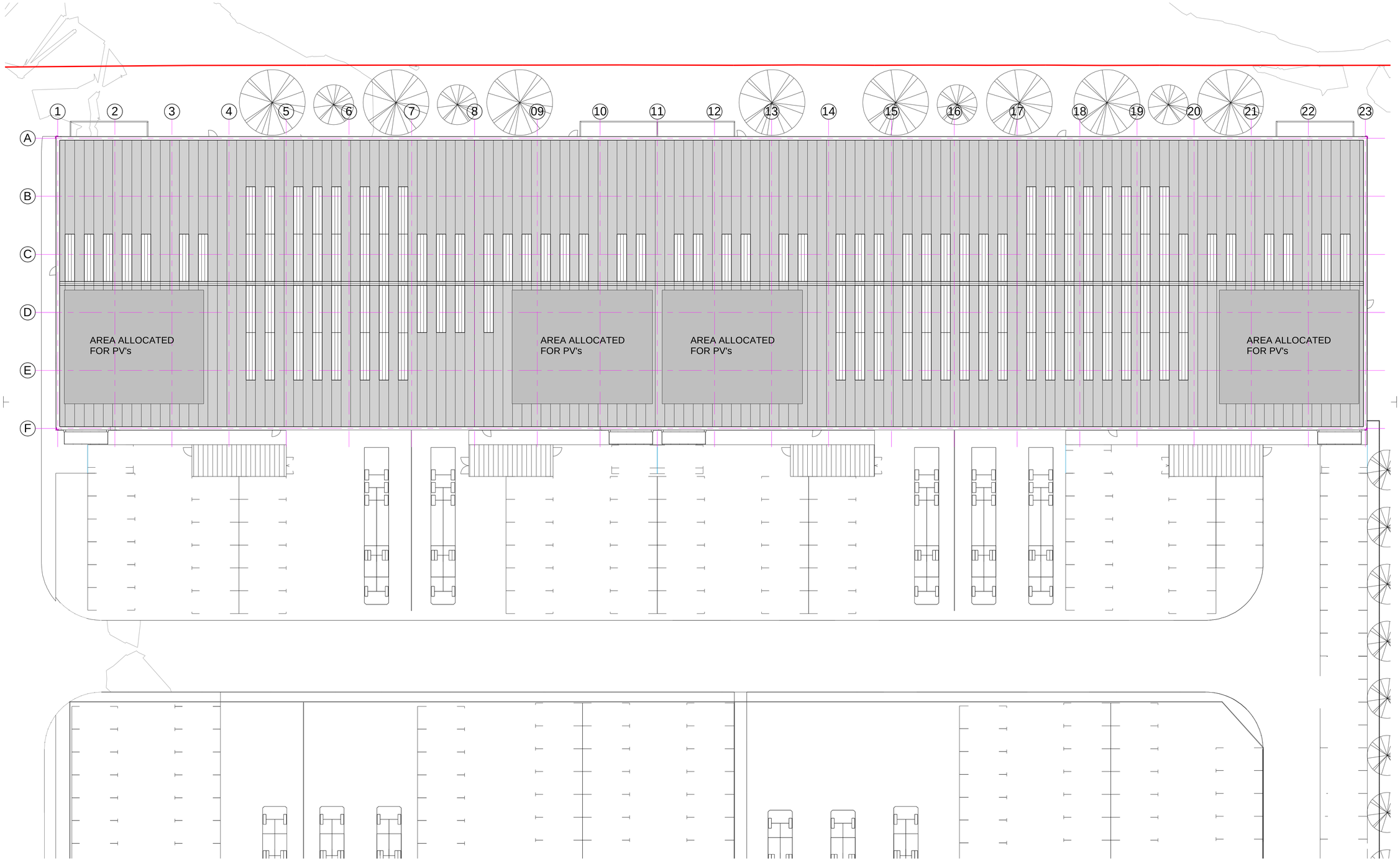
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2 0 2 4 6 8 10

SCALE 1:200 m

Notes

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Units 06- 09 Roof Plan
1 : 200

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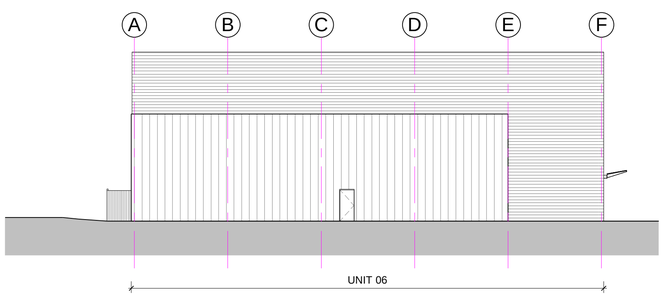
Units 6-9 South Elevation

1 : 200



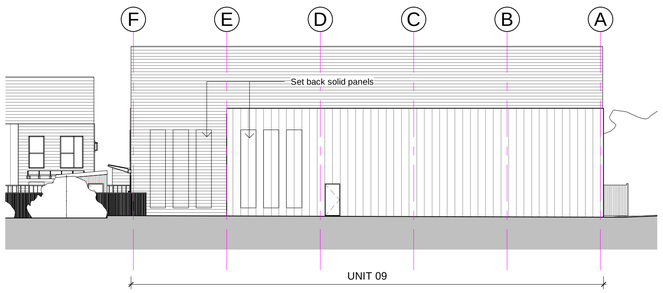
Units 6-9 North Elevation

1 : 200



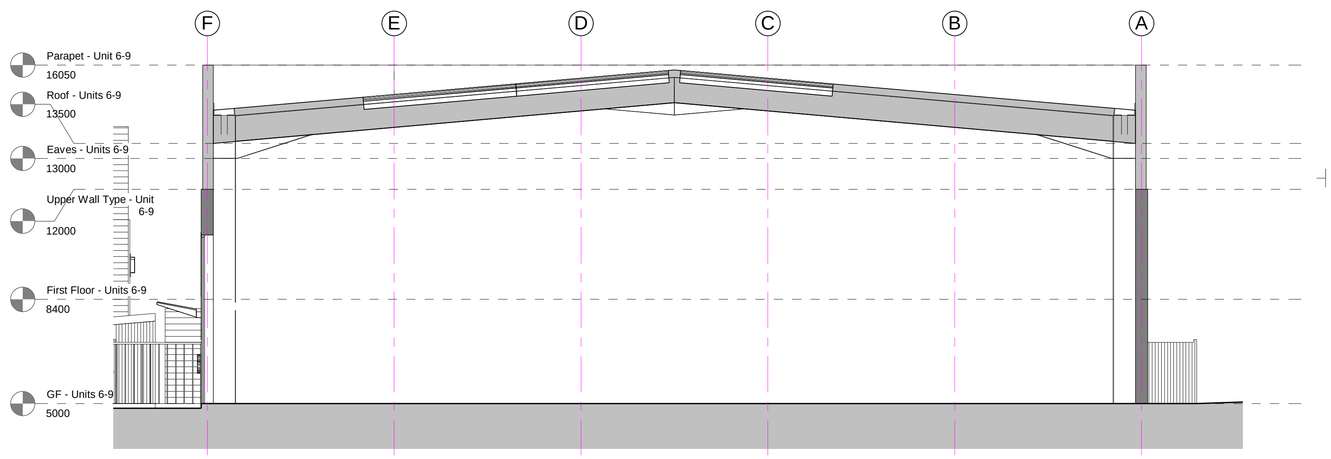
Units 6-9 West Elevation

1 : 200



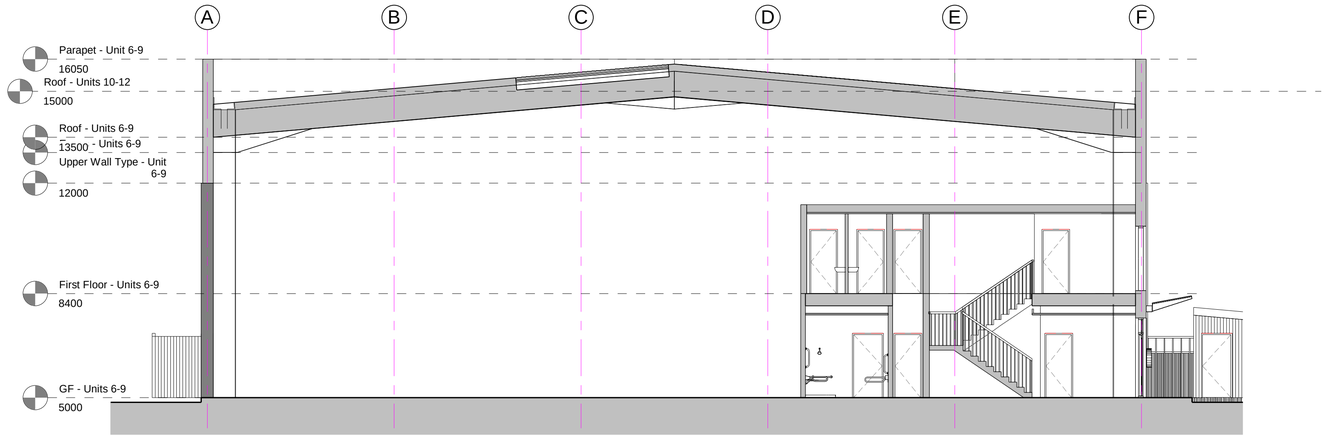
Units 6-9 East Elevation

1 : 200



Units 6-9 Warehouse Section

1 : 100



Unit 06 Section - Staircore

1 : 100

Notes

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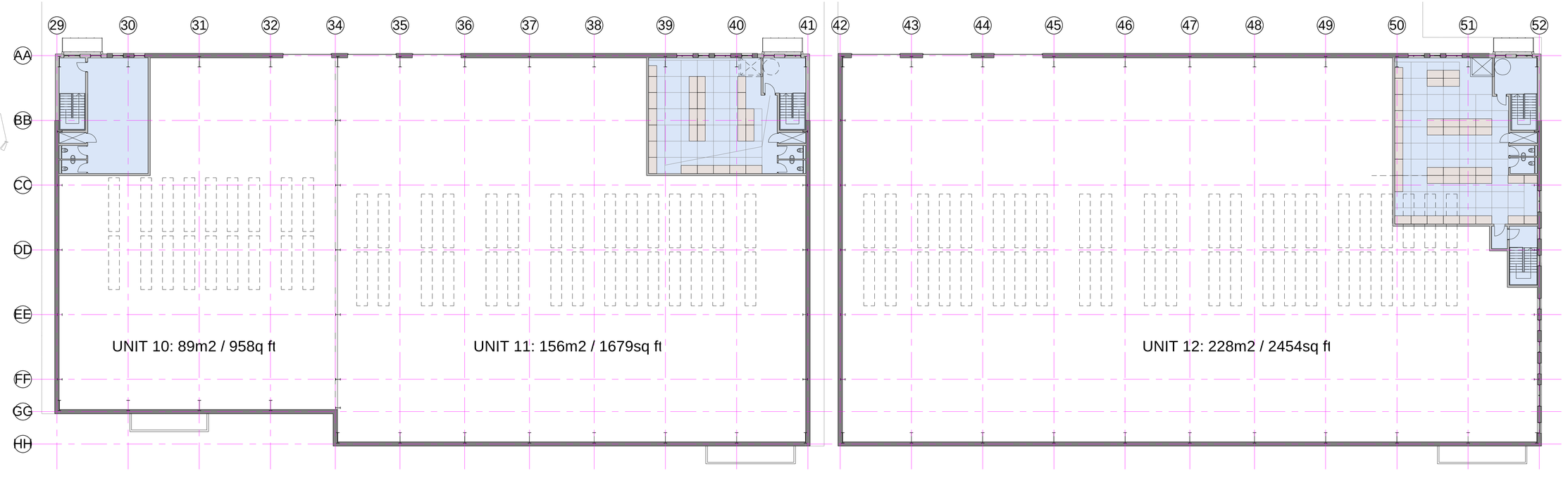
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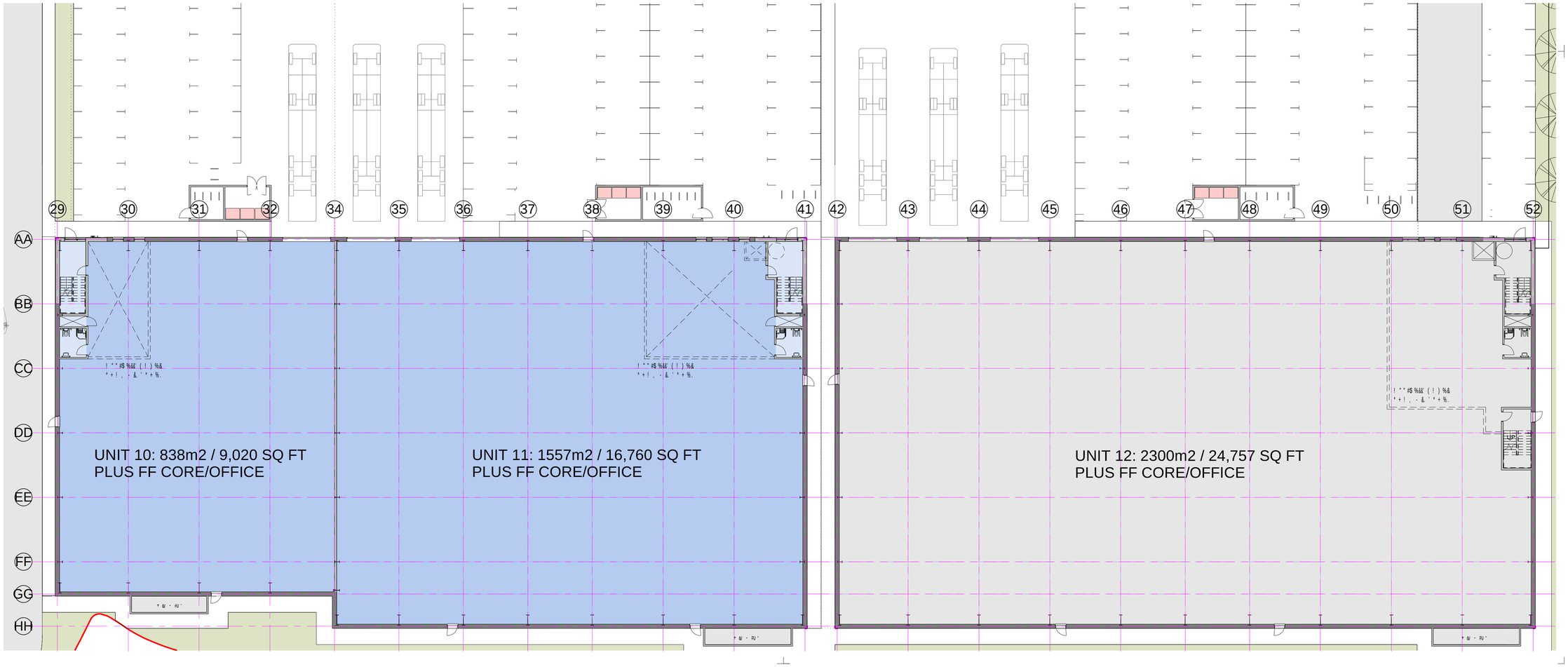
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Notes

This drawing may be scaled for the purposes of Planning Applications, Land Registry and for Legal plans where the scale bar is used, and where it verifies that the drawing is an original or an accurate copy. It may not be scaled for construction purposes.
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SCALE 1:200

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Notes

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Units 10 - 12 Roof Plan
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SCALE 1:200 m

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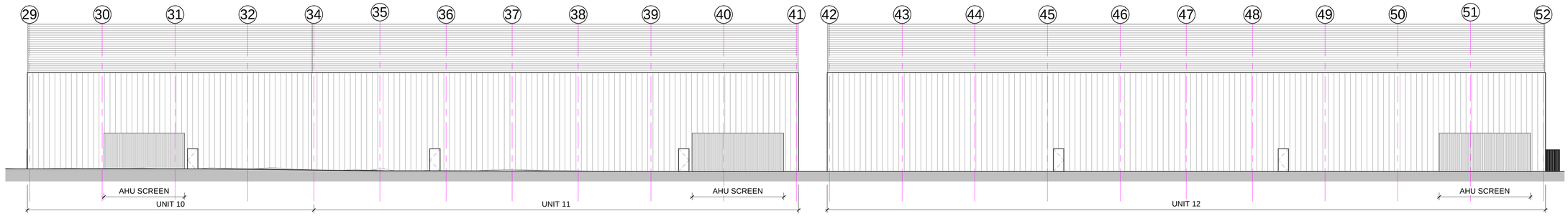
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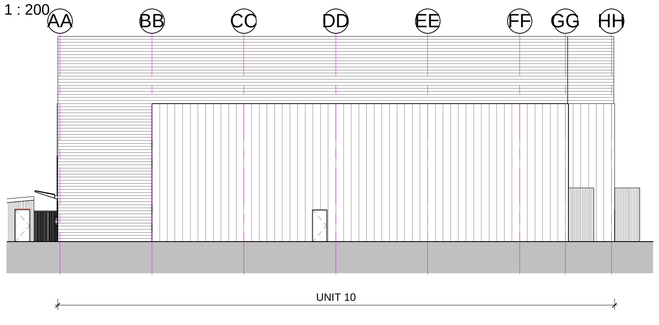
Units 10-12 North Elevation

1 : 200



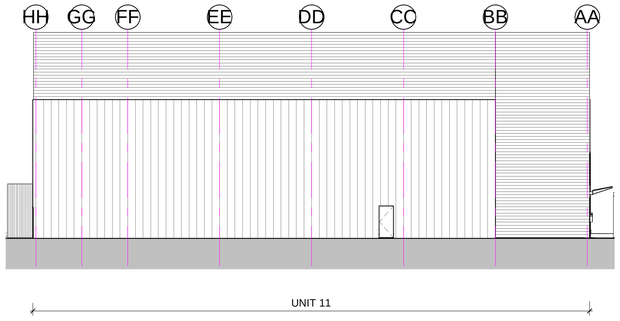
Units 10 - 12 South Elevation

1 : 200



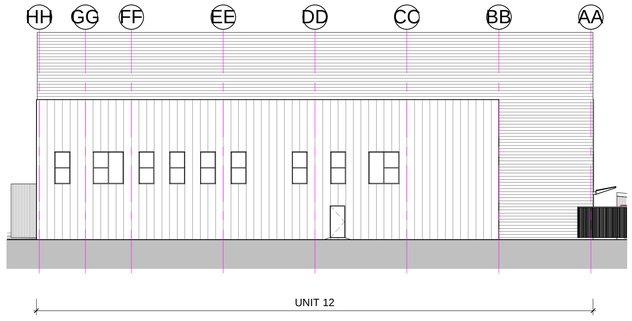
Unit 10 West Elevation

1 : 200



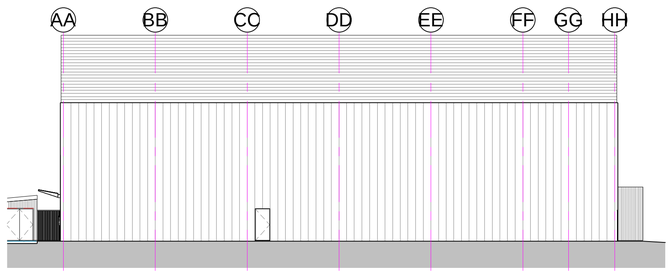
Unit 11 East Elevation

1 : 200



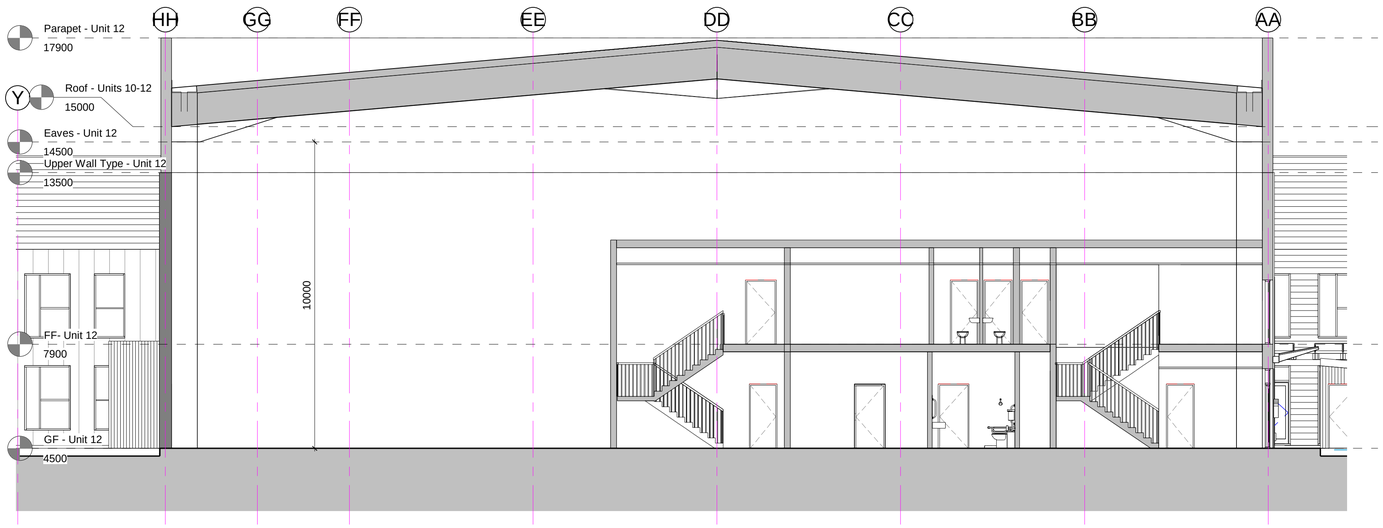
Unit 12 East Elevation

1 : 200



Unit 12 West Elevation

1 : 200



Unit 12 Section - Staircore

1 : 100

Notes

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SCALE 1:200 m

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APPENDIX B

Topographic and CCTV Survey

N

RI4

RI5

Building 1000

Revolving Doors

Flat Roof Level
14.63

Flat Roof Level
14.70

Flat Roof Level
10.14

Flat Roof Level
10.11

Flat Roof Level
10.85

Flat Roof Level
10.33

Flat Roof Level
10.02

Neighbouring Properties

Neighbouring Properties

Neighbouring Properties

0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m

Notes :

Station	Easting	Northing
A	471327.174	105618.327
B	471287.031	105621.157
C	471223.321	105623.543
D	471150.333	105630.388
DHL	471086.942	105616.462
E	471138.230	105558.475
F	471204.372	105565.594
G	471180.662	105494.346
H	471089.990	105554.552
I	471090.650	105580.715
RI1	471401.011	105657.802
RI2	471386.909	105675.204
RI4	471185.132	105819.519
RI5	471091.903	105809.724
Z	471338.290	105617.911
SEA	471441.101	105765.709
SEB	471599.619	105763.903
SEC	471416.131	105855.587
SECHL	471353.954	105867.887
SED	471516.282	105854.354

Stations A, B, C, D, DHL, E, F, H, I, Z, RI4, RI5 and SED are marked w
Stations G, RI1, RI2, SEA, SEB, SEC and SECHL are marked with a Woo

ON DETAIL SURVEY

AB	Air Brick	DP	Electricity Pick	RL	
AC	Asbestos Cement	EK	Earth Rod	RP	
AD	Assumed Crossing Level	EP	Fence Post	SA	
AG	Assumed Direction	FH	Fire Hydrant	SA	
AL	Assumed Line	FL	Flood Light	SC	
AR	Assumed Route	FS	Flag Staff	SD	
ASP	Artificial Source Point	G	Gully	SI	
AT	Air Tower	GV	Gas Valve	SL	
AV	Air Valve	IC	Inspection Cover	SP	
BH	Borehole Location	IL	Invert Level	Spr	
BO	Back Drop	IO	Kerb Outlet	SS	
BS	Bollard	IO	Kerb Outlet	SS	
BH	Borehole	LI	Light Box	SW	
BT	Bench	LL	Lamp	SWI	
BL	Basement Light	MB	Mooring Bollard	SVP	
BO	Bollard	MH	Manhole Cover	Tac	
BS	Bus Stop	MH	Manhole	TC	
BS	Bus Stop	MP	Mile Post/Stone	TC	
BT	British Telecom Cover	NFI	No Further	TCB	
BT	British Telecom Box	NP	Notice Board	TH	
CAB	Cabinet	NR	Note Marker	TH	
CB	Catch Pit	NT	Nail Tablet	TL	
CBT	Cabinet Level	NPV	No Pipes Visible	TP	
CC	Control Cabinet	OHL	Overhead Line	TW	
CS	Coastal Survey	OSA	Off Survey Area	TWP	
CHL	Channel Level	PO	Post	TP	
CL	Cable Level	PB	Power Box	TR	
CL	Cover Level	PBM	Permanent Bench Mark	UTSA	
Co	Concrete	PE	Polyethylene	UTL	
CP	Control Point	PG	Permanent Ground Marker	VC	
CPS	Conc Paving Slabs	PM	Plastic	VC	
CTC	Cable TV	PLA	Plastic	VP	
D	Depth	PO	Parking Meter	VP	
DA	Depth Deep	PO	Post	WA	
DI	Drainage Inlet	PO	Polycarbyn/Hands	WH	
ABB	Dilapidated	PZ	Piezometer	WL	
DP	Dormpipe	RA	Retaining Eye	WL	
GS	Downstream	RL	Road	WO	
EB	Electricity Box	RFL	Roof Level	WS	
EC	Electricity Cover	RP	Reflector Post	WV	

ON FENCES/WALLS/DIVISIONS

BW	Barbed Wire Fence	PIR	Post an
CBF	Close Boarded Fence	PIW	Post an
CJ1	Close Boarded Fence	SAF	Safety Fe
CJ1	Corrugated Iron Fence	SJR	Stand F
CJ2	Chain Link Fence	SJW	Stand F
EF	Electric Fence	W	Brick Wa
FPB	Panel / Board Fence	CB	Concrete
HF	Hedge Fence	RW	Retaine
IFR	Iron Rail Fence	RW	Retaine
PFL	Palisade Fence	SW	Stone Wa

ON BUILDINGS

ASB	Asbestos	RL	Ridge Leve
AT	Air Terminal	RG	Roof Gutte
CL	Cill Level	RW	Rain Water
CH	Ceiling Height	SP	Spring Of
CHE	Ceiling Track Height	SV	Sprung Str
DH	Door Head		Height
EL	Eave Level	SS	Soil Pipe Di
EL	Eave Level	SOIL	Soil Pipe
FL	Flame Height	SVP	Sewer Ver
GL	Ground Level	UB	Underside
GR	Ground Roof Light	USB	Underside
HL	Head Level	WI	Water Hole
PL	Parapet Ceiling	WP	Water Pipe
PL	Parapet Level	WT	Water Stor

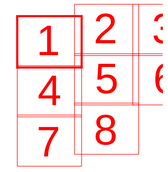
KEY FOR UNDERGROUND SERVICES



ABBREVIATION KEY



UTILITY SURVEY NOTES



Rev: Comments

SURVEYE
Surveying &
www.surveybase.c
Bath: 01225 314370 - London: 020

Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Technology
Sheet (1 of 8 A0)

Client:
AWW

Date
26/0

Scale
A0 @

Drawn by:
dD - AS

Checked by:
dB - RI

Project Code:
Db4207-USF

Grid Orientation:
North GPS

Site Level Datur
OS GPS

All dimensions are to be checked on site where applicable.This drawing must
and only written dimensions should be respected.

Tree species and sizes on this drawing are not guaranteed, and if critical should be verified by an
average about the trees, and heights are approximate at the time of the survey.

N

0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m

Notes :

Station	Easting	Northing	Le
A	471327.174	105619.327	5.
B	471287.031	105621.157	5.
C	471223.321	105623.543	4.
D	471150.333	105638.388	5.
DHL	471086.942	105616.462	4.
E	471138.230	105558.475	4.
F	471204.372	105585.594	4.
G	471100.662	105494.346	4.
H	471089.990	105554.552	4.
I	471090.650	105580.715	4.
RI1	471401.011	105657.802	7.
RI2	471386.909	105675.284	7.
RI4	471185.132	105819.519	5.
RI5	471091.903	105889.724	5.
Z	471338.290	105617.911	5.
SEA	471441.101	105765.709	7.
SEB	471580.619	105763.993	8.
SEC	471416.131	105855.587	7.
SECHL	471353.864	105867.887	5.
SED	471516.282	105854.354	5.

Stations A, B, C, D, DHL, E, F, H, I, Z, RI4, RI5 and SED are marked with a PK Nail.
Stations G, RI1, RI2, SEA, SEB, SEC and SECHL are marked with a Wooden stake.

ON DETAIL SURVEY

AB	Air Brick	EP	Electricity Pole	RI	Road Sign
AC	Asbestos Cement	ER	Earth Rod	RP	Rain Water
AD	Assumed Centreline Line	FH	Fire Hydrant	S	Soil Pipe
AO	Assumed Direction	FH	Fire Hydrant	SA	Survey Aba
AP	Air Pipe	FL	Flood Light	SC	Stop Cock
AS	Assumed Route	FS	Flag Staff	SC	Stop Cock
ASP	Artificial Stone Pitching	G	Gully	SI	Spun Iron
AT	Air Tower	GC	Gully Cover	SL	Sign Line
AV	Air Valve	IC	Inspection Cover	SP	Sign Post
BB	Bollard/Beacon	IL	Invert Level	Spr	Spring
BD	Bark Drop	IO	Kerb Outlet	SS	Sewerage
BE	Bench Mark	IS	Kerb Stone	St	Structure
BR	Barrier	LT	Light	SW	Stop Tap
BS	Basement Light	LT	Light Pole	SY	Survey Ce
BX	Bollard	MB	Mooring Bollard	SVP	Stack Vent
C	Cable	MC	Manhole Cover	Tac	Tactile P
BS	Bus Stop	MP	Mile Post/Stone	TC	Telecom Cu
BT	British Telecom Cover	NPI	No Further Inspection	TCB	Telephone
CB	Cable Junction Box	NI	Note Indicator	TL	Traffic Lig
CB	Cabinet	NM	Note Marker	TP	Tidal Ha
CAT	Catchpit	NP	No Pipes Visible	TR	Trial Pit
CAT	Catchment Level	NPV	No Pipes Visible	TS	Traffic Sig
CC	Chatwell Cabinet	OA	Off Survey Area	TSP	Top Of Ret
CHL	Channel Level	PO	Post	TT	Telegraph
CL	Cable Level	PB	Post Box	UC	Unable to
CL	Crown Level	PBM	Permanent Bench Mark	UTL	Unable to
Co	Concrete	PE	Polyethylene	UTL	Unable t
CP	Control Point	PG	Pedestrian Guard	VC	Vehicle C
CPS	Conc Paving Slabs	PM	Meter	VI	Vinifiex
CTV	Cable TV	PLA	Plastic	VP	Vehicle Di
CV	Culvert	PM	Pedestrian Meter	VP	Vehicle Pr
D	Drainage	PO	Polyurethane/Concrete	VR	Vapour Re
DH	Double Horn	PT	Pelcometer	WL	Water Level
EB	Telephone Box	PW	Pumping Ice	WL	Water Level
EC	Downstream	RI	Road	WI	Water Wash
EB	Electricity Box	RL	Roof Level	WS	Window Sans
EC	Electricity Cover	RP	Reflector Post	WV	Water Valv

ON FENCES/WALLS/DIVISIONS

BW	Barbed Wire Fence	PIR	Post and Rail Fen
CB	Close Boarded	PIW	Post and Wire Fen
CB	Close boarded Fence	SF	Safety Fence
CI	Corrugated Iron Fence	SR	Steel Railings
CL	Chain Link Fence	TF	Timber Post Fence
EF	Electric Fence	W	Brick Wall
FB	Panel / Board Fence	W	Concrete Wall
HH	Hedge Height	WF	Retaining Wall
HR	Iron Rail Fence	WW	Retaining Wall
PIL	Palisade Fence	W	Stone Wall

ON BUILDINGS

ASB	Asbestos	RL	Ridge Level
CL	Cill Level	RP	Rain Water Pipe
CL	Cill Level	RW	Rain Water Pipe
DH	Door Height	SO	Spring Of Arch
DW	Doorway Track Height	SCH	Spring Of Ceiling Height
DH	Door Head	SD	Standing Door
EL	Eave Level	SDL	Soil Pipe
F	Frame Height	SVP	Sewer Vent Pipe
FL	Floor Level	UB	Underside Of Beam
GR	Glazed Roof Light	UG	Underside Of Beam
H	Head Level	WH	Water Heater
PW	Parapet Walling	WT	Water Tank
PL	Parapet Level	WT	Water Storage Tank

KEY FOR UNDERGROUND SERVICES



ABBREVIATION KEY



UTILITY SURVEY NOTES

Rev:	Comments	By	Chkd	Da
-	-			

SURVEYBAS
Surveying & BIM
www.surveybase.co.uk
Bath: 01225 314370 - London: 02039 0668

Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Technology Park
Sheet (2 of 8 A0)

Client:	Date
AWW	26/04/2019
	Scale: A0 @ 1:200

Drawn by:	Checked by:	Project Code:	Revi
db - AS	db - RI	Db4207-USP	-

Grid Orientation:	Site Level Datum
North GPS	OS GPS

All dimensions are to be checked on site where applicable.This drawing must not be scaled, and only written dimensions should be respected.

Tree species and sizes on this drawing are not guaranteed, and if critical should be verified by an arboriculturist. Tree spr average about the trunk, and heights are approximate at the time of the survey.

SECHL

Building 1000

Building 4000

Walkway

Build

N

SEC

SED

SEA

SEB

Building 7000

Premier Inn

Notes :

Station	Easting	Northing	Level
A	471327.174	105618.327	5.139
B	471287.031	105621.157	5.047
C	471223.321	105623.543	4.507
D	471150.333	105638.388	5.041
DHL	471086.942	105616.462	4.603
E	471138.239	105558.475	4.859
F	471204.372	105585.594	4.301
G	471100.662	105494.346	4.442
H	471089.998	105554.552	4.446
I	471090.650	105580.715	4.591
RI1	471401.011	105657.882	7.633
RI2	471386.909	105675.284	7.584
RI4	471105.132	105819.519	5.133
RI5	471091.903	105889.724	5.373
Z	471138.298	105617.911	5.141
SEA	471441.101	105765.709	7.673
SEB	471500.619	105763.903	8.388
SEC	471416.131	105855.587	7.946
SECHL	471353.964	105867.887	5.373
SED	471516.282	105854.354	5.263

Stations A, B, C, D, DHL, E, F, H, I, Z, RI4, RI5 and SED are marked with a PK Nail.
Stations C, RI1, RI2, SEA, SEB, SEC and SECHL are marked with a Wooden stake.

ON DETAIL SURVEY

AB	Air Brick	EP	Electricity Pylon	RS	Road Sign
AC	Asbestos Cement	EB	Earth Rod	RP	Rain Water Pipe
AL	Approximate Levels	EW	Electric Wire	RF	Refuse
AD	Assumed Direction	FH	Fire Hydrant	SA	Survey Abandoned
AI	Air Inlet	FB	Flood Barrier	SC	Stop Cock
AR	Assumed Route	FS	Flag Staff	SC	Stop Cock
ASP	Artificial Stoner	G	Gully	SI	Spun Iron
AT	Air Test	GV	Gas Valve	SP	Sign Post
AT	Air Tower	IC	Inspection Cover	SP	Sign Post
AV	Air Valve	IL	Invert Level	Spr	Spring
BC	Broadcast Telecon	K	Kerb Inlet	SR	Survey Reading
BD	Back Drop	KO	Kerb Outlet	SS	Structure Supp
BH	Borehole	L	Light	SS	Sump
BR	Bollard	LT	Light	SSh	Survey Station
BL	Beacon Light	MB	Mooring Bollard	SVP	Soil Vent Pipe
BOL	Bollard	MH	Manhole Cover	TAC	Tactile Paving
BS	Bus Stop	MP	Mile Post/Stone	TC	Telecom Cover
BT	British Telecom Cover NPI		No Further	TCB	Telephone Call
BTB	British Telecom Box	NF	Not Found	TH	Trial Hole Point
CAB	Cabinet	NK	Note Marker	TP	Tidal Probe /
CAT	Catchpit	NP	No Paint	TW	Top of Wall Level
CAT	Catchpit	NPV	No Pipes Visible	TX	Text
CL	Centre Line	OC	Open Cover	UB	Unknown Box
Ch	Chainage	OA	Off Survey Area	UW	Top Of Wall
CHL	Channel Level	PO	Post	TF	Telegraph Pole
CL	Cover Level	PB	Post Box	UC	Unable to Gain
CL	Cover Level	PBM	Permanent Bench Mark	UTGA	Unable to Gain
Co	Concrete	PE	Polyethylene	UTL	Unable to Lif
CP	Control Point	PG	Permanent Ground	VC	Vehicle Crossi
CPS	Conc Paving Slabs		Marker	VI	Verified ICI
CTV	Cable TV	PLA	Plastic	VOP	Vehicle Detecti
CV	Cover Level	PM	Pedestrian Meter	VP	Vent Pipe
D	Depth (cm)	PO	Post	VT	Vapour Trapway
DI	Depth Unknown	PO	Polycarbonate/Marker	WA	Water Level
dIM	Dilapidated	PZ	Piezometer	WL	Water Level
DIS	Disused	RE	Reference Eye	WM	Water Meter
DIS	Downstream	RI	Rising	WO	Water Wash Out
EB	Electricity Box	RFL	Roof Level	WS	Window Sample
EC	Electricity Cover	RF	Reflector Prism	WT	Water Valve

ON FENCES/WALLS/DIVISIONS

BW	Barbed Wire Fence	FrR	Frost and Rail Fence
CB	Close Boarded	FrW	Frost and Wall Fence
CB	Close Boarded Fence	SR	Safety Fence
CrS	Corrugated Iron Fence	SR	Gravel Railings
CW	Chain Link Fence	SW	Stone Retaining Wall
EF	Electric Fence	W	Brick Wall
HW	Hewn / Board Fence	W	Concrete Wall
HR	Hedge Row	W	Retaining Wall
IrR	Iron Rail Fence	RW	Retaining Wall
PrL	Palisade Fence	W	Stone Wall

ON BUILDINGS

ASB	Asbestos	RL	Ridge Level
C	Canopy	RW	Rain Water Pipe
CH	Ceiling Height	SBT	Storage Tank
CH	Ceiling / Sill Height	SCH	Sump Or Catchpit
DH	Door Head		Height
E	Eave Height	SD	Soil Pipe Door
EL	Eave Level	SOIL	Soil Pipe
F	Frame Height	SVP	Sewer Vent Pipe
FL	Floor Level	TF	Telegraph Pole
GRL	Glazed Roof Light	UGB	Underside Of Beam
H	Head Level	WP	Water Heater
PL	Parapet Level	WT	Water Tank
PL	Parapet Level	WT	Water Storage Tank

KEY FOR UNDERGROUND SERVICES

ABBREVIATION KEY

UTILITY SURVEY NOTES

Flat Roof Level 19.21

Flat Roof Level 19.21

0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m

1 m

1	2	3
4	5	6
7	8	

Rev:	Comments	By	Chkd	Date
-	-	-	-	-

SURVEYBASE
Surveying & BIM
www.surveybase.co.uk
Bath: 01225 314370 - London: 02039 066892

Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Topographical Survey Of Langstone Technology Park Sheet (3 of 8 A0)

Client:	Date
AWW	26/04/2019
	Scale: A0 @ 1:200

Drawn by:	Checked by:	Project Code:	Revision:
db - AS	db - RI	Db4207-USP	-

Grid Orientation:	Site Level Datum
North GPS	OS GPS

All dimensions are to be checked on site where applicable.This drawing must not be scaled, and only written dimensions should be respected.

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N

0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m

Notes :

Station	Easting	Northi
A	471327.174	105618
B	471287.031	105621
C	471223.321	105623
D	471150.333	105638
DHL	471086.942	105616
E	471138.230	105558
F	471204.372	105585
G	471100.662	105494
H	471089.990	105554
I	471090.650	105580
RI1	471401.011	105657
RI2	471386.909	105675
RI4	471165.132	105819
RI5	471093.903	105899
Z	471338.290	105617
SEA	471441.101	105765.
SEB	471500.619	105763.
SEC	471416.131	105855.
SECHL	471353.964	105867.
SED	471516.282	105854.

Stations A, B, C, D, DHL, E, F, H, I, Z, RI4, RI5 and SED are n
Stations G, RI1, RI2, SEA, SEB, SEC and SECHL are marked with

ON DETAIL SURVEY

AB	Air Brick	EP	Electricity
AC	Asbestos Cement	ER	Earth Rod
AD	Assumed Drawing Level	FH	Fire Hydrant
AD	Assumed Direction	FH	Fire Hydrant
AI	Air Inlet	FS	Flag Stand
AS	Assumed Route	FS	Flag Staff
ASP	Artificial Stone	G	Gully
AT	Air Test	GP	Garage Door
AT	Air Valve	IC	Inspection Cov
AV	Air Valve	IL	Invert Level
BC	Bollard Beacon	KO	Kerb Outlet
BD	Back Drop	KO	Kerb Outlet
BH	Borehole	LP	Lamp Post
BK	Bollard	LT	Light Unit
BL	Bay	M	Mooring Bolla
BS	Basement Light	MB	Manhole Cover
BS	Bollard	Mn	Manhole Cover
BT	Bus Stop	MP	Mile Post/Sto
BT	British Telecom Cover	NH	No Further
BX	British Telecom Box	NP	Notice Board
CAB	Cabinet	NR	Node Marker
CAT	Catchpit	NT	No Trace Fou
CAT	Catenary Level	NV	No Visible Vis
CC	Concrete Cover	OA	Off Survey Ar
CC	Control	OA	Off Survey Ar
CHL	Channel Level	PG	Post
CL	Cable Level	PH	Pipe Box
CL	Cover Level	PM	Permanent Bench
Co	Concrete	PE	Polyethylene
CP	Car Park	PI	Private Inspection
CPS	Conc Paving Slabs	PM	Meter
CTV	Cable TV	PM	Pneumatic
CV	Control Valve	PO	Parking Meter
D	Diameter	PU	Polyurethane
DM	Dilapidated	PZ	Piezometer
DO	Drop	RE	Reading Eye
DS	Downstream	RL	Road
EB	Electricity Box	RL	Roof Level
EC	Electricity Cover	RP	Reflector Pos

ON FENCES/WALLS/DIVISIONS

BW	Barbed Wire Fence	PrR	Pro
CB	Close Boarded	PrW	Pro
C/B	Close Boarded Fence	S/F	Sal
C/I	Corrugated Iron Fence	S/R	Silk
CL	Chain Link Fence	S/W	Sto
E/F	Electric Fence	W	Wir
FPB	Panel / Board Fence	W	Cur
HH	Hedge Height	WM	Wal
HR	Iron Rail Fence	WM	Rai
PAL	Palisade Fence	W	Stra

ON BUILDINGS

ASB	Asbestos	RI	Ridge
CL	Canopy Level	RC	Ridge C
EL	Eave Level	RW	Raine
GW	Ceiling Height	SH	Sprin
DH	Door Head	VC	Vent C
FL	Floor Level		Height
EL	Eave Level	SS	Soil
FH	Frame Height	SVA	Soil
FL	Floor Level	SVP	Sewe
GRL	Glazed Roof Light	UB	Unde
HL	Head Level	UB	Unde
RC	Roof Covering	WI	Wate
PAL	Parapet Level	WT	Water

KEY FOR UNDERGROUND SERVICES

ABBREVIATION KEY

UTILITY SURVEY NOTES

1 2 4 5 7 8

Rev: Comments

SURVEY
Surveying
www.surveyba
Bath: 01225 314370 - London:

Langstone Technology Par
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Techn
Sheet (4 of 8 A0)

Client:
AWW

Drawn by:	Checked by:	Project Code
db - AS	db - RI	Db420

Grid Orientation:	Site Level
North GPS	OS GPS

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average about the bole, and heights are approximate at the time of the survey.

N

Building 4000

Building 7000

Building 6000

CL AT BOTTOM OF
MH NEEDED FOR CORRECT
INVERT
(THIS MANHOLE IS OUTSIDE THE REQUIRE

RI1

RI2

A

Z

B

C

Notes :

Station	Easting	Northing	Level
A	471327.174	105618.327	5.139
B	471287.831	105621.157	5.047
C	471223.321	105623.543	4.507
D	471150.333	105638.388	5.041
DHL	471086.942	105636.462	4.603
E	471138.230	105558.475	4.859
F	471204.372	105505.594	4.301
G	471100.662	105494.346	4.442
H	471089.999	105554.552	4.446
I	471090.650	105580.715	4.591
RI1	471401.011	105657.802	7.633
RI2	471306.909	105675.284	7.584
RI4	471105.132	105819.519	5.133
RI5	471091.903	105809.724	5.373
Z	471138.200	105617.511	5.141
SEA	471441.101	105765.709	7.673
SEB	471508.619	105763.903	8.388
SEC	471416.131	105855.587	7.946
SECHL	471353.054	105867.887	5.373
SED	471516.282	105854.354	5.263

Stations A, B, C, D, DHL, E, F, H, I, Z, RI4, RI5 and SED are marked with a PK Nail.
Stations G, RI1, RI2, SEA, SEB, SEC and SECHL are marked with a Wooden stake.

ON DETAIL SURVEY

AB	Air Brick	EP	Electricity Pole
AC	Asbestos Cement	ER	Earth Rod
ACL	Asbestos Cleaning Lid	ES	Electric Socket
AD	Assumed Direction	FH	Fire Hydrant
AF	Air Flow	FL	Flood Light
AS	Assumed Route	FS	Flag Staff
ASP	Artificial Stone Paving	G	Gully
AT	Air Tower	GV	Gas Valve
AV	Air Valve	IC	Inspection Cover
B	Beacon/Beacon	IL	Invert Level
BD	Back Drop	IO	Kerb Inlet Gully
BH	Bore Hole	KO	Kerb Outlet
BL	Bollard	L	Light
BP	Basement Light	LS	Light Standard
BOL	Bollard	MB	Mounting Bollard
BS	Bus Stop	MC	Manhole Cover
BT	British Telecom Cover	MH	Manhole
CAB	Cabinet	MP	Mile Post/Stone
CC	Control Cover	NF	No Further
CAT	Catenary Level	NP	No Pipes Visible
CB	Catch Pit/Basin	NT	No Trace
CC	Chamber	OA	Off Survey Area
CHL	Channel Level	PC	Post
CL	Centre Line	PO	Pull Box
CL	Cover Level	PBM	Permanent Bench Mark
Co	Concrete	PE	Polyethylene
CP	Control Point	PG	Proposed Ground
CPS	Conc Paving Slabs		Marker
CTV	Cable TV	PLA	Plastic
D	Diameter	PM	Pressure Meter
D	Depth (deep)	PO	Post
DI	Drainage Interior	PVC	Polyvinylchloride
dkM	Ekspidriveed	PZ	Piezometer
DP	Down Pipe	RE	Reflective Eye
DS	Downstream	RI	Road
EB	Electricity Box	RL	Roof Level
EC	Electricity Cover	RP	Reflector Post
		RS	Road Sign
		RW	Rain Water Pipe
		SA	Survey Abandoned
		SB	Setback
		SC	Stop Cock
		SI	Spun Iron
		SL	Street Light
		SP	Sign Post
		Spr	Spring
		SR	Structure Railing
		SS	Structure Scupp
		ST	Stream
		SW	Surface Water
		SVP	Soil Vent Pipe
		TC	Traffic Counts
		TCB	Telephone Call
		TL	Traffic Light
		TP	Tidal Probe /
		TW	Top Of Wall Level
		TX	Text
		UC	Unknown Cover
		VM	Trig Of Wall
		VP	Telegraph Pole
		VT	Vent Pipe
		VTA	Unable to Gain
		UTL	Unable to Lif
		VC	Vent Pipe/Cow
		VI	Viaf/Bell Cl
		VP	Vehicle Detecti
		VT	Vent Pipe
		VTH	Vapour Hydrant
		WL	Water Level
		WM	Water Meter
		WO	Water Wash Out
		WS	Window Sample
		WV	Water Valve

ON FENCES/WALLS/DIVISIONS

BW	Barbed Wire Fence	PIR	Post and Rail Fence
CB	Close Boarded Fence	PIW	Post and Wire Fence
CB	Close Boarded Fence	SR	Safety Fence
CI	Corrugated Iron Fence	SR	Gravel Railings
CL	Chain Link Fence	SW	Stone Retaining Wall
EF	Electric Fence	W	Brick Wall
FPB	Panel / Board Fence	W	Concrete Wall
HH	Hedge Fence	WR	Retaining Wall
MR	Iron Rail Fence	RW	Retaining Wall
PAL	Palisade Fence	W	Stone Wall

ON BUILDINGS

ASB	Asbestos	RL	Ridge Level
AV	Air Vent	RC	Rain Chancel
CH	Ceiling Height	RWP	Rain Water Pipe
CH	Ceiling / Sack Height	SA	Spring Of Arch
DH	Door Head	SCH	Sack / Ceiling Height
E	Eave Level	SD	Sliding Door
E	Eave Level	SOIL	Soil Pipe
F	Frame Height	SVP	Sewer Vent Pipe
GL	Ground Level	TP	Telephone Pole
GRL	Glazed Roof Light	USB	Underside Of Beam
H	Head Level	WP	Water Heater
PI	Parapet Level	WT	Water Tank
PL	Parapet Level	WST	Water Storage Tank

KEY FOR UNDERGROUND SERVICES

Foul/Combined water drain	
Foul/Combined drain 300Ø and above	
Surface water drain	
Surface water drain 300Ø and above	
End of trace	EOT
Electric cables	E E E E E
HV cables	HV HV HV HV HV
Gas	GAS GAS GAS GAS GAS
Water	W W W W W
Telephone	BT BT BT BT BT
Catv	CATV CATV CATV CATV
CCTV	CCTV CCTV CCTV CCTV CCTV
Comms	COM COM COM COM COM
Fibre Optics	FO FO FO FO FO
Pipe	PIPE PIPE PIPE PIPE PIPE
Vents	V V V V V
Fuel	F F F F F
Offsets	O O O O O
Vapour Recovery	VR VR VR VR VR
Gauge Lines	G G G G G
Unidentified GPR	U-GPR U-GPR U-GPR U-GPR
Unidentified EML	U-EML U-EML U-EML U-EML
Token From Records	E-TKN E-TKN E-TKN E-TKN
Assumed Routes	GAS-AR GAS-AR GAS-AR GAS-AR
Empty Ducts	ED ED ED ED ED

KEY FOR UNDERGROUND SERVICES

Foul/Combined water drain	
Foul/Combined drain 300Ø and above	
Surface water drain	
Surface water drain 300Ø and above	
End of trace	EOT
Electric cables	E E E E E
HV cables	HV HV HV HV HV
Gas	GAS GAS GAS GAS GAS
Water	W W W W W
Telephone	BT BT BT BT BT
Catv	CATV CATV CATV CATV
CCTV	CCTV CCTV CCTV CCTV CCTV
Comms	COM COM COM COM COM
Fibre Optics	FO FO FO FO FO
Pipe	PIPE PIPE PIPE PIPE PIPE
Vents	V V V V V
Fuel	F F F F F
Offsets	O O O O O
Vapour Recovery	VR VR VR VR VR
Gauge Lines	G G G G G
Unidentified GPR	U-GPR U-GPR U-GPR U-GPR
Unidentified EML	U-EML U-EML U-EML U-EML
Token From Records	E-TKN E-TKN E-TKN E-TKN
Assumed Routes	GAS-AR GAS-AR GAS-AR GAS-AR
Empty Ducts	ED ED ED ED ED

0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m

ABBREVIATION KEY

UTILITY SURVEY NOTES

1 2 3
4 5 6
7 8

Rev:	Comments	By	Chkd	Date

SURVEYBASE
Surveying & BIM
www.surveybase.co.uk
Bath: 01225 314370 - London: 02039 066892

Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Technology Park
Sheet (5 of 8 A0)

Client:	Date
AWW	26/04/2019
	Scale
	A0 @ 1:200

Drawn by:	Checked by:	Project Code:	Revision:
db - AS	db - RI	Db4207-USP	---

Grid Orientation:	Site Level Datum
North GPS	OS GPS

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Building 7000

N

THE REQUIRED SURVEY AREA)

Langbrook Farm Pub

Notes :

Station	Easting	Northing	Level
A	471327.174	105618.327	5.139
B	471287.931	105621.157	5.047
C	471223.321	105623.543	4.507
D	471150.333	105638.388	5.041
DHL	471086.942	105636.462	4.603
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RI1	471401.011	105657.802	7.633
RI2	471306.989	105675.284	7.584
RI4	471105.132	105819.519	5.133
RI5	471091.903	105809.724	5.373
Z	471138.290	105617.511	5.141
SEA	471441.101	105765.709	7.673
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Stations G, RI1, RI2, SEA, SEB, SEC and SECHL are marked with a Wooden stake.

