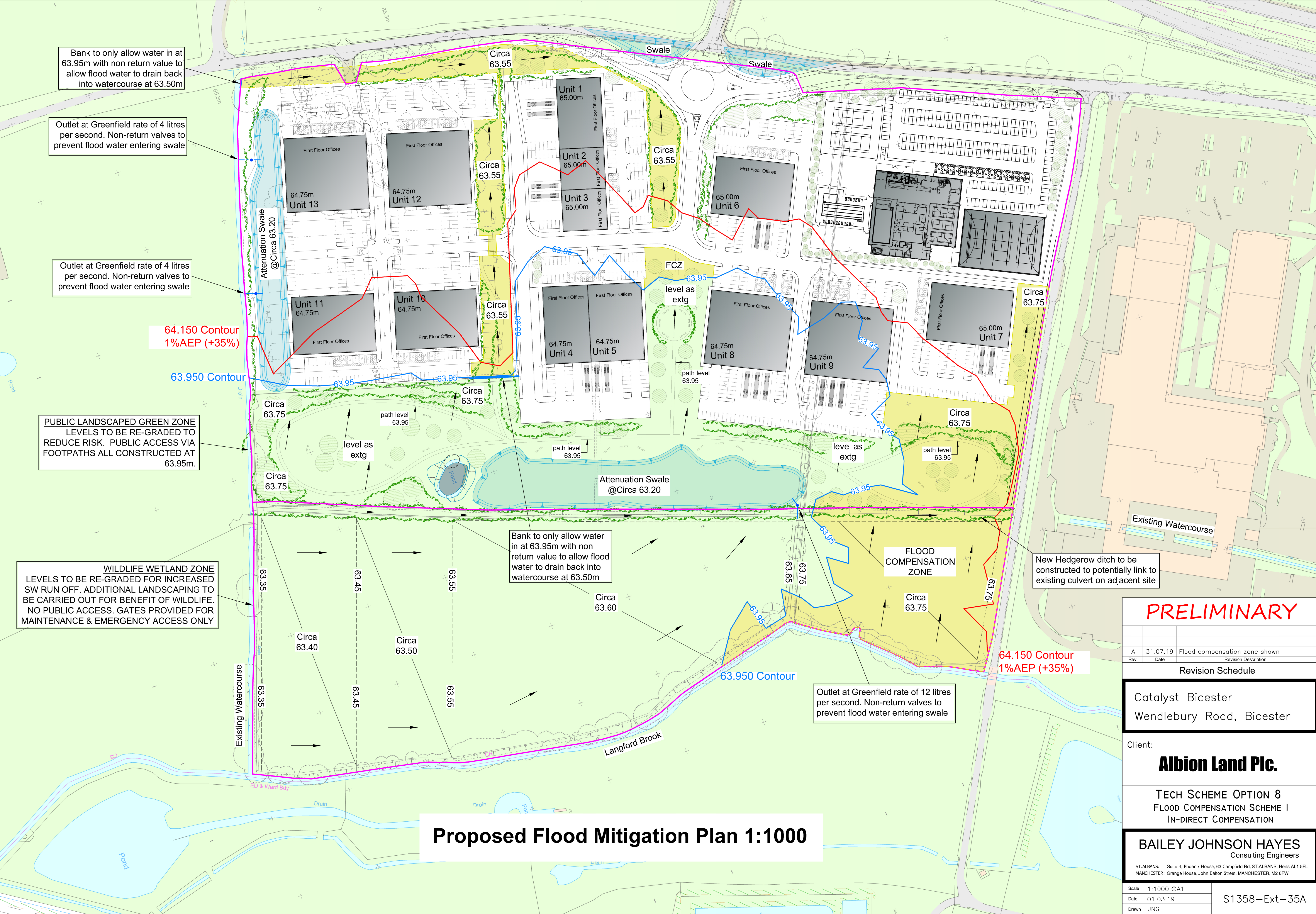




PRELIMINARY

Rev	Date	Revision Description
A	31.07.19	Flood compensation zone shown

Revision Schedule

Catalyst Bicester
Wendlebury Road, Bicester

Client:
Albion Land Plc.

