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FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

3-4 New Broadway, Hampton, TW12 1JG

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1 EXECUTIVE SUMMARY

This Drainage Assessment reviews the existing drainage arrangement at the application site and proposes a Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF) and surface water drainage strategy in line with Local Authority and Lead Local Flood Authority (LLFA) guidance.

The site is located at 3-4 New Broadway, Hampton, TW12 1JG

The existing site is a commercial unit with the proposals to extend and convert the building to add a number of residential units.

Flooding
The site is less than 1 hectare in size and within flood zone 1. The sources of flooding assessed, and proposed mitigation measures are listed in the table below.

Source	Risk Category (after mitigation)	Comments
Fluvial (Rivers and Sea)	Very Low	Site within flood zone 1
Coastal and tidal	Negligible	Not near coast or tidal waterbody
Groundwater	Low	Proposed finished floor levels are 150mm above external ground levels and natural topography reduces risk.
Surface water	Low	Low due to natural topography and presence of surface water drainage and infiltration
Sewers	Very Low	Low due to natural topography and sewer location
Reservoirs	Very Low	Reservoir at low danger of failure

Surface Water Drainage
It is proposed to discharge surface water into the existing combined sewer on site at a reduced discharge rate of no more than 50% of existing.

The drainage design is included in this report and a total attenuation volume of approximately 4 cubic metres is proposed to cater for the 100 year +40% storm event.

This attenuation will be provided under the proposed ground floor terrace areas.

An additional 10% allowance for urban creep has been included in the sizing of surface water storage by adding 10% to the areas in the modelled calculations.

Maintenance/management of all onsite drainage infrastructure has been considered within a separate maintenance plan appended to this report. This will be updated through the development process.

The proposed drainage strategy is entirely based on-site.

Overall, the proposed development has an acceptable flood risk within the terms and requirements of the NPPF. The proposals provide a high level of water treatment, runoff reduction and flooding protection for the proposed development and are in accordance with all requirements of the Lead Local Flood Authority (LLFA).

Foul Drainage

It is proposed to discharge the foul drainage from the site into the existing combined sewer running through the site.

2 INTRODUCTION

2.1.1 Jomas was commissioned to undertake a Drainage Assessment for the proposed development of land located at 3-4 New Broadway, Hampton, TW12 1JG

2.1.2 This Drainage Assessment has been produced in support of a planning application and should be read in conjunction with the other planning documents.

2.1.3 The existing site contained a number of commercial units, with the proposals to extend and convert part of the site to add a number of new residential units. Proposed development details are provided in Appendix A.

3 SITE DESCRIPTION

3.1.1 The existing site is located at 3-4 New Broadway, Hampton, TW12 1JG

3.1.2 The site location information is as follows:

- Nearest Postcode: TW12 1JG

3.2 Topography

Site Topography

3.2.1 An onsite topographic survey has been carried out and is provided in Appendix B.

3.2.2 The site is generally rectangular in shape and falls from north to south.

4 DESIGN PRINCIPLES AND POLICY REQUIREMENTS

4.1.1 Since April 2015, Lead Local Flood Authorities (LLFA's) have become a statutory consultee on surface water drainage for many planning applications. For this site, the following is considered to be the required level of detail required for planning approval:

- A Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF) and National Planning Guidance (NPG)
- SuDS: Designs, Maintenance Plans & Calculations - for SuDS proposed, the LLFA require product specifications or design drawings, <u>all supporting calculations and a maintenance plan</u>. This needs to include details of any attenuation structures and in accordance with the CIRIA C753 SuDS Manual.

4.2 General Principles for Flooding

4.2.1 The National Planning Policy Framework (NPPF) states that when determining planning applications, local planning authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where informed by a site-specific FRA. This assessment is required for:

"Proposals of 1 hectare (ha) or greater in Flood Zone 1, all new development (including minor development and change of use) in Flood Zones 2 and 3 and an area within Flood Zone 1, which has critical drainage problems as notified to the local planning authority by the Environment Agency (EA)."

4.2.2 In accordance with the March 2014 Planning Practice Guidance (PPG), which supports the NPPF, the objectives of this FRA are to establish:

- *Whether a proposed development is likely to be affected by current or future flooding from any source;*
- *Whether it will increase flood risk elsewhere;*
- *Whether the measures proposed to deal with these effects and risks are appropriate.*

4.3 General Principles for Surface Water Drainage

4.3.1 The DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March, 2015) and LLFA Policy DM25.3 requires sustainable drainage systems in all development to reduce surface water runoff and provide water treatment on site. This includes but is not limited to addressing the following issues in order of preference:

- store rainwater for later use
- use infiltration techniques, such as porous surfaces in non-clay areas
- attenuate rainwater in ponds or open water features for gradual release
- attenuate rainwater by storing in tanks or sealed water features for gradual release
- discharge rainwater direct to a watercourse

- discharge rainwater to a surface water sewer/drain
- discharge rainwater to the combined sewer.

Consideration must be given to the direction of water flow across the site and where this may be dispersed and incorporating any features that will help reduce surface water run-off. All developments should infiltrate surface water or achieve greenfield runoff rates where possible and this needs to be demonstrated as part of the planning submission.

5 FLOODING INFORMATION

5.1 Flood Risk from Rivers (Fluvial)

5.1.1 As the site is within Flood Zone 1, there is a low risk of fluvial flooding to the site.

5.1.2 Based on the above, the risk of flooding from rivers is considered very low.

5.2 Coastal and Tidal Flood Risk

5.2.1 The site is located inland and is not near any tidally influenced watercourses; therefore, there is negligible risk of flooding from this source.

5.3 Geology and Hydrogeology

5.3.1 Groundwater flooding occurs when the water table rises to the surface and is most likely to occur in low-lying areas underlain by permeable rocks.

5.3.2 The British Geological Survey (BGS) and Aquifer Maps on the MAGIC map identifies the area as follows:

Bedrock – London Clay

Superficial Drift – Sandy Gravel

Other – Medium-High groundwater vulnerability

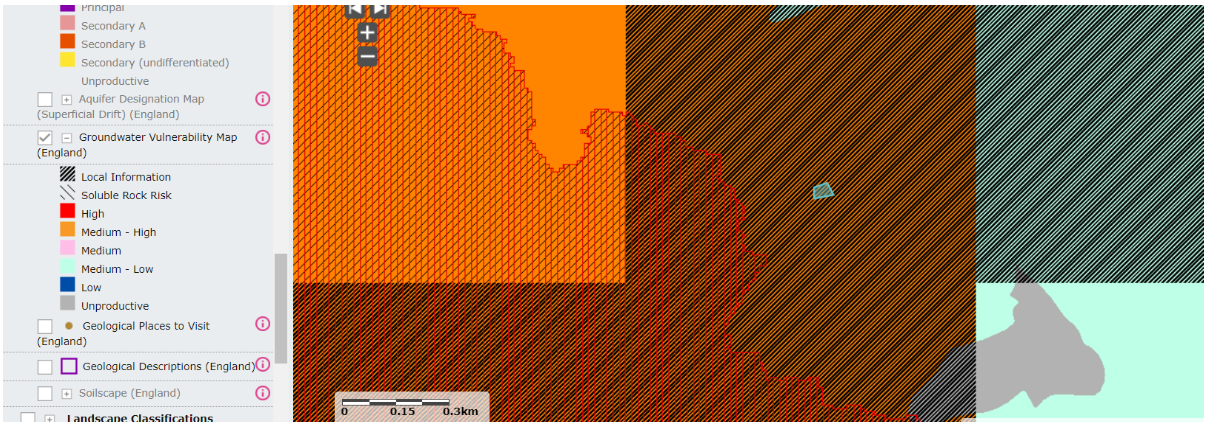


Figure 1: Groundwater Vulnerability Map

5.3.3 Infiltration testing has not been completed, however due to the likely clay ground conditions and presence of existing sewers, it is unlikely that infiltration is viable.

5.3.4 As the ground is of minimal permeability, the site is considered to be at Low risk of groundwater flooding.

5.4 Surface Water Flood Risk (Overland Flows)

5.4.1 Surface water flooding occurs when the rainwater does not drain away through the normal drainage system or infiltrate the ground, but instead lies on or flows over the ground.

5.4.2 The EA produced a Risk of Flooding from Surface Water Map in December 2013. The maps were produced using 'direct rainfall' modelling. Although they consider local drainage capacity, non-surface water influences such as rivers, seas or groundwater are not considered. The map is based on LIDAR topographic data which is not suitable for site specific assessment and therefore, where available, topographic survey data should be used to provide a more accurate understanding of potential flow paths.

5.4.3 The map shows the entire country within four different risk categories, defined below in Table 1.

Table 1: EA Surface Water Flood Risk Categories

Risk Category	Definition
High	Each year, there is a chance of flooding of greater than 1 in 30 (3.3%)
Medium	Each year, there is a chance of flooding of between 1 in 30 (3.3%) and 1 in 100 (1%)
Low	Each year, there is a chance of flooding of between 1 in 100 (1%) and 1 in 1000 (0.1%)
Very Low	Each year, there is a chance of flooding of less than 1 in 1000 (0.1%)

5.4.4 An extract of the map, provided below, shows that the proposed area of development is at low risk of surface water flooding.

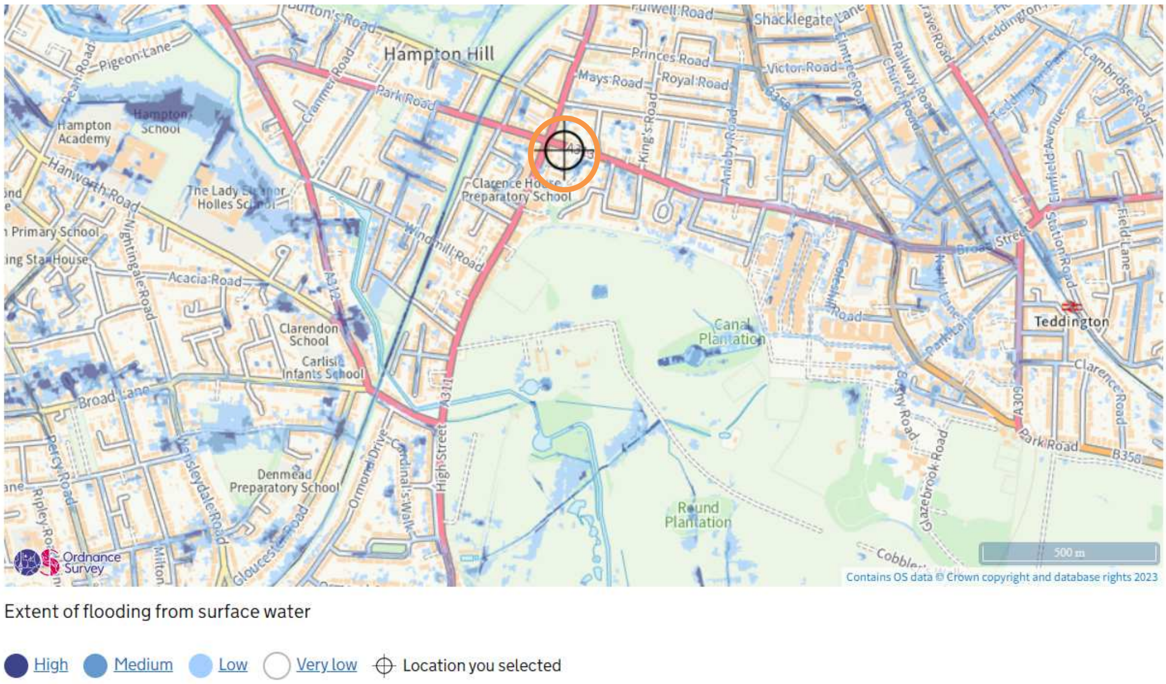


Figure 2: EA Flood Risk from Surface Water Map

5.4.5 Proposed floor levels will be raised above the existing ground to ensure the risk of flooding is minimised.

5.4.6 Based on the EA's mapping, historical data and local topography, risk of surface water flooding to the site is considered to be Low.

5.5 Sewer/Drainage Flood Risk

5.5.1 Sewer flooding is often caused by excess surface water entering the drainage system when there is insufficient sewer capacity to cope with this excess water, but also due to 'one off' events such as blockages.

5.5.2 There are existing combined water sewers running through the site.

5.5.3 On the basis there is considered to be a Medium risk of sewer flooding to the site.

5.6 Reservoir Flood Risk

5.6.1 The EA has produced a Reservoir Flood Map that shows that the site is at low risk from reservoir flooding. This map indicates very low risk of reservoir flooding at this site.

5.6.2 It should be emphasised that the risk of flooding from reservoir breach is very small since the EA is the enforcement authority for the Reservoirs Act (1975) and all large raised reservoirs are inspected and supervised by reservoir panel engineers.

5.6.3 On the basis there is considered to be a very low risk of reservoir flooding to the site.

5.7 Summary of risk levels

5.7.1 Post-development, the risk of flooding is summarised below.

Table 2: Flood Risk Categories

Source	Risk Category
Fluvial (Rivers and Sea)	Very low
Coastal and tidal	Negligible
Groundwater	Low
Surface water	Low
Sewers	Medium
Reservoirs	Very low

6 SITE DRAINAGE INFORMATION

6.1.1 The DEFRA Sustainable Drainage Systems Non-Statutory Technical Standards for Sustainable Drainage Systems (March, 2015) states that the following options must be considered for disposal of surface water runoff in order of preference:

- Discharge to ground
- Discharge to a surface water body
- Discharge to a surface water sewer
- Discharge to a combined sewer

Discharge to Ground

6.1.2 The potential for surface water to discharge to ground has been assessed through a review of the likely ground conditions and possible infiltration structures.

6.1.3 The surface geology of this site is impermeable and infiltration is unlikely to be possible.

6.1.4 Infiltration testing will be completed as part of the detailed design and the design revised accordingly should infiltration be possible

Discharge to Surface Water Body

6.1.5 There are no suitable surface water bodies near to the site that can be used for surface water discharge.

Discharge to Surface Water Sewer/Combined Sewer

6.1.6 Discharge to the public sewer network should only be considered once all other options for draining surface water from the site have been exhausted. There is an existing combined sewer running through the site that will be used for discharge of surface water

6.2 Sustainable Drainage Systems (SuDS)

6.2.1 To maximise the potential use of SuDS at the site, a review has been undertaken as shown in Table 3 in accordance with the SuDS Hierarchy. This review highlights the components referenced in the SuDS Hierarchy and provides recommendations on whether the components could be incorporated into the development.

Table 3: SuDS Selection Based on the SuDS Hierarchy

Component	Recommendation
Green/Blue roofs	Whilst the use of green and blue roofs provides additional environmental benefits such as enhanced aesthetics and ecology, its exposure to wind and orientation must be considered. Access to undertake the construction and maintenance easily and safely is also a high priority. If feasible, depending on the roof design, a green/blue roof will provide water quality, biodiversity and aesthetic benefits to the site. Additionally, the green/blue roof/s will offer some attenuation for run-off, reducing volumes of

Component	Recommendation
	run-off and in higher frequency events (i.e. 1in2 year storms) will result in no run-off for the building. Green roofs have not been considered for the small roof areas.
Basins and Ponds	Ponds and attenuation basins can provide overland storage of surface water whilst also providing additional biodiversity and aesthetic/amenity value. There are no external areas available for a basin or pond.
Filter Strips and Swales	Swales are linear vegetated drainage features, which provide overland conveyance and storage of surface water whilst trapping sediments and hydrocarbons within run-off. They also create biodiverse areas for planting and habitat. Swales have not been considered for this site as the external areas are to be used for recreational purposes.
Infiltration Devices	Infiltration devices are likely to be suitable for the main drainage system due to the permeable nature of the existing ground. Infiltration is unlikely to be suitable for this site.
Permeable Paving	Whilst incorporating attenuation storage, permeable paving also provides treatment through filtration of silt (and attached pollutants), settlement and retention of solids, adsorption of pollutants and biodegradation of organic pollutants, including petrol and diesel. Tanked permeable paving is to be used for storage of all surface water.
Tanked Systems	This is the least sustainable option in terms of the SuDS Hierarchy. However, the use of tanked systems would still be of benefit compared to traditional drainage systems as it does allow run-off to be slowed down to an acceptable discharge rate. There are no tanks proposed for the site.
Other	Water Butts are proposed

7 SURFACE WATER DRAINAGE DESIGN

7.1 Site Areas

7.1.1 The site currently comprises a number of existing commercial units. The proposed development extends the site to add a number of residential units. The existing and proposed areas are summarised below.

Table 4: Site Areas

Parameter	Existing (m2)	Existing (%)	Proposed (m2)	Proposed (%)
Impermeable area	150	52	225	79
Permeable area	136	48	61	21
Total area	286	100	286	100

7.1.2 It is assumed that the surface water runoff from the site currently drains to the combined sewer.

7.2 Design Considerations

7.2.1 Consideration has been given to the following when calculating the proposed impermeable areas.

- The 2013 EA 'Rainfall Run-off Management for Developments' Report (SC030219) states that urban creep, the process of gradually increasing impermeable area within an urban area (through paving soft landscaped surfaces and constructed outbuildings etc), is an acknowledged issue. To include an allowance for urban creep, the impermeable area used in the drainage calculations has been increased by 10% in accordance with the recommendation made in SC030219.

7.2.2 The climate change allowance used in the Drainage Strategy is in line with updated EA guidance values published in February 2016 for increased rainfall intensities by 2115.

7.3 Greenfield Run-Off Rates

7.3.1 The existing run-off rates are provided in Appendix C and summarised below.

7.4 Existing Run-Off Rates

7.4.1 The existing run-off rates for a variety of return periods have been calculated using the Wallingford method.

7.4.2 The total site area is 286 square metres and is 79% impermeable, resulting in an impermeable area of 225 square metres. Taking conservative peak 1 year, 30 year and 100 year rainfall rates of 50mm/hr, 125mm/hr and 185mm/hr respectively, the maximum existing peak discharge rates have been calculated as follows.