ON DETAIL SURVEY

AB	Air Brick	Elec	Electricity Poke
AC	Asbestos Cement	Eth	Earth Rod
AD	Assumed Boundary Line	FB	Fence Broken
AI	Assumed Direction	FH	Fire Hydrant
AL	Assumed Line	FL	Flood Light
AR	Assumed Route	FS	Flag Staff
ASP	Artificial Source Protection	G	Gully
AT	Air Toilet	GV	Gate Valve
AV	Air Valve	IC	Inspection Cover
BC	Broadcast Beacon	IL	Invert Level
BD	Back Drop	IP	Iron Pipe Post
BH	Bore Hole	KO	Kerb Outlet
BR	Boundary Rail	LA	Light Arm
BS	Basement Light	LT	Light Tube
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BOL	Bollard	MC	Manhole Cover
BP	Bus Pole	MH	Manhole Cover
BS	Bus Stop	MP	Mile Post/Stone
BT	British Telecom Cover hh't	NF	No Further
BX	British Telecom Box	NP	Notice Post
CAB	Cabinet	NP	Nails Marker
CAT	Catchpit	NV	No Visible
CAT	Catenary Level	NPV	No Pipes Visible
CC	Control Cabinet	OHL	Overhead Line
CI	Channel Invert	OS	Off Survey Area
CHL	Channel Level	PO	Post
CL	Cover Level	PP	Power Pole
CL	Crash Level	PBM	Permanent Bench Mark
Co	Concrete	PE	Polyethylene
CP	Cable Post	PG	Permanent Ground Marker
CPS	Conc Paving Slabs	PL	Pipeline
CTV	Cable TV	PLA	Plastic
D	Depth	PM	Pedestrian Meter
D	Depth (Level)	PO	Post
Dr	Depth Unknown	PVC	Polyvinyl Chloride
dRM	Dilapidated	PZ	Piezometer
DS	Downspout	RE	Reference Eye
DS	Downstream	RI	Rodd
EB	Electricity Box	RL	Roof Level
EC	Electricity Cover	RP	Reflector Post
RU	Road Sign		
RW	Rain Water Pipe		
SA	Survey Abandoned		
SB	Setback		
SC	Stop Cock		
SI	Spun Iron		
SL	Street Light		
SP	Sign Post		
Spg	Spring		
SR	Security Railing		
SS	Security Screen		
SW	Surface Water		
SWP	Storm Water Pipe		
SVP	Soil Vent Pipe		
T	Tactile Paving		
TC	Telecom Cover		
TCB	Telephone Call Box		
TH	Traffic Head		
TL	Tidal Level		
TP	Telegraph Pole		
TR	Traffic Route		
UTA	Unable to Gain Access		
UTL	Unable to Lift		
VC	Vandlead C.I.		
VI	Vandlead C.I.		
VP	Vehicle Detects		
VP	Vent Pipe		
W	Water Hydrant		
WL	Water Level		
WM	Water Meter		
WO	Water Wash Out		
WS	Window Sample		
WV	Water Valve		

ON FENCE/WALLS/DIVISIONS

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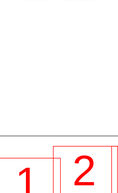
KEY FOR UNDERGROUND SERVICES

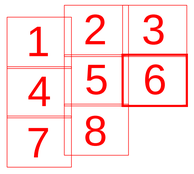


ABBREVIATION KEY



UTILITY SURVEY NOTES





Rev: Comments By Chkd Date

SURVEYBASE
Surveying & BIM
www.surveybase.co.uk
Bath: 01225 314370 - London: 02039 066892

Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Technology Park
Sheet (6 of 8 A0)

Client:	Date
AWW	26/04/2019
	Scale: A0 @ 1:200

Drawn by:	Checked by:	Project Code:	Revision:
db - AS	db - RI	Db4207-USP	---

Grid Orientation:	Site Level Datum
North GPS	OS GPS

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0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m



Notes :

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RI5	471091.903	105809.724	5.373
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SEB	471508.619	105763.903	8.388
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ON DETAIL SURVEY

AB	Air Brick	EP	Electricity Pole
AC	Asbestos Cement	ER	Earth Rod
AD	Abandoned Land Drain	ES	Electricity Socket
AI	Assumed Direction	FH	Fire Hydrant
AL	Assumed Line	FM	Flow Meter
AS	Assumed Route	FS	Flag Staff
ASP	Artificial Stone Paving	G	Gully
AT	Air Valve	GV	Gas Valve
AV	Air Valve	IC	Inspection Cover
AV	Air Valve	IL	Invert Level
BC	Bollard Reflector	IP	Iron Pipe
BD	Back Drop	KO	Kerb Outlet
BH	Borehole	L	Light
BL	Bollard	LI	Light Iron
BO	Bouy	LP	Lighting Pole
BS	Bayonet Light	MB	Mounting Bollard
BOL	Bollard	MC	Manhole Cover
BP	Bore Pipe	MP	Marker Post
BS	Bus Stop	MP	Mile Post/Stone
BT	British Telecom Cover	NFI	No Further Investigation
BW	Boundary Wall	NM	Note Marker
CAB	Cabinet	NI	Nails Marker
CAT	Catchpit	OF	Overflow
CAT	Catenary Level	NPV	No Pipes Visible
CC	Chamber Cover	PO	Post Office
CC	Chamber Cabinet	OSA	OP Survey Area
CHL	Channel Level	PO	Post
CL	Cover Level	PB	Post Box
CL	Crest Level	PBM	Permanent Bench Mark
Co	Concrete	PE	Polyethylene
CP	Concrete Pad	PG	Permanent Ground Marker
CPS	Conc Paving Slabs	Pillar(s)	
CTY	Cable TV	PLA	Parking Meter
D	Depth	PM	Polypipe
D	Depth(ins)	PO	Polypipe/Manhole
DM	Diagram	PT	Pedometer
dMH	Dilapidated	RE	Reflector Eye
DP	Down Pipe	RL	Roof Level
DRN	Downstream	RR	Road
EB	Electricity Box	RRL	Roof Level
EC	Electricity Cover	RT	Reflector Post
RL	Road Sign		
RM	Rain Water Pipe		
SA	Survey Abandoned		
SC	Stop Cock		
SI	Spun Iron		
SS	Stainless Steel		
SP	Sign Post		
Spr	Spring		
SR	Security Railing		
SS	Structure Trap		
ST	Stream		
SW	Sodium Vapour		
SVP	Steel Vent Pipe		
TAC	Tactile Paving		
TC	Telecom Cover		
TCB	Telephone Call Box		
TK	Telephone Kiosk		
TV	Tidal Water		
TW	Traffic Control Level		
TK	Tank		
TS	Traffic Signal		
TW	Trial Of Well		
TP	Telegraph Pole		
TS	Traffic Signs		
UTA	Unable to Gain Access		
UTL	Unable to Lift		
UCI	Unidentified C.I.		
VC	Vantheat C.I.		
VP	Vehicle Detects		
VV	Valve		
VC	Valve Chamber		
WL	Water Level		
WM	Water Meter		
WO	Water Wash Out		
WS	Window Sample		
WV	Water Valve		

ON FENCES/WALLS/SUBDIVISIONS

BW	Barbed Wire Fence	PiR	Post and Rail Fence
CB	Close Boarded Fence	PoR	Post and Rail Fence
CB	Close Boarded Fence	SF	Safety Fence
ICH	Corrugated Iron Fence	SR	Gravel Railings
EF	Electric Fence	SW	Stone Boundary Wall
EF	Electric Fence	W	Brick Wall
FPB	Panel / Board Fence	W	Concrete Wall
HH	Hedge Height	WR	Retaining Wall
IrR	Iron Rail Fence	RWall	Retaining Wall
PiL	Palisade Fence	W	Stone Wall

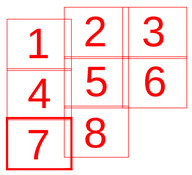
ON BUILDINGS

ASB	Asbestos	RL	Ridge Level
AV	Air Vent	RW	Rain Water Pipe
CH	Ceiling Height	SP	Spring Of Arch
CH	Ceiling Height	SCH	Sub Ceiling Height
DH	Door Head	SD	Sliding Door
E	Eave Level	SOIL	Soil Pipe
E	Eave Level	SVP	Sewer Vent Pipe
F	Frame Height	UB	Underside Of Beam
GRL	Grazed Roof Light	UBB	Underside Of Beam
H	Head Level	WH	Water Heater
PL	Parapet Level	WT	Water Tank
PL	Parapet Level	WST	Water Storage Tank









Rev:	Comments	By	Chkd	Date

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Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Technology Park
Sheet (7 of 8 A0)

Client:
AWW

Date
26/04/2019

Scale
A0 @ 1:200

Drawn by:	Checked by:	Project Code:	Revision:
db - AS	db - RI	Db4207-USP	---

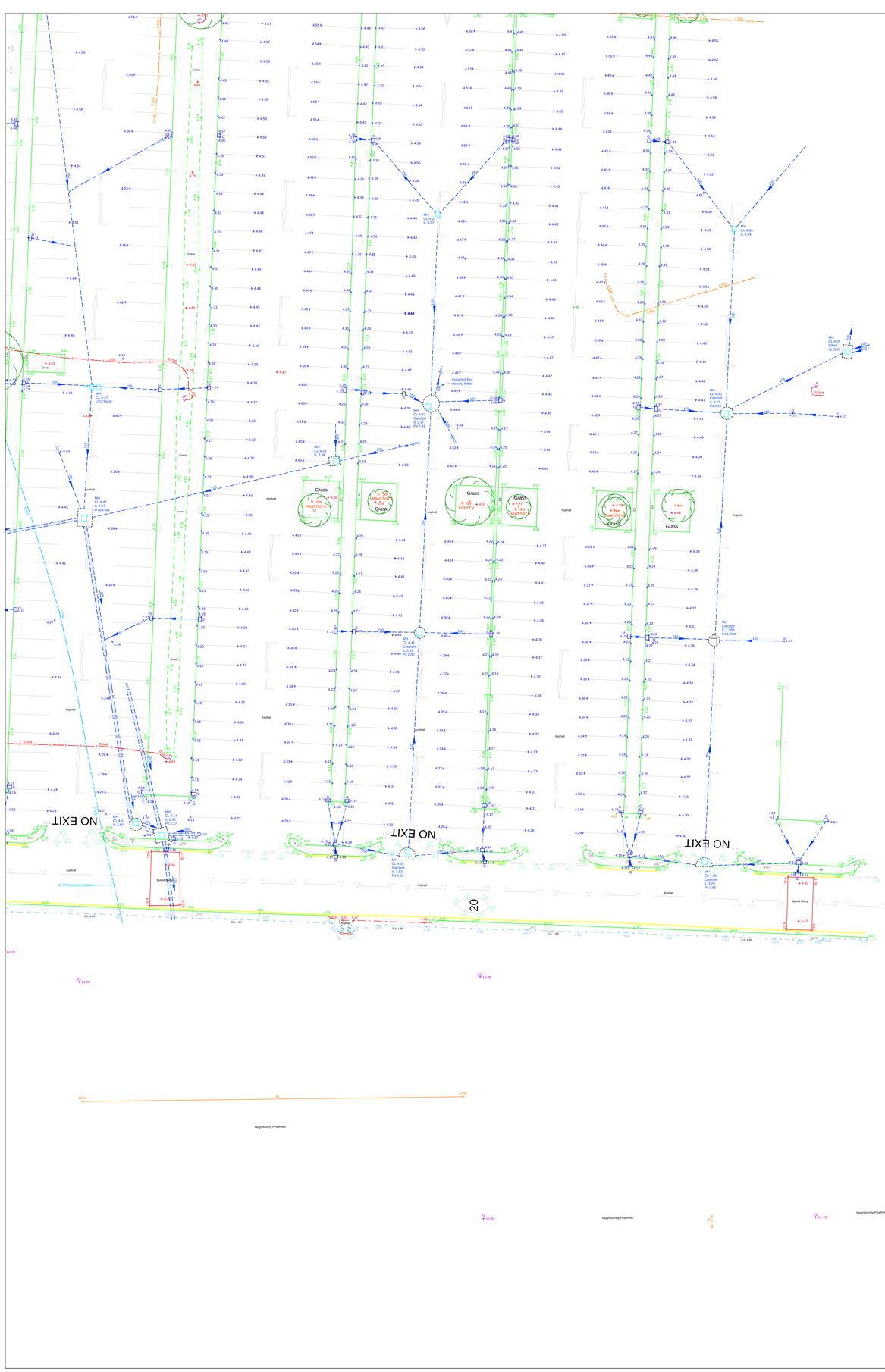
Grid Orientation:
North GPS

Site Level Datum
OS GPS

All dimensions are to be checked on site where applicable.This drawing must not be scaled, and only written dimensions should be respected.

Tree species and sizes on this drawing are not guaranteed, and if critical should be verified by an arboriculturist. Tree spreads are average about the trunk, and heights are approximate at the time of the survey.

0 3m 6m 9m 12m 15m 18m 21m 24m 27m 30m



Utility Types

Gas	GAS GAS GAS GAS GAS
Water	W W W W W
Telephone	BT BT BT BT BT
Catv	CATV CATV CATV CATV
CCTV	CCTV CCTV CCTV CCTV
Comms	COM COM COM COM COM
Fibre Optics	FO FO FO FO FO
Pipe	PIPE PIPE PIPE PIPE
Vents	V V V V V
Fuel	F F F F F
Offsets	O O O O O
Vapour Recovery	VR VR VR VR VR
Gauge Lines	G G G G G
Unidentified GPR	U-GPR U-GPR U-GPR U-GPR U-GPR
Unidentified EML	U-EML U-EML U-EML U-EML U-EML
Taken From Records	E-TFR E-TFR E-TFR E-TFR E-TFR
Assumed Routes	GAS-AR GAS-AR GAS-AR GAS-AR
Empty Ducts	EC EC EC EC EC
Earth Rod	ER ER ER ER ER
Rising Main	RM RM RM RM RM
Overhead	OH OH OH OH OH
Heating Pipes	
Traffic Signals	TS TS TS TS TS

Where chamber extents are significantly greater than the cover size, their approximate extents are shown thus;

ABBREVIATION KEY

AR	assumed route
BD	base bend
BG	backdrop
CP	cable pit
CL	cover level
DC	down comer
DP	down pipe
EOT	end of trace
EP	electricity pole
FH	fire hydrant
G	gully
GV	gate valve
HOR	head of run
HL	high level
IC	inspection chamber
IL	invert level
LP	lamp post
PRV	pipe riser
RE	rodding eye
RWP	rainwater pipe
SV	scour valve
SVP	soil vent pipe
TC	trapped exit
TFR	taken from records
TP	telegraph pole
UT	unable to find
UTL	unable to locate
UTS	unable to survey
UTT	unable to trace
VP	vent pipe
WC	water course
WM	water meter
WO	wash out valve

UTILITY SURVEY NOTES

ELECTROMAGNETIC AND/OR GROUND PENETRATING RADAR TECHNIQUES HAVE BEEN USED TO LOCATE AND MAP UNDERGROUND UTILITIES AND FEATURES ON THIS DRAWING. ALL HAVE MADE EVERY ENDEAVOUR TO MAKE SURE THAT THE INFORMATION SHOWN IS AS ACCURATE AS POSSIBLE. HOWEVER, WE CANNOT GUARANTEE THAT THE RESULTS FROM THESE TYPES OF SURVEYS ARE NOT INFALLIBLE AND SHOULD THE LOCATION OR DEPTH OF SERVICES/FEATURES BE OF PARTICULAR IMPORTANCE TO A PROJECT, THEN IT IS STRONGLY ADVISED THAT TRIAL EXCAVATIONS SHOULD BE UNDERTAKEN TO CONFIRM SURVEY RESULTS.

ALL HAVE USED ALL RECORD DRAWINGS THAT WERE AVAILABLE TO US BY THE CLIENT OR BY THE STATUTORY UTILITY PROVIDERS AT THE TIME OF THE SURVEY. ANY INFORMATION TAKEN FROM THESE DRAWINGS IS PURE SUPPLY AND WE CANNOT VOUCH FOR THE ACCURACY OR COMPLETENESS OF THE RECORDS. ANY DETAILS THAT HAVE BEEN TAKEN FROM RECORDS (TFR) HISTORIC RECORD INFORMATION IS OFTEN INCOMPLETE/INACCURATE AND CANNOT BE RELIED UPON.

A SINGLE LINE INDICATING A UTILITY MAY INDICATE THE PRESENCE OF MULTIPLE SERVICES WITHIN CLOSE PROXIMITY TO EACH OTHER. WHERE A SINGLE LINE TYPE IS SHOWN WE RECOMMEND HAND DIGGING WITHIN 0.5m, TO EXPOSE HIDDEN SERVICES.

WHERE QUOTED, DEPTH INFORMATION OF UNDERGROUND SERVICES/FEATURES IS STATED. DEPTHS ARE GENERALLY WITHIN +/- 10% ACCURATE, BUT CANNOT BE GUARANTEED. ANY DEPTHS SHOWN ARE USUALLY TO THE TOP OF PIPE/CABLE/FEATURE (EXCEPT SEWERS AND DRAINS ARE USUALLY TO INVERT (BASE OF DRAINAGE CHANNEL) UNLESS OTHERWISE STATED.

AT ALL WE USE SKILLED STAFF AND MODERN CALIBRATED EQUIPMENT TO PERFORM OUR SURVEYS, HOWEVER, THE COMPLETENESS OF ANY UNDERGROUND SURVEY CANNOT BE 100% GUARANTEED AND WE CANNOT BE HELD RESPONSIBLE FOR ANY INACCURACIES BEYOND THOSE THAT COULD BE REASONABLY EXPECTED BY A COMPETENT COMPANY.

CONTRACTORS UTILISING OUR DRAWINGS FOR INTRUSIVE WORK SHOULD TAKE ALL REASONABLE MEASURES TO WORK SAFELY IN ACCORDANCE WITH HSG47 GUIDELINES "AVOIDING DANGER FROM UNDERGROUND SERVICES".

Notes :

Station	Easting	Northing	Level
A	471327.174	105618.327	5.139
B	471287.831	105621.157	5.047
C	471223.321	105623.543	4.507
D	471150.333	105638.388	5.041
DHL	471086.942	105636.462	4.603
E	471138.230	105558.475	4.859
F	471204.372	105505.594	4.391
G	471100.662	105494.346	4.442
H	471089.999	105554.552	4.446
I	471090.650	105580.715	4.591
RI1	471401.011	105657.882	7.833
RI2	471306.989	105675.284	7.584
RI4	471185.132	105819.519	5.133
RI5	471091.983	105809.724	5.373
Z	471138.290	105617.911	5.144
SEA	471441.101	105765.709	7.673
SEB	471500.619	105763.903	8.388
SEC	471416.131	105855.587	7.946
SECHL	471353.954	105867.887	5.373
SED	471516.282	105854.354	5.263

Stations A, B, C, D, DHL, E, F, H, I, Z, RI4, RI5 and SED are marked with a PK Nail.
Stations G, RI1, RI2, SEA, SEB, SEC and SECHL are marked with a Wooden stake.

ON DETAIL SURVEY

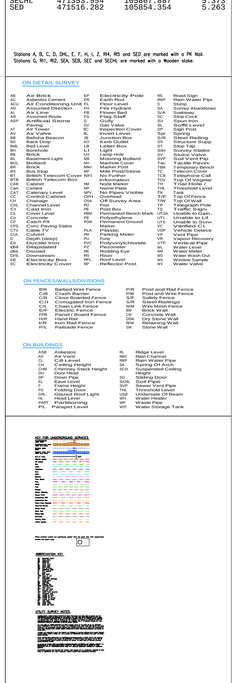
AB	Air Brick	EP	Electricity Poke
AC	Asbestos Cement	EB	Earth Rod
AD	Abandoned Driveway	FB	Fence Broken
AI	Assumed Direction	FH	Fire Hydrant
AL	Air Line	FL	Fence Leaning
AR	Assumed Route	FS	Flag Staff
ASP	Artificial Stone Pitch	G	Gully
AT	Air Tower	GV	Gate Valve
AV	Air Valve	IC	Inspection Cover
AW	Aviation Beacon	IL	Invert Level
BO	Back Drop	KO	Kerb Outlet
BH	Bore Hole	L	Light Column
BR	Boundary	LT	Light
BL	Bollard Light	MB	Mounting Bollard
BOL	Bollard	MC	Manhole Cover
BS	Bus Stop	MH	Manhole Cover
BS	Bus Stop	MP	Mile Post/Stone
BT	British Telecom Cover hi	NF	No Further
BT	British Telecom Box	NM	Name Unknown
CAB	Cabinet	NP	Note Marker
CAT	Catchpit	NV	No Invert Visible
CAT	Catenary Level	NVI	No Pipes Visible
CC	Control Cabinet	OP	Observation
CH	Chainage	OSA	OS Survey Area
CHL	Channel Level	PI	Post
CL	Cover Level	PO	Post Box
CL	Cover Level	PBM	Permanent Bench Mark
Co	Concrete	PE	Polyethylene
CP	Cable Pit	PG	Proposed Ground
CPS	Conc Paving Slabs		Marker
CTV	Cable TV	PLA	Plastic
D	Depth	PM	Parking Meter
D	Depth(Comp)	PO	Post
Dr	Depth(Hand)	PO	Polypony/Manhole
dRM	Dilapidated	PZ	Piezometer
DS	Downpipe	RE	Rodding Eye
DIS	Downstream	RP	Riser
EB	Electricity Box	RFL	Roof Level
EC	Electricity Cover	RP	Reflector Post
		RL	Road Sign
		RWP	Rain Water Pipe
		SA	Survey Abandoned
		SC	Silage Clamp
		SC	Stop Cock
		SI	Spun Iron
		SIG	Signal Head
		SP	Sign Post
		Spr	Spring
		SR	Safety Railing
		SS	Structure Soap
		SS	Sump
		SSH	Stainless Steller
		ST	Stop Valve
		SVP	Soil/Vent Pipe
		Tac	Tactile Pavers
		TC	Traffic Counter
		TC	Telecom Cover
		TCB	Telephone Call
		TL	Traffic Light
		TM	T Mat Holes
		TP	Transition Level
		TS	Tank
		TW	Telephone
		TW	Top Of Wall
		TP	Telegraph Pole
		UC	Unable to Cover
		UTA	Unable to Gain
		UTL	Unable to Lif
		VC	Vehicle Counte
		VI	Varifeed C.I.
		VP	Vehicle Detecto
		VP	Vent Pipe
		VTP	Vitrified Pipe
		WL	Water Level
		WM	Water Meter
		WI	Water Wash Out
		WS	Window Sample
		WV	Water Valve

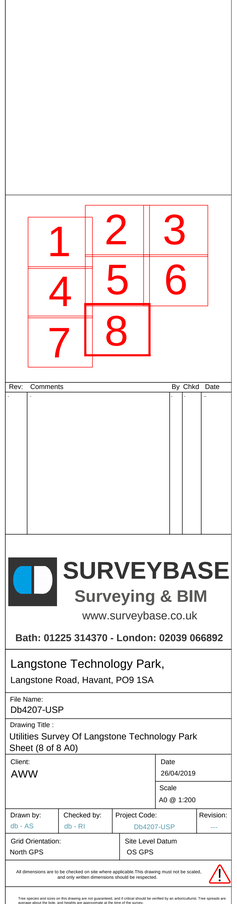
ON FENCES/WALLS/DIVISIONS

BW	Barbed Wire Fence	PrR	Post and Rail Fence
CB	Close Boarded Fence	PrW	Private Wire Fence
CrB	Close Boarded Fence	SaR	Safety Fence
ICrA	Corrugated Iron Fence	SrR	Gravel Railings
ICrR	Corrugated Iron	SrR	Steel Railings
EnF	Electric Fence	BW	Brick Wall
HRF	Hurdle Fence	CW	Concrete Wall
PaF	Panel Board Fence	DW	Dry Stone Wall
IrR	Iron Rail Fence	RW	Retaining Wall
PrF	Palisade Fence	SW	Stone Wall

ON BUILDINGS

ASB	Asbestos	RL	Ridge Level
AV	Air Vent	RC	Rain Chancel
CH	Ceiling Height	RWP	Rain Water Pipe
CH	Ceiling Level	S	Spring Of Arch
DH	Door Head Height	SCH	Sub Ceiling Height
DH	Door Head	SD	Sliding Door
E	Eave Level	SOIL	Soil Pipe
F	Frame Height	SVP	Sewer Vent Pipe
F	Frame Level	TW	Top Of Window
GRL	Glazed Roof Light	USB	Underside Of Beam
H	Head Level	WP	Water Heater
PL	Parapet Ceiling	WT	Water Tank
PL	Parapet Level	WST	Water Storage Tank





Rev:	Comments	By	Chkd	Date
-	-	-	-	-

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Langstone Technology Park,
Langstone Road, Havant, PO9 1SA

File Name:
Db4207-USP

Drawing Title :
Utilities Survey Of Langstone Technology Park
Sheet (8 of 8 A0)

Client:	Date
AWW	26/04/2019
	Scale: A0 @ 1:200

Drawn by:	Checked by:	Project Code:	Revision:
db - AS	db - RI	Db4207-USP	---

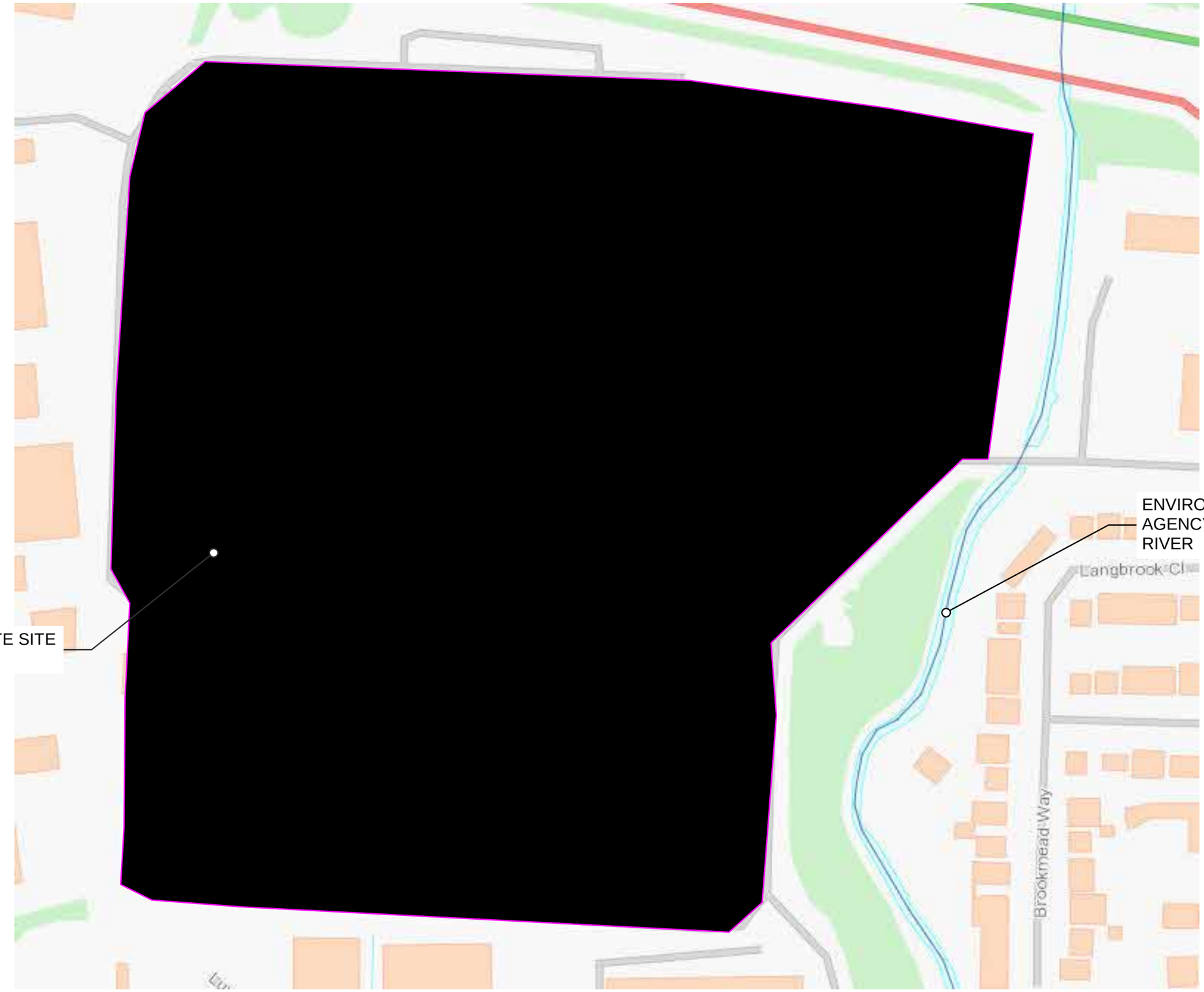
Grid Orientation:	Site Level Datum
North GPS	OS GPS

All dimensions are to be checked on site where applicable.This drawing must not be scaled, and only written dimensions should be respected.

Tree species and sizes on this drawing are not guaranteed, and if critical should be verified by an arboriculturist. Tree spreads are average about the tree, and heights are approximate at the time of the survey.

APPENDIX C

Existing Drainage



SOURCE: ENVIRONMENT AGENCY MAIN RIVER MAP

clancy consulting
Over 40 years in business

JOB NUMBER : 8/1982

DRAWING NUMBER : SK003

TITLE : EA MAIN RIVER LOCATION

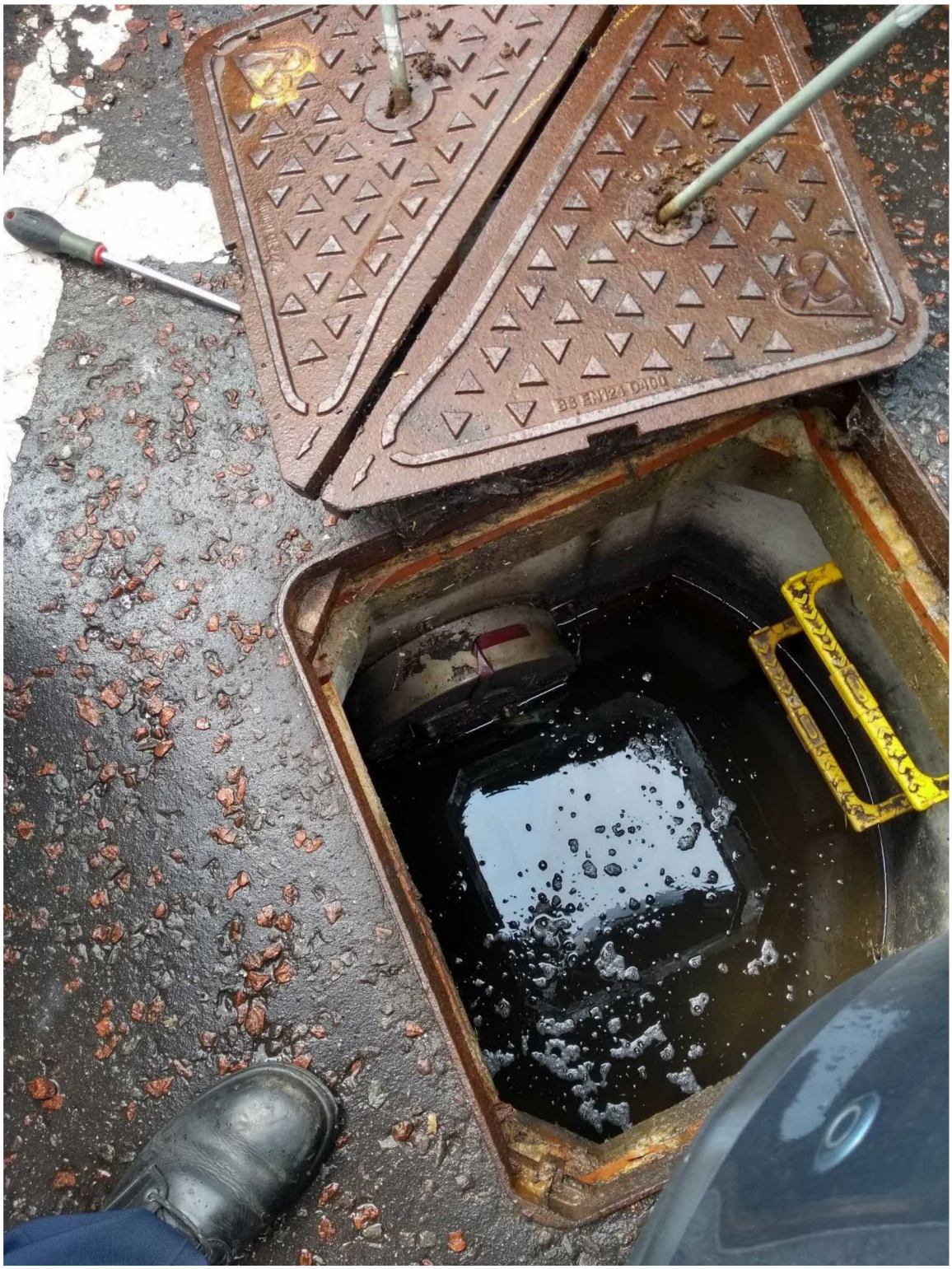
DRAWN BY : CH

DATE : JUNE 2019

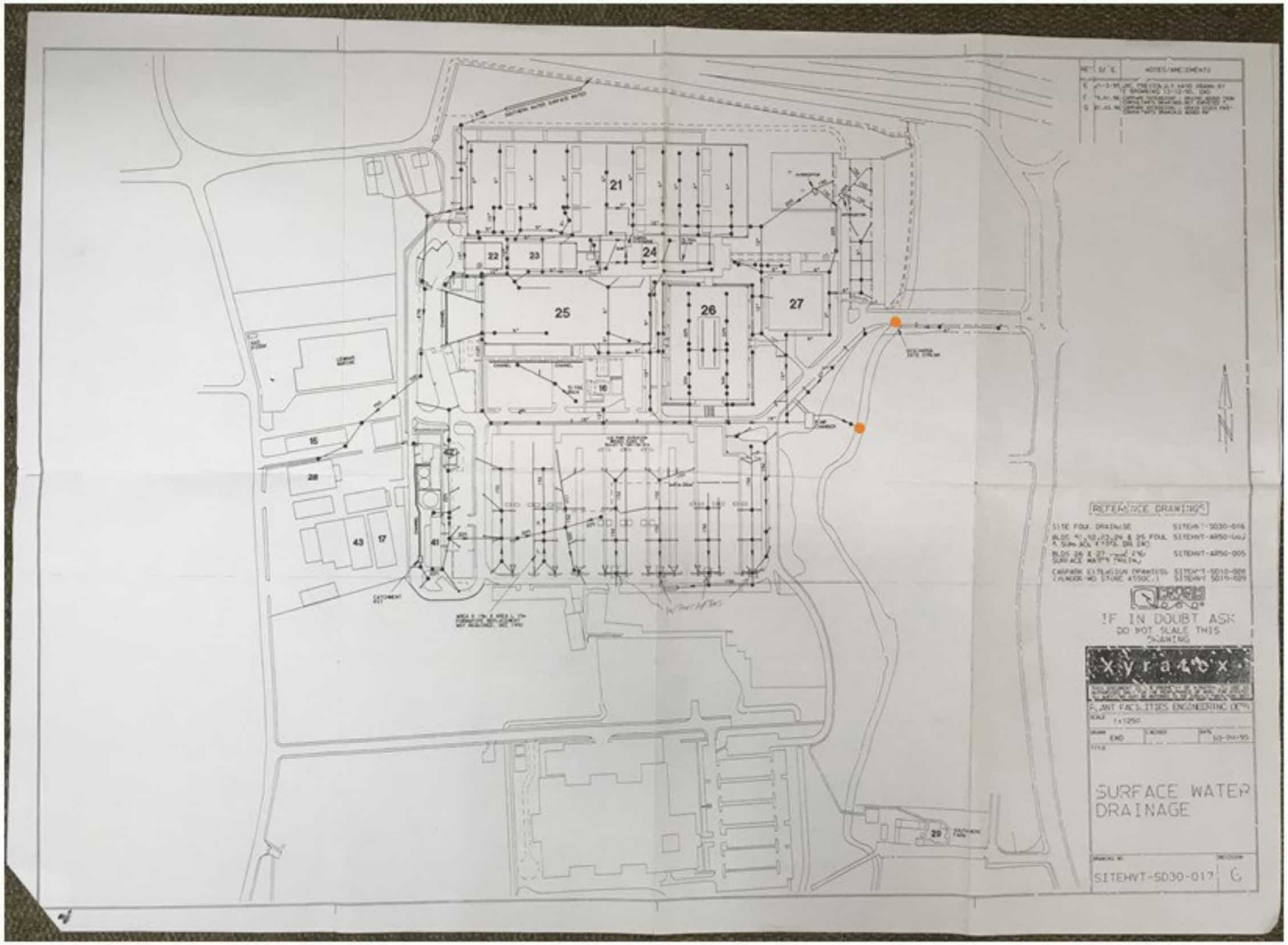
REVISION P01

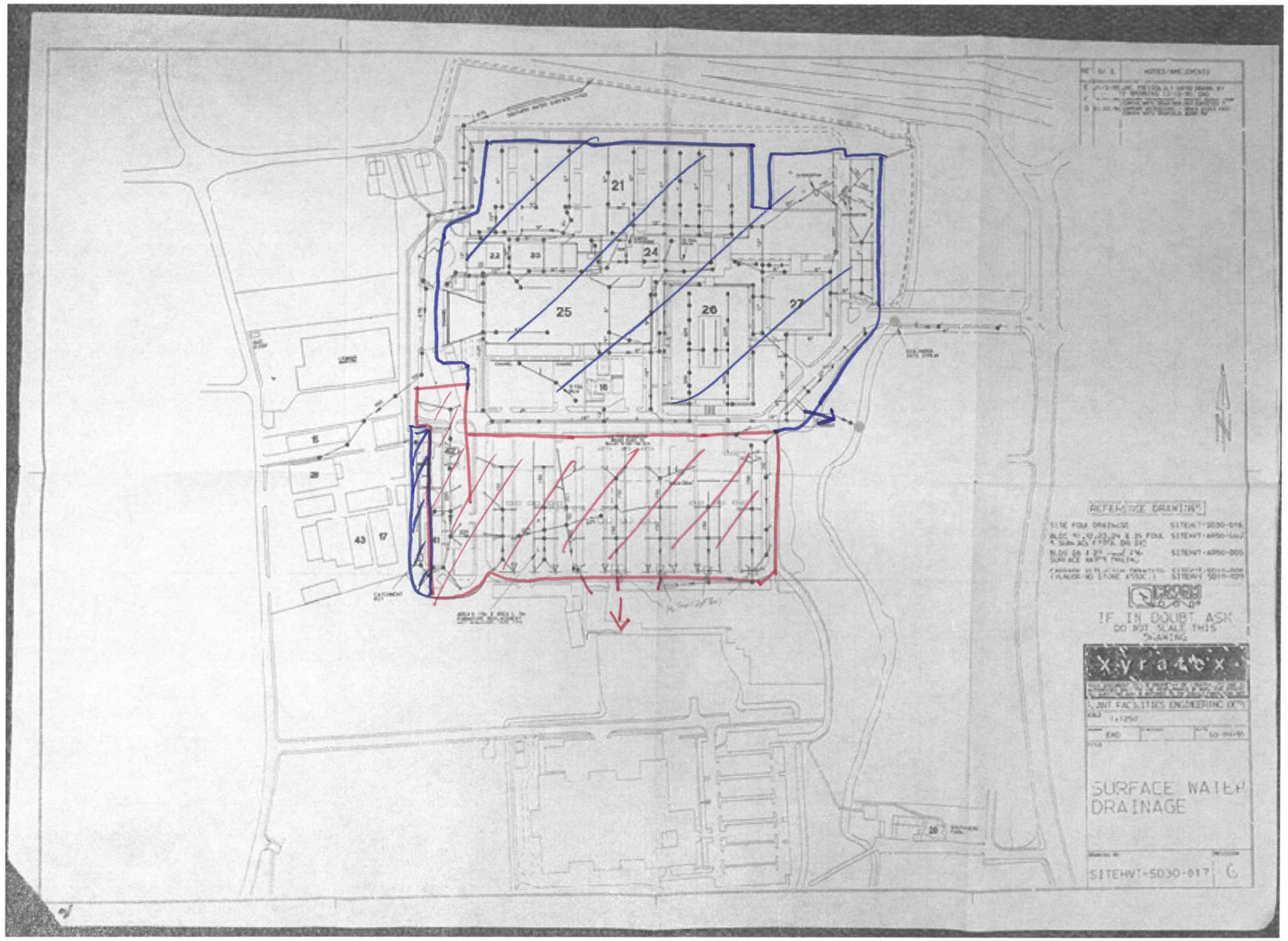
Flow control currently on site in north car park.

The following photos were taken after the CCTV survey was undertaken to identify the previously unknown flow control devices. The restriction on the flow is currently unknown and will be required to be established in detailed design for full hydraulic modelling.


BS EN124 D400




NOTES/AMENDMENTS
21
22
23
24
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27
15
28
43
17
41
16
29
REFERENCE DRAWINGS
SITE FOUL DRAINAGE SITEHWT-SD30-016
SURFACE WATER DRAINAGE SITEHWT-SD30-005
IF IN DOUBT ASK
DO NOT SCALE THIS DRAWING
Xyratex
PLANT FACILITIES ENGINEERING (UK)
SCALE 1:1250
DRAWN END
DATE 03-Oct-95
SURFACE WATER DRAINAGE
SITEHWT-SD30-017
G


21
22
23
24
25
26
27
43
17
IF IN DOUBT ASK
DO NOT SCALE THIS
DRAWING
SURFACE WATER
DRAINAGE
SITEHWT-SD30-017
G

28

42

MH

MH

41

MH

MH44

MH45

MH47

TO BUDDS FARM

MH

100ϕ

0·910ϕ FOUL SEWER FROM HAYLING ISLAND

MH

MH

MH

MH

MH

MH

MH

MH

19

REFERENCE DRAWINGS

1 SITE UTILITIES INDEX MAP. DRG No, SITE HV

2 SITE MAP DRG No SITE HVT SD30-011

(29) I.B.M BUILDINGS

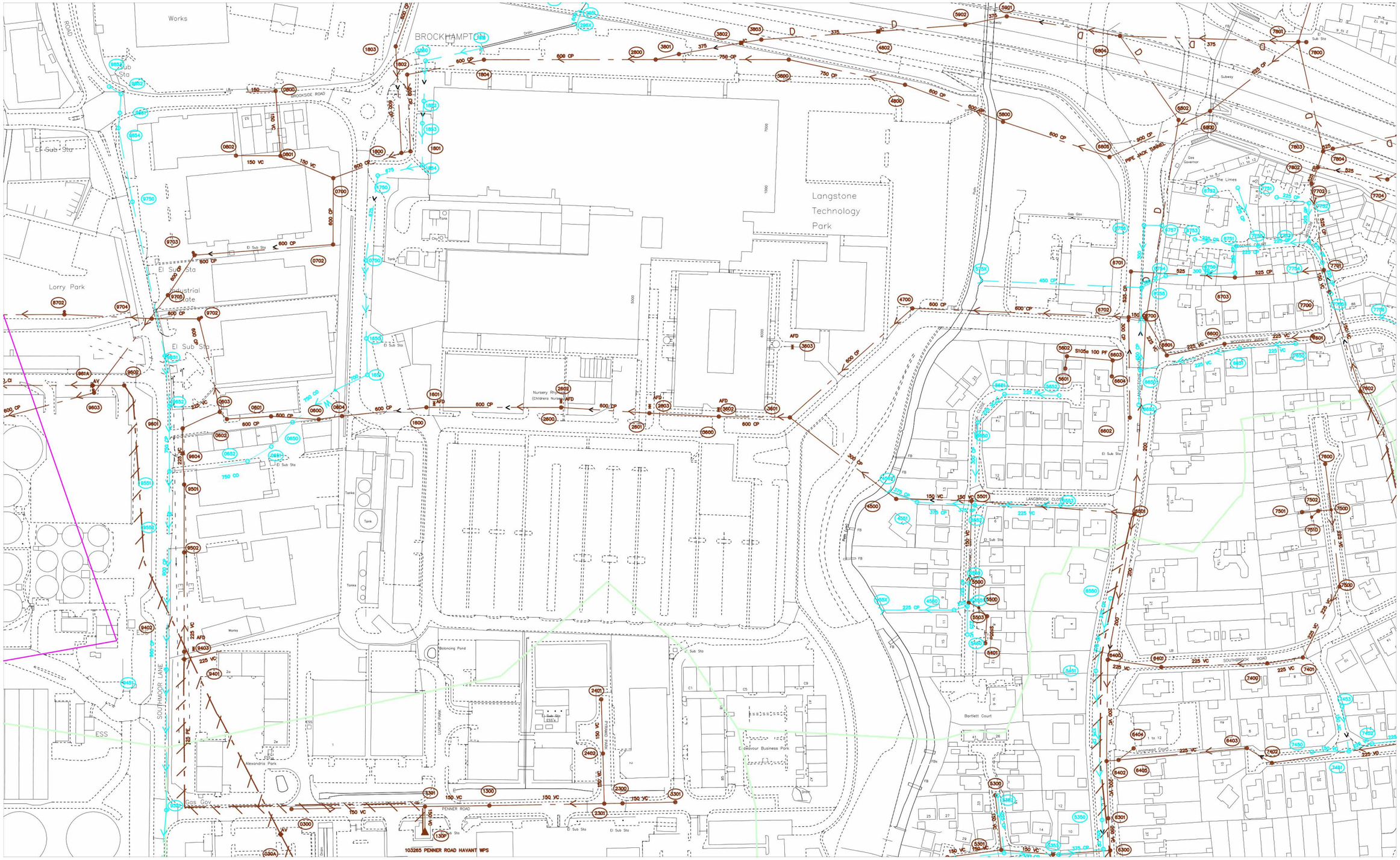
SITE BOUNDARY

FOUL SEWERS

ABANDONED FOUL SEWERS

SEWER RECORDS PAGE 1 OF 2

105916



105338

470855

471797

O.S. REF. SU7105NW	Drawn by: ghoshri	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 determnined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement
	Scale: 1:2500	
Title: Langstone Technology Park 2B	Date: 12/10/2015	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.

N

Southern Water

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	
0300X	4.118	1.693	150	VC	CIRC	
030AX			900	UNK	CIRC	
0600X	4.04	1.19	600	CP	CIRC	
0601X	3.95		600	CP	CIRC	
0602X	3.9	0.94	600	CP	CIRC	
0603X	3.89		600	CP	CIRC	
0604X			UNK	UNK	CIRC	
0650X			750	CO	CIRC	
0651X			750	CO	CIRC	
0652X			750	CO	CIRC	
065ZX		4.346	750	CO	CIRC	
0700X	4.64		600	CP	CIRC	
0702X	4.41	1.26	600	CP	CIRC	
0750X	5.1	3.7	UNK	UNK	CIRC	
0800X	4.51		150	VC	CIRC	
0801X	4.8		150	VC	CIRC	
0802X	4.75	3.44	150	VC	CIRC	
1300X	4.232	0.803	150	VC	CIRC	
1301X	4.244	0.309	150	VC	CIRC	
130PX			125	PE	CIRC	
1600X	5.09	1.14	600	CP	CIRC	
1650X	5.416	3.516	UNK	UNK	CIRC	
1651X	5.426		700	UNK	CIRC	
1750X			675	UNK	CIRC	
1800X	5.54	1.61	600	CP	CIRC	
1801X	5.35	1.45	600	CP	CIRC	
1802X	5.3	1.7	600	CP	CIRC	
1803X	4.96	2.1	600	CP	CIRC	
1804X	5.39	1.79	600	CP	CIRC	
1850X			UNK	UNK	CIRC	
1852X	5.528	3.958	UNK	UNK	CIRC	
1853X	5.415	3.975	UNK	UNK	CIRC	
1854X	6.59	3.905	675	UNK	CIRC	
185IX	−1		UNK	UNK	CIRC	
2300X	4.149	1.549	150	VC	CIRC	
2301X	4.165	1.456	150	VC	CIRC	
2401X	4.057	1.981	150	VC	CIRC	
2402X	3.976	1.7	150	VC	CIRC	
2600X	4.72	1.48	600	CP	CIRC	
2601X	5.64		600	CP	CIRC	
2800X	5.69		600	CP	CIRC	
295IX	−1		600	UNK	CIRC	
3301X	4.2	1.816	150	VC	CIRC	
3600X	4.701	1.711	UNK	UNK	CIRC	
3601X	6.13		600	CP	CIRC	
3800X	6.1	2.7	750	CP	CIRC	
3801Y	5.383		UNK	UNK	CIRC	*
3801X	5.383	1.939	375	UNK	CIRC	*
3803X	5.913	2.161	375	UNK	CIRC	
4500X	4.6	2.43	300	CP	CIRC	
4550X	4.78	4.03	225	CP	CIRC	
4551X	4.95	4.34	375	CP	CIRC	
4700X	5.18	2.18	600	CP	CIRC	
4800X	5.84		750	CP	CIRC	
5300X	5.15	4.61	150	VC	CIRC	
5301X	5.42		150	VC	CIRC	
5350X	5.58	3.78	450	CP	CIRC	
5351X	5.43		450	CP	CIRC	
5352X	5.19	4.34	225	CP	CIRC	
5353X	5.56	3.67	375	CP	CIRC	
5354X	5.42		300	CP	CIRC	
5401X			UNK	UNK	CIRC	
5450X	4.86	4.29	225	VC	CIRC	
5451X	6.33	4.27	375	CP	CIRC	
5500X	4.6	3.71	150	VC	CIRC	
5501X	5.05	3.41	150	VC	CIRC	
5503X			UNK	UNK	CIRC	
550DX			UNK	UNK	CIRC	
5550X	5.03	4.26	225	CP	CIRC	
5551X	4.91		225	VC	CIRC	
5552X	5.15	4.37	375	CP	CIRC	
5553X	6.12	5.23	225	VC	CIRC	
5601X			100	PF	CIRC	
5602X			100	PF	CIRC	
5650X	5.37	4.62	300	CP	CIRC	
5651X	5.77	4.98	225	VC	CIRC	
5652X	6.57	5.71	225	VC	CIRC	
5800X	5.02	2.52	600	CP	CIRC	
5901X	7.48	3.228	375	UNK	CIRC	
5902X	7.583	3.124	375	UNK	CIRC	
6300X	5.37		200	VC	CIRC	
6301X	5.52	3.78	200	VC	CIRC	
6400X	6.05		200	VC	CIRC	
6401X	6.12	4.73	225	VC	CIRC	
6402X	5.62		200	VC	CIRC	
6403X	5.76	4.37	225	VC	CIRC	
6404X			UNK	UNK	CIRC	
6405X			225	VC	CIRC	
6501X	6.486	5.557	200	UNK	CIRC	*
6501Y	6.486	5.078	200	UNK	CIRC	*
6501Y	6.486		UNK	UNK	CIRC	*
6550X	6.3	4.5	375	CP	CIRC	
6600X	7.02	5.59	225	VC	CIRC	
6601X	6.94	5.29	225	VC	CIRC	
6602X			300	CP	CIRC	
6603X			100	PF	CIRC	
6650X	7.02		450	CP	CIRC	
6651X	7.11	6.4	225	VC	CIRC	
6652X	6.842	5.322	UNK	UNK	CIRC	
6700Y	7.12	4.52	UNK	UNK	CIRC	*
6700X	7.12		150	CP	CIRC	*
6701X	7.23	3.28	525	CP	CIRC	
6702X	7.07		600	CP	CIRC	
6703X	7.84	3.58	525	UNK	CIRC	
6750X	7.88	5.5	300	CP	CIRC	
6751X	7.97		300	CP	CIRC	
6752X	8.31	6.71	225	CP	CIRC	
6753X	7.98	6.05	225	CP	CIRC	
6754X	7.92	5.31	300	CP	CIRC	
6755X	7.429		450	CP	CIRC	
6756X	7.64	6.795	300	UNK	CIRC	
6757X	7.354	6.869	UNK	UNK	CIRC	
6800X	8.23	3.18	900	CP	CIRC	
6804X	9.101	3.514	UNK	UNK	CIRC	
6805X	6.53	2.58	600	CP	CIRC	
7400X	6.01	5.01	225	VC	CIRC	
7401X	5.92	5.12	225	VC	CIRC	
7402X	5.694	4.499	UNK	UNK	CIRC	
7450X	5.48	4.56	150	VC	CIRC	
7451X	5.26		225	VC	CIRC	
7452X	5.45	4.18	225	VC	CIRC	
7453X	5.17	4.42	150	VC	CIRC	
7500X	6.16	5.2	225	VC	CIRC	
7501X			UNK	UNK	CIRC	
7502X			UNK	UNK	CIRC	
750DX			225	VC	CIRC	
751DX			UNK	UNK	CIRC	
7600X	6.72	5.71	225	VC	CIRC	
7601X	7.15	5.9	225	VC	CIRC	
7602X	7.01	5.11	150	VC	CIRC	
7650X	7.23	6.55	225	VC	CIRC	
7700X	7.09	3.94	150	VC	CIRC	
7701X	7.34		525	CP	CIRC	
7702X	7.92	4.02	525	CP	CIRC	
7704Y	8.767		525	UNK	CIRC	
7750X	7.8		225	CP	CIRC	
7751X	8.01	6.44	225	CP	CIRC	
7752X	7.87	6.27	225	CP	CIRC	
7753X	7.6		225	CP	CIRC	
7754X	7.47	6.2	225	CP	CIRC	
7755X	7.36	6.38	225	CP	CIRC	
7756X	6.852	5.972	UNK	UNK	CIRC	
7800X	8.2	3.7	525	CP	CIRC	
7801Y	8.12		525	CP	CIRC	*
7801Y	8.12		375	UNK	CIRC	*
7801X	8.12	3.47	UNK	UNK	CIRC	*
7802X	8.53		525	CP	CIRC	
7803X	8.274		UNK	UNK	CIRC	
7804X	8.172	4.107	525	UNK	CIRC	
8702X	4.51	0.36	600	CP	CIRC	
9351X	3.04	1.54	900	CP	CIRC	
9401X	3.14	1.96	225	VC	CIRC	
9402X	3.04	1.94	225	VC	CIRC	
9451X	2.84	1.69	900	CP	CIRC	
9501X	3.4	1.61	225	VC	CIRC	
9502X	3.39	1.88	225	VC	CIRC	
9551X	3.59	1.98	750	CP	CIRC	
9552X	3.33	1.76	900	CP	CIRC	
9601X	3.81		225	VC	CIRC	
9602X			UNK	UNK	CIRC	
9603X	4.42	0.64	600	CP	CIRC	
9604X	3.49	1.54	225	VC	CIRC	
961AX	3.99	1.56	900	CI	CIRC	
9651X	3.95	2.26	750	CP	CIRC	
9652X	3.76	2.11	750	CP	CIRC	
9702X	4.14	0.57	600	CP	CIRC	
9703X	4.73	0.85	600	CP	CIRC	
9704X	3.96	0.52	600	CP	CIRC	
9705X	4.54	0.87	600	CP	CIRC	
9750X	4.59		750	CP	CIRC	
9851X			600	CP	CIRC	
9852X			600	CP	CIRC	
9853X			675	CP	CIRC	
9854X			750	CP	CIRC	

LINE STYLES / COLOURS

- Brown — Foul
- Foul Syphon Sewer
- Foul Vacuum Main
- Foul Rising Main
- Red — Combined
- Combined Syphon Sewer
- Combined Rising Main
- Lateral Drain
- Orange — Building Over Agreement Area
- Dark Blue — Treated Effluent
- Purple — Sludge
- Sewer Catchment
- Section 104 Area
- Light Blue — Surface Water
- Surface Water Rising Main
- Yellow — Private
- Green — Access Shaft
- Decommissioned

MATERIALS

AK	Alkathene
BAC	Bonded Asbestos Cement
BRC	Brick (Common)
BRE	Brick (Engineering)
CC	Concrete Box Culvert
CI	Cast Iron
CO	Concrete (In-Situ)
CP	Concrete (Pre-Cast)
CSB	Concrete Segments (bolted)
CSU	Concrete Segments (unbolted)
DI	Ductile Iron
GRC	Glass Reinforced Concrete
GRP	Glass Reinforced Plastic
MAC	Masonry in regular Courses
MAR	Masonry in random Courses
PE	Polyethylene
PF	Pitch Fibre
PP	Polypropylene
PVC	Polyvinyl Chloride
RPM	Reinforced Plastic Matrix
SI	Spun Iron
ST	Steel
VC	Vitrified Clay
XXX	Other
ZZZ	Unknown