TECH SCHEME OPTION 8
FLOOD COMPENSATION SCHEME I
IN-DIRECT COMPENSATION

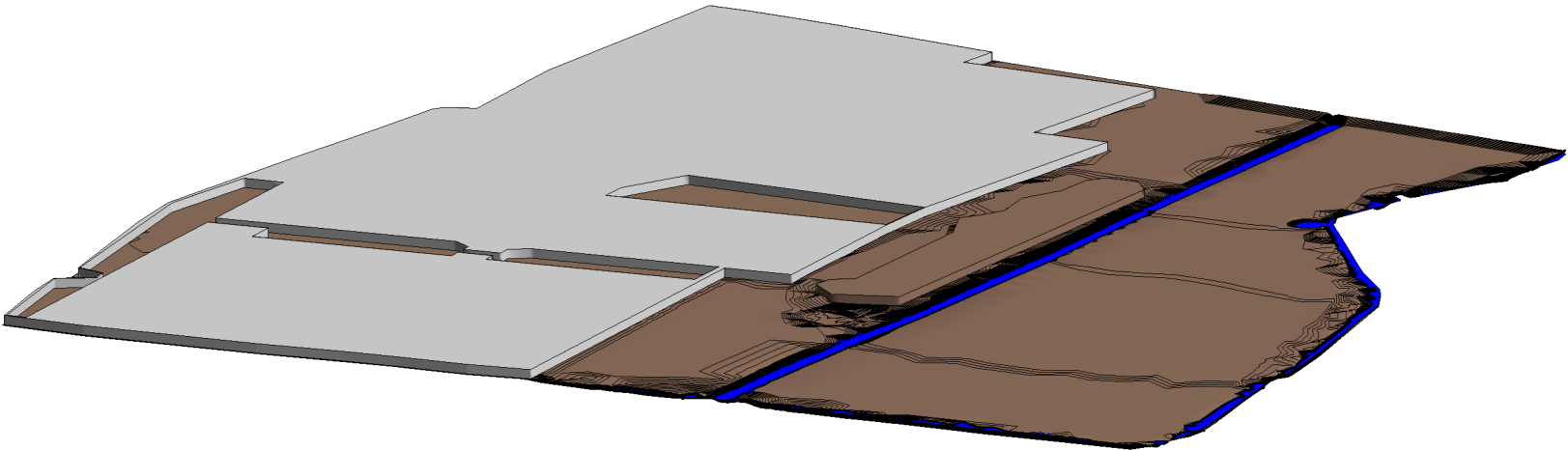
BAILEY JOHNSON HAYES
Consulting Engineers

ST. ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST. ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

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Date	01.03.19
Drawn	JNG

S1358-Ext-35A

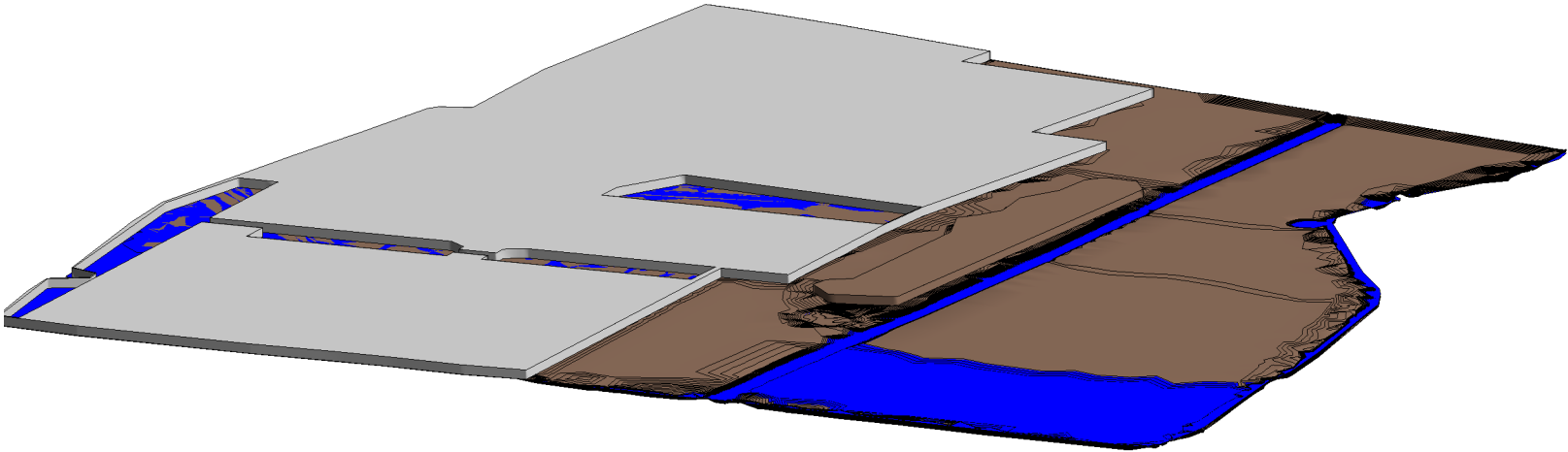
Flood Level	Expected Flood Level (m)
1 in 5 year (20% AEP)	63.650
1 in 20 year (5% AEP)	63.940
1 in 100 year (1% AEP)	64.050
1 in 100 year + 35% CC (1% AEP + 35% CC)	64.150
1 in 1000 Year (0.1% AEP)	64.200



3D 63.150m - 63.350m

Rev	Date	Revision Description
Revision Schedule		
Promised Land Farm Bicester		
Client:- Albion Land PLC		
Flood Compensation - Slice 63.150m-63.350m		
BAILEY JOHNSON HAYES Consulting Engineers		
MANCHESTER: Orange House, John Dalton Street, Tel:0161 275 7777 Fax:0161 225 2222 ST ALBAN: Phoenix House, 62 Campbell Road, Tel:01274 841172 Fax:01274 841885		
Scale	1 : 1 @A1	Project Ref.
Date	06/21/19	Drawing No.
Drawn By	BJH	Checked By
S1358		3D-010

