

ADEPT

CIVIL AND STRUCTURAL CONSULTING ENGINEERS



Drainage Strategy & FRA Sovereign Distillery

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CIVIL AND STRUCTURAL CONSULTING ENGINEERS

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1.0 Introduction

Adept Consulting Engineers Ltd was commissioned to provide a Flood Risk Assessment (FRA) and Drainage Strategy for Network Space in support of a planning application for the redevelopment of a number of units on the former Sovereign Distillery off Wilson Road, Liverpool.

An initial drainage strategy and Flood Risk Assessment was prepared in 2021 by Tetrattech and submitted for planning, however further investigations into the existing drainage were undertaken which has materially changed the required drainage strategy. This will be further discussed in section 5 of this report.

2.0 Limitations of report

Preliminary calculations and a concept drainage design have been undertaken as part of this study. The preliminary calculations and concept design are based on the information and assumptions covered in this report at the time of preparation and provide a concept design for points of connection and general design parameters only.

The report is based on the interpretation and assessment of data provided by third parties. Adept Consulting Engineers Limited cannot guarantee the reliability of the third-party information obtained. The conclusions and findings of the report may change if the third-party data is subsequently amended or updated.

3.0 Description of the site

The site is located within the grounds of the former Sovereign Distillery, Wilson Road, Liverpool. The postcode is L36 6AW and the NGR SJ 45658 89812. The site is identified on the appended location plan.

Site description	
Total Site Area	4.346ha
Existing Impermeable Area	3.446ha
Land use	Industrial
Topography	The southern portion of the site is relatively flat around 23-25m AOD, the northern portion of the site steps up to 26-27m AOD.

A topographic survey is appended.

4.0 Hydrology, Hydrogeology and Geology

Watercourses and waterbodies

Chapel Brook is located due Northeast of the site. Stadt Moers Park is also located due Northeast of the site contains a substantial pond/lake.

Sewerage

Public sewerage is located on the site and is indicated on the appended United Utilities asset plans.

Further detailed assessment of this sewer is programmed.

Geology

An extract of the geological investigation is appended. Percolation tests are to be carried out.

5.0 Existing Drainage Assessment

The Tetrattech drainage strategy assumed free discharge from the existing site and based the existing flow rates on the total hard standing area and calculating using the Rational method. However, Further surveys revealed the outfall pipes from the site were small (2No. 150mm and 1No. 225mm). When the maximum capacity of these pipes is considered, the existing flows are heavily restricted by these pipes and there is evidence of existing attenuation onsite.

Adept have estimated the actual existing maximum flow rates to be the following:

Unit G – 2No. 150mm Ø estimated at 1:100 = 35.4l/s

Units F and C – 1No. 225mm Ø measured at 1:180 = 38.6l/s

6.0 Proposed Development

Development Outline

The proposed development entails demolishing two existing units, constructing two new units, extending one existing unit and refurbishing a number of smaller units. Refer to Proposed Site Layout below for Unit references,

From the SI, Infiltration has been ruled out however Infiltration test in line with BRE365 should be undertaken to confirm this.



Proposed Surface Water Drainage Strategy

Units G1 & G2

The discharge rate for the site has been based on the following criteria, Knowsley Council's Pro-Forma 2 for Sustainable Drainage Systems, the site has been classified as Brownfield. Therefore a 50% reduction in discharge rate has been applied.

Total impermeable area	1.026 ha
Peak discharge from site	17.7/s
Maximum attenuation volume required to accommodate the peak 1 in 100 year + 40% CC storm	570m³

A drainage strategy drawing is appended, based upon these figures.

The site will attenuate up to 1 in 100 +40% CC storm and the flow will be restricted to 17.7l/s discharging to the public surface water sewer running through the site. It should be possible for this area of the site to drain by gravity to this outfall. Any surface water from tarmacked areas will pass through a Full retention separator. Roof drainage will go directly into the attenuation tank, bypassing the interceptor

United Utilities (UU) were contacted via a pre-planning enquiry and confirmed that surface water could discharge to their surface water sewer if no other options from the SuDS priority list were available.

SuDS Assessment and Water Quality

Permeable surfaces should be included to provide water quality treatment. The use of tree pits may also be considered at detailed design stage and in collaboration with the landscape architect. A Geological survey has been carried out to determine the geological nature of the site and is appended. The site is not located within a Non-Statutory Drinking Water Safeguard Zone (Surface Water). The site is however located in an area of medium Groundwater vulnerability, appropriate water quality treatment indices should be applied to (and achieved) surface water runoff. As this is a new development Rainwater Harvesting (rwh) should be considered and where appropriate applied (rwh systems with no end of line use become redundant, defunct and a liability).

Foul Drainage

There is an existing combined drainage system running through the site. The proposed development will discharge to this sewer at a location to be confirmed by UU.

Units F & Unit G (North)

The discharge rate for the site has been based on the following criteria. Knowsley Council's Pro-Forma 2 for Sustainable Drainage Systems, the site has been classified as Brownfield. Therefore a 50% reduction in discharge rate has been applied.

Total impermeable area	1.449ha
Peak discharge from site	15.5l/s
Maximum attenuation volume required to accommodate the peak 1 in 100 year + 40% CC storm	1088.3m³

A drainage strategy drawing is appended, based upon these figures.

The site will attenuate up to 1 in 100 +40% CC storm and the flow will be restricted to 15.5/s discharging to the public surface water sewer running through the site. It should be possible for this area of the site to drain by gravity to this outfall. Any surface water from tarmacked areas will pass through a Full retention separator. Roof drainage will go directly into the attenuation tank, bypassing the interceptor

The system discharges into the existing 225mm Ø outfall pipe (Pending condition survey).

SuDS Assessment and Water Quality

Permeable surfaces should be included to provide water quality treatment. The use of tree pits may also be considered at detailed design stage and in collaboration with the landscape architect. A Geological survey has been carried out to determine the geological nature of the site and is appended. The site is not located within a Non-Statutory Drinking Water Safeguard Zone (Surface Water). The site is however located in an area of medium-high Groundwater vulnerability, appropriate water quality treatment indices should be applied to (and achieved) surface water runoff. As this is a new development Rainwater Harvesting (rwh) should be considered and where appropriate applied (rwh systems with no end of line use become redundant, defunct and a liability).

Foul Drainage

There is an existing combined drainage system running through the site. The proposed development will discharge to this sewer at a location to be confirmed by UU.

Unit C (South)

The discharge rate for the site has been based on the following criteria. Knowsley Council's Pro-Forma 2 for Sustainable Drainage Systems, the site has been classified as Brownfield. Therefore a 50% reduction in discharge rate has been applied.

Total impermeable area	0.997ha
Peak discharge from site	3.8l/s
Maximum attenuation volume required to accommodate the peak 1 in 100 year + 40% CC storm	409m³

A drainage strategy drawing is appended, based upon these figures.

The site will attenuate up to 1 in 100 +40% CC storm and the flow will be restricted to 3.8l/s discharging to the public combined water sewer running through the site. It should be possible for this area of the site to drain by gravity to this outfall. Any surface water from tarmacked areas will pass through a Full retention or a Bypass separator. Roof drainage will go directly into the attenuation tank, bypassing the interceptor

The system outfalls via a new manhole to the existing SW sewer in the highway verge. Ownership TBC and outfall to be agreed.

SuDS Assessment and Water Quality

Permeable surfaces should be included to provide water quality treatment. The use of tree pits may also be considered at detailed design stage and in collaboration with the landscape architect. A Geological survey has been carried out to determine the geological nature of the site and is appended. The site is not located within a Non-Statutory Drinking Water Safeguard Zone (Surface Water). The site is however located in an area of medium-high Groundwater vulnerability, appropriate water quality treatment indices should be applied to (and achieved) surface water runoff. As this is a new development Rainwater Harvesting (rwh) should be considered and where appropriate applied (rwh systems with no end of line use become redundant, defunct and a liability).

Foul Drainage

There is an existing combined drainage system running through the site. The proposed development will discharge to this sewer at a location to be confirmed by UU.

7.0 Flood Risk Sources and Extents

Summary

A summary of the sources and level of flood risk (negligible, low, medium or high) is given in Table 1. below.