Contributing Area (ha) x 1 yr Rainfall (mm/hr) x 2.78

225/1000 x 50 x 2.78 = **3.1 l/s**

Contributing Area (ha) x 30 yr Rainfall (mm/hr) x 2.78

225/1000 x 125 x 2.78 = **7.8 l/s**

Contributing Area (ha) x 100yr Rainfall (mm/hr) x 2.78

225/1000 x 185 x 2.78 = **11.6 l/s**

7.4.3 The discharge rates for the existing and proposed site are summarised below.

Table 5: Existing Greenfield Run-off Rates

Parameter	Existing Discharge (l/s)	Greenfield Discharge (l/s)	Proposed Discharge (l/s)
QBAR	NA	0.04	NA
1 year	3.1	0.04	1.5
30 year	7.8	0.1	2.7
100 year	11.6	0.14	3.2
100 year +40%	NA	NA	4.1

7.5 Drainage Design

7.5.1 It is proposed to discharge the roofwater from the buildings into storage systems beneath the ground floor terraces with reduced discharge to the combined sewer. Discharge will be limited to less than 50% of existing for all storm events up to and including the 100 year +40% storm event.

7.5.2 A calculation of the required storage volume is provided in Appendix C. A total attenuation volume of approximately 4 cubic metres (2.9 cubic metres in the subbase and 1.1 cubic metre in the manholes) is proposed to cater for the 100 year +40% storm event.

7.6 Exceedance Flooding and Overland Flow

7.6.1 The area is not subject to overland flow routes or surface water flooding as discussed in sections 5.3 and 5.4 above.

7.6.2 The drainage system has been designed to cater for the 1 in 100 year + 40% climate change storm. ie in this storm event all surface water will be collected on site and slowly released. Thus, the overland flow route will only be in use in the event of drainage network failure, storms in excess of the 1 in 100 year + 40% climate change storm or flows from offsite flowing through the site.

7.6.3 Due to the site levels falling across the site, all overland flow will move towards the south and into the existing unpaved road where it will infiltrate into the ground. See overland flow plan in Appendix C.

7.7 Consents, Offsite Works and Diversions

7.7.1 The proposed surface water drainage strategy is accommodated entirely on-site. Consent will be required from Thames Water for the connections to the combined sewer and also any new construction over the existing sewer.

7.8 Maintenance

7.8.1 A SuDS maintenance plan has been prepared to outline the management of the potential SuDS features. The maintenance plan is provided in Appendix D.

8 FOUL DISCHARGE

8.1 Discharge to Public Sewer Network

8.1.1 There are existing Thames Water sewers running through the site.

8.1.2 The foul drainage will connect into this sewer to Thames Water approval.

9 DRAINAGE DURING CONSTRUCTION

9.1 Construction Run-off Management

9.1.1 Installing the surface water and foul drainage system, whilst managing temporary run-off, are key aspects of the construction works involved in any development. The information provided below is in accordance with the 'C698 Site handbook for the construction of SUDS' (CIRIA, 2007).

9.1.2 Please note that the measures recommended below are recommendations only and need to be confirmed at the construction stage by the client and the contractor.

9.2 Management of Construction (Including Drainage)

9.2.1 Drainage is typically an early activity in the construction stage of a development, taking form during the earthworks phase. However, final construction i.e. piped drainage system connections to the SuDS devices, should not take place until the end of site development work, unless a robust strategy for silt-removal is implemented prior to occupation of the site.

9.2.2 A plan for the management of construction (including phasing of works, details of any offsite works etc.) cannot be provided at this early stage, as construction work plans are not yet known. However, the following key points are general construction issues associated with SuDS which will be addressed when these plans are complete:

- Silt-laden waters from construction sites represent a common form of waterborne pollution;
- These silt-laden waters cannot enter SUDS drainage systems unless specifically designed to accept this as it can clog the systems and pollute receiving waters. Therefore, piped drainage systems should not be connected to the attenuation SuDS devices until the late stages of construction.
- Any gullies and piped systems should be capped off during construction and fully jetted and cleaned prior to connection to the attenuation SuDS devices.

9.3 Temporary Drainage During Construction

9.3.1 The three principal aspects of drainage control during construction are trapping sediment, conveying run-off, and controlling run-off.

9.3.2 Sediment traps and barriers can include basin traps and sediment fences (with any necessary boundary controls). The principal basins are to be installed after the construction site is accessed. Sediment fences and barriers will then be installed as needed during grading.

9.3.3 Conveyance of run-off can be achieved through small ditches/stream, storm drains, channels and sloped drains with sufficient inlet/outlet protection.

9.3.4 Slope stability needs to be considered when using any channels to convey run-off across the site into any basins etc.

9.3.5 Run-off control measures will need to be implemented in order not overwhelm the temporary system and cause flooding issues. Run-off rates from the site will be managed so they are no greater than pre-development or in keeping with the best practice guidance to minimise risk of blockage. Any additional conveyance measures are to be installed as needed during grading.

9.3.6 Run-off control to include provision of perimeter ditches or appropriate levels grading to direct any water from the construction site to remain on site.

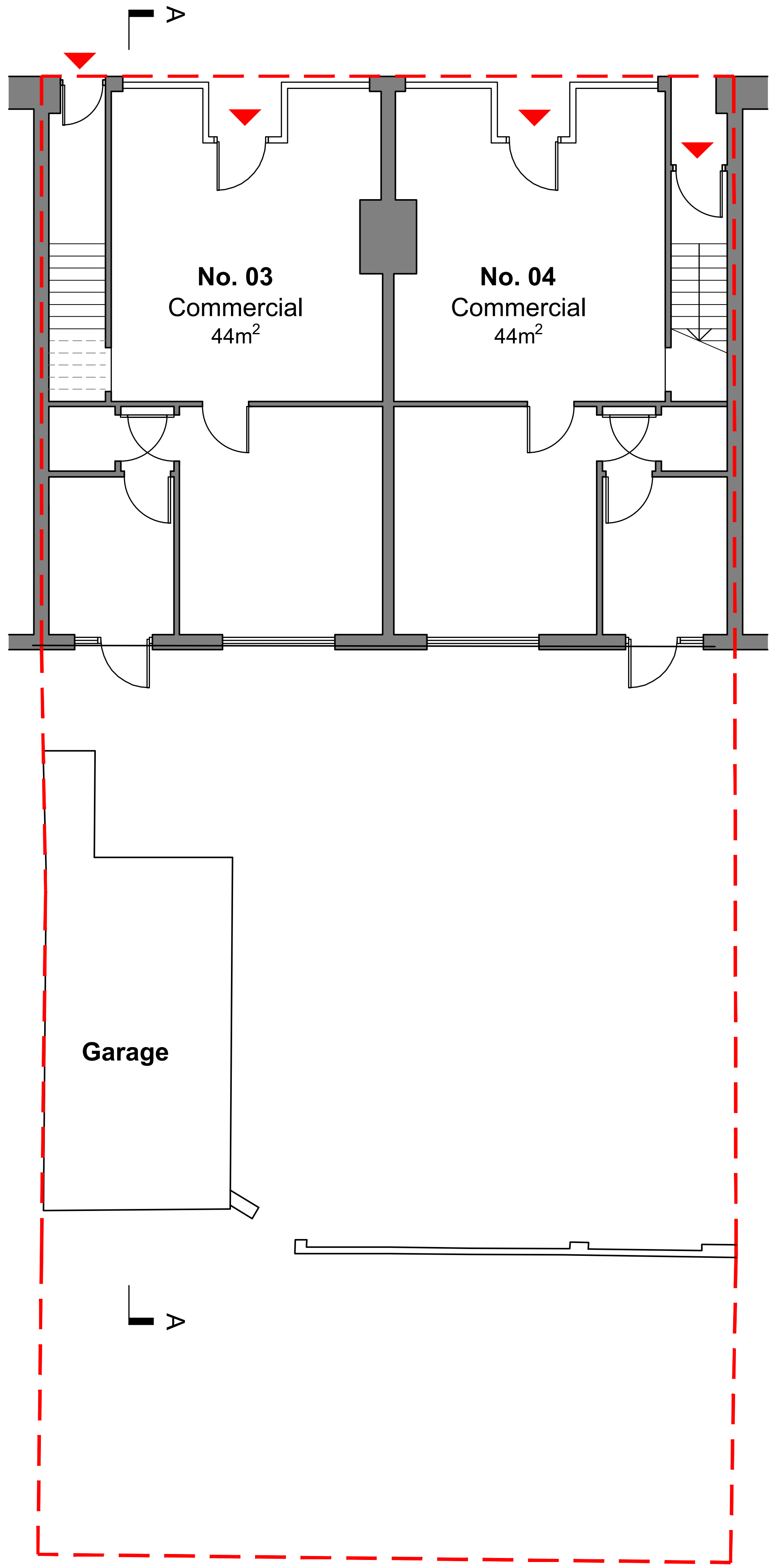
9.3.7 Any necessary surface stabilisation measures are to be applied immediately on all disturbed areas where construction work is either delayed or incomplete.

9.3.8 Maintenance inspections are to be performed weekly, and maintenance repairs to be made immediately after periods of rainfall.

9.4 Protection of Drainage Infrastructure during Construction

9.4.1 All drainage infrastructure should be protected from damage by construction traffic and heavy machinery through the implementation of measures such as protective barriers, and storing construction materials away from the drainage infrastructure.

Appendix A: Proposed Development Details



All dimensions to be checked on site prior to construction or manufacture. Refer also to written specification of works where applicable. No dimensions should be scaled from this drawing for construction purposes. Any discrepancies found between this drawing and other drawings should be referred to consultants immediately.

REV	AMENDMENTS	DATE

PROJECT	DRAWING	STATUS
New Broadway/ Hampton Road	Existing Plans	PLANNING

CLIENT	SCALE	DATE	CHECKED	DRAWING No.	REVISION
	1:100 @ A3	JUNE 2023	MS	2103_PL.05_001	

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Existing Front Elevation

Existing Rear Elevation

Existing Rear Elevation (at site boundary showing garage/boundary wall)

REV	AMENDMENTS	DATE

PROJECT	DRAWING			STATUS	
New Broadway/ Hampton Road	Existing Elevations			PLANNING	
CLIENT	SCALE	DATE	CHECKED	DRAWING No.	REVISION
	1:100 @ A3	JUNE 2023	MS	2103_PL.05_005	

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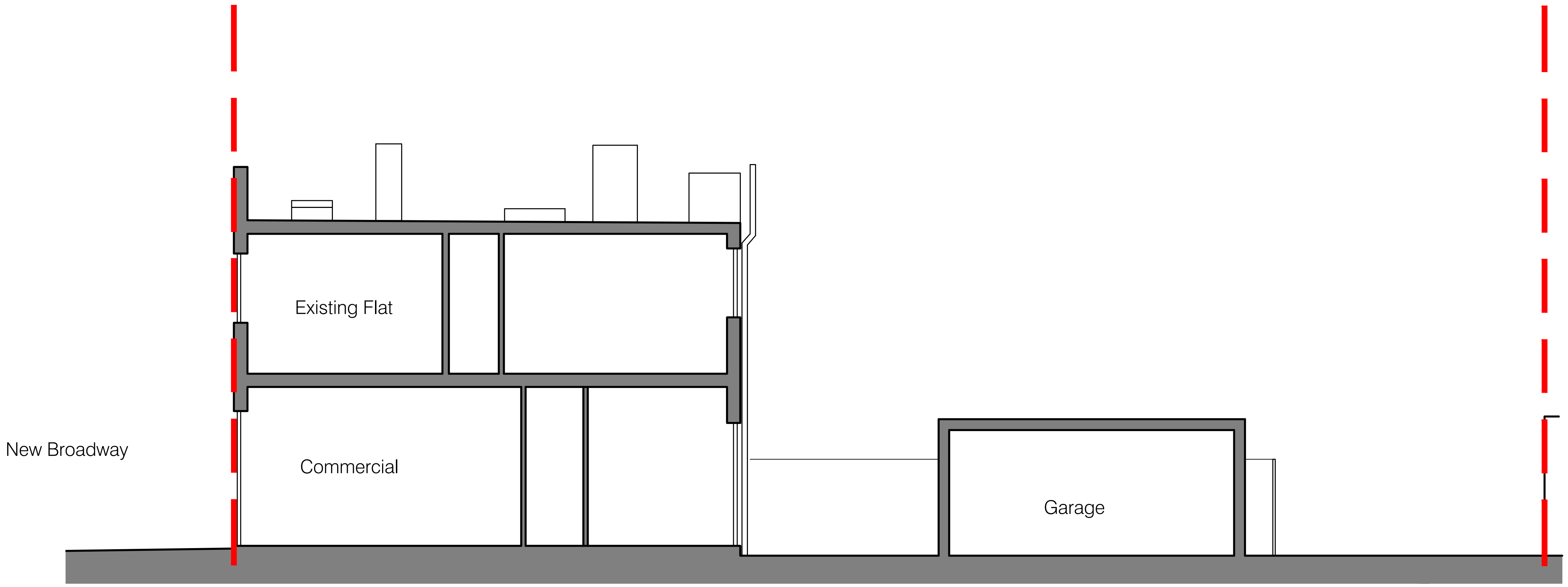

Existing Section A-A

All dimensions to be checked on site prior to construction or manufacture. Refer also to written specification of works where applicable. No dimensions should be scaled from this drawing for construction purposes. Any discrepancies found between this drawing and other drawings should be referred to consultants immediately.

REV	AMENDMENTS	DATE

PROJECT
New Broadway/ Hampton Road

DRAWING
Existing Section A-A

STATUS
PLANNING

CLIENT

SCALE	DATE	CHECKED	DRAWING No.	REVISION
1:100 @ A3	JUNE 2023	MS	2103_PL.05_010	

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REV	AMENDMENTS	DATE

PROJECT	DRAWING	STATUS
New Broadway/ Hampton Road	Proposed Site Plan	PLANNING

CLIENT	SCALE	DATE	CHECKED	DRAWING No.	REVISION
	1:200 @ A3	JUNE 2023	MS	2103_PL.05_100	

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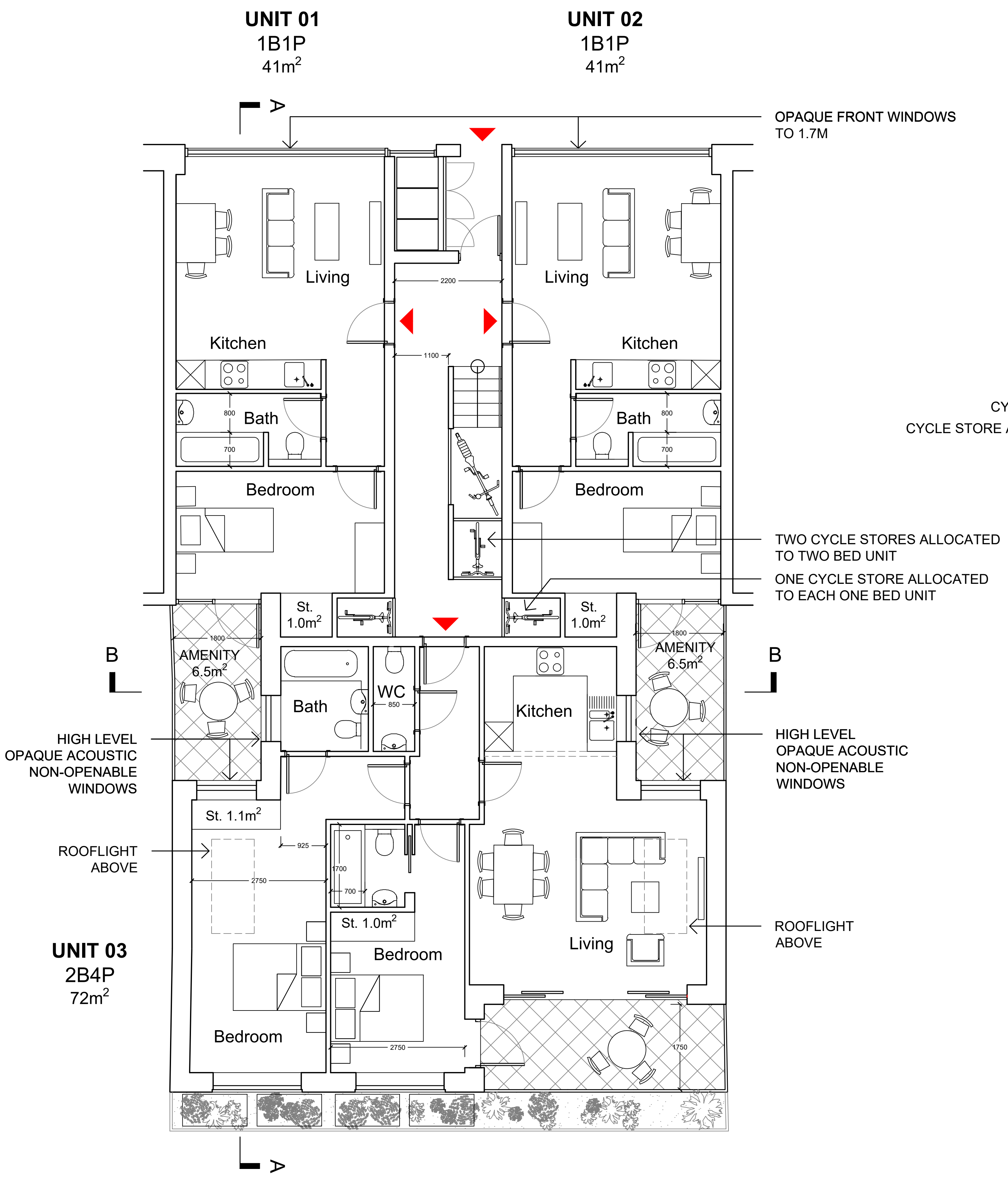
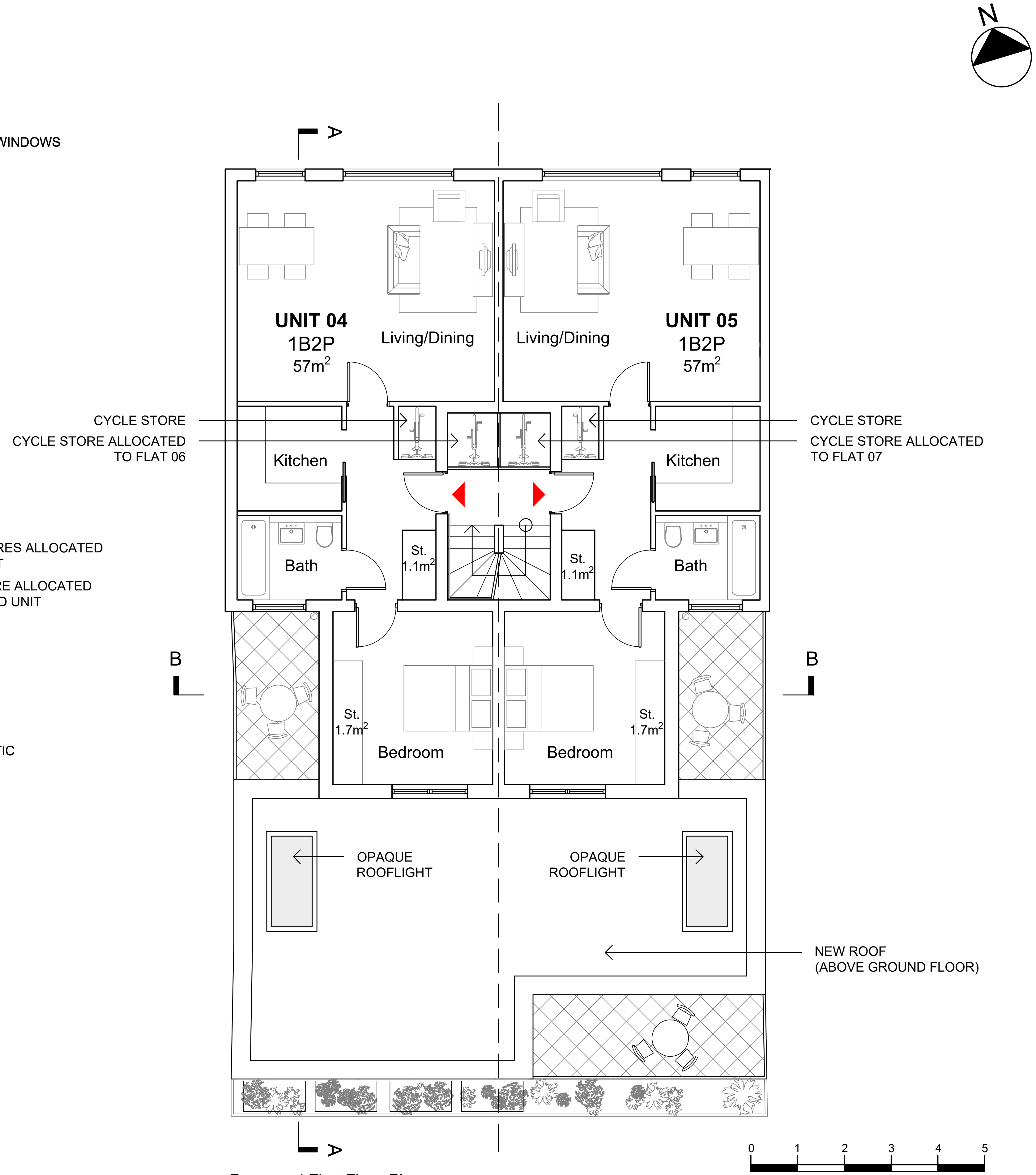