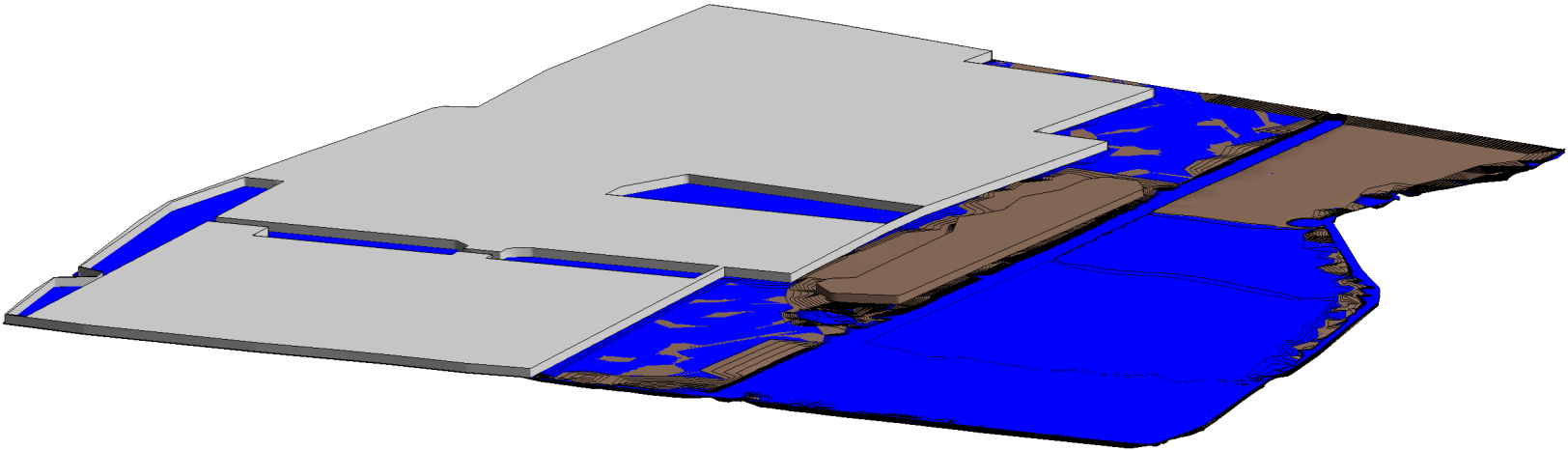
Flood Level	Expected Flood Level (m)
1 in 5 year (20% AEP)	63.650
1 in 20 year (5% AEP)	63.940
1 in 100 year (1% AEP)	64.050
1 in 100 year + 35% CC (1% AEP + 35% CC)	64.150
1 in 1000 Year (0.1% AEP)	64.200



3D 63.350m - 63.550m

Rev	Date	Revision Description
Revision Schedule		
Promised Land Farm Bicester		
Client:- Albion Land PLC		
Flood Compensation - Slice 63.250m-63.550m		
BAILEY JOHNSON HAYES Consulting Engineers		
MANCHESTER: Orange House, John Dalton Street, Tel:0161 275 7777 Fax:0161 225 0502 ST ALBANS: Phoenix House, 62 Campbell Road, Tel:01272 841172 Fax:01272 841585		
Scale	1 : 1 @A1	Project Ref.
Date	06/21/19	Drawing No.
Drn BJH	Chkd BJH	S1358 3D-011
		Rev.

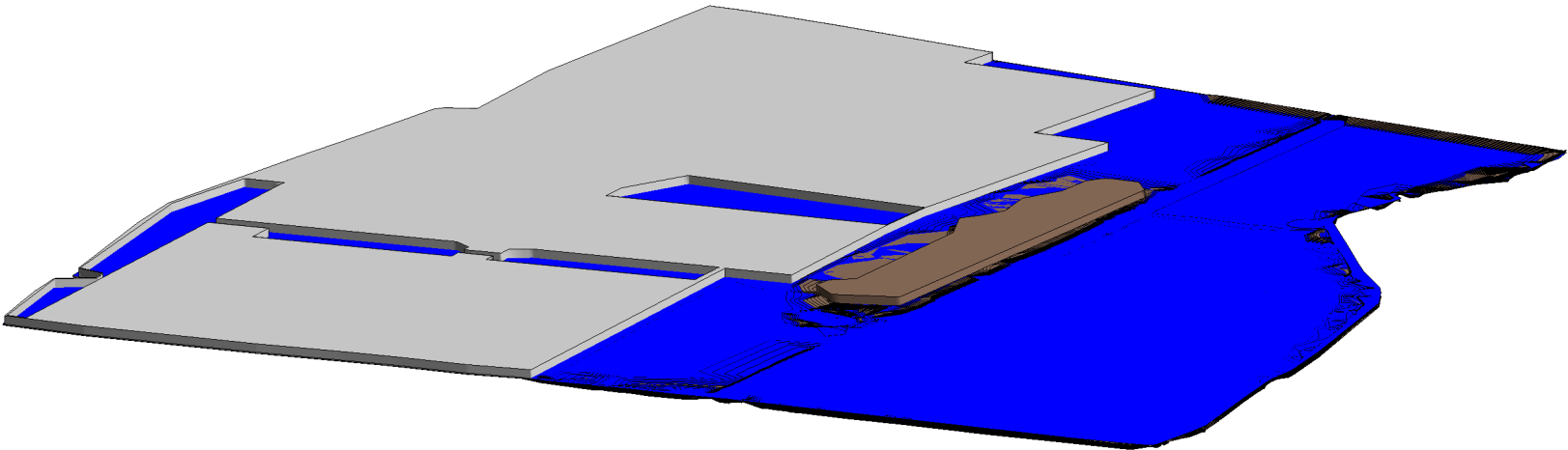
Flood Level	Expected Flood Level (m)
1 in 5 year (20% AEP)	63.650
1 in 20 year (5% AEP)	63.940
1 in 100 year (1% AEP)	64.050
1 in 100 year + 35% CC (1% AEP + 35% CC)	64.150
1 in 1000 Year (0.1% AEP)	64.200



3D 63.550m - 63.750m

Rev	Date	Revision Description
Revision Schedule		
Promised Land Farm Bicester		
Client:- Albion Land PLC		
Flood Compensation - Slice 63.550m-63.750m		
BAILEY JOHNSON HAYES Consulting Engineers		
MANCHESTER: Orange House, John Dalton Street, Tel:0161 275 7777 Fax:0161 225 2222 ST ALBANS: Pipers House, 62 Campbell Road, Tel:01272 841172 Fax:01272 841585		
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Date	06/21/19	Drawing No.
Drn BJH	Chkd BJH	S1358 3D-012
		Rev.

