Member of the Surbana Jurong Group

Kennet Centre

Drainage Statement

Prepared For:
Lochailort Newbury Limited

RBG Project No.:
4508

Document No.:
4508-RBG-ZZ-XX-RP-CV-00002

Revision:
P02

Status:
S1 - For Review & Comment

Date:
04 February 2021

Report Amendment Register

Revision	Section / Page No.	Revision Description	Author	Reviewer	Date
P01		For planning	Edmond Veillard	Jon Gold	08/01/2021
P02		Planning	Edmond Veillard	Jon Gold	04/02/2021

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Date: 2021.02.04 11:48:03Z00'00'

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Signing for and on behalf of

Robert Bird & Partners Ltd

Date: 04/02/2021

REVIEWER:

Jonathan Gold

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Jon Gold

Signing for and on behalf of

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Table of Contents

1.0 Introduction

1.1. General

Robert Bird Group (RBG) have been appointed by Lochailort to undertake the below ground drainage design works for the Kennet Centre Development in Newbury.

This Drainage Statement has been produced in order to assist West Berkshire Council (WBC), as the Lead Local Flood Authority (LLFA), determine the suitability of the drainage design for the planning application.

This Drainage Statement has been prepared based on the following information:

- Architect's Proposed GA Drawings by Collado Collins Architects (ref: 20011-P0-100_Rev P1, Jan 2021)
- Topographical Survey by Geomatic Surveyors (ref: 396KC01, October 2019)
- Thames Water Asset Location Search (ref: 1108775, May 2020)
- Ground Investigation Report by Soiltechnics (ref: STS5074-G01, September 2020)

Robert Bird Group cannot accept liability for the accuracy or otherwise of any information derived from third party sources.

This drainage statement should be read in conjunction with the Flood Risk Assessment (Ref: 4508-RBG-ZZ-XX-RP-CV-00002) produced by RBG.

1.2. Objective of this Report

The objective of this drainage statement is to establish the proposed drainage strategy for the site for planning approval. In order to achieve this the following information is provided:

- Site background
- The proposed discharge strategy for surface water drainage
- Flow rate information and required attenuation storage
- Proposed SuDS measures to achieve attenuation storage
- Maintenance requirements for the drainage systems
- Drawings of the surface water network layout
- Exceedance flow route information
- Summary of the discharge strategy for foul water

2.0 Proposed Development Site

2.1. Location

The site is located towards the centre of Newbury, Berkshire, site postcode, RG14 5EN. The site is approximately 1.64ha in size and comprises the Kennet Shopping Centre. The Kennet Shopping Centre is a mixed two-storey and three-storey structure, which is internally partitioned into separate retail/commercial units. A multi-storey car park is present to the south-west corner and a cinema is present to the south-east.

The site lies within a predominantly commercial/retail area and is bordered by Bartholomew Street to the west, Market Street to the south and Cheap Street and Market Place to the east. Commercial buildings border the site to the north.

2.2. Proposed Development

The existing buildings on the site are to be demolished except for the car park and cinema. The proposed redevelopment will be a mixed-use development, comprising residential and commercial premises and associated public realm improvements. The latest Architects General Arrangement Plan for the Ground Floor can be found in Appendix A.

2.3. Site Description

2.3.1 Topography

Local topography is relatively flat, with the site located towards the floor of a valley carrying the River Kennet, which merges into the Kennet and Avon Canal and flows west-east some 85m to the north of the site.

The existing site is relatively flat with levels varying between 76.5 and 77.2mAOD. In general, the northern part of the site is lower with levels rising towards the south.

Please see Appendix B for the Topographical Survey for the site.

2.3.2 Geology

The ground investigation report identified that made ground and alluvium deposits are likely to underly the site to a depth of 3-4m. Beneath these strata superficial deposits of Beenham Grange Gravel Member can be found to a depth 7-8m which are in turn underlain by the Seaford Chalk Formation, which extended to the depth of the intrusive boreholes (~25m deep).

Groundwater was encountered during the site investigation at depths of between 2.53m and 3.5m.

2.3.3 Hydrology and Hydrogeology

The River Kennet lies approximately 100m to the north of the site which is classed as a main river by the EA.

Groundwater was encountered during the intrusive Site Investigation. This was encountered within the made ground and alluvium deposits.

Aquifer designation mapping provided by DEFRA indicates the site lies in a Principal aquifer zone for Bedrock and a Secondary A aquifer zone for Superficial Deposits. Groundwater vulnerability mapping provided by DEFRA indicates that the site lies in a zone that is designated as a 'Medium Risk', therefore any contamination entering the ground has a risk of contaminating groundwater resources.

The site lies in a Groundwater Source Protection Zone designated as Zone III (Total Catchment). SPZs are defined around potable groundwater abstraction sites and the designation implies that groundwater recharge is presumed to be discharged at the source.

2.3.4 Existing Drainage

The existing site discharges foul and surface water to the public Thames Water sewers in Cheap Street and Bartholomew Street. It is noted that the Thames Water sewers are separate systems.

Record information suggests that surface water from the existing buildings is discharged into the Thames Water 750mm dia surface water sewer in Cheap Street. A number of foul water connections from the site discharge to the Thames Water 225mm dia foul sewer in Bartholomew Street and to the Thames Water 225mm dia foul sewers in Market Place and Cheap Street.

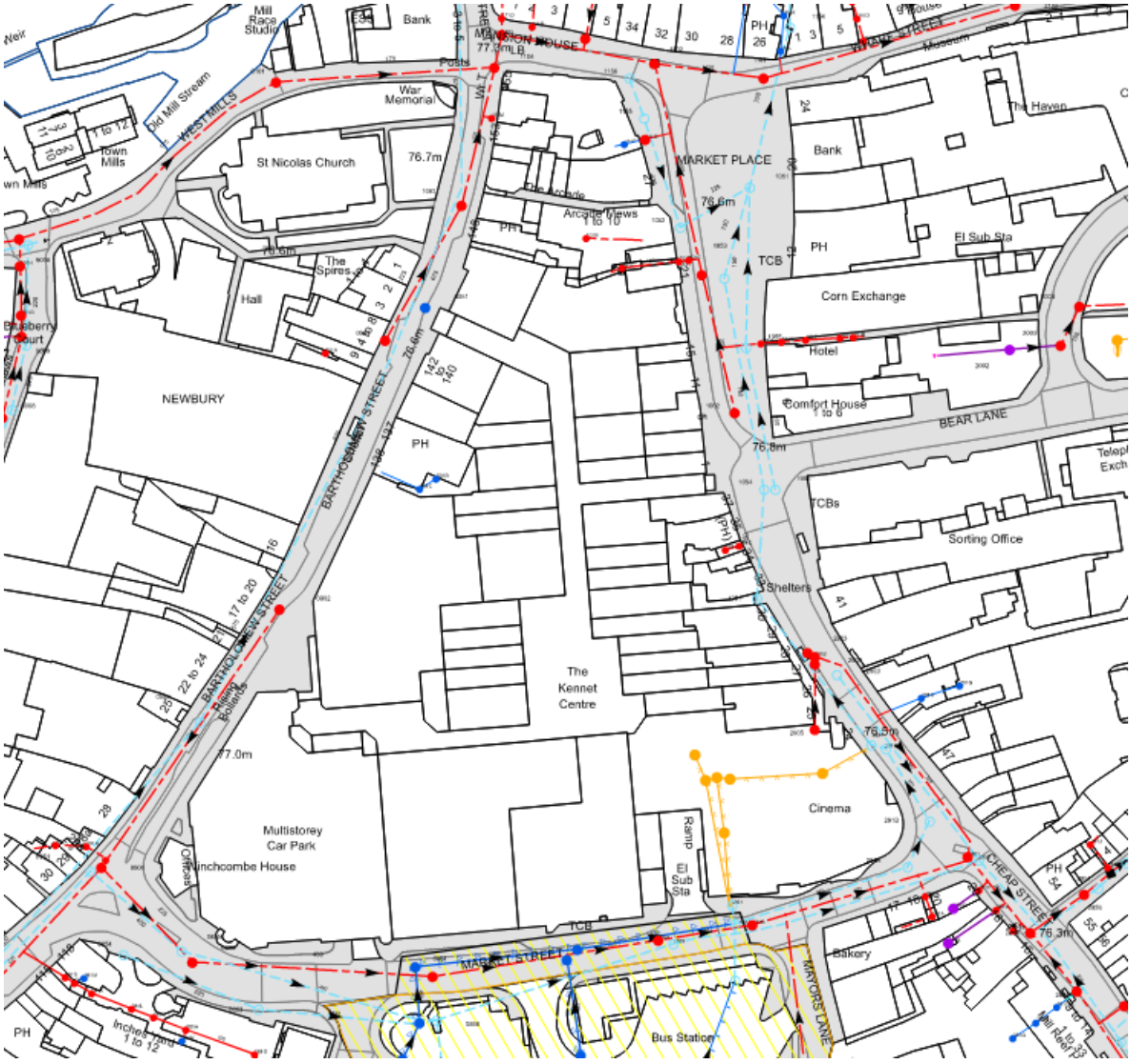

Figure 2.1: Thames Water Sewer Asset Map (extracted from Asset Location Search)

2.3.5 Flood Risk

Please refer to the site specific FRA (Ref: 4508-RBG-ZZ-XX-RP-CV-00002) for further information on flood risk and proposed site levels.