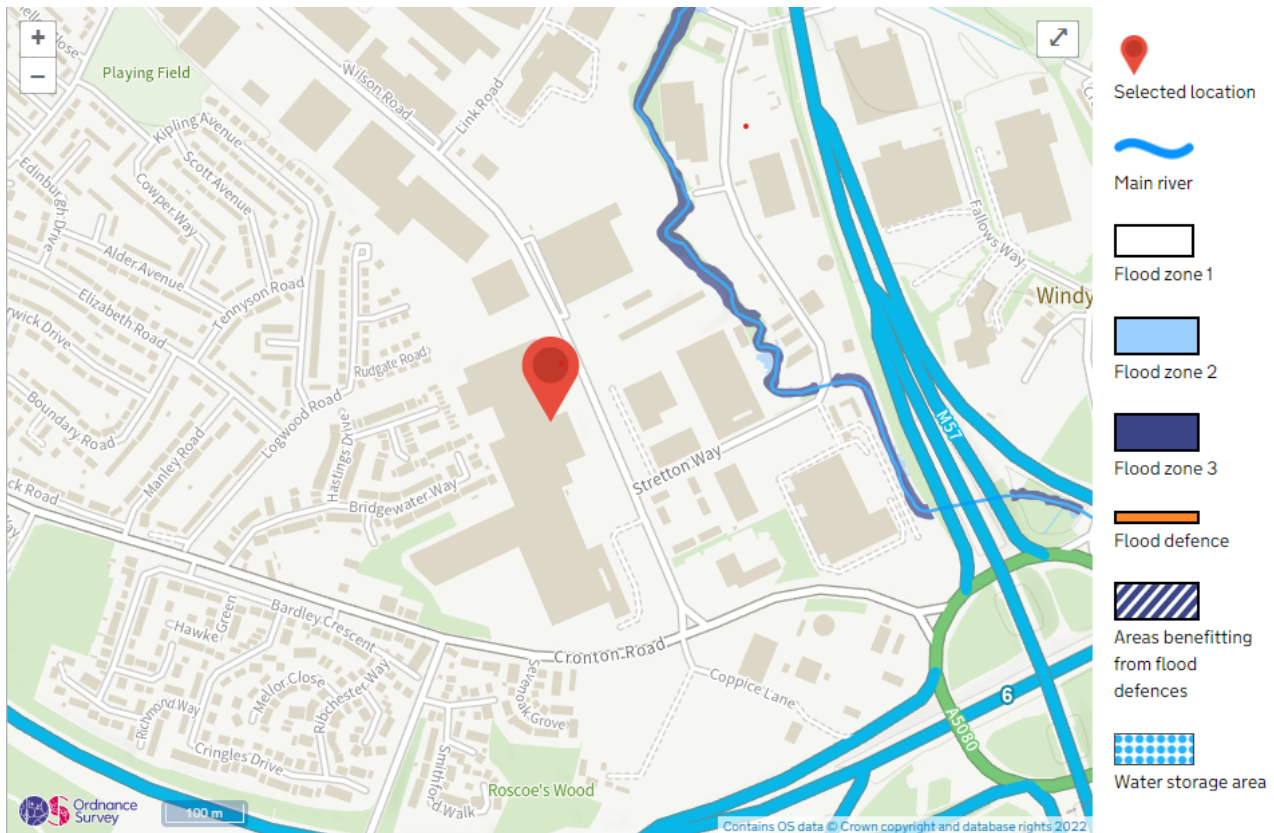
Table 1. Summary of the Sources and Extent of Flood Risk	
Source	Risk Level
Fluvial	Very Low
Tidal - Coastal	Very Low
Surface Water / Pluvial	Low
Groundwater	Low
Surcharged Sewers	Low
Other Man Made Sources	Very Low

The proposed development, classified as More Vulnerable and located within Flood Zone 1, will not be party to sequential testing.

The sources and level of flood risk are demonstrated below.

Fluvial

Shown to be in Flood Zone 1 no further discussion required.
An extract from the gov.uk website is shown below,



Tidal

The site is not at risk of tidal flooding.

Surface Water / Pluvial

Surface water flood risk mapping from the gov.uk website shows that the site is in general at low risk of flooding. There is evidence of flooding to the eastern portion of the site, this is shown to be below 300mm depth and of low velocity risk.

An extract from the gov.uk website is shown below.

Learn more about this area's flood risk

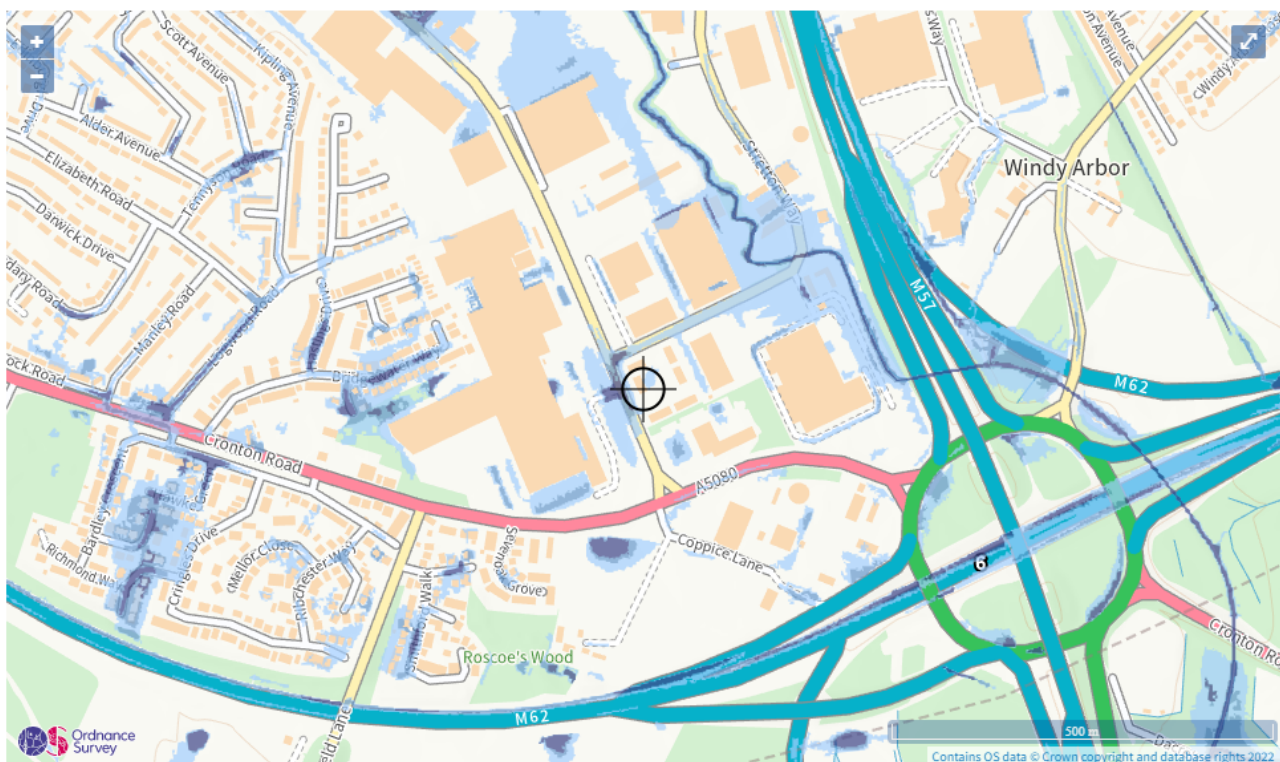
Select the type of flood risk information you're interested in. The map will then update.

Flood risk

Extent of flooding

Location

Enter a place or postcode



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low ⊕ Location you selected

Groundwater Flooding

The land falling toward the northwest of the site suggests ground water would emanate downslope from the site.

Surcharged Sewers

Existing sewerage is located on site and remains the responsibility of the statutory undertaker. Normal threshold elevations to surrounding ground, 150mm would offer suitable protection.

Other Man-Made Sources

The site is not at risk of reservoir or canal flooding.

Climate Change

Based on a typical lifespan for this type of development of 100 years, the contingency allowance for climate change has been based on 40% climate change.

Design Consideration and Flood Mitigation

Property freeboard and downslope groundwater movement.

Discussions with Statutory Bodies

Discussion with the Environment Agency- N/A

Discussion with the Lead Local Flood Authority- Via the planning process

Discussion with Sewerage Undertaker- A Developer Enquiry has been submitted. Response is attached.

8.0 Conclusions

Existing Drainage

Existing drainage on site is indicated on the appended plans, Existing UU SW sewers will be used for new connections.

Proposed Drainage Strategy and SuDS Hierarchy

Attenuation and controlled release at reduced brownfield rates to the nearest surface water sewers is proposed. The site will drain by gravity.

Site Investigation carried out has suggested due to the existing ground the site is not suitable for soakaways however there will be soakaway tests carried out in accordance to BRE 365 to confirm this.

There are no watercourses nearby that offer a viable connection.

Foul flows will connect to the existing public combined water sewer system.

A SuDS maintenance schedule is appended for guidance purposes only. This is based on guidance from CIRIA, however asset owners may detail their own schedule that equals or surpasses the CIRIA standards. Adopted sewerage will be maintained in accordance with the adopting authorities' maintenance requirements.

Flood Risk

The site has a "low" flood risk classification.