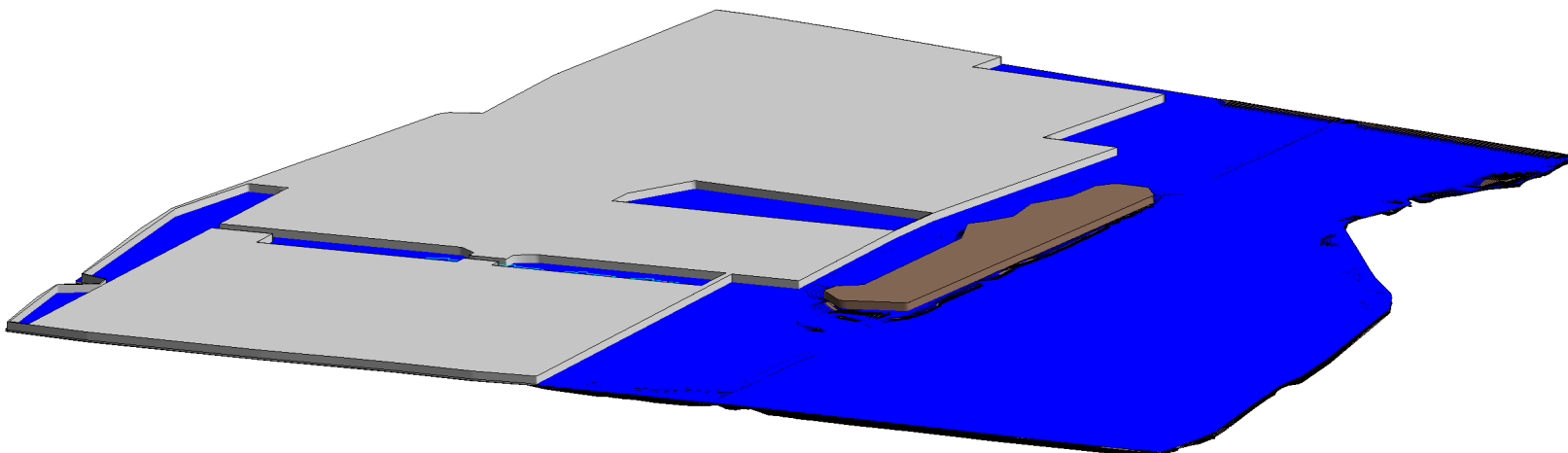
Flood Level	Expected Flood Level (m)
1 in 5 year (20% AEP)	63.650
1 in 20 year (5% AEP)	63.940
1 in 100 year (1% AEP)	64.050
1 in 100 year + 35% CC (1% AEP + 35% CC)	64.150
1 in 1000 Year (0.1% AEP)	64.200



3D 63.750m - 63.950m

Rev	Date	Revision Description	Rev.
Revision Schedule			
Promised Land Farm Bicester			
Client:- Albion Land PLC			
Flood Compensation - Slice 63.750m-63.950m			
BAILEY JOHNSON HAYES Consulting Engineers			
MANCHESTER: Orange House, John Dalton Street, Tel:0161 225 7777 Fax:0161 225 0202 ST ALBAN'S: Pipers House, 63 Campbell Road, Tel:01227 841172 Fax:01227 841085			
Scale	1 : 1 @A1	Project Ref.	Drawing No.
Date	06/21/19	S1358	3D-013
Drawn By	BJH	Checked By	BJH

Flood Level	Expected Flood Level (m)
1 in 5 year (20% AEP)	63.650
1 in 20 year (5% AEP)	63.940
1 in 100 year (1% AEP)	64.050
1 in 100 year + 35% CC (1% AEP + 35% CC)	64.150
1 in 1000 Year (0.1% AEP)	64.200



3D 63.950m - 64.150m

Rev	Date	Revision Description	Rev.
Revision Schedule			
Promised Land Farm Bicester			
Client:- Albion Land PLC			
Flood Compensation - Slice 63.950m-64.150m			
BAILEY JOHNSON HAYES Consulting Engineers			
MANCHESTER: Orange House, John Dalton Street, Tel:0161 275 7777 Fax:0161 225 0202 ST ALBANS: Phoenix House, 62 Campbell Road, Tel:01272 841172 Fax:01272 841085			
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Date	06/21/19	S1358	3D-014
Drawn By	BJH	Checked By	BJH

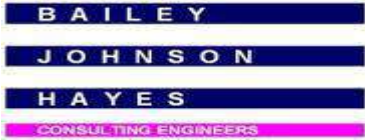
Slice	Existing Slice Capacity M³		New Site Slice Capacity M³		Difference (Gain) M³
63.150-63.350	322		760		438
63.350-63.550	1205		1831		626
63.550-63.750	6475		7023		548
63.750-63.950	13779		14099		320
63.950-64.150	21151		21470		319