3.0 Surface Water Drainage

3.1. Surface Water Management Strategy

3.1.1 Drainage Hierarchy

In line with the policies set out in WBCs SuDS Supplementary Planning Document, surface water run-off is to be managed as close to source as possible in line with the following drainage hierarchy. Run off rates are to be restricted in line with guidance.

	SuDS technique	Proposed	Comment
Most sustainable	Store rainwater for later use	✗	Rainwater harvesting is not feasible for the development. Green roofs are proposed in the development
	Use infiltration techniques, such as porous surfaces in non-clay areas	✗	Infiltration is not feasible due to the underlying ground strata and shallow ground water table.
	Attenuate rainwater in ponds or open water features for gradual release	✗	Site is too constrained to allow for open water features
	Attenuate rainwater by storing in tanks or sealed water features for gradual release	✓	Potential on site for sealed water storage features
	Discharge rainwater direct to watercourse	✗	There are no surface water bodies close to the application site
	Discharge to a surface water sewer/drain	✓	Surface water sewers are present in Cheap Street / Bartholomew Street.
Least sustainable	Discharge rainwater to the combined sewer.	✗	Not required due to presence of surface water sewers

Table 3.1: Sustainable Drainage Hierarchy

The feasibility of blue roofs and rainwater harvesting has been assessed during the concept design phase. Blue roofs have been discounted due to the loading implications for the structure and placement of services on the roof. Rainwater harvesting at roof level is not commercially viable for the development. A green roof is proposed on one of the site buildings.

There is the opportunity to place SuDS features within the public realm elements of the site. Permeable Paving, tree pits and rain gardens are to be considered wherever possible.

3.1.2 Catchment Analysis

An analysis of the existing and proposed catchment areas for the site has been undertaken. The total site area of the buildings to be redeveloped is 1.64ha, with this entire area currently being impermeable brownfield land.

A proportion of the roof area of the building is to be constructed using green roof methods. The sizing and location of the green roof is to be confirmed at the next design stage.

3.1.3 Climate Change

WBC as the LLFA have advised that when assessing for the effects of climate change of rainfall intensity a climate change factor of 40% is to be applied to the 1 in 100-year event.

3.1.4 Design Strategy

Surface water will be collected from roof areas via downpipes and external hardstanding through channels, gullies or porous surfaces. A pipe system will then convey the surface water to the public sewer. All surface water is to discharge to the Thames Water surface water sewer in Cheap Street via existing connections from the site that are to be retained. The rate of discharge will be limited in line with planning requirements.

The existing and greenfield flow rates from the site have been modelled. The existing rate has been calculated using the Rational Method. The Greenfield Runoff Rates have been calculated using the IH124 Method. Proposed flow rates have been modelled using Microdrainage software using FEH rainfall data which takes the 1 in 2 year event as the minimum return period.

Due to the highly constrained nature of the site it will not be possible to reduce surface water discharge from the site to greenfield runoff rates. WBC as the LLFA were consulted during a pre-application meeting and confirmed that a 50% reduction in discharge rates from the existing case should be achieved during the design. Minutes from the Pre-Application meeting can be found in Appendix C.

	Existing Site Runoff	Greenfield Runoff Rate	Proposed Discharge Rate	Proposed Reduction
Storm event	**Discharge (l/s)**	**Discharge (l/s)**	**Discharge (l/s)**	**%**
1 in 2 year	99.4	3.2 (Qbar)	48.8	51%
1 in 30 year	241.2	7.3	93.0	61%
1 in 100 year	311.7	10.2	144.4	54%

Table 3.2: Modelled Runoff Rates

To achieve the proposed reduction in the discharge rates, attenuation storage is required to prevent flooding . The total volume of storage provided by the SuDS is given in Table 3.4 below.

SuDS Technique	Plan Area (m^2)	Storage Volume (m^3)	Notes
Permeable Paving	1900	285	Volume based on 500mm subbase with 30% porosity
Attenuation Tank	915	348	Cellular Storage tank 400mm deep with 95% porosity
Green roofs	TBC	-	To be confirmed at next design stage
Total Storage Volume	633 m^3		

Table 3.3: Storage Volumes on site

The attenuation volumes have been set to prevent any flooding on site during the 1 in 30 year storm event and restrict on site flooding to areas away from buildings in the 1 in 100 year storm event with a 40% increase in peak rainfall factored in to allow for climate change.

At this stage no allowance in the design has been made for the attenuation effects of the green roof as the coverage and build up of the green roof is to be determined at the next design stage.

Refer to appendix D for the drainage calculations and appendix E for a general arrangement plan for the proposed drainage.

3.2. SuDS Measures

The following SuDS measures are proposed for the site:

Technique	Image	Description	Advantages	Disadvantages
Green/Brown roof		Multi-layered system that covers the roof of a building with vegetation cover/landscaping over a drainage layer. Designed to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows.	Mimics greenfield state of building footprint for high density developments, good removal of pollutants, ecological benefits, insulates buildings, sound absorption.	Additional weight, not appropriate for steep roofs, maintenance of roof vegetation.
Porous Paving/ Porous Asphalt		Surfacing that allows rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored before infiltrating the ground or discharging to the sewerage system.	Provides source attenuation and low-level treatment of highway runoff. Reduction in runoff volume via potential infiltration.	Often requires increased construction depth and may not be applicable to heavy traffic loadings.
Below ground Storage		Oversized pipes, tank systems and modular geocellular systems that can be used to create a below ground storage structure.	Modular and flexible, dual usage (infiltration/storage, high void ratios, can be installed beneath trafficked and soft landscaped areas.	No water quality treatment.
Rain Gardens and Bio-retention Areas		Planted features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate. Rain gardens receive runoff from adjacent areas of paving	Incorporate into landscaping, good removal of pollutants, reduces runoff rates and volumes, low cost.	Requires considered use of water tolerant plant species.

3.3. Maintenance Schedule

Maintenance during the operational phase of the development is to be the responsibility of the private development and conducted by the site owner/operator.

A summary of the anticipated maintenance and operations requirements for the strategy is proposed for the site to maintain the drainage networks:

Suds component:	Geocellular boxes, oversized pipes and tanks	
Maintenance	**Action**	**Frequency**
Regular maintenance	- check inlets, outlets, control structures, catchpits and overflows	Monthly or annually or after a large storm

Occasional tasks	- jetting and suction where silt has settled	As required
Remedial work	- reinstate	As required

Suds component:	**Permeable pavements**	
Maintenance	**Action**	**Frequency**
Regular maintenance	- swept clean with a stiff broom and hose with clean water	Monthly
	- mow grass edges to paving at 35-50mm and Remove weeds and leaves	As required
	- check outlets and control structures	Monthly depending on detail
Occasional tasks	- jetting to remove dirt, grime and moss.	As required
Remedial work	- small areas of damage can be repaired using the same blend as the surrounding surface.	As required

Suds component:	**Green roof**	
Maintenance	**Action**	**Frequency**
Regular maintenance	- mow grasses (if appropriate) as required	As required
	- inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Anually
	- inspect underside of roof for evidence of leakage	Anually
Occasional tasks	- removal of litter and debris to prevent clogging of inlet drains and interference with plant growth	Six monthly / annually or as required
Remedial work	- if erosion channels are evident, these should be stabilised with additional soil substrate similar to the original material. Sources of erosion damage must be identified and controlled.	As required

Suds component:	**Rain Gardens**	
Maintenance	**Action**	**Frequency**
Regular maintenance	- cut grasses/planting as required	As required
	- inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Anually
Occasional tasks	- removal of litter and debris to prevent clogging of drains and interference with plant growth	Six monthly / annually or as required
Remedial work	- rehabilitation of drainage layers or geotextiles if they become clogged	As required

3.4. Exceedance Routes

During extreme rainfall events, larger than 1 in 100 year storm events, surface water runoff may mobilise as overland flow routes. These flows are to be directed away from buildings and a dry escape route is to be provided in the event an evacuation is required. The flow controls at the discharge points from the site are to be fitted with an emergency drain down mechanism in order that water can be discharged in the event of blockage or extreme rainfall.

Refer to appendix F for a plan showing proposed exceedance flow routes.

3.5. Thames Water Consultation

A pre-planning enquiry has been submitted to Thames Water to determine the capacity of the local sewer network. A response is currently awaited. It is proposed to connect to the 750mm Thames Water sewer in Cheap Street via the existing surface water connections from the existing buildings on the site.