LEGEND - SEWERS

- Manhole (SW)
- Manhole (F&C)
- Lamp hole (SW)
- Lamp hole (F&C)
- Pumping Station (SW)
- Pumping Station (F&C)
- Side entry manhole (SW)
- Side entry Manhole (F&C)
- Blind shaft (SW)
- Blind shaft (F&C)
- Ejector station (SW)
- Ejector station (F&C)
- Watertight door (SW)
- Watertight door (F&C)
- Flushing ch. Mn-e (SW)
- Flushing ch. Mn-e (F&C)
- Flushing ch. No-e (SW)
- Flushing ch. No-e (F&C)
- Demarcation Chamber
- Washout (SW)
- Washout (F&C)
- Rodding Eye (SW)
- Rodding Eye (F&C)
- Gauging point (SW)
- Gauging point (F&C)
- Intercept chamber (SW)
- Intercept chamber (F&C)
- Storm Tank (SW)
- Storm Tank (F&C)
- Vortex chamber (SW)
- Vortex chamber (F&C)
- Label ellipse
- Dummy/S24 manhole
- Outfall
- Penstock chamber
- Damboards
- Storm Overflow
- Backdrop manhole
- Other (s)
- Other
- Change in sewer (s)
- Change in sewer
- Reflux valve
- Flap valve
- Cascade
- Anode
- Valve
- Closed Valve
- Air Valve
- Hatch box (SW)
- Hatch box (F&C)
- Direction arrow
- Emptying valve
- Catchpit
- Soakaway
- Inlet
- Balancing Pond
- Wastewater treatment works
- Marine treatment works
- Outfall headworks
- Vent
- Vent column
- Tidal storage tank
- Blank end
- Head of Public Sewer
- Micro Pumping Station

SHAPES (S)

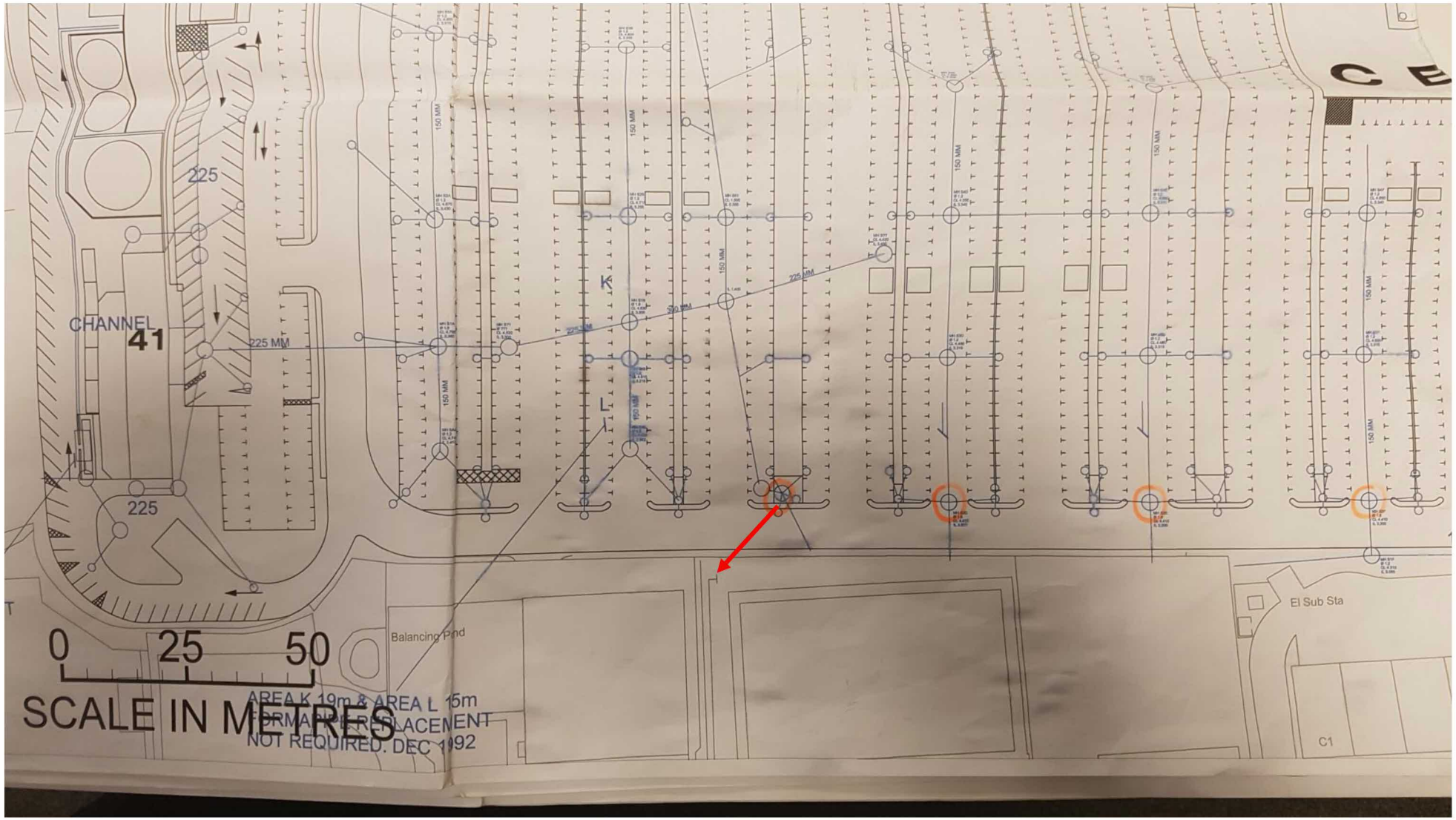
A	Arched	R	Rectangular
B	Barrel	S	Square
C	Circular	T	Trapezoidal
E	Egg	U	U Shape
H	Horseshoe	X	Other

NODE REFERENCING SYSTEM

- 1st digit: hundred metre easting identifier
- 2nd digit: hundred metre northing identifier
- 3rd digit: sewer type identifier
  - 0-4 = Foul/Combined
  - 5-9 = Surface Water
- 4th digit: next sequential node

Drawn by:	ghoshri
Title:	Langstone Technology Park 2B
Date:	12/10/2015

Southern Water


225
CHANNEL
41
225 MM
225
150 MM
K
L
0 25 50
SCALE IN METRES
AREA K 19m & AREA L 15m
FORMAL RE-PLACEMENT
NOT REQUIRED. DEC 1992
Balancing Pond
El Sub Sta
C1

APPENDIX D

Drainage Calculations

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Project				Job no.	
LANGSTONE TECHNOLOGY PARK				8-1982	
Calcs for				Start page no./Revision	
AREA 1 - 1 IN 1 YEAR				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **0.61**
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × $M5\_15min_i$ = **7.2** mm
Design rainfall intensity	I_{max} = M1_15min / D = **28.7** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **2044** m^2
Percentage of area that is impermeable	p = **46** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **7.5** l/s

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LANGSTONE TECHNOLOGY PARK				8-1982	
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AREA 1 - 1 IN 30 YEAR				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.50**
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × $M5\_15min_i$ = **17.6** mm
Design rainfall intensity	I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **2044** m^2
Percentage of area that is impermeable	p = **46** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **18.4** l/s

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AREA 1 - 1 IN 100 YEAR				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.94**
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × $M5\_15min_i$ = **22.7** mm
Design rainfall intensity	I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **2044** m^2
Percentage of area that is impermeable	p = **46** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **23.7** l/s

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AREA 2 - 1 IN 1 YEAR				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **0.61**
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × $M5\_15min_i$ = **7.2** mm
Design rainfall intensity	I_{max} = M1_15min / D = **28.7** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **25439** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **203.2** l/s

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AREA 2 - 1 IN 30 YEAR				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.50**
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × $M5\_15min_i$ = **17.6** mm
Design rainfall intensity	I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **25439** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **497.6** l/s

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AREA 2 - 1 IN 100 YEAR				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.94**
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × $M5\_15min_i$ = **22.7** mm
Design rainfall intensity	I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **25439** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **641.6** l/s

HR Wallingford
Working with water

Greenfjeld runoff estimation for sites

www.uksuds.com | Greenfjeld runoff tool

Calculated by:	
Site name:	Langstone Technology Park (Area 3)
Site location:	Havant

This is an estimation of the greenfjeld runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfjeld runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	50.84623° N
Longitude:	0.98899° W
Reference:	
Date:	2019-06-17 10:02

Methodology	IH124

Site characteristics

Total site area (ha)	0.1822

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	3	3
HOST class	---	---
SPR/SPRHOST	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	719	719
Hydrological region	7	7
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

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

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

Where flow rates are less than 5.0 l/s consents are usually set at 5.0l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfjeld runoff rates

	Default	Edited
Qbar (l/s)	0.54	0.54
1 in 1 year (l/s)	0.46	0.46
1 in 30 years (l/s)	1.24	1.24
1 in 100 years (l/s)	1.72	1.72

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

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Project				Job no.	
LANGSTONE TECHNOLOGY PARK				8-1982	
Calcs for				Start page no./Revision	
AREA 4 NORTH CAR PARK AREA 530.7M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **0.61**
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × $M5\_15min_i$ = **7.2** mm
Design rainfall intensity	I_{max} = M1_15min / D = **28.7** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **531** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **4.2** l/s

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AREA 4 NORTH CAR PARK AREA 1693.5M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **0.61**
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × $M5\_15min_i$ = **7.2** mm
Design rainfall intensity	I_{max} = M1_15min / D = **28.7** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **1694** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **13.5** l/s

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LANGSTONE TECHNOLOGY PARK				8-1982	
Calcs for				Start page no./Revision	
AREA 4 NORTH CAR PARK AREA 2655.6M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **0.61**
Rainfall for 15min storm with 1 year return period	M1_15min = Z2 × $M5\_15min_i$ = **7.2** mm
Design rainfall intensity	I_{max} = M1_15min / D = **28.7** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **2656** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **21.2** l/s

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **1** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i = Z1 \times M5\_60min$ = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **0.61**
Rainfall for 15min storm with 1 year return period	$M1\_15min = Z2 \times M5\_15min_i$ = **7.2** mm
Design rainfall intensity	$I_{max} = M1\_15min / D$ = **28.7** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **5213** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	$Q_{max} = A_{catch} \times p \times I_{max}$ = **41.6** l/s

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Project				Job no.	
LANGSTONE TECHNOLOGY PARK				8-1982	
Calcs for				Start page no./Revision	
AREA 4 NORTH CAR PARK AREA 530.7M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.50**
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × $M5\_15min_i$ = **17.6** mm
Design rainfall intensity	I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **531** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **10.4** l/s

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.50**
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × $M5\_15min_i$ = **17.6** mm
Design rainfall intensity	I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **1694** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **33.1** l/s

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.50**
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × $M5\_15min_i$ = **17.6** mm
Design rainfall intensity	I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **2656** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **51.9** l/s

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **30** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.50**
Rainfall for 15min storm with 30 year return period	M30_15min = Z2 × $M5\_15min_i$ = **17.6** mm
Design rainfall intensity	I_{max} = M30_15min / D = **70.4** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **5213** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **102.0** l/s

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AREA 4 NORTH CAR PARK AREA 530.7M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.94**
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × $M5\_15min_i$ = **22.7** mm
Design rainfall intensity	I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **531** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **13.4** l/s

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AREA 4 NORTH CAR PARK AREA 1693.5M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.94**
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × $M5\_15min_i$ = **22.7** mm
Design rainfall intensity	I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **1694** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **42.7** l/s

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AREA 4 NORTH CAR PARK AREA 2655.6M^2				1	
Calcs by	Calcs date	Checked by	Checked date	Approved by	Approved date
CH	27/06/2019				

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.94**
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × $M5\_15min_i$ = **22.7** mm
Design rainfall intensity	I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **2656** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **67.0** l/s

DESIGN RAINFALL

In accordance with the Wallingford Procedure

Tedds calculation version 2.0.01

Design rainfall intensity

Location of catchment area	Bournemouth
Storm duration	D = **15** min
Return period	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period	r = **0.350**
5-year return period rainfall of 60 minutes duration	M5_60min = **19.0** mm
Increase of rainfall intensity due to global warming	$p_{climate}$ = **0** %
Factor Z1 (Wallingford procedure)	Z1 = **0.62**
Rainfall for 15min storm with 5 year return period	$M5\_15min_i$ = Z1 × M5_60min = **11.7** mm
Factor Z2 (Wallingford procedure)	Z2 = **1.94**
Rainfall for 15min storm with 100 year return period	M100_15min = Z2 × $M5\_15min_i$ = **22.7** mm
Design rainfall intensity	I_{max} = M100_15min / D = **90.8** mm/hr

Maximum surface water runoff

Catchment area	A_{catch} = **5213** m^2
Percentage of area that is impermeable	p = **100** %
Maximum surface water runoff	Q_{max} = A_{catch} × p × I_{max} = **131.5** l/s

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Contract Title			Contract No.	
Langstone Technology Park				
Part of Structure			Calculation Sheet No:	
Attenuation tank sizing			Rev	
Drawing ref:	Check By:	Date	Calcs By: CH	Date 27/06/2019

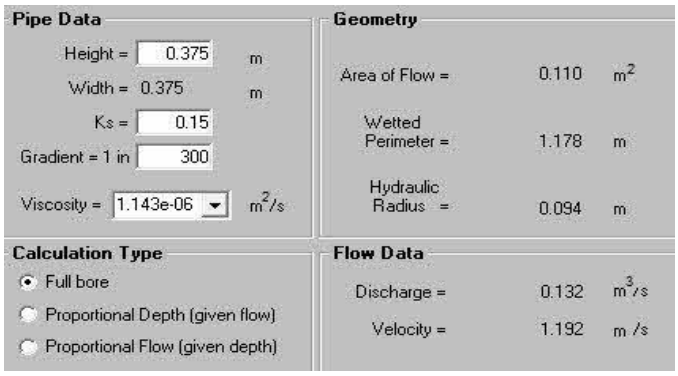
South West Car park and industrial area

As there will be heavy vehicle access to this area, permeable paving has been considered unsuitable for use in the car park. Therefore the surface water will be captured and attenuated before drainaing off site at the current discharge location.

Total impermeable area	25439	m^2
Unit 01	489	m^2
Unit 02	349	m^2
Unit 03	420	m^2
Unit 04	349	m^2
Unit 05	700	m^2
Unit 06	1115	m^2
Unit 07	766	m^2
Unit 08	929	m^2
Unit 09	1301	m^2
Unit 10	838	m^2
Unit 11	1557.0	m^2
Unit 12	2300	m^2
Total unit area	11113	m^2
Parking area	14326	m^2

Assuming a mixture of oversized pipes and attenuation storage for the site,
Designing for a 1 in 100 + 40% CC storm event

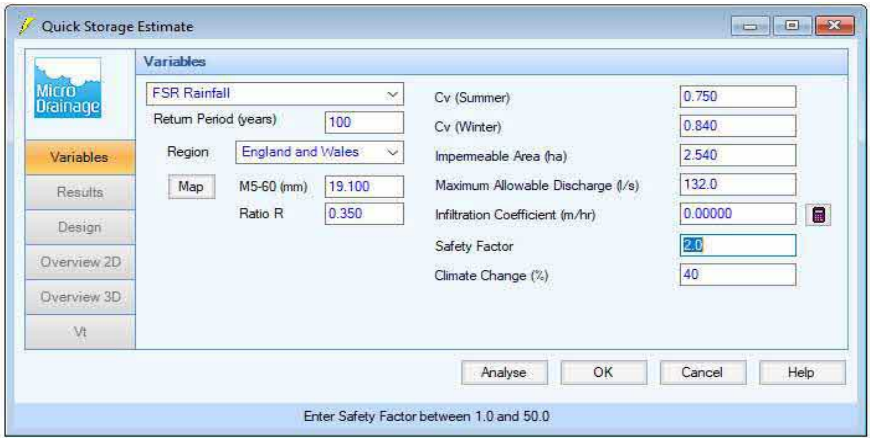
Existing pipe leaving site is 375mm diameter
Pipe has unknown gradient. Assume 1:300

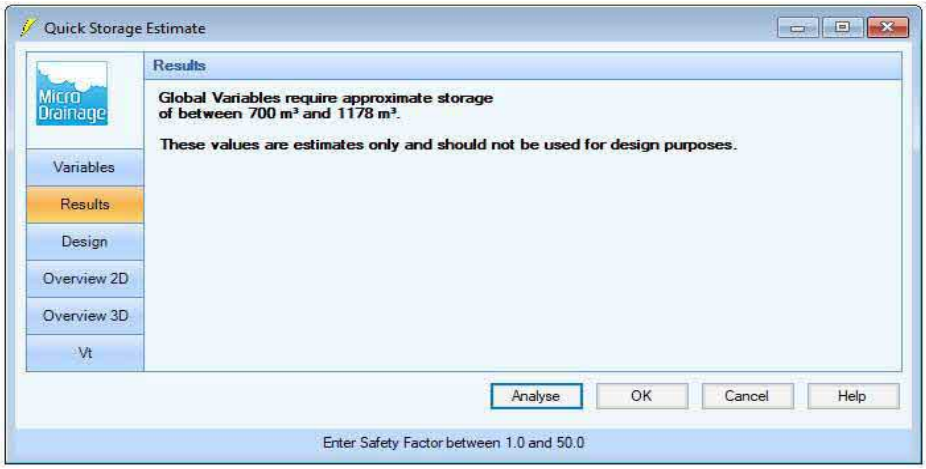


Maximum flow through pipe is 132 l/s

This is lower than the run off rate and will be used as the flow control limit.

Storage estimate based on total impermeable area





Minimum volume required	700	m^3
Maximum volume required	1178	m^3

Using oversized pipes for storage on the site

Pipe diameter	0.6	m
Pipe length	252	m

Total storage volume provided in pipes	71.25	m^3
Total storage volume required	1106.75	m^3
Assuming tanks will have a depth of	0.8	m
The footprint of storage required is	1383.44	m^2

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Contract Title			Contract No.	
Langstone Technology Park				
Part of Structure			Calculation Sheet No:	
Attenuation tank sizing			Rev	
Drawing ref:	Check By:	Date	Calcs By:	Date
			CH	27/06/2019

Permeable paving

As infiltration is currently not proven viable, a permeable paving design based on impermeable ground conditions will be designed following guidance from interpave.

Hydraulic design

Surface type	C	

Using Figure 20 in Edition 6 of interpave's permeable paving guide.

FSR M60 rainfall	20	mm
r'	0.4	

Using Table 5

1 in 100 year +40% CC sub-base thickness	260	mm

The site is very flat and therefore the run off from sloped ground will not be checked.

Additional depth required due to impermeable area drainaing into permeable paving
It has been assumed that the impermeable area is equal the permeable paving.
Using section 6.2.8 from the interpave permeable paving guide.

260 x (11.52 + 11.52) / 11.52

Sub-base thickness	520	mm

Structural design

Using table 7

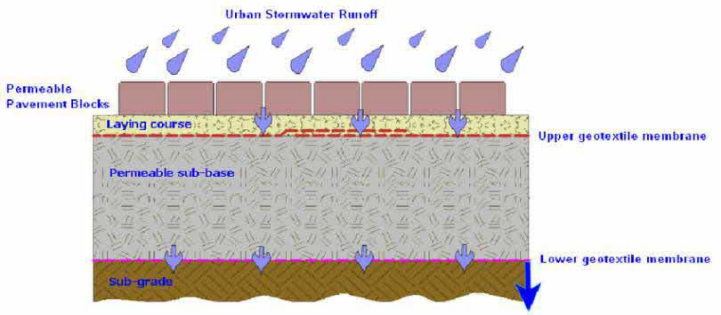
Design loading	Category 4	

Using figure 24

Block + sufacing	130	mm
Hydraulically bound coarse aggregate	150	mm
Coarse aggregate	150	mm
Capping	150	mm

Adjusting for CBR

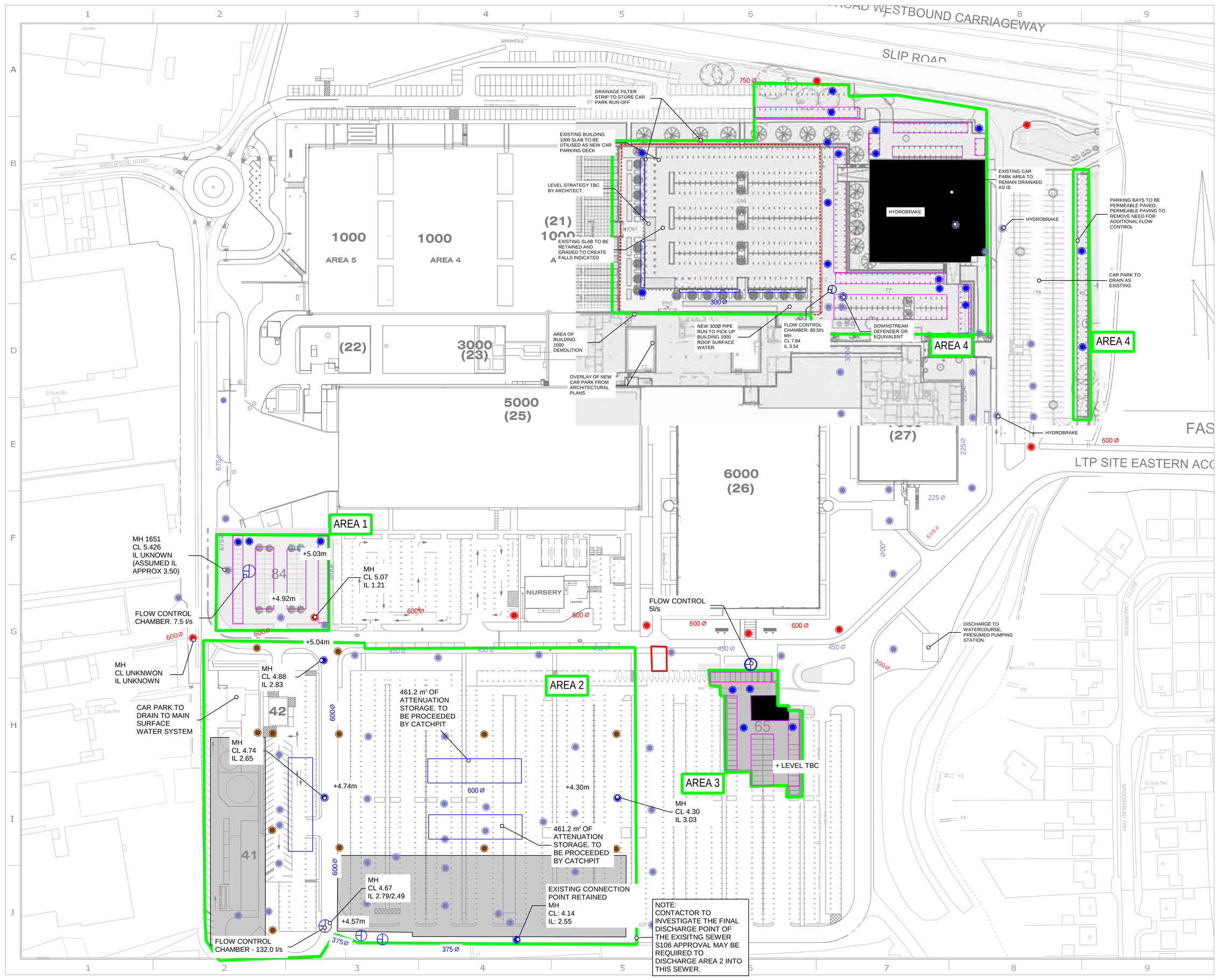
Assume CBR	2	%
New capping thickness	350	mm

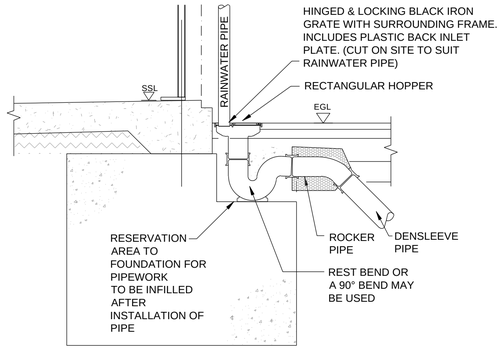


130
520
350

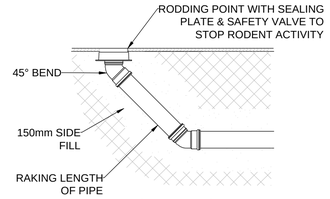
APPENDIX E

Proposed Drainage Strategy


DRAINAGE FILTER STRIP TO STORE CAR PARK RUN-OFF
EXISTING BUILDING 1000 SLAB TO BE UTILISED AS NEW CAR PARKING DECK
LEVEL STRATEGY TBC BY ARCHITECT.
EXISTING SLAB TO BE RETAINED AND GRADED TO CREATE FALLS INDICATED
AREA OF BUILDING 1000 DEMOLITION
OVERLAY OF NEW CAR PARK FROM ARCHITECTURAL PLANS
NEW 300Ø PIPE RUN TO PICK UP BUILDING 1000 ROOF SURFACE WATER.
FLOW CONTROL CHAMBER: 80.5l/s MH CL 7.84 IL 3.54
DOWNSTREAM DEFENDER OR EQUIVALENT
EXISTING CAR PARK AREA TO REMAIN DRAINAED AS IS
HYDROBRAKE
PARKING BAYS TO BE PERMEABLE PAVED. PERMEABLE PAVING TO REMOVE NEED FOR ADDITIONAL FLOW CONTROL
CAR PARK TO DRAIN AS EXISTING
AREA 4
AREA 1
AREA 2
AREA 3
MH 1651 CL 5.426 IL UKNOWN (ASSUMED IL APPROX 3.50)
FLOW CONTROL CHAMBER. 7.5 l/s
MH CL UNKNWON IL UNKNOWN
CAR PARK TO DRAIN TO MAIN SURFACE WATER SYSTEM
MH CL 5.07 IL 1.21
MH CL 4.88 IL 2.83
MH CL 4.74 IL 2.65
461.2 m³ OF ATTENUATION STORAGE. TO BE PROCEEDED BY CATCHPIT
MH CL 4.67 IL 2.79/2.49
EXISTING CONNECTION POINT RETAINED MH CL: 4.14 IL: 2.55
FLOW CONTROL CHAMBER - 132.0 l/s
FLOW CONTROL 5l/s
MH CL 4.30 IL 3.03
+ LEVEL TBC
DISCHARGE TO WATERCOURSE, PRESUMED PUMPING STATION.
NOTE: CONTACTOR TO INVESTIGATE THE FINAL DISCHARGE POINT OF THE EXISITNG SEWER S106 APPROVAL MAY BE REQUIRED TO DISCHARGE AREA 2 INTO THIS SEWER.
1000 AREA 5
1000 AREA 4
(21) 1000
(22)
3000 (23)
5000 (25)
6000 (26)
(27)
84
42
41
65
NURSERY
BROOKSIDE ROAD
SLIP ROAD
WESTBOUND CARRIAGEWAY
LTP SITE EASTERN ACC
BROOKMEAD WAY
LANGBROOK CLOSE
MANHOLE
+5.03m
+4.92m
+5.04m
+4.74m
+4.30m
+4.57m
750 Ø
600 Ø
450 Ø
375 Ø
300 Ø
225 Ø
675Ø
SITE BOUNDARY
EXISTING SURFACE SEWER
EXISTING FOUL SEWER
PROPOSED SURFACE SEWER
PROPOSED FOUL SEWER
SURFACE WATER STORAGE
UNIQUE DRAINAGE ITEM
APPROXIMATE DEVELOPMENT AREA
PROPOSED PERMEABLE PAVING
clancy consulting
Over 40 years in business.
JOB NUMBER : 8/1982
DRAWING NUMBER : SK04
TITLE : PROPOSED DRAINAGE STRATEGY
DRAWN BY : CH
DATE : JUNE 2019
REVISION P02



TYPICAL EXTERNAL RWP WITH ACCESS GULLY



RODDING EYE

Dia (mm)	Bd (m)	GRANULAR MATERIAL TO NOMINAL SINGLE SIZED AS FOLLOWS.
100	0.5	100 DIA. 10mm
150	0.6	150 DIA. 10mm/ 14mm.
225	0.7	200 DIA.
300	0.85	& ABOVE 10mm/ 14mm/ 20mm.
375	1.05	
450	1.15	
525	1.20	
600	1.35	
1050	1.80	

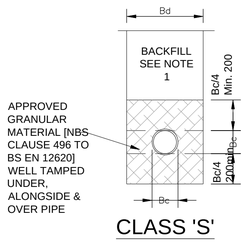
NOTE 1
Bd. = TRENCH WIDTH AT CROWN OF PIPE - (NARROW TRENCH WIDTH CONDITIONS)
Bc = OUTSIDE DIAMETER OF PIPE

CLASS 'A' & CLASS 'S' FOR PIPE DIAMETERS 100 TO 525. GENERAL CASE CLASS 'S'.
CLASS 'A' FOR USE WHERE CROWN OF PIPE IS WITHIN 1.2m OF U/S OF PAVING.
CLASS 'F' FOR 100 & 150 DIAMETER CONCRETE OR VITRIFIED CLAY ONLY.
CLASS 'F' IS NOT TO BE USED FOR PLASTIC PIPES.

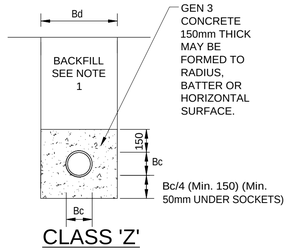
1. BACK FILL TO TRENCHES TO BE SELECTED GRANULAR MATERIAL. MAX. PARTICLE SIZE NOT EXCEEDING 75mm, AND NOT MORE THAN 10% PASSING 75mm SIEVE. MATERIAL SHALL NOT CONTAIN ANY CLAY LUMPS OR ANY OTHER FOREIGN MATTER.

2. PIPES TO BE VITRIFIED CLAY TO BSEN 295 OR PVC-U TO BSEN 1404-1:1998 TO CONTRACTOR CHOICE

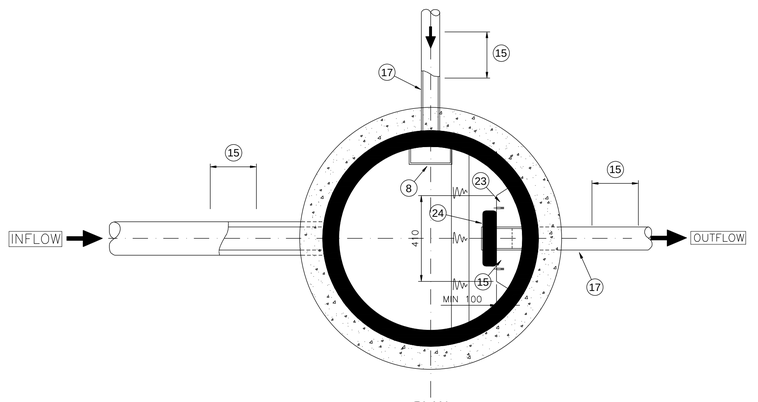
EXTERNAL PIPE BEDDING DETAILS



CLASS 'S'



CLASS 'Z'



SECTION

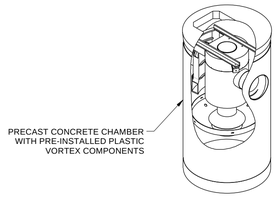
PLAN

KEY

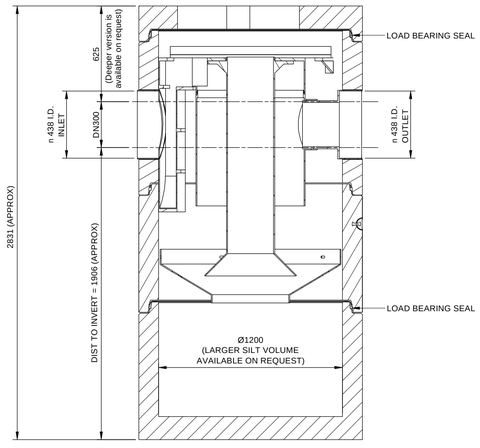
1. FOR ACCESS COVER TYPE REFER TO MANHOLE SCHEDULE ON DRAWING 2/5943-900.
2. COVER FRAME BEDDED ON AND HAUNCHED IN CLASS M1, M2 OR EPOXY MORTAR NO GREATER THAN 20mm THICK. APPROVED PACKING MATERIAL MAY BE USED IF REQUIRED.
3. 10mm UNCOMPRESSED THICKNESS OF 'TOKSTRIP' OR SIMILAR APPROVED COMPRESSIBLE SEALANT TO ALL HORIZONTAL JOINTS.
4a. TYPE 2 COVER FRAME SEATING RINGS WITH 600x600 CENTRAL ACCESS OPENING OR MIN TWO COURSES OF ENGINEERING BRICK.
4b. TYPE 1 COVER FRAME SEATING RING WITH 600x600 ECCENTRIC ACCESS OPENING (BSEN752-3 & BSEN1917) BEDDED ON MORTAR.
5. REINFORCED PRECAST CONCRETE (SULPHATE RESISTING) HEAVY DUTY COVER SLAB TO BS5911:PART 200 WITH 750x600 ACCESS OPENING, BEDDED ON MORTAR.
6. PRECAST CONCRETE (SULPHATE RESISTING) CHAMBER RINGS TO BS5911:PART 200.
7. MIX ST4 SULPHATE RESISTING CONCRETE SURROUND MIN 150 THICK.
8. POLYPROPYLENE ENCAPSULATED DOUBLE STEP RUNGS TO BS1247 PARTS 1 & 2. MIN WIDTH 280mm AT 250mm CTRS.
9. GRANO CONCRETE BENCHING (MIN 20mm THICK) TO BE BROUGHT UP TO A DENSE SMOOTH FACE NEATLY SHAPED AND FINISHED TO ALL BRANCH CONNECTIONS. BENCHING SLOPE TO BE BETWEEN 1 IN 10 AND 1 IN 30.
10. BOTTOM CHAMBER SECTION TO BE BUILT INTO BASE CONCRETE MIN 75mm.
11. CONSTRUCTION JOINT.
12. INVERT WITHIN CHAMBER TO BE FORMED USING A CHANNEL PIPE.
13. MIX ST4 CONCRETE.
14. DISTANCE BETWEEN TOP OF PIPE AND UNDERSIDE OF PRECAST CHAMBER TO BE 100.
15.

PIPE DIA	ROCKER PIPE LENGTH
150-600	600
675-750	1000
825+	1250

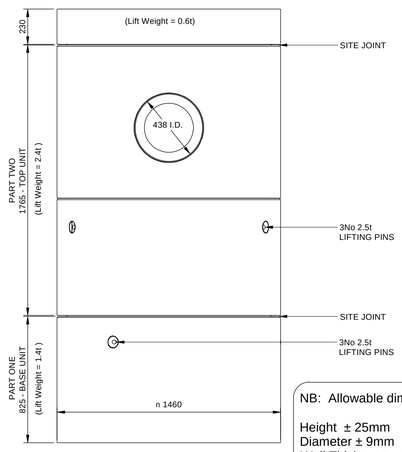
16. ALL PIPES ENTERING OR LEAVING MANHOLES SHALL HAVE A FLEXIBLE JOINT WITHIN 600mm OF THE INSIDE FACE OF THE MANHOLE.
17. SHORT LENGTH PIPE TO BE SIMILAR LENGTH TO ROCKER PIPE.
18. PIPE JOINT WITH CHANNEL TO BE LOCATED MIN 100mm FROM INSIDE FACE OF CHAMBER.
19. TOE HOLES TO BE PROVIDED IN BENCHING OF SEWER GREATER THAN 450mmØ FOR ACCESS TO INVERT.
20. 150 MIN STANDARD CONCRETE MIX 'ST2' SURROUND TO SUMP AND TO 150 MIN ABOVE OUTGOING PIPE INVERT. ALTERNATIVELY, 150 MIN STANDARD CONCRETE MIX 'ST2' CAST INSITU SUMP IN LIEU OF PRECAST CONCRETE CHAMBER RINGS.
21. 225 MIN INSITU CONCRETE BASE SLAB (STANDARD MIX 'ST4').
22. INLETS AND OUTLETS TH0ROUGHLY PACKED AND SEALED WITH MORTAR AROUND PIPES.
23. 'HYDRO-BRAKE' FIXED TO CONCRETE MOUNTING BLOCK WITH MASONRY STUD ANCHOR FIXING BOLTS.
24. 'HYDRO-BRAKE OR SIMILAR' FLOW CONTROL FITTED WITH PIVOTING BY-PASS DOOR.
25. PIVOTING BY-PASS DOOR OPERATING STEEL ROPE WITH PULL HANDLE FIXED JUST UNDER ACCESS COVER FOR MANUAL OPERATING AT GROUND LEVEL.
26. CONCRETE BENCHING.



DOWNSTREAM DEFENDER INSTALLATION



Section A - A



Elevation on Inlet

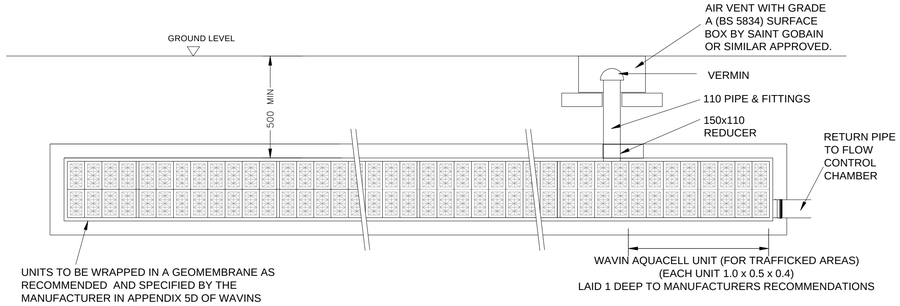
NB: Allowable dimensional variation

Height ± 25mm
Diameter ± 9mm
Wall Thickness ± 10mm

DOWNSTREAM DEFENDER DN 1200 CONCRETE CHAMBER HDPE INTERNAL COMPONENTS

(SCALE 1:50)

TYPE 2 MANHOLE - VORTEX FLOW CONTROL (HYDRO-BRAKE) CHAMBER. NTS



FOR 1 IN 100 YEAR + 40% CLIMATE CHANGE STORAGE (PRIVATE)

PIPEWORK SHOWN INDICATIVELY ONLY.
SEE GENERAL ARRANGEMENT FOR LOCATIONS AND LEVELS OF PIPEWORK.

AQUACELL NOTES
AQUACELLS TO HAVE TYPE 1 OR TYPE 2 SUB-BASE BACKFILL TO THE SIDES AND OVER THE CELLS ONLY. MATERIAL TO BE COMPACTED IN ACCORDANCE WITH TABLE 6/1 OR 8/1 OF THE SPECIFICATION FOR HIGHWAY WORKS AND TAKING INTO ACCOUNT MAXIMUM ROLLER WEIGHTS AS ADVISED BY WAVIN.

CONSTRUCTION PLANT **NOT** TO TRAFFIC NEAR OR OVER AQUACELL LOCATIONS UNLESS SPECIFICALLY AUTHORISED BY THE ENGINEER.

AQUACELL SURFACE WATER STORAGE DETAILS

PRELIMINARY DRAWING
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Project: LANGSTONE TECHNOLOGY PARK
LANGSTONE ROAD
HAVANT, PO9 1SA

Office: NORWICH 01603 305190

Discipline: CIVIL ENGINEERING

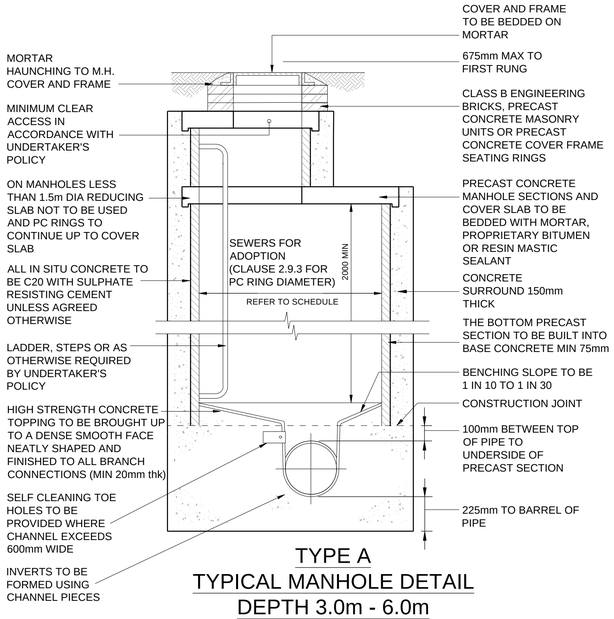
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SHEET 1 OF 2

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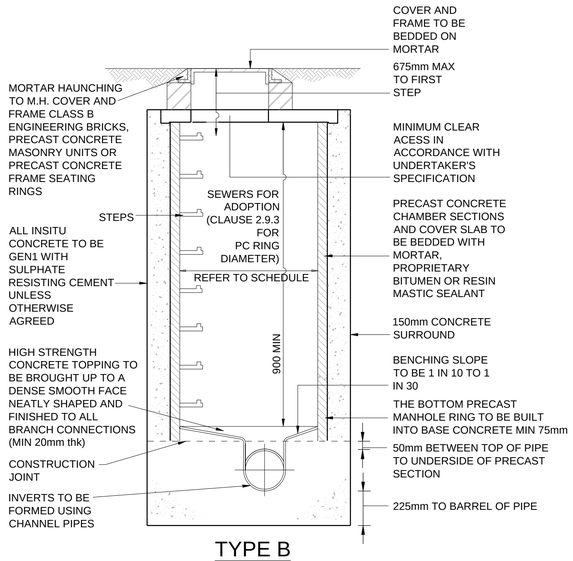
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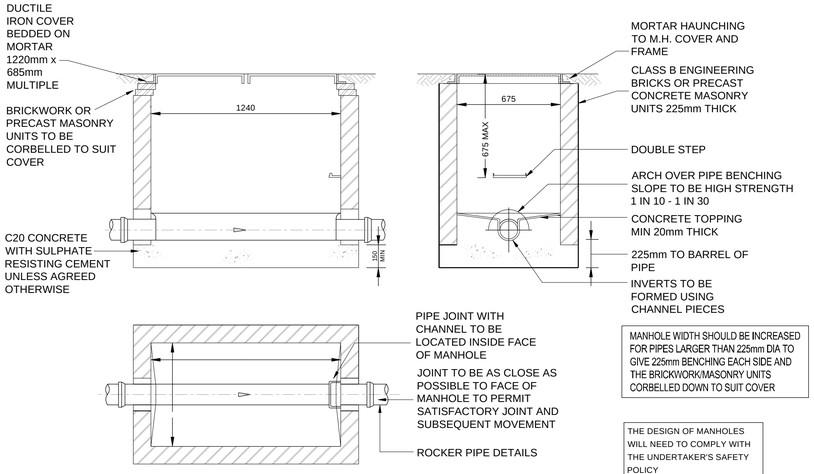
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Type	**Level**	**Drawing No.**	**Revision**
DET	DRN	400410	P1



TYPE A
TYPICAL MANHOLE DETAIL
DEPTH 3.0m - 6.0m



TYPE B
TYPICAL MANHOLE DETAIL
MAX DEPTH OF 3.0m



MANHOLE WIDTH SHOULD BE INCREASED FOR PIPES LARGER THAN 225mm DIA TO GIVE 225mm BENCHING EACH SIDE AND THE BRICKWORK/MASONRY UNITS CORBELLED DOWN TO SUIT COVER

THE DESIGN OF MANHOLES WILL NEED TO COMPLY WITH THE UNDERTAKER'S SAFETY POLICY

TYPE C
TYPICAL MANHOLE DETAIL
DEPTH 1.0m - 1.45m

THE DESIGN OF MANHOLES WILL NEED TO COMPLY WITH THE UNDERTAKER'S SAFETY POLICY

PIPE Dia (mm)	INTERNAL DIA OF MANHOLE
< 375	1200
375 - 400	1350
500 - 700	1500
750 - 900	1800
> 900	CONSULT WITH SEWERAGE UNDERTAKER

NOTE: MANHOLE CHAMBER ACCESS TO BE IN ACCORDANCE WITH FIGURE B.7 FROM SEWERS FOR ADOPTION 7 TO ALLOW ADEQUATE ACCESS FOR MAINTENANCE

Rev	Date	Description	By	Check	App.
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Client: TRINITY INVESTMENT MANAGEMENT

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Office: NORWICH 01603 305190

Discipline: CIVIL ENGINEERING

Title: INDICATIVE DRAINAGE DETAILS
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Downstream Defender®

High-Level Treatment in a Small Footprint

Product Profile

The Downstream Defender® is an advanced vortex separator used to treat stormwater runoff in pretreatment or stand-alone applications. Its unique flow-modifying internal components distinguish the Downstream Defender® from conventional and simple swirl separators that typically bypass untreated peak flows to prevent washout of captured pollutants. Its wide treatment flow range, low headloss, small footprint and low-profile make it a compact and economical solution for capturing nonpoint source pollution.

Components

1. Inlet to Precast Vortex Chamber
2. Cylindrical Baffle
3. Center Shaft
4. Outlet Pipe
5. Sediment Storage Sump
6. Access Lid

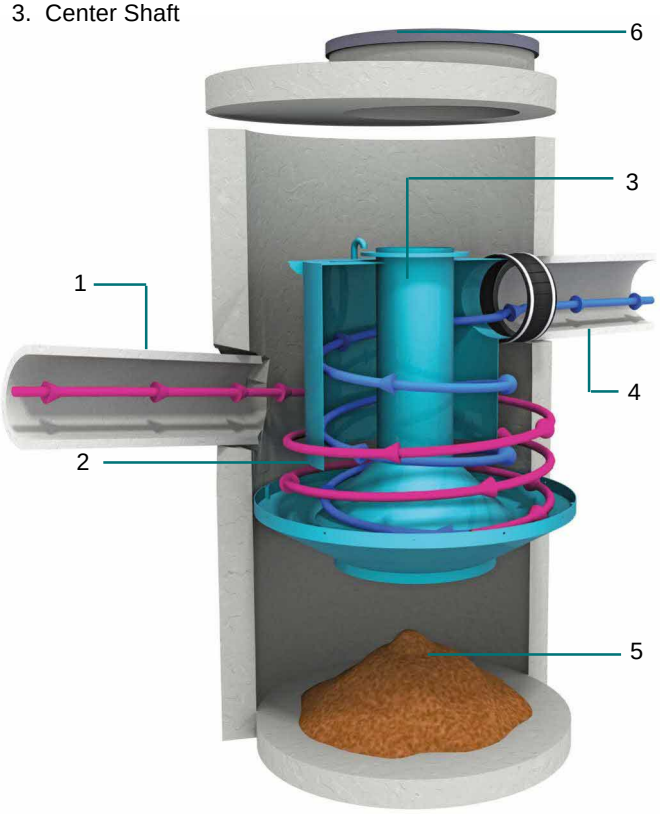


Fig.1 The Downstream Defender® has internal components designed to maximize pollutant capture and minimize pollutant washout.

Applications

- Removal of total suspended solids (TSS), floatable trash and petroleum products from stormwater runoff
- New construction or redevelopment of commercial and residential sites
- Pollutant hotspots such as maintenance yards, parking lots, gas stations, streets, highways, airports and transportation hubs
- Site constrained LID or green infrastructure based developments
- LEED® development projects

Advantages

- Special internal components maximize pollutant capture and minimize footprint, headloss and washout
- Captures and retains a wide range of TSS particles
- High peak treatment flow rates
- Treats the entire storm with no washout or untreated bypass flows
- Low maintenance requirements - no dredging required, and no screens or media to block
- Variable inlet/outlet angles for ease of site layout

How it Works

Advanced hydrodynamic vortex separation is a complex hydraulic process that augments gravity separation with low-energy rotary forces. The flow modifying internal components used in the Downstream Defender® harness the energy from vortex flow and maximize the time for separation to occur while deflecting high scour velocities (**Fig.1**).

Polluted stormwater is introduced tangentially into the side of the precast vortex chamber to establish rotational flow. A cylindrical baffle with an inner center shaft creates an outer (magenta arrow) and inner (blue arrow) spiraling column of flow and ensures maximum residence time for pollutant travel between the inlet and outlet.

Oil, trash and other floating pollutants are captured and stored on the surface of the outer spiraling column. Low energy vortex motion directs sediment into the protected sump region. Only after following a long three-dimensional flow path is the treated stormwater discharged from the outlet pipe. Maintenance ports at ground level provide access for easy inspection and clean-out.

Downstream Defender®

Drainage Profile

The Downstream Defender® is designed with a submerged tangential inlet to minimize turbulence within the device. Turbulence increases system headlosses and reduces performance by keeping pollutant particles in suspension.

The inlet elevation of the Downstream Defender® is located one inlet pipe diameter lower than the elevation of the outlet invert (**Fig.2**). This arrangement ensures that influent flows are introduced to the treatment chamber quiescently below the water surface elevation, minimizing turbulence.

The unique flow-modifying internal components also minimize hydraulic losses. There are no internal weirs or orifices; large clear openings ensure low headloss at peak flow rates with little risk of blockages that cause upstream flooding.

Inspection and Maintenance

Nobody maintains our systems better than we do. To ensure optimal, ongoing device performance, be sure to recommend Hydro International as a preferred service and maintenance provider to your clients.



Call **1 (800) 848-2706** to schedule an inspection and cleanout or learn more at **hydro-int.com/service**

Sizing & Design

The Downstream Defender® can be used to meet a wide range of stormwater treatment objectives. It is available in 5 precast models that fit easily into the drainage network (**Table 1)**. Selection and layout of the appropriate Downstream Defender® model depends on site hydraulics, site constraints and local regulations. Both online (**Fig.3a)** and offline (**Fig.3b**) configurations are common.

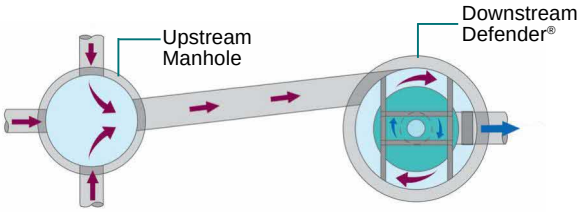


Fig.3a The Downstream Defender® in an online configuration.

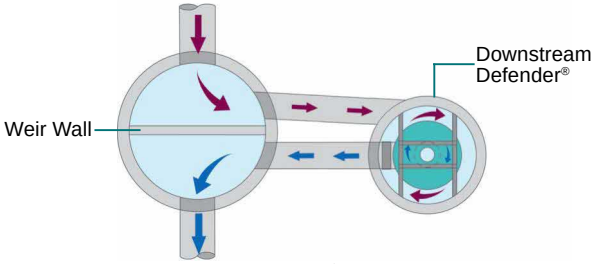


Fig.3b The Downstream Defender® in an offline configuration.

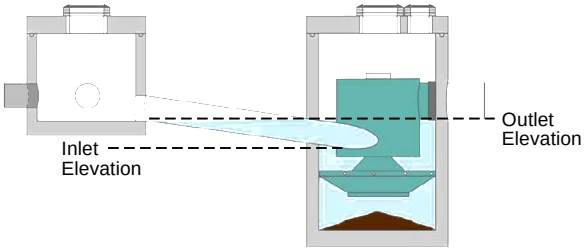


Fig.2 The Downstream Defender® has a submerged inlet that reduces headloss and improves efficiency of pollutant capture.



Free *Stormwater Sizing Tool*

This simple online tool will recommend the best separator, model size and online/offline arrangement based on site-specific data entered by the user.

Go to hydro-int.com/sizing to access the tool.

Table 1. Downstream Defender® Design Chart.

Model Number and Diameter		Peak Treatment Flow Rate		Maximum Pipe Diameter		Oil Storage Capacity		Sediment Storage Capacity		Minimum Distance from Outlet Invert to Top of Rim		Standard Height from Outlet Invert to Sump Floor	
(ft)	(m)	(cfs)	(L/s)	(in)	(mm)	(gal)	(L)	(yd^3)	(m^3)	(ft)	(m)	(ft)	(m)
4	1.2	3.0	85	12	300	70	265	0.70	0.53	2.8	0.85	4.1	1.25
6	1.8	8.0	227	18	450	216	818	2.10	1.61	3.2	0.98	5.9	1.80
8	2.4	15.0	425	24	600	540	2,044	4.65	3.56	4.2	1.28	7.7	2.35
10	3.0	25.0	708	30	750	1,050	3,975	8.70	6.65	5.0	1.52	9.4	2.85
12*	3.7	38.0	1,076	36	900	1,770	6,700	14.70	11.24	5.6	1.71	11.2	3.41

*Not available in all areas. Contact Hydro International for details.

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Tel: (207) 756-6200 Fax: (207) 756-6212
Email: stormwaterinquiry@hydro-int.com Web: www.hydro-int.com

Hydro International®

The **Hydro-Brake®** Flow Control Series

Hydro-Brake®
Flood



Hydro-Brake®
Optimum



Hydro-Brake®
Agile



Hydro-Brake®
Orifice



The element of control

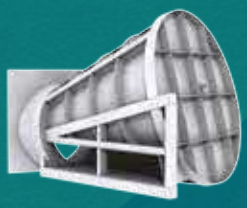
Stormwater Solutions
Turning Water Around®



The Hydro-Brake®
Flow Control Series

A versatile toolbox of precision-engineered devices for surface water, fluvial, foul/combined water, and sewer network flow control.

A Flow Control for Every Site and Budget



Hydro-Brake® Flood

The vortex controlled solution to watercourse flooding.



Hydro-Brake® Optimum

The vortex flow control with no equivalent. Independently verified by BBA and WRc.



Hydro-Brake® Agile

Precision-engineered flow control giving reduced on-site storage for highly constrained applications.



Hydro-Brake® Orifice

The low cost option for unconstrained sites.



The Element of Control

Hydro International has set the highest standards in flow control technology during more than 35 years of specialist water engineering. When it comes to understanding, predicting and controlling the flow of water, Hydro works with scientific rigour.

Our customers are constantly challenged to deliver imaginative solutions, despite tough commercial and physical constraints. Committed to precision in product development and manufacture, we partner with you to engineer the best-possible water management solutions.

Hydro International's unrivalled knowledge and outstanding technical design support give our customers complete reassurance of system performance and value.

We give you the element of control.