Proposed Ground Floor Plan



Proposed First Floor Plan

All dimensions to be checked on site prior to construction or manufacture. Refer also to written specification of works where applicable. No dimensions should be scaled from this drawing for construction purposes. Any discrepancies found between this drawing and other drawings should be referred to consultants immediately.

REV	AMENDMENTS	DATE

PROJECT	DRAWING	STATUS
New Broadway/ Hampton Road	Proposed Ground Floor Plan and Roof Plan	PLANNING

CLIENT	SCALE	DATE	CHECKED	DRAWING No.	REVISION
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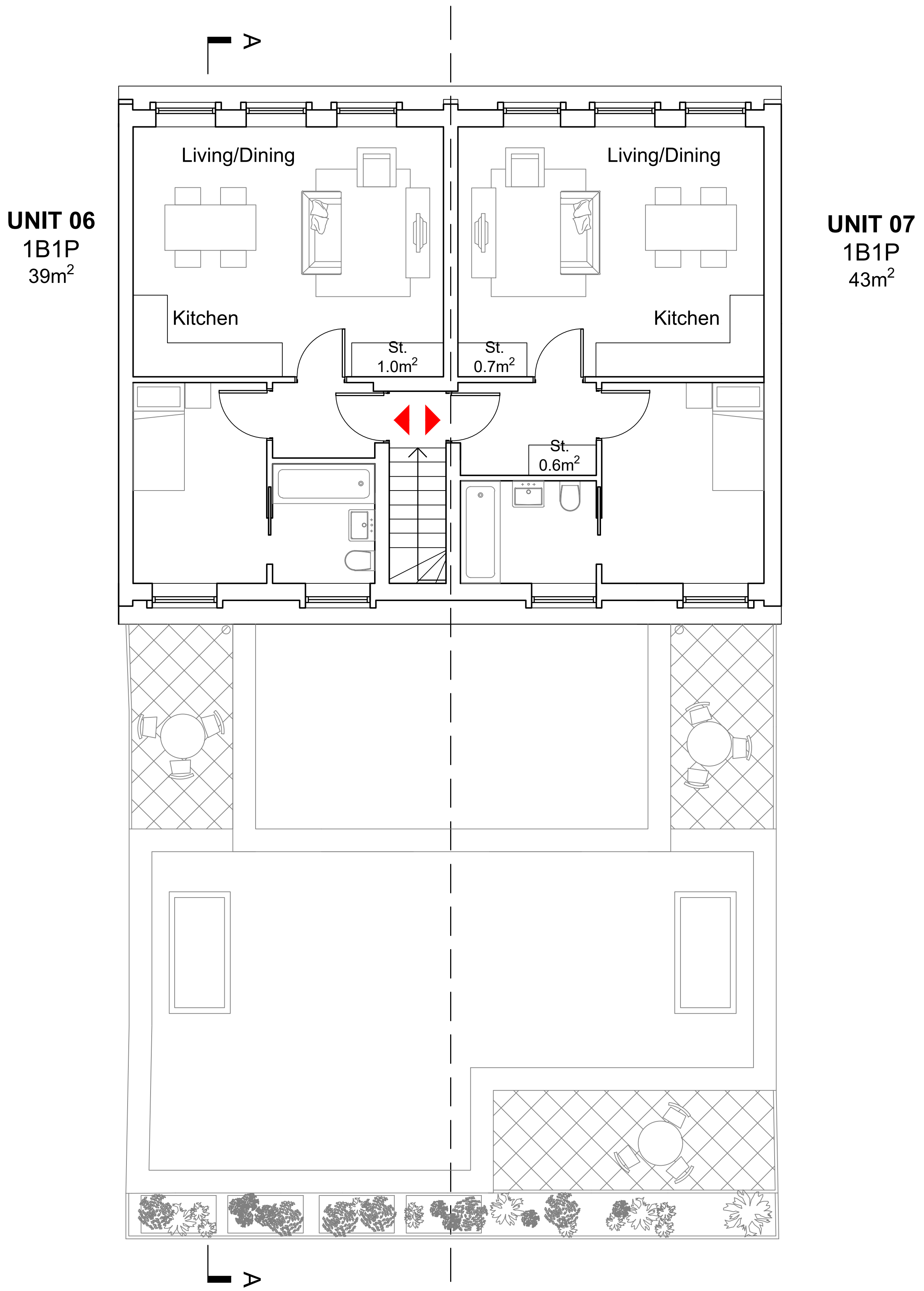
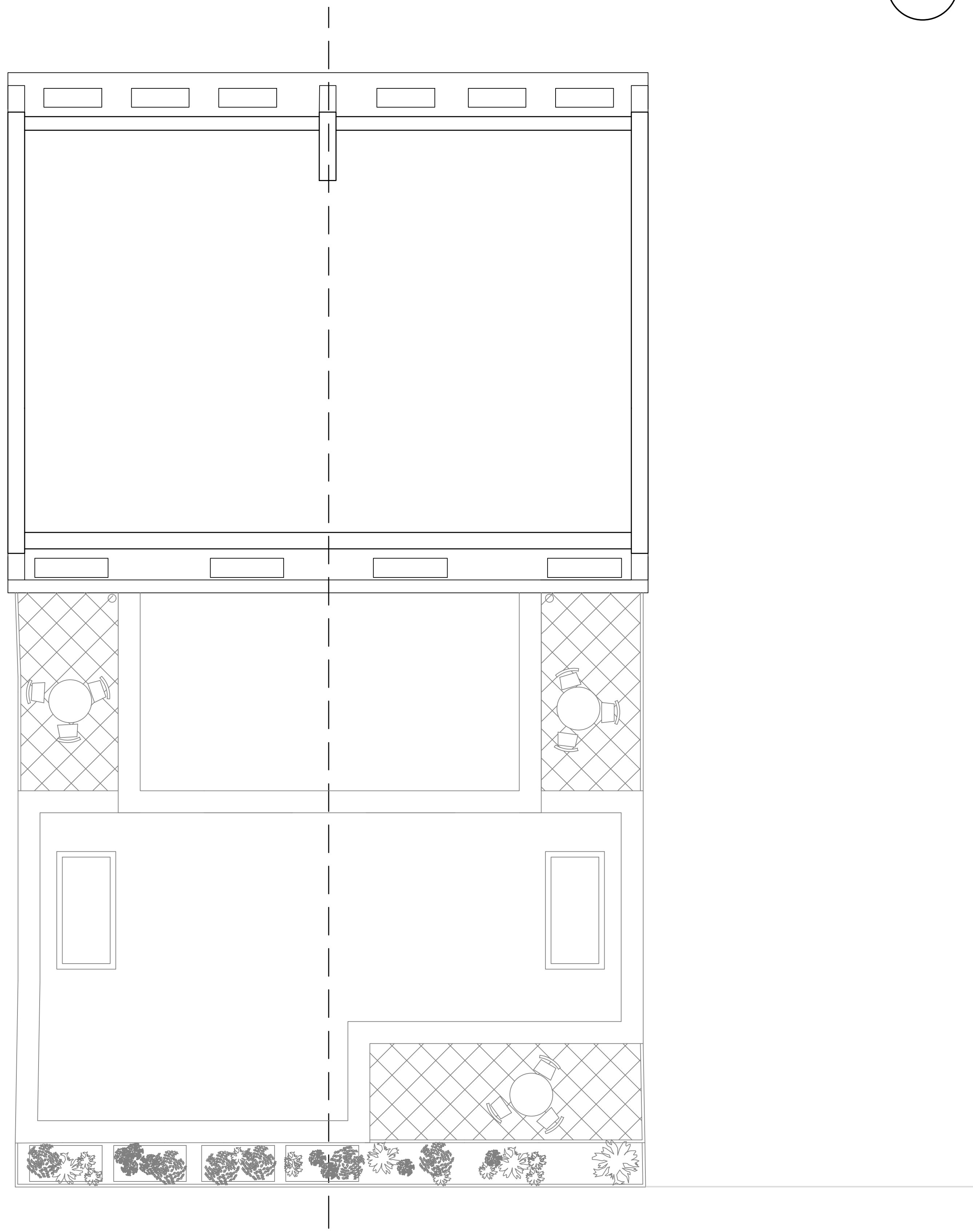


Proposed Second Floor Plan



Proposed Roof Plan

REV	AMENDMENTS	DATE

PROJECT
New Broadway/ Hampton Road

DRAWING
Proposed Ground Floor Plan and Roof Plan

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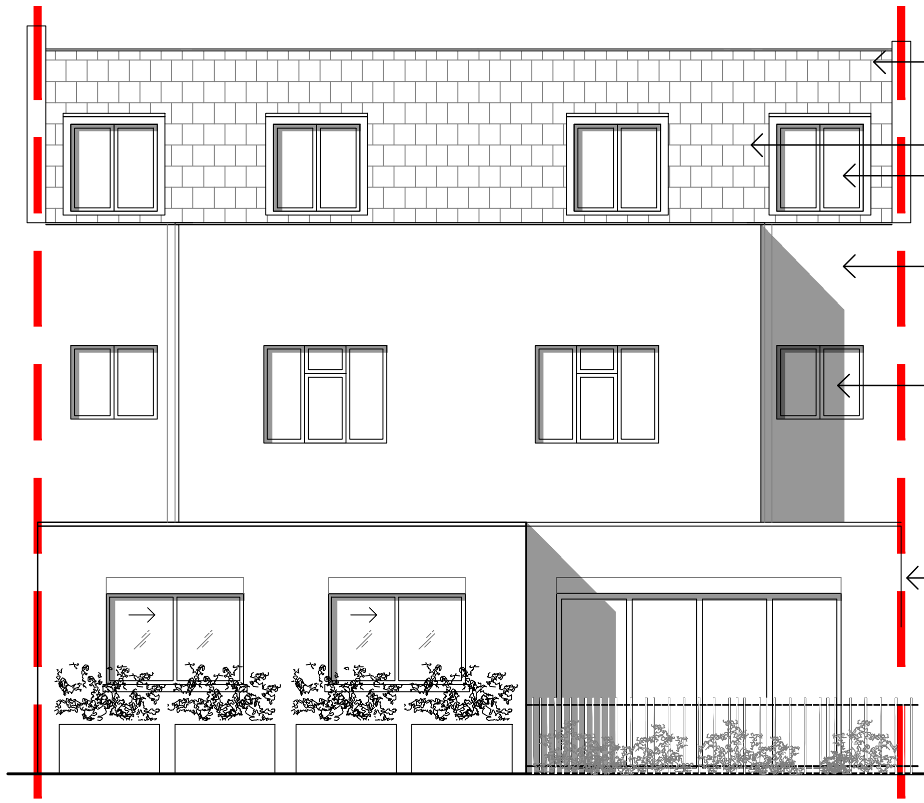
Proposed Front Elevation



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REV	AMENDMENTS	DATE

PROJECT	DRAWING			STATUS	
New Broadway/ Hampton Road	Proposed Elevations			PLANNING	
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	1:100 @ A3	JUNE 2023	MS	2103_PL.05_105	

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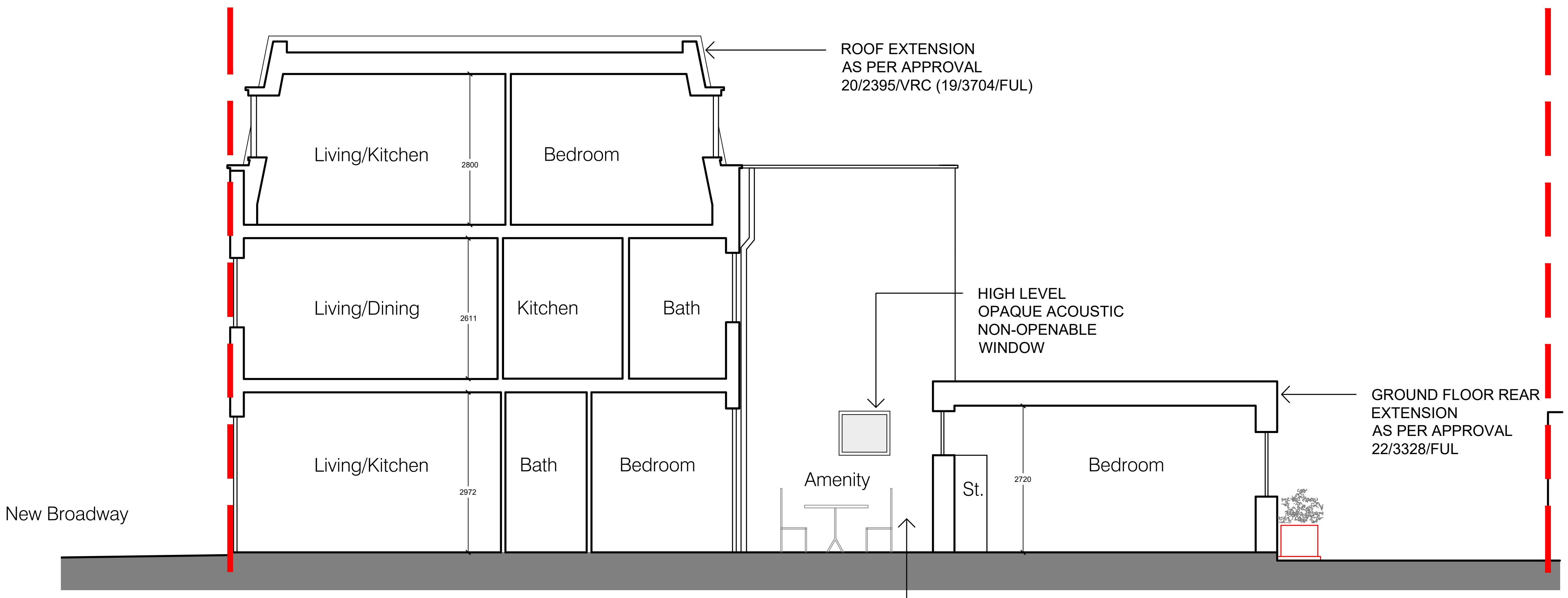