4.0 Foul Water Drainage

4.1. Foul Water Management Strategy

Foul water will be collected from buildings via soil vent pipes, gullies and substacks. A pipe system will then convey the foul water to the public sewer. It is intended that all foul water is to discharge to the Thames Water foul water sewer network via existing gravity connections from the site that are to be retained. These include the following connections:

- 100mm connection to the 225mm Thames Water foul sewer in Bartholomew Street
- 100mm connection to the 225mm Thames Water foul sewer in Market Place
- 150mm connection to the 225mm Thames Water foul sewer in Market Place
- 150mm connection to the 225mm Thames Water foul sewer in Cheap Street

4.2. Thames Water Consultation

A pre-planning enquiry has been submitted to Thames Water to determine the capacity of the local sewer network. A response is currently awaited. It is proposed to reuse the connections listed above. This will be confirmed at the next design stage when the existing connections are surveyed.

Appendix A

Architectural Ground Floor Site Plan

NOTES

CONSULTANTS
- Refer to highways consultant's drawings for details
- Refer to landscape consultant's drawings for details

AREAS
- Refer to area schedule

N

Rev	Notes	Date	By	Auth
P1	Issued for Planning Submission	29/01/2021		

0m 10m 20m 30m 40m 50m

VISUAL SCALE 1:500 @ A1

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Date: 29/01/2020
Drawn By: LK
Checked by: RC
Scale @ A1: 1 : 500
Scale @ A3: 1 : 1000
CAD File No:

LOCHAILORT

Eagle Quarter, Newbury
Proposed Site Plan - Ground Floor

PLANNING

20011 P0-100

1 Revision

Northbrook Street
River Kennet
River Kennet
River Kennet
Bridge Street
Mansion House Street
Wharf Street
Newbury Town Council
St Nicolas Church
The Arcade
Oldfellows Road
Market Place
The Corn Exchange
Bear Lane
The Newbury
Bartholomew Street
The Catherine Wheel
Cheap Street
Bartholomew Street
Market Street

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KEY
APPLICATION BOUNDARY
OWNERSHIP BOUNDARY

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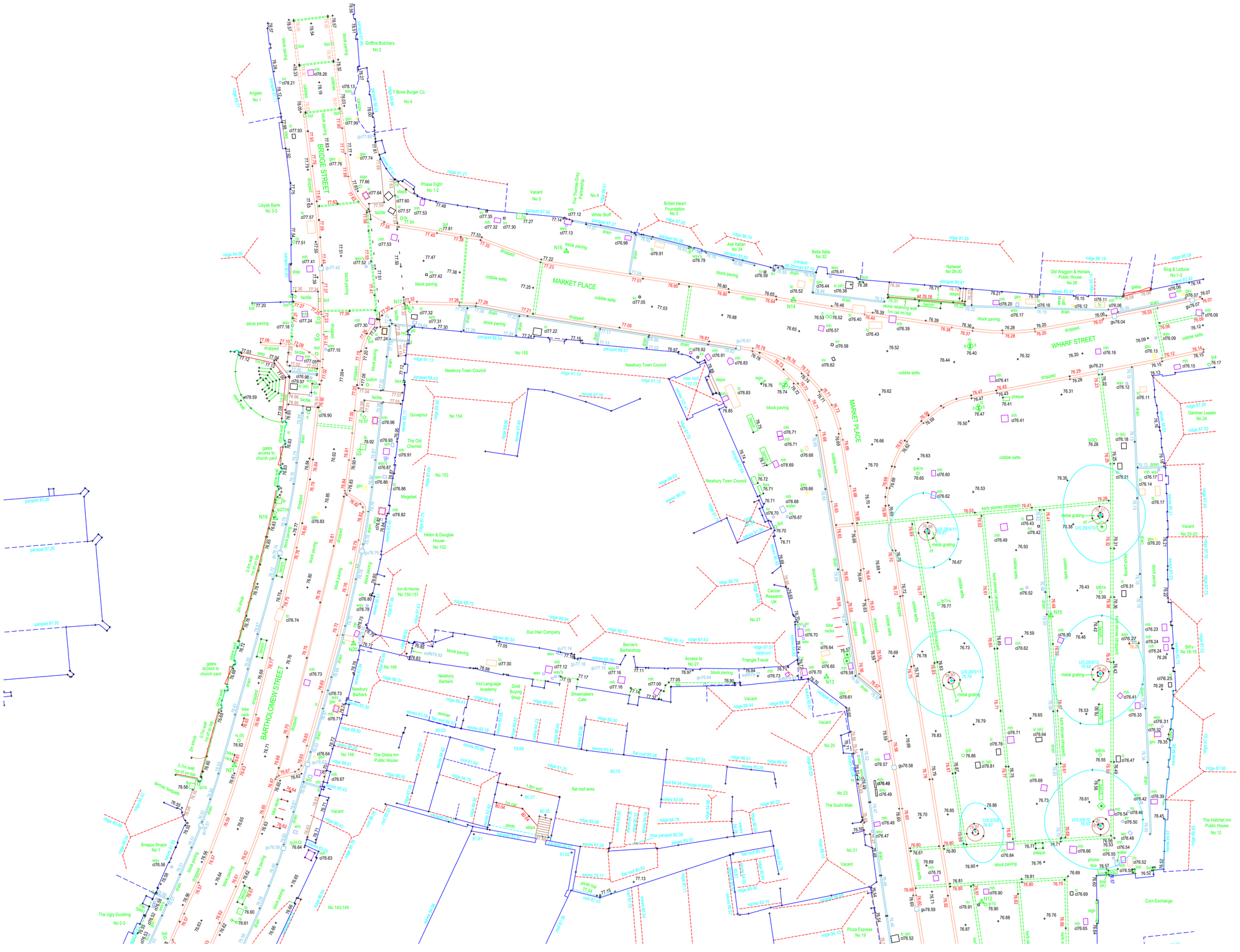
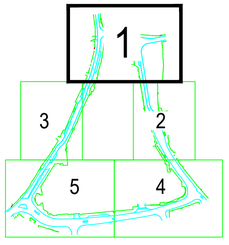
Eagle Quarter, Newbury
Proposed Plan - Ground Floor

PLANNING
20011 P0-AP2-100 1 Revision

Appendix B

Topographical Survey





TREES

A	Ash
AL	Alder
AP	Apple
B	Beech
C	Cedar
CB	Copper Beech
CH	Cherry
CY	Cypress
E	Elm
EL	Elder
EU	Eucalyptus
F	Fir
FM	Field Maple
FR	Fruit
HZ	Hazel
HC	Horse Chestnut
HO	Holm Oak
HW	Hawthorn
HY	Holly
JM	Japanese Maple
LB	Laburnum
LM	Lime
LO	Locust Tree
LR	Laurel
M	Maple
MG	Magnolia
OK	Oak
P	Pine
PA	Palm
PL	Plane
PM	Plum
PO	Poplar
PP	Pissardii Plum
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ABBREVIATIONS

BT	British Telecom
BOL	Bollard
CB	Control Box
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EP	Electricity Pole
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GSV	Gas Stop Valve
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MKR	Marker
MW	Monitoring Well
O/H	Overhead
R	Road Gully
PB	Post Box
PC	Pram Crossing
RNP	Road Name Plate
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S/A	Soakaway
ST	Stay / Strut
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CBF	Closed Board Fence
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CWF	Chicken Wire Fence
IRF	Iron Railing Fence
PKF	Picket Fence
PRF	Post & Rail Fence
PWF	Post & Wire Fence
SCF	Security Fence
SP	Steel Post
WMF	Wire Mesh Fence
WPF	Wood Panel Fence

NOTES

The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station RF1. Levels are related to OS datum determined from the National GPS Network using OSGM15.

No assumptions should be made regarding the interconnection of manholes. Drainage details have been obtained from surface inspection and should be verified if of critical importance.

The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.