Precision-Engineered for Reliable, Repeatable Performance

The Hydro-Brake® Flow Control Series offers a comprehensive choice for sustainable, performance-optimised attenuation and control whatever the project. Fully scalable and adaptable to your site conditions, there is no need to compromise on your project requirements.

All Hydro International flow controls are manufactured to the same exacting standards of quality. Tested, proven and independently accredited by regulatory bodies across the world, they offer the reassurance of reliable, repeatable performance.

Technical Design Support

Faced with increasingly varied environmental and planning stipulations, engineers need to adapt their solutions accordingly and balance flow rates with storage requirements and optimise the drainage system performance over the duration of a storm. In these circumstances, Hydro International's expert design support can advise on the correct flow control selection and design.

A full range of technical services, including detailed hydraulic modelling, easy-to-use design tools and integration into industry-standard software, all help engineers to achieve optimum hydraulic performance.

Buildable, Maintainable, Adoptable

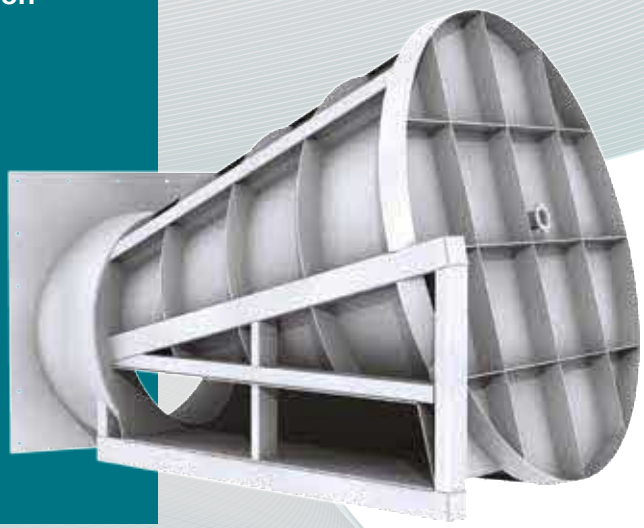
Hydro International flow controls are designed and manufactured for ease of installation and reliable through-life performance with minimum intervention. Simple, predictable, low-maintenance regimes make them straightforward for management organisations to take on, and remove any concerns for adopting authorities.

Hydro-Brake® Flood

Hydro-Brake® Flood is a highly sustainable, precision-engineered vortex technology for preventing watercourse flooding.

Hydro-Brake® Flood flow controls have been installed at the heart of low-maintenance, self-activating flood defences since the 1990s, and now protect more than 6,000 properties from an estimated £200m of flood damage in pioneering schemes across the UK.

Watercourse flood prevention



- No external power.
- No moving parts.
- Upstream flood storage minimised.
- Minimal maintenance.

Bespoke, Precision Engineering

Each Hydro-Brake® Flood is a bespoke solution that precisely manages watercourse flows, right up to major dams with pass forward flow rates of 30 m³/s. The same technology is used just as successfully in smaller, dispersed schemes.

Each Hydro-Brake® Flood scheme is purpose-designed to optimise flow control performance characteristics and precisely calculate the amount of upstream storage required. Using Hydro-Brake® Flood vortex technology can reduce the volume of floodwater to be stored by up to 30% compared to fixed orifice controls.

A Simple, Elegant Solution

The internal geometry of Hydro-Brake® Flood is designed so that water can flow through it without restriction for as long as possible, minimising the upstream storage required. A self-activating vortex is created when the water reaches the pre-determined hydraulic head, holding back excess water, and releasing it at a controlled rate.

Expert Design and Manufacture

Designing fluvial interventions, whether on a large or small scale, requires expert engineering and hydraulic modelling in line with the flood risk management strategy. Hydro International can support with detailed design using Computational Fluid Dynamics and structural design using Finite Element Analysis, scale testing and production of detailed design drawings and specifications.

Hydro-Brake® Flood vortex flow controls are manufactured in high-grade stainless steel to be structurally fit-for-purpose, using modern production and control methods to ensure the design and performance objectives are delivered.

Low Impact, Minimal Maintenance

The Hydro-Brake® Flood has a large open area at all flow rates, resulting in a low risk of blockages. With no power or moving parts, the flow controls require minimal operational attention and maintenance.

Future-Proofed

Hydro-Brake® Flood schemes can be designed to allow for future variances in fluvial flows. A facility for future adjustment to allow for climate change can be incorporated without necessitating new engineering or construction works.

Monitoring

Flood alleviation at the fluvial level can be demonstrated to deliver a level of protection that is worth far more than the project costs. We can offer support and advice on post-installation monitoring of the value of the intervention.

Case Studies



Flood Prevention Scheme Protects 1,750 Properties in Glasgow

Glasgow City Council's £53 m White Cart Water Flood Prevention scheme protects 1,750 properties in the south of the city. Normally a shallow river, White Cart Water is prone to flash flooding. As little as twelve hours of rain can cause water levels to rise by six metres.

New manufacturing and installation techniques were developed as part of the project that saw the world's five largest-ever Hydro-Brake® Flood vortex flow controls installed in 3 dams in the highlands above the city. The final scheme controls flow rates and velocities up to a 1 in 200 year flood event, with a 45% maximum reduction in peak flows, holding back more than 2.5 billion litres of floodwater in upstream storage areas that make best use of the natural environment.



Vortex Technology Protects Northallerton Homes and Businesses

In the North Yorkshire town of Northallerton, a £3.1 million flood alleviation scheme is using Hydro-Brake® Flood technology to protect 170 homes and businesses. Two large Hydro-Brake® Flood vortex flow controls were installed in refurbished culverts on town's outskirts.

They enable excess water to be held back in specially-built flood storage basins. Before the scheme was built, excess floodwaters could overtop the watercourse in the agricultural land on its approach to the culverts sending flows to cause flooding in the east of the town. Hydro International carefully-sized the flow controls to minimise upstream storage requirements.

Hydro-Brake® Flood Selection Criteria

Suitability:	For rivers & watercourses; Flood storage reservoirs		
Flow Range (l/s)	Head Range (m)	Ability to match greenfield discharge rate	On-site water storage requirement
550 – 12,000 *	1.5 – 10 *	n/a	Low
Moving Parts?	External Power?	Risk of blockage?	
No	No	Very low	

* higher flows and heads may be possible (contact Hydro International to discuss)

Hydro-Brake® Optimum

The Hydro-Brake® Optimum is Hydro International's flagship passive flow control device and the most advanced vortex flow control available.

Hydro-Brake® Optimum is the only vortex flow control for which the head and discharge relationship can be fine-tuned to optimise your design. Designers can size a Hydro-Brake® Optimum to achieve the perfect hydraulic performance curve and engineer the best possible passive flow control performance.



Surface water management and SuDS

Combined drainage systems and CSOs

Watercourse flood prevention

Sewer network optimisation

Wastewater treatment plants

- No external energy source.
- No moving parts.
- Future-proof.
- Large outlet clearances prevent blockages.

There is No Equivalent

Hydro-Brake® Optimum dispenses with the need to choose from a range of sizes and types and instead offers built-in flexibility to size each unit for absolute fit. Each Hydro-Brake Optimum® is individually-sized, so you achieve performance without compromise for every project.

Maximise Storage Savings

The increased hydraulic efficiency of the Hydro-Brake® Optimum means you can reduce on-site storage by up to 15% than if an alternative vortex control is used. With reduced storage, you can lower construction and excavation costs as well as saving project time and overall land-use.

Best Value for Every Project

Selecting the superior performance of Hydro-Brake® Optimum does not mean a higher cost for your project. On the contrary, because your upstream storage can be fine-tuned to achieve the smallest volumes, construction, excavation and material costs are reduced.

Easy to Install

Hydro-Brake® Optimum comes with a range of installation options and accessories to make construction and installation as simple as possible.

Setting the Standard

The Hydro-Brake® Optimum is the culmination of more than 35 years of research and development by Hydro International, and the company continues to take an international lead in vortex technology and expertise. Hydro-Brake® Optimum is the only vortex flow control to be independently certified by BBA and WRc.

BBA APPROVAL INSPECTION TESTING CERTIFICATION

WRc Approved PT/329/0412

Minimal Maintenance

With up to 20% larger outlet clearances compared to other vortex devices, there is significantly less risk of blockage with a Hydro-Brake® Optimum. With no power source or moving parts, it offers minimal, predictable maintenance.

Future-Proofed

Hydro-Brake® Optimum can be supplied with an adjustable inlet so flows can be altered by up to 40% post-installation, to allow for future changes in operating conditions, for example as a result of site expansion or climate change.

Flow Control Chamber

A Hydro-Brake® Optimum flow control can be supplied prefitted in a precast reinforced concrete chamber. Custom options including high level emergency bypass, rodding pipe and removable units are also available.

Case Studies



Tight Fit for New Homes

Engineers challenged to solve a “tight fjt” surface water management challenge on a West Yorkshire housing development used the Hydro-Brake® Optimum Design Tool to calculate a solution that optimised the limited pipe storage area. Using conventional fmw control devices would have required more back up storage than would fjt in the space available, but by using Hydro-Brake® Optimum fmood protection measures, challenging discharge limits were met for a 1 in 100 year storm.



‘Optimum’ Savings for Developer with 21st Century Drainage

The fjrst phase of Edinburgh City Council’s 21st Century Homes project, the Gracemount development showcases sustainable construction. A major feature of the drainage solution is Hydro International’s high performance Hydro-Brake Optimum® to control surface water which saved the developers over 30% in storage construction costs.

Photo courtesy of Edinburgh City Council

Hydro-Brake® Optimum Selection Criteria

Suitability:	Most sites, from very low to very high fmw rates		
Flow Range (l/s)	Head Range (m)	Ability to match greenfjeld discharge rate	On-site water storage requirement
0.7 – 550 *	0.4 – 4.0	Very good	Low
Moving Parts?	External Power?	Risk of blockage?	
No	No	Very low	

* lower fmows may be possible (contact Hydro International to discuss)



Explore the Options with our Online Design Tool

Hydro-Brake® Optimum Flow Control Design Tool is an online sizing engine that gives you the fmexibility to compare fmow control design options, output detailed design drawings and hydraulic data and import the results into commercially-available hydraulic modelling software.

www.hydrobrakeoptimum.com

Hydro-Brake® Hotline: 01275 337937
hydrobrake@hydro-int.com

Hydro-Brake® Agile

The Hydro-Brake® Agile flow control delivers precision engineering with best value for even the most constrained sites.

The Hydro-Brake® Agile flow control is a float-activated flow control that maintains a constant discharge to deliver precise performance over a wide range of heads. It is ideally suited to applications with constrained discharge requirements or where the flood storage area available through attenuation is very limited.





Surface water management and SuDS



Combined drainage systems and CSOs



Watercourse flood prevention



Sewer network optimisation



Wastewater treatment plants

- No external energy source.
- Rapid drain-down provides resilience to subsequent rainfall events.
- Future-proof – simple adjustments possible for future changes in operating conditions.
- Repeatable, predictable maintenance regime.

Meet Stringent Discharge Consents

Designing flood storage, whether above or below ground, is dependent on the rate at which excess water can be controlled and discharged. The Hydro-Brake® Agile flow control is the only flow control design that achieves a constant rate of discharge and therefore the minimum possible upstream storage.

Whether controlling surface water on a housing development, or regulating flows in a wastewater treatment works, investment in a precision-engineered device can result in considerable savings in total project costs.

Sustainable Solution

The Hydro-Brake® Agile flow control provides sustainable control of flood storage without the need for external power sources or control circuits. Simple adjustments can be made to future-proof the device to allow for climate change.

Quality Manufacture

The Hydro-Brake® Agile flow control is precision-engineered using high-grade stainless steel with long-life, durable components and CE marked in accordance with the EU Machinery Directive (2006/42/EC). Manufactured in the UK, the flow control can be transported quickly to site to meet project timescales.

Easy to Install and Maintain

During dry weather periods, and especially during the first flush of a storm, the outlet area is at its largest, reducing the risk of blockages.

In the event of a blockage, an integrated release mechanism can be operated from surface level, enabling the gate to be fully opened and returned to its operating position.

Hydro-Brake® Agile Flow Control Chamber

The Hydro-Brake® Agile flow control can be supplied pre-fitted in a precast reinforced concrete chamber for quick and easy installation on site.

A range of outlet pipe sizes is also available to suit site requirements. Once lifted into position, the connecting pipework can be connected and a cover slab installed. To suit the location and invert required, the chamber depth can be easily varied with concrete rings.

Example Solutions

Constrained Space

For an urban in-fill housing project in a heavily-developed inner city area, the design team were keen to deliver an effective drainage strategy. However, there was limited space available, conflicting demands from new and existing services, and an existing drainage infrastructure with very limited capacity to accept additional flows.

Using a flow control that provided a near-constant discharge rate within the parameters of the available downstream capacity, the surface water was moved off-site as quickly and effectively as possible, enabling the on-site storage to be reduced to a level that could be accommodated in the heavily constrained space available.

Constant Discharge

Providing temporary flood storage through attenuation was the solution to a known surface water flooding problem. A flow control was needed to limit flow to the existing drainage network, with the excess rainwater overflowing into an off-line attenuation tank. Implementation costs had to be kept to an absolute minimum or the project may not have been feasible. In addition, any surcharge to the upstream drainage network would have moved flooding to a different part of the catchment.

A constant discharge flow control was therefore used to pass forward an appropriate amount of flow at all times, minimising pressure on the upstream network and only putting floodwater into the attenuation structure when absolutely necessary.

Hydro-Brake® Agile Selection Criteria

Suitability:	Constrained sites with stringent discharge consents		
Flow Range (l/s)	Head Range (m)	Ability to match greenfield discharge rate	On-site water storage requirement
4.5 – 100	0.4 – 2.4	Good	Very low
Moving Parts?	External Power?	Risk of blockage?	
Yes	No	Not suited to all sites	

Hydro-Brake® Orifice

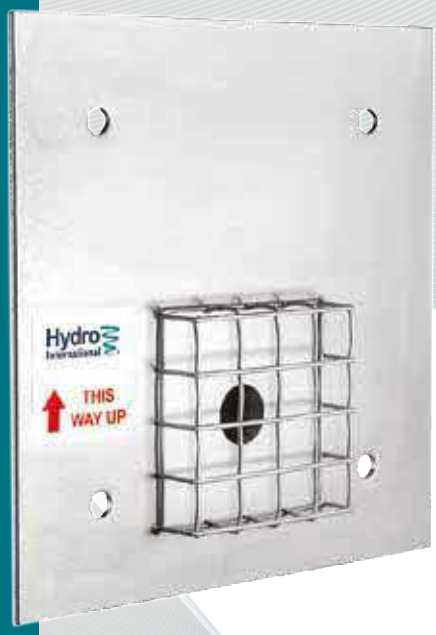
The Hydro-Brake® Orifice delivers cost-effective, precise, repeatable flow control and is suitable for unconstrained sites with generous discharge consents

The Hydro-Brake® Orifice is a precision-cut, sharp-edged orifice plate flow control, available in a broad range of configurations. A low-cost, low-complexity flow control, it is the ideal choice where there is minimal limitation on space available for on-site flood storage and attenuation, or where there are generous discharge consents.

Surface water management and SuDS

Watercourse flood prevention

Sewer network optimisation



Flexible and Versatile

Already trusted as part of Hydro International's family of precision-engineered flow control devices, the Hydro-Brake® Orifice can be designed and manufactured to meet a wide variety of configurations. With the Hydro-Brake® Orifice there is no need to compromise on your project needs.

Configured for Each Site

Each Hydro-Brake® Orifice is manufactured to suit the precise hydraulic requirements specified for the application. Our experienced professional engineering team will work with you to understand the needs of your site and recommend the best solution.

A wide variety of configurations and mounting options is available, for example integrated mesh guards, curve mount, pipe inserts and slide- or pivot-mounts. Hydro International can advise on sizing and flow rates and recommend the best solution for your site.

Quality Manufacture

The Hydro-Brake® Orifice is manufactured from high-grade stainless steel under strict Quality Assurance to the exacting methods and tolerances set out in the international standard BS EN ISO 5167-2: 2003.

Simple to Install

The Hydro-Brake® Orifice is simple to install. It can also be supplied pre-fitted in a precast reinforced concrete chamber for 'plug-and-play' installation on site.

Resilience by Design

The Hydro-Brake® Orifice can be supplied with integrated protection against the risk of blockages. Alternatively, the Hydro-Brake® Orifice can be mounted on moveable or removable structures to allow for manual intervention to drain the control chamber from surface level and clear any blockages that do occur.

Hydro-Brake® Orifice Selection Criteria

Suitability:	Unconstrained sites with generous discharge consents		
Flow Range (l/s)	Head Range (m)	Ability to match greenfield discharge rate	On-site water storage requirement
2.5 – 100 *	0.25 – 2.0 *	Not suited to all sites	Unconstrained
Moving Parts?	External Power?	Risk of blockage?	
No	No	Not suited to all sites	

* flows and heads may be possible outside of these ranges (contact Hydro International to discuss)

Hydro-Brake® Flow Control Series Selection Guide

The Hydro-Brake® Flow Control Series is a versatile toolbox for surface water, fluvial, foul water, and sewer network flow control. No matter what the site and budget, every flow control offers the same precision-engineered performance.

Features	Hydro-Brake® Flood	Hydro-Brake® Optimum	Hydro-Brake® Agile	Hydro-Brake® Orifice
Suitability	For watercourses; Flood storage reservoirs	Most sites, from very low to very high flow rates	Constrained sites with stringent discharge consents	Unconstrained sites with generous discharge consents
Flow Range (l/s) *	550 – 12,000	0.7 – 550	4.5 – 100	2.5 – 100
Head Range (m) *	1.5 – 10	0.4 – 4.0	0.4 – 2.4	0.25 – 2.0
Ability to Match Greenfield Discharge Rate	n/a	Very good	Good	Not suited to all sites
Moving Parts	No	No	Yes	No
External Power Requirement	No	No	No	No
Constant Discharge	No	No	Yes	No
On-site Storage	Low	Low	Very low	Unconstrained
Risk of Blockage	Very low	Very low	Not suited to all sites	Not suited to all sites

* flows and heads outside of these ranges may be possible (contact Hydro International to discuss)

Expert Design Support

No matter how big or small the project, Hydro International's professional engineers are on hand to provide free support to designers and specifiers to aid with the correct selection and configuration of Hydro flow controls for each project design.

Our dedicated design support team advises on best-practice sizing, flow and storage calculations for the Hydro-Brake® Flow Control Series within your surface water, fluvial, sewer or wastewater plant design.

Consultancy

Hydro International's Consultancy team is available for civil engineering, flood risk management and hydraulic system modelling for new and retrofit development, fluvial or wastewater treatment plant projects.

Documentation

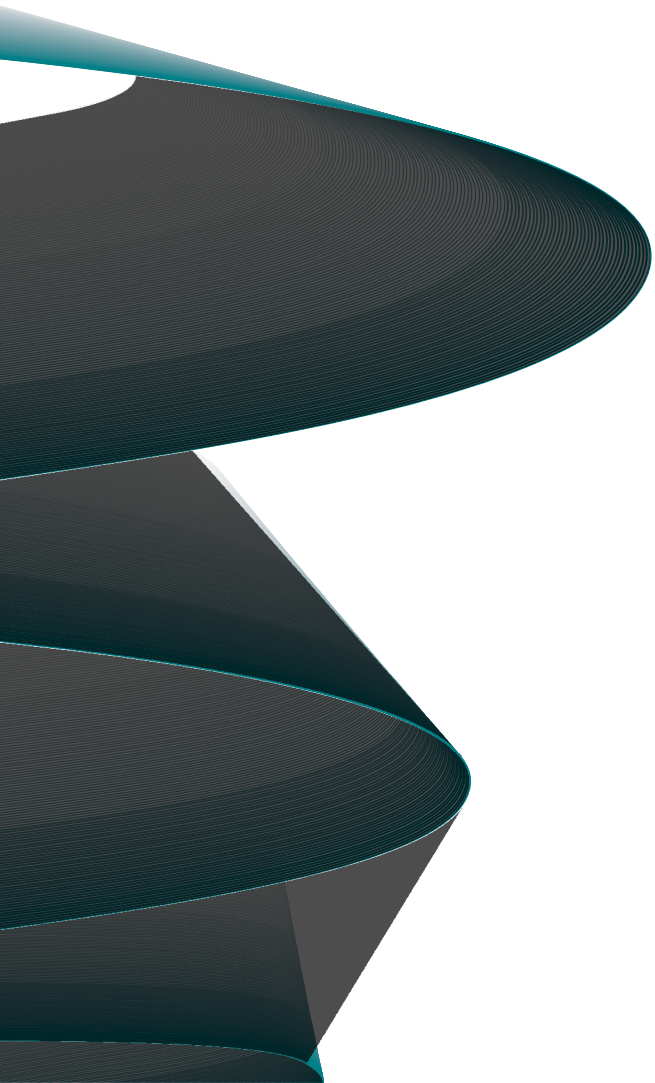
Our dedicated design support team can assist with the output of hydraulic data to support your system design and dimensioned installation drawings, as well as advising on successful integration with other Hydro International water treatment and storage products.

Call the Hydro-Brake® Hotline 01275 337937 or email hydrobrake@hydro-int.com.

For Flow Control
Product and Design Advice:

Tel: 01275 337937

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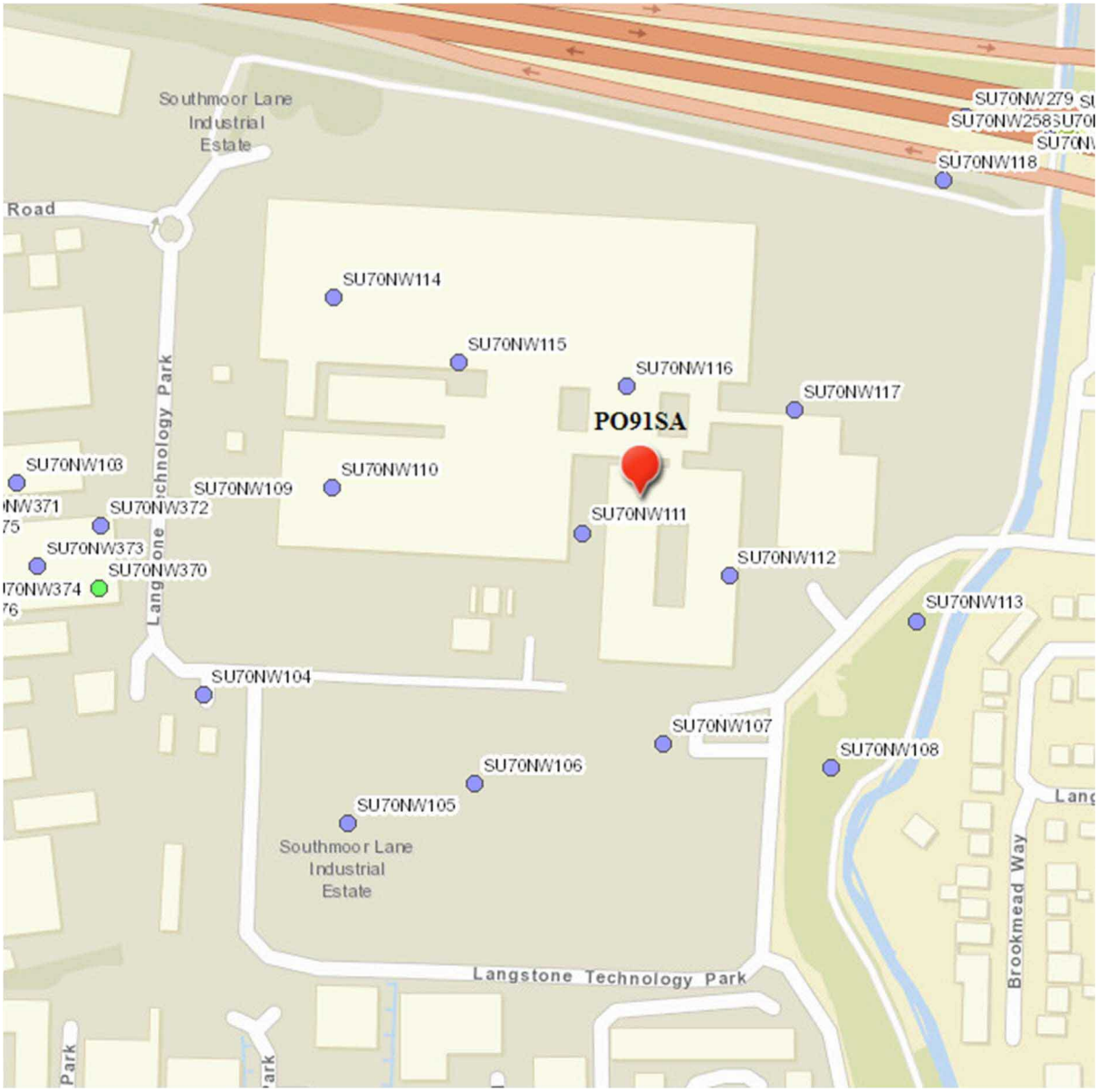
Turning Water Around...®

Rev C/0117

APPENDIX F

Borehole Logs

Borehole Location Log



SU70NW118

I. B. M.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 20

SU70NW/118

7147 0587

Type of Boring: Shell and auger

Dia. of boring: 6in. to 16ft 6in.

Lining tubes: 6in. to 16ft

Ground level: 5·18m 17·0' O.D.

Date started: 15-11-66

Date completed: 16-11-66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
15-11-66	nil		1' 0"	D		1' 6"	15·5'	Brown PEAT
5' 0"	nil	▽	2' 0"- 3' 0"	C(12)				Medium dense flint GRAVEL with some light grey-brown silty clay
	4' 0"		5' 0"- 6' 0"	C(19)		4' 6"	12·5'	
	5' 0"	5' 9"	8' 0"- 9' 0"	C(20) W				Medium dense flint GRAVEL with traces of chalk
	9' 0"		10' 0"- 11' 0"	C(45)				
	11' 6"		11' 9"	D		11' 6"	5·5'	
	11' 6"		12' 0"- 13' 6"	U4(115)				
15' 0"	13' 0"	10' 0"	14' 0"- 15' 0"	C(21)				Chalk COBBLES in a matrix of firm putty chalk
16-11-66 16' 6"	16' 0"	5' 0" 1' 5"	16' 6"	D				
	16' 0"		17' 0"- 18' 0"	C(12)				

END OF BOREHOLE
Depth: 16ft 6in.
Elevation: 0·5' O.D.

Key

- ▽ denotes ground-water first encountered
- U4( ) .. 4 in. dia. undisturbed sample
- U1½( ) .. 1½ in. .. .. ..
- D .. disturbed sample
- B .. bulk sample
- W .. water sample
- S( ) .. standard penetration test
- C( ) .. cone penetration test
- (24) .. number of blows
- • .. sample not recovered

Remarks

Scale: 1 in. = 8 Ft.

FIG. 21

Form No. 190 (Revised 9/65)

Marples Ridgway Limited

Site Investigation Division

SU70NW117

I.S.H.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 14

SU70NW/117

7140 0576

Type of Boring: Shell and auger

Dia. of boring: 8in. to 18 Ft 6in.

Lining tubes: 8in. to 14 Ft 6in.

Ground level: 15·4 O.D. (4-69)

Date started: 1-11-66

Date completed: 1-11-66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
1-11-66	nil		1' 0"	D		2' 0"	12·9'	Topsoil
5' 0"	5' 0"	▽	4' 0" - 5' 0"	C(45) B				
	5' 0"	5' 0"	0' 0"	W				
	7' 0"		7' 0" - 8' 0"	C(50)				Dense flint GRAVEL with traces of chalk
	10' 0" 11' 0"		10' 0" - 11' 0"	C(20) B				
	15' 0"		15' 0" - 16' 0"	C(34)		15' 0"	1·9'	
18' 0"	14' 0"	14' 0"	15' 0" - 16' 0"	1,4(67) H				Chalk COBBLES in a matrix of firm putty chalk

END OF BOREHOLE
Depth: 18Ft 6in.
Elevation: -1·1' O.D.

Key

▽ denotes ground-water first encountered
U4( ) " 4 in. dia. undisturbed sample
U1½( ) " 1½ in. " " "
D " disturbed sample
B " bulk sample
W " water sample
S( ) " standard penetration test
C( ) " cone penetration test
(24) " number of blows
• " sample not recovered

Remarks

Scale: 1 in. = 8 Ft.

FIG. 15

Form No. 190 (Revised 9/65)

Morples Ridgway Limited

Site Investigation Division

SU70NW107

I.B.M.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 4

SU 70 NW/107

7134 0560

Type of Boring: Shell and auger

Dia. of boring: 8in. to 28ft.

Lining tubes: 6in. to 27ft.

Ground level: 4.02m 13·2' O.D.

Date started: 11·11·66

Date completed: 12·11·66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
11·11·66	nil		1' 6"	D		1' 6"	11·7'	Topsoil
	nil		2' 6" - 3' 6"	C(20)				Firm dark grey calcareous silty CLAY with gravel
3' 0"	nil	▽	4' 0"	D		3' 0"	9·2'	
	4' 0"		5' 0" - 6' 0"	C(45)				Dense flint GRAVEL with grey sand
	7' 0"		8' 0" - 9' 0"	C(31)				
	9' 0"	5' 6"	9' 6"	B & W		9' 0"	4·2'	
	9' 6"		10' 6" - 11' 6"	C(65)				Very dense flint GRAVEL with some brown clayey fine sand
	12' 0"		12' 0"	D		11' 9"	1·5'	
	13' 0"		13' 0" - 14' 0"	S(16)				Firm light grey CLAY and brown sandy CLAY with traces of chalk
	14' 0"		14' 6"	B		14' 0"	-0·8'	
			15' 0" - 16' 0"	C(29)				
	16' 6"		17' 6" - 18' 6"	C(30)				
20' 6"	18' 6"	12' 0"	19' 0" - 20' 6"	U4(28)				Chalk COBBLES in a matrix of firm putty chalk with occasional flints
12·11·66	20' 0"	5' 6"	21' 0" - 22' 0"	C(18)				
	23' 0"		24' 0" - 25' 0"	C(12)				
	24' 6"		25' 0" - 25' 6"	B				
28' 0"	24' 0"		27' 0" - 28' 0"	C(21)				
	27' 0"	9' 0"						

END OF BOREHOLE
Depth: 28Ft.
Elevation: -14·6' O.D.

R.J.W.
20.10.83

Key

▽ denotes ground-water first encountered
U4( ) " 4 in. dia. undisturbed sample
U1½( ) " 1½ in. " " "
D " disturbed sample
B " bulk sample
W " water sample
S( ) " standard penetration test
C( ) " cone penetration test
(24) " number of blows
• " sample not recovered

Remarks

Scale: 1 in. = 8 Ft.

FIG. 5

Form No. 190 (Revised 9/65)

Murphy Ridgway Limited

Site Investigation Divisi

SU70NW106

I.B.M.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 3

SU70NW/106

7125 0558

Type of Boring: Shell and auger

Dia. of boring: 6in. to 164ft.

Lining tubes: 6in. to 154ft. 6in.

Ground level: 11·9' O.D.

Date started: 10-11-66

Date completed: 10-11-66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
10-11-66	nil		1' 8"	D		1' 0"	10·9'	Soft dark grey CLAY with topsoil and decayed vegetation
	nil		1' 8" - 3' 0"	U4(50)				Soft dark grey SILT with some peat
	nil		4' 5"	D		4' 0"	7·9'	
	nil		5' 0" - 6' 0"	S(8)				Soft light grey clayey SAND with some gravel
7' 0"	7' 0"	▽ 5' 6"	7' 0"	D & W		6' 6"	5·4'	
	7' 0"		8' 0" - 9' 0"	C(64)				Dense flint GRAVEL with some chalk
	8' 0"		8' 0" - 10' 6"	B				
	10' 0"		11' 0" - 12' 0"	C(55)				
	12' 6"		12' 0"	D		12' 6"	- 6'	
	12' 6"		13' 6" - 14' 6"	C(26)				Chalk COBBLES in a matrix of firm putty chalk with some flints
16' 0"	16' 6"	1' 0"	14' 0" - 16' 0"	E				
	16' 6"		16' 0"	D				
	16' 6"		16' 6" - 17' 6"	C(56)				

END OF BOREHOLE
Depth: 16ft
Elevation: -4·1 O.D.

R.J.M. 3.10.83

Key

▽ denotes ground-water first encountered
U4( ) " 4 in. dia. undisturbed sample
U1½( ) " 1½ in. " " "
D " disturbed sample
B " bulk sample
W " water sample
S( ) " standard penetration test
C( ) " cone penetration test
(24) " number of blows
• " sample not recovered

Remarks

Scale: 1 in. = 8 Ft.

FIG. 4

Form No. 190 (Revised 9/65)

Marples Ridgway Limited

Site Investigation Division

SU70NW105

I.B.H.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 2

SU70NW/105
7119 0556

Type of Boring ..... Shell and auger
Dia. of boring ..... 6in. to 17Ft. 6in.
Lining tubes ..... 6in. to 17Ft.

Ground level 12·9' O.D.
Date started 9-11-66
Date completed 9-11-66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
9-11-66	nil		1' 0"	D		1' 0"	11·7'	Topsoil
	nil		1' 0" - 5' 0"	U4(75)				Firm brown sandy CLAY with medium gravel and traces of chalk
	nil		5' 0" - 6' 0"	C(20)				
7' 0"	6' 0"	⊻	6' 0"	D		6' 0"	6·9'	
	6' 0"		7' 0" - 8' 0"	C(45)				Dense flint GRAVEL with some putty chalk
	9' 0"		9' 0"	D		9' 0"	3·9'	
	10' 0"		10' 0" - 12' 0"	U4(64)				Firm grey CLAY and brown sandy CLAY with traces of chalk and flints
	10' 0"		12' 0" - 14' 0"	B				
	15' 0"		14' 0" - 15' 0"	C(51)		14' 0"	-1·0'	
17' 0"	15' 0"	4' 0"	16' 0" - 17' 0"	U4( ) *				Firm putty CHALK with flints
	15' 0"		16' 0" - 17' 0"	B & W				
	17' 0"		18' 0" - 19' 0"	C(82)				

END OF BOREHOLE
Depth: 17Ft. 6in.
Elevation: -4·6' O.D.

A.J.W. 20.10.67

Key

⊻ denotes ground-water first encountered
U4( ) " 4 in. dia. undisturbed sample
U1½( ) " 1½ in. " "
D " disturbed sample
B " bulk sample
W " water sample
S( ) " standard penetration test
C( ) " cone penetration test
(24) " number of blows
* " sample not recovered

Remarks

Scale: 1 in. = 8 Ft.

FIG. 3

Form No. 190 (Revised 9/65)

Marples Ridgway Limited

Site Investigation Division

SU70NW104

SU70NW/104

I.B.M.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 1 7112 0562

Type of Boring: Shell and auger
Dia. of boring: 6in. to 19ft 6in.
Lining tubes: 6in. to 19ft.

Ground level: 14·1' O.D. 4·30m
Date started: 5-11-66
Date completed: 8-11-66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
5-11-66	nil		1' 6"	D		1' 0"	13·1'	Topsoil
	nil		2' 6" - 3' 6"	C(55)				Firm brown sandy CLAY with gravel
	nil		4' 3"	D		4' 0"	10·1'	
6' 0"	6" 6' 0"	2' 3" 6' 0"	5' 0" - 6' 0"	C(57)		6' 0"	8·1'	Firm brown putty CHALK with flints and firm brown CLAY with fine gravel
8-11-66	7' 0"	5' 9"	8' 0" - 9' 0"	C(15)				Dense flint GRAVEL with some firm putty chalk
	10' 0" 12' 0" 13' 0"	7' 3"	11' 0" - 12' 0" 12' 0" 13' 0" - 15' 0"	C(29) W B				
	15' 0"		14' 0" - 15' 0"	C(45)				
	18' 0"		17' 0" - 18' 0"	C(32)				
19' 6"	19' 0" 19' 0"	5' 0"	19' 6" 20' 0" - 21' 0"	D C(42)				
								END OF BOREHOLE Depth: 19ft 6in. Elevation: -5·4' O.D.

Key

- ▽ denotes ground-water first encountered
- U4( ) .. 4 in. dia. undisturbed sample
- U1½( ) .. 1½ in. .. .. ..
- D .. disturbed sample
- B .. bulk sample
- W .. water sample
- S( ) .. standard penetration test
- C( ) .. cone penetration test
- (24) .. number of blows
- • .. sample not recovered

Remarks

A standpipe was installed at a depth of 10ft 6in. below ground level.

Scale: 1 in. = 8 Ft.

FIG. 2

Form No. 190 (Revised 9/63)

Morples Ridgway Limited

Site Investigation Division

SU70NW109

I.S.M.

PROPOSED DEVELOPMENT AT BROOKSIDE ROAD, HAVANT, HAMPSHIRE

RECORD OF BOREHOLE No. 6

SU 70 NW/109

7111057.1

Type of Boring ..... Shell and auger

Dia. of boring ..... 6in. to 18ft 6in.

Lining tubes ..... 6in. to 15ft 6in.

Ground level ..... 13·9 O.D. (4·24m)

Date started 10-11-66

Date completed 10-11-66

Date and Depth of Boring	Depth of Casing	Water Level	Samples: Depth	Samples: Type	Change of Strata: Legend	Change of Strata: Depth	Change of Strata: Reduced Level	Description of Strata
10-11-66	nil		1' 6"	D		1' 6"	12·4	Topsoil
			3' 0" - 4' 6"	U4(51)		4' 9"	9·2	Soft brown silty CLAY
	5' 0"		5' 6"	D		6' 0"	7·9	Very soft light grey-brown silty CLAY with gravel and traces of chalk
6' 6"	6' 6"	▽ 6' 6"	7' 6"	W				Dense flint GRAVEL
	6' 6"		7' 0" - 8' 6"	C(58) B				
	10' 0"		10' 6" - 11' 6"	C(89)		10' 0"	3·9	Soft brown sandy CLAY with flints
						10' 6"	3·4	Very dense flint GRAVEL with some light brown sandy clay and traces of chalk
	15' 0"		15' 6" - 16' 6"	C(57) B		15' 0"	0·9	Firm brown putty CHALK with flints and firm brown CLAY with fine gravel
	15' 0"		15' 0" - 15' 6"	U4(125)		16' 0"	-2·1	Chalk COBBLES in a matrix of firm putty chalk
18' 6"	15' 6"	4' 6"	17' 6" - 18' 6"	C(60) D				

END OF BOREHOLE

Depth: 18ft 6in.

Elevation: -4·6 O.D.

R.T.W.

2.10.83

Key

▽ denotes ground-water first encountered

U4( ) " 4 in. dia. undisturbed sample

U1½( ) " 1½ in. " "

D " disturbed sample

B " bulk sample

W " water sample

S( ) " standard penetration test

C( ) " cone penetration test

(24) " number of blows

• " sample not recovered

Remarks

Scale: 1 in. = 8 Ft.

FIG. 7

Site Investigation Division

Form No. 190 (Revised 9/65)

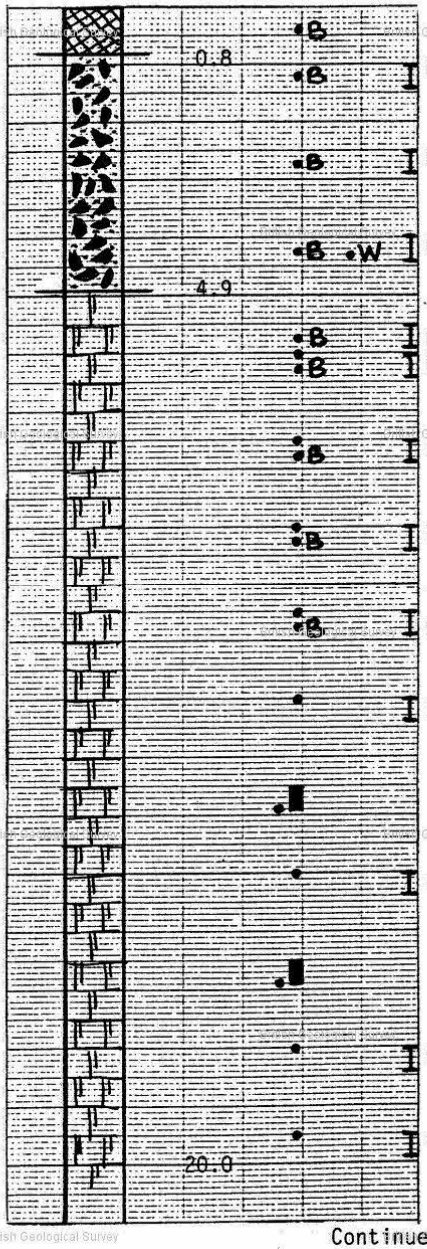
Marples Ridgway Limited

SU70NW370

SITE SOUTHMOOR LANE, HAVANT FIGURE 2a

BOREHOLE 1 DIAMETER 150 mm DEPTH 25.0 m DATE 28-29/11/91

Scale: 1:100



TOPSOIL and rubble FILL

Medium dense/dense silty clayey very sandy fine, medium and coarse flint GRAVEL with some chalk nodules

Moderately strong/strong white CHALK with some flints

100mm diameter core sample

• disturbed sample

I N (Test 19, BS 1377.1975)

NR ... non-recovery

•W ... water sample

•B ... bulk sample

APPENDIX G

Operation and Maintenance

TABLE B.25 SuDS maintenance inspection checklist

General information			
Site ID			
Site location and co-ordinates (GIS if appropriate)			
Elements forming the SuDS scheme		Approved drawing reference(s)	
Inspection frequency		Approved specification reference	
Type of development		Specific purpose of any parts of the scheme (eg biodiversity, wildlife and visual aspects)	

Inspection date								
	Details	Y/N	Action required	Date completed	Details	Y/N	Action required	Date Completed
General inspection items								
Is there any evidence of erosion, channelling, ponding (where not desirable) or other poor hydraulic performance?								
Is there any evidence of accidental spillages, oils, poor water quality, odours or nuisance insects?								
Have any health and safety risks been identified to either the public or maintenance operatives?								
Is there any deterioration in the surface of permeable or porous surfaces (eg rutting, spreading of blocks or signs of ponding water)?								
Silt/sediment accumulation								
Is there any sediment accumulation at inlets (or other defined accumulation zones such as the surface of filter drains or infiltration basins and within proprietary devices)? If yes, state depth (mm) and extent. Is removal required? If yes, state waste disposal requirements and confirm that all waste management requirements have been complied with (consult environmental regulator)								

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TABLE B.25 SuDS maintenance inspection checklist

Inspection date								
	Details	**Y/N**	**Action required**	**Date completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Is surface clogging visible (potentially problematic where water has to soak into the underlying construction or ground (eg underdrained swale or infiltration basin)?								
Does permeable or porous surfacing require sweeping to remove silt?								
System blockages and litter build-up								
Is there evidence of litter accumulation in the system? If yes, is this a blockage risk?								
Is there any evidence of any other clogging or blockage of outlets or drainage paths?								
Vegetation								
Is the vegetation condition satisfactory (density, weed growth, coverage etc)? (Check against approved planting regime.)								
Does any part of the system require weeding, pruning or mowing? (Check against maintenance frequency stated in approved design.)								
Is there any evidence of invasive species becoming established? If yes, state action required								
Infrastructure								
Are any check dams or weirs in good condition?								
Is there evidence of any accidental damage to the system (eg wheel ruts?)								
Is there any evidence of cross connections or other unauthorised inflows?								
Is there any evidence of tampering with the flow controls?								

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TABLE B.25 SuDS maintenance inspection checklist

Inspection date								
	Details	**Y/N**	**Action required**	**Date completed**	**Details**	**Y/N**	**Action required**	**Date Completed**
Are there any other matters that could affect the performance of the system in relation to the design objectives for hydraulic, water quality, biodiversity and visual aspects? (Specify.)								
Other observations								
Information appended (eg photos)								
Suitability of current maintenance regime								
Continue as current Increase maintenance Decrease maintenance								
Next inspection								
Proposed date for next inspection								

BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

An introduction to sustainable drainage systems or SuDS

SuDS are a new environmentally friendly approach to managing rainfall that uses landscape features to deal with surface water. SuDS aim to:

- control the flow, volume and frequency of water leaving a development area
- prevent pollution by intercepting silt and cleaning runoff from hard surfaces
- provide attractive surroundings for the community
- create opportunities for wildlife.

SuDS at Robinswood Primary School and Matson Park

The SuDS are designed to prevent flooding of Robinswood Primary School and to control the flow of water from springs in Matson Park using attractive landscape features.

- A low bank has been constructed in the park as a dam when water flows down the route of an old ditch during heavy rain.
- The everyday flow from springs above the path in the park has been directed along a new stream in the park, which keeps a new wildlife pond full of water but also allows it to soak into the ground or flow onward to a controlled outfall into the school grounds.
- The controlled outfall into the school grounds allows heavy rainfall to leave the park slowly and make its way through green space above the school playing field.
- Exceptional storms or prolonged heavy rain can overflow from the park across a grass weir on the bank into the "environment space" at the top of the playing field retained by a low bank running along the contour to the old oak tree.
- The school wildlife pond, with a toddler fence around it, gives children in the school an opportunity to learn about animals and plants that live in water and to understand how the SuDS control system works.
- Water will slowly soak into the ground as it travels along the SuDS system, but in exceptional storms some water may overflow down the side of the playing field towards the road as it did in the past but without going through the school first.

Managing the SuDS

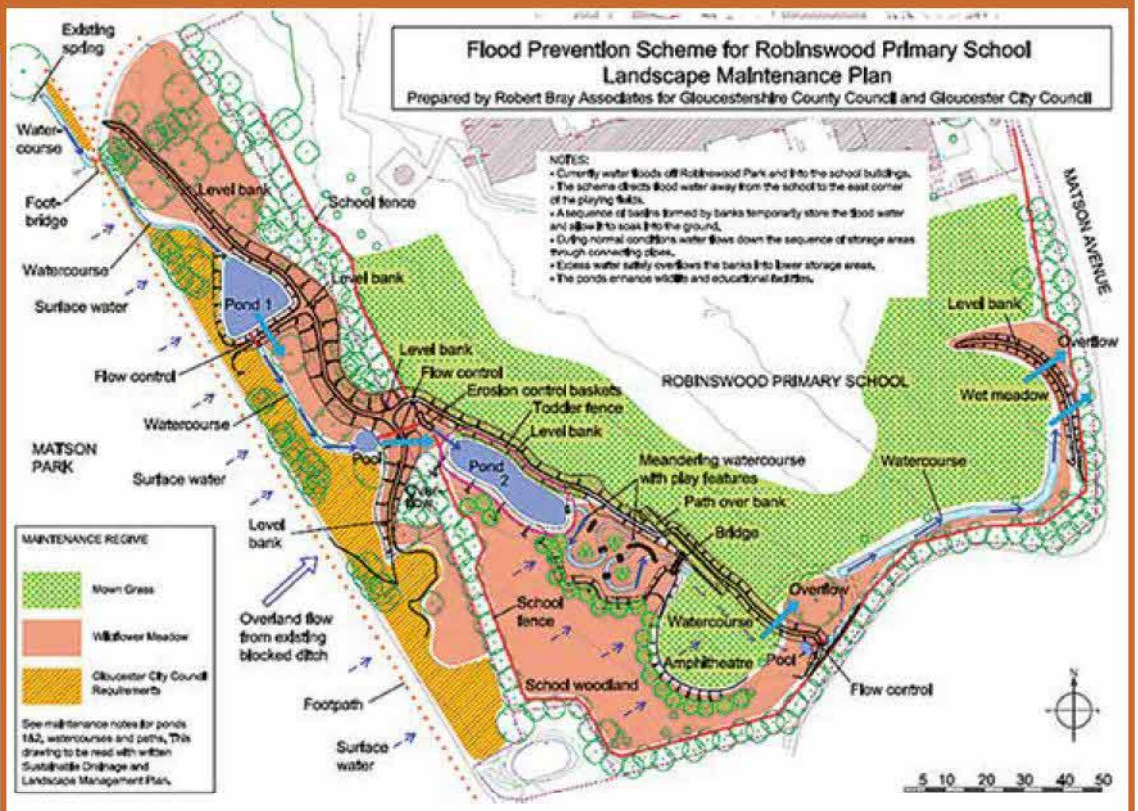
The SuDS at Robinswood Primary School have been designed for easy maintenance to comprise:

- regular day-to-day care – litter collection, grass cutting and checking the inlets and outlets where water enters or leaves a SuDS feature
- occasional tasks – managing pond vegetation and removing any silt that builds up in the SuDS features
- remedial work – repairing damage where necessary.

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School



Matson Park SuDS management

The SuDS sequence begins where the springs emerge above the path, near the park entrance from Underhill Road, and take a changed route under a new bridge to form a stream in the park.

Action:

- Strim or mow grass where the springs emerge and allow vegetation to grow to at least 100 mm or to full height annually in the low flow channel or stream bed.

The new stream carries water to the first wildlife pond (Pond 1 – see site plan).

Action:

- Mow the path verge and grass up to the stream as current practice by GCC.
- Cut stream vegetation annually in September–November, removing cuttings to a wildlife pile or from site.
- Allow grass beyond the stream to develop as meadow and cut at 100 mm September–November removing cuttings to a wildlife pile or from site.

The wildlife pond will develop wetland vegetation round the edge with reasonably short grass towards the park side to allow people to look at the water.

Longer meadow grass on the far side of the pond and beyond the stream will provide a home for wildlife and an opportunity for creative play.

Action:

- Mow the path verge and grass up to the stream and pond edge from park side as current practice by GCC.
- Cut meadow grass beyond stream at 100 mm September–November removing cuttings to a wildlife pile or from site.

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

- Monitor how the pond edge develops, and cut 30% of vegetation at 100 mm each year during September–November, if required, removing cuttings to wildlife piles or from site.
- Occasionally remove pond vegetation, if it spreads across the pond, by hand clearing, raking or machine clearance, using a 1–3 tonne tracked vehicle, with cuttings removed to wildlife piles or from site.
- Check the outlet from the pond and the inlet on the other side of the bank are clear.

The stream flows onward from the pond through grass to a "micropool", before it leaves the park through a final outlet into the school grounds "environment space" at the top of the playing field.

There is a grass overflow weir over the bank down to the school fence which should be cut annually to ensure that erosion does not occur. Brambles should be allowed to re-colonise the base of the bank on the school side for security reasons.

Action:

- Mow path verge and grass to the stream from the park side as current practice by GCC.
- Cut meadow grass beyond stream at 100 mm September–November removing cuttings to a wildlife pile or from site.
- Cut "micropool" vegetation annually September–November, if required, removing cuttings to a wildlife pile or from site.
- Cut overflow weir as meadow grass at 100 mm September–November removing cuttings to a wildlife pile or from site.

Robinswood Primary School SuDS management

Water from the Matson Park flows slowly through the bank, or overflows over a grass weir in exceptional rainfall. The water arrives on the school site through the fence onto a stone-filled basket channel flowing along a grass swale to the second wildlife pond and "environment space" (Pond 2 see site plan).

Action:

- Strim or mow grass around stone-filled basket channel and along the swale to the pond at 100 mm with grass at maximum height 150 mm.

The school wildlife pond will develop a wetland edge along the 1 m wide wet ledge before rising up to a flat dry ledge (or bench) provided for safety.

Action:

- Allow grass beyond the pond and away from the school side to develop as meadow and cut at 100 mm in September–November removing cuttings to a wildlife pile on site.
- On the school side, cut the grass regularly at 100 mm with grass at maximum height 150 mm for access.
- Monitor pond vegetation and cut 30% of edge at 100 mm each year, if necessary, during September–November, removing cuttings to wildlife piles.
- Occasionally remove pond vegetation if it spreads across the pond by hand clearing or raking being careful not to damage the pond liner.

The water leaves the pond under a small bridge into a swale maze flowing to a flat activity area.

Water leaves the southern end of the environment space through an outlet in the bank with a micropool in front of it.

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Action:

- Cut the grass in the swale maze channel once each year, September–November, at 100 mm removing cuttings to wildlife piles.
- Cut grass paths, verges and the flat activity area at 35–50 mm with 75 mm maximum, leaving cuttings *in situ* or remove to wildlife piles.
- Cut all other areas within the environment space as meadow cut at 100 mm in September–November removing cuttings to a wildlife pile on site during school summer holiday.
- Check that the outlet and the inlet on each side of the bank is clear.

Should water reach the outlet from the environment space then it will flow down a grass swale, a flat bottomed grass channel, to another holding basin before overflowing slowly through the boundary onto the road.

Action:

- Cut the shallow swale and meadow as part of normal playing field maintenance.

SuDS and landscape maintenance – summary

		Frequency	Unit Rate	Total
Regular maintenance				
1	**Litter management**			
1.1	Pick up all litter in SuDS and landscape areas and remove from site	12 visits monthly		
2	**Grass maintenance – all cuttings to wildlife piles**			
2.1	Mow all grass verges, paths and amenity at 35–50 mm with 75 mm max, leaving grass *in situ*	As required or monthly		
2.2	Mow all dry swales, dry SuDS basins and margins to low flow channels and other SuDS features at 100 mm with 150 mm max Cut wet swales or basins annually as wildflower areas	4–8 visits as required Annually		
2.3	Wildflower areas strimmed to 50 mm in September or at the end of school holidays Or Wildflower areas strimmed to 50 mm on 3 year rotation 30% each year	1 visit annually 1 visit annually		
3	**Inlets and outlets**			
3.1	Inspect monthly, remove silt from slab aprons and debris, strim 1 m round for access	12 visits monthly		
4	Hard surfaces – not applicable			
4.1	Sweep all paving regularly, sweep and suction brush permeable paving in autumn after leaf fall	1 visit		
Occasional tasks				
5	**Inspection and control chambers – not applicable**			
5.1	Annual inspection, remove silt and check free flow	1 visit		

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

		Frequency	Unit Rate	Total
6	**Wetland and pond vegetation**			
6.1	Wetland vegetation to be cut at 100 mm on 3–5 year rotation, 30% each year, all cuttings to be removed to wildlife piles or from site	As required		
7	**Silt management**			
7.1	Inspect swales, ponds, wetlands annually for silt accumulation	1 visit		
7.2	Excavate silt, stack and dry within 10 m of the SuDS feature, but outside the design profile where water flows, spread, rake and overseed	As required		
8	**Native planting**			
8.1	Remove lower branches where necessary to ensure good ground cover to protect soil profile from erosion	1 visit annually		
Remedial work				
9	**Inspect SuDS system regularly to check for damage or failure** **Undertake remedial work as required**	**As required**		

SuDS scheme checklist

SuDS schemes include landscape features and control structures to manage runoff as it flows to site outfalls. The following lists the SuDS components and extra features which may be found on a site.