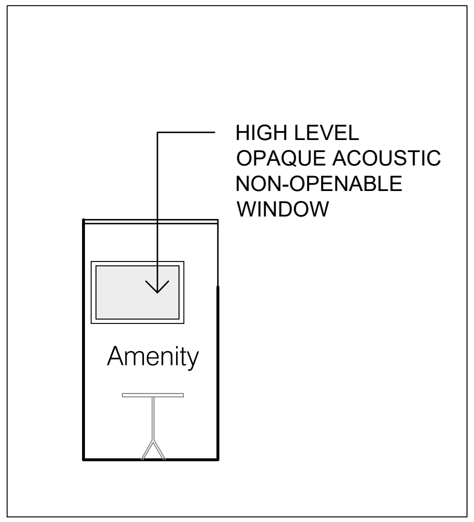
Proposed Section A-A

REV	AMENDMENTS	DATE

PROJECT New Broadway/ Hampton Road	DRAWING Proposed Section A-A		STATUS PLANNING
CLIENT	SCALE 1:100 @ A3	DATE JUNE 2023	CHECKED MS
DRAWING No. 2103_PL.05_110	REVISION		

Mark Smith Architects Limited

Proposed Section B-B



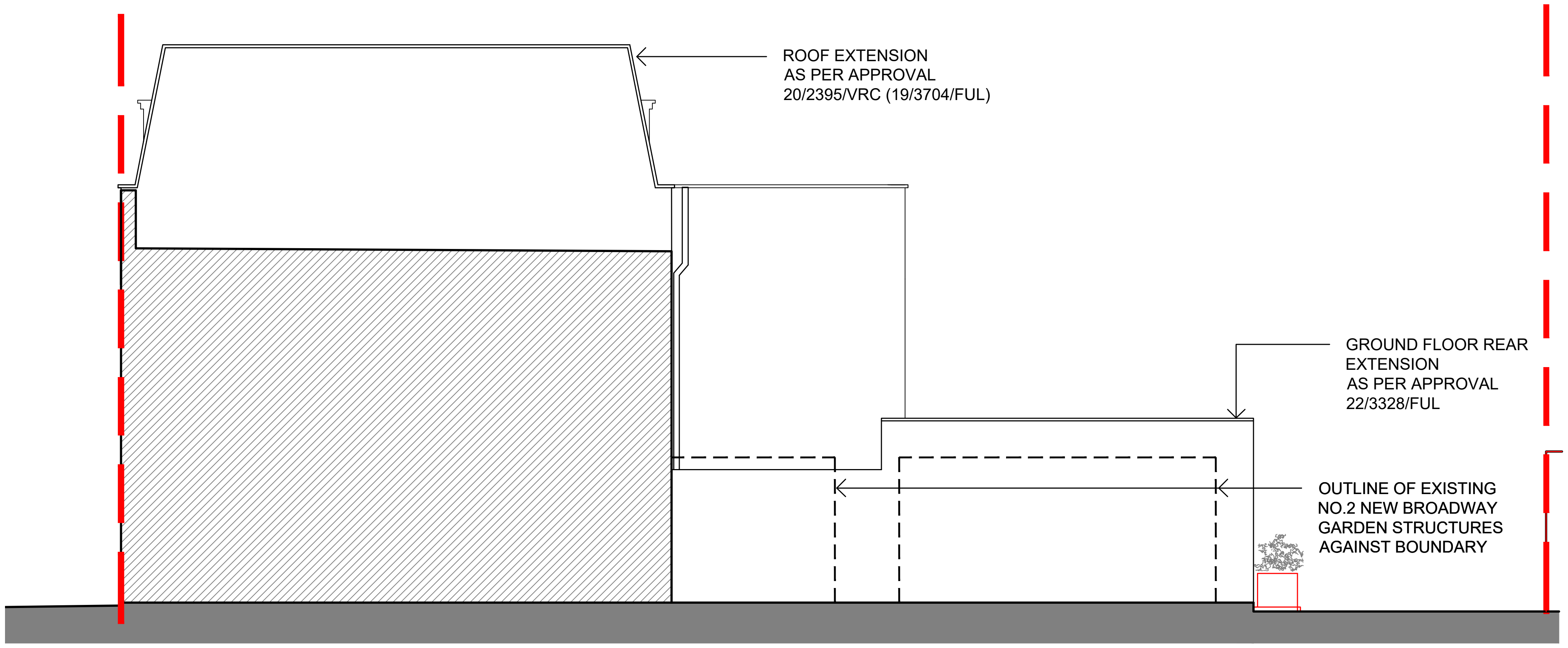
Proposed End Courtyard Elevation

All dimensions to be checked on site prior to construction or manufacture. Refer also to written specification of works where applicable. No dimensions should be scaled from this drawing for construction purposes. Any discrepancies found between this drawing and other drawings should be referred to consultants immediately.

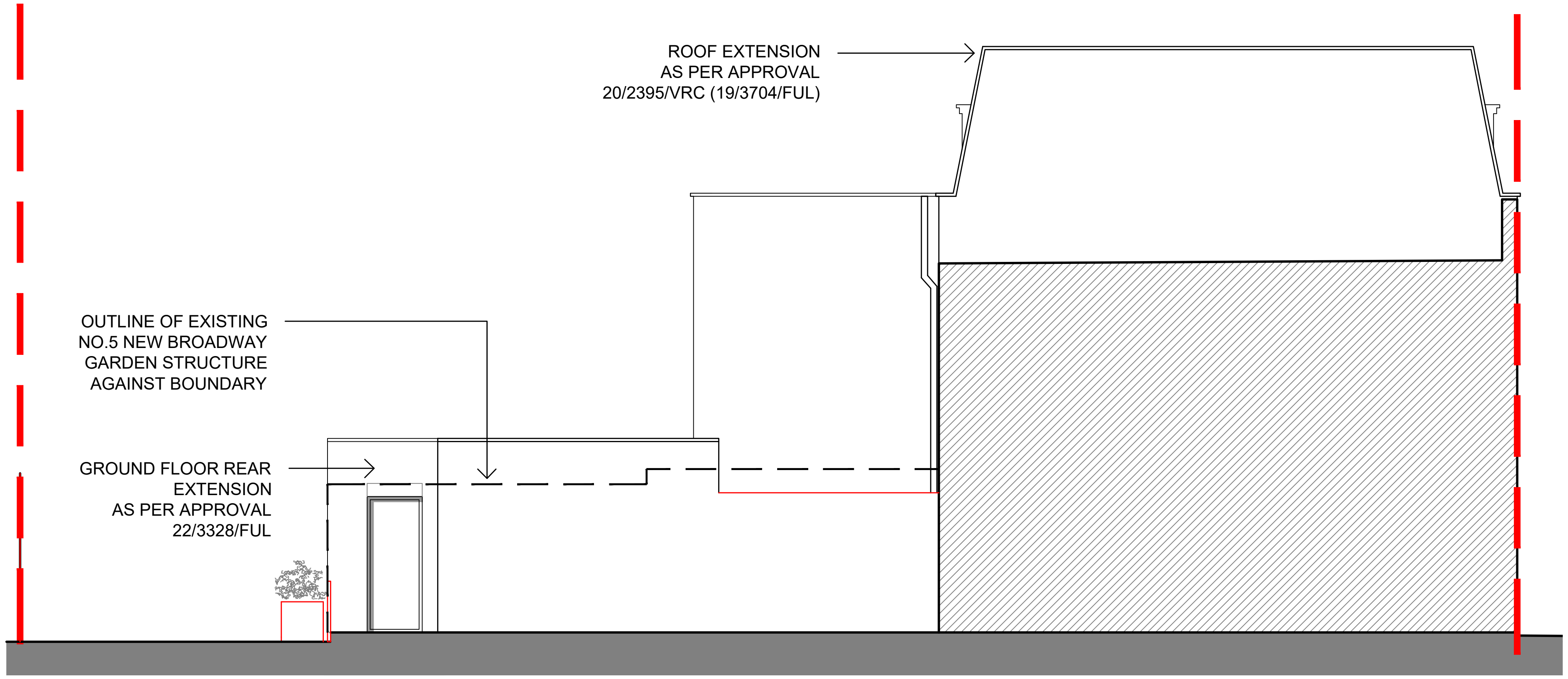
REV	AMENDMENTS	DATE

PROJECT New Broadway/ Hampton Road	DRAWING Proposed Section B-B		STATUS PLANNING	
CLIENT	SCALE 1:100 @ A3	DATE JUNE 2023	CHECKED MS	DRAWING No. 2103_PL.05_111	REVISION

Mark Smith Architects Limited



Proposed West Elevation



Proposed East Elevation

All dimensions to be checked on site prior to construction or manufacture. Refer also to written specification of works where applicable. No dimensions should be scaled from this drawing for construction purposes. Any discrepancies found between this drawing and other drawings should be referred to consultants immediately.

REV	AMENDMENTS	DATE

PROJECT	DRAWING	STATUS
New Broadway/ Hampton Road	Proposed Side Elevations	PLANNING

CLIENT	SCALE	DATE	CHECKED	DRAWING No.	REVISION
	1:100 @ A3	JUNE 2023	MS	2103_PL.05_120	

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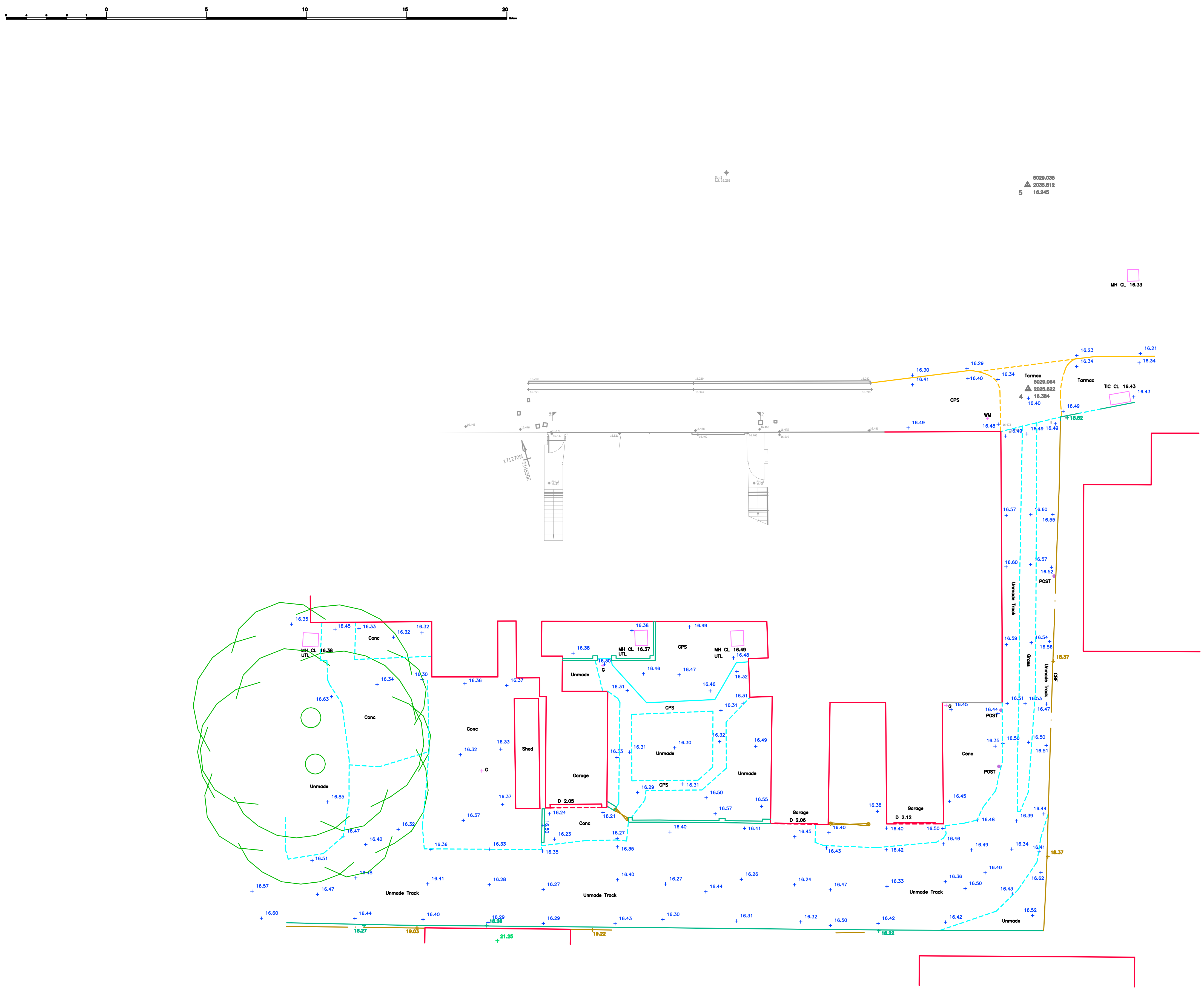
Appendix B: Topographic Survey



SURVEYED BY

ABM surveys

BASEPOINT BUSINESS CENTRE
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OUR REF 3970

LEGEND

	SURVEY STATION	—W—	FRESH WATER
	BANK	—E—	O/H ELECTRICITY
	CEILING HEIGHT	– –E– –	U/G ELECTRICITY
	FLOOR BOARD DIRECTION	—T—	O/H TELEPHONE
+ 12.34	LEVEL POSITION	– –T– –	U/G TELEPHONE
	REGISTRATION MARK	– –G– –	GAS
	SAPLING	—CTV—	CABLE TELEVISION
0.3/7/6	GIRTH/HEIGHT/SPREAD (Diameter)		FOUL DRAINAGE
			STORM DRAINAGE
			HEDGE
			FENCE

ABBREVIATIONS (Where Applicable)

AC	AIR CONDITIONING UNIT	IC	INSPECTION COVER
AH	ARCH HEIGHT	IL	INVERT LEVEL
ASS	ASSUMED CONNECTION	LP	LAMP POST
AV	AIR VALVE	MH	MANHOLE
B	BEAM HEIGHT	MKR	MARKER
BGP	BREAK GLASS POINT	NB	NOTICE BOARD
BOL	BOLLARD	NFI	NO FURTHER INFORMATION
BW	BRICK WALL	NP	STREET NAME PLATE
CAM	CAMERA	O/H	OVERHEAD
CD	CABLE DUCT	P	POST
CE	CLEANING EYE	PL	PAVEMENT LIGHT
CL	COVER LEVEL	RAD	RADIATOR
CM	CABLE MARKER	RG	ROAD GULLEY
CONC	CONCRETE	RS	ROAD SIGN
CPS	CONC. PAVING SLABS	RSJ	ROLLED STEEL JOIST
CSU	CEILING SLOPES UP	RW	RETAINING WALL
CTV	CABLE TELEVISION	RWP	RAIN WATER PIPE
D	DOOR HEIGHT	SC	STOP COCK
DP	DOWN PIPE	SH	SPRING HEIGHT
ECP	ELEC. CABLE PIT	SKL	SKY LIGHT
EIC	ELECTRICITY IC	SL	SUMP LEVEL
EJB	ELEC. JUNCTION BOX	SV	SLUICE VALVE
EP	ELECTRICITY POLE	SVP	SOIL VENT PIPE
ER	EARTHING ROD	TCB	TELEPHONE CALL BOX
F	FALSE	TIC	TELECOMMUNICATIONS IC
FH	FIRE HYDRANT	TL	THRESHOLD LEVEL
FIG	FEEDS INTO GROUND	TP	TELEPHONE POLE
FL	FLOOR LEVEL	TS	TRAFFIC SIGNAL
FP	FEEDER PILLAR	TSCU	TS CONTROL UNIT
G	GULLEY	UTL	UNABLE TO LIFT
GV	GAS VALVE	VP	VENT PIPE
H	HEIGHT	WH	WINDOW HEAD HEIGHT
HB	HAND BASIN	WM	WATER METER
HD	HEATING DUCT	WS	WINDOW SILL HEIGHT
HYD	HYDRANT	WV	WATER VALVE

FENCE TYPES AND DETAILS

BWF	BARBED WIRE	PRF	POST & RAIL
CBF	CLOSED BOARDED	PWF	POST & WIRE
CLF	CHAIN LINK	PF	PANEL
CPF	CHESTNUT PALING	RF	RAILINGS
IRF	IRON RAILINGS	(SEC)	SECURITY
OBF	OPEN BOARDED		

LEVEL DATUM

DATUM USED : PREVIOUS SURVEY

REVISION

No.	DATE	REVISION

REDTREE VENTURES

JOB TITLE

NEW BROADWAY
HAMPTON HILL
TW12 1JG

DRAWING TITLE

SITE SURVEY

SCALE		Drawing No:
1/100		
DATE	SHEET SIZE	
OCT 20	A1	

Appendix C: Drainage Drawings and Calculations

Print | Close Report

HR Wallingford — Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	andrew wallace
Site name:	New Broadway
Site location:	Hampton

Site Details

Latitude:	51.42852° N
Longitude:	0.35363° W
Reference:	3235447309
Date:	Jan 24 2023 11:49

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach IH124

Site characteristics

Total site area (ha): .0286

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics	Default	Edited
SAAR (mm):	599	599
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