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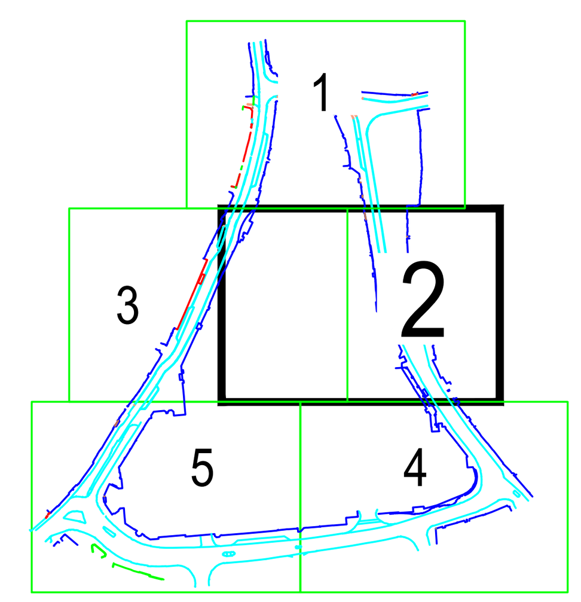

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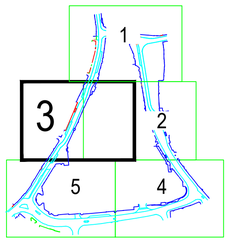
PWF	Post & Wire Fence
SCF	Security Fence
SP	Steel Post
WMF	Wire Mesh Fence
WPF	Wood Panel Fence



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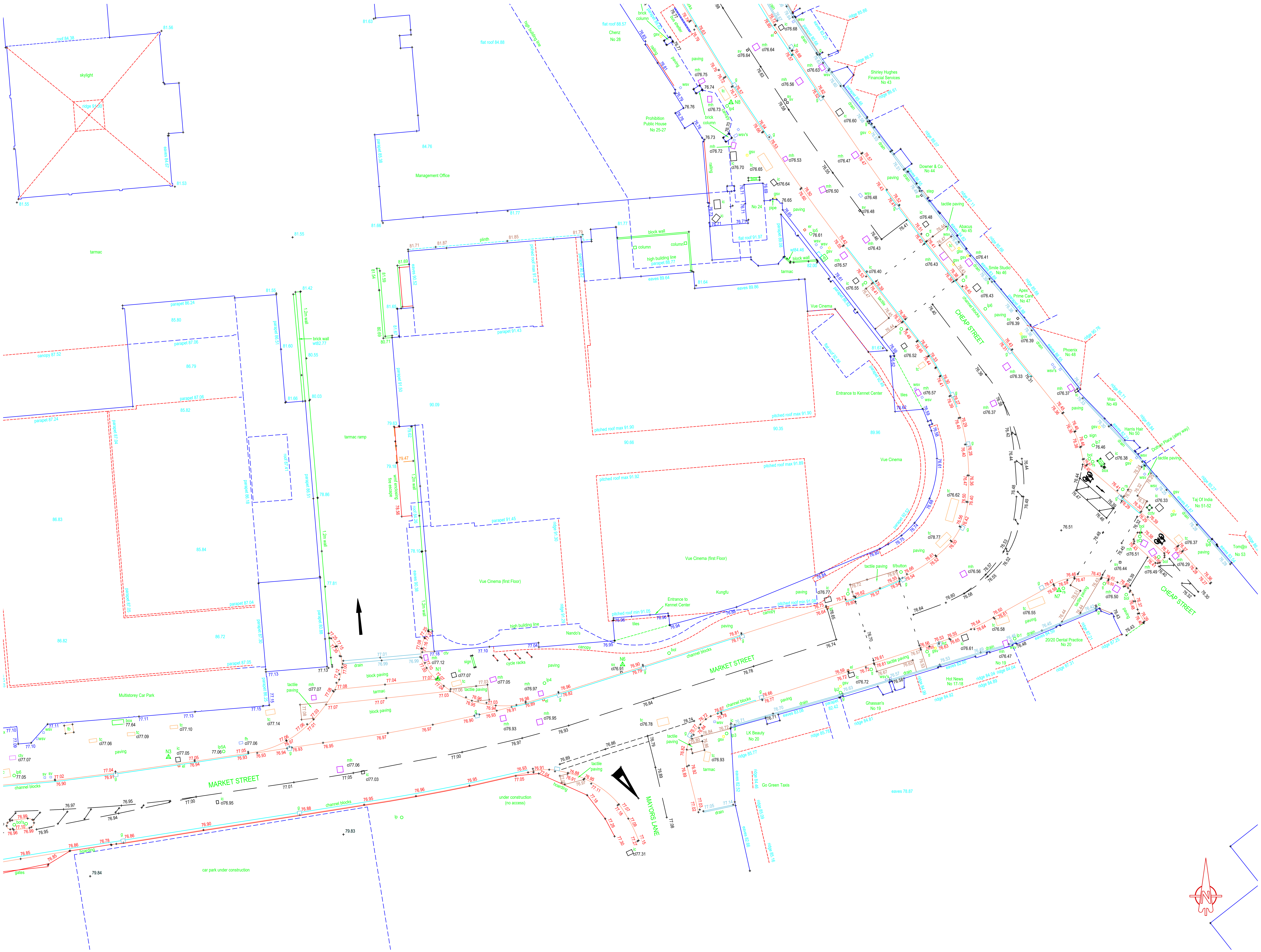
LOCHAILORT INVESTMENTS	Client
KENNET CENTRE NEWBURY BERKSHIRE	Contract
SITE SURVEY	Title
396KC01 - SHEET 3	Drawing Number
OCTOBER 2019	Date
1:200 (at A1)	Scale
MJR ST	Surveyor(s)



TREES

A	Ash
AL	Alder
AP	Apple
B	Beech
C	Cedar
CB	Copper Beech
CH	Cherry
CY	Cypress
E	Elm
EL	Elder
EU	Eucalyptus
F	Fir
FM	Field Maple
FR	Fruit
HZ	Hazel
HC	Horse Chestnut
HO	Holm Oak
HW	Hawthorn
HY	Holly
JM	Japanese Maple
LB	Laburnum
LM	Lime
LO	Locust Tree
LR	Laurel
M	Maple
MG	Magnolia
OK	Oak
P	Pine
PA	Palm
PL	Plane
PM	Plum
PO	Poplar
PP	Pissardii Plum
PR	Pear
R	Redwood
RD	Red Oak
RH	Rhododendron
RO	Rowan
SB	Silver Birch
SC	Sweet Chestnut
SP	Scots Pine
SU	Spruce
SY	Sycamore
U	Unidentified
W	Willow
WN	Walnut
Y	Yew

Species / Dia / Spread (max) / Ht
e.g. OK / 0.6 / 8 / 15

ABBREVIATIONS

BT	British Telecom
BOL	Bollard
CB	Control Box
CL	Cover Level
CTV	Cable Television
EL	Electric
EP	Electricity Pole
FH	Fire Hydrant
GSV	Gas Stop Valve
HT	Height
HVC	High Voltage Cable
IC	Inspection Cover
IL	Invert Level
LP	Lamp Post
MH	Man-Hole
MKR	Marker
MW	Monitoring Well
O/H	Overhead
G	Road Gully
PB	Post Box
PC	Pram Crossing
RNP	Road Name Plate
RS	Road Sign
S/A	Soakaway
ST	Stay / Strut
SV	Stop Valve (Unidentified)
TB	Telephone Box
TC	Telecom
TH	Trial Hole
TL	Traffic Light
TP	Telegraph Pole
UTL	Unable to Lift
VP	Vent pipe
WM	Water Meter
WSV	Water Stop Valve

FENCES

BWF	Barbed Wire Fence
CBF	Closed Board Fence
CP	Concrete Post
CPF	Chestnut Paling Fence
CWF	Chicken Wire Fence
IRF	Iron Railing Fence
PKF	Picket Fence
PRF	Post & Rail Fence
PWF	Post & Wire Fence
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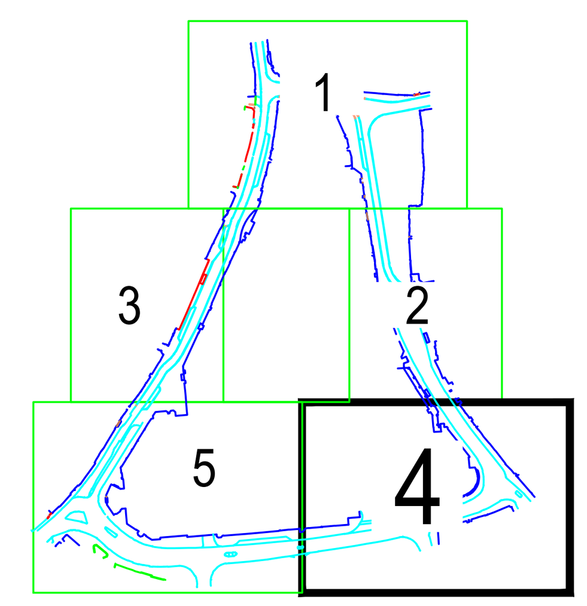