- **Filter strips** are grass verges that allow runoff to flow through vegetation to a swale, wetland, infiltration area or other SuDS component.
- **Swales** are linear, flat-bottomed grassed or vegetated channels that convey water from one place to another. They can also store water and allow it to soak into the ground.
- **Underdrained swales** are stone-filled trenches with a perforated pipe in the bottom covered by engineered sandy soil and turf. These intercept dirty water and allow it to soak into the ground or lead it to a water storage feature.
- **Filter drains** clean, store and convey water to another feature or allow it to soak into the ground. They are stone-filled trenches, sometimes with a perforated pipe in the bottom. These may be enlarged to treat dirty water, as treatment trenches, or increase soakage into the ground, as infiltration trenches.
- **Permeable surfaces** are permeable block paving, porous asphalt, gravel or free-draining soils that allow rain to percolate through the surface into underlying drainage layers. They should be protected from silt, sand, compost, mulch etc.
- **Infiltration basins, trenches, soakaways** and most of the preceding SuDS features allow water to soak into the ground.
- **Basins, ponds and wetlands** are depressions in the ground where water is stored and treated. Water levels rise after rain and then drop to the normal level as the excess soaks into the ground or is released slowly to a watercourse or drain. Some water may be held back as a pond for final treatment, amenity or wildlife interest.
- **Bioretention areas** are planted areas with engineered topsoil over drainage layers that allow water to soak into the ground.

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

- **Green roofs** are planted with sedum or other plant material. They clean and absorb water allowing it to evaporate. Excess water is drained from the roof to other SuDS features.
- **Inlet and outlets structures** are often conveyance pipes protected with mesh guards. They should be free from obstruction at all times to allow free flow through the SuDS.
- **SuDS flow control structures** are usually small orifices in control chamber, slots or V-notches in weirs. They are usually near the surface, so are accessible and easy to maintain. They may be in baskets, in small chambers or in the open.
- **Inspection chambers** and rodding eyes are used on bends or where pipes come together. They allow cleaning of the system if necessary.
- **Overflows** can be below ground through gratings and chambers or over grass weirs in the open. They should be kept clear at all times to protect areas from flooding.
- **Flood routes (exceedance routes)** allow water volumes exceeding the capacity of the SuDS system to escape from the site without causing damage to property. This route should be clear of obstructions at all times.

SuDS design usually avoids use of below-ground structures such as gully pots, oil separators and other sumps, which are a wildlife hazard, often ineffective and expensive to maintain. SuDS design also reduces pipework, manholes and interceptors. However, water may be conveyed in surface features such as rills and channels, with changes in level managed in spouts or cascades. These hard landscape features require standard landscape maintenance.

Sustainable drainage maintenance specification

General requirements

General requirements	
Maintenance activities comprise ▪ regular maintenance ▪ occasional tasks ▪ remedial work	Frequency
Generally Litter Collect all litter or other debris and remove it from site at each site visit	Monthly

- **Avoid** use of weed-killers and pesticides, to prevent chemical pollution.
- **Avoid** de-icing agents wherever possible to allow bioremediation of pollutants in permeable surfaces.
- **Protect** all permeable, porous and infiltration surfaces from silt, sand, mulch and other fine particles.

Exclusions

- Maintenance of rainwater harvesting chambers, pumps etc.

Filter strips and swales

- **Filter strips** are grass verges next to hard surfaces that allow runoff to flow through vegetation, removing silt and pollution.
- **Swales** are linear, flat-bottomed grassed or vegetated channels that convey water from one place to another, which can also store water and allow it to soak into the ground.
- **Underdrained swales** are free-draining swales with stone-filled trenches in the bottom covered by engineered sandy soil and turf that clean dirty water and allow it to soak into the ground or lead it to a water storage feature.

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Filter strips and swales	
Regular maintenance	**Frequency**
Grass Mow amenity grass access paths and verges surrounding swales and filter strips at 35–50 mm minimum and 75 mm maximum or as specified. Mow filter strips and swales at 100 mm with 150 mm maximum to filter and control runoff in normal grass swales, removing first and last cut in season, and if grass is longer than 150 mm removing cuttings to wildlife piles on site. Where marsh or wetland develops in the swale due to wet conditions then cut annually, or as required, at 100 mm, removing cuttings to wildlife piles on site	Monthly or as required Monthly or as required Annual or as required
Occasional tasks	**Frequency**
Where there is a build-up of silt on the filter strip, swale, underdrained swale or at inlets, ie 50 mm or more above the design level, then remove and spread on site. Undertake when ground is damp in autumn or early spring and transplant turf and overseed to original design levels. Spread excavated material on site above SuDS design profile, eg top of banks, in accordance EA (2010)	As required
Remedial work	**Frequency**
All damage to be made good to design profile unless there is a design flaw	As required

Filter drains

- **Filter drains** are stone-filled trenches, sometimes with a perforated pipe in the bottom, that collect, clean and store runoff before conveying the water to another SuDS feature or allowing it to soak into the ground.
- **Treatment trenches** are enlarged filter drains designed to treat a known volume of dirty water or increase soakage into the ground. They may also be used to intercept overland flows, when they are referred to as **cut off drains**.

Filter drains and infiltration trenches	
Regular maintenance	**Frequency**
Grass edges Mow 1 m min. wide grass surround to drain at 100 mm and 150 mm maximum to filter runoff and protect drain from silt	Monthly or as required
Occasional tasks	**Frequency**
Weeds Hand pull or spot treat individual weed growth, only if necessary, ensuring that weed-killer does not enter the filter drain. Weed growth usually dies in dry weather	As required
Remedial work	**Frequency**
Siltation at surface Where there is no protective geotextile, remove all stone and perforated pipe replacing as original spec. and include separating geotextile as below. Where there is a separating geotextile (see spec.) then remove surface stone layer and separating geotextile that protects the stone drain below. Replace geotextile and top stone layer	As required

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Pervious pavements

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

Pervious pavements	
Regular maintenance	**Frequency**
Cleaning Brush regularly and remove sweepings from all hard surfaces	Monthly
Occasional tasks	**Frequency**
Permeable pavements: Brush and vacuum surface once a year to prevent silt blockage and enhance design life	Annually
Remedial work	**Frequency**
Monitor effectiveness of permeable pavement, and when water does not infiltrate immediately advise the client of possible need for reinstatement of top layers or specialist cleaning. Recent experience suggests that jet washing and suction cleaning will substantially reinstate pavement to 90% efficiency	As required

Infiltration systems – soakaways, infiltration trenches and infiltration basins

- **Infiltration basins, trenches, soakaways** and most of the preceding SuDS features allow water to soak into the ground.

Soakaways, infiltration trenches and infiltration basins	
Regular maintenance	**Frequency**
Grass edges Mow 1 m min. wide grass surround to drain at 100 mm and 150 mm maximum to filter runoff and protect infiltration structure from silt	Monthly or as required
Infiltration basins Protect grass surface from compaction and siltation and manage main area of basin for design function or appearance	As required
Occasional tasks	**Frequency**
Infiltration basins Where there is a build-up of silt in the basin at inlets (ie 50 mm or more above the design level), remove when the ground is damp in autumn or early spring and turf to the original design levels. Spread excavated material on site above SuDS design profile (eg top of banks), in accordance with EA (2010).	As required
Infiltration trench Hand pull or spot treat individual weed growth, only if necessary, ensuring that weed-killer does not enter the drain and inhibit natural breakdown of pollutants	As required
Remedial work	**Frequency**
Infiltration basin Where the infiltration basin is compacted, reinstate by removal of silt and de-compaction of the surface by scarifying, spiking or the use of hollow tines to the basin area	As required

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Detention basins, ponds and wetlands

- Detention basins, ponds and wetlands are depressions in the ground that store water. Water levels rise after rain and then drop to the normal level as the excess soaks into the ground or is released slowly to a watercourse or drain. Some water is often held back in a pond or wetland for final "polishing" treatment or amenity interest.
- Detention basins are usually dry.
- Ponds can be permanent or temporary and are mainly open water.
- Wetlands are mainly aquatic vegetation but can have small areas of open water like ponds.

Detention basins, ponds and wetlands	
Regular maintenance	**Frequency**
Grass Mow grass access paths and verges surrounding basins, ponds and wetlands areas at 35–50 mm minimum and 75 mm maximum, or as specified, to provide a cared-for appearance and allow pedestrian access	Monthly or as required
Mow rough grass areas for occasional access or habitat reasons at 100 mm and maximum 150 mm with cuttings removed to wildlife piles	As required, 4–6 times annually
Grass areas not required for access may be managed for wildlife interest and to reduce costs. Two cuts in July and September or one cut annually in September or October as specified, and cuttings removed to wildlife piles	Annually or as required
Wet woodland management Manage annually as detailed spec. with cuttings left in situ or removed to wildlife piles	Annually or as required
Wetland vegetation Cut (strim) at 100 mm with cuttings removed to wildlife piles September–October Or Maintain as a mosaic to be cut 25–30% in any one year at 100 mm in September or October with cuttings removed to wildlife pile	Annually or as required
Occasional tasks	**Frequency**
Where silt accumulates on apron or area in front of inlet or outlet, remove and land apply within design profile of SuDS. Where silt accumulates more than 150 mm in base of wetland, undertake a phased removal of silt subject to client approval. Confirm whether a liner is present to hold water or prevent pollution of groundwater and protect. Remove silt as instructed, but not more than 30% of pond or wetland area at any one time and to an agreed depth but not the subsoil layer. Retain as much representative existing vegetation as possible to ensure rapid re-colonisation of open areas. Stack excavated material adjacent to wetland to allow de-watering of silt. Undertake silt removal during September–October to minimise damage to protected wildlife and ensure regrowth of aquatic vegetation before winter. Spread excavated material on site above SuDS design profile, eg top of banks, in accordance with EA (2010).	Annually or every 3 years, as required

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Detention basins, ponds and wetlands	
Remedial work	**Frequency**
Although not usually required, this may be needed due to damage to liners or control structures	Undertake as design details or as required

Inlets, outlets, controls and inspection chambers

- **Inlets and outlets structures** may be surface structures or conveyance pipes with guards or headwalls. They should be kept free from obstruction at all times.
- **SuDS flow control structures** can be protected orifices, slots weirs or other controls at or near the surface to be accessible and easy to maintain. They may be in baskets, in small chambers or in the open.
- **Inspection chambers** and rodding eyes are used on bends or where pipes come together and allow cleaning of the system if necessary. They should be designed out of the system where possible.

Inlets, outlets, controls and inspection chambers	
Regular maintenance	**Frequency**
Inlets, outlets and surface control structures Inspect surface structures, removing obstructions and silt as necessary. Check there is no physical damage. Strim vegetation 1 m min. surround to structures and keep hard aprons free from silt and debris	Monthly Monthly
Inspection chambers and below-ground control chambers Remove cover and inspect, ensuring that water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in autumn	Annually
Occasional maintenance	
Check topsoil levels are 20 mm above edges of baskets and chambers to avoid mower damage	As necessary
Remedial work	**Frequency**
Unpack stone in basket features and unblock or repair and repack stone as design detail as necessary	As required
Repair physical damage if necessary	As required

Overflows and flood routes

- **Overflows** are overland across weirs, through gratings or within chambers and should be kept clear at all times to protect areas from flooding. They allow onward flow when part of the SuDS system is blocked.
- **Flood routes (exceedance routes)** allow water volumes that exceed the capacity of the SuDS system to pass through or round the site without causing damage to property. These routes should be clear of obstructions at all times.

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Overflows and flood routes	
Regular maintenance	**Frequency**
Overflows – Jet the pipes leading from overflow structures annually and check by running water through the overflow. Check free flow at next SuDS feature – inlet to basin or chamber	Annually
Overflows – Remove any accumulated grass cuttings or other debris on top of grass weirs or stone-filled baskets overflows	Monthly
Flood routes – Make visual inspection. Check route is not blocked by new fences, walls, soil or other rubbish. Remove as necessary	Monthly
Remedial	**Frequency**
Overflows – If overflow is not clear then dismantle the structure and reassemble to design detail	As required

Ornamental planting and existing vegetation

- **Ornamental trees –** All ornamental planting to be kept weed free and pruned, using secateurs to keep the shrubs to an agreed and reasonable size.
- **Native trees and shrubs –** All native planting to be allowed to grow freely, removing overhanging branches as required.

Planting and existing vegetation – review	
Regular maintenance	**Frequency**
Grass maintenance	
Amenity grass – Mow all grass verges, paths and amenity grass at 35–50 mm with 75 mm max. All cuttings to remain in situ	16 visits
Rough grass – Mow at 75–100 mm but not to exceed 150 mm All cuttings to wildlife piles	4 – 8 visits
Wildflower areas strimmed to 50 mm in Sept–Oct. Or Wildflower areas strimmed to 50 mm July and Sept. Or Wildflower areas strimmed to 50 mm on 3 year rotation, 30% each year. All cuttings to wildlife piles	1 visit 2 visit 1 visit
Ornamental tree and shrub planting Weed all shrub beds as detailed spec. as necessary. Cut back planting from lights, paths and visibility sight lines in late autumn and as necessary. Cut hedges slightly tapered back from base with flat top at specified height. Do not mulch planting adjacent to permeable or porous paving surfaces. Remove stakes and ties from trees when no longer needed for support and within 3 years of planting. Protect from strimmer damage and remove competitive growth until well established	4 visits

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BOX B.2 Example SuDS Maintenance Plan for Robinswood Primary School

Planting and existing vegetation – review	
Native trees and shrub planting Prune to shape in year 1. Protect trees from strimmer damage and remove competitive growth until well established. Remove stakes and ties from trees when no longer needed for support and within 3 years from planting	1 visit
Existing trees Check existing trees for safety	1 visit
Remedial	**Frequency**
Replace trees and shrubs that fail in the first 5 years after planting. Carry out tree surgery as necessary	

Spillage – emergency action

Most spillages on development sites are of compounds that do not pose a serious risk to the environment if they enter the drainage in a slow and controlled manner with time available for natural breakdown in a treatment system. Therefore, small spillages of oil, milk or other known organic substances should be removed where possible using soak mats as recommended by the Environment Agency, with residual spillage allowed to bioremediate in the drainage system.

In the event of a serious spillage, either by volume or of unknown or toxic compounds, then isolate the spillage with soil, turf or fabric and block outlet pipes from chamber(s) downstream of the spillage with a bung(s). (A bung for blocking pipes may be made by wrapping soil or turf in a plastic sheet or closely woven fabric.)

Contact the Environment Agency immediately.

Queries regarding a design feature

In the event of a concern or failure of a SuDS design feature contact:

Robert Bray Associates, Sustainable Drainage Consultants and Landscape Architects

Fairfield, Coronation Road, Rodborough, Stroud, Gloucestershire GL5 3SB

T: (01453) 764885

F: (01453) 765545

E: bob@robertbrayassociates.co.uk

W: www.sustainabledrainage.co.uk

Heavy vibrating rollers are definitely not recommended around plastic pipes or tanks due to the high pressures that they can generate. Thin layers with smaller plant are recommended. DfT (2009) should be referred to for guidance for plant and methods for achieving compaction. The manufacturers' recommendations usually limit plant size above geocellular units to no more than 2300 kg/m width. However, the loading resulting from this will still need to be checked in the design. If such plant is to be used adjacent to the units, the resulting compaction pressures need to be checked.

Any arch or flexible pipe structures depend on the even resistance provided from soil or aggregate on both sides of the arch/pipe for their structural capacity. Even slight differences in the level of filling on each side of the arch/pipe as it progresses could potentially cause uneven deflections and increase the stress within the structure above design values. Close supervision during backfilling is therefore vital. The backfill around geocellular tanks should also be brought up evenly around all sides.

Bedding directly below a concrete pipe should have minimal compaction. The fill at the side of the pipe should be well compacted to a level 300 mm above the crown of the pipe. Only light compaction should be applied to the backfill directly over the crown of the pipe to a point 300 mm above it. With reasonable workmanship and supervision, the bedding factors used in the design should be relatively conservative.

21.12.6 Wrapping

All storage tanks should be watertight in accordance with the relevant standards. Geocellular and similar structures using geomembranes to hold water should be sealed in accordance with waterproofing standards (ie welded joints rather than adhesive taped) and the integrity of the seal checked on site through the use of non-destructive testing, to ensure that it is leak-proof. Advice on appropriate integrity and seam tests for geomembranes, that could be adapted for testing membranes around storage tanks, is provided in Mallett *et al* (2014). Care needs to be taken during installation to protect against damage of both the tank structure and the geotextile and the geomembrane wrapping. Follow-on trades can also cause damage and put the integrity and performance of the structure at risk.

21.13 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is required to ensure the effective long-term operation of below-ground storage systems. Maintenance responsibility for systems should be placed with a responsible organisation. Table 21.3 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be developed during the design phase, and will be specific to the type of tank that is adopted. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements. Further detail on the preparation of maintenance specifications and schedules of work is given in Chapter 32.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.

- Generic health and safety guidance is provided in Chapter 36.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

21.14 REFERENCES

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20.14 OPERATION AND MAINTENANCE REQUIREMENTS

Regular inspection and maintenance is important for the effective operation of pervious pavements. Maintenance responsibility for a pervious pavement and its surrounding area should be placed with an appropriate responsible organisation. Before handing over the pavement to the client, it should be inspected for clogging, litter, weeds and water ponding, and all failures should be rectified. After handover, the pavement should be inspected regularly, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

Pervious pavements need to be regularly cleaned of silt and other sediments to preserve their infiltration capacity. Extensive experience suggests that sweeping once per year should be sufficient to maintain an acceptable infiltration rate on most sites. However, in some instances, more or less sweeping may be required and the frequency should be adjusted to suit site-specific circumstances and should be informed by inspection reports.

A brush and suction cleaner (which can be a lorry-mounted device or a smaller precinct sweeper) should be used for regular sweeping. Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material. Any lost material should be replaced. It is also possible to clean the surface using lightweight rotating brush cleaners combined with power spraying using hot water, as shown in **Figure 20.30**. This is done every two years at the site shown.

If the surface has clogged then a more specialist sweeper with water jetting and oscillating and rotating brushes may be required, especially for porous asphalt surfaces, to restore the surface infiltration rate to an acceptable level. The specialist equipment should be adjusted so that it does not strip binder from the aggregate in the asphalt.



Figure 20.30 Deep cleaning a supermarket car park, Dundee (courtesy Abertay University)

The likely design life of grass reinforcement will be dictated by trafficking and is likely to be about 20 years if designed correctly. For concrete block permeable paving the design life should be no different from standard paving, assuming that an effective maintenance regime is in place to minimise risks of infiltration clogging. Porous asphalt will lose strength and begin to fatigue due to oxidation of the binder. This is likely to occur slightly faster in porous asphalt than normal asphalt, so the design life will be reduced slightly. Porous concrete should have a similar design life to a normal concrete slab.

The reconstruction of failed areas of concrete block pavement should be less costly and disruptive than the rehabilitation of continuous concrete or asphalt porous surfaces due to the reduced area that is likely to be affected. Materials removed from the voids or the layers below the surface may contain heavy metals and hydrocarbons and may need to be disposed of as controlled waste. Sediment testing should be carried out before disposal to confirm its classification and appropriate disposal methods.

▶ Guidance on waste management is provided in **Chapter 33**.

Table 20.15 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Plans and schedules should be prepared during the design phase. Specific maintenance needs of the pervious pavement should be monitored, and maintenance schedules adjusted to suit requirements.

▶ Further detail on the preparation of maintenance specifications and schedules of work is given in **Chapter 32**.

TABLE 20.15 Operation and maintenance requirements for pervious pavements

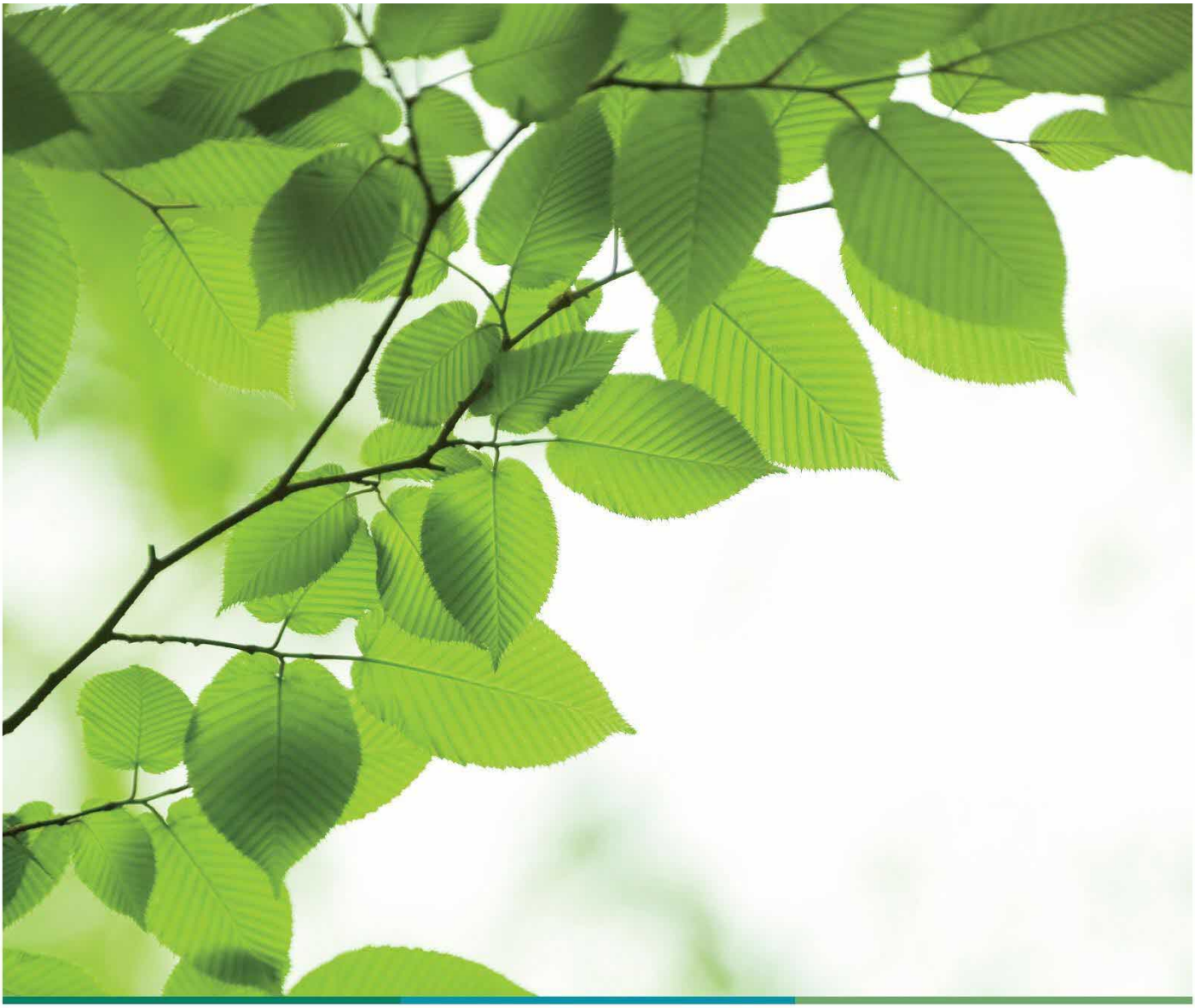
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the 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 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	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Many of the specific maintenance activities for pervious pavements can be undertaken as part of a general site cleaning contract (many car parks or roads are swept to remove litter and for visual reasons to keep them tidy) and therefore, if litter management is already required at site, this should have marginal cost implications.

Generally, pervious pavements require less frequent gritting in winter to prevent ice formation. There is also less risk of ice formation after snow melt, as the melt water drains directly into the underlying sub-base and does not have chance to refreeze. A slight frost may occur more frequently on the surface of pervious pavements compared to adjacent impermeable surfaces, but this is only likely to last for a few hours. It does not happen in all installations and, if necessary, this can be dealt with by application of salt. It is not likely to pose a hazard to vehicle movements.

▶ Generic health and safety guidance is presented in **Chapter 36**.

CDM 2015 requires designers to ensure that all maintenance risks have been identified, eliminated, reduced and/or controlled where appropriate. This information will be required as part of the health and safety file.



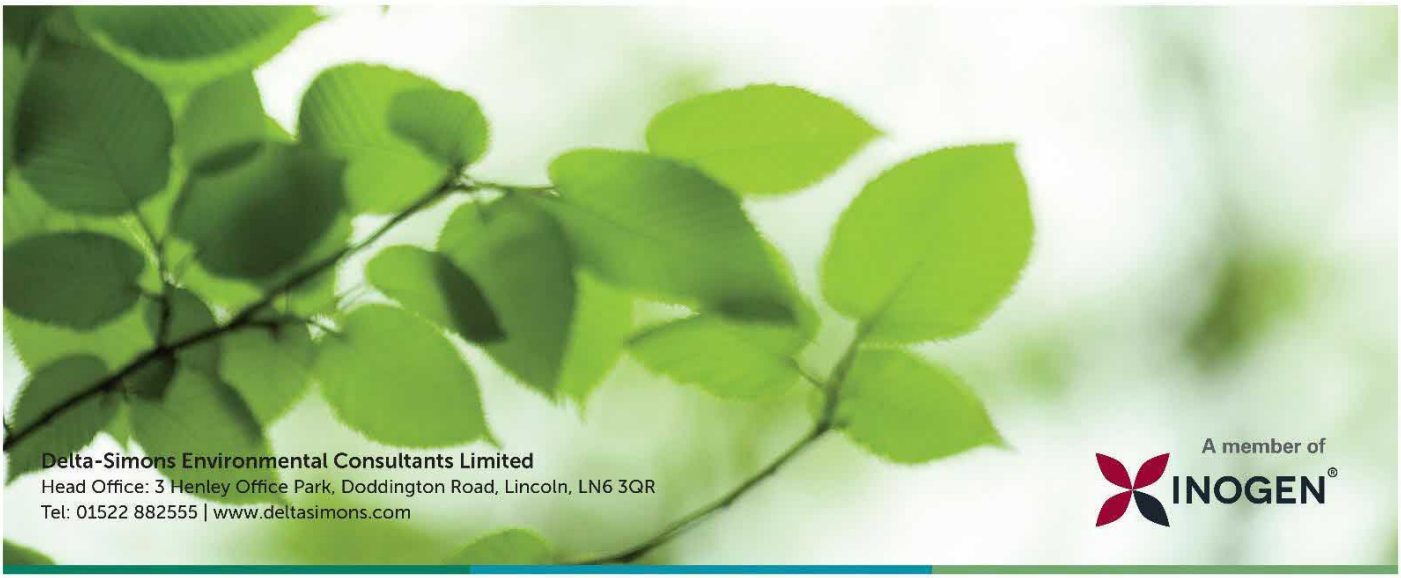
Phase I Environmental Assessment

Langstone Technology Park, Havant, PO9 1SA

Presented to **Havant S.a.r.l**

Issued: November 2020

Delta-Simons Project No. 15-0754.07



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Report Details

Client	Havant S.a.r.l
Report Title	Phase I Environmental Assessment
Site Address	Langstone Technology Park, Havant, PO9 1SA
Project No.	15-0754.07
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Quality Assurance

Issue No.	Status	Issue Date	Comments	Author	Technical Review	Authorised
01	Final	13/11/2020	-	[redacted]		
				Heidi Richardson Consultant	Jayne Trevelyan Associate	Jayne Trevelyan Associate

About us

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Specialising in Environment, Health & Safety and Sustainability, Delta-Simons provide support and advice within the property development, asset management, corporate and industrial markets. Operating from ten locations - Lincoln, Birmingham, Bristol, Dublin, Leeds, London, Manchester, Newcastle, Norwich and Nottingham - we employ over 100 environmental professionals, bringing experience from across the private consultancy and public sector markets.

Delta-Simons is proud to be a founder member of the Inogen® Environmental Alliance, a global corporation providing multinational organisations with consistent, high quality and cost effective environmental, health, safety, energy and sustainability solutions. Inogen assists multinational clients by resolving liabilities from the past, addressing today's requirements and delivering solutions for the future. With more than 200 offices located on every continent, more than 6,430 staff worldwide, and projects completed in more than 120 countries, Inogen provides a single point of contact for diverse markets as Automotive, Chemical, Consumer Products & Retail, Financial, Food & Beverage, Healthcare, Insurance, Manufacturing, Non Profit Organisations, Oil & Gas, Real Estate, Services Firms, Technology and Transportation, among others.

Executive Summary

Site Use & Surrounding Area	The Site is occupied by a science park comprising a number of interlinked commercial offices and light industrial properties, with car parking, access roads and li landscaping. The Site is located in a mixed commercial and residential area.
Environmental Setting	The Site is considered to be of a moderate environmental sensitivity give presence of Secondary A Aquifers (which comprises some cohesive deposits) over a Principal Aquifer; the proximity of the Mill Stream; the presence of statutory designated ecological sites downstream of the Site (Chichester and Langstone harbour); and the mixed commercial, light industrial and residential use of the surrounding area.
Contamination Potential	While chemical storage, diesel back-up generators and electrical substations we previously identified on-Site, the Site appeared well managed and no signif potential contamination concerns were noted associated with the current Site use. The Site was predominantly unoccupied until the development of a sewage works i the north-east by 1909. By 1973, the sewage works was no longer present, and th Site had been redeveloped into an IBM computer products manufacturer. Since th 1970's, some redevelopment has occurred on-Site, though the main buildings have largely remained unchanged. Potentially contaminative uses associated with computer manufactory include previous 'wet' processes in B1000, diesel powered boilers in the area of the current gas boiler systems (B3000), an effluent treatment and chemical storage area in the area of B22, and effluent treatment and former chemical storage in the area of B41 and B42. Also, a former pollution incident was reported to have occurred in the 1980's, however, no further details are known. Based on the recent available information, two hotspots of hydrocarbon contamination have been identified with recommendations for off-Site removal, and it was considered for the areas investigated basic gas protection measures should be installed.
Contaminant Linkage Assessment & Land Contamination Conclusions	Delta-Simons has completed a land contamination risk assessment based available information. Information has indicated that significant widespread contamination is unlikely to be present. However, localised contamination was recently identified at the Site, which it has been recommended to be remediated (excavated and given the historical use of the Site, the potential for further localised contamination to be present is possible. It is, therefore, considered that the risk of significant possible contaminant linkages to exist is low to moderate for a continued use and fo proposed redevelopment.
Key Land Contamination Recommendations	No further works are considered to be required for land contamination purposes in the context of an ongoing use. A number of recommendations have been provided associated with the propo development in Section 4.1.
Overall Land Contamination Statement of Risk	On the basis of available information, Delta-Simons considers that with rega potential land contamination issues and associated environmental liabilities, ir current use or future redevelopment, the Site represents an overall inves opportunity with a **Low to Moderate** risk.

Flood Risk Advisory	Based on the information reviewed, the majority of the Site is not located within an area considered to be of an elevated risk of fluvial flooding. Several areas of the Site a shown to be at potential risk of surface water flooding, however, no associated issues were reported on-Site with the exception of minor water ingress at Building 1(Available information indicates that flooding events have occurred at associated with surcharging of the foul system, however, it is understood that a non return valve was installed at the Site. Whilst a Flood Risk Assessment is available for the current development proposals, it is likely that a further assessment and drainage strategy will be required to support the proposed redevelopment of the Client's masterplan.
This is intended as a summary only. Further detail and limitations of the assessment is provided within the main body of the Report.	

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1.0 Introduction

1.1 Appointment

Delta-Simons Environmental Consultants Limited ("Delta-Simons") was instructed by Havant S.a.r.l (the "Client") to carry out a Phase I Environmental Assessment of Langstone Technology Park, Havant, PO9 1SA (the "Site").

1.2 Context & Purpose

The aim of this assessment is to consider the potential for land contamination related liabilities to be present prior to the potential investment of the Site, and future redevelopment with several new buildings for the park.

1.3 Scope of Works

The scope of works undertaken for this assessment was:

- Review of the environmental setting of the Site, including the current use/ status of the Site and surrounding area, and review of the geology, hydrogeology and hydrology;
- Review of the historical activities of the Site and surrounding area;
- Review of regulatory database information relating to the Site;
- Review of the online planning records for the Site;
- Consult and review information from the Local Authority in relation to Part 2A of the Environmental Protection Act;
- Review of relevant third party reports relating to the Site or surrounding area;
- Develop an outline Conceptual Site Model and a qualitative assessment of the potential for land contamination related liabilities to be present; and
- Complete a review of the flood risk associated with the Site.

A list of the data sources consulted is provided in Appendix A.

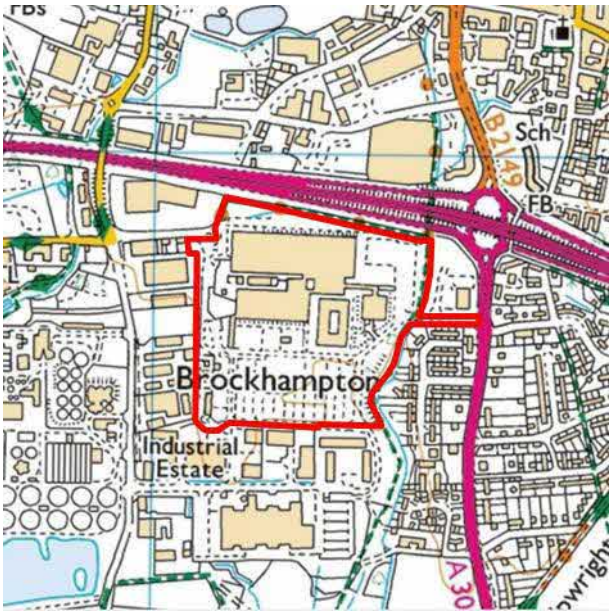
The scope of works did not include a Site reconnaissance; however, Delta-Simons have previously undertaken visits in 2015, 2018 and 2019.

1.4 Limitations

The standard limitations associated with this assessment are presented in Appendix B.

2.0 Site Context & Data Review

2.1 Site Information



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Bing maps

Site Location		Site Layout	
Co-ordinates	Centred approximately at National Grid Reference 471300, 105700.	Elevation	Approximately 4 to 8 m AOD
		Area	14.3 Ha
Site Location	The Site is located to the south-west of the junction of the A27 and A3023, i Langstone area of Havant.		
Current Site Use	The Site is occupied by a science park comprising a number of interlinked commercial offices and light industrial buildings, with car parking in the south, east and north of the Site, hardstanding and access roads and landscaping confined to limited areas. A brief summary of the building uses is summarised below: ▲ Building 1000 (B1000) – predominantly offices (partly vacant) with some laboratories and a warehouse; ▲ Building 2000 (B22) – general maintenance store and water softening equipment; ▲ Building 3000 (B3000) – main plant room (including boilers and chillers); ▲ Building 4000 (B4000) – offices and canteen; ▲ Building 5000 (B5000) – data centre, offices and small electronics repair centre; ▲ Building 6000 (B6000) – main reception, offices and call centres; ▲ Building 7000 (B7000) – offices and laboratories; ▲ Building 41 (B41) – gym; ▲ Building 42 (B42) – electrical substation; and ▲ A nursery is also present in centre of the Site.		

Previous Site Reconnaissance	Delta-Simons has conducted Site visits on 29th July 2015, 27th April 2018 and 18th June 2019 as part previous assessments. A series of Site photographs from the walkover are presented as Appendix C and a Site Plan showing the references to the features is presented as Figure 1. Pertinent information that was observed or reported on-Site is summarised as follows: ▲ A large waste storage area and waste processing building (E and 1C, Figure constructed in circa 2011 was present in western part of Site, comprising compactors for general, mixed recycling and cardboard waste, trade waste bins and wheelie bins. A large water tank and pump room was also located in this area. Two further waste storage areas comprising the same waste streams but also including feed waste were located adjacent to the backup generator by B4000 (1D, Figure 1) and within B4000 (1E, Figure 1) associated with food waste and bunded wa cooking oil storage (spill kits were noted to be present). Dark staining was noted on the asphalt hardstanding in the vicinity of the waste cooking oil. A large cooking pot containing waste oil was also noted in this area without secondary containment. A Waste Electrical and Electronic Equipment (WEEE) bin and a fluorescent light bulb container were stored at ground level in B1000 (1F Figure 1); ▲ A diesel back-up generator with an associated bunded 1,400 L aboveground storage tank (AST) and a battery bank was located on an enclose concrete platform between B3000 and B4000 (1D, Figure 1). No staining was noted beneath the external fill point or within the tank bund, however, minor staining was present beneath the generator unit. Spill kits were observed in this area. The Sit representative stated that the AST was refilled manually using 200 L drums onc per year. The bund was also fitted with a leak alarm; ▲ A tenant operated diesel-powered back-up generator with an associated approximate 6,000 L capacity AST was located adjacent to the west of B2000 (1G, Figure 1). The Site representative informed Delta-Simons of a small diesel lea however, this was contained within the generator's transmitter box in 2018. The total amount of spilled oil was approximately 3 L; ▲ The Site representative stated that there were a further three tenant operated diesel-powered back-up generators located within B1000. However, no access granted during the Site walkover; ▲ Two sprinkler pumps were located in B1000 (1F, Figure 1) of which one electricity powered and one diesel powered. The diesel powered pum connected by aboveground pipework to an approximate 1,000 L capacity A situated in a bund. No hydrocarbon staining was noted within the bund or within the vicinity of the pipework and pump. The Site representative indicated that the AS was refilled manually from drums using a hand pump; ▲ Asbestos containing materials (ACMs) are common across the Site. An onli interactive register is held and asbestos signage is present in several a Envirochem were reportedly responsible for annual reinspection and asbe removal at the Site. A secure ACMs store (assumed from maintenance activities and fire extinguisher store was located within B1000 Area 3 (1F, Figure 1). ACMs are collected by a specialist contractor on an ad-hoc basis; ▲ A former chemical storage and processing area (V, Figure 1) was present in t south-west of the Site. Only concrete plinths and bunds remained, and no significant staining was observed. One of the bunds was reportedly undergoing infilling wi construction materials (asphalt, concrete etc.). A former vehicle was area/catchment pit was present in this area, and an area of adjacent car parki was noted to be partially flooded; ▲ The area in the south-west (V, Figure 1) in 2015 was reportedly associated with a deionised water production plant and caustic storage area, in addition to an effluent treatment plant and buffer holding tanks. Used engines/ motors were noted to b stored on pallets externally in this area in 2015;

	▲ In 2018, a newly landscaped area with a vent pipe (assumed associatec drainage) was located along the south-western Site boundary; ▲ A former gardener's store was present in the south-west (N, Figure 1); ▲ A secure drum store with several 200 L capacity drums containing substar marked as toxic organic solids, mixed agrochemicals and agrochemical washings (some provided with drip trays) was situated at ground floor level in the sc western area of B1000. A compressed gas cylinder store was also located in thi area which included air, nitrogen, hydrogen and helium (F, Figure 1). A bunc 10,000 L capacity AST for diluted waste process fluid, associated with fertili application research, was additionally located in the area of the drum store; ▲ A waste pallet storage area and compactor were present to the west of B5000 (G, Figure 1); ▲ Gardening waste storage, a contractor parking area and former electricity substation were located to the south-west of B5000 (H, Figure 1); ▲ A total of 15 electrical plant rooms were present across the Site (including J, K and L, Figure 1), including substations, transformers and electrical switch gear appeared to be in good order and no spillages of transformer oils was noted, baring minor staining within a transformer bund to the east of B3000. During the walkover in 2018, Delta-Simons was informed by the Site representative that all PCBs ha been removed and converted to silicone-based oils; ▲ A building (B22) in the north-west of the Site (M, Figure 1) was used as a genera maintenance store and contained a brine tank, water softening tanks and rainwater tanks. Also, present were: two 200 L capacity drums containing swit insulating oil on a wooden pallet; two 200 L drums containing waste water and glycol mix; a small hazardous chemical store; battery store; paint locker; rock salt store gardening equipment; and chemical store. Delta-Simons was informed by the Site representative that a former pH testing and deionising plant had been remov approximately 10 years ago. A disused waste process water treatment plant wa also located in B22; ▲ During the 2015 walkover, the Site Facilities Manager stated that the area aroun B22 had been used by the former tenant (IBM) as a chemical store and processing area, with two remnant ASTs remaining in 2015. The former processes understood to include air and chemical extraction systems, solvent recovery plant, carbon absorption tanks, and storage of hydrochloric acid, sodium hyperchloride xylene, nitrogen and cyanide; ▲ B3000 (1H, Figure 1) contained three gas boilers, water treatment chemicals (zinc chloride, biocide, sodium nitrite and potassium hydroxide all provic secondary containment) and three chillers; ▲ During the 2018 walkover, a small diesel spill from a vehicle was reported in t south-west of the southern car park area, which was reported to hav managed with spill kits. Also, empty cooking oil drums and an abandoned vehicle were identified next to the Mill Stream; ▲ In 2015, Delta-Simons was informed by the Facilities Manager that a pollu incident which required remediation works had occurred in 1984, howeve further details were available; ▲ A surface water pump house was present to the east of B6000 (O, Figure 1); ▲ According to a drainage plan provided for review on-Site, eight oil interceptors are present within the Site's surface water drainage system (including P & Q, Figure 1) which were reported to be inspected every six months and serviced/ emptied every 18 months. The Site representative indicated that surface water runoff from eastern area of the Site discharges into the Mill Stream; and

	▲ A discharge consent (Ref: 725513403, dated 13th July 2007) for the release waste-water from the cooling tower system to the sewer is held on-Site. *While chemical storage, diesel back-up generators and electrical substations w present on-Site, the Site appeared well managed and no significant contamination concerns were noted associated with the current Site use. Howev based on discussions with Site personnel and observations, potentially contaminativ processes were undertaken on-Site associated with the former use, particularly in th south-west and in the central western area. A former pollution incident was also reported in the 1980's.*	
Current Surrounding Area	**North**	Landscaping and the A27 with a retail park beyond (including a petrol fillir station).
	East	The Mill Stream with a hotel, restaurant and residential properties with gardens beyond.
	South	Endeavour Business Park comprising commercial office and distribution units.
	West	Commercial office, distribution and light manufacturing units with a sewa works beyond.
	The surrounding land use is considered to represent a potential off-Site sour contamination.	
Future Redevelopment	It is understood that the Client may undertake redevelopment of the Site in future. Planning permission has been granted for 'Part-demolition of Building 1000 and associated works; the erection of new flexible use industrial units; and a new parking layout with associated works' on 22nd July 2020 (reference: APP/19/00703). However, the current proposed masterplan includes additional redevelopment of the majority of the Site to include the demolition of several buildings and refurbishment of Buildings 4000 and 6000, with the addition of a multi-storey car park. A copy of the masterplan is provided as Drawing 1.	

2.2 Environmental Setting

Geology	From Geology Mapping within the Envirocheck® Report and information provided by the BGS, the Site is indicated as being predominantly underlain by superficial deposits c Alluvium comprising clay, silt, sand and gravel. River Terrace Deposits, compris sand, silt and clay are shown in the north-western and south-western corners of the Site. A small area of Head Deposits, comprising clay and gravel, is shown in the south-west of the Site between the boundary of the Alluvium and Terrace Deposits. The underlying bedrock comprises the Lewes Nodular, Seaford, Newhaven, Culver and Portsdown Chalk Formations. An area of Made Ground is shown adjacent to the north-east of the Site. While no Made Ground is shown on-Site from available BGS mapping, given the development history, Made Ground would be anticipated to be present above the superficial deposits.
Specific Geology	During an investigation across the southern area of the Site in 2019, ground conditions identified comprised: ▲ Tarmac and sub-base, or grass and topsoil, underlain by Made Ground (granul deposits with brick, concrete and occasional pottery and slate or cohesive deposits with gravels including flint, concrete and occasional brick and chalk) to 3.1 metre below ground level (m bgl);

	▲ Superficial River Terrace/ Brickearth across the majority of the Site comprising silty, sandy gravelly Clay, with silty peat identified at one location to, and also cla sandy gravel to 5.5 m bgl; ▲ Weathered Chalk bedrock comprising sandy gravelly clay or clayey sandy grav with gravel comprising chalk and flints to 6.0 m bgl; over ▲ Chalk to a maximum depth of 24.9 m bgl. Fragments of organic material (including decaying wood, rootlets and grass) were also identified at three locations between 0.2 m and 3.1 m bgl.
Hydrogeology	The EA classifies the superficial deposits as Secondary A Aquifers and the Chalk as a Principal Aquifer. The EA data also indicates that the Site is not in a designated groundwater Sou Protection Zone (SPZ), however, a SPZ 1 (inner zone) is located approximately 170 m to the north-east associated with two potable groundwater abstractions listed 460 m to the north and 710 m to the north-west. During a recent investigation, groundwater was identified within the superficial deposits between 2.1 and 2.8 m bgl rising to 2.0 and 2.5 m bgl. Within the two deeper locations, groundwater was identified at depths of 5.8 and 6.0 m bgl rising to 3.0 m bgl.
Hydrology	The Mill Stream is located adjacent to the east of the Site, which flows to the c approximately 750 m to the south. According to the Envirocheck® Report, there are no licensed abstraction records from surface water located within 1 km of the Site.
Coal Mining	The Site is not located within an area that is potentially affected by coal mining activity.
Radon Gas	The Site lies within an area where less than 1% and 3-5 % are at or above the Publ Health England recommended "action level" for radon. The Envirocheck® Report indicates that basic radon protective measures are necessary in the construction of new buildings or extensions at the Site.
Ecological Receptors	It is understood that there is a tree preservation order in place for the north-western area of the Site. It is understood from information provided within the Envirocheck® Report that the Chichester and Langstone Harbour, listed 315 m to the south and 459 m to the sou east of the Site, is classed as: an Area of Outstanding Natural Beauty; a Ramsar Site; a Site of Special Scientific Interest; and a Special Protection Area.
Heritage Interest	According to historicengland.org.uk, the closest area of heritage interest is loc approximately 95 m to the north-east of the Site associated with a Grade II L Building (Langstone Hotel). The Solent Maritime located 545 m south-west is also classified as a Special Area Conservation.
Environmental Sensitivity	*The Site is considered to be of a moderate environmental sensitivity given: the presence of Secondary A Aquifers (which comprises some cohesive deposits) over a Princip Aquifer; the proximity of the Mill Stream; the presence of statutory designated ecological sites downstream of the Site (Chichester and Langstone harbour); and the r commercial, light industrial and residential use of the surrounding area.*

2.3 Historical Use of the Site & Surrounding Area

Approach	The historical development of the Site and surrounding area has been assessed through a review of available historical OS maps, Google Earth historical satellite imagery an other sources. A summary of the key historical Site uses and developments in surrounding area is presented below. Copies of pertinent historical maps are includec as Appendix D.
Historical Features On-Site	From the earliest available mapping dated 1867, the Site was predomin agricultural use with small unspecified buildings, watercourses, and an orchard partially located in the north-west. On 1897 mapping, an aqueduct and sluice were labelled along a watercourse in the south of the Site, subsequently labelled as a drain from mapping. By 1909 mapping, the north-east of the Site was developed with a sewage works wit associated filter and sludge beds, and an engine house. Further development to bot the sewage works and small buildings are noted between 1932 and 1969 mapping. From 1953 mapping, an allotment garden was labelled in the centre of the Site. From 196 mapping, the entire Site had been redeveloped with a works and hardstanding in t centre of the Site. A separate building and an electricity substation were located in the south of the Site also at this time. It is noted that slopes are shown surrounding majority of the buildings suggesting that Site levels were raised. Between 1984 and 1989 mapping, the Site was further developed to a layout large consistent with the current format when the southern third of the Site was redeveloped with car parking removing the former structure in this area. Also, the south-west of the Site was occupied by several tanks, with further tanks and an electricity substa labelled in the west of the Site. A review of aerial imagery provided by Google Earth shows the Site in its contemporary layout between 1999 and current imagery, with the exception of minor reconfiguration of plant and buildings in the south-west of the Site and around B22.
Historical Information from other Sources	From internet searches, it is understood that the current Langstone Technology Pa was formerly used by IBM as a computer products manufacturer (known as IBM Havant where many IBM computer products were made, such as disk files, mai computers, printers, ATMs, multiplexors and mid-range computers). In 1994, the Si began trading as Xyratex. A WSP 2005 assessment (discussed in Section 2.7) reported that the Site representative stated that B1000 was historically used for wet manufacturing processes. This included activities such as etching and substrate processes. The Site representative also reported to WSP that remediation in th decontamination of acid, arsenic and copper penetrated concrete was undertaken 1998/ 1999 in B1000. This is reported to have involved the removal of concrete until i was proven that the remaining concrete was no longer contaminated. Effluents generated from B1000 were reported to be transferred to B41 (south-w corner of the Site) for treatment. After treatment processes were undertaken, the effluent was discharged from the Site via foul sewer. This discharge was reportedly regulated by a trade effluent discharge consent. The effluent treatment facilities were no lo operational in 2005 and had been partially decommissioned. It was also reported tha B41 was historically used as a de-ionising water treatment plant. WSP indicated that B42 was reportedly formerly used for the storage of petrol mixtures. A report produced by Campbell Reith Hill (discussed further in Section 2.7) suggests that the wider area was associated with decoy sites to draw German bombing raids awa from areas such as Portsmouth during the Second World War.

Potentially Contaminative Historical Features Off-Site	Potential sources of contamination within 100 m of the Site include: ▲ Buildings associated with the wider sewage works located adjacent to the north o the Site between 1909 and circa 1969 mapping; ▲ Havant Mill (corn) located approximately 60 m to the north-east of the Site between 1867 and circa 1967 mapping; ▲ A works and plastics factory located approximately 25 m to the south-west of tl Site from 1973 to the most recent map edition of 2015; ▲ A boatbuilding works/ unspecified works located approximately 50 m to the north west of the Site from 1973. The unit was labelled as an unspecified works from 1993 and remains present; ▲ A pumping station with tank located approximately 25 m to the south-east of the Site from 1973 to circa 1993; ▲ A marine accessory works located approximately 60 m to the west of the Site from 1973. The unit increased in size by 1989 and was located 25 m west and the un remains present; ▲ Industrial properties including factories, an electronics factory, an engineering works and a warehouse located approximately 80 m to the north of the Site from 1969 tc circa 2006 when a large number of these were redeveloped as a superstore with a petrol filling station; and ▲ Further industrial units (including unspecified works, engineering wor factories) to the west from 1987 to the present. Within the wider area, pertinent features include Budd's Farm Sewage Works from approximately 125 m west from 1963. The works increased in size by 1969 and 1993 and remains present.
Unexploded Ordnance (UXO)	According to the Zetica risk map, the UXO risk at the Site is moderate. A Detailed Unexploded Ordnance Report by 1st Line Defence (DA8760-00, dated May 2019) has been identified for the Site. Overall, the report considered that there was a medium risk from German aerial delivered UXO and anti-craft UXO, with a low to medium risk from items of Allied Ordnance. A copy of the report is included within the Previous Reports as Appendix H.
Implications for Land Contamination Risk	*The historical uses of the Site, most notably the sewage works, computer manufacturing and ancillary processes, are considered to represent potential sources of contamination. Potential sources of contamination identified in the surrounding area include a mill, sewage works, factories, an engineering works, a warehouse, a boatbuilding wor works, a plastics factory, works, a pumping station with a tank and a petrol filling station.*

2.4 Environmental Database Review

Approach	The Landmark Envirocheck® Report provides a database of environmental information held by various bodies including the EA, Local Authority (LA), Health & Safety Executive (HSE) and the British Geological Survey (BGS) amongst others. A full copy c Envirocheck® Report is provided in Appendix E and the most relevant information summarised below.
Features On-Site	There are several relevant entries included within the Landmark Envirocheck® Report relating to the Site, summarised as follows: ▲ Four Discharge Consents (two noted to be 1 m off-Site; however, the oper names are consistent with the on-Site discharges) for the discharge of 'other matter- surface water' into a freshwater river, first granted in April 1978. The

	representative previously informed Delta-Simons that a discharge consent for th release of wastewater from the cooling towers into the sewers is held on-Site; ▲ Two revoked Integrated Pollution Controls associated with Adflex Solutions Ltd for processes involving halogens within the chemical industry. The permit, dated 1997, is assumed to be associated with a former operator at the Site; ▲ A Part B Permit (formerly Local Authority Pollution Prevention and Control) v granted to Teleplan and White Electronics in June 2013. From an internet searc this is understood to be associated with the assembly of hard disk drive testers; ▲ A Licensed Waste Management Facility associated with Teleplan and Electronics relating to a WEEE treatment facility in the west. The licence was issued in June 2013; ▲ Several areas of potentially infilled land which appear to be associated with former drainage ditch network; and ▲ Three Contemporary Trade Directory Entries for a printers', general engineers and computer manufacturer.
Potentially Contaminative Features Off-Site	Pertinent entries in the Landmark Envirocheck® Report located within 100 m of the Site includes: ▲ Four Part B Permits associated with the coating of metal and plastic, and for t respraying of road vehicles; ▲ Two Pollution Incidents to Controlled Waters located 80 m east (minor incide associated with the release of oils to a stream in 1995 and 95 m nor (significant incident) associated with diesel in the stream from vehicle washing and de-waxing in January 1997; ▲ Four Registered Radioactive Substances located 45 m and 90 m north-west for the disposal of radioactive waste; and ▲ Thirty-three Contemporary Trade Directory Entries, which includes: tool design and manufacture; domestic appliance servicing; air conditioning; cleaning servi engineers (general, precision and aviation); spraying (paint & coatings); gara services (body builders and repairs); crane hire and sales; electronic compone manufacture; and marine electrical services. Within the wider area, pertinent entries include: ▲ A Historical Landfill located 190 m to the south-west of the Site that was licensed to accept wastes types including household; no dates are provided; ▲ A Local Authority Recorded Landfill Site located 210 m to the south-west of the Site that was licensed to accept household, acid and commercial waste until December 1965; ▲ A Fuel Station Entry and Part B Permit associated with a petrol station located 140-150 m north of the Site; and ▲ A obsolete Fuel Station Entry located 140 m to the west of the Site.
Implications for Land Contamination Risk	*The former chemical processes and waste management facility are consider represent potential on-Site sources of contamination. Whilst entries within the immediate vicinity of the Site have been identified, they are considered to represent limited potential sources of off-Site contamination.*

2.5 Planning Review

On-line Planning Portal	Havant Borough Council	**Date Accessed**	19/10/2020
Findings	From a review of the Council's online planning database, a large number of applications have been identified for the Site. These include a number of extensions, new car parking areas, new buildings, the creation of ditches and culverts, and for the installatic infrastructure (including a fume cupboard, waste compactor, back-up generators a cooling units) between the early 1990s and 2013. Pertinent applications identified include the following: ▲ APP/10/00272 – 'Demolition of existing steel-clad building and two portacabins t make way for a single storey timber framed building to house a 52 place nurs school'. This application was granted consent in September dated 20 contaminated land conditions were set. ▲ APP/13/00411 – 'Extension of standby generator room to accommodate attenuating louvre for installation of additional generator unit and installation of 6 Liebert and Excool roof mounted cooling units'. This application was granted consent in Jun 2013; and ▲ APP/15/00484 – 'Change of use from store to gym facility of B41'. This application was granted consent in July 2015. Whilst no contaminated land planning conditions were set, correspondence with the Environmental Control Officer dated July 2015 which included a Site inspection, indicated that while the potential for contamination could not be ruled out, the officer was satisfied that the change of use could go ahead without the need for intrusive ground investigation. However, this was caveated t say that should the area be redeveloped, the potential contamination risks should be further assessed. An Envirochem laboratory analysis report is provided which appears to relate to effluent in the area. The context of the testing is not clear and appears for waste disposal. The contaminant levels are generally low; ▲ APP/19/00296 – 'Erection of a new building entrance structure, reception lob refurbishment and associated hard and soft landscaping works (Building 6000)'. This application was granted consent in May 2019. No contaminated land conditions were set; ▲ APP/19/00297 – 'Proposed alteration to the existing east facing elevat accommodate a new entrance threshold and associated external works (Buildi 6000)'. This application was granted consent in June 2019. No contaminated lan conditions were set; ▲ GEN/19/00354 – 'EIA Screening Opinion - Erection of new industrial units rationalisation of south car park, demolition of part of the northernmost building with new elevation on the remaining part of the building, new screen on adjacent building and extension to existing car park'. No documentation was available to view on the online planning portal. This application was decided in May 2019, however, there is no information to confirm whether an EIA was undertaken; and ▲ APP/19/00703 – 'Part-demolition of Building 1000 and associated works; the erection of new flexible use industrial units; and a new parking layout with associated works to layout and access and felling of two trees subject to a Tree Preservation Ord (Norway Maples)'. The application was granted in July 2020. As par application a Preliminary Risk Assessment (19-0687.01) by Delta-Simons submitted, and information from the Environmental Control Officer indicates that the Council were in agreement of the recommendation for intrusive investig Subsequently, a contaminated land condition was imposed as Condition 9		

	required: an intrusive investigation (Part 1), and if required the submission of appropriate remediation strategy (Part 2) and verification plan (Part 3). Copies of the relevant documentation is provided as Appendix F.