Recommendations for further work/investigation and obtaining agreement

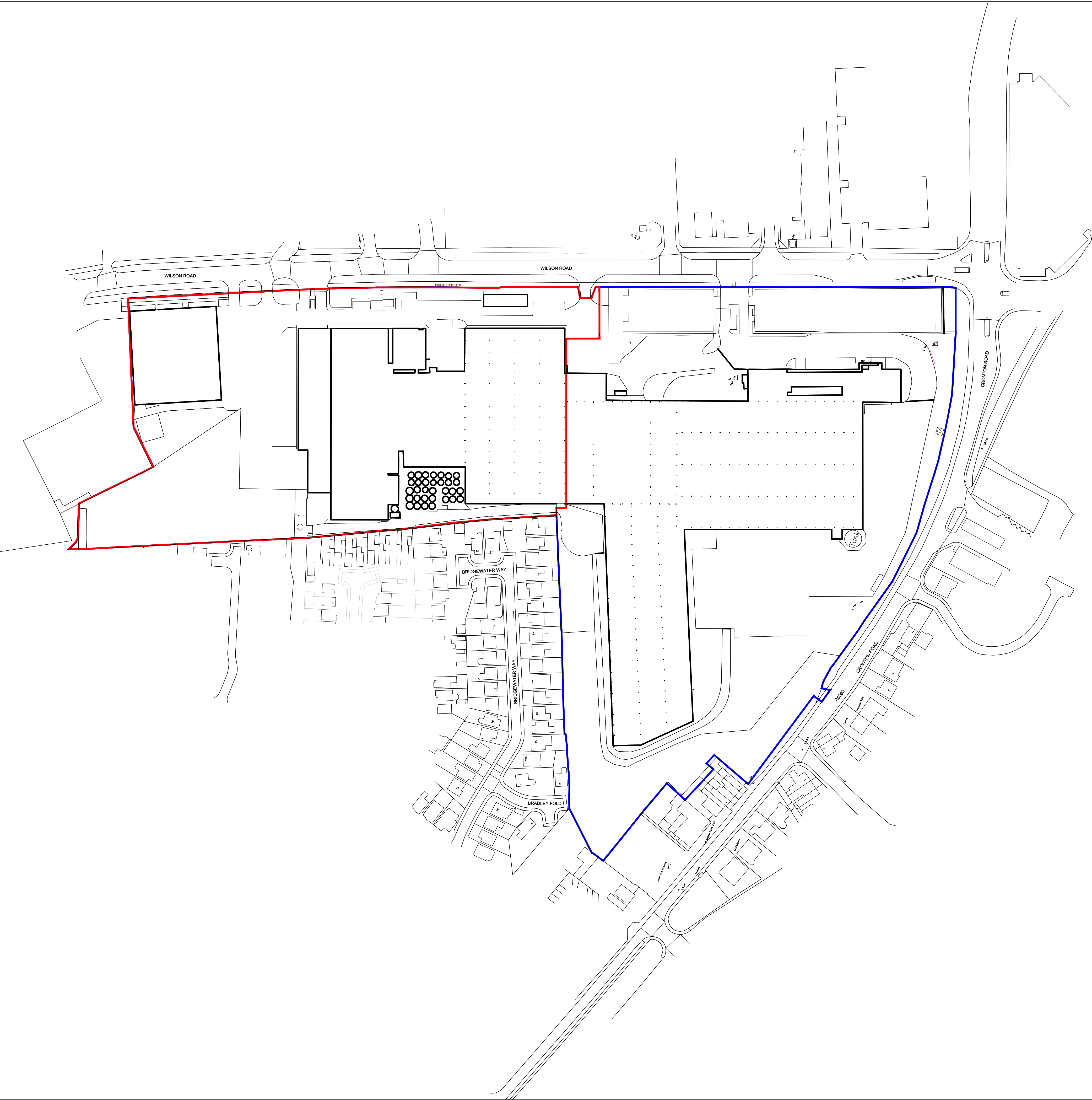
Further soakaway tests required to confirm site is not suitable for soakaways.

Confirm ownership of existing SW sewer in Highway verge.

Confirm condition and any remedials for the 225mm Ø pipe being reused as outfall.

Appendix A

- Location Plan
- Topographical Survey
- Site layout



NOTES

AEWTP026C

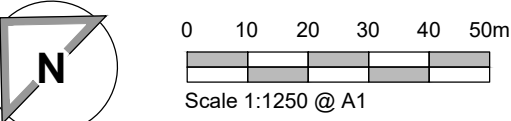
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- All works are to be undertaken in accordance with Building Regulations and the latest British Standards.
- All proprietary materials and products are to be used strictly in accordance with the manufacturers recommendations.

CDM 2015

Client notified of duties: 27/11/20

Principal Designer: Network Space

Unless noted below, all known hazards have been highlighted on the drawing:



Blue line ownership boundary:
26.91 acres / 10.89ha
Red line site boundary:
10.75 acres / 4.35ha

NOTES:

- Layout based on CAD plan provided by Halewood International

P01 18/07/22 SJK DJS
Initial Issue

REV Date Drawn by: - Checked by: -

Status Purpose of Issue
S2 For Information

drawing stage Tender

client
Network Space Land Limited

project
Sovereign Business Park
Huyton

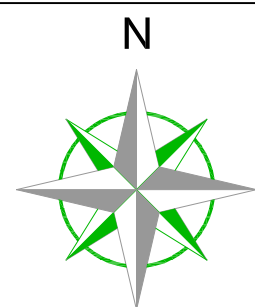
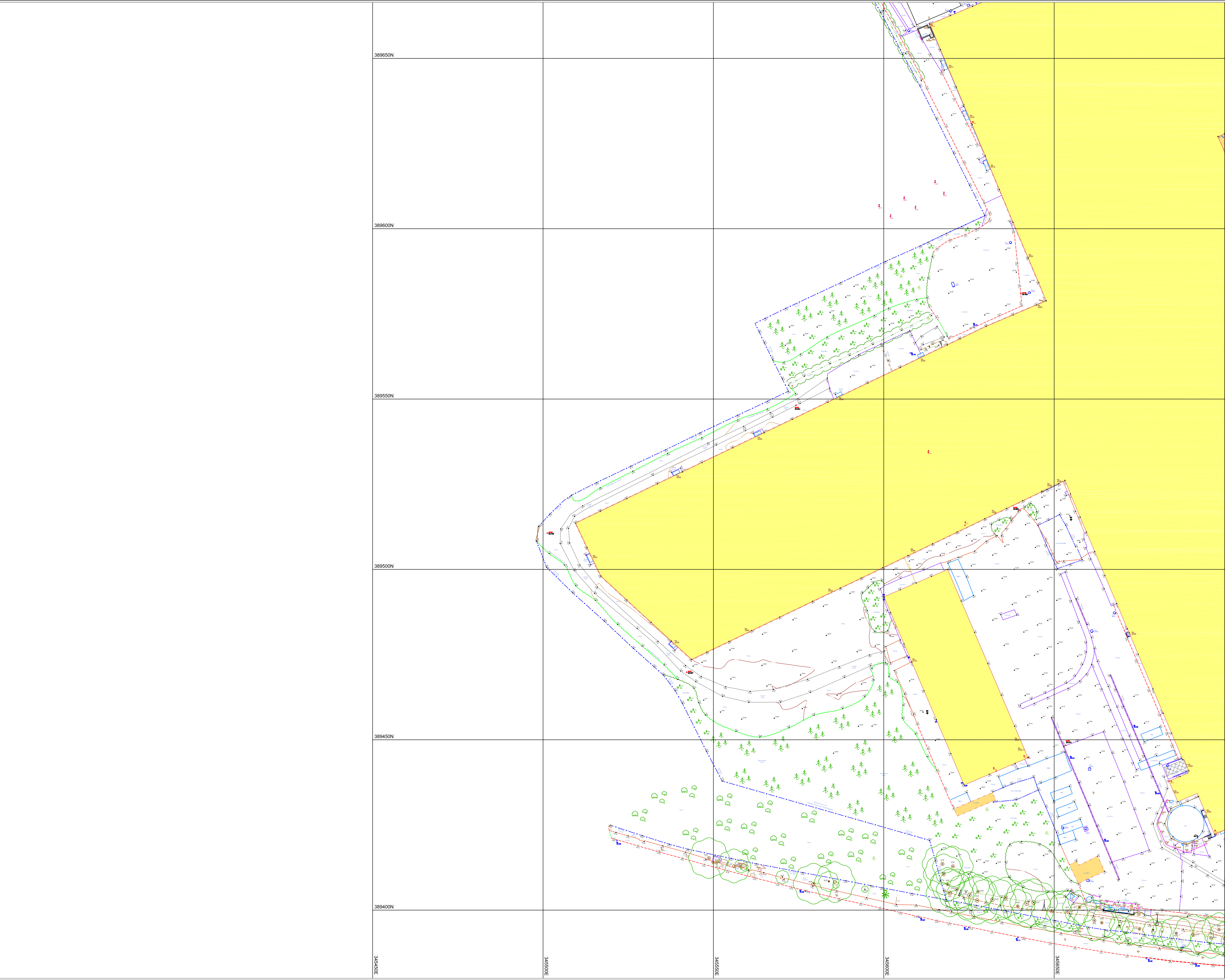
drawing title
Site - Location Plan

date July 22 drawn SJK
scale@A1 1:1250 checked DRS

Rev
P01

Job No
12211-AEW-XX-XX-DR-A-1001

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Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH36	345639.9897	389517.4089	23.5295
GH37	345653.3678	389448.3721	23.0730
GH38	345710.1938	389397.7378	22.5016
GH39	345818.7874	389448.2443	23.6003
GH40	345752.2724	389550.8666	23.5768
GH41	345733.1266	389611.5566	23.8174
GH42	345745.0852	389667.4805	24.4726
GH43	345715.0368	389717.7403	24.9991
GH44	345688.9304	389794.1306	26.1992
GH45	345625.8441	389801.4885	27.2295
GH46	345561.4169	389732.5767	24.9148
GH47	345600.9018	389675.9597	24.1659
GH48	345640.2914	389580.9400	23.7930

OS Note:
Some services may have been omitted due to parked vehicles.
The Ordnance Survey file is to be used as a guide only.