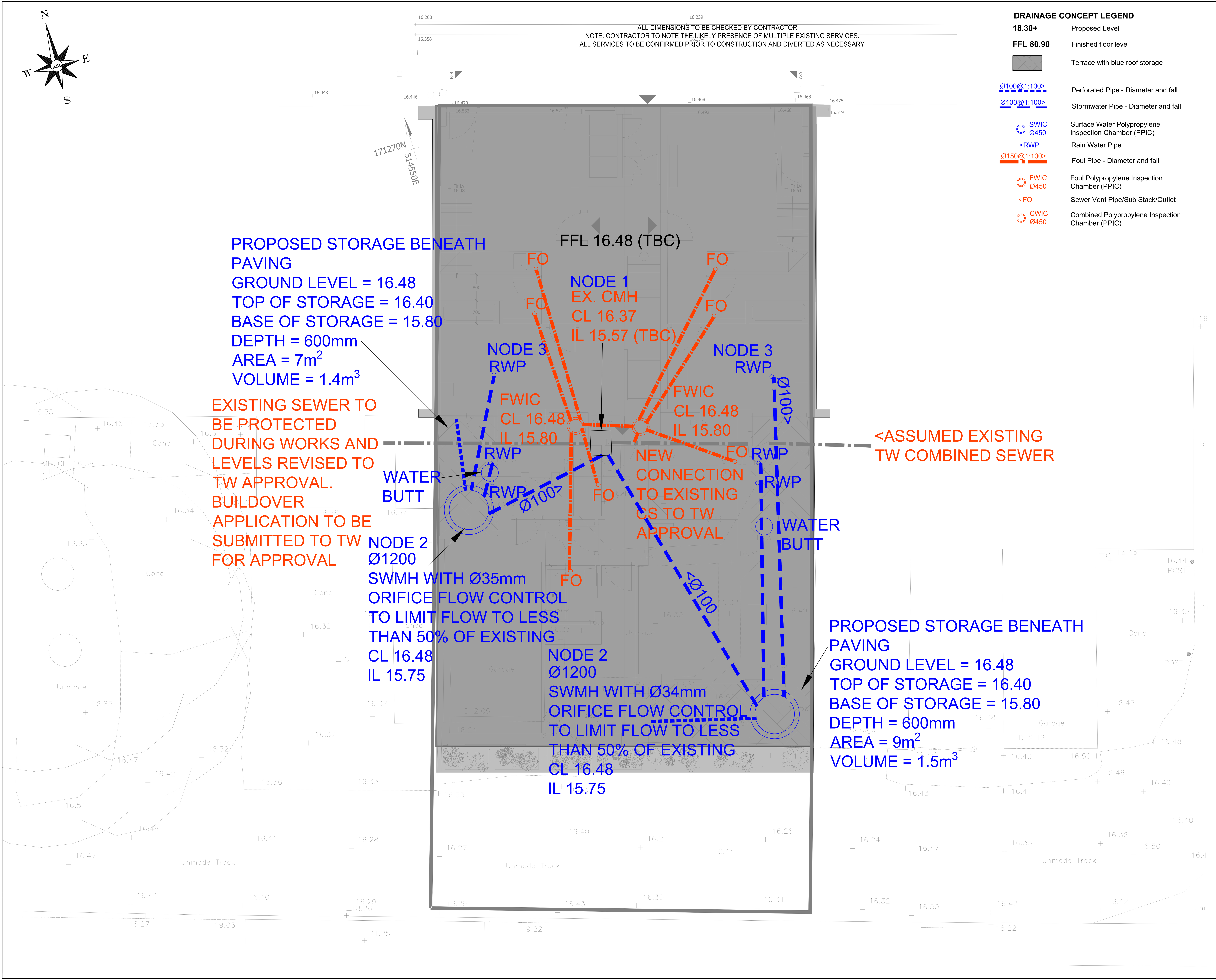
(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	0.04	0.04
1 in 1 year (l/s):	0.04	0.04
1 in 30 years (l/s):	0.1	0.1
1 in 100 year (l/s):	0.14	0.14
1 in 200 years (l/s):	0.16	0.16



Job. No.	P4931J2730	Rev.

DRAINAGE NOTES

1. THIS DRAWING IS FOR PLANNING ONLY AND IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT SERIES DESIGN DRAWINGS, SPECIFICATIONS AND DOCUMENTATION.
2. CONSTRUCTION TO BE IN ACCORDANCE WITH ALL BRITISH AND EUROPEAN STANDARDS AND BUILDING REGULATIONS.
3. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES ABOVE LOCAL DATUM.
4. ANY DISCREPANCIES IN THE DETAILS SHOWN ARE TO BE REPORTED TO THE EMPLOYER'S REPRESENTATIVE/ENGINEER PRIOR TO CONSTRUCTION.
5. ALL EXISTING SERVICES ARE TO BE LOCATED PRIOR TO THE COMMENCEMENT OF ANY WORKS. THE CONTRACTOR MUST NOTIFY THE ENGINEER IMMEDIATELY OF ANY CONFLICT WITH THE PROPOSED WORKS.
6. THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD, FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1. SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.
7. NODE NUMBERS REFER TO CALCULATIONS WITHIN DRAINAGE REPORT.
8. ALL DRAINAGE SHOWN IS SUBJECT TO DETAILED DESIGN AND IS NOT FOR CONSTRUCTION.
9. ALL RWP AND FO SHOWN ARE INDICATIVE ONLY AND SUBJECT TO APPROVAL AND SETTING OUT BY THE ARCHITECT.
10. UNLESS NOTED OTHERWISE, PIPES TO BE:
    FOUL PIPES UNDER BUILDING ø100@1:40,
    FOUL PIPES EXTERNAL ø100@1:80,
    SURFACE WATER PIPES ø150@1:100

Notes.

Key dimensions to be checked by engineer before major structural works commence on site.

1. This survey has been computed and drawn about O S National Grid.
2. All levels are in metres and relate to O S National Datum by GPS instruments.
3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

Rev	Date		By	Chkd
A	27/01/23	For Planning	AW	AW
B	21/07/23	For Planning	AW	AW

JOMAS
ENGINEERING
ENVIRONMENTAL
Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

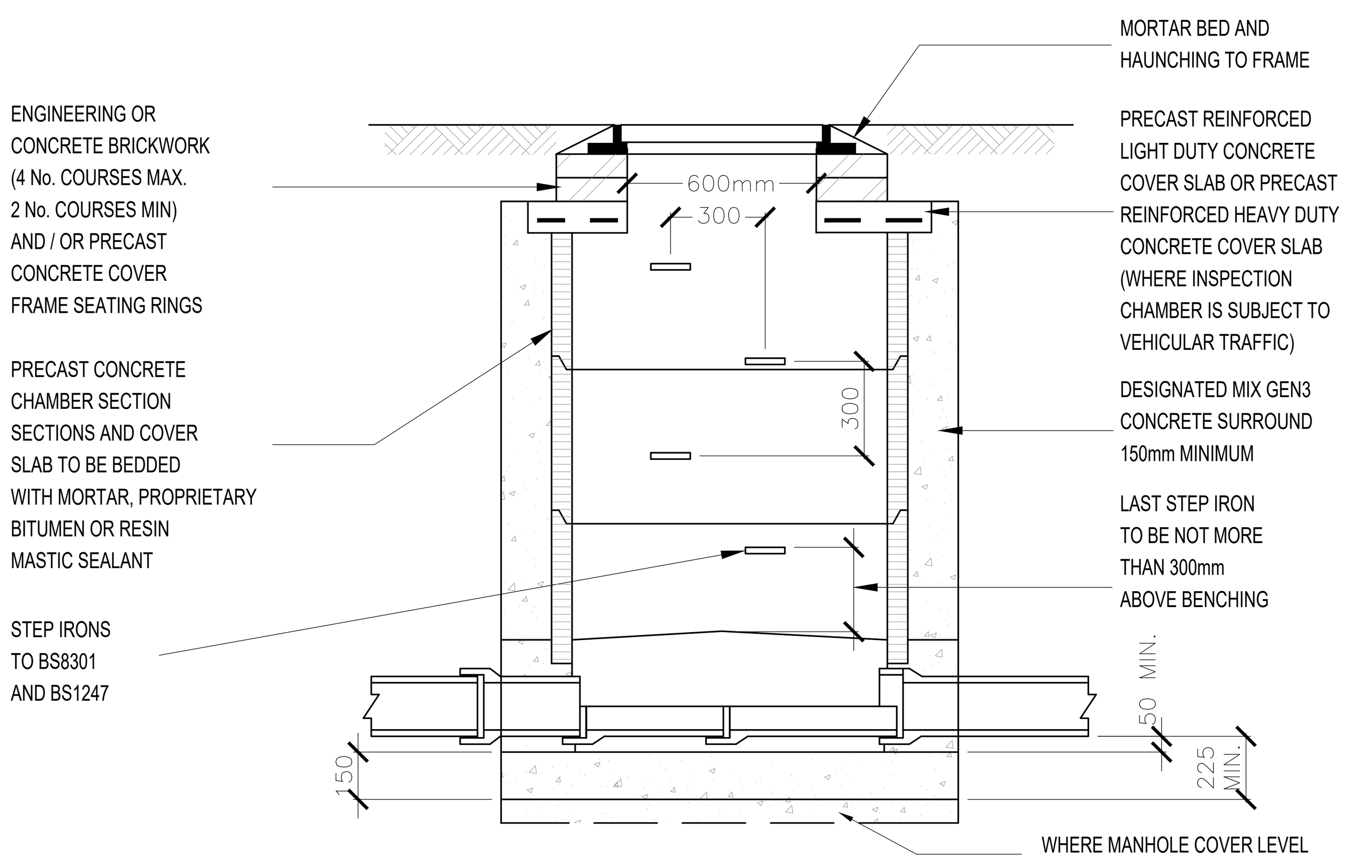
Project
3-4 New Broadway, Hampton, TW12 1JG

Drawing
Proposed Drainage Plan

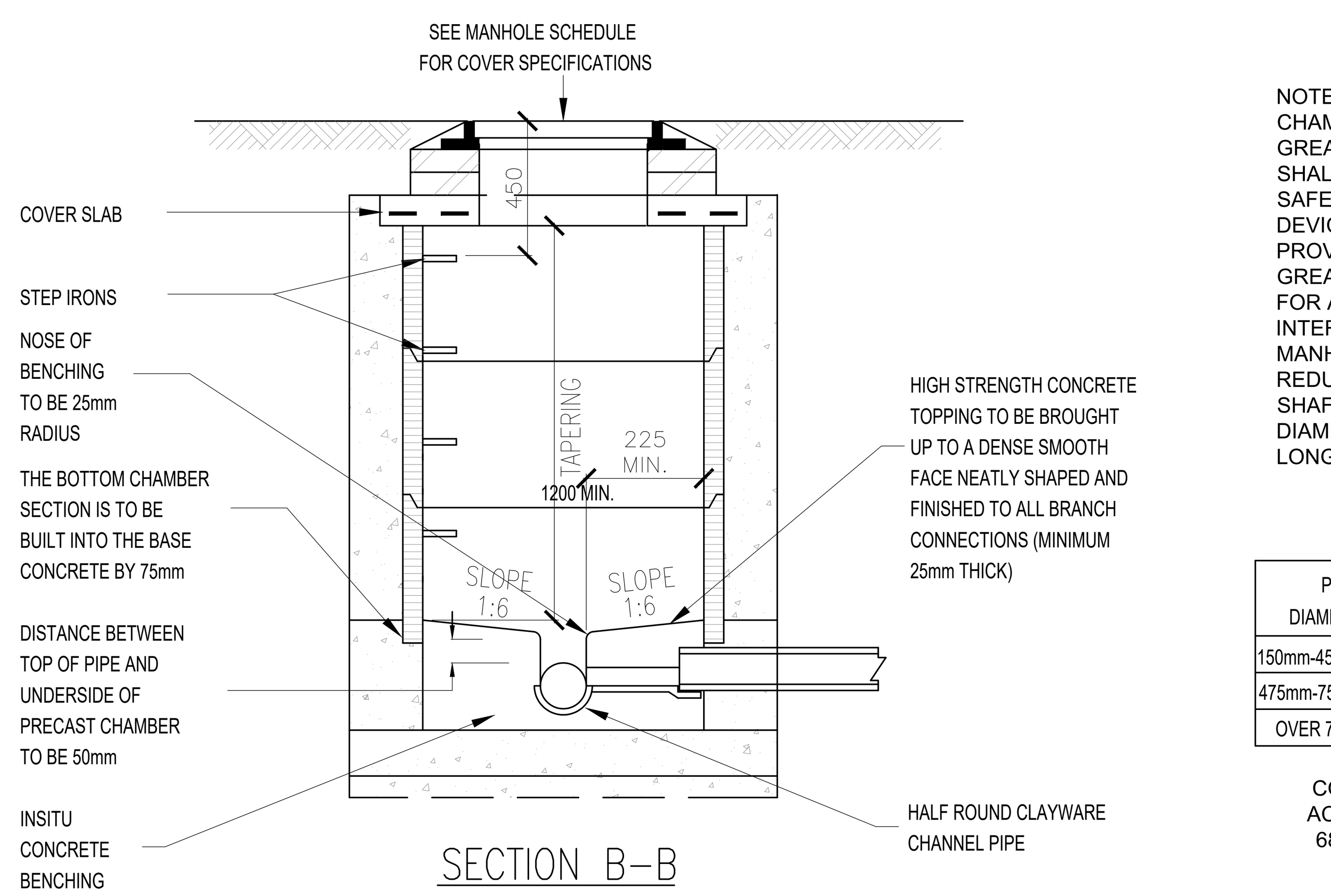
Dwg no	Checked	Surveyor
C01	AW	-
Date 24.01.23	Scale 1:50 @ A1	
Job No. P4931J2730		Rev. B
Grid	Contours	Level Datum

ALL DIMENSIONS TO BE CHECKED BY CONTRACTOR

NOTE: Details for private drainage only.



SECTION A-A



SECTION B–B

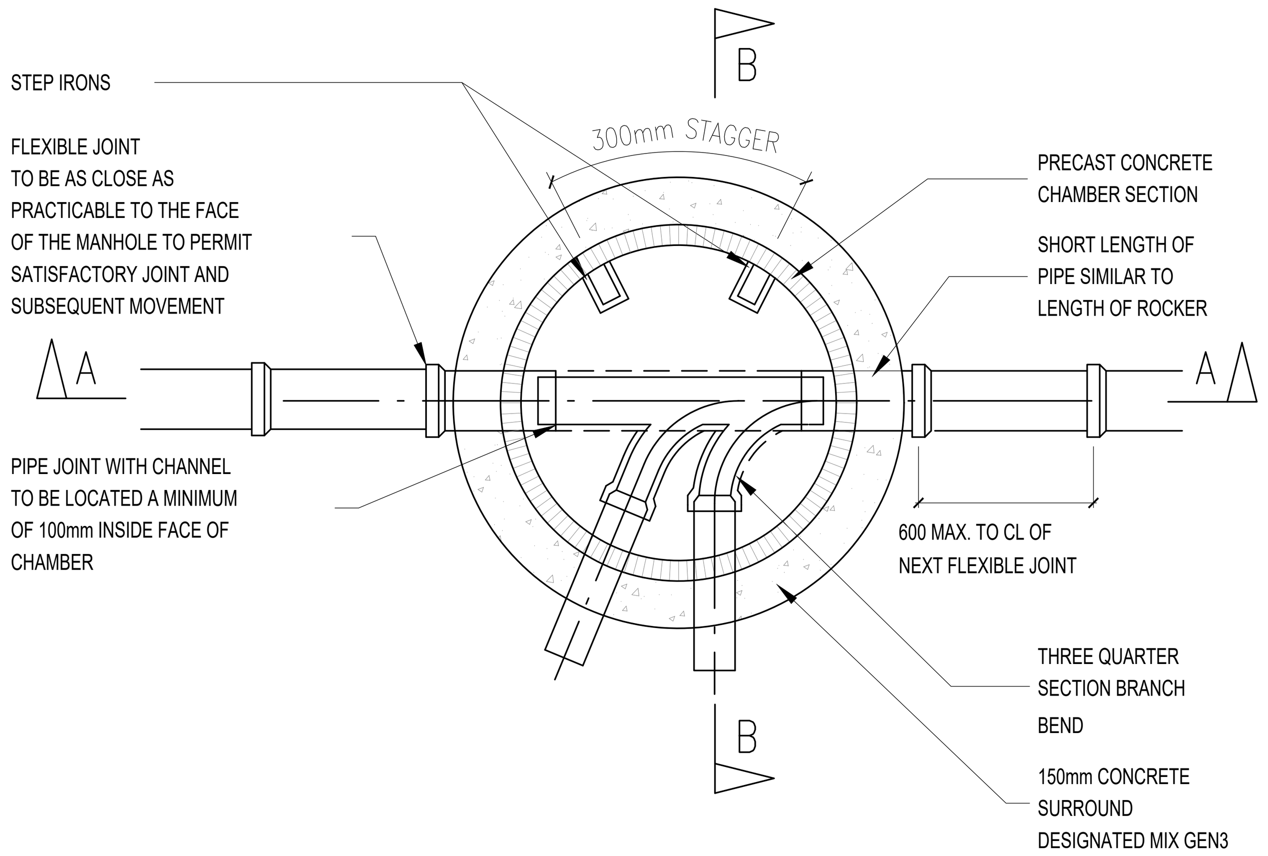
PRECAST CONCRETE MANHOLE TYPE B (PCC) IN EXTERNAL AREAS DETAIL

SCALE 1:20

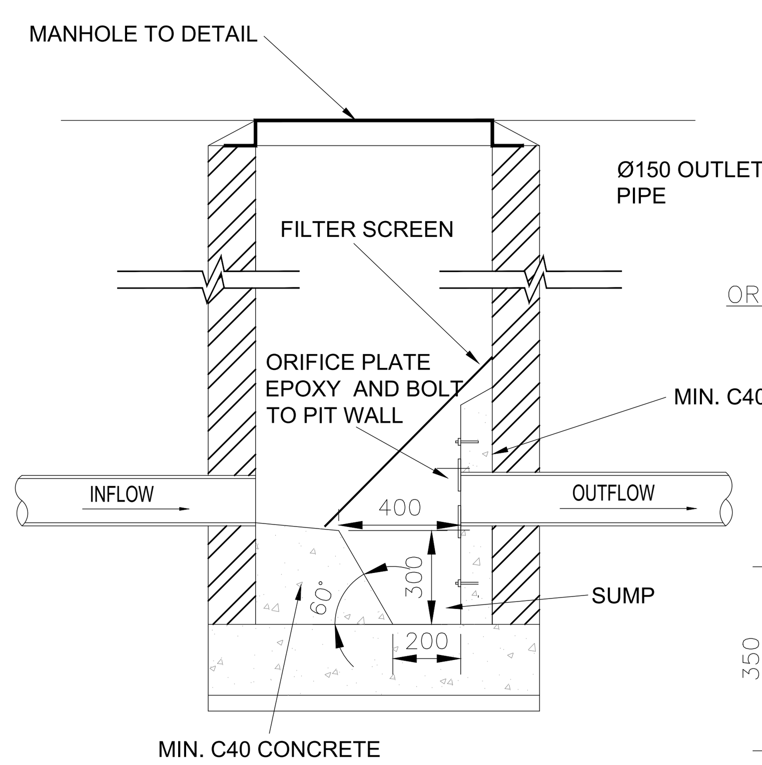
NOTES:
CHAMBERS WITH OUTGOING PIPES GREATER THAN 500mm DIAMETER SHALL BE FITTED WITH GUARD BARS, SAFETY CHAINS OR OTHER SAFETY DEVICES. TOE HOLES TO BE PROVIDED IN BENCHING OF SEWERS GREATER THAN 450mm DIAMETER FOR ACCESS TO INVERT. WHERE INTERNAL HEIGHT EXCEEDS 1800mm MANHOLE MAY BE PROVIDED WITH REDUCING COVER AND SHAFT. SHAFT DIAMETER TO BE 600mm DIAMETER OR 900mm DIAMETER IF LONGER THAN 900mm.