2.6 Regulatory Authority Consultation

Local Authority – Part 2A	From correspondence in August 2015 with the Contaminated Land Officer (CLO Havant Borough Council, the CLO confirmed that the Site is not considered to h priority for inspection under Part 2A of the EPA 1990. During a subsequent telephon conversation as part of a 2018 assessment and email exchange in 2020, the confirmed that the Site's status under Part 2A remains unchanged.
Local Authority – Additional Comments	The CLO confirmed in August 2015 that the former uses of the science park associated with manufacturing, research and development and waste proce activities. Potential sources of contamination identified by the CLO include on transformers, boiler house, UPS facilities, fuel stores, flammables storage and seale drainage systems with the majority concentrated in the south-west of the Site. The CLO noted in August 2015 that they had undertaken a visit to the south-weste corner of the Site (associated with planning application APP/15/00484). No comments in relation to significant concerns were identified at that time. Whilst the CLO identified potential sources of contamination from diesel fu 'flammables' likely to be toluene BTEX and possible plasticisers (phthalate, vin chloride), the CLO noted that given the good management practices, provision condition of containment and the lack of staining or spillages, the risk of contamina release was considered to be low. The CLO also noted that the Council is aware of three separate reports associated with the Site, however, it was not known if these were in the public domain: ▲ Travers Morgan, dated 1993; ▲ Structural Soils Ltd, dated 1995; and ▲ GVA Grimley, dated 1999. As part of the 2018 enquiry, the CLO issued several reports relating to the Site or nearby land, which are discussed in Section 2.7. A copy of the previous and current Regulatory Authority response is inclu Appendix G.
Building Control	The WSP 2005 report (discussed in Section 2.7) references consultation with the Building Control Officer at Havant Borough Council. The Officer is reported to have informed WSP that the Site was raised above ground level thereby reducing the possibility for flooding. The Officer is reported to have commented that they were unaware of any significa ground stability issues within the area. However, they were aware that part of the subject Site had been built with pilled foundations. WSP reported that the Officer was unaware of any ground gas problems in relation to the historical use of the Site or from curre neighbouring site activities. Additionally, WSP reported that the Officer was not aware of any flooding issues in the immediate area of the Site, although the Officer did confirm that the 'Langstone Mill Stream' adjacent the Site boundary was known to be susceptible to partial flooding further inland.

2.7 Previous Reports

List of Reports	Delta-Simons has obtained the following reports relating to the Site and wider area: ▲ Ground Investigation Report, IBM, Langstone Road by Soils Limited dated April 1994 (extracts only and relates to land off Site to the south); ▲ Wetland Study by Symonds Travis Morgan dated April 1997 (relates to land off-Site to the south); ▲ Contamination Assessment Report by Campbell Reith Hill dated May 2001 (relates to land off-Site to the south); ▲ Site Investigation Report by STATS dated October 2003 (relates to the north-wes of the Site); ▲ Phase I Environmental Audit by WSP dated September 2004 (relates to the entire Site); ▲ Geo-Environmental Appraisal Report by Clancy Consulting, dated October 20 (relates to the north-east and south of the Site; and ▲ Supplementary Site Investigation by Clancy Consulting, dated September 2((relates to the north-east and south of the Site). Copies of the reports are provided in Appendix H.
Soils Limited Ground Investigation (1994)	The available information comprises extracts only, with no Site plan or context of tl assessment, however, the following was reported: ▲ Significant contamination was not identified in soil samples; ▲ Facial coliforms were identified in a groundwater sample (indicated to likel associated with an 'offsite' sewage works or damaged foul pipe); ▲ No putrescible materials that could give rise to hazardous gases was encountered; ▲ A landfill site was located to the west; ▲ No significantly elevated ground gases were recorded; and ▲ Piles or ground improvement was recommended.
Symonds Travis Morgan Wetland Study (1997)	The report relates to land to the south and presents a detailed hydrogeological stuc associated with the then proposed development to the south of the Site. While majority of the information is irrelevant to this assessment, a plan in the report confirms that the above Soils Limited Ground Investigation relates to land off-Site to the south of the Site.
Campbell Reith Hill Contamination Assessment (2001)	The report relates to land off-Site to the south and indicates the following perti information: ▲ Previous investigations are reported to have identified that historically sev sludge spreading may have taken place. One of these investigations repc elevated levels of mercury concentrations in the drainage ditches and w adjoining the site. The spreading of sewage sludge and a historical nearby platinç works were identified as possible sources. No recordable concentrations of mercury were however identified in the soils by the following investigation; and ▲ Slightly elevated concentrations of polycyclic aromatic hydrocarbons (PAH) a arsenic were recorded in soils and sediment from drainage ditches, however, they were below the adopted screening criteria.

STATS Site Investigation Report (2003)	The report relates to the north-western area of the Site in relation to a proposed ne paved car park and roundabout (which does not appear to have been taken forward). The assessment comprised a desk study and ground investigation comprisin excavation of 13 trial pits and 8 dynamic cone penetration tests (to generate values). No exploratory hole plan is provided. Pertinent points are summarised as follows: ▲ A sub-surface concrete tank was uncovered which was presumed to be related t the sewage works that were present on the Site. The tank was found to be in-fillec with a clayey sand containing many whole bricks and occasional metalwork; ▲ Elevated copper and zinc were recorded, although below Delta-Simons screenin values, and all other soil contamination was below the screening criteria adopted by STATS. No groundwater analysis was conducted; ▲ Geotechnical hazards reported included shrinkable clay soils, compressible soil obstructions, Made Ground and silt rich soils; ▲ Aggressive Chemical Environment for Concrete (ACEC) Classification is AC-1s with a Design Sulphate Class of DS-1 was reported. STATS suggested that a desi CBR value of 6% could be adopted; and ▲ STATS considered the Site fell into the "moderately low subsidence risk" categor relating to potential chalk dissolution and states that Edmund's database of known natural and man-made chalk solution features illustrates there are no such features in the immediate vicinity of the Site.
WSP Phase I (2005)	The report was undertaken in the context of the proposed investment purchase of th Site. Potentially contaminative activities identified during a Site walkover were limited to the storage of diesel fuel in two above ground storage tanks (with a total capacity 3,000 litres) and the storage of waste materials. No significant issues were identifi associated with the current use of the Site. The following third-party reports were also reviewed by WSP as part of the assessment (not seen by Delta-Simons): ▲ A 1999 Environmental Monitoring Program undertaken by CASELLA Ltd. The report detailed results of effluent monitoring, industrial emissions monitoring, groundwater monitoring, surface water monitoring and building fabric monitoring. It was state that the report reviewed a number of intrusive and non-intrusive investigations, which identified potential issues associated with: low concentrations of toluene and purgeable hydrocarbons from effluent monitoring for B2000; groundv contamination associated with chlorinated solvents; and copper contamination within a concrete slab. It was noted by WSP that the effluent treatment facility had bee decommissioned, that the identified groundwater contamination was outside of the Site boundary and that the concrete slab had been remediated; ▲ A 1999 Initial Ground Investigation by Soil Consultants Limited (reported to hav been associated with the northern area of the Site), which was stated to identified potential issues associated with elevated levels of cadmium within t boreholes, and elevated levels of arsenic, lead, copper, zinc and mercury within a single borehole, however, it was noted by WSP that the soil guidance values used for comparison at that time were no longer applicable; and ▲ A 2004 Addendum, Site Investigation Report undertaken by STATS. It was state that the report identified potential issues associated with elevated levels of ground gas within Made Ground. It was noted that the report was based on a monitoring event and did not record flow rate. It is also suggested that Batelle UK Limited and Havant International Limited had outstanding intrusive investigation report for the north-west area of the Site, with intrusive

	boreholes placed west of B1000 to assess groundwater and other ground environmental factors. This report has not been seen by Delta-Simons. WSP concluded that based upon the information and intrusive investigations reviewed, no significant contamination issues had been identified for the continued commercial use of the Site. However, it was noted that the potential presence of residual contamination, which may require remediation in the event of redevelopment could not be discounted. It was considered that the Site represented a low/ medium environmental risk.
Geo-Environmental Appraisal (2019)	Clancy undertook an intrusive investigation in July 2019 across the north-eastern an southern areas of the Site to support the demolition and redevelopment works detailed in planning application APP/19/00703. The report also includes limited discussion of the UXO Report discussed above in Section 2.3. Investigation works at the Site included the advancement of eight window sam boreholes to 5.5 m bgl, four hand trial pits to 1.4 m bgl, four cable percussive boreholes to 24.9 m bgl and the excavation of two trial pits for soakaway testing purposes. Visual and olfactory evidence of hydrocarbon contamination was identified a locations (WS2 & WS5) between 1.0 to 1.6 m and 2.5 to 3.5 m, respectively. From nine samples of Made Ground and six samples of natural soils, no elevated levels (in comparison to Site Screening Values (SSV)) of inorganic contaminan commercial/ industrial end use were identified. In regard to organic determinands, elevated levels of hydrocarbons (aliphatic C10-12 C12-16 & Aromatic C12-16) were identified at WS2 and WS5 noted to be above 'Water Screening Values'. It is noted that from a review of the values, these fall below Delta-Simons soil Generic Assessment Criteria (GAC) for a commercial/ industria however, exceed GAC values for potable water. It was noted by Clancy that no elevated levels of hydrocarbons were identified from samples taken from 3.9 m bgl. Clancy noted that WS2 was located in an area of former waste storage and exist substation, with WS5 located adjacent to historical tanks in the west whicl considered to likely be the source of contamination. From four rounds of gas monitoring, carbon dioxide levels were identified up to 7.2 % v/v with a maximum flow rate of 0.7 l/hr. No elevated levels of methane were identified. The Site was considered to represent a Characteristic Situation 1; however, given the level of carbon dioxide (above 5 %), depth and nature of the Made Ground, and presence of peat in the area, Clancy recommended for the Site to be raised to a Characte Situation 2. Overall, the following recommendations were provided: ▲ Additional investigations in the area of WS2 and WS5 to delineate the identif hydrocarbon contamination with regards to controlled waters; ▲ Preparation of a remediation strategy following delineation; ▲ The installation of gas protection measures in line with CS2 within new units wi independent verification; and ▲ The consideration of UXO during future excavations with the potential for supervision by an EOD engineer to brief and support site personnel.
Supplementary Investigation (2020)	Clancy undertook a supplementary investigation across the south of the Site in J 2020. The report also makes note of two letter reports by Clancy Consulting September 2019 (10/1425/002) and June 2020 (10/1425/003), which have not seen by Delta-Simons; however, information from these was noted to be included within report. Further works at the Site included the advancement of two cable percussive boreholes to 20.0 m bgl, and twenty-five window sample boreholes to 4.5 m bgl.

	Ground conditions identified Made Ground (consistent with the material identifie 2019) to 1.1 m bgl. Visual and olfactory evidence of contamination was identified at one location. From three samples of Made Ground and twenty-four samples of natural ground, a slight exceedance of perylene was identified at one location; however, given the very low value and relatively low volatility, this was not considered to represent a signficiant risk to future Site users. Total petroleum hydrocarbon (TPH) compounds were recorded in Made Grour excess of solubility limits at two hotspot locations along with a number of elevated volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC). From six groundwater samples, slight exceedances of lead and nickel were identified at one location, along with marginally elevated total PAH (maximum of 0.96 µg/l) and TPH (maximum of 283 µg/l); however, the concentrations were not considere significantly elevated. It was noted by Clancy that no elevated source of PAHs was identified within soils, and it was considered that this was representative of either an off-Site source or on-S source which had not yet been identified. Based on testing it was considered that the majority of Made Ground and natural soils would be suitable for disposal as non-hazardous waste with localised TPH impacted soils requiring disposal to a hazardous waste landfill. Overall recommendations for the proposed development included the following: ▲ Development of a Remediation Method Statement; ▲ Development of a Materials Management Plan if Site won soils are proposed for re-use on-Site; ▲ Excavation and removal of identified contamination hotspots in the vicinity of WS2 and WS5 with subsequent inspection and verification of excavation works; ▲ Implementation of a watching brief for previously unidentified soil contaminat during the groundworks; ▲ Collection and laboratory analysis of soil samples from finished formation l across the Site to verify that residual contaminant concentrations are below guidance values; and ▲ Provision of a Verification Report to assist with discharge of planning conditic relating to contaminated land.
Implications for Land Contamination Risk	*Several ground investigation reports appear to have been produced for the Si number of which have not been seen by Delta-Simons. Based on the recent availabl information, two hotspots of hydrocarbon contamination have been identifiec recommendations for off-Site removal, and it was considered for the areas investigated basic gas protection measures should be installed.*
Implications for Redevelopment	*Considering the recent investigations only covered areas in the north-east and soutl and the proposed development covers the majority of the Site, further i investigation is recommended.*

2.8 Flood Risk Advisory

Initial Flood Risk Review	A review of mapping provided by the EA indicates that whilst the majority of the Site is not located within an area at risk of flooding from rivers or the sea, a small area of th access road is shown to be at medium risk of fluvial flooding from Mill Stream. Anecdotal information previously provided from a Site representative indicates that this small area of the access road does not have a history of flooding.

	The EA Long-Term Flood Risk Map (Surface Water) indicates the majority of the Sit largely to be at very low risk from surface water flooding. There are localised areas c low risk, small areas of medium risk (around the boundary of Building 5000 and south-west corner of Building 7000), and an isolated pocket of high risk associated with a localised topographical depression south of Building 1000. During previous Site visits, Delta-Simons was informed that all surface water from th car parking passes through interceptors and a surface water pumping station in the east of the Site, prior to discharge into the Mill Stream. It was also noted that water ingres occasionally occurs within a electrical switch room located within Building 1000 following intense rainfall with evidence of sandbags and flood barrier observed at the entrance. The Site is located within an area considered to be at potential susceptibility groundwater flooding; however, no incidents of groundwater flooding have previousl been highlighted. Delta-Simons has previously reviewed a Foul Water Flood Risk Assessment produced by Atkins in 2008 (2008 FRA) which highlighted an incident of historic foul water sewer flooding in 2008 due to surcharge of the foul water system. The 2008 FF recommended several mitigation measures to prevent flooding associated with the foul water systems on-Site. Information provided to Delta-Simons in 2019 indicates that non-return valve was installed near Building 7000, which is likely to reduce the risk c sewer flooding at the Site. It should be noted that all the flood maps are indicative only.
Clancy Consulting Flood Risk Assessment and SUDS Strategy (2019)	A FRA and SUDS strategy was produced for the Site in 2019 associated wit proposed reconfiguration of Building 1000, addition of car parking and redevelopment of the south-western area of the Site. Overall, it was considered that the development area was at low risk of flooding (from all sources) with the proposed drainage to attenuate flows from impermeable area current run off rates through underground geocellular tanks, oversized pipes, permeable paving and flow control devices. Two letter reports by Clancy have also been identified from August and October 201 which further discuss the potential flood risk at the Site following comments from the EA. The letter reports note that a flood defence (embankment) is present to the east of the Site which comprises a crest height of approximately 2 m above the modelled river level (including 20% climate change) which would therefore provide suitable protection from potential flood events.
Implications for Flood Risk	*Based on the information reviewed, the majority of the Site is not located within an area considered to be of an elevated risk of fluvial flooding. Whilst a small area of the access road in the east of the Site is shown to be at moderate risk of flooding associated wit the Mill Stream, this is understood to be protected by an embankment.* *Several areas of the Site are shown to be at potential risk of surface water floodi however, no associated issues were reported on-Site with the exception of minor water ingress at Building 1000.* *Available information indicates that flooding events have occurred at the Site associated with surcharging of the foul system, however, it is understood that a non-return val was installed at the Site.*
Implications for Redevelopment	*Whilst a Flood Risk Assessment is available for the current development proposals, it is likely that a further assessment and drainage strategy will be required to support t proposed redevelopment of the Client's masterplan.*

3.0 Land Contamination Risk

3.1 Introduction

A Conceptual Site Model (CSM) represents the relationships between contaminant sources, pathways and receptors, to support the identification and assessment of Possible Contaminant Linkages (PCL).

Where PCL are identified, a preliminary risk assessment is undertaken to assess the likelihood that each possible linkage exists and to determine whether these pose potentially unacceptable risks to identified receptors and require further assessment. Where this linkage is of a form that subsequently leads to the potential for land being identified as 'contaminated land' under the terms of Part 2A of the Environmental Protection Act 1990, the linkage is termed a significant contaminant linkage.

At the preliminary risk assessment stage, which is typically based upon desk study information and Site reconnaissance, the decision on whether a PCL poses a potentially unacceptable risk is based upon professional judgement. The significance of the PCL will also be determined dependant on the context of the land use and the purpose of the assessment.

Assessing risks from land contamination underpins the suitable for use approach adopted under Part 2A of the Environmental Protection Act 1990 and its associated regulatory regime.

3.2 Conceptual Site Model

The Site is occupied by a science park comprising a number of interlinked commercial offices and light industrial properties, with car parking in the south, east and north of the Site, hardstanding and access roads, and landscaping confined to limited areas. While chemical storage, diesel back-up generators and electrical substations were previously identified on-Site, the Site appeared well managed and no significant potential contamination concerns were noted associated with the current Site use.

The Site was predominantly unoccupied until the development of a sewage works in the north-east by 1909. By 1973, the sewage works was no longer present, and the Site had been redeveloped into an IBM computer products manufacturer. Since the 1970's, some redevelopment has occurred on-Site, though the main buildings have largely remained unchanged. Potentially contaminative uses associated with the computer manufactory include previous 'wet' processes in B1000, diesel powered boilers in the area of the current gas boiler systems (B3000), an effluent treatment and chemical storage area in the area of B22, and effluent treatment and former chemical storage in the area of B41 and B42. Also, a former pollution incident was reported to have occurred in the 1980's, however, no further details are known.

Potential sources of contamination identified in the surrounding area include a mill, a sewage works, factories, an engineering works, a warehouse, a boatbuilding works/ works, a plastics factory, works, a pumping station with a tank and a petrol filling station.

The Site is considered to be of a moderate environmental sensitivity given: the presence of Secondary A Aquifers (which comprises some cohesive deposits) over a Principal Aquifer; the proximity of the Mill Stream; the presence of statutory designated ecological sites downstream of the Site (Chichester and Langstone harbour); and the mixed commercial, light industrial and residential use of the surrounding area.

Based on the recent available information, two hotspots of hydrocarbon contamination have been identified with recommendations for off-Site removal, and it was considered for the areas investigated basic gas protection measures should be installed.

3.3 Contaminant Linkage Assessment

Based on the information reviewed within this Report, the following preliminary risk assessment table has been formulated, which identifies all PCL in the context of the Sites proposed redevelopment.

Risk definitions used for the following assessment are provided as follows:

- Low risk – Low likelihood and either no or mild severity. Negligible/ unlikely contaminated land situation. Either no action recommended, or possible action during changes in conditions;

- Moderate risk – Likely probability and medium severity. Plausible contaminated land situation. Possible action recommended following further risk assessment; and
- High risk – High likelihood and severe severity. Likely or demonstrable contaminated land situation. Action (possibly urgent) recommended.

Contaminant Linkage Assessment				
Source(s)	**Pathway(s)**	**Receptor(s)**	**Risk Rating**	**Justification & Mitigation (if required)**
Potentially contaminated soils and/or groundwater located beneath the Site.	Direct contact/ ingestion and inhalation of dust and vapours.	Site users.	**Low Risk**	Whilst the presence of further localised contamination is possible, given the Site is to be predominately covered by buildings and hardstanding, which will significantly constrair the associated pathways, the risk is considered to be low.
	Direct contact, ingestion and inhalation of dust and vapours.	Maintenance workers during any future sub-surface works at the Site.	**Moderate Risk**	Site workers may become exposed to localised contaminated soils and groundwater during intrusive groundworks undertaken at the Site. Safe working practices should be undertaken and appropriate Personal Protective Equipment (PPE) should be used that will reduce the risk to low.
	Leaching of contaminants and vertical migration.	Groundwater beneath the Site.	**Low to Moderate Risk**	Previous investigations across the southern area of the Site have identified localis contamination and the potential for further localised contamination to be prese possible. Also, there is the potential for contaminants to be mobilised during construction works, and in the absence of Site-wide available information, the risk is considered to be low to moderate.
	Permeation of hydrocarbons through plastic pipe work.	Water supply pipes.	**Low to Moderate Risk**	Hydrocarbons, especially aromatics and chlorinated solvents are known to permea plastic pipes, particularly when encountered at high concentrations. Whilst widsprea hydrocarbon contamination was not previously identified, the proposed redevelopmen may introduce water supply pipes to potentially localised areas of contamir Upgraded water supply pipes may be required in order to reduce this risk to low.
	Lateral migration through any groundwater beneath the Site.	Off-Site receptors (neighbouring properties/ users and nearby surface water).	**Low to Moderate Risk**	The Mill Stream is located adjacent to the east of the Site and available informa indicates that groundwater will be present at shallow depth. While the buildings hardstanding across the majority of the Site will limit potential contaminant migration, the construction activities may mobilise contaminants. Therefore, the risk to off-Site receptors is also considered to be low to moderate.
Ground gas.	Vertical and lateral migration of ground gases.	Site users & the buildings on-Site.	**Low to Moderate Risk**	Based on the available information, slightly elevated levels of carbon dioxide previously identified in the southern and north-eastern areas of the Site in line Characteristic Situation 2. The Site is also partially located within an intermediate radon gas area. Based on the proposed development, basic gas protection measures are likely to be required in any new buildings.
Potentially contaminated soil and groundwater from off-Site sources.	Lateral migration and subsequent inhalation.	Groundwater beneath the Site and future Site users.	**Low Risk**	Whilst potential off-Site sources of contamination have been identified, giv proposed use of the Site, which will be predominantly covered by buildi hardstanding, the risk to Site users is considerably reduced. Overall, th considered to be low.

4.0 Conclusions & Recommendations

4.1 Land Contamination/ Ground Conditions

Risk Assessment Summary/ Conclusions	Delta-Simons has completed a land contamination risk assessment based on available information. Information has indicated that significant widespread contamination is unlikely to be present. However, localised contamination recently identified at the Site, which it has been recommended to be remediated (excavated) and given the historical use of the Site, the potential for further localised contamination to be present is possible. It is, therefore, considered that the risk significant possible contaminant linkages to exist is low to moderate for a continued use and for the proposed redevelopment.
Recommendations – Ongoing Use	No further works are considered to be required for land contamination purposes in the context of an ongoing use.
Recommendations – Future Redevelopment	Given that a future redevelopment of the Site is proposed that covers a wider area than originally investigated, it is expected that the regulatory bodies will require a further intrusive investigation, under the planning process. In the first instance recommended that an up to date Preliminary Risk Assessment is completed and submitted along with any future planning application. Following an updated Preliminary Risk Assessment and Ground Investigation a Detailed Quantitative Risk Assessment (DQRA) may be required in order to confirm whether any remedial works are required and in order to derive Site-specific remediation targets. Following a DRQA, localised remedial works is possible. Also, additional costs could be incurred by: any ground materials requiring off-Site disposal; the upgrading of water supply pipes; the provision of ground gas/ radon protection measures; and importing clean/ certified topsoil in any areas of future landscaping. Ground conditions are variable with deeper areas of Made Ground and foundations from historical structures. Ground improvement and/ or a piled foundation solution are likely to be required, which costs should be considered. It is also prudent to further consider the potential for encountering UXO during future groundworks. Any ground workers who are required to perform sub-surface work at the Site should be made aware of the possibility of encountering localised contamination. Therefore, good standards of personal hygiene should be observed with appropriate levels of PPE provided and utilised and toolbox talks given to contractors prior to the commencement of works.

4.2 Statement of Risk/Land Contamination Liability Assessment

This Assessment considers both perceived and actual risks using the contaminant linkage concept, with the principal measure of risk being whether significant harm (to people, animals, property (including buildings, cattle etc.), or statutory ecological receptors) or pollution of controlled waters (surface water bodies, aquifers, coastal waters, or territorial waters) is being caused, or whether there is a significant possibility of such harm being caused.

The overall risk classification, based on the source-pathway-receptor principle, adopted for this preliminary assessment, is defined as follows:

- Low risk – issue unlikely to present a liability or cost;
- Moderate risk – issue may present a liability or cost, but these may be limited; and

- High risk – likely that significant liabilities and/or costs exist.

Regulatory Action under Part 2A, EPR or EDR	There is considered to be a **Low** risk of enforcement action by the regulat authorities under Part 2A of the Environmental Protection Act 1990, the Environmental Permitting Regulations 2016 or the Environmental Damage Regulations 2015, whilst the Site remains in its current use. However, it should be noted that appropriate works (including additional intrusive investigation) will be required in order to support f future development proposals.
Third Party Liability	The potential for legal action by surrounding landowners based on the potential f contamination to migrate off-Site and result in private or statutory nuis considered to be **Low**.
Investment/Asset Impact	Delta-Simons considers there to be a **Low to Moderate** risk of impact on the value of the Site from significant contamination issues, in the context of the Site remaining ir its current use or for the proposed redevelopment.
Overall Statement of Risk	On the basis of available information, Delta-Simons considers that with regar potential soil and groundwater contamination issues and associated environment liabilities, the Site represents an investment opportunity with a **Low to Moderate** overall risk status in the context of its current use and proposed redevelopment.

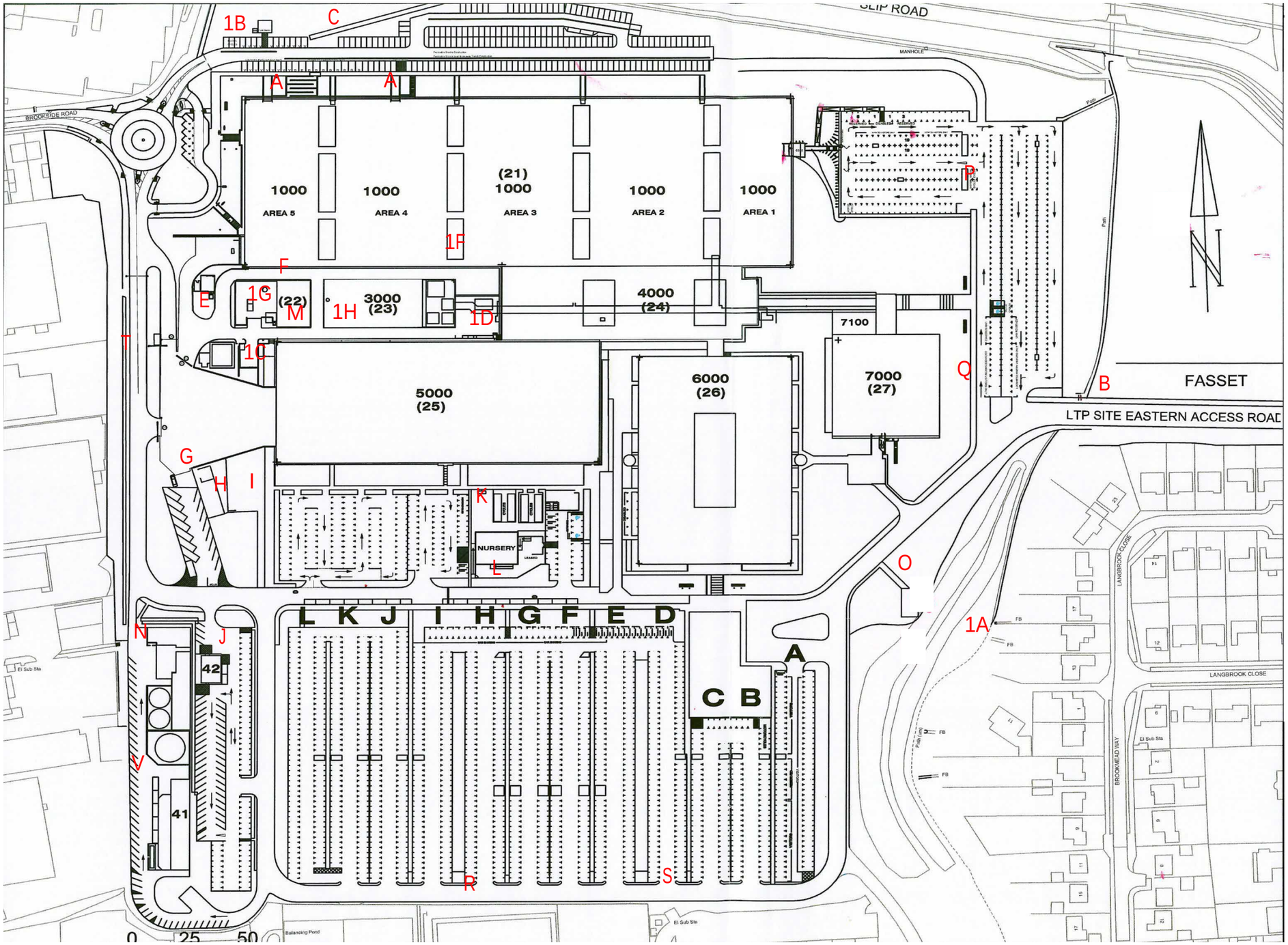
4.3 Flood Risk Advisory

Conclusions & Recommendations	Based on the information reviewed, the majority of the Site is not located within area considered to be of an elevated risk of fluvial flooding. Several areas of the Site are shown to be at potential risk of surface water flooding, however, no associat issues were reported on-Site with the exception of minor water ingress at Build 1000. Available information indicates that flooding events have occurred at the Sit associated with surcharging of the foul system, however, it is understood that a non- return valve was installed at the Site. Whilst a Flood Risk Assessment is available for the current development proposals, it is likely that a further assessment and drainage strategy will be required to support the proposed redevelopment of the Client's masterplan.

4.4 Other Redevelopment Considerations

Recommendations	Additional environmental surveys were completed and submitted to the Local Planning Authority to support the previous proposed development works, which included those associated with ecology, heritage, air quality, noise and sustainability (BREEA These are all likely to require updating for any future planning re-submission.

Figure 1 – Site Features Plan



Project No. 15-0574.02	Title: **Langstone Technology Park Figure 1 - Site Features Plan**	Scale: NTS	Date: 07-May-18
deltasimons			Drawn: KH
			Checked: SJB

Drawing 1 – Proposed Masterplan



Car park 1st floor
1 : 2000

Notes

This drawing may be scaled for the purposes of Planning Applications, Land Registry and for Legal plans where the scale bar is used, and where it verifies that the drawing is an original or an accurate copy. It may not be scaled for construction purposes.
Always refer to figured dimensions. All dimensions are to be checked on site. Discrepancies and/or ambiguities between this drawing and information given elsewhere must be reported immediately to this office for clarification before proceeding. All drawings are to be read in conjunction with the specification and all works to be carried out in accordance with latest British Standards / Codes of Practice.

Rev	Date	Init	Notes	Chkd
A	15.05.20	LI	Updated following client comments	

North

20 0 20 40 60 80 100

SCALE 1:2000 m

Client

Drawing Originator

AWW inspired environments
London - 106 Weston Street London SE1 3QB 020 7160 6000
Bristol - Rivergate House, Bristol, BS1 6LC 0117 903 2636
Plymouth - East Quay House, Plymouth, PL4 0HX 01752 261 282
RIBA Chartered Practice www.aww-uk.com

Project Title
Langstone Technology Park

Drawing Title
Future Masterplan

Scale	Sheet	Drawn	Checked	Date
1 : 2000	A3	LI	IJ	13.05.20

Status	Project No.	
PRELIMINARY	4046	
Drawing Reference	Drawing No.	Revision
	0170	A

Plan provided by Client

GEO-ENVIRONMENTAL APPRAISAL REPORT

Langstone Technology Park,
Havant,
Portsmouth
PO9 1SA

October 2019
Report Ref: 10/1425/001

Prepared on Behalf of:

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GEO-ENVIRONMENTAL APPRAISAL REPORT
LANGSTONE TECHNOLOGY PARK, HAVANT, PORTSMOUTH

Report Reference: 10/1425/001

Date: October 2019

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EXECUTIVE SUMMARY

Client	AG Langstone B.V.
Location	The site comprises an approximately rectangular section of land occupying an area of 16Ha. The site is located toward the southern periphery of Hava approximately 600m south of the Town Centre, and 1.5km south-ea Junction 5 of the A3(M). Vehicular access onto the site is obtained from tl west via Brookside Road, and from the east via a dedicated access road (LTP Site Eastern Access Road). The approximate National Grid Reference for the centre of the site is 471300, 105700.
Development	The site is proposed to be partially re-developed comprising the demolition and reconfiguration of an existing laboratory and manufacturing unit located toward the north of the site in order to extend parking provision wi associated landscaping and the construction of four (4No.) light industri commercial units with associated parking across the south of the site v associated car parking.
Site History	Historical OS maps of the area indicate the site was undeveloped until the early 1900s when a large sewage works and engine house occupied the nc eastern section of the site. During the subsequent decades this underwent significant expansion. In the mid 1950s, an allotment g occupied the centre of the site. In the early to mid 1970s, the site had undergone large-scale redevelopment, resulting in the construction of many of the existing commercial / industrial units. In addition, by this time a large building and a electrical sub-station occupied the southern section of the site, withi existing car-parking area. By the early 1990s the building / electricity substation across the south of the site had been replaced by the existing car park and the site is understood to have been in its current configuration. The surroundin area has been a mix of undeveloped, and industrial land uses with mills, sewage works, works and industrial units along with a retail park with assoc infrastructure all located / historically located within close proximity to the site.
Unexploded Ordnance	It is considered that there is an overall Medium Risk from German and an aircraft UXO at the site. It was also considered that the risk from Allied Ordnance was Low-Medium. It was recommended that a site-specific plan for the management of UXO risk be written for the site, that briefings be given to operativ commencement of intrusive investigation works, and that these briefings b supplemented with UXO specialist engineer attendance during the works, and magnetometer survey of excavation positions.
Geology	The majority of the site is indicated to be underlain by superficial Alluv Deposits. The western periphery of the site was recorded to be underlain b River Terrace Deposits. A thin, linear band of superficial Head deposit indicated to be present across the central and southern sections of the site. Bedrock underlying the site is recorded to comprise chalk.
Mining	The site is not located within an area which may be affected by coal mini activity and no BGS recorded mineral sites are within 500m. There is 'very low' or 'no' hazard potential with regard to ground stability issues including, ground dissolution and landslides hazards. The potential haza associated with collapsible ground, shrinking or swelling clay and running sand was considered 'low'. The potential hazard associated with compressible ground was considered 'moderate'.
Environmental Setting	The nearest identified environmental receptors are the underlying superficia strata which is classified as a Secondary A Aquifer, solid strata classified as a Principle Aquifer and water course immediately to the east of the site thougl the site is not situated within a Source Protection Zone and no groundwater or surface water abstractions have been identified within 250m of the site.

	The closest identified formal surface water feature is Langstone Mill Channel, which flows north to south past the site immediately beyond the ea boundary.
Flooding	The site is not within an area susceptible to flooding from rivers or sea without defences however due to the size of the proposed development, a formal Flood Risk Assessment is likely to be required for the site.
Ground Conditions	Made Ground was identified during the intrusive investigation works to depths of up to 3.1m bgl. and generally comprised a variable sequence of e predominantly granular or cohesive materials of various subtypes. Sub-surface hardstanding was encountered in several locations across the site, generally corresponding with the locations of historic / demolished buildings There remains the possibility that buried structures may be present elsewhere on site which have not been identified during this investigation. The Made Ground was underlain by a sequence of interbedded granular and cohesive strata interpreted to predominantly comprising river terrace deposits and or a highly weathered material derived from the underlying bedrock. These superficial deposits were proven to a maximum depth of between 5.1m ar 6.0m bgl. Solid chalk bedrock was encountered below the superficial deposits across the site, proven to a maximum of 24.85m bgl. Groundwater was generally encountered across the site during the fieldwork at depths of between approximately 2.0m to 3.0m.
Soil Contamination	Visual and olfactory evidence of hydrocarbon contamination was recorded ir WS2 and WS5 between though chemical testing did not ide contaminants which exceeded relevant SSVs for commercial / industrial en use in terms of human health and no asbestos fibres or AC encountered during the investigation. Whilst no elevated concentrations of the determinands tested have l recorded in terms of human health, localised concentrations of contaminants not identified / investigated during this investigation may be present in quantities considered harmful in terms of human health. Should during any investigation / remediation / construction works identify visual or olfac evidence of contamination, a suitably qualified environmental consultant should be contacted to further assess any potential issues. Additional works may be required to suitably quantify the risk to potential and identified receptors. In respect to controlled waters, chemical testing has identified ele concentrations of organic contaminants when compared to SSVs for commercial / industrial end use in the locations of WS2 and WS5. Given th presence of controlled waters beneath the site and groundwater identified a approximately 2.0m to 3.0m bgl, it is recommended that further work undertaken in these areas with the retrieval of soil and groundwater samples to suitably delineate the identified contamination and further assess the risk these contaminants pose.
Concrete Classification	Laboratory testing indicates that sub-surface concrete should be prepared as Design Sulphate Class DS-1 with an ACEC classification of AC-1.
Foundation Recommendations	It is considered that a shallow foundation solution may prove problematic given the very variable nature of the shallow natural strata. If a shallow foundatic solution is utilised, excavations may need to over-deepened in areas of deeper Made Ground or very loose / very soft natural strata. Any shallow foundations may span strata of varying characteristics and may be at risk of differen settlement. We would therefore recommend that foundations are reinforced to protect against differential settlement. Given the above, a piled foundation may prove more suitable. Additional advice should be sought from a specialist piling contractor regarding the pile desig (i.e. type, length and diameter). If a piled foundation solution is to be utilised there may be differential settlement between piled structures surrounding ground level.

Hazardous Ground Gas	Ground gas monitoring was undertaken on 4 occasions and has recorded 7.2% carbon dioxide. No methane has been identified and gas flow rates typically absent. Based on the gas screening values available, the site can be classified as Characteristic Situation 1 (CS1). According to the current guidance and best practice however, where carbo dioxide concentrations are recorded in excess of 5%, consideration should be given to increasing the classification to CS2. In this instance, given the relatively short monitoring period, the presence of elevated carbon dioxide, deple oxygen levels, the depth and nature of the filled ground and presence of peat in the local area, we would recommend that the characteristic situat increased to CS2 and that gas protective measures are installed in all r structures in accordance with guidance provided in BS 8485: 2015 "Code of Practice for the Design of Protective Measures for Methane & Carbon Dioxide Ground Gases for New Buildings".
Soakaway Testing	As part of the investigation, soakaway testing was undertaken in ger accordance with the guidance provided in BRE digest 365 'Soakaway Design' in two locations with falling head tests also undertaken in two locations in order to supplement the soakaway data. Recorded infiltration rates suggest that the superficial deposits exhibit marginal to good drainage characteristics, and that soakaway drainage / permeable paving may be suitable subject to des parameters. Infiltration rates within the granular Made Ground also show good drainage characteristics however it should be noted that soakaway drainage in Made Ground is generally not considered acceptable by regulators. Whilst no visual or olfactory evidence of contamination was observed and laboratory test results within this area have not highlighted any elevated concentrations of the determinands tested, further thought should be given to the suitability of thi location for the installation of soakaways. Due to the presence of chalk there is a risk of ground dissolution featu caused by traditional soakaway structures that concentrate infiltration t localised area. In low to medium density chalk traditional soakaways must have a minimum of 5-10m separation from buildings and structures to avoid generation of dissolution features that may impact on building foundati (CIRIA C574 'Engineering in Chalk'). Distributive soakaways such as permeable paving and sub-base infiltration that do not concentrate infiltration avoid the risk of generating groundwater dissolution features.
Further Works	Based on the information available to date we would recommend the following further works are required: Additional investigations to be carried out in the location of WS2 and WS5 to delineate identified organic contamination with regards controlled waters. Soil and water samples to be recovei laboratory testing. Preparation of a Remediation Strategy following delineation of t organic contamination for approval with the Local Authority. Gas protective measures to be installed in all new structu accordance with CS2 conditions. The installation of the protect measures should be independently verified to ensure they are fit fo purpose and to assist with planning discharge. The continued risk of unexploded ordinance should be consider during any future excavations and an EOD engineer may be required on site to brief and support site personnel.

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Site Location Plan
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Appendix IV	Geotechnical Laboratory Results
Appendix V	Foundation Pit Sections
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1.0 INTRODUCTION

1.1 Background

Clancy Consulting Limited has been instructed by AG Langstone B.V to carry out a Geo-Environmental Appraisal for Langstone Technology Park, Havant, Portsmouth. Current redevelopment proposals include the partial demolition and reconfiguration of an existing building (Building 1000) located towards the north of the site in order to extend parking provision with associated landscaping, the construction of two new entrance / lobby areas to the existing Building 6000 and the demolition of the existing buildings in the south west of the site to facilitate the construction of four new light industrial buildings comprising twelve units with associated car parking. The newly constructed units will occupy a total area of approximately 12,500m^2 (use classes B1C, B2 and B8). Additional areas of proposed car parking are also planned in the south east and west of the site.

A Phase 1 Desk Study has been carried out for the site by Delta Simons Environmental Consultants Ltd which should be read in conjunction with this current, site investigation report. Clancy Consulting Ltd have also been provided with a copy of a Detailed UXO Risk Assessment for the site. Both of these documents are referenced below.

Delta Simons Environmental Consultants Ltd. (May 2019) *'Preliminary Geo-Environmental Risk Assessment'*

1st Line Defence Ltd. (May 2019) 'Detailed Unexploded Ordnance (UXO) Risk Assessment'

The Delta Simons report references two other phases of investigation, the reports of which are referenced below. Clancy Consulting Ltd have not however been in receipt of a copy of these reports.

WSP (December 2005) 'Phase I Environmental Assessment'

Delta-Simons Environmental Consultants Ltd. (September 2018) 'Phase I Environmental Assessment'

A site location plan and proposed site layout plan are presented in Appendix I.

1.2 Objectives

The objectives of this investigation are summarised below:

Review and provide a summary of data obtained during a previous Phase 1 geo-environmental site investigation carried out by a third party, inclusive of land use history, environmental setting, geology, hydrology, hydrogeology, mining and potential geotechnical hazards at the site and surrounding area.

Undertake a ground investigation comprising the excavation of trial pits, window sample and cable percussive boreholes in order to examine the ground conditions present at the site, and the characteristics of existing building foundations.

Carry out chemical testing of the soils to assess whether any contamination risk exists with regard to the environment and / or human health.

Undertake testing for the presence of asbestos fibres in soils and any fragments of asbestos containing materials (ACMs) encountered during the site investigation to assess whether any risk exists with regard to human health.

Carry out a gas risk assessment to investigate the potential risk to end users of the site from hazardous ground gas.

Refine the Preliminary Risk Assessment and Conceptual Site Model with regard to potential contamination sources, pathways and receptors.

Carry out geotechnical testing of the soils to further assess their physical characteristics and provide indicative recommendations for foundations.

Provide recommendations regarding the requirement for further investigations, if required, to satisfy the Local Planning Authority.

1.3 Limitations of the Study

Clancy Consulting Limited cannot be held responsible for any omissions, misrepresentation, errors or inaccuracies with the supplied third-party reporting / information. The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information or improved practices and changes in legislation may require a reinterpretation of the report in whole or in part.

Clancy Consulting Limited reserves the right to amend either conclusions or recommendations in light of any further information that may become available. The report is provided for the sole use of AG Langstone B.V. for the objectives discussed previously only and is confidential to them.

The report may not be relied upon by any other party without prior written consent of Clancy Consulting Limited. Those using this information in subsequent assessments or evaluations do so at their own risk.

There is a possibility that buried structures may be present beneath the site associated with potential historic buildings which have not been identified during this investigation.

1.0 DESK STUDY

2.1 Sources of Information

The following sections summarise the data presented in the documents referenced above, supplemented by data obtained from statutory and online data sources including those provided by the British Geological Survey (BGS), the Environment Agency, and DEFRA.

2.2 Site Setting and Description

Langstone Technology Park, hereafter referred to as ‘the site’, comprises an approximately rectangular section of land occupying an area of 16Ha. The site is located toward the southern periphery of Havant, approximately 600m south of the Town Centre, and 1.5km south-east of Junction 5 of the A3(M). Vehicular access onto the site is obtained from the west via Brookside Road and from the east via a dedicated access road (LTP Site Eastern Access Road). The approximate National Grid Reference for the centre of the site is 471300, 105700.

Langstone Technology Park comprises a series of large buildings subdivided into leased units of varying purposes. The largest of the buildings located toward the north of the site and referred to

as 'Building 1000' is a single-storey structure built atop of a man made embankment and understood to contain a number of office, manufacturing and laboratory units with access tunnels running from the car park to the north to beneath the building.

Occupying the centre of the site are a series of buildings including two plant buildings ('Building 2000 and 3000'), offices and amenity complex with associated courtyards ('Building 4000'), a large data and distribution centre ('Building 5000') with waste storage area to the west, and three-storey office buildings ('Building 6000 and 7000'). A small on-site nursery is present to the south of Building 5000.

Toward the south-western corner of the site is a small gymnasium, vehicle washing area (with associated subsurface drainage) storage area and a number of circular historic tank bases. A site walkover undertaken by a third party (Delta Simons) in July 2015 recorded this area to have previously been used as a deionised water production facility, a caustic and buffer chemical storage area, and an effluent treatment plant. Additional information is provided in Section 2.17 below.

Access infrastructure and open landscaping is covering the rest of the site, with engineered slopes within the landscaping areas across the site, suggesting that significant earthworks have previously taken place. The remainder of the site is currently occupied by car parking areas.

The site is bound to the west and south by a series of commercial / light industrial units fronting onto Southmoor Road and Penner Road which run parallel to the site approximately 100m from the respective boundaries. These units are separated from the site by thin, linear sections of heavily vegetated landscaping. Immediately beyond the eastern boundary of the site is a vegetated river corridor associated with Langstone Mill Channel, which runs north to south past the site, eventually flowing into Bridge Lake approximately 500m to the south. Beyond this corridor to the east is a large residential estate.

North of the site, beyond the landscaping areas is the main carriageway of the A27. The associated verges are wooded with a public footpath with forms a site access in the north east of the site. Beyond the A27, approximately 100m to the north is a retail park which includes a Petrol Filling Station.

Open space belonging to Southmoor Nature Reserve is present approximately 250m to the south separating the tidal lakes (Bridge Lake and Storehouse Lake) from the various industrial / commercial concerns located on and in the vicinity of the site.

2.3 Phase 1 Desk Study Findings

2.3.1 Site History

As part of the Phase 1 Desk study undertaken by Delta Simons Environmental Consultants Ltd. available historical Ordnance Survey (OS) maps, and aerial photography were examined in order to assess the development history and previous land uses at the site and in the surrounding area. The findings of this assessment are summarised below.

The first available OS map dated 1867 records the site and immediate surrounds to have been under predominantly agricultural use with several small, unspecified buildings recorded toward the north-western and western peripheries of the site. Havant Corn Mill was recorded approximately 90m north-east of the site. A watercourse was shown flowing north-east to south-west across the northern section, and a series of artificial drainage channels ran west to east across the southern section of the site, associated with the Mill Stream / Channel which was located off-site to the east. By 1897, an aqueduct and sluice were shown in the south-western corner of the site associated with the southern drainage channel.

The OS map dated 1909 showed a large sewage works and engine house occupying the north-eastern corner of the site. During the subsequent decades this facility underwent significant expansion. The OS Map dated 1932 showed several large filter beds within the treatment complex.

By 1954 a number of tanks and sludge beds were identified within the sewage works complex and an allotment garden occupied the centre of the site. OS Maps dated 1962 and 1963 record the sewage works simply as 'works', however the orientation of infrastructure within the complex suggests ongoing operation of the facility. By this time, small scale residential development had occurred to the west, and to a greater extent to the east beyond Langstone Mill Channel, and a larger sewage works complex had been constructed approximately 200m to the south-west.

The A27 Havant bypass had been constructed to the north of the site by 1966 resulting in the demolition and removal of Havant Corn Mill. Industrial premises were recorded approximately 50m north-west of the site at this time.

OS maps dated 1972-1975 show the large-scale redevelopment of the site, resulting in the construction of commercial / industrial units occupying the approximate footprints of existing Buildings 1000, 3000, 5000, 4000, 6000 and 7000. In addition, by this time a large building and an electrical sub-station occupied the southern section of the site, within the existing car-parking area. The entire complex was referred to as 'works'. Additional works / industrial units were recorded immediately west of the site, and the retail park located north of the A27 had also been constructed by this time. The sewage works to the south-west had undergone expansion.

By 1990 the building / electricity sub-station across the south of the site had been replaced by a car-park. A number of tanks and an electricity sub-station were recorded across the southwest of the site. Additional industrial units had been constructed immediately west of the site.

By 1993 the site is understood to have been in its current configuration, and by 2000 the industrial units currently located immediately beyond the southern site boundary had been constructed.

A number of potential sources of contamination were identified by Delta Simons within 150m of the site, including:

> The sewage works present on-site between 1909 until circa 1972, and later industrial / commercial activity undertaken at the site following redevelopment including tanks and sub-stations, and prior to the current site use.
>
> Havant Mill, located approximately 90m north-east of the site between 1867 and ca. 1966.
>
> The sewage treatment facility shown approximately 200m southwest of the site between 1962 and the present day.
>
> An unspecified works unit shown approximately 50m north-west of the site between 1966 to present day.
>
> Unspecified works shown immediately west of the site between 1972 and present day.
>
> Other various works including a depot and tanks which were recorded at or in excess of 150m from the site to the north-west and north, but which were not specifically described by Delta Simons within the summary text.

2.3.2 Unexploded Ordnance (UXO) Risk Assessment

The review of historical mapping for the area does not show any significant building damage or demolition which would likely be associated with bomb damage. However, a site-specific assessment of risk with regard to Unexploded Ordnance (UXO) was undertaken by 1st Line Defence in May 2019 on behalf of Delta Simons in support of the Phase 1 Desk Study produced for the site.

The 1st Line Defence UXO assessment considered that there is an overall **Medium Risk** from German and anti-aircraft UXO at the site. It was also considered that the risk from Allied Ordnance was **Low-Medium.**

It was recommended that a site-specific plan for the management of UXO risk be written and briefings be given to operatives prior to commencement of intrusive investigation works. These briefings should be supplemented with UXO specialist engineer attendance during any intrusive works to undertake a magnetometer survey of excavation positions.

2.3.3 Geology

The 1:50,000 British Geological Survey (BGS) scale map for the area (Sheet No. 316, Fareham) indicates that the majority of the site is underlain by superficial Alluvium deposits, with River Terrace deposits underlying the western periphery of the site.

A thin, linear band of superficial Head deposits (clay, sand and gravel) is indicated to be present across the central and southern sections of the site.

Bedrock underlying the site is recorded to comprise chalk of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (undifferentiated) of Cretaceous age. These materials are biogenic and detrital, generally formed by shallow marine processes involving the deposition of carbonate material (coccoliths) forming distinctive beds of chalk.

The BGS do not record the site to be underlain by artificial ground, however given the setting and development history which includes possible large-scale earthworks and reconciliation of former sludge beds, some Made Ground would be expected. Artificial ground associated with the construction of the A27 is identified by the BGS immediately north-east of the site.

The environmental search undertaken as part of the Delta Simons report identified eight records of potentially infilled land (water) located on-site, which were presumed to be associated with the drainage channels/aqueduct shown on historical maps. An additional seven areas of infilled land (water) were recorded off-site, within 250m.

Twelve historical British Geological Survey (BGS) boreholes were recorded within the site boundaries, excavated in 1966 as part of a ‘proposed development at Brookside Road’. Recorded ground conditions generally comprised topsoil to a depth of approximately 0.8m bgl overlying superficial deposits consisting of clay, silt, gravel and occasional peat layers. Chalk bedrock comprising cobbles in a matrix of ‘firm putty chalk’ with flints was encountered below the superficial deposits and recorded to a maximum depth of approximately 5.60 m bgl.

2.3.4 Mining & Ground Stability

According to Coal Authority records, the site is not located within an area which may be affected by coal mining activity. The BGS consider that ‘no hazard’ is present at the site with regard to ‘non-coal’ mining (underground) and there are no recorded mineral sites within 500m.