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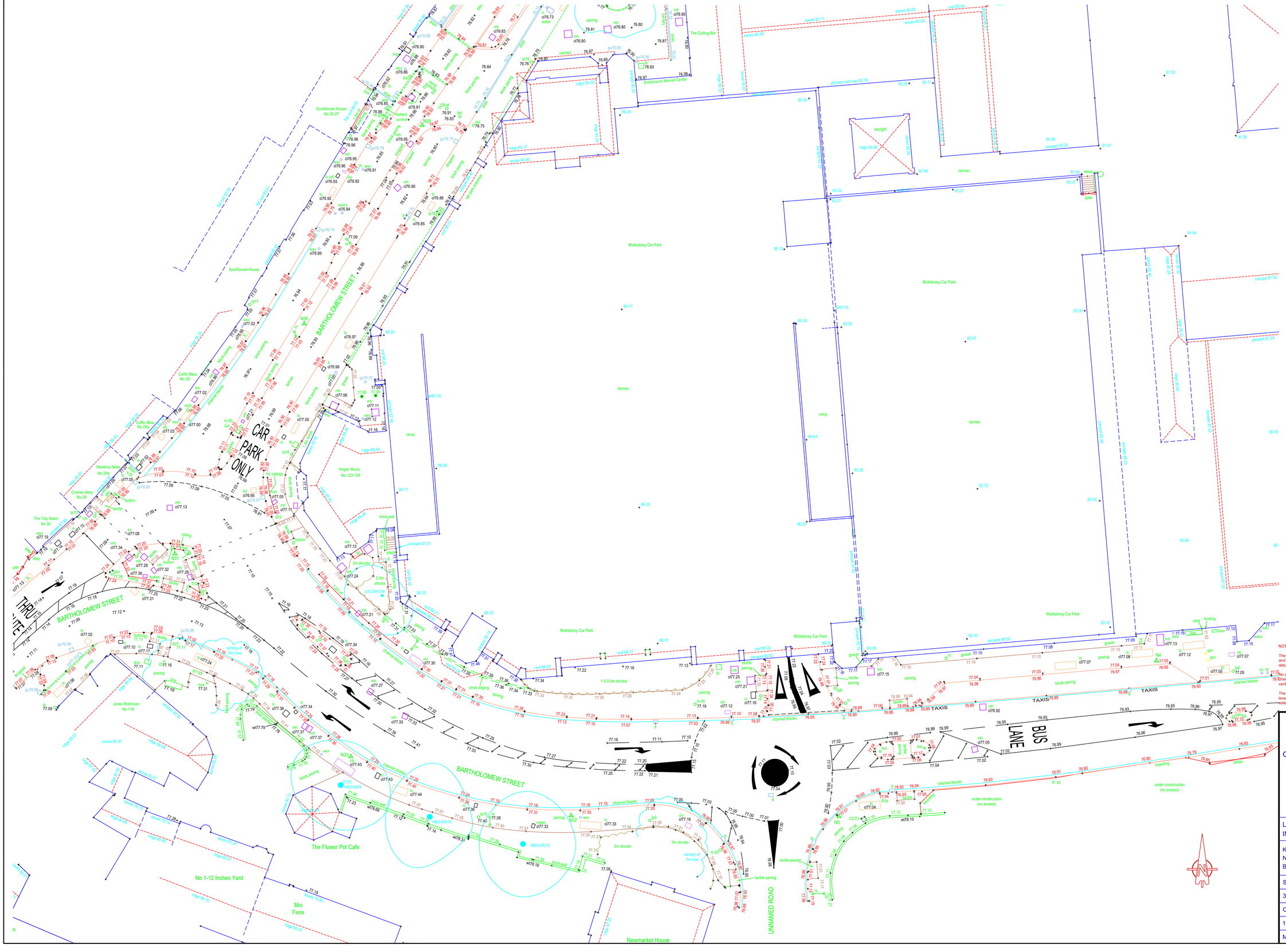
396KC01 - SHEET 4	Drawing Number
OCTOBER 2019	Date
1:200 (at A1)	Scale
MJR ST	Surveyor(s)



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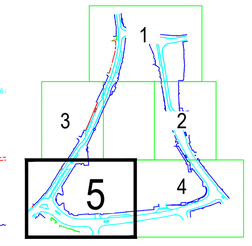

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KENNET CENTRE NEWBURY BERKSHIRE	Contract
SITE SURVEY	Title
396KC01 - SHEET 5	Drawing Number
OCTOBER 2019	Date
1:200 (at A1)	Scale
MJR ST	Surveyor(s)

Appendix C

WBC Consultation

Meeting Minutes

Robert Bird Group
Member of the Surbana Jurong Group

West Berkshire LLFA Meeting: 4508 Kennet Centre

Date:	12th August 2020	
Time:	14:00	
Location:	MS Teams	
Attendees:	Jon Bowden (WBC)	JB
	Stuart Clark (WBC)	SC
	Ciaran Morrissey (RBG)	CM
	Edmond Veillard (RBG)	EV
	Hugo Bianchi (RBG)	HB
	James Croucher (LI)	JC
Apologies:	Hugo Haig (LI)	HH
	Cormac Ennis (RBG)	CE
Minutes:	EV / CM	
Distribution:	As above	
Next Meeting:	N/A	

Agenda

1. Site Description, Location, Development Type

2. Planning Documentation Review - Flood Risk Assessment, Drainage Statement (inc. SuDS Strategy)

3. Flood Risk
    a. Flood Zone requirements
    b. Flood Levels – mitigation measures

4. Drainage Strategy
    a. Drainage Hierarchy
    b. Discharge
    c. Proposed SuDS Measures

5. AOB and Next steps

		ITEM / ACTION	ACTION	DATE
1.0		**Site Description, Location, Development Type**		
	1.1	LI note entire site to be redeveloped with exception of cinema and MSCP which are to be retained with modifications. No basements proposed on the site.	-	
	1.2	Creation of open air public realm through centre of site. Public realm to be entirely pedestrianised (except in cases of emergency)	-	
	1.3	RBG note existing site is entirely brownfield	-	
2.0		**Planning Documentation Review**		
	2.1	WBC confirm that Flood Risk Assessment and Drainage Strategy to be two separate documents for planning submission	-	
	2.2	WBC confirm there is no specific SuDS Proforma for surface water drainage rates and attenuation volumes. RBG to set out in Drainage Strategy	-	
3.0		**Flood Risk**		
	3.1	RBG note that the site lies in Flood Zone 2 and the usage classes of the development are compatible with planning requirements	-	
	3.2	WBC confirm that threshold levels should be set in accordance with EA guidance and BS 8533 where practicable. Noted that this is difficult to achieve where existing highway levels do not meet these criteria. Post meeting note: EA modelled flood level for 1 in 100 year event +70% CC = 76.74m, 300mm freeboard to be provided where practicable	-	
	3.3	Requirement for sequential and exception test to be determined by planners, WBC note that exception test is considered unlikely	-	
	3.4	WBC note there is specific risk from groundwater flooding due to shallow groundwater table	-	
	3.5	WBC note historical flooding has occurred to Market Street during heavy rainfall	-	
4.0		**Drainage Strategy**		
	4.1	WBC confirm discharge strategy to sewers is acceptable, high ground water table precludes infiltration.	-	
	4.2	RBG note that it will be challenging to reduce discharge from site to greenfield runoff rates due to constrained city centre location of site. WBC confirm that a 50% reduction from existing is a suitable for preliminary design. RBG to provide initial assessment of attenuation volumes and discharge rates once design is progressed to determine final rate.	RBG	
	4.3	RBG note that as cinema and car park structures are to be retained, it is preferential to retain existing drainage strategy and remove the building footprints from rainfall area calculations. WBC note that the option to drain these area to the new development storage should be considered. RBG to explore rerouting these areas.	RBG	
	4.4	WBC to confirm FEH or FSR Rainfall method	WB	
	4.5	WBC confirm that a climate change allowance of 40% to be applied to rainfall	-	
	4.6	LI note potential for blue / green roofs extremely limited. WBC note small planters and areas soft landscaping on roofs would be welcomed.	RBG/LI	
	4.7	LI to consider rainwater harvesting	LI	
	4.8	WBC note that permeable paving is not aesthetically ideal. RBG to consider methods to make more appealing with Landscape Architect. Comparison to be made with Parkway Shopping Centre paving	RBG	
	4.9	WBC note use of rills, tree pits and soft landscaping in public realm will be welcomed	-	
	4.10	WBC note to reuse existing connection to brick sewer along Bartholomew St.	-	
5.0		**AOB**		

	5.1	LI to liaise with architects / landscape architects over use of green walls	LI	
	5.2	WB and LI to liaise regarding upgrading streetscape features on Bartholomew St and area's surrounding Kennet Centre	WBC/LI	
	5.3.	LI seeking to abstract groundwater via boreholes. WBC note this should be organised directly with the EA Post meeting note: RBG to set up meeting with EA	RBG	

Appendix D

Drainage Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Ciaran Morrissey
Site name:	Kennet Centre
Site location:	Newbury

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.