Option 8

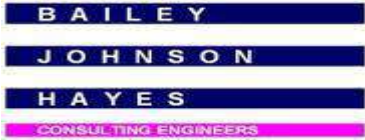
Level	Existing Capacity			New Level Capacity	Difference
63.150	514.000			776.000	-262.000
63.350	836.000			1536.000	-700.000
63.550	2041.000			4367.000	-2326.000
63.750	8516.000			11390.000	-2874.000
63.950	22295.000			25489.000	-3194.000
64.150	43446.000			46959.000	-3513.000

APPENDIX H

BAILEY JOHNSON HAYES SURFACE WATER DRAINAGE SCHEME & CALCULATIONS

 Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk	Project	Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	Project No. S1358	Sheet No. D1
	Section	Surface Water Drainage Design	Drawing No.	Rev. 2
			By P.A.B.	Date Jul 2019
			Checked	Date

Calculations
<u>PROPOSED DEVELOPMENT</u> <u>CATALYST BICESTER</u> <u>WENDLEBURY ROAD, BICESTER</u> <u>FOR</u> <u>ALBION LAND</u> SURFACE WATER DRAINAGE DESIGN <u>1.0 INTRODUCTION</u> The following calculations are prepared to justify the principles for design of below-ground surface water drainage systems for the above development. The development plot has an area of 9.7 ha and exhibits a gentle gradient from west to east. With the exception of a chicken farm in the southwestern corner, the site is presently undeveloped and comprises of open fields used as arable land. The proposed scheme is to develop the site with new roads, buildings and external yard hardstanding areas for B1(c), B2, and B8 use classes, and a Leisure Club. The site presently drains naturally in an easterly direction towards Langford Brook which forms the eastern site boundary. Ground levels within the site boundary shall be adjusted by local raising levels in the northern sector to create a plateau for building development, with associated lowering of levels within the western and southern sectors to provide flood compensation. Details of the flood compensation scheme are appended to the BJH site-specific flood risk assessment. The surface water drainage strategy for the developed site is to maintain the existing outfall arrangements and limit flows to existing greenfield values by utilising substantial retention swales and/or below-ground

 Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk	Project	Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	Project No. S1358	Sheet No. D2
	Section	Surface Water Drainage Design	Drawing No.	Rev. 2
			By P.A.B.	Date Jul 2019
			Checked	Date

Calculations

attenuation storage, and incorporating flow control devices to the drainage network. The design for the site drainage shall include an allowance for climate change.

2.0 GROUND CONDITIONS

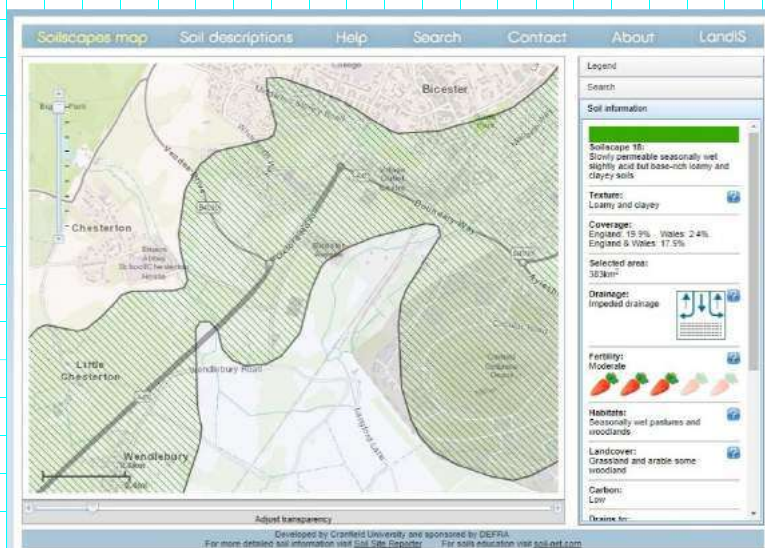
The published BGS geology map indicates Alluvium across the majority of the site. The Alluvium is absent in the northwest and the southwest of the site, where River Terrace deposits are shown. Solid geology of the Kellaways Formation is anticipated below, comprising interbedded sandstone and siltstone of the Kellaways Sand Member, underlain by mudstone interbedded with siltstone and sandstone of the Kellaways Clay Member. Kellaways Sand is shown to be absent in the north of the site. The Kellaways Formation is anticipated to be underlain by limestone of the Cornbrash Formation.

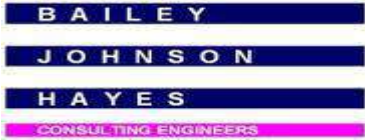
A series of 18 trial pits have been excavated by Applied Geology on behalf of Albion Land Ltd. Topsoil and subsoil was encountered at surface across the site and was underlain by Superficial Deposits comprising Alluvium and River Terrace Deposits, which in turn was underlain by the Kellaways Formation, predominantly comprising clay, with initial horizons of sand in the southeast of the site. This is broadly consistent with the published geological records. Groundwater was recorded as seepages in all trial pits, with the exception of TP12 (no River Terrace Deposits present) within the River Terrace Deposits at depths of between 0.5m and 1.3m bgl.