There is a 'very low' or 'no' hazard potential at the site with regard to ground stability issues including, ground dissolution and landslides hazards. The potential hazard associated with collapsible ground, shrinking or swelling clay and running sand was considered 'low'. The potential hazard associated with compressible ground was considered 'moderate'.

'Moderate' hazard with regard to ground dissolution was recorded approximately 97m north of the site.

2.3.5 Hydrogeology

According to Environment Agency groundwater vulnerability maps, the various superficial deposits recorded across the site have been classified as a Secondary (A) Aquifer, whilst the underlying chalk bedrock is classified as a Principal Aquifer.

The site is not located within a groundwater Source Protection Zone (SPZ), however an SPZ Zone 1 (inner protection zone) is located 173m north-east of the site.

There are three groundwater abstraction licences recorded within 500m of the site, all of which relate to the abstraction of water for potable use from a borehole located approximately 461m north of the site.

No groundwater discharge consents have been recorded within 500m of the site.

2.3.6 Hydrology

The nearest identified formal surface water feature is Langstone Mill Channel, which flows north to south past the site immediately beyond the eastern boundary. Historical mapping has identified additional drainage channels which were previously present across the north-eastern and southern sections of the site. The current status of these former channels is unknown.

A series of tidal waterways, referred to as Bridge Lake, Storehouse Lake, Chalkdock Lake, North Lake and South Lake, which collectively make up a saline estuary are located approximately 500m south of the site.

No surface water abstraction points have been recorded within 500m of the site.

Sixty-six surface water discharge consents have been recorded within 500m. Two of these entries were recorded as being on site and were related to the to the discharge of 'other matter-surface water' resulting from the manufacture of computers / electronics / optical products. The receiving water was not supplied, however, based on the location of the site and adjacent watercourses is anticipated to be Langstone Mill Channel. The consent was originally issued in April 1978 to Xyratex Ltd. and superseded in March 1995 with a similar authorisation issued to Fasset Ltd. The latest iteration of the consent is understood to be active.

Four pollution incidents to controlled waters were recorded within 250m. The closest recorded incident occurred on March 1995 approximately 82m east of the site, involving the release of 'unknown oils / related products' into an undisclosed watercourse. This was considered to be a Category 3 (minor) incident. An additional Category 2 (significant) incident occurred on January 1997 approximately 94m north-east of the site, involving the release of 'diesel oil' into an undisclosed watercourse.

A prosecution relating to controlled waters has been recorded within 250m. This incident involved 'tipping brick rubble onto land without a waste management license' in February 2005.

2.3.7 Flood Risk

According to Environment Agency records, the majority of the site is located in Flood Zone 1 and is therefore not within an area susceptible to flooding from rivers or sea without defences. The eastern periphery of the site, immediately adjacent Langstone Mill Channel is located within Flood Zone 2 (Fluvial Models). With the exception of a small section of the LTP Site Eastern Access Road, no on-site infrastructure is impacted by this designation. Zone 3 (Fluvial Models) is located immediately east of the site.

Due to the size of the proposed development (>1Ha), a formal Flood Risk Assessment is likely to be required.

An area benefitting from flood defences is recorded approximately 70m west of the site. No flood storage areas have been recorded within 250m.

The site is located within a BGS Groundwater Flooding Susceptibility Area where there is potential for groundwater flooding to occur at surface.

2.3.8 Radon Risk Potential

The Radon Guidance on protective measures for new dwellings indicates that the site is located within an area where between 3% and 5% of homes are above the National Radiological Protection Board (NRPB) recommended action level.

As a result, basic radon gas protective measures are likely to be required in new buildings at the site.

It is recommended that a site-specific radon risk assessment be obtained.

2.3.9 Landfill and Waste Management Sites

A historic landfill facility has been recorded within 500m of the site, which was used to dispose of household waste and was located approximately 191m south-west. The rate of input, date of operation / closure, and the size of the facility have not been recorded.

One landfill site has been recorded by the Local Authority within 500m, located 201m to the south-west, off Southmoor Lane and was operated by Havant Borough Council. The facility was authorised to accept household, commercial and acidic waste. No further information was available regarding maximum input rate, size, or last date of input, however, the site is understood to have closed.

Seven historic waste treatment, transfer and disposal facilities were recorded within 500m of the site with one of these entries located on-site. Teleplan Ltd are authorised to operate an electronics (WEEE) treatment facility within the current site boundary; no further detail have been provided, however the authorisation is understood to be active. The closest off-site entry relates to a household, commercial and industrial transfer station which was located 302m west of the site. Authorisation to operate was issued in September 1997 and was surrendered in October 2010.

Two additional registered (EA) waste transfer facilities have been recorded within 500m and the closest is located 281m west of the site and is authorised to accept concrete and brick rubble, construction and demolition wastes and soils. The remaining facility is located approximately 369m west, and is authorised to accept batteries, degradable commercial and household waste, inert materials, metal waste and special waste. Both facilities are understood to be active.

Three registered waste treatment / disposal sites have been identified within 500m. The closest entry relates to a scrapyard located approximately 248m north of the site and the accepted waste was restricted to scrap metal, and associated vehicle wastes. The license lapsed or was cancelled in August 1990. The remaining treatment facilities were located in excess of 350m from the site.

2.3.10 Industrial Land Uses

Seventy-six contemporary trade directory entries have been recorded within 250m of the site, of which eighteen are currently active. Three entries (all inactive) have been recorded on site.

The inactive on-site entries relate to printing activities undertaken by Diamond Print and Mail Centre Ltd., computer manufacture (Xyratex Ltd.) and general engineering (Saacke Combustion Services Ltd.).

Active off-site trade directory entries include; tool design and manufacturers, blind awning and canopy manufacture, domestic appliance servicing and repair, domestic cleaning services, air conditioning and refrigeration contractors, spray painting/coating, precision engineering, marine electrical services, petrol filling stations, garage services, electrical engineers, metal finishing services and pallet manufacture.

Potentially contaminative inactive entries included; fireplace and mantelpiece manufacture, air conditioning and refrigeration contractors, domestic cleaning services, general engineering, commercial vehicle repair, car body repairs, precision engineering, aviation engineering, crane hire, printers, electronic component manufacture and distribution, pest and vermin control, marine engineering, case manufacturers, hospital, road haulage services, packaging manufacturers, waste disposal services, tyre dealers, distribution services, plastic injection moulding, sheet metal work, screen printing, car component manufacture, garage services, dry cleaners, boatbuilding, metal finishing, builders merchants, plastic product manufacture and lighting manufacture.

Two petrol filling stations (PFS) are recorded within 250m. The closest (Havant Lorry Park) is located approximately 137m north of the site. This facility is recorded to be obsolete. An additional active PFS (Tesco Havant Extra) is recorded approximately 141m north.

Twelve industrial manufacturing points of interest were recorded on-site. These records include manufacturing businesses (Fasset Ltd, Havant International Ltd.) and nine unspecified tanks. An additional fourteen manufacturing points of interest (predominantly ‘works’ facilities) are recorded off-site within 250m.

2.3.11 Environmental Permits, Incidents and Registers

Two Integrated Pollution Control (IPC) consents and three Integrated Pollution Prevention and Control (IPPC) authorisations have been issued within 500m of the site according to the database search undertaken as part of the Delta Simons Phase I Desk Study. Two of these entries (both IPC) were recorded on-site, authorising ‘processes involving halogens within the chemical industry’ by Adflex Solutions Ltd. The initial authorisation was issued in March 1995 and varied (non-substantially) in January 1997. Authorisation was subsequently revoked, however no associated date has been supplied. The remaining recorded IPPC authorisations were located in excess of 350m from the site, and related to the combustion of waste derived fuel, and landfilling activities.

Fifteen Local Authority Pollution Prevention and Control permits are recorded within 500m, one of which is located on-site. The on-site authorisation is held by Teleplan and White Electronics Ltd. and relates to ‘unspecified’ Part B activities. Additional authorised processes within 150m of

the site include 'coating of metal and plastic' at a site located 29m to the south-west, and 'respraying of motor vehicles' at facilities located 45m, 76m, 78m, and 119m south-west, and 121m west. The majority of these authorisations remain active.

Six authorisations under the Radioactive Substances Act for the keeping, use and disposal of radioactive substances have been issued within 500m. These authorisations are all held by Apollo Fire Detectors Ltd. at premises located between 44m and 126m north-west of the site.

2.3.12 Sensitive Land Uses

The site is situated within a Nitrate Vulnerable Zone for surface waters.

An area of outstanding natural beauty (Chichester Harbour) has been designated by Natural England approximately 406m to the south-east. In addition, Chichester and Langstone Harbours, recorded approximately 306m to the south have been designated a RAMSAR site.

A Site of Special Scientific Interest (Langstone Harbour) has been designated by Natural England approximately 306m south of the site.

According to historicengland.org.uk there is one area of heritage interest located within 100m. This feature is a Grade II Listed Building known as Langstone Hotel.

2.3.13 Planning

A search of the Havant Borough Council Planning Portal was undertaken by Delta Simons on 13th May 2019 in order to identify any applications on, or in the vicinity of the site pertinent to the proposed development.

Several applications were identified, the majority of which are understood to relate to minor external changes or changes in use of on-site buildings.
The following specific applications were identified:

> Demolition of existing steel-clad building and two portacabins to make way for a single storey timber framed building to house a nursery school with capacity for 52 pupils (ref. APP/10/00272, dated August 2010)
>
> Construction of Waste Compactor Housing and Consumables store (ref. APP/11/00168, dated February 2011)
>
> Installation of 2 no. roof mounted condenser units and associated chiller pipework to support 2 no. additional internal computer room air conditioning units (ref. APP/15/01225, dated October 2015)

Delta Simons state that no additional potentially contaminative activities or other information pertinent to the assessment was identified from the historical planning records.

2.4 Summary of Other Previous Investigations

As part of the Preliminary Geo-Environmental Risk Assessment Report, Delta Simons provided a summary of previous investigation works undertaken at the site. An overview of these investigations is provided below.

2.4.1 WSP Phase I Environmental Assessment December 2005

Investigations were undertaken in December 2005 by WSP Ltd ('Phase I Environmental Assessment – Langstone Technology Park') though we have not been in receipt of a copy of this report.

Potentially contaminative activities identified during a site walkover undertaken as part of the investigation were limited to the storage of diesel fuel in two above ground storage tanks and the storage of waste materials.

During the investigation the Contaminated Land Officer at Havant Borough Council was contacted. According to WSP, the Officer stated that based on the historical and neighbouring land uses, and the use of good quality hardstanding, the site was not considered to pose a concern with regard to human health given its continued use as a technology park. It was noted that in the case of redevelopment, further intrusive investigations would be required.

The following third-party reports were also reviewed as part of WSP's assessment, however, were not provided to Delta Simons:

> A 1999 Environmental Monitoring Program undertaken by Casella Ltd. The report is understood to have detailed results of effluent monitoring, industrial emissions monitoring, ground water monitoring, surface water monitoring and building fabric monitoring. WSP indicated that the Casella Ltd. report reviewed a number of intrusive and non-intrusive investigations previously undertaken at the site, and identified potential issues associated with; elevated, but relatively low concentrations of toluene and hydrocarbons recorded during effluent monitoring for Building 2000, groundwater contamination associated with chlorinated solvents; and copper contamination 'within a concrete slab'. It was noted by WSP that the effluent treatment facility had subsequently been decommissioned, that the identified groundwater contamination was outside the current Site boundary and that the concrete slab had since been remediated.
>
> A 1999 Phase I Environmental Audit undertaken by WSP Environmental.
>
> A 1999 Initial Ground Investigation by Soil Consultants Limited, which was understood to have identified potential issues associated with elevated concentrations of cadmium in soil samples taken from two boreholes excavated at the site, and elevated levels of arsenic, lead, copper, zinc and mercury within samples taken from a single borehole. It was noted by WSP that the soil guidance values used for comparison at that time were no longer applicable.
>
> A 2003 and 2004 'Addendum Site Investigation Report' undertaken by STATS Ltd. WSP indicated that the report identified potential issues associated with elevated concentrations of ground gases within Made Ground at the site. This report was, however based on a single monitoring visit and did not record flow rate.

WSP stated within the report that based upon the information obtained the contamination issues identified did not represent a significant risk with regard to the continued commercial use of the site. It was noted, however that the potential presence of residual contamination, which may require remediation in the event of redevelopment, could not be discounted.

Given the ground gas concentrations identified in a previous investigation at the site, it was considered that the presence of ground gas could not be discounted, as such, further ground gas testing was recommended.

2.4.2 Delta-Simons Phase I Environmental Assessment September 2015

Delta Simons produced a Phase I Environmental Assessment, dated September 2015 though we have not been in receipt of a copy of this report. The report was undertaken as an appraisal of 'inground' environmental risks and liabilities, as part of a pre-divestment assessment of the site. It was undertaken in the context of the site remaining under commercial/ industrial use.

As part of the investigation a site walkover was undertaken. At the time of the investigation, the site was occupied by offices, laboratories, light manufacturing/ engineering, a gym, and a nursery.

The following potential sources of contamination were identified during the Site Walkover carried out on 29th July 2015:

Waste storage areas were identified toward the east and west of the site. The Site Facilities Manager stated that the western waste storage area had been used by the former tenant (IBM) for chemical storage and processing. Associated plant remained present, including two above ground storage tanks. The plant was understood to include air and chemical extraction systems, solvent recovery equipment, carbon absorption tanks, and chemical storage which included hydrochloric acid, sodium hypochlorite, xylene, nitrogen and cyanide.

Further general waste storage areas were observed to the west and south-west of Building 5000 (comprising vegetation, metal cardboard, domestic waste, vehicle tyres and drums)

Beneath Building 1000 in north-western corner of the site, was a chemical drum store. The drums were located within an area of secondary containment;

Electricity sub-stations were identified in the south-western corner and the centre of the site

A back-up generator was located between Building 3000 and Building 4000 (central section of the site)

In the south-west corner of the site, a deionised water production plant and caustic storage area were recorded, in addition to an effluent treatment plant and buffer holding tanks. It was understood that this area had undergone previous intrusive investigation works, however, no further information was available. Used engines/ motors were noted to be stored on pallets externally in this area.

It was noted that Asbestos Containing Materials were present within the fabric of the buildings on-site, managed via an Asbestos Register. No evidence of leakages/ spillages was observed during the walkover and no significant issues of potential environmental concern (aside from the potential sources listed above) were identified.

The following additional anecdotal information was obtained during the walkover:

It was understood that surface water pooling occurs in car park areas during periods of increased precipitation.

Delta Simons was informed by the Facilities Manager that a pollution incident which required remediation works had taken place in 1984, however, no further details were available. Delta Simons did not consider this to represent a significant cause for concern in the context of the current commercial / industrial use of the site.

Two oil interceptors were recorded within the eastern car parking area.

Two tunnel entries (into an embankment) were present within the northern elevation of Building 1000 toward the north-western corner of the site.

A surface water pump house was observed to the east of Building 6000.

2.5 Desk Study Conclusions / Recommendations

Based on the data presented above, Delta Simons Environmental Consultants Ltd. carried out a Preliminary Risk Assessment in accordance with the guidance established in Environment Agency document CLR 11 'Model Procedures for the Management of Land Contamination'. identifying and evaluating potential sources of contamination, possible receptors following redevelopment, and potential contaminant linkages.

The site was considered by Delta Simons to represent 'moderate' environmental sensitivity based on the presence of the underlying superficial Secondary A Aquifer, the Principal bedrock aquifer, and the commercial / industrial use of the site and surrounding area.

The following potential contaminant sources were considered significant:

On-site:

Potential sources of contamination at the site are considered to include; limited quantities of fuel and chemical storage associated with the current site use(s), chemical storage and activities associated with the site's former uses (electronics manufacture), and historical use of the north-eastern section of the site as a sewage works between 1909 and ca.1972.

Off-site:

Delta Simons considered significant potential historical off-site sources of contamination (within 150m) to include; a mill, a sewage works, factories, an engineering works, a warehouse, a boatbuilding works / works, a plastics factory and a pumping station with a tank.

Current potential off-site sources of contamination were considered to include; vehicle respraying processes, metal coating processes, a landfill, a fuel station and facilities for tool design, precision engineering, aviation engineering and engineering services.

Given that the proposed redevelopment requires the partial demolition of existing on-site buildings in the northeast of the site and the construction of new buildings in the south-west, it was recommended that an intrusive site investigation be undertaken to assess uncertainties / data gaps identified in the preliminary Conceptual Site Model.

1.0 SITE INVESTIGATION

3.1 Investigation Design & Objectives

Based on the findings and recommendations presented in the Delta Simons Environmental Consultants Ltd. Preliminary Geo-Environmental Risk Assessment, an intrusive investigation was designed and undertaken by Clancy Consulting Ltd. The design was provided by the appointed Clancy Consulting Ltd Structural Engineer and approach based on guidance provided in BS 10175 Code of Practice for Investigation of Potentially Contaminated Land (2011).

The aim of the investigation was to provide initial characterisation of ground conditions at the site, in order to produce and refine a representative Conceptual Site Model, to carry out contamination and geotechnical assessments to inform civil and structural design and to ensure that the site is suitable for the proposed end-use.

An additional objective of the investigation was to examine the geotechnical competence of materials at the site, including an examination of the existing structure's foundations, in order to provide indicative foundation solutions and to support future detailed geotechnical design.

3.2 Exploratory Fieldwork

The ground investigation works were carried out between 17th and 25th July 2019 and comprised the following works:

Excavation of 8 No. window sample boreholes (WS1 to WS8) to a maximum depth of 5.45m bgl.

Hand excavation of 4 No. trial pits (HTP1 to HTP4) to a maximum depth of 1.4m bgl.

Excavation of 4 No. cable percussive boreholes to a maximum depth of 24.85m bgl.

Excavation of 2 No. trial pits using a mechanical excavator to depths of between 2.05m and 2.10m bgl to enable soakaway testing in accordance with BRE 365.

Indicative infiltration testing (falling head) within selected window sample boreholes (WS2 and WS6).

Soil samples for chemical and geotechnical laboratory testing were collected at regular intervals from each exploratory hole location and sealed in appropriate plastic and glass containers provided by the laboratory.

The exploratory locations were positioned within areas proposed for redevelopment with a targeted approach towards locations of potential contamination, proposed structures and infrastructure.

WS1 and BH1/1A were located to the south of Building 6000. These excavations were positioned so as to identify ground conditions in this area to aid in structural design. In addition, HTP1 and HTP2 were excavated immediately adjacent to Building 6000 in order to examine the construction characteristics of the existing building foundations.

WS3, WS4 and BH2 were positioned to the north and south of the existing main car park, within the footprints of two of the proposed new buildings. The purpose of excavations was to examine the ground conditions, geotechnical competence and contaminative status of the ground in this area. HTP3 was excavated within the existing car park between these buildings in order to provide general coverage of the site with regard to soil sampling / chemical testing and to assess the build-up of the existing car park.

WS5 and BH3 were excavated within the footprint of the westernmost of the proposed new buildings in order to provide geotechnical data to enable foundation design. These locations examine the potential for contamination to be present as a result of the previous operation of a deionised water plant, caustic tanks, effluent treatment plant and vehicle wash identified in this area during the Delta Simons Report.

WS2 was located toward the centre / west of the site within a proposed car park area, adjacent to an existing electricity sub-station on site. In addition to establishing geotechnical characteristics

the objective of this excavation was to determine the chemical quality of soils in this area, which has previously also been established as historically being used for the temporary storage of waste.

WS6, WS7, WS8, BH4, HTP4 were excavated toward the north-east of the site, within the area that was historically occupied by a sewage treatment works, and which is to be redeveloped (partial demolition of Building 1000 and the construction of a new vehicle parking area). HTP4 was excavated adjacent to the existing building in order to examine the existing building foundations and assist with future design work.

SA1 and SA2 were excavations undertaken to enable soakaway testing and were positioned toward the south and north of the site to examine the permeability of the subsurface within areas where the installation of drainage is currently under consideration. Falling head tests were also undertaken in WS2 and WS6 for this purpose.

An exploratory hole location plan is provided in Appendix I as Drawing No. 10/1425/002.

3.3 Ground Conditions

Details of the ground conditions encountered, along with records of the soil samples taken are presented on the exploratory hole records in Appendix II with a summary of the ground conditions provided below.

3.3.1 Made Ground

Made Ground was encountered in all exploratory hole locations to depths of between 0.65m and 3.1m bgl. However, HTP1 to HTP4, SA2, WS7 and WS8 were terminated within Made Ground and therefore did not prove the base of the material.

Tarmac hardstanding was encountered at surface in nine of the excavations with thicknesses of between 0.1m and 0.25m. The tarmac hardstanding was commonly underlain by sub-base type materials of sandy gravel of limestone to a maximum depth of 0.65m or sandy gravel of flint to a maximum depth of 0.35m bgl. In WS5, HTP1 and HTP2, this was directly underlain by concrete with a thickness of between 0.05m (WS5) and 0.19m (HTP1 and HTP2). In HTP1 and HTP2 the concrete was steel reinforced with 8mm rebar.

In the locations of BH1, BH1A, WS2, WS6 to WS8 and SA1 to SA2, the Made Ground was found to be topped by grass and occasionally topsoil type materials.

The composition of the underlying Made Ground was highly variable, reflecting the variability of infrastructure and land use across the site.

In the locations of BH1, BH1A, WS7, WS8, SA1 and SA2 (where historic structures were found to be present), the Made Ground was found to comprise a mix of granular deposits with gravel and cobbles of brick and concrete and (in the location of SA2) occasionally fragments of pottery and slate to a maximum depth of 2.45m bgl. These deposits are consistent with soils derived from the demolition process and reworking of demolition type materials.

Elsewhere on site, the Made Ground comprised a mix of granular and cohesive deposits with gravels often including flint, concrete and occasionally brick and chalk proven to a maximum depth of 1.6m bgl.

Fragments of organic material including decaying wood, rootlets and grass were noted between 1.0m and 1.25m in WS2, in WS6 between 1.5m and 3.1m bgl and in HTP1 between 0.24m and 1.4m,

Visual and olfactory evidence of hydrocarbon contamination was identified in WS2 and WS5 between the depths of 0.95m to 1.6m and 2.5m to 3.45m respectively, spanning both Made Ground and natural stratas.

Subsurface Structures / Obstructions

Subsurface hardstanding / obstructions were encountered in WS3, WS5, BH1, BH1A, HTP1 and HTP2 and SA2.

In WS3 a layer of 0.1m thick tarmac was encountered at a depth of 0.35m bgl, underlain by layer of concrete, recorded to a depth of 0.65m bgl. This represented the base of the Made Ground in this excavation.

A thin layer of tarmac was also recorded toward the middle of the Made Ground profile in WS5 between 0.35m and 0.40m bgl.

A layer of in-situ concrete was encountered in BH1 and BH1A at a depth of 1.0m and recorded to 1.15m bgl. A small void was recorded immediately below the concrete between 1.15m and 1.30m bgl. This concrete may represent the floor / hardstanding associated with the historic buildings in this location.

Buried structures were encountered in SA2 in the form of a historic building foundation and drainage, proven to the depth of 2.1m bgl.

It is noteworthy that it is possible that buried structures / basements may present in other areas of the site which have not been identified during this investigation.

3.3.2 Superficial Strata

River Terrace Deposits/Brickearth

A variable, alternating sequence of predominantly granular and cohesive strata potentially consistent with materials described by the BGS as River Terrace Deposits or Brickearth (depending on the publication) was encountered below the Made Ground, or topsoil in each of the excavations.

The BGS indicate that these deposits are likely to be restricted to the western periphery of the site, however intrusive investigation works suggest that the deposits extend across much of the, as far east as SA1.

In general, where encountered, these materials comprised one of three different types.

A cohesive material typically described as very soft to soft light brown / brownish white / grey occasionally silty, slightly sandy to sandy, slightly gravelly to very gravelly clay. The gravel component was described as rounded to sub-angular, fine to coarse of flint.

Predominantly granular material described as very loose to medium dense brown / light brown clayey, sandy gravel. The gravel was described as angular to rounded, fine to coarse of flint.

Firm brown very sandy slightly gravelly clay. Gravel was described as sub-rounded, fine to coarse of flint. This material was characterised by the presence of frequent wood fragments.

In addition to the above, in WS4 a band of greenish grey silt underlain by greenish grey clay with sand lenses was encountered from 2.5m to the base of the borehole at 5.45m bgl.

Underlying the Made Ground in BH4 was a layer of very soft plastic brown amorphous very silty peat, which was recorded between 1.0m and 1.6m bgl. This was the only significant organic deposit recorded during this investigation.

Weathered Chalk Bedrock

Materials consistent with weathered bedrock were encountered across the site underlying the superficial horizons described above and located above intact chalk rock (where encountered).

The degree of weathering varied substantially across the site, and at various locations this material was described as an extremely weathered predominantly cohesive material (very soft to firm occasionally sandy gravelly clay), or a de-structured predominantly granular material described as medium dense clayey, sandy gravel. In both cases the gravel component was described as angular to rounded, fine to coarse of chalk and flint.

The cohesive strata was recorded in WS1, BH1A and BH2 between a minimum of 2.6m and proven to a maximum of 5.45m. The granular material was encountered in WS2, BH1A, BH3, BH4 between a minimum of 2.5m proven to a maximum of 6.0m. Where both types were encountered within the same excavation, the cohesive material was located above the granular.

3.3.3 Chalk Bedrock (Undifferentiated)

Chalk was recorded in BH1A to BH4 below the superficial and weathered materials described above. The chalk was encountered at depths of between 5.1m and 6.0m bgl and recorded to a maximum depth of 24.85m bgl.

In general, where encountered, this material was described as structureless chalk (Grade Dm) composed of uncompacted brownish/light brownish / yellowish / greyish cream slightly sandy slightly gravelly occasionally cobbly silt. The gravel / cobble component was described as sub-angular to sub-rounded very weak chalk and black flint.

An exception was encountered in BH4 between 15.0m and 16.50m bgl where a slightly less weathered horizon was recorded. This material was described as structureless chalk (Grade Dc) composed of uncompacted light greyish cream sandy, silty sub-angular to sub-rounded medium to coarse gravel. This material was underlain by the Grade Dm chalk described above.

3.4 Groundwater

Groundwater was encountered across the site during the fieldwork at depths of between 1.9m and 6.0m rising to between 1.8m and 3.7m. Groundwater was not recorded in WS2 or WS6 due to the undertaking of falling head tests in these locations. The soils were however noted to be ‘wet’ from 3.5m and 4.8m respectively.

Groundwater was not encountered with any of the trial pits or within WS7 and WS8.

Subsequent monitoring visits are to be undertaken on four occasions over the coming months in the locations of BH1A, BH3, WS3 and WS4. The results will be reported upon completion of the monitoring works.

3.5 Laboratory Chemical Testing

Selected soil samples were recovered at regular intervals and submitted to a UKAS / MCerts accredited laboratory for a general and targeted suite of analysis.

Nine samples of Made Ground and six samples of underlying natural soils were submitted for chemical testing.

Testing included analysis of some or all of the following determinands: *arsenic, beryllium, cadmium, chromium (VI), copper, lead, mercury, nickel, selenium, vanadium, zinc.*

Selected soil samples were also tested for *speciated PAH, speciated TPH, asbestos identification, speciated PCBs, Total Organic Carbon, pH and water-soluble sulphate.*

Copies of the laboratory test certificates are presented in Appendix III.

4.0 TIER 1 CONTAMINATION ANALYSIS

4.1 Soil Guidelines

At a Tier 1 stage the long-term human health toxicity of the soil has been assessed with reference to the LQM / CIEH S4ULs for Human Health Risk Assessment and CL:AIRE Category 4 Screening Levels (C4SLs). The proposed development will comprise the partial demolition of an existing laboratory and manufacturing unit located toward the north of the site in order to extend parking provision, the construction of four (4No.) light industrial / commercial units with associated adjacent parking provision across the southern section and additional parking in the east and west of the site. The newly constructed parking area toward the north of the site will include provision for peripheral ornamental landscaping, however following redevelopment, the majority of the site will remain under hardstanding.

On this basis, chemical test results have been compared against Site Screening Values (SSVs) for a commercial / industrial end use.

Where appropriate the statistical significance of the chemical test results has been assessed by reference to the CIEH & CL:AIRE publication “Guidance on Comparing Soil Contamination Data with a Critical Concentration” (2008).

For the purpose of this report a ‘planning scenario’ has been applied which aims to demonstrate that there is a 95% probability that the true population mean falls below the critical concentration (soil screening value).

4.2 Inorganic Contamination

Nine samples of Made Ground and six samples from the natural strata were submitted for chemical testing for inorganic determinands. Statistical analysis of the test results has been carried out for the Made Ground with individual analysis of the natural soil samples.

The test result and statistical analyses of the Made Ground samples indicate that all 95%^{ile} concentrations for the inorganic determinands tested fell below their respective SSVs when compared to values generated for commercial end use.

Statistical outliers were recorded for beryllium and water soluble boron in WS2 at 1.1m with respective recorded concentrations of 1.1 mg/kg and 2.6 mg/kg compared to the respective SSV

of 12 mg/kg and 240000 mg/kg. As nether of the concentrations recorded exceed the respective SSVs, these records are not considered significant.

A statistical outlier was recorded for cadmium in SA1 at 0.6m with a concentration of 1.8 mg/kg compared to the SSV of 190 mg/kg. As the record does not exceed the SSV, it is not considered significant.

No exceedances were recorded for any of the natural samples tested when compared to values generated for commercial end use.

The results of the chemical analyses of inorganic contaminants indicate that both the Made Ground and underlying natural soils are uncontaminated in regard to human health when compared with the appropriate published Soil Screening Value.

4.3 Organic Contamination

Visual and olfactory evidence of hydrocarbon contamination was recorded in the Made Ground and natural soils in WS2 along within the natural soil in WS5. Potentially impacted samples from both of the excavations were subsequently recovered and scheduled to chemical analysis for organic determinands. Additional samples were recovered from across the site for laboratory testing to determine background concentrations.

Nine samples of Made Ground and six samples of the underlying natural soils were scheduled for speciated PAH analysis. One sample of Made Ground, and three samples of natural materials were also scheduled for speciated TPH analysis with one sample of the Made Ground tested for PCB analysis.

No elevated concentrations of the 16 PAH compounds or TPH fractions tested were recorded within the Made Ground or natural soils when compared to SSVs generated for a commercial end use.

A statistical outlier was recorded for the PAH compound naphthalene in WS2 at 1.1m with a recorded concentration of 0.29 mg/kg compared to the SSV of 190 mg/kg. As the concentration does not exceed the SSV, the record is not considered significant.

Despite the above, in the location of WS2 at 1.1m and WS5 at 2.6m where visual and olfactory evidence of hydrocarbon contamination was observed during the investigation works, concentrations of TPH fractions Ali C10-C12, Ali C12-C16 and Aro C12-C16 have been recorded in excess of Water Screening Values (WSVs).

The concentration recorded for TPH fraction Ali C10-C12 in WS2 at 1.1m was 242 mg/kg and in WS5 was at 2.6m was 89 mg/kg compared to the WSV of 48 mg/kg. For Ali C12-C16 the concentrations were recorded as 2210 mg/kg and 318 mg/kg respectively compared to the WSV of 24 mg/kg. The concentrations of Aro C12-C16 were recorded as 1830 mg/kg and 218 mg/kg respectively compared to the WSV of 169 mg/kg.

Given the presence of the superficial Secondary A and Principal bedrock Aquifers beneath the site and that groundwater has been identified between approximately 2.0 to 3.0m bgl, it is considered that a viable pathway may exist through which identified contaminants may migrate into the controlled waters. In the location of WS5 at 2.6m bgl, the sample was taken below the ground water level.

It is noteworthy that samples from WS2 at 2.4m and WS5 at 3.9m were retrieved and tested to establish the extent of any vertical migration of these identified contaminants. Both samples did not record any elevated concentrations of the determinands tested.

PCBs

One sample, taken from WS2 at a depth of 1.1m bgl was scheduled for speciated PCB analysis.

Individual PCB species (PCB105, PCB118, PCB156 and PCB167) were recorded above laboratory levels of detection. The sum recorded concentration of these contaminants was 0.148 mg/kg, which whilst elevated did not exceed the adopted SSV of 0.240 mg/kg for the 'sum of dioxin-like PCBs' on commercial/industrial sites taken from Environment Agency Science Report SC050021 'Soil Guideline Values for dioxins, furans and dioxin-like PCBs in soil'

Total Organic Carbon

Seven samples (one from the shallow natural and six from the underlying chalk bedrock) from across the site were retrieved and sent to a UKAS accredited laboratory to be tested for total organic carbon (TOC).

The TOC content of the shallow natural sample was 1.08% with the TOC in the chalk bedrock ranging from 1.69% to 4.67%.

To derive the percentage of soil organic matter (SOM), in accordance with CLEA guidance the TOC must be divided by 0.58.

As such, the shallow natural soil sample has a SOM of 1.86% with the chalk bedrock recording SOMs ranging from 2.91% to 8.05%.

4.4 Asbestos Contamination

Seven soil samples taken from the Made Ground were screened using microscopy for the presence of asbestos fibres.

None of the samples tested proved the presence of asbestos fibres, or asbestos containing materials in excess of qualitative levels of detection.

1.0 CONTAMINATION ASSESSMENT

5.1 General

Based on the information obtained during the preliminary ground investigation and laboratory testing, a 'Conceptual Site Model' (CSM) has been amended accordingly. The conceptual Site Model is used as a basis to identify contamination sources, pathways and receptors and is subject to constant refinement as more information becomes available.

5.2 Environmental Setting & End Use

Made Ground was identified during the intrusive investigation works to depths of up to 3.1m bgl. and generally comprised a variable sequence of either predominantly granular or cohesive materials of various subtypes.

The Made Ground was underlain by a sequence of interbedded granular and cohesive strata and / or a highly weathered material derived from the underlying bedrock. These superficial deposits were proven to a maximum depth of 6.0m bgl.

Solid bedrock was encountered below the superficial deposits across the site and proven to 24.85m bgl.

Visual and olfactory evidence of hydrocarbon contamination was recorded in WS2 between 1.0m and 1.25m and 1.6m spanning Made Ground and natural soils along with the natural strata in WS5 between 2.5m and 4.0m bgl.

Groundwater was encountered at approximately 2.0m to 3.0m across the site.

Whilst a complex distribution of lower and higher permeability horizons has been proven within these units, the overall hydrogeological character of the geology underlying the site is not considered to be substantially different from the preliminary risk assessment; comprising a sequence of moderately permeable (Secondary A Aquifer) superficial strata, underlain by highly permeable (Principal Aquifer) bedrock. As such, the environmental setting remains of 'moderate' sensitivity.

5.3 Revised Conceptual Site Model

In accordance with CLR11 "Model Procedures for the Management of Land Contamination" (2004) and BSI 10175 "Code of Practice for Investigation of Potentially Contaminated Land" (2011), a Preliminary Conceptual Site Model was developed to identify potential contamination sources, migration pathways and receptors within the study area.

Chemical testing undertaken during the site investigation did not identify any contaminants which exceeded relevant SSVs for commercial / industrial end use in terms of human health. No asbestos fibres or ACMs were encountered during the investigation.

Whilst no elevated concentrations of the determinands tested have been recorded in terms of human health, localised concentrations of contaminants not identified / investigated during this investigation may be present in quantities considered harmful in terms of human health.

Site workers involved in excavations for foundations, roads, sewers etc. may come into direct shallow Made Ground soils which have not been identified during this investigation. As any Made Ground does represent a potential risk, we would therefore recommend that simple precautionary measures be adopted during the construction phase i.e. good personal hygiene, provision of welfare facilities and basic personal protective equipment i.e. gloves and safety glasses. Should during any future investigation / remediation / construction works identify visual or olfactory evidence of contamination, a suitably qualified environmental consultant should be contacted to further assess any potential issues. Additional works may be required to suitably quantify the risk to potential and identified receptors.

In respect to controlled waters, chemical testing has identified elevated concentrations of organic contaminants when compared to SSVs for commercial / industrial end use with the following contamination sources have been identified within the Made Ground and natural soils in WS2 and natural soils in WS5.

> Elevated concentrations of TPH fractions Ali C10-C12, Ali C12-C16 and Aro C12-C16 in WS2 at 1.1m and WS5 at 2.6m.

WS2 was positioned in the location of a historic waste storage area and also adjacent to an existing electricity sub-station with WS5 adjacent to the historic tanks in the west of the site which are likely to be the source of contamination in these locations. Given the presence of controlled waters beneath the site and groundwater identified at approximately 2.0m to 3.0m bgl, it is recommended that further works be undertaken in these areas with the retrieval of soil and groundwater samples to suitably delineate the identified contamination and further assess the risk these contaminants pose.

Further thought should be given in these areas to any proposed hardstanding design and the use of permeable surfaces / soakaways as the introduction of water into these soils may increase the risk of the identified contaminants mobilising and migrating into controlled groundwaters.

1.0 HAZARDOUS GAS ASSESSMENT

6.1 General

Made Ground was identified during the intrusive investigation works to depths of up to 3.1m bgl. and generally comprised a variable sequence of either predominantly granular or cohesive materials of various subtypes with fragments of putrescible materials noted in two locations. Visual and olfactory evidence of hydrocarbons was also noted in two locations which can be a source of hazardous ground gasses. A review of historical maps of the area has identified historic sewage works with associated engine house and filter beds on site with industrial buildings historically occupying the south of the site. Within the surrounding area, another sewage works, mills, industrial units and infilled land / landfill have also been identified which could be viewed as sources of filled ground and potentially organic materials with the potential to generate hazardous ground gases.

Natural strata beneath the site and within the surrounding area including alluvium and river terrace deposits are indicated to potentially contain peat and other organic materials with peaty soils and fragments of decaying wood / grass identified within the natural soils on site. The chalk bedrock could also be viewed as being a potential source of ground gasses, with samples retrieved for TOC testing recording organic concentrations up to 8.05%.

6.2 Scope of Works

In view of the above, four gas monitoring wells were installed in BH1, BH3, WS3 and WS4 with response zones set in the Made and natural strata. An initial gas monitoring programme was scheduled to comprise four monitoring visits over a minimum one month period in general accordance with CIRIA Report C665.

6.3 Monitoring Results

Monitoring has been undertaken on four occasions between 12th September and 30th September 2019 with atmospheric pressures recorded ranging between 1009mb and 1027mb. Falling atmospheric pressure was recorded on two occasions.

Copies of the results are presented in Appendix VII and summarised in the table below.

Table 1 – Gas Monitoring Results

Hole ID	Methane (%v/v)	Carbon Dioxide (%v/v)	Flow Rate (l/hr)	Gas Screening Value (l/hr)
BH1A	0.0	4.7	0.7	0.0329
BH3	0.0	4.8	0.1	0.0048
WS3	0.0	7.2	0.1	0.0072
WS4	0.0	0.0	0.1	0.0000

The monitoring results have not recorded any methane concentrations and maximum carbon dioxide concentration of 7.2%. Gas flow rates were found to be generally absent with the maximum flow rate recorded of 0.7 l/hr. Based on the monitoring results, the worst-case Gas Screening Value (i.e. 7.2% carbon dioxide and 0.7 l/h flow) is 0.0504 l/hr.

In addition to the above, depleted oxygen was recorded in WS3 on one occasion with oxygen recorded at 10.9%.

6.4 Discussion

Based on the available results and the worst-case gas screening value of 0.0504 l/hr recorded, the site can be classified as Characteristic Situation 1 (CS1).

According to the current guidance and best practice however, where carbon dioxide concentrations are recorded in excess of 5%, consideration should be given to increasing the classification to CS2. In this instance, given the relatively short monitoring period, the presence of elevated carbon dioxide, depleted oxygen levels, the depth and nature of the filled ground and presence of peat in the local area, we would recommend that the characteristic situation be increased to CS2 and that gas protective measures are installed in all new structures in accordance with guidance provided in BS 8485: 2015 "Code of Practice for the Design of Protective Measures for Methane & Carbon Dioxide Ground Gases for New Buildings".

There is now a requirement for the installation of gas protective measures to be independently verified in order to achieve discharge of planning conditions relating to contaminated land. Guidance is provided in CIRIA C735 "Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gas".

We can advise on the verification procedures to ensure regulatory approval.

1.0 GEOTECHNICAL ASSESSMENT

7.1 General

It should be noted that this Section does not comprise or represent a Geotechnical Design Report (GDR) but instead provides preliminary information and recommendations based on the findings of the Ground Investigation.

The geotechnical section of the ground investigation was designed in general accordance with guidance presented in BS EN 1997-2:2007. The objective of the investigation was to obtain preliminary information in order to assess the geotechnical properties of the ground and provide recommendations for foundation and infrastructure design.

7.2 In Situ Geotechnical Testing

In-situ standard penetration tests (SPTs) were carried out during window sample and cable percussive drilling at approximately 1.0m to 1.5m intervals in order to allow the assessment of ground conditions by establishing soil strength/density characteristics.

7.2.1 Made Ground

SPT 'N' values of between 15 and 40 were recorded within the granular Made Ground. The mean of the recorded 'N' values was 22.75. 'N' values of between 8 and 45 were recorded within the cohesive component with a mean recorded 'N' value of 17.2.

SPT 'N' values in excess of 50 were recorded within the Made Ground in BH1, BH1A and WS8 where obstructions were encountered.

7.2.2 Natural Strata

The SPTs carried out within the shallow natural strata up to 3.45m recorded 'N' values ranging from 1 to >50 indicating these soils to be in a very variable condition.

Beneath this, the SPTs recorded 'N' values ranging from 10 to 28 (with the exceptions of WS4 and BH2 at 4.0m with respective 'N' values of 9 and 4) indicating these soils to be in a medium dense, firm and stiff condition.

7.2.3 Solid Strata

Within the chalk bedrock, the SPT 'N' values generally increased in depth with 'N' values from 6.0m to 13.5m bgl ranging from 6 to 21, 'N' values between 15.0m to 18.0m ranging from 15 to 26 (with the exception of BH3 where an 'N' value of >50 was recorded), from 18.0m to 21.0m ranging from 22 to >50 and from 21.0m proven to a maximum to 24.5m, the SPT 'N' values were all recorded as >50.

In accordance with CIRIA C574 'Engineering in Chalk', the SPT 'N' values indicate that the base of weathering within the chalk bedrock is between 15.0m and 18.0m bgl.

7.3 Laboratory Geotechnical Testing

7.3.1 Triaxial Compression Tests

It was initially intended to recover samples of any cohesive soils for triaxial compression testing in order to provide accurate classification of the soil strength. The clay soils were however found to contain a high sand and gravel content rendering them unsuitable for the recovery of undisturbed samples for laboratory analysis.

Undisturbed samples were recovered from within the chalk however only one (BH1 at 6.0 to 6.45m) was found suitable for triaxial compression testing. The test result recorded a Cu value of 38 kPa.

7.3.2 Plasticity Indices

Four soil samples were recovered from the shallow natural clay deposits from WS1 at 2.5m, WS4 at 2.9m BH4 at 2.1m and SA1 at 1.3m. The four samples were submitted to a UKAS accredited laboratory for Determination of Liquid and Plastic Limits in accordance with BS1377: Part 2: 1990: Methods 3.0,4.4 and 5.0.

NHBC Standards Chapter 4.2 (Building Near Trees) states that in order to assess the volume change potential of cohesive soils, the Modified Plasticity Index should be calculated. The Modified Plasticity Index is defined as the Plasticity Index of the soils multiplied by the percentage of particles less than 425µm.

The results recorded Modified Plasticity Indices ranged from 2.7% in WS1 at 2.5m to 11.7% in WS4 at 2.9m (with the exception of SA1 at 1.3m). Therefore, in accordance with Table 1 of NHBC Standards Chapter 4.2, these soils to be of '**low**' volume change potential.

In SA1 at 1.3m, the Modified Plasticity Index was recorded as 55.0%, indicating these soils to be of '**high**' volume change potential.

7.3.3 Particle Size Distribution

Two soil samples were recovered, one from the shallow Made Ground (HTP3 at 0.15m to 0.2m) and one from the natural granular strata (WS3 at 1.5m) and sent to a UKAS accredited laboratory for particle size distribution testing.

The laboratory test results confirm that these soils are predominantly granular in nature.

7.3.4 CBR Tests

Soil samples from depths between 0.6m and 0.8m bgl were collected from three locations (SA1, SA2 and WS2) and tested by a UKAS accredited laboratory for soaked laboratory CBR tests.

The test results recorded minimum CBR values of 2.7% in SA1 at 0.7m, 1.1% in SA2 at 0.6m and 16.8% in WS2 at 0.6m to 0.8m.

7.3.5 Intact Dry Density of Chalk

Across the site, beneath the superficial deposits, structureless chalk was encountered generally comprising slightly sandy slightly gravelly silt. Fourteen samples were retrieved from WS1 at 4.8m, BH1 at 10.5m to 10.95m, BH2 at 5.0m to 5.45m, 5.6m, 7.5m to 7.95m, 8.0m, and 17.00m to 17.95m, BH3 at 9.0m to 9.45m, 19.0m and 21.0 to 21.45m and from BH4 at 6.5m, 9.1m, 11.5m and 18.9m and submitted to a UKAS accredited laboratory for Saturated Moisture Content and Intact Dry Density testing.

In Accordance with Table 3.2 of CIRIA C574 ‘Engineering in Chalk’, the results recorded for the samples tested are generally consistent with chalk of ‘medium density’ with areas of ‘low density’ recorded in BH1 at 10.5m to 10.95m and in BH2 at 5.0m to 5.45m and 7.5m to 7.95m. Areas of ‘high density’ chalk were encountered in BH4 at 9.1m and 18.9m.

The geotechnical laboratory results are presented in Appendix IV.

7.4 Foundations

7.4.1 Existing Foundations

Three hand excavated trial pits (designated HTP1, HTP2 and HTP4) were excavated alongside the perimeter of existing buildings. The overall objective was to extend these excavations to the base of the foundations in order to determine construction characteristics and founding stratum. HTP1 and HTP2 were excavated adjacent the southern elevation of Building 6000, whilst HTP4 was excavated along the eastern building line of Building 1000.

Building 6000

HTP1 and HTP2 were excavated adjacent to Building 6000 in order to investigate the existing building foundations.

HTP1 was excavated adjacent to a concrete column which extended vertically to a depth of 0.6m bgl, before stepping out horizontally from the column line for a distance of approximately 0.85m. The foundation then extended vertically to a depth of 1.2m, before again stepping out horizontally. At 1.2m depth the foundation extended 1.2m out from the column line before again extending vertically, proven to a depth of 1.4m bgl. The excavation was terminated at 1.4m bgl, at which depth neither the foundation base, nor founding stratum could be proven.

HTP2 was undertaken against a non-loadbearing brick wall, which extended to a depth of 0.3m bgl. A concrete foundation was encountered at this depth which stepped out horizontally by 0.05m, before extending vertically to 0.65m bgl in one half of the trial pit and to the full depth of the excavation at 1.2m bgl in the other half of the trial pit. The foundation base and founding stratum were not exposed.

It is understood from anecdotal evidence that building 6000 is constructed on pad foundations, however the investigation could neither prove or disprove this hypothesis.

Building 1000

HTP4 was excavated to investigate the exist foundations of Building 1000.

The foundation extended vertically to 0.15m bgl where it stepped out horizontally to 0.92m from the building (minus the thickness of the cladding). The foundation then extended vertically to 0.35m bgl before stepping out horizontally to 1.27m from the building. The foundation further extended vertically to 0.5m bgl and was found to be seated within the Made Ground. To confirm that this was the foundation base, the excavation undercut the concrete footing, and was extended to 1.2m bgl.

It is considered that given Building 1000 is situated on a raised mound comprising Made Ground, the foundations encountered may not be representative of the whole building. Given that there are tunnels running beneath the site, deeper foundations may be encountered during demolition.

During the excavation, a metal pipe was encountered adjacent to the concrete footing. The nature and rout of this pie is currently unknown.

Copies of the foundation sections are included in Appendix V, and the exploratory hole logs are provided in Appendix II.

7.4.2 Foundation Recommendations

The following foundation recommendations assume that the proposed development will comprise the partial demolition and reconfiguration of an existing laboratory and manufacturing unit (Building 1000) located toward the north of the site in order to extend parking provision, and the construction of four light industrial / commercial units with associated parking provision across the southern section of the site.

The ground investigation has identified Made Ground across the site to depths up to 3.1m underlain by interbedded granular and cohesive strata and or a highly weathered material derived from the underlying bedrock. These superficial deposits were proven to a maximum depth of between 5.1m and 6.0m bgl and found to be in a very variable condition with SPT ‘N’ values ranging from 1 to >50.

Solid chalk bedrock was encountered below the superficial deposits across the site. In general, where encountered, this material was described as structureless chalk (Grade Dm) composed of uncompacted slightly sandy slightly gravelly occasionally cobbly silt.

SPT ‘N’ values obtained from tests conducted within the chalk (Grade Dm) generally increased with depth with un-weathered horizons indicated from between 15.0m to 18.0m bgl. Dry density testing indicates the chalk to generally be of ‘medium density’ with areas of ‘low density’ recorded in two locations up to 10.95m bgl.

Groundwater was encountered across the site during this investigation at depths generally between 2.0m and 3.0m bgl.

It is considered that a shallow foundation solution within the superficial deposits encountered may prove problematic, though an allowable bearing capacity of 40 to 50 kN/m^2 based on a 1m^2 pad foundation could be assumed in such material. If a shallow foundation solution is utilised, excavations may need to over-deepened in areas of deeper Made Ground or very loose / very soft natural strata. Any shallow foundations may span strata of varying characteristics and may be at risk of differential settlement. We would therefore recommend that foundations are reinforced to protect against differential settlement.

Given the above, a piled foundation may prove more suitable. Additional advice should be sought from a specialist piling contractor regarding the pile design (i.e. type, length and diameter).

If a piled foundation solution is to be utilised, there may be differential settlement between piled structures and the surrounding ground level.

7.5 Concrete Classification

In accordance with BRE Special Digest 1, the site has been classified as “brownfield” with a mobile groundwater regime.

The concentrations of sulphate in aqueous extractions were determined using the gravimetric method. The pH value of each sample was determined using the electrometric method.
Four samples taken from the Made Ground, four from the natural superficial deposits and four from the underlying chalk bedrock were tested for water soluble sulphate content. In addition, ten samples of made ground, six soil samples from the natural superficial deposits and four samples of the chalk bedrock were tested for pH.

Sulphate concentrations did not exceed laboratory level of detection (LOD) of 10 mg/l in any of the samples analysed. The characteristic sulphate value has therefore been set at the laboratory LOD of is therefore 10mg/l. The lowest recorded pH was 7.01.

Therefore, in accordance with Table C2 of SD1, sub-surface concrete should be Design Sulphate Class DS-1 with an ACEC classification of AC-1.

7.6 Waste Management

Arisings generated from excavations for foundations and service trenches etc. may be classified as waste and it is the responsibility of the holder of such material to form a view as to whether or not it constitutes waste.

Guidance on how this can be achieved is set out in the Development Industry Code of Practice (CoP) (CL:AIRE, March 2011).

The handling, re-use or disposal of waste materials is regulated by the Environment Agency, who take into account the CoP in determining whether materials are classified as waste. If materials are handled with in accordance with the CoP it is considered unlikely that they will be considered waste at the point when they are used during development. This might be because the materials were never formally discarded or because they have been processed as part of a ‘recovery’ operation and therefore ceased to be waste.

Should site won material be intended for re-use on site a Materials Management Plan will be required from a suitably qualified environmental consultant in order to comply with the CoP.

7.7 Infiltration Tests

7.7.1 Soakaway Testing

Soakaway testing was undertaken in general accordance with the guidance provided in BRE digest 365 'Soakaway Design' in two locations (SA1 and SA2). Mechanically excavated trial pits were undertaking to depths of approximately 2.0m bgl with the vertical sides trimmed and squared before being partially filled with water and the rate of infiltration recorded. Infiltration rates have subsequently been calculated in order to examine soils permeability characteristics and the feasibility of soakaway drainage.

The results of the soakaway tests are presented in Table 2 below. The monitoring certificates are included as Appendix VI.

Table 2 – Soakaway Test Results

Location	Test Depth (m bgl)	Indicative Infiltration Rate (m/s)
SA1 (Test 1)	0.99 – 2.05	4.37×10^{-5}
SA1 (Test 2)	0.95 – 2.05	3.81×10^{-5}
SA1 (Test 3)	0.90 – 2.05	3.95×10^{-5}
SA2 (Test 1)	1.51 – 2.10	6.26×10^{-4}
SA2 (Test 2)	1.50 – 2.10	8.36×10^{-4}
SA2 (Test 3)	1.53 – 2.10	1.04×10^{-3}

Infiltration rates recorded during the tests carried out in SA1 indicate that the natural strata in this location exhibit marginal drainage characteristics and that soakaway drainage / permeable paving may be suitable subject to design parameters.

The infiltration rates recorded within the Made Ground in SA2 indicate good drainage characteristics, however it should be noted that soakaway drainage in Made Ground is generally not considered acceptable by regulators. Whilst no visual or olfactory evidence of contamination was observed and laboratory test results within this area have not highlighted any elevated concentrations of the determinands tested, further thought should be given to the suitability of this location for the installation of soakaways.

Due to the presence of chalk there is a risk of ground dissolution features caused by traditional soakaway structures that concentrate infiltration to a localised area. In low to medium density chalk traditional soakaways must have a minimum of 5-10m separation from buildings and structures to avoid the generation of dissolution features that may impact on building foundations (CIRIA C574 'Engineering in Chalk'). Distributive soakaways such as permeable paving and sub-base infiltration that do not concentrate infiltration avoid the risk of generating groundwater dissolution features.

7.7.2 Preliminary Infiltration Tests

During the intrusive investigation, preliminary infiltration (falling head) tests were carried out in two of the window sample boreholes (WS2 and WS6) in order to examine the feasibility of soakaways as a means of surface water disposal and supplement the above soakaway testing results. The boreholes were excavated to the depth of 2.0m bgl with a response zone set between 1.5m and 2.0m bgl.

An approximate permeability value of 1.80 x10^{-4} was calculated within WS2 indicating these soils to have good drainage characteristics. The water in WS6 failed to infiltrate over the duration of the test, indicating these soils to have very poor drainage characteristics.

1.0 CONCLUSIONS AND RECOMMENDATIONS

It is understood that site is proposed to be partially re-developed comprising the partial demolition and reconfiguration of an existing laboratory and manufacturing unit located toward the north of the site in order to extend parking provision with associated landscaping and the construction of four (4No.) light industrial / commercial units with associated parking across the south of the site with associated car parking.