PIPE DIAMETER	ROCKER PIPE * LENGTH
150mm-450mm	500mm-750mm
475mm-750mm	750mm-1000mm
OVER 750mm	1200mm

* OR LINTEL AND COMPRESSIBLE SEALANT IN ACCORDANCE WITH CLAUSE 689 OF THE SPECIFICATION.

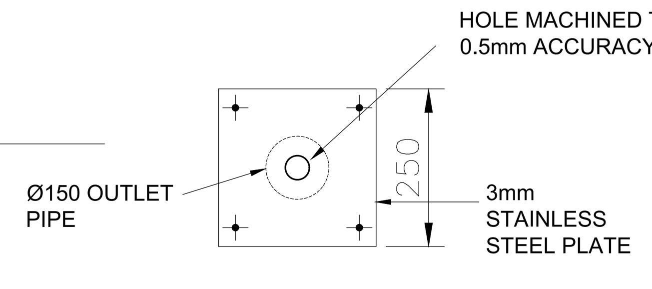


PLAN



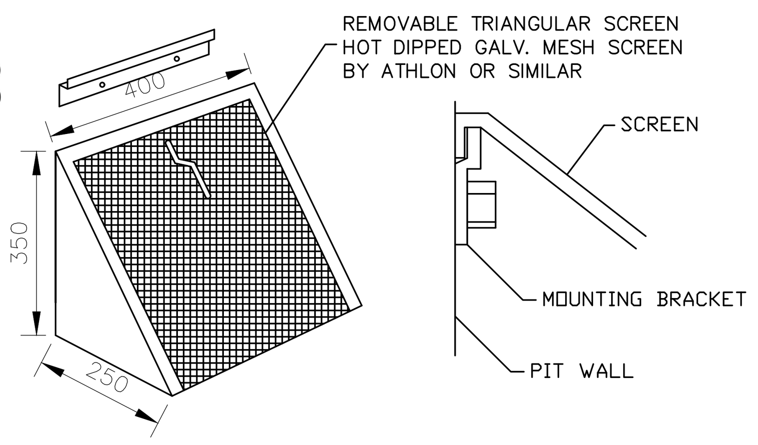
ORIFICE PLATE MANHOLE

NOT TO SCALE

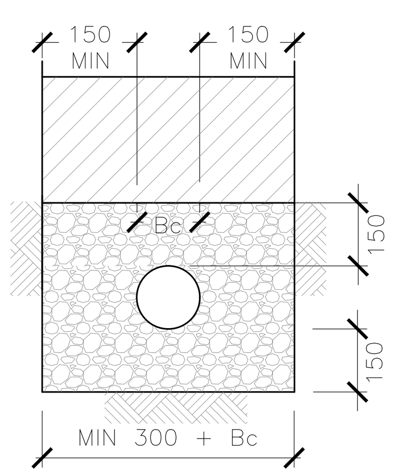


ORIFICE PLATE ELEVATION

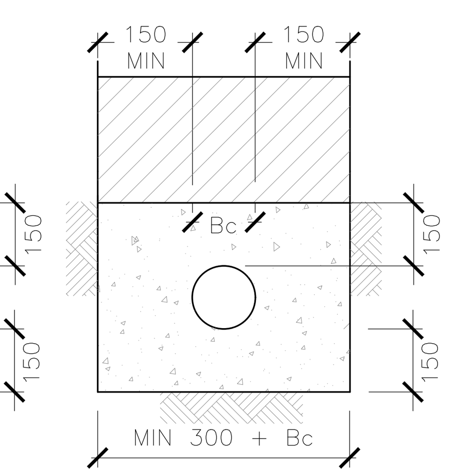
SCALE 1:20



MULTI PURPOSE FILTER SCREEN



GENERAL PIPE BEDDING DETAIL



PIPE BEDDING DETAIL FOR ALL PIPES THAT PASS BELOW OR NEAR FOUNDATIONS, PIPES WITH LESS THAN 600mm COVER IN ALL EXTERNAL AREAS AND PIPES WITH LESS THAN 1200mm COVER BELOW ROADS AND DRIVEWAYS

SELECTED FILL: FREE FROM STONES LARGER THAN 40mm, LUMPS OF CLAY OVER 100mm, TIMBER, FROZEN MATERIAL, VEGETABLE MATTER.

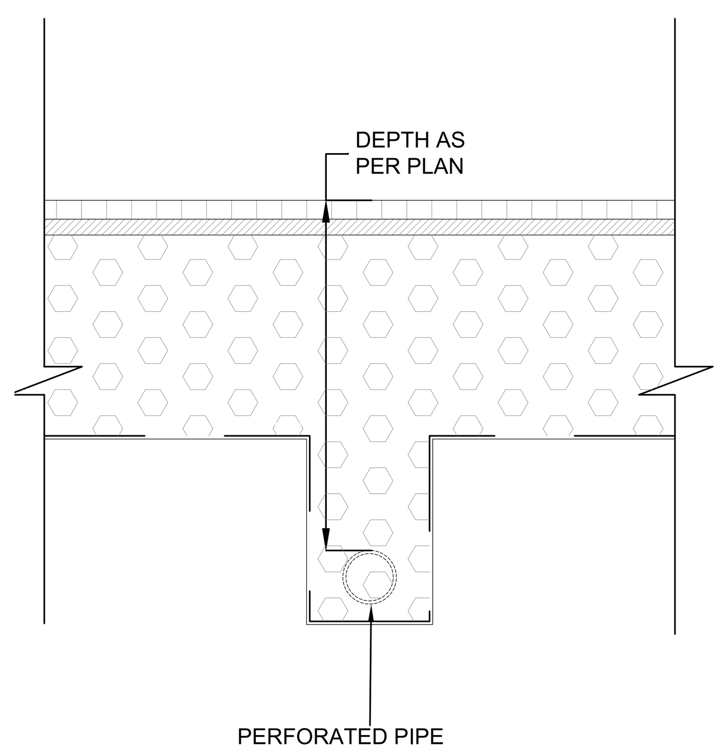
GRANULAR MATERIAL: TO CONFORM TO BS EN 1610 ANNEX B TABLE B.15 AND SHOULD BE SINGLE SIZE MATERIAL OR GRADED MATERIAL FROM 5mm UP TO A MAXIMUM SIZE OF 10mm FOR 100mm PIPES, 14mm FOR 150mm PIPES, 20mm FOR PIPES FROM 150mm UP TO 600mm DIAMETER AND 40mm FOR PIPES MORE THAN 600mm DIAMETER.

GEN1 CONCRETE IN ACCORDANCE WITH BS 8500–1:2002.

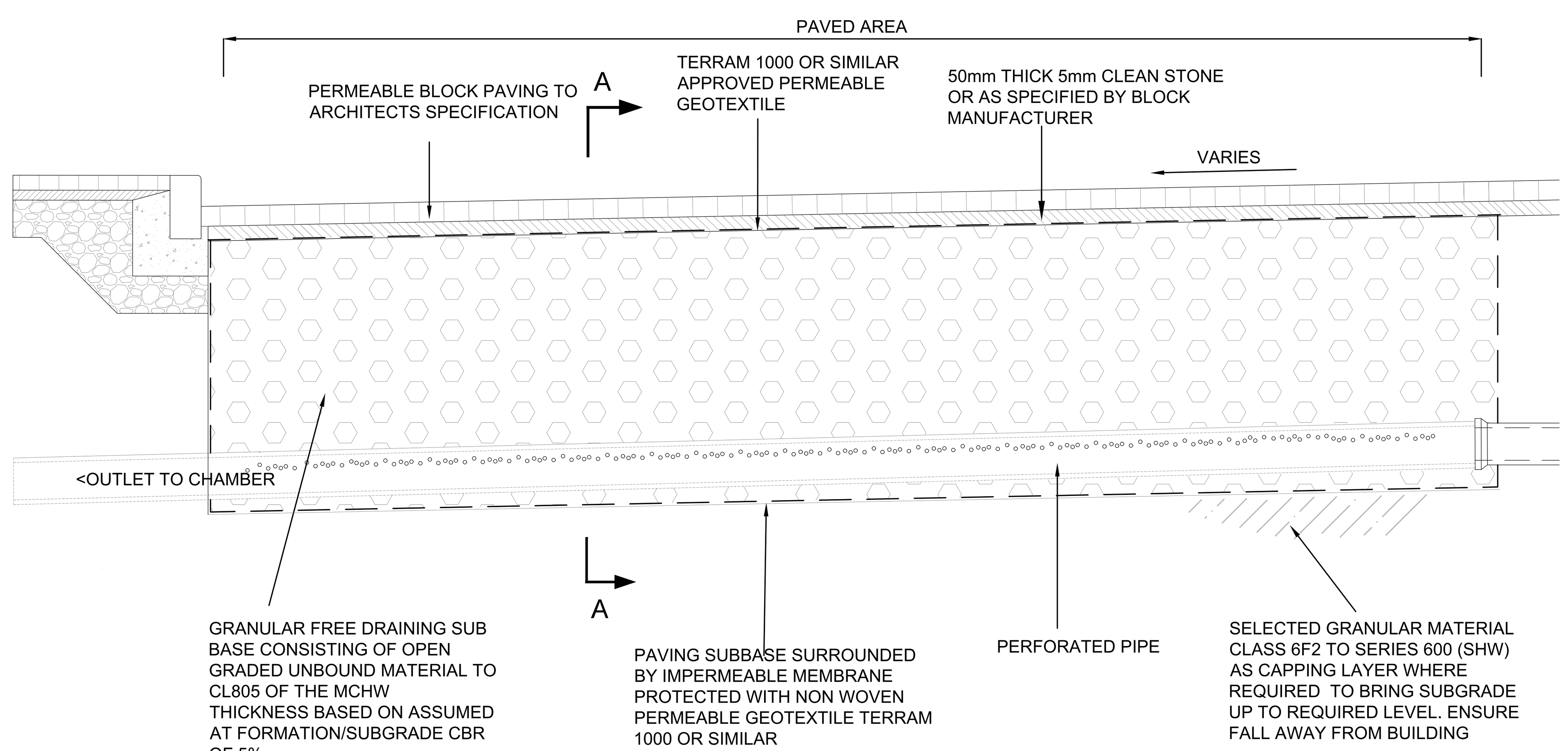
NOTE:
PIPES LESS THAN 1200mm BELOW ROADS AND LESS THAN 600mm BELOW OTHER EXTERNAL AREAS SHALL HAVE A 150mm GEN1 CONCRETE SURROUND. OTHER THAN PIPES CAST WITHIN PILECAPS ALL PIPES BELOW SUSPENDED SLAB SHALL HAVE GRANULAR SURROUND AS SHOWN.

PIPE BEDDING DETAIL

SCALE 1:10



SECTION A-A



PERMEABLE PAVING DETAIL

SCALE 1:20

Job. No. P4931J2730 | Rev.

NOTES

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5. FOR GRAVITY SEWERS, ALL DRAINAGE AND FITTINGS ARE TO BE FLEXIBLY JOINTED UPVC TO BS EN 1401–1 OR CLAYWARE TO BS EN295 OR CONCRETE TO BS5911 PART 100
6. CHAMBER WALLS 225 THICK TO BE CONSTRUCTED IN CLASS B ENGINEERING BRICKS TO SHW SERIES 2400 IN DESIGNATION (i) MORTAR OR IN–SITU STRENGTH CLASS C16/20 CONCRETE TO CLAUSE 2602
7. CHAMBER WALLS AND COVER SLAB TO BE CONSTRUCTED IN PRECAST CONCRETE TO BS EN 1917 AND BS 5911–3.
8. CONCRETE MIXES INDICATED ON THIS DRAWING ARE DESIGNATED MIXES IN ACCORDANCE WITH BS8500–1:2006. ALL CONCRETE TO BE SULPHATE RESISTANT
9. BACKFILL TO ALL TRENCHES UNDER CARRIAGEWAYS TO BE TYPE 1 SUB–BASE MATERIAL, ELSEWHERE BACKFILL TO BE IN ACCORDANCE WITH THE SPECIFICATION, FREE DRAINING READILY COMPACTIBLE MATERIAL, FREE FROM RUBBISH AND ORGANIC MATTER, FROZEN SOIL CLAY LUMPS AND LARGE STONES. TO BE COMPACTED IN LAYERS NOT EXCEEDING 150mm THICK.
10. A FLEXIBLE JOINT SHALL BE PROVIDED AS CLOSE AS IS FEASIBLE TO OUTSIDE FACE OF ANY STRUCTURE INTO WHICH A PIPE IS BUILT, IN ACCORDANCE WITH THE DETAIL.
11. THE GENERAL SPECIFICATION OF MATERIALS AND WORKMANSHIPS FOR THE CONSTRUCTION OF THE ACCESS ROAD, FOOTPATHS AND OTHER AREAS OF HARDSTANDING SHALL BE THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS, VOLUME 1. SPECIFICATION OF HIGHWAY WORKS (SHW) PUBLISHED BY THE STATIONARY OFFICE.
12. ALL PIPES TO BE LAID SOFFIT TO SOFFIT UNLESS NOTED OTHERWISE.
13. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH BS EN124 AND SHALL BE OF A NON–ROCKING DESIGN WHICH DOES NOT RELY ON THE USE OF CUSHION INSERTS. CLASS D COVERS SHALL BE USED IN CARRIAGEWAYS, HARD SHOULDERS AND PARKING AREAS USED BY ALL TYPE OF ROAD VEHICLES. CLASS C SHALL BE USED IN FOOTWAYS, PEDESTRIAN AREAS AND ALL COMPARABLE LOCATIONS.

Notes.

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B	21/07/23	For Planning	AW	AW

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Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

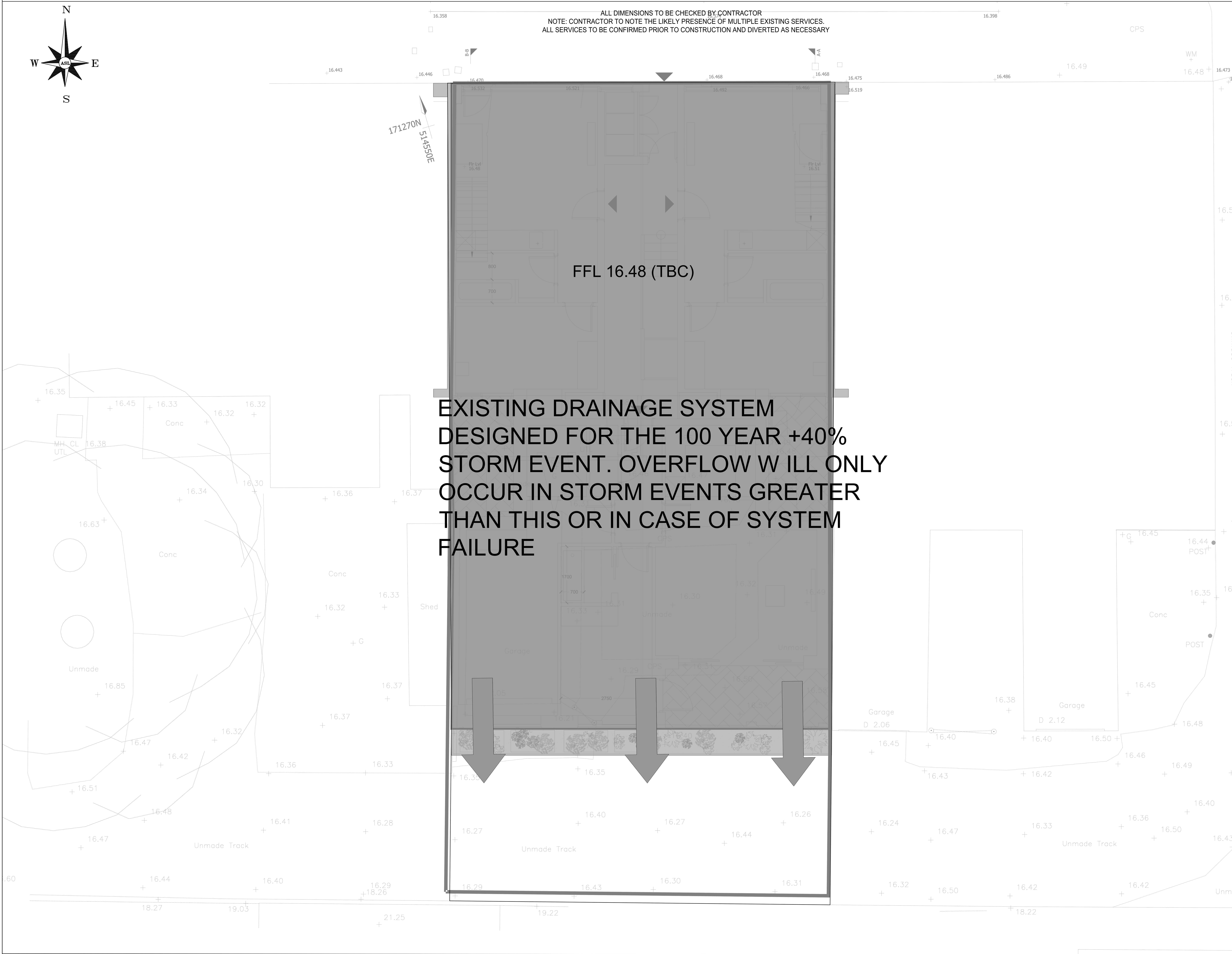
Project
3-4 New Broadway, Hampton, TW12 1JG

Drawing
Proposed Drainage Details

Dwg no	Checked	Surveyor
C02	AW	-
Date 24.01.23	Scale AS SHOWN	

Job No. P4931J2730 | Rev. B

Grid | Contours | Level Datum



Job. No. **P4931J2730** Rev.