OS Buildings **Surveyed Buildings**

This survey has been orientated to the Ordnance Survey (O.S.) National Grid OSG836(15) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS AN).

A true OSG836 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.

The survey has been correlated to this point and a further one or more OSG836 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

	Buildings		Overhead Cable		Fences		Inversion chamber		Rd
	Level datum		Trench		Fences		Inversion chamber		Rd
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	Level datum		Trench		Fences				

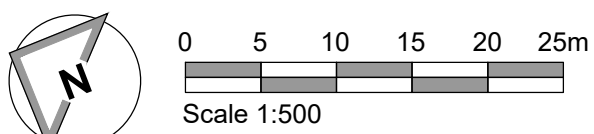
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- Title overlay drawings and ownership boundaries are produced using all reasonable endeavours. AEW cannot be responsible for the accuracy or scale discrepancy of base plans supplied to them.
- All works are to be undertaken in accordance with Building Regulations and the latest British Standards.
- All proprietary materials and products are to be used strictly in accordance with the manufacturers recommendations.

CDM 2015

Client notified of duties: 12/10/21

Principal Designer: Network Space

Unless noted below, all known hazards have been highlighted on the drawing:



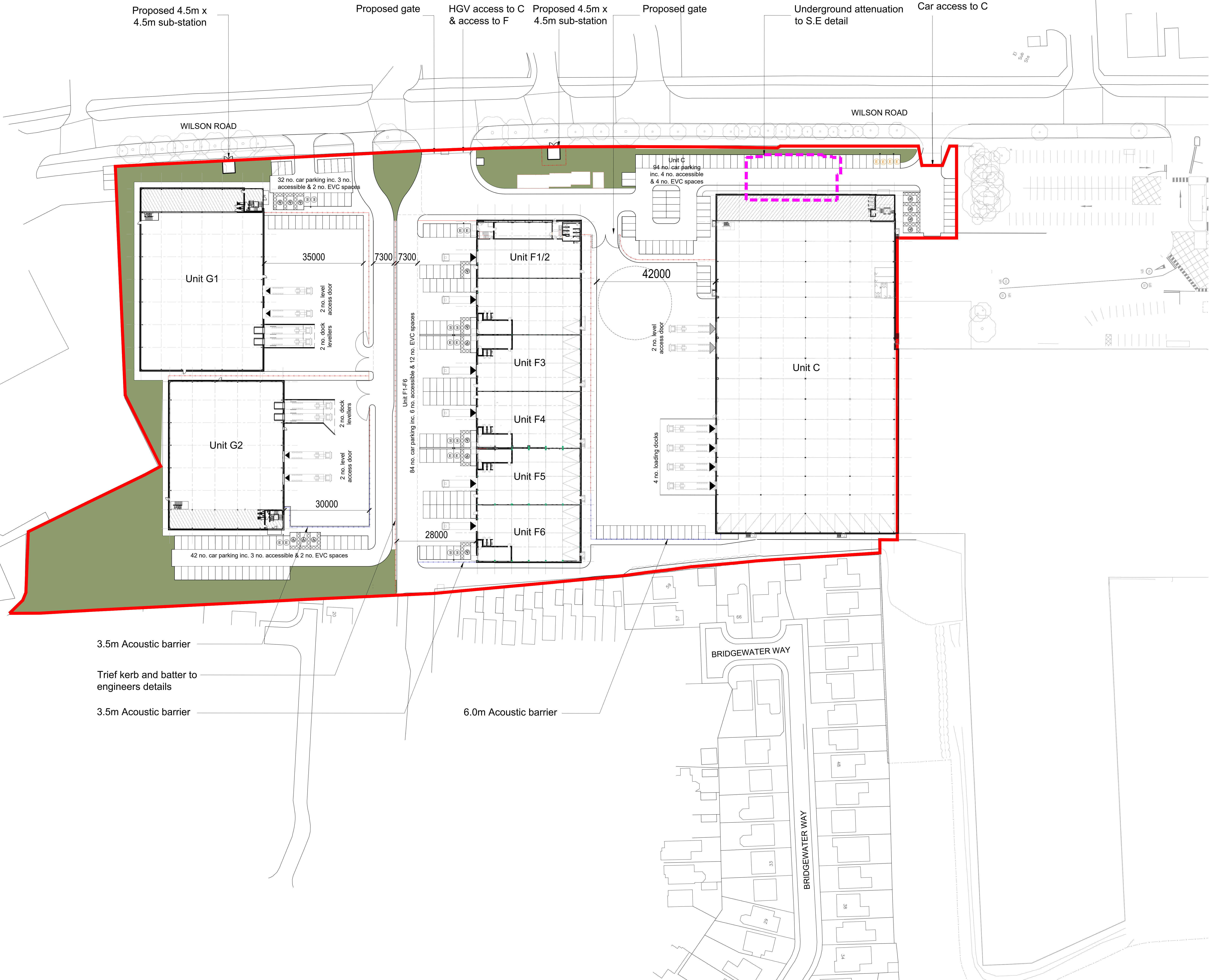
Red line site boundary:
10.75acres / 4.35ha

Note:

- **Underground subject to GPR survey**
- **Layout based on Greenhatch Topographical Survey, drawing ref: 40493_T_Rev0 (10.06.21)**
- **Refer to Richard Eaves Landscape proposals for landscape design and details**
- **Refer to external works drawings for finished and boundary treatments**

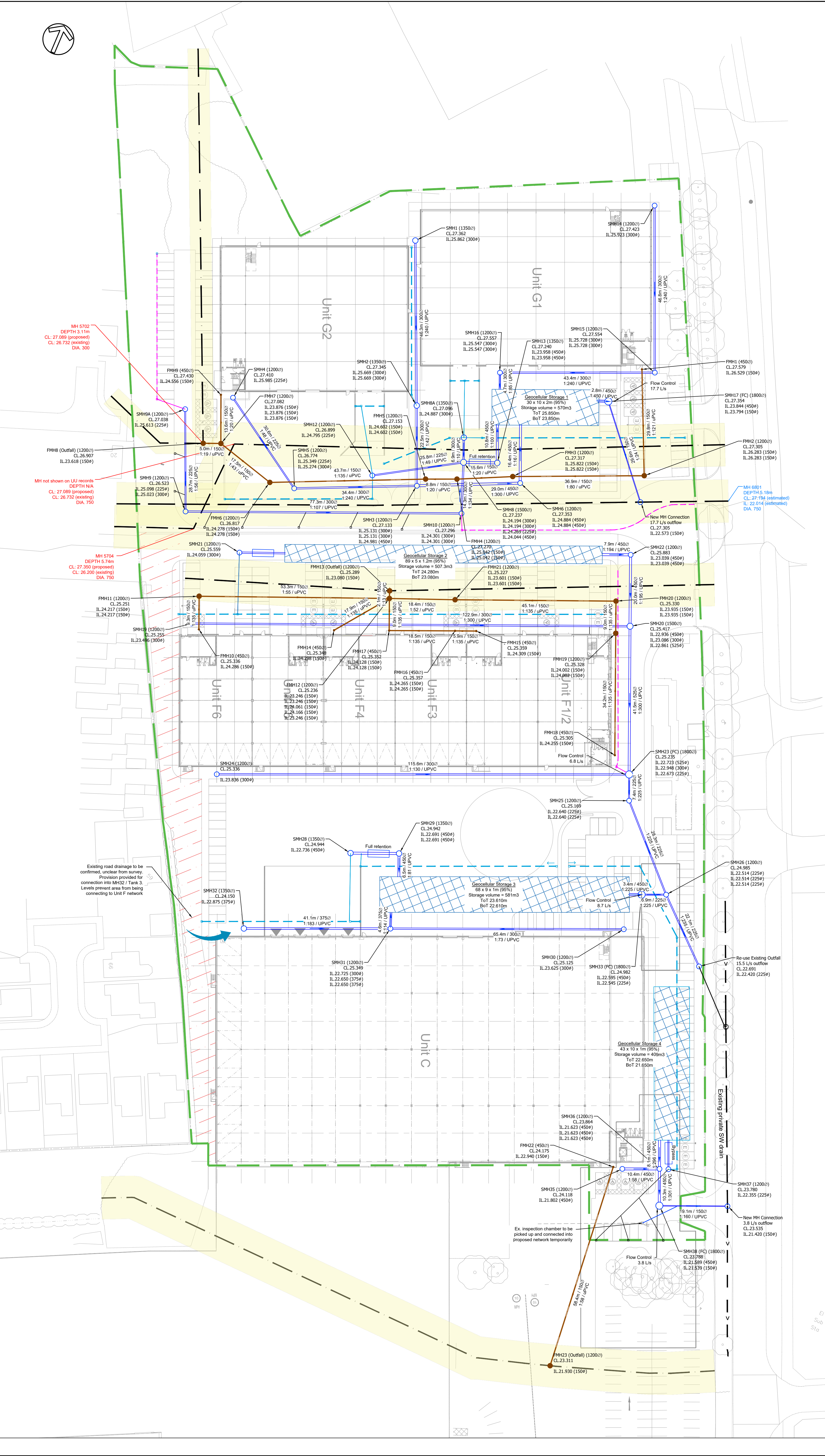
R01	05/05/22	HN	DRS
Initial Issue			
REV	Date	Drawn by:	Checked by:
S2		For Information	
Drawing stage: Tender			
Client: Network Space Land Limited			
Project: Sovereign Business Park Huyton			
Drawing title: Site - Proposed Masterplan			
date	May 22	drawn	HN
scale@AD	1:500	checked	DRS