3.0 DESIGN

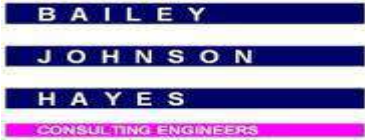
3.1 Greenfield Runoff Estimate

Greenfield runoff estimation is undertaken using the UK SuDS Tools Website using the Institute of Hydrology Report 124 methodology. Based upon soils information for the development site obtained from the Cranfield Soil and AgriFood Institute Soilscales Viewer

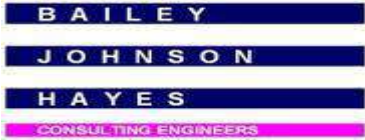


 Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk	Project	Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	Project No. S1358	Sheet No. D3
	Section	Surface Water Drainage Design	Drawing No.	Rev. 2
			By P.A.B.	Date Jul 2019
			Checked	Date

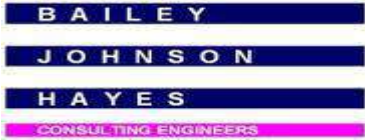
Calculations
and the ground conditions established during the trial pitting exercise undertaken by Applied Geology, the SOIL is conservatively considered to be type 3 for the purpose of greenfield runoff estimation. The default value of SOIL type 1 (sandy highly permeable material), allocated by the UK SuDS Tools Website for the subject site, is considered inappropriate and is therefore edited within the input data. Greenfield runoff is calculated using the Institute of Hydrology Report 124 methodology; the appended calculation sheet confirms the 1:1 greenfield runoff rate = 20.43 litres/sec 3.2 Quick Storage Estimate For the purpose of initial sizing of flood storage requirements it shall be assumed that the outflow from the whole site shall be restricted to 20.4 l/sec for all rainfall events up to and including the 1 in 100 year event inclusive of an allowance of 40% for climate change in accordance with government guidance. Drainage design is undertaken using the Source Control module of Microdrainage Windes software. The surface water drainage shall be split into two systems; Units 10-13 shall drain into Swale 1, and Units 1-9 shall drain into Swale 2. Both swales shall discharge to existing field ditches which in turn outfall to Langford Brook to the east. The total permissible outflow rates are apportioned at 8 l/sec from Swale 1, and 12 l/sec from Swale 2. Input data and results of Quick Storage Estimates are presented on the following sheets nos 1 and 39. For 1 in 100 year +40% storm events (using FEH design rainfall) the software predicts storage volumes between 1869 m³ and 2553 m³ will be required for Swale 1, and between 5179 m³ and 6702 m³ will be required for Swale 2. 3.3 Drainage Layouts The attached BJH drawings M1358-DD01, DD02 & DD03 illustrate the hard surfaced drained site areas, pipe design references and lengths, and the layout of principal below-ground drainage runs respectively. The Leisure Centre plot has dedicated surface water attenuation provisions by virtue of private below-ground storage and an hydrobrake flow control to restrict flows to 60 l/sec at the outfall manhole connecting to the shared system constructed through the industrial plot. This information is input to the Windes software and modelled in the Simulation module. 3.4 Units 10-13 – Swale 1 In order to establish the critical storm event a simple model is created within the Source Control module of Windes using a Swale fitted with an Hydrobrake flow control device to restrict outflows to 8 l/sec. Microdrainage pages 2-4 indicate that the critical storm is a 1440 minute winter event. Swale 1 dimensions are shown on the attached BJH drawing M1358-DD04. 3.4.1 Simulation 100yr+40%CC Winter Storms Design storms from 2160minute duration to 15min duration are modelled in Simulation, to include the critical 1440 minute design storm.

 Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk	Project	Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	Project No. S1358	Sheet No. D4
	Section Surface Water Drainage Design		Drawing No.	Rev. 2
			By P.A.B.	Date Jul 2019
			Checked	Date

Calculations
Microdrainage pages 5-14 include complete details of the network i.e. online controls and storage provisions for a 2160 minute winter design storm. The water level in Swale 1 is 63.995; discharge to outfall is 8 l/sec. Microdrainage pages 15-16 include simulation criteria and results for a 1440 minute winter design storm. The water level in Swale 1 is 64.004; discharge to outfall is 8 l/sec. Microdrainage pages 17-18 include simulation criteria and results for a 960 minute winter design storm. The water level in Swale 1 is 63.995; discharge to outfall is 8 l/sec. Microdrainage pages 19-20 include simulation criteria and results for a 720 minute winter design storm. The water level in Swale 1 is 63.980; discharge to outfall is 8 l/sec. Microdrainage pages 21-22 include simulation criteria and results for a 600 minute winter design storm. The water level in Swale 1 is 63.967; discharge to outfall is 8 l/sec. Microdrainage pages 23-24 include simulation criteria and results for a 480 minute winter design storm. The water level in Swale 1 is 63.947; discharge to outfall is 8 l/sec. Microdrainage pages 25-26 include simulation criteria and results for a 360 minute winter design storm. The water level in Swale 1 is 63.918; discharge to outfall is 8 l/sec. Microdrainage pages 27-28 include simulation criteria and results for a 240 minute winter design storm. The water level in Swale 1 is 63.871; discharge to outfall is 8 l/sec. Microdrainage pages 29-30 include simulation criteria and results for a 180 minute winter design storm. The water level in Swale 1 is 63.839; discharge to outfall is 8 l/sec. Microdrainage pages 31-32 include simulation criteria and results for a 120 minute winter design storm. The water level in Swale 1 is 63.795; discharge to outfall is 8 l/sec. Microdrainage pages 33-34 include simulation criteria and results for a 60 minute winter design storm. The water level in Swale 1 is 63.722; discharge to outfall is 8 l/sec. Microdrainage pages 35-36 include simulation criteria and results for a 30 minute winter design storm. The water level in Swale 1 is 63.657; discharge to outfall is 8 l/sec. Microdrainage pages 37-38 include simulation criteria and results for a 15 minute winter design storm. The water level in Swale 1 is 63.599; discharge to outfall is 8 l/sec. In this extreme design case isolated surface flooding up to 2m3 is predicted to occur within the service yard between Units 10 and 12, and the access road between Units 10 and 11; the water not threaten the buildings and will be temporarily held as ponding on the pavement surface until the storm abates.

 Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk	Project	Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	Project No. S1358	Sheet No. D5
	Section	Surface Water Drainage Design	Drawing No.	Rev. 2
			By P.A.B.	Date Jul 2019
			Checked	Date

Calculations
For 100yr+40%CC design storms the peak water level in Swale 1 is 64.004 (depth 0.804m) for an outflow restriction of 8 l/sec. 3.5 Units 1-9 – Swale 2 3.5.1 Simulation 100yr+40%CC Winter Storms The detailed calculations for the drainage network serving Units 1-9 -Swale 2 confirm that the 2880 minute winter storm is the critical design case. Design storms from 4320minute duration to 15min duration are modelled in Simulation, to include the critical 2880 minute design storm. Microdrainage pages 40-54 include complete details of the network i.e. online controls and storage provisions for a 4320 minute winter design storm. The water level in Swale 2 is 63.862; discharge to outfall is 12 l/sec. Microdrainage pages 55-57 include simulation criteria and results for a 2880 minute winter design storm. The water level in Swale 2 is 63.904; discharge to outfall is 12 l/sec. Microdrainage pages 58-60 include simulation criteria and results for a 2160 minute winter design storm. The water level in Swale 2 is 63.896; discharge to outfall is 12 l/sec. Microdrainage pages 61-63 include simulation criteria and results for a 1440 minute winter design storm. The water level in Swale 2 is 63.867; discharge to outfall is 12 l/sec. Microdrainage pages 64-66 include simulation criteria and results for a 960 minute winter design storm. The water level in Swale 2 is 63.822; discharge to outfall is 12 l/sec. Microdrainage pages 67-69 include simulation criteria and results for a 720 minute winter design storm. The water level in Swale 2 is 63.783; discharge to outfall is 12 l/sec. Microdrainage pages 70-72 include simulation criteria and results for a 600 minute winter design storm. The water level in Swale 2 is 63.756; discharge to outfall is 12 l/sec. Microdrainage pages 73-75 include simulation criteria and results for a 480 minute winter design storm. The water level in Swale 2 is 63.723; discharge to outfall is 12 l/sec. Microdrainage pages 76-78 include simulation criteria and results for a 360 minute winter design storm. The water level in Swale 2 is 63.681; discharge to outfall is 12 l/sec. Microdrainage pages 79-81 include simulation criteria and results for a 240 minute winter design storm. The water level in Swale 2 is 63.623; discharge to outfall is 12 l/sec. Microdrainage pages 82-84 include simulation criteria and results for a 180 minute winter design storm. The water level in Swale 2 is 63.576; discharge to outfall is 12 l/sec.

 Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk	Project	Catalyst Bicester, Wendlebury Rd, Bicester. for Albion Land.	Project No. S1358	Sheet No. D6
	Section	Surface Water Drainage Design	Drawing No.	Rev. 2
			By P.A.B.	Date Jul 2019
			Checked	Date

Calculations
Microdrainage pages 85-87 include simulation criteria and results for a 120 minute winter design storm. The water level in Swale 2 is 63.502; discharge to outfall is 12 l/sec. Microdrainage pages 88-90 include simulation criteria and results for a 60 minute winter design storm. The water level in Swale 2 is 63.380; discharge to outfall is 12 l/sec. Microdrainage pages 91-93 include simulation criteria and results for a 30 minute winter design storm. The water level in Swale 2 is 63.286; discharge to outfall is 12 l/sec. Microdrainage pages 94-96 include simulation criteria and results for a 15 minute winter design storm. The water level in Swale 2 is 63.238; discharge to outfall is 8 l/sec. In this extreme design case isolated surface flooding up to 7.5m³ is predicted to occur within the service yard between Units 6 and 8; the water not threaten the buildings and will be temporarily held as ponding on the pavement surface until the storm abates. For 100yr+40%CC design storms the peak water level in Swale 2 is 63.904 (depth 1.004m) for an outflow restriction of 12 l/sec. <u>4.0 EXCEEDANCE EVENTS</u> Site levels will be arranged to ensure that overland flow routes are created to encourage any build-up of surface water to flow in an easterly direction towards Langford Brook. Similarly the bunding to the Swale will be constructed to ensure that there is facility for overspill to occur in an easterly direction away from the development land.