Site Details

Latitude:	51.39993° N
Longitude:	1.324° W
Reference:	2715138385
Date:	Jul 03 2020 14:51

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.646

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):	738	738
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):	3.19	3.19
1 in 1 year (l/s):	2.71	2.71
1 in 30 years (l/s):	7.34	7.34
1 in 100 year (l/s):	10.18	10.18
1 in 200 years (l/s):	11.93	11.93

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 447129 166981 SU 47129 66981
Data Type	Point
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	42.588	0.100	425.9	0.350	5.00	0.0	0.600	o	450	Pipe/Conduit	
S2.000	39.731	0.100	397.3	0.256	5.00	0.0	0.600	o	375	Pipe/Conduit	
S1.001	30.207	0.100	302.1	0.072	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.002	46.209	0.120	385.1	0.079	0.00	0.0	0.600	o	450	Pipe/Conduit	
S3.000	23.434	0.100	234.3	0.267	5.00	0.0	0.600	o	375	Pipe/Conduit	
S3.001	40.229	0.220	182.9	0.136	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	-10.48	5.73	76.000	0.350	0.0	0.0	0.0	0.98	155.7	0.0
S2.000	-10.46	5.73	76.000	0.256	0.0	0.0	0.0	0.90	99.7	0.0
S1.001	-9.73	6.17	75.900	0.677	0.0	0.0	0.0	1.16	185.2	0.0
S1.002	-8.68	6.91	75.800	0.756	0.0	0.0	0.0	1.03	163.8	0.0
S3.000	-11.25	5.33	76.000	0.267	0.0	0.0	0.0	1.18	130.2	0.0
S3.001	-10.29	5.83	75.900	0.403	0.0	0.0	0.0	1.34	147.6	0.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.003	51.160	0.300	170.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S4.000	32.841	0.146	225.0	0.139	5.00	0.0	0.600	o	375	Pipe/Conduit	
S4.001	44.467	0.150	296.4	0.175	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.002	44.880	0.150	299.2	0.159	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.003	-8.14	7.37	75.680	1.159	0.0	0.0	0.0	1.86	526.4	0.0
S4.000	-11.00	5.45	76.000	0.139	0.0	0.0	0.0	1.20	133.0	0.0
S4.001	-9.74	6.16	75.854	0.314	0.0	0.0	0.0	1.05	115.7	0.0
S4.002	-8.72	6.88	75.704	0.473	0.0	0.0	0.0	1.04	115.1	0.0

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	76.800	0.800	Open Manhole	1350	S1.000	76.000	450				
S2	76.800	0.800	Open Manhole	1350	S2.000	76.000	375				
S2	76.800	0.900	Open Manhole	1350	S1.001	75.900	450	S1.000	75.900	450	
								S2.000	75.900	375	
S3	76.800	1.000	Open Manhole	1350	S1.002	75.800	450	S1.001	75.800	450	
S4	76.800	0.800	Open Manhole	1350	S3.000	76.000	375				
S5	76.800	0.900	Open Manhole	1350	S3.001	75.900	375	S3.000	75.900	375	
S4	76.620	0.940	Open Manhole	1500	S1.003	75.680	600	S1.002	75.680	450	
								S3.001	75.680	375	
S	76.620	1.240	Open Manhole	0		OUTFALL		S1.003	75.380	600	
S8	76.620	0.620	Open Manhole	1350	S4.000	76.000	375				
S9	76.620	0.766	Open Manhole	1350	S4.001	75.854	375	S4.000	75.854	375	
S10	76.620	0.916	Open Manhole	1350	S4.002	75.704	375	S4.001	75.704	375	
S	76.620	1.066	Open Manhole	0		OUTFALL		S4.002	75.554	375	

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	76.620	75.380	75.497	0	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S4.002	S	76.620	75.554	75.536	0	0

Online Controls for Storm

Complex Manhole: S4, DS/PN: S1.003, Volume (m³): 13.1

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0227-2500-0400-2500
Design Head (m)	0.400
Design Flow (l/s)	25.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	227
Invert Level (m)	75.680
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	25.0
Flush-Flo™	0.294	25.0
Kick-Flo®	0.377	24.3
Mean Flow over Head Range	-	16.8

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.6	1.200	42.3	3.000	66.0	7.000	99.7
0.200	22.7	1.400	45.6	3.500	71.1	7.500	103.2
0.300	25.0	1.600	48.7	4.000	75.9	8.000	106.6
0.400	25.0	1.800	51.5	4.500	79.5	8.500	110.0
0.500	27.8	2.000	54.2	5.000	83.9	9.000	113.2
0.600	30.3	2.200	56.8	5.500	88.1	9.500	116.3
0.800	34.8	2.400	59.2	6.000	92.1		
1.000	38.8	2.600	61.6	6.500	96.0		

Orifice

Diameter (m) 0.193 Discharge Coefficient 0.600 Invert Level (m) 75.680

Complex Manhole: S10, DS/PN: S4.002, Volume (m³): 6.1

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0166-1200-0400-1200
Design Head (m)	0.400
Design Flow (l/s)	12.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	166
Invert Level (m)	75.704
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.400	12.0
Flush-Flo™	0.229	12.0
Kick-Flo®	0.345	11.2
Mean Flow over Head Range	-	8.9

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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.9	1.200	20.2	3.000	31.4	7.000	47.4
0.200	11.9	1.400	21.8	3.500	33.8	7.500	49.1
0.300	11.7	1.600	23.2	4.000	36.1	8.000	50.7
0.400	12.0	1.800	24.5	4.500	37.9	8.500	52.3
0.500	13.3	2.000	25.8	5.000	40.0	9.000	53.9
0.600	14.5	2.200	27.0	5.500	42.0	9.500	55.3
0.800	16.7	2.400	28.2	6.000	43.9		
1.000	18.5	2.600	29.3	6.500	45.7		

Orifice

Diameter (m) 0.135 Discharge Coefficient 0.600 Invert Level (m) 75.704

Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	55.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.200	Membrane Depth (mm)	100

Porous Car Park Manhole: S2, DS/PN: S2.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	55.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.200	Membrane Depth (mm)	100

Porous Car Park Manhole: S2, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.200	Membrane Depth (mm)	100

Porous Car Park Manhole: S4, DS/PN: S3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.200	Membrane Depth (mm)	100

Complex Manhole: S4, DS/PN: S1.003

Cellular Storage

Invert Level (m)	75.680	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	605.0	0.0	0.401	0.0	0.0
0.400	605.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	138.9	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.200	Membrane Depth (mm)	100

Porous Car Park Manhole: S8, DS/PN: S4.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	27.8	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.020	Membrane Depth (mm)	100

Complex Manhole: S10, DS/PN: S4.002

Cellular Storage

Invert Level (m)	75.704	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	310.0	0.0	0.401	0.0	0.0
0.400	310.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	20.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.0
Max Percolation (l/s)	194.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	76.020	Membrane Depth (mm)	100

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 447129 166981 SU 47129 66981
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	2	+0%	100/15 Summer			
S2.000	S2	15 Winter	2	+0%	100/15 Summer			
S1.001	S2	15 Winter	2	+0%	100/15 Summer			
S1.002	S3	15 Winter	2	+0%	100/15 Summer			
S3.000	S4	15 Winter	2	+0%	100/15 Summer			
S3.001	S5	15 Winter	2	+0%	100/15 Summer			
S1.003	S4	120 Winter	2	+0%	100/30 Summer	100/60 Winter		
S4.000	S8	15 Winter	2	+0%	100/15 Summer			
S4.001	S9	15 Winter	2	+0%	100/15 Summer			
S4.002	S10	120 Winter	2	+0%	100/30 Winter			

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	76.205	-0.245	0.000	0.35		48.5	OK	
S2.000	S2	76.193	-0.182	0.000	0.40		36.5	OK	
S1.001	S2	76.147	-0.203	0.000	0.55		87.1	OK	
S1.002	S3	76.064	-0.186	0.000	0.64		94.3	OK	
S3.000	S4	76.158	-0.217	0.000	0.36		40.6	OK	
S3.001	S5	76.072	-0.203	0.000	0.43		57.4	OK	
S1.003	S4	75.850	-0.430	0.000	0.07		34.0	OK	1
S4.000	S8	76.098	-0.277	0.000	0.15		17.8	OK	
S4.001	S9	76.010	-0.219	0.000	0.36		37.7	OK	
S4.002	S10	75.826	-0.253	0.000	0.14		14.8	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 447129 166981 SU 47129 66981
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	100/15 Summer			
S2.000	S2	15 Winter	30	+0%	100/15 Summer			
S1.001	S2	15 Winter	30	+0%	100/15 Summer			
S1.002	S3	15 Winter	30	+0%	100/15 Summer			
S3.000	S4	15 Winter	30	+0%	100/15 Summer			
S3.001	S5	15 Winter	30	+0%	100/15 Summer			
S1.003	S4	60 Winter	30	+0%	100/30 Summer	100/60 Winter		
S4.000	S8	15 Winter	30	+0%	100/15 Summer			
S4.001	S9	15 Winter	30	+0%	100/15 Summer			
S4.002	S10	60 Winter	30	+0%	100/30 Winter			