Schedule of Accommodation				
Unit	Ground Floor GIA	First Floor / Office GIA	TOTAL UNIT GIA	Car Parking (Accessible)
Unit C	7,565 m ² / 81,429 R ²	557 m ² / 6,000 R ²	8,122 m ² / 87,429 R ²	90 (4)
Unit F1	722 m ² / 7,729 R ²	219 m ² / 2,357 R ²	937 m ² / 10,086 R ²	14 (1)
Unit F2	719 m ² / 7,739 R ²	-	719 m ² / 7,739 R ²	14 (1)
Unit F3	719 m ² / 7,739 R ²	-	719 m ² / 7,739 R ²	14 (1)
Unit F4	718 m ² / 7,729 R ²	-	718 m ² / 7,729 R ²	14 (1)
Unit F5	718 m ² / 7,792 R ²	-	718 m ² / 7,729 R ²	14 (1)
Unit F6	722 m ² / 7,772 R ²	-	722 m ² / 7,772 R ²	14 (1)
Unit G1	2,752 m ² / 29,622 R ²	344 m ² / 3,703 R ²	3,096 m ² / 33,325 R ²	40 (3)
Unit G2	2,080 m ² / 22,389 R ²	260 m ² / 2,799 R ²	2,340 m ² / 25,188 R ²	42 (3)
TOTAL SITE GIA			18,091 m ² / 194,736 R ²	256 (16)



Appendix B

- Drainage Strategy
- Drainage Calculations
- Relevant Communications
- Additional Survey Information
- SuDS Maintenance Schedule



Do Not Scale			
DESIGN REVIEW			
Design review by:	**	Checked by:	**
Residual hazards:			



Health, Safety &
Environmental Notes



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NOTES

Architectural Site Plan

- AEW Architects
12211-AEW-XX-DR-A-0503-S2-P07

Existing Topographical Survey

- GreenHatch Group
40493_T

1. All Dimension in mm unless notified otherwise

2. All Levels in mAOD in relation to Topographical survey coordination unless notified otherwise

Key	
	Site Boundary
	Existing Combined Sewer
	Existing Surface Water Sewer
	UU Easement
	Proposed Surface Water Drain
	Proposed Foul Water Drain
	Petrol Interceptor
	Attenuation
	Gully and Drain
	Drainage Channel
	Kerb Drain

21.07.22	Tender issue	JZG	AL	P2
08.07.22	Initial Issue	JZG	AL	P1
Date	Description	By	Chk	Rev

ADEPT
CIVIL AND STRUCTURAL CONSULTING ENGINEERS

Web: www.adeptcsce.com
Email: info@adeptcsce.com
Tel: 0113 239 4518 (Leeds)
Tel: 0161 974 3620 (Manchester)

Originating Office

Project

Sovereign Distillery, Huyton

Title

Proposed Drainage Strategy

Client

Network Space

Scale @ A1	Initial author	Initial checker	Approver	Initial Date				
1:500	JZG	AL	RP	June 22				
Status	Purpose	Adopt Ref						
S3		Tender 100.22042						
Project Number		Originator	Volume	Level	Type	Role	Org. No.	Rev.
100.22042-ACE-00-ZZ-DR-C-1000								P2

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details:	Company Address:		
Type: Junctions			
Storm Phase: Phase			



Outlets

Junction	Outlet Name	Outgoing Connection	Outlet Type
MH38	Outlet (1)	13.002	Hydro-Brake®
	Invert Level (m)	21.539	
	Design Depth (m)	1.111	
	Design Flow (L/s)	3.8	
	Objective	Minimise Upstream Storage Requirements	
	Application	Surface Water Only	
	Sump Available	☒	
	Unit Reference	SHE-0091-3800-1111-3800	
MH1	Outlet	1.000	Free Discharge
MH2	Outlet	1.001	Free Discharge
MH13	Outlet	3.002	Free Discharge
MH16	Outlet	6.002	Free Discharge
MH17	Outlet	1.005	Hydro-Brake®
	Invert Level (m)	23.794	
	Design Depth (m)	2.056	
	Design Flow (L/s)	17.7	
	Objective	Minimise Upstream Storage Requirements	
	Application	Surface Water Only	
	Sump Available	☒	
	Unit Reference	SHE-0173-1770-2056-1770	
MH4	Outlet	2.000	Free Discharge
MH5	Outlet	2.001	Free Discharge
MH9	Outlet	4.000	Free Discharge
MH10	Outlet	4.001	Free Discharge
MH12	Outlet	5.001	Free Discharge
MH8	Outlet	3.001	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details:	Company Address:		
Type: Junctions			
Storm Phase: Phase			



Junction	Outlet Name	Outgoing Connection	Outlet Type
MH11	Outlet	5.000	Free Discharge
MH7	Outlet	3.000	Free Discharge
MH20	Outlet	7.001	Free Discharge
MH23	Outlet	7.002	Hydro-Brake®
	Invert Level (m)	22.673	
	Design Depth (m)	1.721	
	Design Flow (L/s)	6.8	
	Objective	Minimise Upstream Storage Requirements	
	Application	Surface Water Only	
	Sump Available	☒	
	Unit Reference	SHE-0111-6800-1721-6800	
MH25	Outlet	7.003	Free Discharge
MH26	Outlet	7.004	Free Discharge
MH22	Outlet	8.002	Free Discharge
MH24	Outlet	9.000	Free Discharge
MH33	Outlet	10.004	Hydro-Brake®
	Invert Level (m)	22.545	
	Design Depth (m)	1.065	
	Design Flow (L/s)	8.7	
	Objective	Minimise Upstream Storage Requirements	
	Application	Surface Water Only	
	Sump Available	☒	
	Unit Reference	SHE-0136-8700-1065-8700	
MH30	Outlet	11.000	Free Discharge
MH31	Outlet	11.001	Free Discharge
MH27	Outlet	10.000	Free Discharge
MH28	Outlet	10.001	Free Discharge
MH29	Outlet	10.002	Free Discharge
MH19	Outlet	7.000	Free Discharge
MH35	Outlet	13.000	Free Discharge
MH36	Outlet	13.001	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Junctions Storm Phase: Phase	Company Address:		



Junction	Outlet Name	Outgoing Connection	Outlet Type
MH3	Outlet	1.002	Free Discharge
MH6	Outlet	1.003	Free Discharge
MH14	Outlet	6.000	Free Discharge
MH15	Outlet	6.001	Free Discharge
MH21	Outlet	8.000	Free Discharge
MH32	Outlet	12.000	Free Discharge
MH37	Outlet	14.000	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



Cellular Storage

Type : Cellular Storage

Dimensions

Exceedence Level (m)	25.850
Depth (m)	2.000
Base Level (m)	23.850
Number of Crates Long	10
Number of Crates Wide	30
Number of Crates High	2
Porosity (%)	95
Crate Length (m)	1
Crate Width (m)	1
Crate Height (m)	1
Total Volume (m³)	570.000

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	3.002
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	6.002
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (2)

Inlet Type	Point Inflow
Incoming Item(s)	1.003
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	1.004
Outlet Type	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



Cellular Storage (1)

Type : Cellular Storage

Dimensions

Exceedence Level (m)	23.610
Depth (m)	1.000
Base Level (m)	22.610
Number of Crates Long	68
Number of Crates Wide	9
Number of Crates High	2
Porosity (%)	95
Crate Length (m)	1
Crate Width (m)	1
Crate Height (m)	0.5
Total Volume (m³)	581.400

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	10.002
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	11.001
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	10.003
Outlet Type	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



Cellular Storage (2)

Type : Cellular Storage

Dimensions

Exceedence Level (m)	24.280
Depth (m)	1.200
Base Level (m)	23.080
Number of Crates Long	89
Number of Crates Wide	5
Number of Crates High	3
Porosity (%)	95
Crate Length (m)	1
Crate Width (m)	1
Crate Height (m)	0.4
Total Volume (m³)	507.300

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	8.000
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	8.001
Outlet Type	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Storm Phase: Phase	Company Address:		



Cellular Storage (3)

Type : Cellular Storage

Dimensions

Exceedence Level (m)	22.650
Depth (m)	1.000
Base Level (m)	21.650
Number of Crates Long	43
Number of Crates Wide	10
Number of Crates High	2
Porosity (%)	95
Crate Length (m)	1
Crate Width (m)	1
Crate Height (m)	0.5
Total Volume (m³)	408.500