GREENFIELD RUNOFF ESTIMATE

Calculated by: peter brooks

Site name: Promised Land Farm

Site location: Bicester

Site coordinates

Latitude: 51.88559° N

Longitude: 1.16552° W

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

Reference: 6484523

Date: 2018-10-25T08:25:55

Methodology

IH124

Site characteristics

Total site area (ha)	9.7
----------------------	-----

Methodology

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

	Default	Edited
SOIL type	1	3
HOST class	---	---
SPR/SPRHOST	0.1	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm)	617	617
Hydrological region	6	6
Growth curve factor: 1 year	0.85	0.85
Growth curve factor: 30 year	2.3	2.3
Growth curve factor: 100 year	3.19	3.19

Notes:

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

Normally limiting discharge rates which are less than 2.0 l/s/ha 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 consents are usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	1.41	24.04
1 in 1 year (l/s)	1.19	20.43
1 in 30 years (l/s)	3.23	55.29
1 in 100 years (l/s)	4.48	76.69

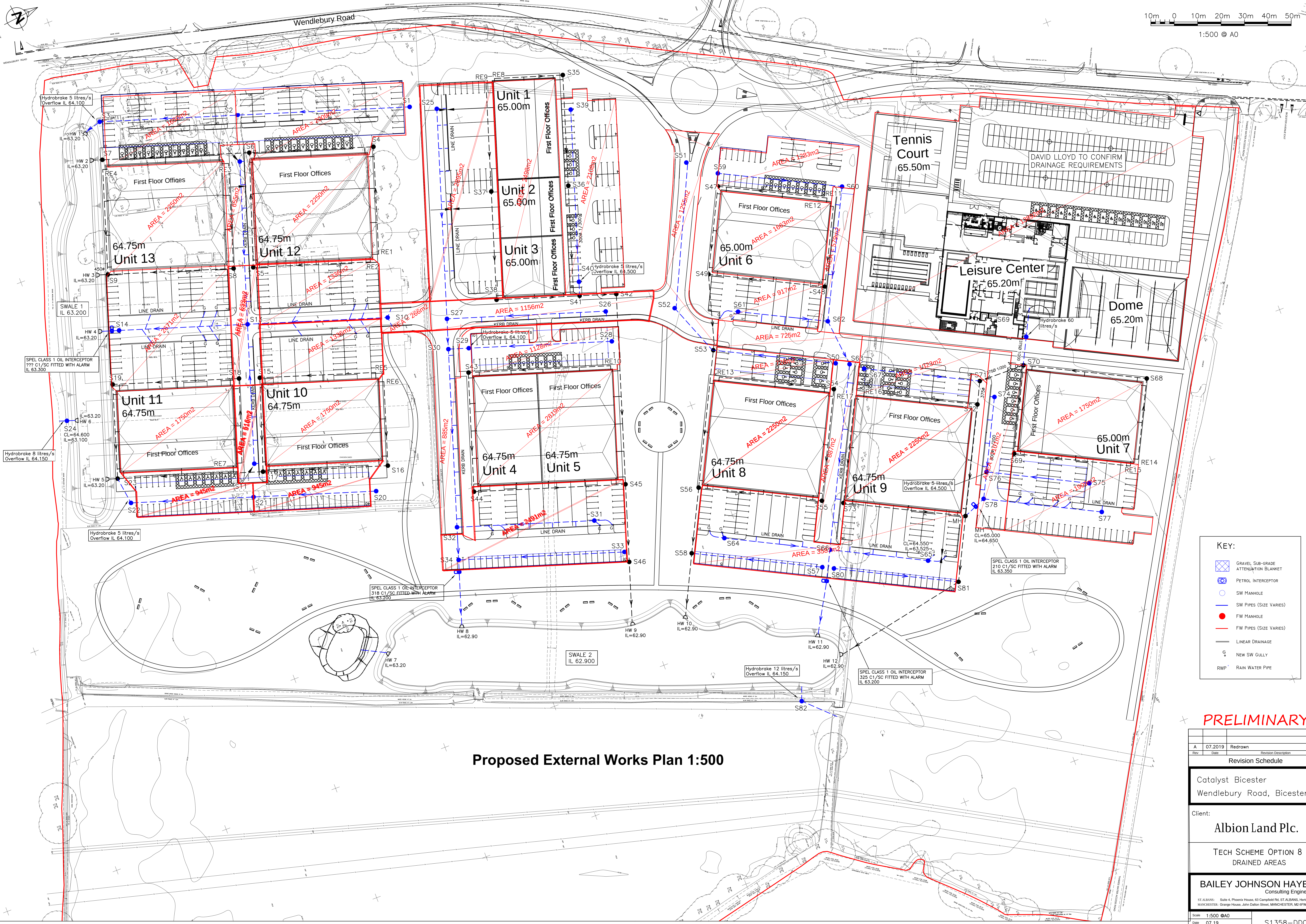
BAILEY JOHNSON HAYES DRAWINGS

S1358-DD01A – Drained Areas

S1358-DD02A – SW drainage design refs

S1358-DD03A – Proposed SW Drainage

S1358-DD04A – Proposed Swales



Proposed External Works Plan 1:500

KEY:

- Gravel Sub-grade Attenuation Blanket
- Petrol Interceptor
- SW Manhole
- SW Pipes (Size Varies)
- FW Manhole
- FW Pipes (Size Varies)
- Linear Drainage
- New SW Gully
- RWP Rain Water Pipe

PRELIMINARY

Rev	Date	Redrawn	Revision Description
A	07.2019		

Catalyst Bicester
Wendlebury Road, Bicester

Client:
Albion Land Plc.

TECH SCHEME OPTION 8
DRAINED AREAS

BAILEY JOHNSON HAYES
Consulting Engineers

ST ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST ALBANS, Herts AL1 5FL
MANCHESTER: Grange House, John Dalton Street, MANCHESTER, M2 6FW

Scale: 1:500 @A0
Date: 07.19
Drawn: PAB

S1358-DD01