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	76.363	-0.087	0.000	0.66		92.0	OK	
S2.000	S2	76.371	-0.004	0.000	0.62		56.0	OK	
S1.001	S2	76.311	-0.039	0.000	0.84		133.5	OK	
S1.002	S3	76.238	-0.012	0.000	1.00		147.8	OK	
S3.000	S4	76.274	-0.101	0.000	0.81		90.8	OK	
S3.001	S5	76.208	-0.067	0.000	0.98		132.1	OK	
S1.003	S4	76.036	-0.244	0.000	0.14		64.2	OK	1
S4.000	S8	76.190	-0.185	0.000	0.39		46.3	OK	
S4.001	S9	76.144	-0.085	0.000	0.92		97.5	OK	
S4.002	S10	75.970	-0.109	0.000	0.27		28.8	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 447129 166981 SU 47129 66981
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

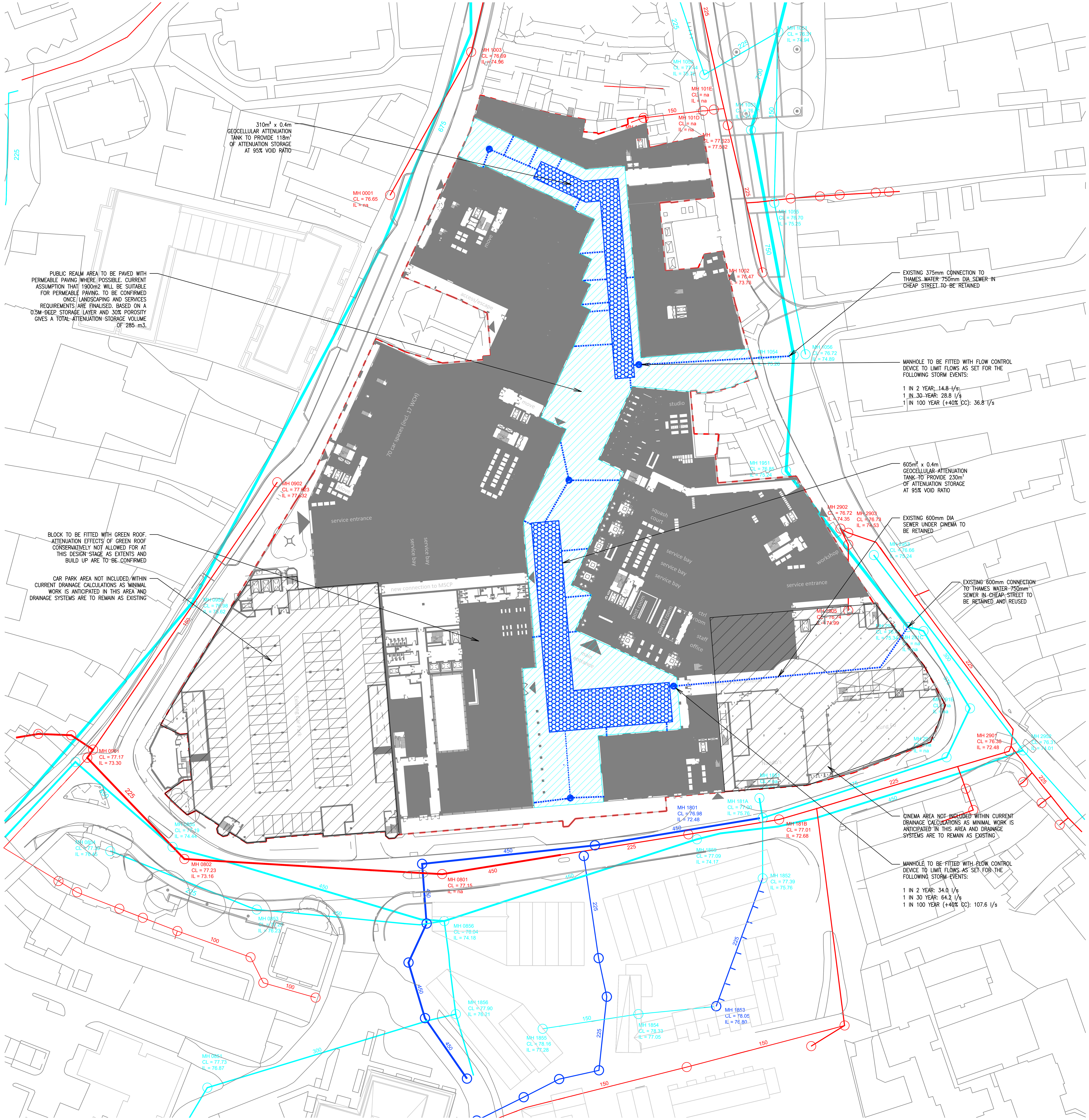
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	60 Winter	100	+40%	100/15 Summer			
S2.000	S2	60 Winter	100	+40%	100/15 Summer			
S1.001	S2	60 Winter	100	+40%	100/15 Summer			
S1.002	S3	60 Winter	100	+40%	100/15 Summer			
S3.000	S4	60 Winter	100	+40%	100/15 Summer			
S3.001	S5	60 Winter	100	+40%	100/15 Summer			
S1.003	S4	60 Winter	100	+40%	100/30 Summer	100/60 Winter		
S4.000	S8	15 Winter	100	+40%	100/15 Summer			
S4.001	S9	15 Winter	100	+40%	100/15 Summer			
S4.002	S10	60 Winter	100	+40%	100/30 Winter			

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	76.693	0.243	0.000	0.71		98.9	FLOOD RISK	
S2.000	S2	76.694	0.319	0.000	0.70		63.0	FLOOD RISK	
S1.001	S2	76.679	0.329	0.000	1.08		171.8	FLOOD RISK	
S1.002	S3	76.651	0.401	0.000	1.30		191.6	FLOOD RISK	
S3.000	S4	76.721	0.346	0.000	0.79		88.6	FLOOD RISK	
S3.001	S5	76.677	0.402	0.000	1.00		134.0	FLOOD RISK	
S1.003	S4	76.621	0.341	0.567	0.23		107.6	FLOOD	1
S4.000	S8	76.463	0.088	0.000	0.58		68.4	FLOOD RISK	
S4.001	S9	76.406	0.177	0.000	1.44		152.8	FLOOD RISK	
S4.002	S10	76.168	0.089	0.000	0.35		36.8	SURCHARGED	

Appendix E

Drainage General Arrangement Plan



NOTES:

1. DO NOT SCALE FROM THIS DRAWING
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE BUILDING REGULATIONS, LOCAL AUTHORITY REQUIREMENTS, BS EN752, BS EN 12056 AND BS8000 PART 14.
3. ALL PIPE WORK EXTERNAL TO THE BUILDING IS TO BE PLASTIC TO BS EN 1401 EXCEPT FOR CONNECTIONS TO EXISTING SEWERS. ALL PIPE WORK CAST THROUGH FOUNDATIONS TO BE CAST IRON TO BS EN 877
4. SITE LAYOUT IS BASED ON COLLADO COLLINS REV K PRELIMINARY GENERAL ARRANGEMENT LAYOUTS, RECEIVED 25.11.2020
5. THAMES WATER SEWERS TAKEN FROM THE ASSET LOCATION SEWER RECORD DRAWINGS, ACCESSED MAY 2020.
6. EXISTING SITE SEWER INFORMATION AND CONNECTION LOCATIONS ARE BASED ON 1980s RECORD DRAWINGS.
7. DRAINAGE STRATEGY AND SURFACE WATER DISCHARGE RATES ARE SUBJECT TO AGREEMENT WITH THE LLFA AND THAMES WATER.
8. SURFACE WATER IS TO BE DISCHARGED TO THE EXISTING SEWER NETWORK. RECORD DRAWINGS SHOW THAT THE EXISTING NETWORK HAS BEEN DESIGNED TO ALLOW FOR CONNECTIONS FROM THIS SITE. A SURVEY IS RECOMMENDED TO DETERMINE THE AS BUILT CONDITION, LINE AND LEVEL OF THESE SEWERS AND VERIFY INVERT LEVELS.
9. THE SURFACE WATER DRAINAGE NETWORK IS INDICATIVE ONLY. THE LAYOUT OF PIPEWORK, CHAMBERS AND SUDS FEATURES WILL BE DETERMINED WHEN MORE DETAILED ARCHITECTURAL, MEP AND LANDSCAPE INFORMATION BECOMES AVAILABLE AT THE NEXT DESIGN STAGE.
10. HARDSTANDING AREAS WITHIN THE PUBLIC REALM ARE TO BE PAVED WITH PERMEABLE PAVING WHERE POSSIBLE. TREES AND PLANTERS WITHIN THE PUBLIC REALM WILL BE INCORPORATED INTO THE SURFACE WATER DRAINAGE NETWORK AS SUDS FEATURES TO ATTENUATE RAIN WATER.