Inlets

Inlet

Inlet Type	Point Inflow
Incoming Item(s)	14.000
Bypass Destination	(None)
Capacity Type	No Restriction

Inlet (1)

Inlet Type	Point Inflow
Incoming Item(s)	Catchment Area (14)
Bypass Destination	(None)
Capacity Type	No Restriction

Outlets

Outlet

Outgoing Connection	14.001
Outlet Type	Free Discharge

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Connections Storm Phase: Phase	Company Address:		



Name	Length (m)	Connection Type	Slope (1:x)	Manning's n	Colebrook-White Roughness (mm)	Diameter / Base Width (mm)	Upstream Cover Level (m)	Upstream Invert Level (m)
1.000	46.251	Pipe	240.000		0.6	300	27.362	25.862
3.002	10.800	Pipe	100.000		0.6	450	27.240	23.958
1.005	29.592	Pipe	24.236		0.6	150	27.354	23.794
1.004	2.752	Pipe	450.000		0.6	450	27.358	23.850
6.002	4.669	Pipe	85.000		0.6	300	27.557	25.547
2.000	30.634	Pipe	48.224		0.6	225	27.410	25.985
3.001	9.451	Pipe	109.895		0.6	450	27.237	24.044
5.000	19.425	Pipe	63.480		0.6	150	26.150	25.176
3.000	22.877	Pipe	33.942		0.6	150	26.301	25.325
7.001	41.521	Pipe	300.000		0.6	525	25.417	22.861
7.002	7.355	Pipe	225.000		0.6	225	25.235	22.673
7.003	28.292	Pipe	224.540		0.6	225	25.169	22.640
7.004	22.122	Pipe	235.343		0.6	225	24.985	22.514
8.002	20.034	Pipe	194.502		0.6	450	25.883	23.039
9.000	115.569	Pipe	130.146		0.6	300	25.336	23.836
10.004	6.884	Pipe	225.000		0.6	225	24.982	22.545
11.000	65.390	Pipe	72.659		0.6	300	25.125	23.625
10.000	19.150	Pipe	300.000		0.6	300	24.100	22.950
10.001	13.592	Pipe	300.000		0.6	450	24.944	22.736
10.002	7.495	Pipe	92.805		0.6	450	24.942	22.691
11.001	4.558	Pipe	113.959		0.6	375	25.349	22.650
10.003	3.424	Pipe	225.000		0.6	450	25.009	22.610
8.001	7.921	Pipe	194.000		0.6	450	25.543	23.080
7.000	122.869	Pipe	299.681		0.6	300	25.255	23.496
13.000	10.397	Pipe	58.082		0.6	450	24.118	21.802
13.001	10.320	Pipe	301.089		0.6	450	23.864	21.623
14.001	8.090	Pipe	295.801		0.6	450	23.911	21.650
13.002	19.092	Pipe	160.049		0.6	150	23.788	21.539
4.000	77.323	Pipe	107.085		0.6	300	26.523	25.023
4.001	14.325	Pipe	133.878		0.6	300	27.296	24.301
2.001	34.395	Pipe	240.000		0.6	300	26.774	25.274
1.002	28.972	Pipe	300.000		0.6	450	27.133	24.981
1.003	16.412	Pipe	15.865		0.6	450	27.353	24.884
1.001	22.464	Pipe	41.765		0.6	300	27.345	25.669
6.000	46.802	Pipe	240.000		0.6	300	27.423	25.923
6.001	43.388	Pipe	240.000		0.6	300	27.554	25.728
5.001	25.836	Pipe	49.117		0.6	225	26.899	24.795
8.000	12.877	Pipe	163.816		0.6	300	25.559	24.059
12.000	41.082	Pipe	182.588		0.6	375	24.150	22.875
14.000	8.220	Pipe	100.000		0.6	225	23.780	22.355

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Connections Storm Phase: Phase	Company Address:		



Name	Downstream Cover Level (m)	Downstream Invert Level (m)	Flow Restriction (L/s)
1.000	27.345	25.669	
3.002	27.195	23.850	
1.005	27.305	22.573	19.3
1.004	27.354	23.844	
6.002	27.440	25.492	
2.000	26.774	25.349	
3.001	27.240	23.958	
5.000	26.899	24.870	
3.000	27.237	24.651	
7.001	25.235	22.723	
7.002	25.169	22.640	7.4
7.003	24.985	22.514	
7.004	24.885	22.420	
8.002	25.417	22.936	
9.000	25.235	22.948	
10.004	24.985	22.514	9.5
11.000	25.349	22.725	
10.000	24.944	22.886	
10.001	24.942	22.691	
10.002	25.001	22.610	
11.001	25.232	22.610	
10.003	24.982	22.595	
8.001	25.883	23.039	
7.000	25.417	23.086	
13.000	23.864	21.623	
13.001	23.788	21.589	
14.001	23.864	21.623	
13.002	23.540	21.420	4.1
4.000	27.296	24.301	
4.001	27.237	24.194	
2.001	27.133	25.131	
1.002	27.353	24.884	
1.003	27.193	23.850	
1.001	27.133	25.131	
6.000	27.554	25.728	
6.001	27.557	25.547	
5.001	27.237	24.269	
8.000	25.554	23.980	
12.000	25.349	22.650	
14.000	23.881	22.273	

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Inflow Summary Storm Phase: Phase		Company Address:	



Inflow Label	Connected To	Flow (L/s)	Runoff Method	Area (ha)	Percentage Impervious (%)	Urban Creep (%)	Adjusted Percentage Impervious (%)	Area Analysed (ha)
Catchment Area	MH14		Time of Concentration	0.173	100	0	100	0.173
Catchment Area (1)	MH1		Time of Concentration	0.139	100	0	100	0.139
Catchment Area (2)	MH10		Time of Concentration	0.073	100	0	100	0.073
Catchment Area (3)	MH8		Time of Concentration	0.264	100	0	100	0.264
Catchment Area (4)	MH12		Time of Concentration	0.176	100	0	100	0.176
Catchment Area (5)	MH21		Time of Concentration	0.398	100	0	100	0.398
Catchment Area (6)	MH19		Time of Concentration	0.116	100	0	100	0.116
Catchment Area (7)	MH20		Time of Concentration	0.100	100	0	100	0.100
Catchment Area (8)	MH24		Time of Concentration	0.124	100	0	100	0.124
Catchment Area (9)	MH23		Time of Concentration	0.112	100	0	100	0.112
Catchment Area (10)	MH32		Time of Concentration	0.132	100	0	100	0.132
Catchment Area (11)	MH27		Time of Concentration	0.214	100	0	100	0.214
Catchment Area (12)	MH28		Time of Concentration	0.277	100	0	100	0.277
Catchment Area (13)	MH23		Time of Concentration	0.074	100	0	100	0.074
Catchment Area (14)	Cellular Storage (3)		Time of Concentration	0.145	100	0	100	0.145
Catchment Area (15)	MH37		Time of Concentration	0.092	100	0	100	0.092
Catchment Area (16)	MH38		Time of Concentration	0.051	100	0	100	0.051
Catchment Area (17)	MH35		Time of Concentration	0.185	100	0	100	0.185
Catchment Area (18)	MH30		Time of Concentration	0.188	100	0	100	0.188
Catchment Area (19)	MH32		Time of Concentration	0.195	100	0	100	0.195
Catchment Area (20)	MH9		Time of Concentration	0.093	100	0	100	0.093
Catchment Area (21)	MH4		Time of Concentration	0.113	100	0	100	0.113
Catchment Area (22)	MH16		Time of Concentration	0.135	100	0	100	0.135
Catchment Area (23)	MH9		Time of Concentration	0.057	100	0	100	0.057
Catchment Area (24)	MH35		Time of Concentration	0.201	100	0	100	0.201
TOTAL		0.0		3.826				3.826

Project:	Date: 05/07/2022			
	Designed by: johann.griffiths	Checked by:	Approved By:	
Report Title: Rainfall Analysis Criteria	Company Address:			

Runoff Type	Dynamic
Output Interval (mins)	1
Time Step	Default
Urban Creep	Apply Global Value
Urban Creep Global Value (%)	0
Junction Flood Risk Margin (mm)	300
Perform No Discharge Analysis	☐

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase	Company Address:		



FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Junction	Storm Event	Cover Level (m)	Invert Level (m)	Max. Level (m)	Max. Depth (m)	Max. Inflow (L/s)	Max. Resident Volume (m³)	Max. Flooded Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Status
MH38	FSR: 100 years: +40 %: 600 mins: Winter	23.788	21.539	22.642	1.103	4.2	2.807	0.000	3.8	243.011	Surcharged
MH39	FSR: 100 years: +40 %: 60 mins: Summer	23.540	21.420	21.473	0.053	3.8	0.000	0.000	3.8	23.724	OK
MH1	FSR: 100 years: +40 %: 15 mins: Winter	27.362	25.862	26.140	0.278	83.7	0.398	0.000	81.6	38.678	OK
MH2	FSR: 100 years: +40 %: 15 mins: Winter	27.345	25.669	25.827	0.158	81.6	0.226	0.000	82.0	38.630	OK
MH13	FSR: 100 years: +40 %: 240 mins: Winter	27.240	23.958	25.813	1.855	72.6	2.655	0.000	72.0	417.263	Surcharged
MH16	FSR: 100 years: +40 %: 15 mins: Winter	27.557	25.547	26.065	0.518	180.1	0.585	0.000	179.2	85.443	Surcharged
MH17	FSR: 100 years: +40 %: 240 mins: Winter	27.354	23.794	25.813	2.019	18.0	2.889	0.000	17.6	421.164	Surcharged
MH18	FSR: 100 years: +40 %: 180 mins: Winter	27.305	22.573	22.646	0.073	17.6	0.000	0.000	17.6	318.765	OK
MH4	FSR: 100 years: +40 %: 15 mins: Winter	27.410	25.985	26.165	0.181	67.7	0.204	0.000	66.5	31.073	OK
MH5	FSR: 100 years: +40 %: 240 mins: Winter	26.774	25.274	25.814	0.539	12.9	0.610	0.000	12.9	73.241	Surcharged
MH9	FSR: 100 years: +40 %: 240 mins: Winter	26.523	25.023	25.814	0.791	17.0	0.894	0.000	17.0	96.533	Surcharged
MH10	FSR: 100 years: +40 %: 240 mins: Winter	27.296	24.301	25.814	1.513	25.3	1.711	0.000	24.5	138.299	Surcharged
MH12	FSR: 100 years: +40 %: 15 mins: Winter	26.899	24.795	25.895	1.100	105.8	1.244	0.000	96.1	48.738	Surcharged
MH8	FSR: 100 years: +40 %: 240 mins: Winter	27.237	24.044	25.814	1.770	73.6	2.532	0.000	72.6	421.192	Surcharged
MH11	FSR: 100 years: +40 %: 15 mins: Winter	26.150	25.176	25.897	0.721	10.6	0.816	0.000	7.3	0.971	Flood Risk
MH7	FSR: 100 years: +40 %: 240 mins: Winter	26.301	25.325	25.814	0.489	0.4	0.099	0.000	0.1	0.570	Surcharged
MH20	FSR: 100 years: +40 %: 480 mins: Winter	25.417	22.861	24.235	1.374	27.3	2.427	0.000	6.3	415.186	Surcharged
MH23	FSR: 100 years: +40 %: 480 mins: Winter	25.235	22.673	24.235	1.562	20.5	2.759	0.000	6.6	430.819	Surcharged
MH25	FSR: 100 years: +40 %: 15 mins: Winter	25.169	22.640	22.708	0.068	6.6	0.076	0.000	6.7	9.685	OK
MH26	FSR: 100 years: +40 %: 720 mins: Summer	24.985	22.514	22.626	0.112	15.2	0.126	0.000	15.2	1104.100	OK

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Junctions Summary Storm Phase: Phase		Company Address:	



MH34	FSR: 100 years: +40 %: 720 mins: Summer	24.88 5	22.42 0	22.525	0.105	15.2	0.000	0.000	15.2	1104.086	OK
MH22	FSR: 100 years: +40 %: 480 mins: Winter	25.88 3	23.03 9	24.235	1.196	26.9	1.352	0.000	6.3	381.517	Surcharged
MH24	FSR: 100 years: +40 %: 15 mins: Winter	25.33 6	23.83 6	24.488	0.652	74.4	0.737	0.000	70.9	33.045	Surcharged
MH33	FSR: 100 years: +40 %: 360 mins: Winter	24.98 2	22.54 5	23.570	1.025	8.9	1.467	0.000	8.7	301.631	Surcharged
MH30	FSR: 100 years: +40 %: 15 mins: Winter	25.12 5	23.62 5	23.841	0.216	112.8	0.245	0.000	110.6	51.268	OK
MH31	FSR: 100 years: +40 %: 360 mins: Winter	25.34 9	22.65 0	23.570	0.920	42.0	1.041	0.000	41.1	355.542	Surcharged
MH27	FSR: 100 years: +40 %: 15 mins: Winter	24.10 0	22.95 0	23.598	0.648	128.4	0.733	0.000	125.7	58.279	Surcharged
MH28	FSR: 100 years: +40 %: 360 mins: Winter	24.94 4	22.73 6	23.570	0.834	40.4	1.194	0.000	39.6	344.583	Surcharged
MH29	FSR: 100 years: +40 %: 360 mins: Winter	24.94 2	22.69 1	23.570	0.879	39.6	1.258	0.000	39.2	341.955	Surcharged
MH19	FSR: 100 years: +40 %: 15 mins: Summer	25.25 5	23.49 6	24.333	0.837	66.5	0.946	0.000	71.7	27.186	Surcharged
MH35	FSR: 100 years: +40 %: 600 mins: Winter	24.11 8	21.80 2	22.642	0.840	21.4	0.950	0.000	21.2	304.078	Surcharged
MH36	FSR: 100 years: +40 %: 600 mins: Winter	23.86 4	21.62 3	22.643	1.020	21.2	1.153	0.000	4.1	424.719	Surcharged
MH3	FSR: 100 years: +40 %: 240 mins: Winter	27.13 3	24.98 1	25.813	0.832	28.8	0.941	0.000	28.8	163.719	Surcharged
MH6	FSR: 100 years: +40 %: 240 mins: Winter	27.35 3	24.88 4	25.814	0.929	28.8	1.051	0.000	28.8	161.960	Surcharged
MH14	FSR: 100 years: +40 %: 15 mins: Winter	27.42 3	25.92 3	26.890	0.968	104.1	1.094	0.000	101.2	47.966	Surcharged
MH15	FSR: 100 years: +40 %: 15 mins: Winter	27.55 4	25.72 8	26.460	0.733	101.2	0.829	0.000	101.5	48.117	Surcharged
MH21	FSR: 100 years: +40 %: 15 mins: Winter	25.55 9	24.05 9	25.121	1.062	238.8	1.201	0.000	237.0	110.267	Surcharged
MH32	FSR: 100 years: +40 %: 15 mins: Winter	24.15 0	22.87 5	23.691	0.816	196.3	0.923	0.000	193.4	89.164	Surcharged
MH37	FSR: 100 years: +40 %: 600 mins: Winter	23.78 0	22.35 5	22.642	0.287	5.1	0.324	0.000	5.1	72.423	Surcharged

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Stormwater Controls Summary Storm Phase: Phase	Company Address:		



FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Stormwater Control	Storm Event	Max. US Level (m)	Max. DS Level (m)	Max. US Depth (m)	Max. DS Depth (m)	Max. Inflow (L/s)	Max. Residual Volume (m³)	Max. Flooded Volume (m³)	Total Lost Volume (m³)	Max. Outflow (L/s)	Total Discharge Volume (m³)	Percentage Available (%)	Status
Cellular Storage	FSR: 100 years: +40 %: 240 mins: Winter	25.813	25.813	1.963	1.963	135.7	559.533	0.000	0.000	18.0	423.270	2	OK
Cellular Storage (1)	FSR: 100 years: +40 %: 360 mins: Winter	23.570	23.570	0.960	0.960	80.3	558.165	0.000	0.000	8.9	302.977	4	OK
Cellular Storage (2)	FSR: 100 years: +40 %: 480 mins: Winter	24.235	24.235	1.155	1.155	53.0	488.201	0.000	0.000	6.2	180.109	4	OK
Cellular Storage (3)	FSR: 100 years: +40 %: 600 mins: Winter	22.642	22.642	0.992	0.992	33.3	405.048	0.000	0.000	3.7	124.922	1	OK

Project:	Date: 05/07/2022		
	Designed by: johann.griffiths	Checked by:	Approved By:
Report Details: Type: Connections Summary Storm Phase: Phase	Company Address:		



FSR: 100 years: Increase Rainfall (%): +40: Critical Storm Per Item

Connection	Storm Event	Connection Type	From	To	Upstream Cover Level (m)	Max. US Water Level (m)	Max. Flow Depth (m)	Discharge Volume (m³)	Max. Velocity (m/s)	Flow / Capacity	Max. Flow (L/s)	Status
1.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH1	MH2	27.4	26.140	0.217	38.678	1.5	1.14	81.6	OK
3.002	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH13	Cellular Storage	27.2	24.933	0.450	171.046	3.0	1.12	361.7	Surcharged
1.005	FSR: 100 years: +40 %: 180 mins: Winter	Pipe	MH17	MH18	27.4	25.809	0.075	318.765	2.0	0.48	17.6	Surcharged
1.004	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	Cellular Storage	MH17	27.4	24.934	0.450	24.890	0.4	0.14	21.0	Surcharged
6.002	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH16	Cellular Storage	27.6	26.065	0.300	85.443	2.5	1.49	179.2	Surcharged
2.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH4	MH5	27.4	26.165	0.172	31.073	2.0	0.89	66.5	OK
3.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH8	MH13	27.2	24.974	0.450	174.149	2.3	1.18	365.1	Surcharged
5.000	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	MH11	MH12	26.2	25.731	0.150	0.028	0.5	0.4	8.9	Surcharged
3.000	FSR: 100 years: +40 %: 120 mins: Summer	Pipe	MH7	MH8	26.3	25.519	0.150	0.000	0.0	0	0.1	Surcharged
7.001	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	MH20	MH23	25.4	23.840	0.525	0.666	0.2	0.04	12.2	Surcharged
7.002	FSR: 100 years: +40 %: 60 mins: Winter	Pipe	MH23	MH25	25.2	23.941	0.069	40.428	0.6	0.19	6.6	Surcharged