Historical OS maps of the area indicate the site was undeveloped until the early 1900s when a large sewage works and engine house occupied the north-eastern section of the site. During the subsequent decades this facility underwent significant expansion. In the mid-1950s, an allotment garden occupied the centre of the site. In the early to mid 1970s, the site had undergone large-scale redevelopment, resulting in the construction of many of the existing commercial / industrial units. In addition, by this time a large building and an electrical sub-station occupied the southern section of the site, within the existing car-parking area. By the early 1990s the building / electricity substation across the south of the site had been replaced by the existing car-park and the site is understood to have been in its current configuration. The surrounding area has been a mix of undeveloped, and industrial land uses with mills, sewage works, works and industrial units along with a retail park with associated infrastructure all located / historically located within close proximity to the site.

The nearest identified environmental receptors are the underlying superficial strata which is classified as a Secondary A Aquifer, solid strata classified as a Principle Aquifer and water course immediately to the east of the site though the site is not situated within a Source Protection Zone and no groundwater or surface water abstractions have been identified within 250m of the site.

Intrusive site investigation works were carried out between 17th and 15th July 2019 and comprised the excavation of 8 No. window sample boreholes 4 No. Cable Percussive boreholes, 4 No. hand excavated, and 2 No. mechanically excavated trial pits. In addition, indicative infiltration testing (falling head) was carried out within selected window sample boreholes (WS2 and WS6), and soakaway testing was undertaken in the machine excavated trial pits.

Made Ground was identified during the intrusive investigation works to depths of up to 3.1m bgl. and generally comprised a variable sequence of either predominantly granular or cohesive materials of various subtypes.

Sub-surface hardstanding was encountered in several locations across the site, generally corresponding with the locations of historic / demolished buildings. There remains the possibility that buried structures may be present elsewhere on site which have not been identified during this investigation.

The Made Ground was underlain by a sequence of interbedded granular and cohesive strata interpreted to predominantly comprising river terrace deposits and or a highly weathered material derived from the underlying bedrock. These superficial deposits were proven to a maximum depth of between 5.1m and 6.0m bgl. Solid chalk bedrock was encountered below the superficial deposits across the site, proven to a maximum of 24.85m bgl.

Groundwater was generally encountered across the site during the fieldwork at depths of between approximately 2.0m to 3.0m.

Visual and olfactory evidence of hydrocarbon contamination was recorded in WS2 and WS5 between though chemical testing did not identify any contaminants which exceeded relevant SSVs for commercial / industrial end use in terms of human health and no asbestos fibres or ACMs were encountered during the investigation.

Whilst no elevated concentrations of the determinands tested have been recorded in terms of human health, localised concentrations of contaminants not identified / investigated during this investigation may be present in quantities considered harmful in terms of human health.

Site workers involved in excavations for foundations, roads, sewers etc. may come into direct shallow Made Ground soils which have not been identified during this investigation. As any Made Ground does represent a potential risk, we would therefore recommend that simple precautionary measures be adopted during the construction phase i.e. good personal hygiene, provision of welfare facilities and basic personal protective equipment i.e. gloves and safety glasses. Should during any future investigation / remediation / construction works identify visual or olfactory evidence of contamination, a suitably qualified environmental consultant should be contacted to further assess any potential issues. Additional works may be required to suitably quantify the risk to potential and identified receptors.

In respect to controlled waters, chemical testing has identified elevated concentrations of organic contaminants when compared to SSVs for commercial / industrial end use in the locations of WS2 and WS5. WS2 was positioned in the location of a historic waste storage area and also adjacent to an existing electricity sub-station with WS5 adjacent to the historic tanks in the west of the site which are likely to be the source of contamination in these locations. Given the presence of controlled waters beneath the site and groundwater identified at approximately 2.0m to 3.0m bgl, it is recommended that further works be undertaken in these areas with the retrieval of soil and groundwater samples to suitably delineate the identified contamination and further assess the risk these contaminants pose.

Further thought should be given in these areas to any proposed hardstanding design and the use of permeable surfaces / soakaways as the introduction of water into these soils may increase the risk of the identified contaminants mobilising and migrating into controlled groundwaters.

Geotechnical testing of the shallow natural cohesive deposits indicate these soils to be of ‘low’ volume change potential with the exception of the location of SA1 where a ‘high’ volume change potential was recorded. That should be taken into consideration for the foundation design.

Laboratory CBR tests carried out in three locations recorded vales ranging from 1.1% to 16.8%.

Dry density tests of the chalk bedrock are generally consistent with chalk of ‘medium density’ with areas of ‘low density’ recorded in BH1 at 10.5m to 10.95m and in BH2 at 5.0m to 5.45m and 7.5m to 7.95m. Areas of ‘high density’ chalk were encountered in BH4 at 9.1m and 18.9m.

Ground gas monitoring was undertaken on 4 occasions and has recorded 7.2% carbon dioxide. No methane has been identified and gas flow rates were typically absent. Based on the gas screening values available, the site can be classified as Characteristic Situation 1 (CS1).

According to the current guidance and best practice however, where carbon dioxide concentrations are recorded in excess of 5%, consideration should be given to increasing the classification to CS2. In this instance, given the relatively short monitoring period, the presence of elevated carbon dioxide, depleted oxygen levels, the depth and nature of the filled ground and presence of peat in the local area, we would recommend that the characteristic situation be increased to CS2 and that gas protective measures are installed in all new structures in accordance with guidance provided in BS 8485: 2015 “Code of Practice for the Design of Protective Measures for Methane & Carbon Dioxide Ground Gases for New Buildings”.

It is considered that a shallow foundation solution may prove problematic given the very variable nature of the shallow natural strata. An allowable bearing capacity of 40 to 50 kN/m^2 based on a 1m^2 pad foundation could be assumed in such material though if a shallow foundation solution is utilised, excavations may need to over-deepened in areas of deeper Made Ground or very loose / very soft natural strata. Any shallow foundations may span strata of varying characteristics and may be at risk of differential settlement. We would therefore recommend that foundations are reinforced to protect against differential settlement.

Given the above, a piled foundation may prove more suitable. Additional advice should be sought from a specialist piling contractor regarding the pile design (i.e. type, length and diameter). If a piled foundation solution is to be utilised, there may be differential settlement between piled structures and the surrounding ground level.

Laboratory testing indicates that sub-surface concrete should be prepared as Design Sulphate Class DS-1 with an ACEC classification of AC-1.

As part of the investigation, soakaway testing was undertaken in general accordance with the guidance provided in BRE digest 365 'Soakaway Design' in two locations with falling head tests also undertaken in two locations in order to supplement the soakaway data. Recorded infiltration rates suggest that the superficial deposits exhibit marginal to good drainage characteristics, and that soakaway drainage / permeable paving may be suitable subject to design parameters. Infiltration rates within the granular Made Ground also show good drainage characteristics however it should be noted that soakaway drainage in Made Ground is generally not considered acceptable by regulators. Whilst no visual or olfactory evidence of contamination was observed and laboratory test results within this area have not highlighted any elevated concentrations of the determinands tested, further thought should be given to the suitability of this location for the installation of soakaways.

Due to the presence of chalk there is a risk of ground dissolution features caused by traditional soakaway structures that concentrate infiltration to a localised area. In low to medium density chalk traditional soakaways must have a minimum of 5-10m separation from buildings and structures to avoid the generation of dissolution features that may impact on building foundations (CIRIA C574 'Engineering in Chalk'). Distributive soakaways such as permeable paving and sub-base infiltration that do not concentrate infiltration avoid the risk of generating groundwater dissolution features.

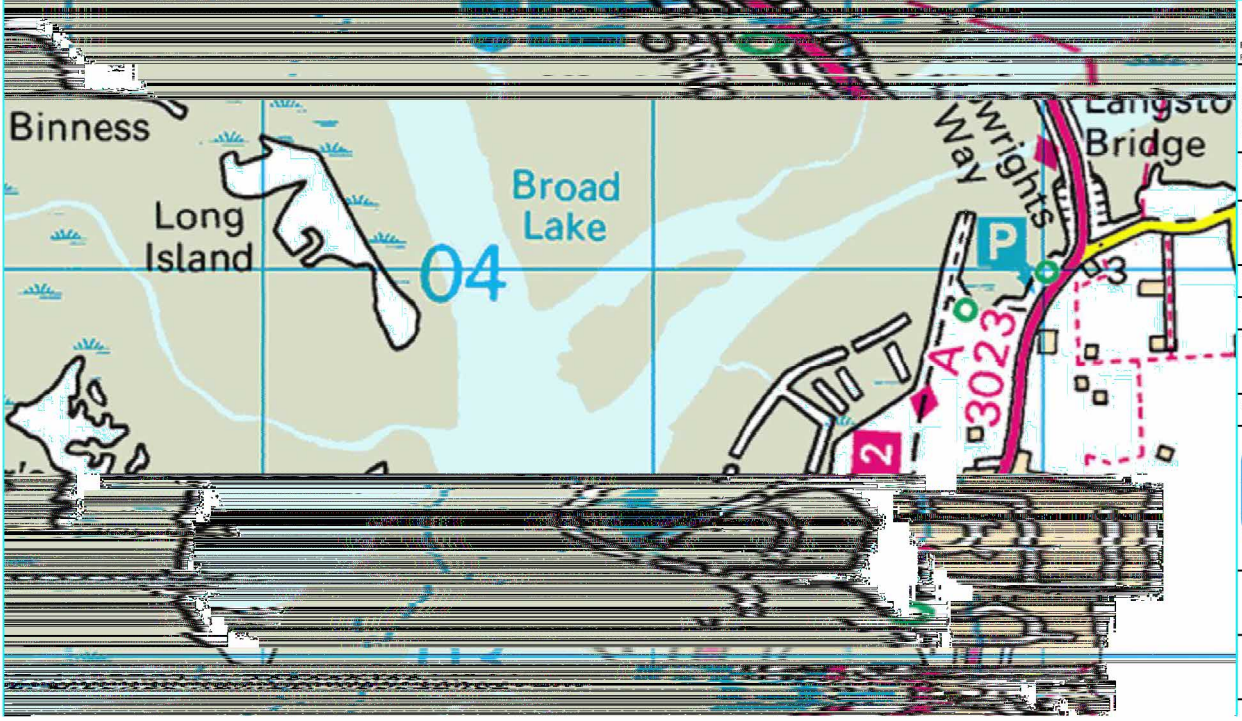
Based on the information available to date we would recommend the following further works are required:

- Additional investigations to be carried out in the location of WS2 and WS5 to delineate identified organic contamination with regards to controlled waters. Soil and water samples to be recovered for laboratory testing.
- Preparation of a Remediation Strategy following delineation of the organic contamination for approval with the Local Authority.
- Gas protective measures to be installed in all new structures in accordance with CS2 conditions. The installation of the protective measures should be independently verified to ensure they are fit for purpose and to assist with planning discharge.
- The continued risk of unexploded ordinance should be considered during any future excavations and an EOD engineer may be required on site to brief and support site personnel.

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Appendix I





REV	DATE	DESCRIPTION	BY	CHK	APP
Rev.	Date	Description	By	Check	App.

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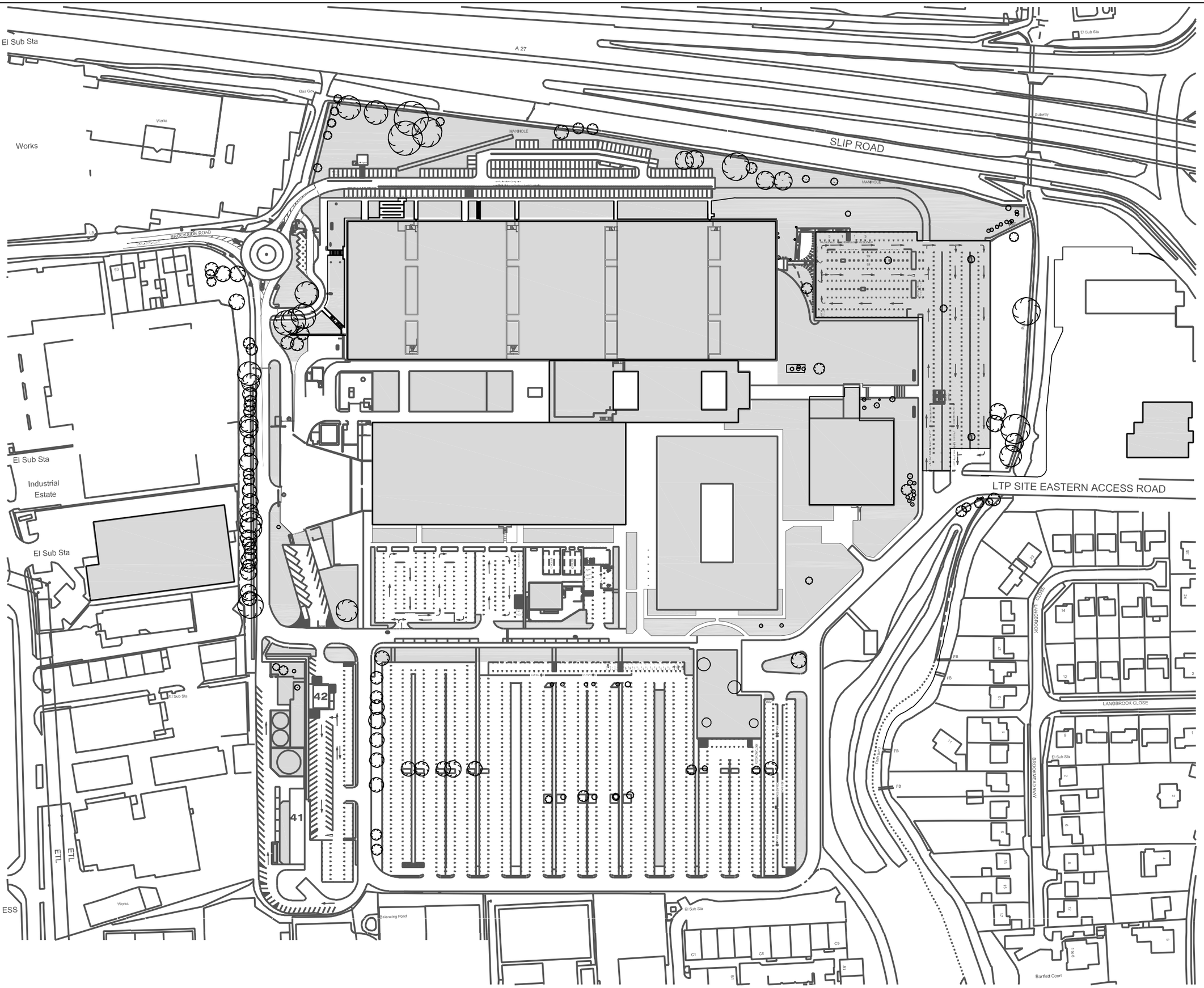
Client	AG Langstone B.V.
Project	Proposed Development Langstone Technology Park Havant
Office	Altrincham
Discipline	Geo-Environmental
Title	Site Location Plan
Scale @ A3	NTS
Status	

clancy consulting

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Originator	Job Number	Discipline	Building/Zone
SHP	10/1425	GEO	
Type	**Level**	**Drawing No.**	**Revision**
		001	A

Birmingham 0121 233 7500 Glasgow 0141 222 1703 Liverpool 0151 227 5300 London 020 3077 3970 Manchester 0161 615 8000 Newcastle 0191 251 0102 Norwich 01603 395160 Redhill 01737 775575 Reading 0118 971 7888



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Rev	Date	Description	By	Check	App.

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Client	AG Langstone B.V.
Project	Proposed Development Langstone Technology Park Havant
Office	Altrincham
Discipline	Geo-Environmental
Title	Existing Site Layout Plan
Scale @ A3	NTS
Status	

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Originator	Job Number	Discipline	Building/Zone
SHP	10/1425	GEO	
Type	**Level**	**Drawing No.**	**Revision**
		A	A

Birmingham 0121 200 7800, Glasgow 0141 222 7720, Liverpool 0151 227 5500, London 020 3477 8970, Manchester 0161 615 6000, Newcastle 0191 221 0702, Norwich 01603 305190, Prestwich 0161 798 7888, Reading 0118 941 7888

Total Site Parking: 1888 (4.5% Disabled)

EXTENT OF NEW ELEVATION REF; 4046A-0200

135,000sq ft FLEXIBLE B1C, B2 & B8 UNITS. REF 4046C-0110

211 39 6 239 143 46 77 178 84 111 21 5 10 32 5 12 8 11 8 21 19 13 19 26 20 41 52 65 366

A 27

Works

Industrial Estate

El Sub Sta

LANGBROOK CLOSE

BROOKMEAD WAY

Bartlett Court

SOUTHWOOD

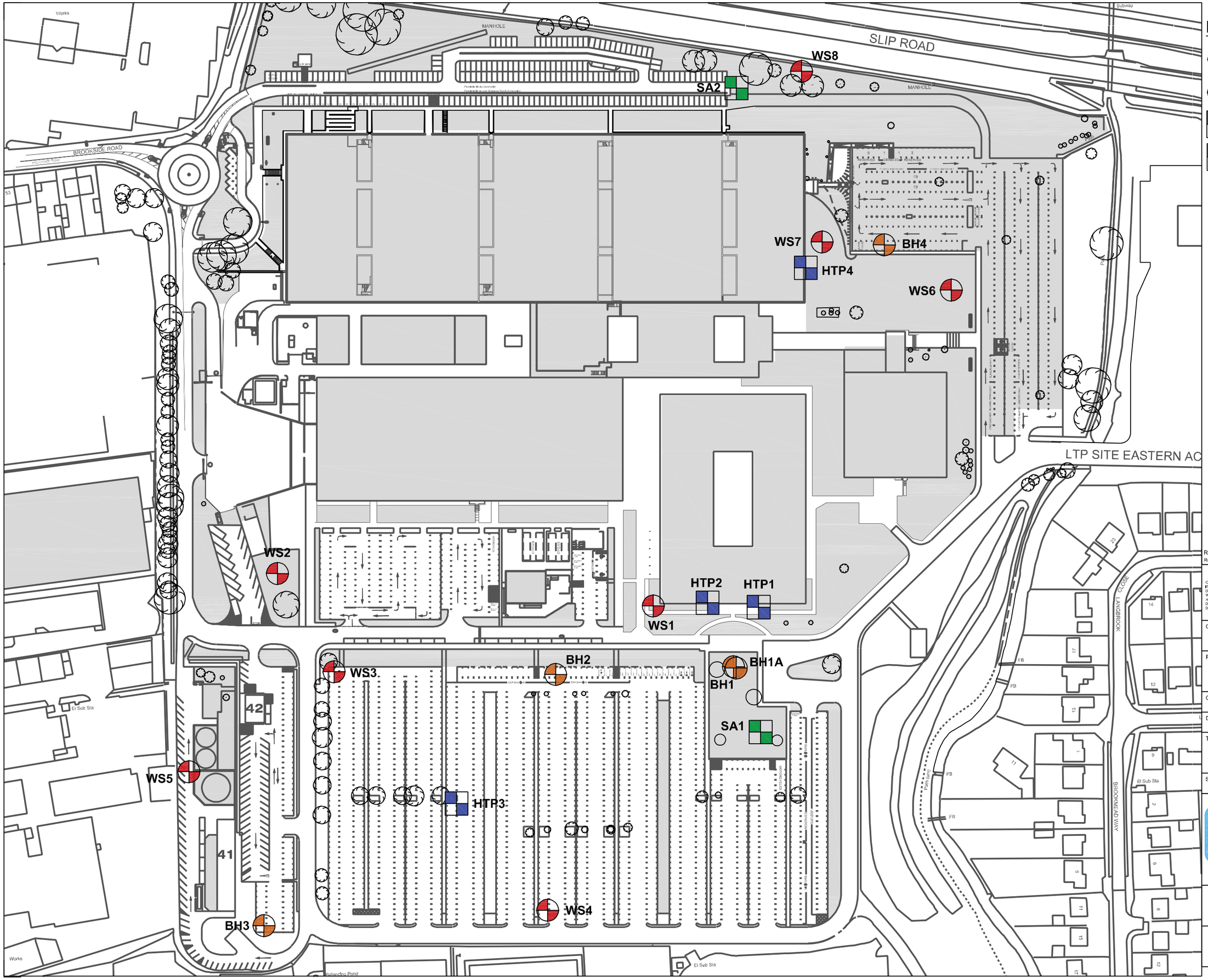
ETL

SCALE 1:2000

20 0 20 40 60 80 100

m

A3



Key

- Cable Percussive Borehole
- Window Sample Borehole
- Hand Excavated Trial Pit
- Soakaway Test Trial Pit

REV	DATE	DESCRIPTION	BY	CHK.	APP.
Rev	Date	Description	By	Check	App.

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Client: Malcolm Hollis

Project: Langstone Technology Park
Havant

Office: Altrincham

Discipline: Geo-environmental

Title: Exploratory Hole
Location Plan

Scale @ A3: NTS

Status:

clancy consulting
www.clancy.co.uk

Originator	Job Number	Discipline	Building/Zone
SHP	10/1425	GEO	

Type	Level	Drawing No.	Revision
		002	A

Birmingham 0121 289 7000 . Glasgow 0141 222 7720 . Liverpool 0151 227 5300 . London 009 3077 9970 . Manchester 0161 613 6500 . Newcastle 0191 221 0702 . Norwich 01603 305190 . Prestwich 01204 675575 . Reading 0118 941 7888

Appendix ll

clancy consulting	Project Title: Langstone Technology Park, Havant		**BH1**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.845214	E Coord: -0.987924
Date: 15/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result
0.20	ES	
0.60	ES	
1.00 - 1.10	SPT	sb 50/85mm

Level	Legend	Depth (m)	Description	Water	Standpipe
		0.40	MADE GROUND: Grass over brown silty sandy gravelly clay. Gravel is angular to sub-rounded fine to coarse of flint with fragments of slate and brick. Occasional roots and abundant rootlets towards the top of the unit.		
		1.00			
		1.10	MADE GROUND: Greyish white clayey sandy angular to sub-rounded fine to coarse gravel of chalk and flint with fragments of brick.		
			MADE GROUND: Concrete obstruction.		
		2.00	End Of Borehole At 1.10 m		
		3.00			
		4.00			
		5.00			
		6.00			
		7.00			
		8.00			

KEY

D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Borehole terminated due concrete obstruction. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH1A
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 4
	GL (mAOD):	N Coord: 50.845214	E Coord: -0.987924
Date: 15/07/2019-17/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Depth (m)	Description
			0.40	MADE GROUND: Grass over brown silty sandy gravelly clay. Gravel is angular to sub-rounded fine to coarse of flint with fragments of slate and brick. Occasional roots and abundant rootlets towards the top of the unit.
1.20 - 1.65	SPT	sb 50/85mm	1.00	
1.40	ES		1.15	MADE GROUND: Greyish white clayey sandy angular to sub-rounded fine to coarse gravel of chalk and flint with fragments of brick.
			1.30	MADE GROUND: Concrete.
2.00 - 2.45	SPT	N=45	2.00	MADE GROUND: Void.
			2.60	MADE GROUND: Brown sandy gravelly clay. Gravel is sub-rounded to rounded fine to coarse of flint and concrete with a low cobble content of concrete. Becoming increasingly gravelly with fragments of brick and a medium cobble content towards the base of the unit.
3.00 - 3.45	SPT	pp 50/230mm	3.00	
3.50	ES			Very dense becoming medium dense light brown sandy very cleyey sub-angular to sub-rounded fine to coarse GRAVEL of flint and chalk.
4.00 - 4.45	SPT	N=10	4.00	
			4.30	Firm light brown sandy gravelly CLAY. Gravel is fine to coarse sub-rounded to rounded of flint and chalk.
5.00 - 5.45	SPT	N=13	5.00	
			5.40	Structureless CHALK composed of uncompact light brownish cream sandy gravelly SILT. Gravel is sub-angular to sub-rounded white. (Grade Dm).
6.00 - 6.45	U		6.00	
			7.00	
7.50 - 7.95	SPT	N=13	7.50	
			8.00	Structureless CHALK composed of uncompact light brownish cream sandy gravelly SILT with low cobble content. Gravel and cobbles are sub-angular to sub-rounded white. Occasional black flecks and flint cobbles. (Grade Dm).
				Borehole Continues

KEY

D - Disturbed Sample
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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

REMARKS

Groundwater encountered at 4.3m rising to 3.7m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
17/07/2019	4.3	3.7			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH1A
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 2 Of 4
	GL (mAOD):	N Coord: 50.845214	E Coord: -0.987924
Date: 15/07/2019-17/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
9.00 - 9.45	SPT	N=13			9.00	Structureless CHALK composed of uncompact light brownish cream sandy gravelly SILT with low cobble content. Gravel and cobbles are sub-angular to sub-rounded white. Occasional black flecks and flint cobbles. (Grade Dm).		
10.50 - 10.95	U				10.00			
12.00 - 12.45	SPT	N=9			11.00			
13.50 - 13.95	SPT	N=16			12.00			
14.50 - 14.95	U				13.00			
15.00 - 15.45	SPT	N=16			13.50	Structureless CHALK composed of uncompact light brownish cream gravelly sandy SILT. Gravel is sub-angular to sub-rounded light brownish cream with occasional black flecks. (Grade Dm).		
					14.00			
					15.00	Structureless CHALK comprised of uncompact whitish cream slightly sandy slightly gravelly SILT. Gravel is sub-angular to sub-rounded whitish cream with very rare black flecks. (Grade Dm).		
					16.00	Borehole Continues		

KEY

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S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 4.3m rising to 3.7m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
17/07/2019	4.3	3.7			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH1A
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 3 Of 4
	GL (mAOD):	N Coord: 50.845214	E Coord: -0.987924
Date: 15/07/2019-17/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
16.50 - 16.95	SPT	N=22				Structureless CHALK comprised of uncompact whitish cream slightly sandy slightly gravelly SILT. Gravel is sub-angular to sub-rounded whitish cream with very rare black flecks. (Grade Dm).		
					17.00			
18.00 - 18.45	SPT	N=26			18.00			
					19.00			
19.50 - 19.95	SPT	N=28				19.50 - 21.00 Gravel of subangular black flint.		
					20.00			
21.00 - 21.45	SPT	pp 50/195mm			21.00	Structureless CHALK comprised of uncompact whitish cream slightly sandy gravelly SILT. Gravel is sub-angular black flint. (Grade Dm).		
22.00 - 22.45	SPT	pp 50/220mm			22.00			
					23.00			
23.50 - 23.95	SPT	pp 50/210mm			23.50			
					24.00	Structureless CHALK comprised of uncompact whitish cream slightly sandy slightly gravelly SILT. Gravel is sub-angular to sub-rounded white with common black flecks. (Grade Dm).		
						Borehole Continues		

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C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 4.3m rising to 3.7m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
17/07/2019	4.3	3.7			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH1A
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 4 Of 4
	GL (mAOD):	N Coord: 50.845214	E Coord: -0.987924
Date: 15/07/2019-17/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
24.50 - 24.85	SPT	pp 50/225mm			25.00	Structureless CHALK comprised of uncompact whitish cream slightly sandy slightly gravelly SILT. Gravel is sub-angular to sub-rounded white with common black flecks. (Grade Dm).		
						End Of Borehole At 24.95 m		
					26.00			
					27.00			
					28.00			
					29.00			
					30.00			
					31.00			
					32.00			

KEY

D - Disturbed Sample
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S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 4.3m rising to 3.7m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
17/07/2019	4.3	3.7			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH2
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 4
	GL (mAOD):	N Coord: 50.845665	E Coord: -0.989051
Date: 17/07/2019-18/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.10	MADE GROUND: Tarmac.		
					0.25	MADE GROUND: Greyish brown sandy angular to sub-angular fine to coarse gravel of limestone.		
					1.00	MADE GROUND: Brown sandy sub-rounded to rounded fine to coarse gravel of flint.		
1.20 - 1.65	C	N=16			1.20	medium dense brown becoming light brown clayey very sandy sub-rounded fine to coarse to rounded GRAVEL of flint with a low cobble content of flint.		
2.00 - 2.45	C	N=10			2.00			
3.00 - 3.45	C	N=2			3.00	Very soft white gravelly CLAY. Gravel is angular to sub-rounded fine to coarse of flint and chalk.		
4.00 - 4.45	C	N=4			4.00			
					4.70			
5.00 - 5.45	U				5.00	Brown sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse of flint.		
					5.50			
6.00 - 6.45	SPT	N=17			6.00	Structureless CHALK composed of uncompact yellowish cream gravelly sandy SILT with a low cobble content. Gravel and cobbles are subangular to sub-rounded greyish white chalk and sub-angular black flint. (Grade Dm).		
					7.00			
7.50 - 7.95	U							
					8.00	Borehole Continues		

KEY

D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.5m rising to 2.3m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
29/07/2019	2.5	2.3			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

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clancy consulting	Project Title: Langstone Technology Park, Havant		BH2
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 2 Of 4
	GL (mAOD):	N Coord: 50.845665	E Coord: -0.989051
Date: 17/07/2019-18/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
9.00 - 9.45	SPT	N=13			9.00	Structureless CHALK composed of uncompact yellowish cream gravelly sandy SILT with a low cobble content. Gravel and cobbles are subangular to sub-rounded greyish white chalk and sub-angular black flint. (Grade Dm).		
10.50 - 10.95	SPT	N=13			10.00			
					11.00	10.50 - 14.00 No cobble content.		
12.50 - 12.95	SPT	N=15			12.00			
					13.00			
14.00 - 14.45	SPT	N=15			14.00	Structureless CHALK composed of uncompact whitish cream gravelly sandy SILT. Gravel is sub-angular to sub-rounded greyish white with occasional black flecks. (Grade Dm).		
					15.00			
15.50 - 15.95	SPT	N=17			15.50	Structureless CHALK composed of uncompact light brownish cream gravelly sandy SILT. Gravel is sub-angular to sub-rounded light brownish cream with occasional black flecks. (Grade Dm).		
					16.00	Borehole Continues		

KEY

D - Disturbed Sample
B - Bulk Sample
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S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.5m rising to 2.3m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
29/07/2019	2.5	2.3			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH2
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 3 Of 4
	GL (mAOD):	N Coord: 50.845665	E Coord: -0.989051
Date: 17/07/2019-18/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
17.00 - 17.45	U				17.00	Structureless CHALK composed of uncompact light brownish cream gravelly sandy SILT. Gravel is sub-angular to sub-rounded light brownish cream with occasional black flecks. (Grade Dm).		
18.50 - 18.95	SPT	pp 50/215mm			18.00			
					18.50	Structureless CHALK composed of uncompact light greyish white gravelly sightly sandy SILT. Gravel is sub-angular to sub-rounded light greyish white with occasional black flecks. (Grade Dm).		
20.00 - 20.45	SPT	pp 50/190mm			19.00			
					20.00			
21.50 - 21.95	SPT	pp 50/195mm			21.00			
					21.50	Structureless CHALK composed of uncompact light greyish white gravelly sightly sandy SILT. Gravel is sub-angular to sub-rounded light greyish white chalk and subangular black flint. (Grade Dm).		
23.00 - 23.45	SPT	pp 50/180mm			22.00			
					23.00			
					24.00	Borehole Continues		

KEY

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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.5m rising to 2.3m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
29/07/2019	2.5	2.3			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH2
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 4 Of 4
	GL (mAOD):	N Coord: 50.845665	E Coord: -0.989051
Date: 17/07/2019-18/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
24.50 - 24.70	SPT	pp 50/215mm			24.70	Structureless CHALK composed of uncompact light greyish white gravelly sightly sandy SILT. Gravel is sub-angular to sub-rounded light greyish white chalk and subangular black flint. (Grade Dm).		
					25.00	End Of Borehole At 24.70 m		
					26.00			
					27.00			
					28.00			
					29.00			
					30.00			
					31.00			
					32.00			

KEY

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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.5m rising to 2.3m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
29/07/2019	2.5	2.3			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH3
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 3
	GL (mAOD):	N Coord: 50.844665	E Coord: -0.991222
Date: 22/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.15	MADE GROUND: Tarmac.		
0.50	ES				0.60	MADE GROUND: Brown slightly clayey sandy angular to sub-angular fine to coarse gravel of limestone (sandy base).		
1.00	ES				1.00			
1.00 - 1.45	SPT	N=25			1.20	MADE GROUND: Greyish brown gravelly sandy silty clay. Gravel is angular to sub-rounded fine to coarse of flint and brick with fragments of slate.		
2.00 - 2.45	SPT	N=21			2.00	Medium dense brown clayey sandy sub-rounded fine to coarse GRAVEL of flint.	▼	
					2.50			
3.00 - 3.45	SPT	N=20			3.00	Medium dense light brown clayey sandy sub-angular to sub-rounded fine to coarse GRAVEL of flint and chalk.		
4.00 - 4.45	SPT	N=28			4.00			
5.00 - 5.45	SPT	N=17			5.00			
					5.10	Structureless CHALK composed of uncompact greyish white gravelly slightly sandy SILT. Gravel is sub-angular to sub-rounded white with rare black specks. (Grade Dm).		
6.00 - 6.45	SPT	N=13			6.00			
					7.00			
7.50 - 7.95	D	N=12						
					8.00	Borehole Continues		

KEY

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C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.0m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
25/07/2019	2				

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH3
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 2 Of 3
	GL (mAOD):	N Coord: 50.844665	E Coord: -0.991222
Date: 22/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					9.00	Structureless CHALK composed of uncompact greyish white gravelly slightly sandy SILT. Gravel is sub-angular to sub-rounded white with rare black specks. (Grade Dm).		
					10.00			
10.50 - 10.95	SPT	N=21						
					11.00			
12.00 - 12.45	SPT	N=18			12.00			
					13.00	13.00 Flint cobble.		
13.50 - 13.95	SPT	N=18			13.50	Structureless CHALK composed of uncompact greyish white very gravelly slightly sandy SILT. Gravel is sub-angular to sub-rounded white. (Grade Dm).		
					14.00			
15.00 - 15.45	SPT	N=26			15.00	Structureless CHALK composed of uncompact greyish white gravelly sandy SILT. Gravel is sub-angular to sub-rounded white with rare black flecks. (Grade Dm).		
					16.00	Borehole Continues		

KEY

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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.0m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
25/07/2019	2				

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH3
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 3 Of 3
	GL (mAOD):	N Coord: 50.844665	E Coord: -0.991222
Date: 22/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
16.50 - 16.93	SPT	pp 50/275mm			17.00	Structureless CHALK composed of uncompact greyish white gravelly sandy SILT. Gravel is sub-angular to sub-rounded white with rare black flecks. (Grade Dm).		
18.00 - 18.28	SPT	pp 50/130mm			18.00	16.00 Flint cobble.		
19.00	D				19.00			
19.50 - 19.66	SPT	pp 50/85mm			20.00			
21.00 - 21.22	SPT	pp 50/65mm			21.00			
					22.00			
22.50 - 22.73	SPT	pp 50/75mm			22.73			
					23.00	End Of Borehole At 22.73 m		
					24.00			

KEY

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C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

REMARKS

Groundwater encountered at 2.0m. Borehole installed with monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
25/07/2019	2				

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting

Project Title: Langstone Technology Park, Havant		BH4
Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 3
GL (mAOD):	N Coord: 50.847282	E Coord: -0.98699
Date: 24/07/2019-25/07/2019	Method: Cable Percussion	Driller: WB Drilling
		Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.10	MADE GROUND: Tarmac.		
0.40	ES				0.30	MADE GROUND: Brown sandy sub-rounded fine to coarse gravel of flint on a geotextile membrane.		
1.10	ES				1.00	MADE GROUND: Brown very gravelly sandy clay. Gravel is angular to sub-rounded fine to coarse of flint and brick with fragments of wood, slate and metal.		
1.20 - 1.65	SPT	N=2			1.60	Very soft plastic brown amorphous very silty PEAT.		
2.00 - 2.45	SPT	N=50			2.00	Firm becoming very stiff brown very sandy gravelly CLAY. Gravel is sub-rounded to rounded fine to coarse of flint with a low cobble content of flint.	▼	
2.10	ES				2.30			
3.00 - 3.45	SPT	N=33			3.00	Medium dense brown clayey fine to coarse SAND and sub-rounded fine to coarse GRAVEL of flint.		
4.00 - 4.45	SPT	N=28			4.00			
5.00 - 5.45	SPT	N=23			5.00			
					5.80			
6.00 - 6.45	SPT	N=12			6.00	Light brown clayey sandy sub-angular to sub-rounded fine to coarse GRAVEL of chalk and flint.	▽	
6.50	D					Structureless CHALK composed of uncompact brownish cream slightly sandy slightly gravelly SILT. Gravel is sub-angular to sub-rounded white. (Grade Dm).		
7.50 - 7.95	SPT	N=15			7.00			
					8.00	Borehole Continues		

KEY

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B - Bulk Sample
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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 6.0m rising to 2.4m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
24/07/2019	6	2.4			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		BH4
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 2 Of 3
	GL (mAOD):	N Coord: 50.847282	E Coord: -0.98699
Date: 24/07/2019-25/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
						Structureless CHALK composed of uncompact brownish cream slightly sandy slightly gravelly SILT. Gravel is sub-angular to sub-rounded white. (Grade Dm).		
9.00 - 9.45 9.10	SPT D	N=8			9.00			
						Structureless CHALK composed of uncompact greyish cream slightly sandy gravelly SILT. Gravel is sub-angular to sub-rounded white. (Grade Dm).		
					10.00			
10.50 - 10.95	SPT	N=6			10.50			
						Structureless CHALK composed of uncompact light greyish white slightly sandy very gravelly SILT. Gravel is sub-angular to sub-rounded white. (Grade Dm).		
11.50	D				11.00			
12.00 - 12.45	SPT	N=7			12.00			
					13.00			
13.50 - 13.95	SPT	N=15						
					14.00			
15.00 - 15.45	SPT	N=22			15.00			
						Structureless CHALK composed of uncompact light greyish cream sandy silty subangular to subrounded medium to coarse GRAVEL. Clasts are white. Matrix is light greyish cream. (Grade Dc).		
					16.00			
						Borehole Continues		

KEY

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S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 6.0m rising to 2.4m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
24/07/2019	6	2.4			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		**BH4**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 3 Of 3
	GL (mAOD):	N Coord: 50.847282	E Coord: -0.98699
Date: 24/07/2019-25/07/2019	Method: Cable Percussion	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
16.50 - 16.95	SPT	N=22			16.50	Structureless CHALK composed of uncompact light greyish cream sandy silty subangular to subrounded medium to coarse GRAVEL. Clasts are white. Matrix is light greyish cream. (Grade Dc).		
					17.00	Structureless CHALK composed of uncompact whitish cream gravelly sandy SILT. Gravel is whitish cream sub-rounded to sub-angular fine to coarse. (Grade Dm).		
18.90	D				18.00			
19.00 - 19.45	C	pp 50/265mm			19.00			
					20.00	Structureless CHALK composed of uncompact whitish cream slightly sandy gravelly SILT. Gravel is whitish cream sub-angular to sub-rounded fine to coarse with rare black specks. (Grade Dm).		
20.50 - 20.95	C	N=23			21.00			
22.00 - 22.45	C	pp 50/150mm			22.00			
					23.00			
23.50 - 23.65	C	pp 50/80mm			23.65			
					24.00	End Of Borehole At 23.65 m		

KEY

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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 6.0m rising to 2.4m. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
24/07/2019	6	2.4			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting

Project Title: Langstone Technology Park, Havant		WS1
Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
GL (mAOD):	N Coord: 50.845884	E Coord: -0.988569
Date: 16/07/2019	Method: Window Sampler	Driller: WB Drilling
		Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.30	ES					MADE GROUND: Grass over brown gravelly clayey fine to medium sand. Gravel is sub-angular to rounded fine to coarse of flint with fragments of pottery. Rootlets towards the top of the unit.		
1.20 - 1.65	SPT	N=15			1.00			
1.60	ES				1.30	Soft and very soft light brown becoming brownish white slightly sandy very gravelly CLAY. Gravel is sub-angular to rounded fine to coarse of flint and chalk.		
2.00 - 2.45	SPT	N=4			2.00			
2.50	ES							
3.00 - 3.45	SPT	N=3			3.00			
					3.70	Firm white gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium of chalk (weathered bedrock).		
4.00 - 4.45	SPT	N=15			4.00			
4.80	D							
5.00 - 5.45	SPT	N=13			5.00			
					5.45	End Of Borehole At 5.45 m		
					6.00			
					7.00			
					8.00			

KEY

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N - Penetration Test 'N' Value
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▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.0m rising to 1.8m bgl.
Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
17/07/2019	2	1.8			

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		**WS2**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.846009	E Coord: -0.990914
Date: 17/07/2019	Method: Window Sampler	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.50	ES				0.55	MADE GROUND: Grass over brown slightly clayey very sandy angular to sub-rounded fine to coarse gravel of flint and concrete with a low cobble content of concrete. Occasional rootlets towards the top of the unit.		
0.60 - 0.80	B							
1.00 - 1.45	SPT	N=16			1.00	MADE GROUND: Brown slightly clayey very gravelly fine to medium sand. Gravel is angular to sub-rounded fine to coarse of flint.		
1.10	ES				1.25			
					1.60	MADE GROUND: Dark blackish grey becoming brown very sandy slightly gravelly clay with fragments of wood and grass. Gravel is sub-rounded fine to coarse of flint. Strong olfactory evidence of hydrocarbons.		
2.00 - 2.45	SPT	N=2			2.00			
					2.10	Firm brown very sandy slightly gravelly CLAY with fragments of wood and grass. Strong olfactory evidence of hydrocarbons.		
2.40	ES							
3.00 - 3.45	SPT	N=8			3.00	Brown clayey sandy sub-angular to sub-rounded fine to coarse GRAVEL of flint.		
					3.50	Very soft becoming soft grey becoming brown sandy silty CLAY. Slightly gravelly towards the top of the unit. Gravel is sub-rounded fine to coarse of flint.		
4.00 - 4.45	SPT	N=12			4.00			
						Medium dense light brown clayey sandy angular to sub-rounded fine to coarse GRAVEL of flint and chalk (wet).		
5.00 - 5.45	SPT	N=22			5.00			
					5.45	End Of Borehole At 5.45 m		
					6.00			
					7.00			
					8.00			

KEY

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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Falling head test was undertaken in the borehole.
Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		WS3
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.845676	E Coord: -0.990613
Date: 16/07/2019	Method: Window Sampler	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.25	ES				0.15	MADE GROUND: Tarmac.		
					0.35	MADE GROUND: Orangish brown very sandy sub-rounded fine to coarse gravel of flint with a low cobble content of flint.		
					0.45	MADE GROUND: Tarmac.		
					0.65	MADE GROUND: Concrete.		
1.20 - 1.65	SPT	N=12			1.00	Brown slightly clayey slightly sandy angular to rounded fine to coarse GRAVEL of flint.		
1.50	D				1.45	Medium dense brown clayey very sandy sub-angular to rounded fine to coarse GRAVEL of flint with bands of sandy gravel and gravelly clay.		
2.00 - 2.45	SPT	N=19			2.00			
3.00 - 3.45	SPT	N=13			3.00		▼	
4.00 - 4.45	SPT	N=28			4.00			
5.00 - 5.45	SPT	N=27			5.00			
					5.45	End Of Borehole At 5.45 m		
					6.00			
					7.00			
					8.00			

KEY

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N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 3.0m bgl. Borehole unstable and collapsed in to 3m bgl. Borehole installed with gas monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
25/07/2019	3				

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		**WS4**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.844701	E Coord: -0.989103
Date: 16/07/2019	Method: Window Sampler	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.15	MADE GROUND: Tarmac.		
0.40 - 0.65 0.40	B ES				0.65	MADE GROUND: Light orangish brown clayey sandy angular fine to coarse gravel of limestone.		
1.20 - 1.65	SPT	N=15			1.00	Firm to stiff brown sandy very gravelly CLAY.		
1.80	ES				1.70			
2.00 - 2.45	SPT	N=15			2.00	Medium dense greyish brown slightly clayey slightly sandy angular to sub-rounded fine to coarse GRAVEL of flint with a medium cobble content of flint.		
2.90 3.00 - 3.45	D SPT	N=5			2.50 3.00	Soft greenish grey sandy SILT.		
					3.40			
4.00 - 4.45	SPT	N=9			4.00	Firm greenish grey sandy CLAY with widely spaced coarse sand partings.		
5.00 - 5.45	SPT	N=16			5.00 5.45			
						End Of Borehole At 5.45 m		
					6.00			
					7.00			
					8.00			

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▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Groundwater encountered at 2.1m bgl. Borehole unstable and collapsed in to 2.0m bgl. Borehole installed with gas monitoring well.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
25/07/2019	2.1				

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		**WS5**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.845351	E Coord: -0.991569
Date: 18/07/2019	Method: Window Sampler	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
					0.10	MADE GROUND: Tarmac.		
					0.15			
					0.35	MADE GROUND: Concrete.		
					0.40			
0.70	ES					MADE GROUND: Brown sandy gravelly clay. Gravel is sub-angular fine to coarse to sub-rounded of flint, brick, limestone and chalk.		
1.20 - 1.65	SPT	N=9			1.00			
						MADE GROUND: Tarmac.		
					1.60	MADE GROUND: Brown sandy gravelly clay with a low cobble content of brick. Gravel is sub-angular to sub-rounded fine to coarse of flint, brick, limestone and chalk.		
2.00 - 2.45	SPT	N=5			2.00	Loose becoming very loose brown clayey sandy angular fine to coarse to sub-rounded GRAVEL of flint.		
2.60	ES					2.50 - 3.45 Stained dark grey.		
3.00 - 3.45	SPT	N=1			3.00	2.50 - 4.00 Visual and olfactory evedence of hydrocarbons.		
3.90	ES					3.45 Becoming white.		
					4.00	End Of Borehole At 4.00 m		
					5.00			
					6.00			
					7.00			
					8.00			

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AGS

REMARKS

Groundwater encountered at 1.9m bgl. Borehole unstable and collapsed in to 1.9m bgl.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed
25/07/2019	1.9				

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		**WS6**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.847089	E Coord: -0.986694
Date: 18/07/2019	Method: Window Sampler	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.80	ES				1.00	MADE GROUND: Grass over brown very sandy slightly gravelly clay with fragments of brick and clinker. Gravel is angular to sub-rounded fine to coarse of flint, concrete and brick. Occasional rootlets towards the top of the unit.		
1.20 - 1.65	SPT	N=14			1.50			
1.70	ES					MADE GROUND: Dark grey sandy gravelly clay. Gravel is angular to sub-rounded fine to coarse of flint, chalk, clinker, brick, mudstone and coal with fragments of wood and decaying rootlets.		
2.00 - 2.45	SPT	N=8			2.00			
3.00 - 3.45	SPT	N=10			3.00			
3.90	ES				3.10	Medium dense light orangish brown very clayey gravelly fine to coarse SAND. Gravel is sub-rounded to rounded fine to coarse of flint and chalk.		
4.00 - 4.45	SPT	N=11			4.00			
5.00 - 5.45	SPT	N=21			5.00	4.80 - 5.45 Wet.		
					5.45	End Of Borehole At 5.45 m		
					6.00			
					7.00			
					8.00			

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AGS

REMARKS

No Groundwater Encountered
Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting

Project Title: Langstone Technology Park, Havant		WS7
Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
GL (mAOD):	N Coord: 50.847365	E Coord: -0.987382
Date: 18/07/2019	Method: Window Sampler	Driller: WB Drilling
		Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.40	ES				1.00	MADE GROUND: Grass over brown clayey gravelly fine to coarse sand with a low cobble content of flint and brick. Gravel is angular to sub-rounded fine to coarse of flint. Occasional rootlets towards the top of the unit.		
1.20 - 1.65	SPT	N=20						
1.40	ES				2.00			
2.00 - 2.45	SPT	N=40			2.45	End Of Borehole At 2.45 m		
					3.00			
					4.00			
					5.00			
					6.00			
					7.00			
					8.00			

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▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Borehole terminated in Made Ground due to cobble construction.Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		**WS8**
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.848019	E Coord: -0.987472
Date: 18/07/2019	Method: Window Sampler	Driller: WB Drilling	Logged By: SHP

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.60	ES					MADE GROUND: Brown sandy gravelly slightly silty clay. Gravel is angular to sub-rounded fine to coarse of brick, concrete and flint.		
1.20 - 1.21	SPT	sb 50/5mm			1.00 1.10 1.21	MADE GROUND: Concrete cobbles obstruction.		
						End Of Borehole At 1.21 m		
					2.00			
					3.00			
					4.00			
					5.00			
					6.00			
					7.00			
					8.00			

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▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Borehole terminated in Made Ground due to concrete obstruction. Borehole backfilled with arisings.

Scale: 1:50

Water Strikes

Date	Strike	Level	Minutes	Casing	Sealed

Daily Log Of Depths

Date	Casing	Water

Chiselling

From	To	Hours

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		HTP1
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.843224	E Coord: -0.988262
Date: 21/07/2019	Method: Hand Excavated	Logged By: SHP	Scale: 1:50

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.50	ES				0.24	MADE GROUND: Red tarmac.	
						MADE GROUND: Black tarmac.	
						MADE GROUND: Concrete with 8 mm rebar towards top of unit.	
					1.00	MADE GROUND: Orangish brown mottled dark grey in part very sandy slightly gravelly clay with a low cobble content of granite. Gravel is fine to coarse angular to sub-rounded of flint with fragments of metal, polystyrene and wood.	
					1.40	1.00 - 1.40 Becoming increasingly gravelly.	
					2.00	End Of Trial Pit At 1.40 m	
					3.00		
					4.00		
					5.00		
					6.00		
					7.00		
					8.00		
					9.00		
					10.00		

KEY

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AGS

REMARKS

No Groundwater Encountered
Trial pit backfilled with arisings.

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		HTP2
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.844518	E Coord: -0.988413
Date: 21/07/2019	Method: Hand Excavated	Logged By: SHP	Scale: 1:50

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
					0.25	MADE GROUND: Red tarmac.	
					0.35	MADE GROUND: Black tarmac.	
						MADE GROUND: Concrete with 8 mm rebar towards middle of unit.	
					1.00		
					1.20	MADE GROUND: Grey gravelly fine to coarse sand with a low cobble content of brick. Gravel is fine to coarse angular to sub-angular of concrete.	
					2.00	MADE GROUND: Brown very clayey gravelly fine to coarse sand with a low cobble content of concrete and flint. Gravel is fine to coarse sub-angular to rounded of flint.	
						End Of Trial Pit At 1.20 m	
					3.00		
					4.00		
					5.00		
					6.00		
					7.00		
					8.00		
					9.00		
					10.00		

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▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Trial pit backfilled with arisings.

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		HTP3
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.845147	E Coord: -0.989939
Date: 21/07/2019	Method: Hand Excavated	Logged By: SHP	Scale: 1:50

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.15 - 0.20	B				0.15	MADE GROUND: Tarmac.	
0.40	ES				0.20	MADE GROUND: Fine to coarse sandy angular gravel of limestone.	
0.60 - 0.75	B				0.75	MADE GROUND: Orangish brown becoming greyish brown sandy gravelly clay with fragments of coal and wood. Gravel is fine to coarse angular to sub-rounded of chalk, flint and brick.	
					0.80	MADE GROUND: Concrete obstruction.	
					1.00	End Of Trial Pit At 0.80 m	
					2.00		
					3.00		
					4.00		
					5.00		
					6.00		
					7.00		
					8.00		
					9.00		
					10.00		

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AGS

REMARKS

No Groundwater Encountered
Trial pit backfilled with arisings.

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		HTP4
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.84722	E Coord: -0.98755
Date: 21/07/2019	Method: Hand Excavated	Logged By: SHP	Scale: 1:50

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.20	ES				0.35	MADE GROUND: Grass over gravelly fine to medium sand with fragments of brick and concrete. Gravel is fine to coarse angular to sub-rounded of flint and concrete.	
					1.00	MADE GROUND: Brown sandy gravelly clay with a low cobble content of flint. Gravel is fine to coarse angular to sub-rounded of flint.	
					1.20	End Of Trial Pit At 1.20 m	
					2.00		
					3.00		
					4.00		
					5.00		
					6.00		
					7.00		
					8.00		
					9.00		
					10.00		

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AGS

REMARKS

No Groundwater Encountered
Trial pit backfilled with arisings.

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		SA1
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.848068	E Coord: -0.987702
Date: 19/07/2019	Method: JCB	Logged By: SHP	Scale: 1:50

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.30	ES				0.45	MADE GROUND: Grass over brown very clayey gravelly fine to medium sand. Abundant rootlets towards the top of the unit. Gravel is angular to sub-rounded fine to coarse of flint. Rare fragments of plastic.	
0.60	ES				0.65		
0.70	B				1.00	MADE GROUND: Brownish grey sandy gravelly cobbles of brick and concrete with fragments of tarmac, shells and metal.	
1.30	ES				1.20		
					1.60	Brown clayey very sandy angular to sub-rounded fine to coarse GRAVEL of of flint.	
					2.00	Firm dark brownish grey sandy CLAY with fragments of wood.	
						Firm light grey sandy slightly gravelly CLAY with rare fragments of wood. Gravel is sub-rounded fine to coarse of flint.	
					3.00	End Of Trial Pit At 2.05 m	
					4.00		
					5.00		
					6.00		
					7.00		
					8.00		
					9.00		
					10.00		

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AGS

REMARKS

No Groundwater Encountered
Trial Pit used for soakaway testing. Trial pit backfilled with arisings.

Printed By GeoLogs (www.GeoLogs.com)

clancy consulting	Project Title: Langstone Technology Park, Havant		SA2
	Project Number: 10/1425	Client: AG Langstone B.V.	Sheet 1 Of 1
	GL (mAOD):	N Coord: 50.845255	E Coord: -0.987848
Date: 19/07/2019	Method: JCB	Logged By: SHP	Scale: 1:50

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.60 0.70	B ES				0.10	MADE GROUND: Grass over brown clayey gravelly sand. Gravel is angular to sub-rounded fine to coarse of flint with fragments of brick and cement.	
					1.00	MADE GROUND: Brown slightly clayey gravelly fine to coarse sand with a medium cobble and boulder content of brick, concrete and pottery. Gravel is angular to sub-rounded fine to coarse of brick, flint, concrete, pottery and slate.	
1.80	B				1.50	MADE GROUND: Firm brown sandy slightly gravelly CLAY. Gravel is sub-rounded fine to coarse of flint. Masonry structure in east of the trial pit.	
					2.00 2.10	End Of Trial Pit At 2.10 m	
					3.00		
					4.00		
					5.00		
					6.00		
					7.00		
					8.00		
					9.00		
					10.00		

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AGS

REMARKS

No Groundwater Encountered
Trial pit used for soakaway testing. Trial pit backfilled with arisings.

Printed By GeoLogs (www.GeoLogs.com)