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   FOUL PIPES EXTERNAL Ø100@1:80,
   SURFACE WATER PIPES Ø150@1:100

STORMWATER CONCEPT LEGEND

18.30x Proposed Level

FFL 80.90 Finished floor level

Overland flow

Notes.

Key dimensions to be checked by engineer before major structural works commence on site.

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3. This survey was measured for a scale of 1:100, any subsequent enlargements should be verified on site.

Amendments

Rev	Date		By	Chkd
A	27/01/23	For Planning	AW	AW
B	21/07/23	For Planning	AW	AW

JOMAS
ENGINEERING
ENVIRONMENTAL
Jomas Associates Ltd.
Unit 24 Sarum Complex,
Salisbury Road,
Uxbridge, UB8 2RZ

Project

3-4 New Broadway, Hampton, TW12 1JG

Drawing

Proposed Overland Flow

Dwg no	Checked	Surveyor
C03	AW	-
Date 24.01.23	Scale 1:50	

Job No. **P4931J2730** Rev. B

Grid | Contours | Level Datum

Design Settings

Rainfall Methodology	FEH-13
Return Period (years)	10
Additional Flow (%)	0
CV	0.750
Time of Entry (mins)	2.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	0.600
Include Intermediate Ground	x
Enforce best practice design rules	x

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)
374	1200
499	1350
749	1500
900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)
1.500	1050
99.999	1200

Circular Link Type

Shape	Circular
Barrels	1
Auto Increment (mm)	75
Follow Ground	x

Available Diameters (mm)

100	150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1			16.500	450	50.000	55.000	0.930
2	0.006	2.00	16.500	1200	50.000	50.000	0.750
3	0.006	2.00	22.500	450	52.000	60.000	0.700
outfall			16.500	450	45.000	55.000	1.015

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	2	1	5.000	0.600	15.750	15.570	0.180	27.8	100	2.09	50.0
1.000	3	2	10.198	0.600	21.800	15.750	6.050	1.7	100	2.03	50.0
1.002	1	outfall	5.000	0.600	15.570	15.485	0.085	58.8	100	2.17	50.0

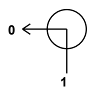
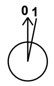
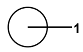
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.470	11.5	1.6	0.650	0.830	0.012	0.0	25	1.038
1.000	6.006	47.2	0.8	0.600	0.650	0.006	0.0	9	2.209
1.002	1.006	7.9	1.6	0.830	0.915	0.012	0.0	31	0.792

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	5.000	27.8	100	Circular	16.500	15.750	0.650	16.500	15.570	0.830
1.000	10.198	1.7	100	Circular	22.500	21.800	0.600	16.500	15.750	0.650
1.002	5.000	58.8	100	Circular	16.500	15.570	0.830	16.500	15.485	0.915

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	2	1200	Manhole	Adoptable	1	450	Manhole	Adoptable
1.000	3	450	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.002	1	450	Manhole	Adoptable	outfall	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	50.000	55.000	16.500	0.930	450		1	1.001	15.570	100
							0	1.002	15.570	100
2	50.000	50.000	16.500	0.750	1200		1	1.000	15.750	100
							0	1.001	15.750	100
3	52.000	60.000	22.500	0.700	450		0	1.000	21.800	100
outfall	45.000	55.000	16.500	1.015	450		1	1.002	15.485	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	19.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m^3/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
10	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node 2 Online Orifice Control

Flap Valve	x	Invert Level (m)	15.750	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.034		

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.5	Invert Level (m)	15.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	22

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	9.0	0.0	0.600	9.0	0.0	0.601	0.1	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	x	Coordinates	x	Full Bore Velocity	x	Time to Half Empty	✓
Node Losses	x	Crossings	x	Proportional Velocity	x	Return Period (years)	30
Link Size	x	Cover Depth	x	Surcharged Depth	x	Discharge Rates	x
Link Length	x	Backdrops	x	Flooding	x	Discharge Volume	x

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	103.832	29.381
1 year 15 minute winter	72.865	29.381
1 year 30 minute summer	67.515	19.105
1 year 30 minute winter	47.379	19.105
1 year 60 minute summer	45.726	12.084
1 year 60 minute winter	30.379	12.084
1 year 120 minute summer	28.340	7.489
1 year 120 minute winter	18.828	7.489
1 year 180 minute summer	21.894	5.634
1 year 180 minute winter	14.231	5.634
1 year 240 minute summer	17.401	4.599
1 year 240 minute winter	11.561	4.599
1 year 360 minute summer	13.397	3.448
1 year 360 minute winter	8.709	3.448
1 year 480 minute summer	10.573	2.794
1 year 480 minute winter	7.024	2.794
1 year 600 minute summer	8.677	2.373
1 year 600 minute winter	5.929	2.373
1 year 720 minute summer	7.750	2.077
1 year 720 minute winter	5.209	2.077
1 year 960 minute summer	6.393	1.683
1 year 960 minute winter	4.235	1.683
1 year 1440 minute summer	4.671	1.252
1 year 1440 minute winter	3.140	1.252
1 year 2160 minute summer	3.372	0.932
1 year 2160 minute winter	2.323	0.932

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 2880 minute summer	2.820	0.756
1 year 2880 minute winter	1.895	0.756
1 year 4320 minute summer	2.149	0.562
1 year 4320 minute winter	1.415	0.562
1 year 5760 minute summer	1.779	0.455
1 year 5760 minute winter	1.151	0.455
1 year 7200 minute summer	1.517	0.387
1 year 7200 minute winter	0.979	0.387
1 year 8640 minute summer	1.329	0.339
1 year 8640 minute winter	0.858	0.339
1 year 10080 minute summer	1.188	0.303
1 year 10080 minute winter	0.767	0.303
10 year 15 minute summer	200.971	56.868
10 year 15 minute winter	141.032	56.868
10 year 30 minute summer	129.855	36.744
10 year 30 minute winter	91.126	36.744
10 year 60 minute summer	86.243	22.792
10 year 60 minute winter	57.298	22.792
10 year 120 minute summer	52.179	13.789
10 year 120 minute winter	34.667	13.789
10 year 180 minute summer	39.634	10.199
10 year 180 minute winter	25.763	10.199
10 year 240 minute summer	31.075	8.212
10 year 240 minute winter	20.646	8.212
10 year 360 minute summer	23.443	6.033
10 year 360 minute winter	15.239	6.033
10 year 480 minute summer	18.333	4.845
10 year 480 minute winter	12.180	4.845
10 year 600 minute summer	14.935	4.085
10 year 600 minute winter	10.205	4.085
10 year 720 minute summer	13.257	3.553
10 year 720 minute winter	8.909	3.553
10 year 960 minute summer	10.821	2.849
10 year 960 minute winter	7.168	2.849
10 year 1440 minute summer	7.784	2.086
10 year 1440 minute winter	5.231	2.086
10 year 2160 minute summer	5.523	1.526
10 year 2160 minute winter	3.806	1.526
10 year 2880 minute summer	4.561	1.223
10 year 2880 minute winter	3.066	1.223
10 year 4320 minute summer	3.418	0.894
10 year 4320 minute winter	2.251	0.894
10 year 5760 minute summer	2.794	0.715
10 year 5760 minute winter	1.808	0.715
10 year 7200 minute summer	2.359	0.602
10 year 7200 minute winter	1.522	0.602
10 year 8640 minute summer	2.048	0.522
10 year 8640 minute winter	1.322	0.522
10 year 10080 minute summer	1.817	0.463
10 year 10080 minute winter	1.173	0.463
30 year 15 minute summer	254.498	72.014
30 year 15 minute winter	178.595	72.014

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 30 minute summer	165.775	46.909
30 year 30 minute winter	116.334	46.909
30 year 60 minute summer	110.635	29.238
30 year 60 minute winter	73.503	29.238
30 year 120 minute summer	66.994	17.704
30 year 120 minute winter	44.509	17.704
30 year 180 minute summer	50.789	13.070
30 year 180 minute winter	33.014	13.070
30 year 240 minute summer	39.713	10.495
30 year 240 minute winter	26.384	10.495
30 year 360 minute summer	29.789	7.666
30 year 360 minute winter	19.364	7.666
30 year 480 minute summer	23.214	6.135
30 year 480 minute winter	15.423	6.135
30 year 600 minute summer	18.859	5.158
30 year 600 minute winter	12.885	5.158
30 year 720 minute summer	16.698	4.475
30 year 720 minute winter	11.222	4.475
30 year 960 minute summer	13.576	3.575
30 year 960 minute winter	8.993	3.575
30 year 1440 minute summer	9.708	2.602
30 year 1440 minute winter	6.524	2.602
30 year 2160 minute summer	6.844	1.892
30 year 2160 minute winter	4.716	1.892
30 year 2880 minute summer	5.625	1.508
30 year 2880 minute winter	3.780	1.508
30 year 4320 minute summer	4.184	1.094
30 year 4320 minute winter	2.755	1.094
30 year 5760 minute summer	3.402	0.871
30 year 5760 minute winter	2.202	0.871
30 year 7200 minute summer	2.859	0.729
30 year 7200 minute winter	1.845	0.729
30 year 8640 minute summer	2.473	0.631
30 year 8640 minute winter	1.596	0.631
30 year 10080 minute summer	2.187	0.558
30 year 10080 minute winter	1.411	0.558
100 year 15 minute summer	329.664	93.284
100 year 15 minute winter	231.343	93.284
100 year 30 minute summer	216.648	61.304
100 year 30 minute winter	152.034	61.304
100 year 60 minute summer	145.356	38.413
100 year 60 minute winter	96.571	38.413
100 year 120 minute summer	88.100	23.282
100 year 120 minute winter	58.532	23.282
100 year 180 minute summer	66.650	17.151
100 year 180 minute winter	43.325	17.151
100 year 240 minute summer	51.959	13.731
100 year 240 minute winter	34.521	13.731
100 year 360 minute summer	38.732	9.967
100 year 360 minute winter	25.177	9.967
100 year 480 minute summer	30.068	7.946
100 year 480 minute winter	19.977	7.946

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 600 minute summer	24.351	6.660
100 year 600 minute winter	16.638	6.660
100 year 720 minute summer	21.505	5.763
100 year 720 minute winter	14.452	5.763
100 year 960 minute summer	17.408	4.584
100 year 960 minute winter	11.531	4.584
100 year 1440 minute summer	12.367	3.314
100 year 1440 minute winter	8.311	3.314
100 year 2160 minute summer	8.657	2.393
100 year 2160 minute winter	5.965	2.393
100 year 2880 minute summer	7.077	1.897
100 year 2880 minute winter	4.756	1.897
100 year 4320 minute summer	5.223	1.365
100 year 4320 minute winter	3.439	1.365
100 year 5760 minute summer	4.221	1.080
100 year 5760 minute winter	2.732	1.080
100 year 7200 minute summer	3.530	0.900
100 year 7200 minute winter	2.278	0.900
100 year 8640 minute summer	3.041	0.776
100 year 8640 minute winter	1.962	0.776
100 year 10080 minute summer	2.680	0.684
100 year 10080 minute winter	1.729	0.684
100 year +40% CC 15 minute summer	461.530	130.597
100 year +40% CC 15 minute winter	323.881	130.597
100 year +40% CC 30 minute summer	303.307	85.825
100 year +40% CC 30 minute winter	212.847	85.825
100 year +40% CC 60 minute summer	203.498	53.779
100 year +40% CC 60 minute winter	135.199	53.779
100 year +40% CC 120 minute summer	123.340	32.595
100 year +40% CC 120 minute winter	81.944	32.595
100 year +40% CC 180 minute summer	93.311	24.012
100 year +40% CC 180 minute winter	60.654	24.012
100 year +40% CC 240 minute summer	72.743	19.224
100 year +40% CC 240 minute winter	48.329	19.224
100 year +40% CC 360 minute summer	54.225	13.954
100 year +40% CC 360 minute winter	35.248	13.954
100 year +40% CC 480 minute summer	42.096	11.125
100 year +40% CC 480 minute winter	27.967	11.125
100 year +40% CC 600 minute summer	34.091	9.325
100 year +40% CC 600 minute winter	23.293	9.325
100 year +40% CC 720 minute summer	30.106	8.069
100 year +40% CC 720 minute winter	20.233	8.069
100 year +40% CC 960 minute summer	24.371	6.417
100 year +40% CC 960 minute winter	16.144	6.417
100 year +40% CC 1440 minute summer	17.314	4.640
100 year +40% CC 1440 minute winter	11.636	4.640
100 year +40% CC 2160 minute summer	12.120	3.350
100 year +40% CC 2160 minute winter	8.351	3.350
100 year +40% CC 2880 minute summer	9.908	2.656
100 year +40% CC 2880 minute winter	6.659	2.656
100 year +40% CC 4320 minute summer	7.312	1.912
100 year +40% CC 4320 minute winter	4.815	1.912

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 5760 minute summer	5.909	1.513
100 year +40% CC 5760 minute winter	3.824	1.513
100 year +40% CC 7200 minute summer	4.942	1.261
100 year +40% CC 7200 minute winter	3.189	1.261
100 year +40% CC 8640 minute summer	4.257	1.086
100 year +40% CC 8640 minute winter	2.747	1.086
100 year +40% CC 10080 minute summer	3.751	0.957
100 year +40% CC 10080 minute winter	2.421	0.957

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	15.592	0.021	0.7	0.0034	0.0000	OK
15 minute winter	2	12	15.863	0.113	1.8	0.2975	0.0000	SURCHARGED
15 minute summer	3	9	21.810	0.010	1.1	0.0016	0.0000	OK
15 minute winter	outfall	12	15.506	0.021	0.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.002	outfall	0.7	0.620	0.094	0.0060	0.7
15 minute winter	2	Orifice	1	0.7				
15 minute summer	3	1.000	2	1.1	0.658	0.023	0.0413	

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	13	15.597	0.027	1.1	0.0042	0.0000	OK
15 minute winter	2	12	15.982	0.232	3.6	0.7554	0.0000	SURCHARGED
15 minute summer	3	9	21.814	0.014	2.1	0.0022	0.0000	OK
15 minute winter	outfall	13	15.510	0.025	1.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.002	outfall	1.1	0.693	0.142	0.0081	1.4
15 minute winter	2	Orifice	1	1.1				
15 minute summer	3	1.000	2	2.1	0.743	0.044	0.0432	

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	15.599	0.029	1.3	0.0046	0.0000	OK
30 minute winter	2	22	16.059	0.309	3.2	1.0492	0.0000	SURCHARGED
15 minute summer	3	9	21.815	0.015	2.6	0.0024	0.0000	OK
30 minute winter	outfall	22	15.513	0.028	1.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.002	outfall	1.3	0.722	0.165	0.0090	2.4
30 minute winter	2	Orifice	1	1.3				
15 minute summer	3	1.000	2	2.6	0.609	0.055	0.0437	

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	15.601	0.031	1.5	0.0050	0.0000	OK
30 minute winter	2	22	16.167	0.417	4.2	1.4641	0.0000	SURCHARGED
15 minute summer	3	9	21.817	0.017	3.4	0.0028	0.0000	OK
30 minute winter	outfall	23	15.515	0.030	1.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.002	outfall	1.5	0.753	0.193	0.0101	3.1
30 minute winter	2	Orifice	1	1.5				
15 minute summer	3	1.000	2	3.4	0.646	0.072	0.0445	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	23	15.605	0.035	1.9	0.0056	0.0000	OK
30 minute winter	2	23	16.379	0.629	6.0	2.2753	0.0000	FLOOD RISK
15 minute summer	3	9	21.820	0.020	4.7	0.0032	0.0000	OK
30 minute winter	outfall	23	15.518	0.033	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.002	outfall	1.9	0.796	0.239	0.0119	4.3
30 minute winter	2	Orifice	1	1.9				
15 minute summer	3	1.000	2	4.7	0.870	0.100	0.0457	

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	10	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	0.600
Time of Entry (mins)	2.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1			16.500	450	50.000	55.000	0.930
2	0.006	2.00	16.500	1200	50.000	50.000	0.750
3	0.006	2.00	22.500	450	52.000	60.000	0.700
outfall			16.500	450	45.000	55.000	1.015

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	2	1	5.000	0.600	15.750	15.570	0.180	27.8	100	2.09	50.0
1.000	3	2	10.198	0.600	21.800	15.750	6.050	1.7	100	2.03	50.0
1.002	1	outfall	5.000	0.600	15.570	15.485	0.085	58.8	100	2.17	50.0

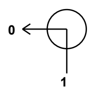
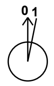
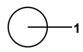
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.470	11.5	1.6	0.650	0.830	0.012	0.0	25	1.038
1.000	6.006	47.2	0.8	0.600	0.650	0.006	0.0	9	2.209
1.002	1.006	7.9	1.6	0.830	0.915	0.012	0.0	31	0.792

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	5.000	27.8	100	Circular	16.500	15.750	0.650	16.500	15.570	0.830
1.000	10.198	1.7	100	Circular	22.500	21.800	0.600	16.500	15.750	0.650
1.002	5.000	58.8	100	Circular	16.500	15.570	0.830	16.500	15.485	0.915

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	2	1200	Manhole	Adoptable	1	450	Manhole	Adoptable
1.000	3	450	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.002	1	450	Manhole	Adoptable	outfall	450	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	50.000	55.000	16.500	0.930	450	1	1.001	15.570	100
						 0	1.002	15.570	100
2	50.000	50.000	16.500	0.750	1200	 1	1.000	15.750	100
						0	1.001	15.750	100
3	52.000	60.000	22.500	0.700	450	 0	1.000	21.800	100
outfall	45.000	55.000	16.500	1.015	450	1 	1.002	15.485	100