Project:	Date: 05/07/2022		
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Report Details: Type: Connections Summary Storm Phase: Phase		Company Address:	



7.003	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH25	MH26	25.2	22.708	0.086	9.685	0.7	0.2	6.7	OK
7.004	FSR: 100 years: +40 %: 720 mins: Summer	Pipe	MH26	MH34	25.0	22.626	0.108	1104.086	0.8	0.45	15.2	OK
8.002	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	MH22	MH20	25.9	23.663	0.450	0.002	0.0	0.03	7.9	Surcharged
9.000	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	MH24	MH23	25.3	24.349	0.300	29.412	1.0	0.73	71.3	Surcharged
10.004	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH33	MH26	25.0	23.058	0.101	11.412	0.5	0.25	8.7	Surcharged
11.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH30	MH31	25.1	23.841	0.300	51.268	1.6	0.85	110.6	OK
10.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH27	MH28	24.1	23.598	0.300	58.250	1.8	1.97	125.7	Surcharged
10.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH28	MH29	24.9	23.281	0.450	133.934	1.8	1.55	287.4	Surcharged
10.002	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH29	Cellular Storage (1)	24.9	23.057	0.407	132.040	3.6	0.85	285.8	OK
11.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH31	Cellular Storage (1)	25.3	23.273	0.375	136.193	3.4	1.6	299.6	Surcharged
10.003	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	Cellular Storage (1)	MH33	25.0	23.058	0.450	12.507	0.5	0.05	10.8	OK
8.001	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	Cellular Storage (2)	MH22	25.5	23.536	0.450	0.048	0.4	0.03	7.9	Surcharged
7.000	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	MH19	MH20	25.3	24.333	0.300	27.024	1.0	1.12	71.7	Surcharged
13.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH35	MH36	24.1	22.258	0.450	106.304	1.5	0.55	232.2	Surcharged

Project:	Date: 05/07/2022		
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13.001	FSR: 100 years: +40 %: 30 mins: Winter	Pipe	MH36	MH38	23.9	22.217	0.450	1.725	0.5	0.05	10.0	Surcharged
14.001	FSR: 100 years: +40 %: 15 mins: Summer	Pipe	Cellular Storage (3)	MH36	23.9	22.035	0.398	0.000	0.0	0.03	4.8	OK
13.002	FSR: 100 years: +40 %: 60 mins: Summer	Pipe	MH38	MH39	23.8	22.273	0.054	23.724	0.7	0.27	3.8	Surcharged
4.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH9	MH10	26.5	25.636	0.300	40.587	1.2	0.78	83.5	Surcharged
4.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH10	MH8	27.3	25.183	0.300	55.744	1.7	1.28	122.8	Surcharged
2.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH5	MH3	26.8	25.516	0.221	31.170	1.2	0.92	65.9	OK
1.002	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH3	MH6	27.1	25.256	0.200	69.790	2.2	0.8	148.5	OK
1.003	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH6	Cellular Storage	27.4	25.010	0.450	69.565	2.5	0.18	148.9	OK
1.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH2	MH3	27.3	25.827	0.152	38.630	2.3	0.48	82.0	OK
6.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH14	MH15	27.4	26.890	0.300	47.966	1.4	1.42	101.2	Surcharged
6.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH15	MH16	27.6	26.460	0.300	48.117	1.4	1.42	101.5	Surcharged
5.001	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH12	MH8	26.9	25.895	0.225	47.767	2.4	1.29	96.1	Surcharged
8.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH21	Cellular Storage (2)	25.6	25.121	0.300	110.267	3.4	2.74	237.0	Surcharged
12.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH32	MH31	24.1	23.691	0.375	89.150	1.8	1.31	193.4	Surcharged

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14.000	FSR: 100 years: +40 %: 15 mins: Winter	Pipe	MH37	Cellular Storage (3)	23.8	22.621	0.225	25.424	1.4	1.03	53.7	Surcharged
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01 Table 1: Flood Zones

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's [Flood Map for Planning \(Rivers and Sea\)](#), available on the Environment Agency's web site, as indicated in the table below.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the [Strategic Flood Risk Assessment](#) when considering location and potential future flood risks to developments and land uses.

Paragraph: 065 Reference ID: 7-065-20140306

Revision date: 06 03 2014

02 Table 2: Flood risk vulnerability classification

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power

stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.

- Wind turbines.

Highly vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.

- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

* “ Landfill is as defined in [Schedule 10 of the Environmental Permitting \(England and Wales\) Regulations 2010](#).

Paragraph: 066 Reference ID: 7-066-20140306

Revision date: 06 03 2014

03 Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the [Sequential Test](#) which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and [Exception Tests](#) do not need to be applied to [minor developments](#) and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;

- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

” * “ In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Paragraph: 067 Reference ID: 7-067-20140306

Revision date: 06 03 2014

Drainage Asset Maintenance Schedule

■ Surface ■ Foul

Maintenance Activity	Drainage Component	Required Action	Typical Frequency
Visual Inspection	Gully Sump unit Catch pit / silt trap Attenuation structures Channel drain Outlet chamber Flow control chamber Swale Soakaway Pond and wetland Bioretention	Inspect for sediment and debris Inspect inlets and outlets for blockage (where applicable)	Monthly for first year and twice yearly thereafter, after severe storm
	Pipework		Twice yearly
	Full retention interceptor Bypass interceptor Forecourt interceptor		Twice yearly or after severe storm as a minimum, refer to manufacturer guidance. Forecourt interceptor requires emptying after fuel spillage
Monitoring	Attenuation structures	Check attenuation inspection points to ensure emptying is occurring (little to no water should be present after consecutive days of dry weather)	Twice yearly, once after heavy rainfall and once after consecutive dry weather
	Soakaway	Check to ensure emptying is occurring	Annually
	Bioretention	Check operation of underdrains by inspection of flows after rain	Annually
Litter and Debris Removal	Pond and wetland Manhole Pervious paving Swale Soakaway Bioretention	Remove all litter and debris	Twice yearly or after severe storm

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Litter and Debris Removal - Continued	All sump units (gullies, channel drains and catch pits) Access chambers and pre-treatment devices Flow control chamber Gutters & leaf guards		Twice yearly (spring, start of winter), or as required
Grass Cutting	Pond and wetland Swale	Grass should be cut to retain grass height within specified design range (typically 75-150mm)	Monthly (during growing season), or as required
Jet Wash	Pipework Attenuation structures	High pressure jet-wash any pipe work which has silt accumulation. Care must be taken that any silts within the pipework are not unnecessarily flushed into the attenuation structures (use of bungs and jet-vac of chamber prior to removal of bungs) High pressure jet-wash all perforated pipework and or access points. All water to be jet vac to remove any suspended silts within the water	Twice yearly, or as required Five yearly, or as required
Sweeping	Pervious paving	Pervious surfaces need to be regularly cleaned of silt and sediment to preserve their infiltration capacity	Yearly, often less where inspections indicate that it is not required
Silt and Rubber Cleaning	Pervious paving	Jet wash if visible signs of silt and rubber build up. Further maintenance options include locally removing block and geotextile, removing the silt/rubber and replacing as before	Paving to be inspected every spring (when dry)
Repair/Reinstate – Remedial Actions	Soakaway Bioretention	Remove and reconstruct soakaway and/or replace or clean void fill if performance deteriorates or failure occurs Infill any holes in or remove and replace filter medium	As required As required
Vegetation Management	Pond and wetland	Build-up of dead vegetation from previous seasons should be removed to reduce organic silt accumulation	Convenient intervals e.g., every three years at the end of landscape contract periods

		Bioretention	Emergent vegetation may need to be harvested to maintain flood volumes Assess plants for disease infection, poor growth, invasive species etc., and replace as necessary.	Every two – ten years, or as required Quarterly inspection, replacement as required
	Sediment Management and Removal	ALL SUDS	Sediment accumulation should be monitored as part of the inspection regime, rate of sediment accumulation noted	Appropriate frequencies determined upon inspection
	Inspection	Pipework Manhole	Check if functioning correctly	Once site is fully operational: twice yearly for 1 st year, annually after
		Pumping station/rising main	Impellers will need inspecting and cleaning as required – refer to manufacturer guidance	Refer to manufacturer guidance
		Grease trap	Monthly inspection with removal of grease as required	Monthly
	Sediment Removal	Washdown separator	Inspect for build up of sediment and remove as required. Refer to manufacturer guidance	Quarterly for 1 st year, twice yearly after. Refer to manufacturer guidance

Additional notes:

- Any defects (broken/misaligned pipes, root infestation, damage to soakaways, missing parts, etc.) that are identified during inspections/maintenance should be reported back to the property/site owner so that remedial actions can be undertaken promptly to repair these defects.
- SuDS maintenance based on CIRIA 2015 chapter 32 where further information can also be found.
- Refer to manufacturer guidance for maintenance schedules of all proprietary treatment systems.