KEY TO HEALTH AND SAFETY SYMBOLS

- INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
- INDICATES A RESIDUAL RISK FOR INFORMATION
- INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION
- INDICATES A RESIDUAL RISK AS A WARNING

LEGEND:

- SITE BOUNDARY
- ATTENUATION STORAGE
- PROPOSED SURFACE WATER PIPE
- PROPOSED SURFACE WATER MANHOLE
- AREA SUITABLE FOR PERMEABLE PAVING
- EXISTING TW SURFACE WATER SEWER
- EXISTING TW FOUL WATER SEWER
- SWMH-01 EXISTING TW SW MANHOLE
- FWMH-01 EXISTING TW FW MANHOLE

Rev	Revision Description	By	App	Date
P01	FOR INFORMATION	CM	EV	08.01.21

Scale	1	2	3	4	5	6	7	8

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS
REFER TO GENERAL NOTES UNLESS NOTED OTHERWISE

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Client
LOCHAILORT NEWBURY LIMITED

Project
KENNET CENTRE

Title
SURFACE WATER DRAINAGE GENERAL ARRANGEMENT PLAN

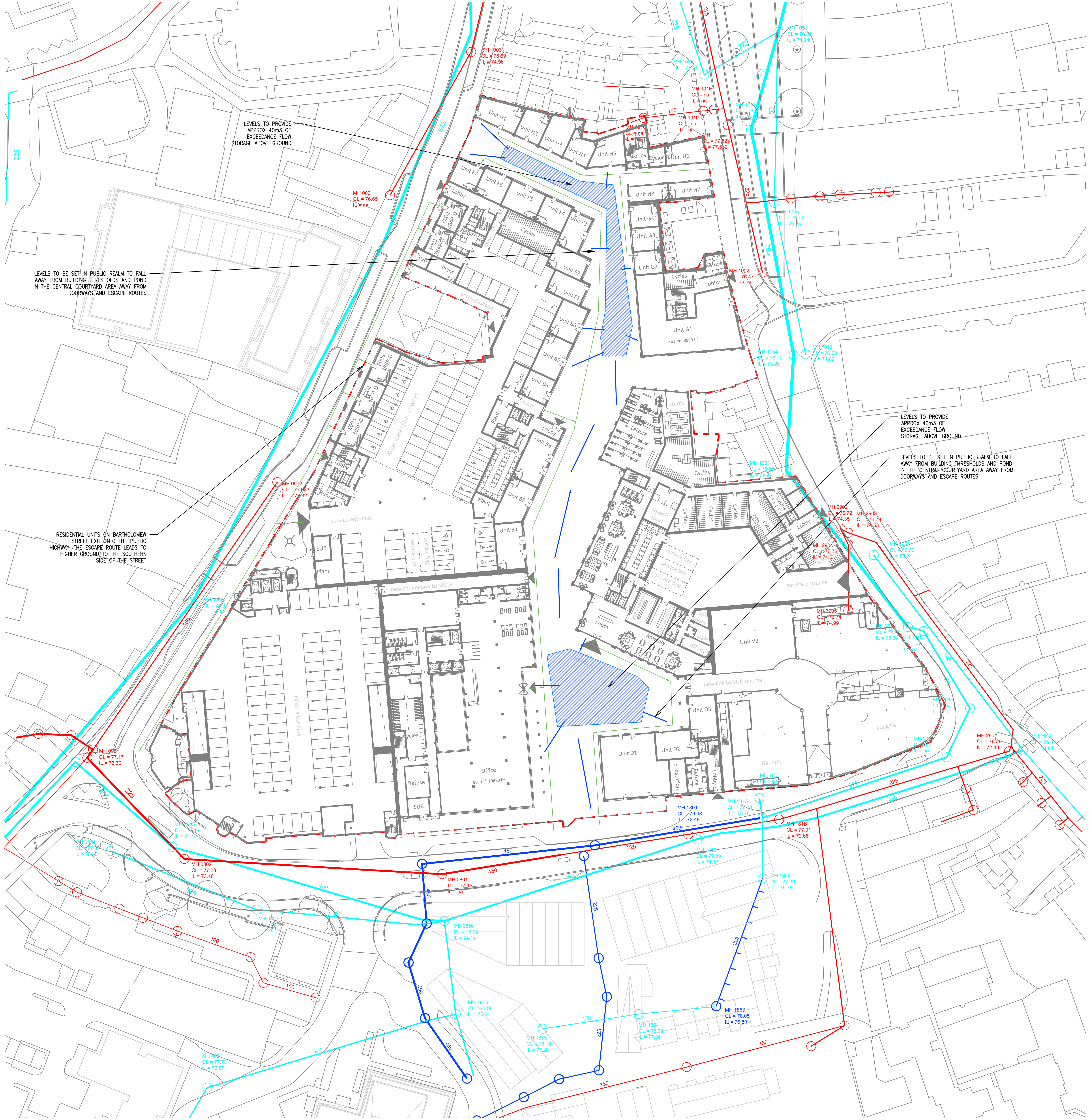
Date: DEC/2020	Drawn: J.BELL
Scale at A1: 1:500	Designer: C. MORRISSEY
Suitability Code: S2	Design Checker: E. VEILLARD
Job Number: 4508	Approved: –

FOR INFORMATION

Drawing Number: 4508-RBG-ZZ-XX-DR-C-52-0001
Revision: P01

Appendix F

Exceedance Flow Routes



NOTES:

1. SITE LIES IN FLOOD ZONE 2 – LOW PROBABILITY OF FLOODING FROM RIVERS OR THE SEA. THE ENVIRONMENT AGENCY HAS BEEN CONSULTED ON LIKELY FLOOD LEVELS. SITE LEVELS ARE TO BE MAINTAINED ABOVE 76.62mAOD WHEREVER POSSIBLE TO PROVIDE SAFE EGRESS IN THE 1 IN 100 YEAR STORM EVENT WITH 35%CC FACTOR. IT IS NOTED THAT THIS IS NOT ACHIEVABLE FOR UNITS ALONG BARTHOLOMEW STREET WHERE IN LOCATIONS LEVELS ARE SLIGHTLY LOWER TO TIE INTO EXISTING LEVELS AT THE HIGHWAY BOUNDARY.
2. FOR UNITS WITH THRESHOLD LEVELS SET ABOVE 76.62mAOD ESCAPE ROUTES ARE CONSIDERED FOR SURFACE WATER FLOODING AND EXCEEDANCE FLOW ROUTES IN EXTREME RAINFALL EVENTS (BEYOND 1 IN 100 YEAR ANNUAL PROBABILITY)
3. ALL RESIDENTIAL PROPERTIES WITHIN THE DEVELOPMENT ARE AT FIRST FLOOR LEVEL (EXCEPT THE PROPERTIES ON BARTHOLOMEW STREET) AND WILL NOT REQUIRE IMMEDIATE EVACUATION IN THE EVENT OF SURFACE WATER FLOODING.
4. IN THE EVENT OF SURFACE WATER FLOODING IT IS INTENDED THAT COMMERCIAL UNITS ARE EVACUATED TO HIGHER GROUND TO THE SOUTH OF THE SITE ALONG MARKET STREET. THE LOCATION OF AN ASSEMBLY SPACE IS TO BE DETERMINED BY THE OPERATOR AND TRANSMITTED TO THE OCCUPANTS ONCE CONFIRMED.
5. THE ESCAPE ROUTE IDENTIFIED FROM THE COMMERCIAL UNITS TO THE PUBLIC HIGHWAY IS ROUTED ALONG LEVEL SURFACES THAT SHOULD NOT IMPEDE THE MOBILITY IMPAIRED.
6. LEVELS ALONG THE ESCAPE ROUTE ARE TO BE SET HIGHER THAN THE SURROUNDING GROUND TO ENSURE THAT THEY REMAIN DRRY AS LONG AS POSSIBLE DURING AN EXTREME STORM EVENT.
7. EXTERNAL AREAS OF THE SITE ARE TO BE LIT AT NIGHT. ALL ESCAPE ROUTE LIGHTING WILL ALSO BE EMERGENCY LIGHTING.

KEY TO HEALTH AND SAFETY SYMBOLS

- –INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION
- –INDICATES A RESIDUAL RISK FOR INFORMATION
- –INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION
- –INDICATES A RESIDUAL RISK AS A WARNING

LEGEND:

- SITE BOUNDARY
- OVERLAND EXCEEDANCE FLOW ROUTES
- EXCEEDANCE STORAGE
- ESCAPE ROUTE

Rev	Revision Description	By	App	Date
P01	FOR INFORMATION	CM	EV	08.01.21

Scale	1	2	3	4	5	6	7	8

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Client
LOCHAILORT NEWBURY LIMITED

Project
KENNET CENTRE

Title
SURFACE WATER DRAINAGE EXCEEDANCE FLOW ROUTES

Date: DEC/2020	Drawn: J.BELL
Scale at A1: 1:500	Designer: C. MORRISSEY
Suitability Code: S2	Design Checker: E. VEILLARD
Job Number: 4508	Approved: J. GOLD

FOR INFORMATION

Drawing Number: 4508-RBG-ZZ-XX-DR-C-52-0010 Revision: P01

FS 538679

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