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	19.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	0.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
10	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node 2 Online Orifice Control

Flap Valve	x	Invert Level (m)	15.750	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.035		

Node 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	1.5	Invert Level (m)	15.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	21

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.0	0.0	0.600	7.0	0.0	0.601	0.1	0.0

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	x
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Approval Settings

Node Size	x	Coordinates	x	Full Bore Velocity	x	Time to Half Empty	✓
Node Losses	x	Crossings	x	Proportional Velocity	x	Return Period (years)	30
Link Size	x	Cover Depth	x	Surcharged Depth	x	Discharge Rates	x
Link Length	x	Backdrops	x	Flooding	x	Discharge Volume	x

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	103.832	29.381
1 year 15 minute winter	72.865	29.381
1 year 30 minute summer	67.515	19.105
1 year 30 minute winter	47.379	19.105
1 year 60 minute summer	45.726	12.084
1 year 60 minute winter	30.379	12.084
1 year 120 minute summer	28.340	7.489
1 year 120 minute winter	18.828	7.489
1 year 180 minute summer	21.894	5.634
1 year 180 minute winter	14.231	5.634
1 year 240 minute summer	17.401	4.599
1 year 240 minute winter	11.561	4.599
1 year 360 minute summer	13.397	3.448
1 year 360 minute winter	8.709	3.448
1 year 480 minute summer	10.573	2.794
1 year 480 minute winter	7.024	2.794
1 year 600 minute summer	8.677	2.373
1 year 600 minute winter	5.929	2.373
1 year 720 minute summer	7.750	2.077
1 year 720 minute winter	5.209	2.077
1 year 960 minute summer	6.393	1.683
1 year 960 minute winter	4.235	1.683
1 year 1440 minute summer	4.671	1.252
1 year 1440 minute winter	3.140	1.252
1 year 2160 minute summer	3.372	0.932
1 year 2160 minute winter	2.323	0.932

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 2880 minute summer	2.820	0.756
1 year 2880 minute winter	1.895	0.756
1 year 4320 minute summer	2.149	0.562
1 year 4320 minute winter	1.415	0.562
1 year 5760 minute summer	1.779	0.455
1 year 5760 minute winter	1.151	0.455
1 year 7200 minute summer	1.517	0.387
1 year 7200 minute winter	0.979	0.387
1 year 8640 minute summer	1.329	0.339
1 year 8640 minute winter	0.858	0.339
1 year 10080 minute summer	1.188	0.303
1 year 10080 minute winter	0.767	0.303
10 year 15 minute summer	200.971	56.868
10 year 15 minute winter	141.032	56.868
10 year 30 minute summer	129.855	36.744
10 year 30 minute winter	91.126	36.744
10 year 60 minute summer	86.243	22.792
10 year 60 minute winter	57.298	22.792
10 year 120 minute summer	52.179	13.789
10 year 120 minute winter	34.667	13.789
10 year 180 minute summer	39.634	10.199
10 year 180 minute winter	25.763	10.199
10 year 240 minute summer	31.075	8.212
10 year 240 minute winter	20.646	8.212
10 year 360 minute summer	23.443	6.033
10 year 360 minute winter	15.239	6.033
10 year 480 minute summer	18.333	4.845
10 year 480 minute winter	12.180	4.845
10 year 600 minute summer	14.935	4.085
10 year 600 minute winter	10.205	4.085
10 year 720 minute summer	13.257	3.553
10 year 720 minute winter	8.909	3.553
10 year 960 minute summer	10.821	2.849
10 year 960 minute winter	7.168	2.849
10 year 1440 minute summer	7.784	2.086
10 year 1440 minute winter	5.231	2.086
10 year 2160 minute summer	5.523	1.526
10 year 2160 minute winter	3.806	1.526
10 year 2880 minute summer	4.561	1.223
10 year 2880 minute winter	3.066	1.223
10 year 4320 minute summer	3.418	0.894
10 year 4320 minute winter	2.251	0.894
10 year 5760 minute summer	2.794	0.715
10 year 5760 minute winter	1.808	0.715
10 year 7200 minute summer	2.359	0.602
10 year 7200 minute winter	1.522	0.602
10 year 8640 minute summer	2.048	0.522
10 year 8640 minute winter	1.322	0.522
10 year 10080 minute summer	1.817	0.463
10 year 10080 minute winter	1.173	0.463
30 year 15 minute summer	254.498	72.014
30 year 15 minute winter	178.595	72.014

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 30 minute summer	165.775	46.909
30 year 30 minute winter	116.334	46.909
30 year 60 minute summer	110.635	29.238
30 year 60 minute winter	73.503	29.238
30 year 120 minute summer	66.994	17.704
30 year 120 minute winter	44.509	17.704
30 year 180 minute summer	50.789	13.070
30 year 180 minute winter	33.014	13.070
30 year 240 minute summer	39.713	10.495
30 year 240 minute winter	26.384	10.495
30 year 360 minute summer	29.789	7.666
30 year 360 minute winter	19.364	7.666
30 year 480 minute summer	23.214	6.135
30 year 480 minute winter	15.423	6.135
30 year 600 minute summer	18.859	5.158
30 year 600 minute winter	12.885	5.158
30 year 720 minute summer	16.698	4.475
30 year 720 minute winter	11.222	4.475
30 year 960 minute summer	13.576	3.575
30 year 960 minute winter	8.993	3.575
30 year 1440 minute summer	9.708	2.602
30 year 1440 minute winter	6.524	2.602
30 year 2160 minute summer	6.844	1.892
30 year 2160 minute winter	4.716	1.892
30 year 2880 minute summer	5.625	1.508
30 year 2880 minute winter	3.780	1.508
30 year 4320 minute summer	4.184	1.094
30 year 4320 minute winter	2.755	1.094
30 year 5760 minute summer	3.402	0.871
30 year 5760 minute winter	2.202	0.871
30 year 7200 minute summer	2.859	0.729
30 year 7200 minute winter	1.845	0.729
30 year 8640 minute summer	2.473	0.631
30 year 8640 minute winter	1.596	0.631
30 year 10080 minute summer	2.187	0.558
30 year 10080 minute winter	1.411	0.558
100 year 15 minute summer	329.664	93.284
100 year 15 minute winter	231.343	93.284
100 year 30 minute summer	216.648	61.304
100 year 30 minute winter	152.034	61.304
100 year 60 minute summer	145.356	38.413
100 year 60 minute winter	96.571	38.413
100 year 120 minute summer	88.100	23.282
100 year 120 minute winter	58.532	23.282
100 year 180 minute summer	66.650	17.151
100 year 180 minute winter	43.325	17.151
100 year 240 minute summer	51.959	13.731
100 year 240 minute winter	34.521	13.731
100 year 360 minute summer	38.732	9.967
100 year 360 minute winter	25.177	9.967
100 year 480 minute summer	30.068	7.946
100 year 480 minute winter	19.977	7.946

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 600 minute summer	24.351	6.660
100 year 600 minute winter	16.638	6.660
100 year 720 minute summer	21.505	5.763
100 year 720 minute winter	14.452	5.763
100 year 960 minute summer	17.408	4.584
100 year 960 minute winter	11.531	4.584
100 year 1440 minute summer	12.367	3.314
100 year 1440 minute winter	8.311	3.314
100 year 2160 minute summer	8.657	2.393
100 year 2160 minute winter	5.965	2.393
100 year 2880 minute summer	7.077	1.897
100 year 2880 minute winter	4.756	1.897
100 year 4320 minute summer	5.223	1.365
100 year 4320 minute winter	3.439	1.365
100 year 5760 minute summer	4.221	1.080
100 year 5760 minute winter	2.732	1.080
100 year 7200 minute summer	3.530	0.900
100 year 7200 minute winter	2.278	0.900
100 year 8640 minute summer	3.041	0.776
100 year 8640 minute winter	1.962	0.776
100 year 10080 minute summer	2.680	0.684
100 year 10080 minute winter	1.729	0.684
100 year +40% CC 15 minute summer	461.530	130.597
100 year +40% CC 15 minute winter	323.881	130.597
100 year +40% CC 30 minute summer	303.307	85.825
100 year +40% CC 30 minute winter	212.847	85.825
100 year +40% CC 60 minute summer	203.498	53.779
100 year +40% CC 60 minute winter	135.199	53.779
100 year +40% CC 120 minute summer	123.340	32.595
100 year +40% CC 120 minute winter	81.944	32.595
100 year +40% CC 180 minute summer	93.311	24.012
100 year +40% CC 180 minute winter	60.654	24.012
100 year +40% CC 240 minute summer	72.743	19.224
100 year +40% CC 240 minute winter	48.329	19.224
100 year +40% CC 360 minute summer	54.225	13.954
100 year +40% CC 360 minute winter	35.248	13.954
100 year +40% CC 480 minute summer	42.096	11.125
100 year +40% CC 480 minute winter	27.967	11.125
100 year +40% CC 600 minute summer	34.091	9.325
100 year +40% CC 600 minute winter	23.293	9.325
100 year +40% CC 720 minute summer	30.106	8.069
100 year +40% CC 720 minute winter	20.233	8.069
100 year +40% CC 960 minute summer	24.371	6.417
100 year +40% CC 960 minute winter	16.144	6.417
100 year +40% CC 1440 minute summer	17.314	4.640
100 year +40% CC 1440 minute winter	11.636	4.640
100 year +40% CC 2160 minute summer	12.120	3.350
100 year +40% CC 2160 minute winter	8.351	3.350
100 year +40% CC 2880 minute summer	9.908	2.656
100 year +40% CC 2880 minute winter	6.659	2.656
100 year +40% CC 4320 minute summer	7.312	1.912
100 year +40% CC 4320 minute winter	4.815	1.912

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +40% CC 5760 minute summer	5.909	1.513
100 year +40% CC 5760 minute winter	3.824	1.513
100 year +40% CC 7200 minute summer	4.942	1.261
100 year +40% CC 7200 minute winter	3.189	1.261
100 year +40% CC 8640 minute summer	4.257	1.086
100 year +40% CC 8640 minute winter	2.747	1.086
100 year +40% CC 10080 minute summer	3.751	0.957
100 year +40% CC 10080 minute winter	2.421	0.957

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	15.592	0.022	0.8	0.0036	0.0000	OK
15 minute winter	2	12	15.868	0.118	1.8	0.2760	0.0000	SURCHARGED
15 minute summer	3	9	21.810	0.010	1.1	0.0016	0.0000	OK
15 minute winter	outfall	12	15.507	0.022	0.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.002	outfall	0.8	0.635	0.103	0.0064	0.7
15 minute winter	2	Orifice	1	0.8				
15 minute summer	3	1.000	2	1.1	0.659	0.023	0.0413	

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	15.598	0.028	1.2	0.0045	0.0000	OK
15 minute winter	2	12	16.002	0.252	3.6	0.7112	0.0000	SURCHARGED
15 minute summer	3	9	21.814	0.014	2.1	0.0022	0.0000	OK
15 minute winter	outfall	12	15.512	0.027	1.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.002	outfall	1.2	0.712	0.157	0.0087	1.4
15 minute winter	2	Orifice	1	1.2				
15 minute summer	3	1.000	2	2.1	0.745	0.044	0.0432	

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	15.600	0.030	1.4	0.0048	0.0000	OK
30 minute winter	2	21	16.081	0.331	3.2	0.9646	0.0000	SURCHARGED
15 minute summer	3	9	21.815	0.015	2.6	0.0024	0.0000	OK
30 minute winter	outfall	22	15.514	0.029	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.002	outfall	1.4	0.741	0.181	0.0097	2.4
30 minute winter	2	Orifice	1	1.4				
15 minute summer	3	1.000	2	2.6	0.611	0.055	0.0437	

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	15.603	0.033	1.7	0.0053	0.0000	OK
30 minute winter	2	22	16.202	0.452	4.2	1.3555	0.0000	FLOOD RISK
15 minute summer	3	9	21.817	0.017	3.4	0.0028	0.0000	OK
30 minute winter	outfall	22	15.516	0.031	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.002	outfall	1.7	0.773	0.213	0.0109	3.1
30 minute winter	2	Orifice	1	1.7				
15 minute summer	3	1.000	2	3.4	0.646	0.072	0.0445	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	22	15.608	0.038	2.2	0.0061	0.0000	OK
30 minute winter	2	22	16.488	0.738	6.0	2.0997	0.0000	FLOOD RISK
15 minute summer	3	9	21.820	0.020	4.7	0.0032	0.0000	OK
30 minute winter	outfall	22	15.521	0.036	2.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	1	1.002	outfall	2.2	0.826	0.275	0.0131	4.3
30 minute winter	2	Orifice	1	2.2				
15 minute summer	3	1.000	2	4.7	0.869	0.100	0.0457	

Appendix D: SuDS Maintenance Report

LONDON BOROUGH OF RICHMOND UPON THAMES

LoDEG

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	3-4 New Broadway
Address & post code	3-4 New Broadway, Hampton, TW12 1JG
OS Grid ref. (Easting, Northing)	E 514558 N 171264
LPA reference (if applicable)	Richmond
Brief description of proposed work	New residential Development
Total site Area	286 m^2
Total existing impervious area	150 m^2
Total proposed impervious area	225 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	No
Existing drainage connection type and location	Combined sewer
Designer Name	Andrew Wallace
Designer Position	Civil Engineer

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Sandy Gravel	
Bedrock geology classification	London Clay	
Site infiltration rate	0	m/s
Depth to groundwater level	Unknown	m below ground level
Is infiltration feasible?		

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use		
2 use infiltration techniques, such as porous surfaces in non-clay areas		
3 attenuate rainwater in ponds or open water features for gradual release		
4 attenuate rainwater by storing in tanks or sealed water features for gradual release		
5 discharge rainwater direct to a watercourse		
6 discharge rainwater to a surface water sewer/drain		
7 discharge rainwater to the combined sewer.		

2c. Proposed Discharge Details

Proposed discharge location	Sewer
Has the owner/regulator of the discharge location been	No

LONDON BOROUGH OF RICHMOND UPON THAMES

LoDEG

	Designer Company	Jomas

	consulted?	

LONDON BOROUGH OF RICHMOND UPON THAMES

LoDEG

3. Drainage Strategy

3a. Discharge Rates & Required Storage				
	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	0.04			
1 in 1	0.04	3.1		1.5
1 in 30	0.1	7.8		2.7
1 in 100	0.14	11.6		3.2
1 in 100 + CC				4.1
Climate change allowance used		40%		
3b. Principal Method of Flow Control		Orifice		

3c. Proposed SuDS Measures			
	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs			
Filter strips	0	0	0
Filter drains	0	0	0
Bioretention / tree pits	0	0	0
Pervious pavements	225	16	4
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	0		0
Total	225	16	4

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	5.3
Drainage hierarchy (2b)	6
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	7
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	7
Proposed SuDS measures & specifications (3b)	7

4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix A
Detailed drainage design drawings, including exceedance flow routes	Appendix C
Detailed landscaping plans	NA
Maintenance strategy	Appendix D
Demonstration of how the proposed SuDS measures improve:	Section 9
a) water quality of the runoff?	
b) biodiversity?	
c) amenity?	

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DRAINAGE MAINTENANCE PLAN

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Report Title: **DRAINAGE AND SUDS MAINTENANCE PLAN**

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Date: **24 January 2023**

Control: Previous Release

Version	Date	Issued By
V1.0	24.01.23	A Wallace

Prepared by: JOMAS ASSOCIATES LTD

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1.0 GENERAL

1.1 Sustainable Drainage Systems (SuDS) are an environmentally friendly approach to managing rainfall. SuDS techniques use landscape features to deal with surface water with the aim to:

1.1.1 Control the flow, volume and frequency of water leaving a development.

1.1.2 Prevent pollution by intercepting silt and cleaning runoff from hard surfaces.

1.1.3 Provide attractive surroundings for the community.

1.2 The surface water drainage strategy for this development utilises permeable paving as the main SUDS features. The following sections provides a brief description of this feature and outlines the maintenance programme that should be adopted.

2.0 CLEANING OF THE DRAINAGE SYSTEM

2.1 Drainage systems should be inspected at regular intervals and where necessary, thoroughly cleaned out at the same time. Any defects discovered should be made good.

2.2 The following operations should be carried out during the periodic cleaning of a drainage system:-

Product Type	Period	Responsibility	Maintenance Methods
Silt Trap	As necessary and before wet season	Owner/ Maintenance Company	• Sediment and debris that accumulated during summer needs to be removed before the wet season. • Inspect and clean out routinely prior to inlet pipework to minimise debris reaching the tank. • Conduct inspections more frequently during the wet season for the area where sediment or trash accumulates more often. Clean and repair as needed.
Standard Manholes/ Inspection Chambers	As necessary	Owner/ Maintenance Company	• Remove and clean any soil and vegetation that covers the manhole cover to prevent blockage of the drainage system at the manhole.

Product Type	Period	Responsibility	Maintenance Methods
			• Renew/replace any damaged/missing bolts and damaged/missing manhole covers.
Drainage Pipes	Six monthly interval	Owner/ Maintenance Company	• Inspect underground drainage pipes to ensure that the distribution pipework arrangement is operational and free from blockages. If required, take remedial action.
Permeable Paving	Monthly for 3 months	Owner/ Maintenance Company	• Inspect and identify any areas that are not operating correctly. If required, take remedial action.
	Monthly	Owner/ Maintenance Company	• Debris removal from catchment surface (where may cause risks to performance).
	Annually	Owner/ Maintenance Company	• Remove sediment from pre-treatment structures.
	Annually and after large storms	Owner/ Maintenance Company	• Inspection/check all inlets and outlets to ensure that they are in good condition and operating as designed.

3.0 SKETCHES AND PLANS

3.1 The locations of the above features can be found by examining Drawing P4931J2730-C01

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