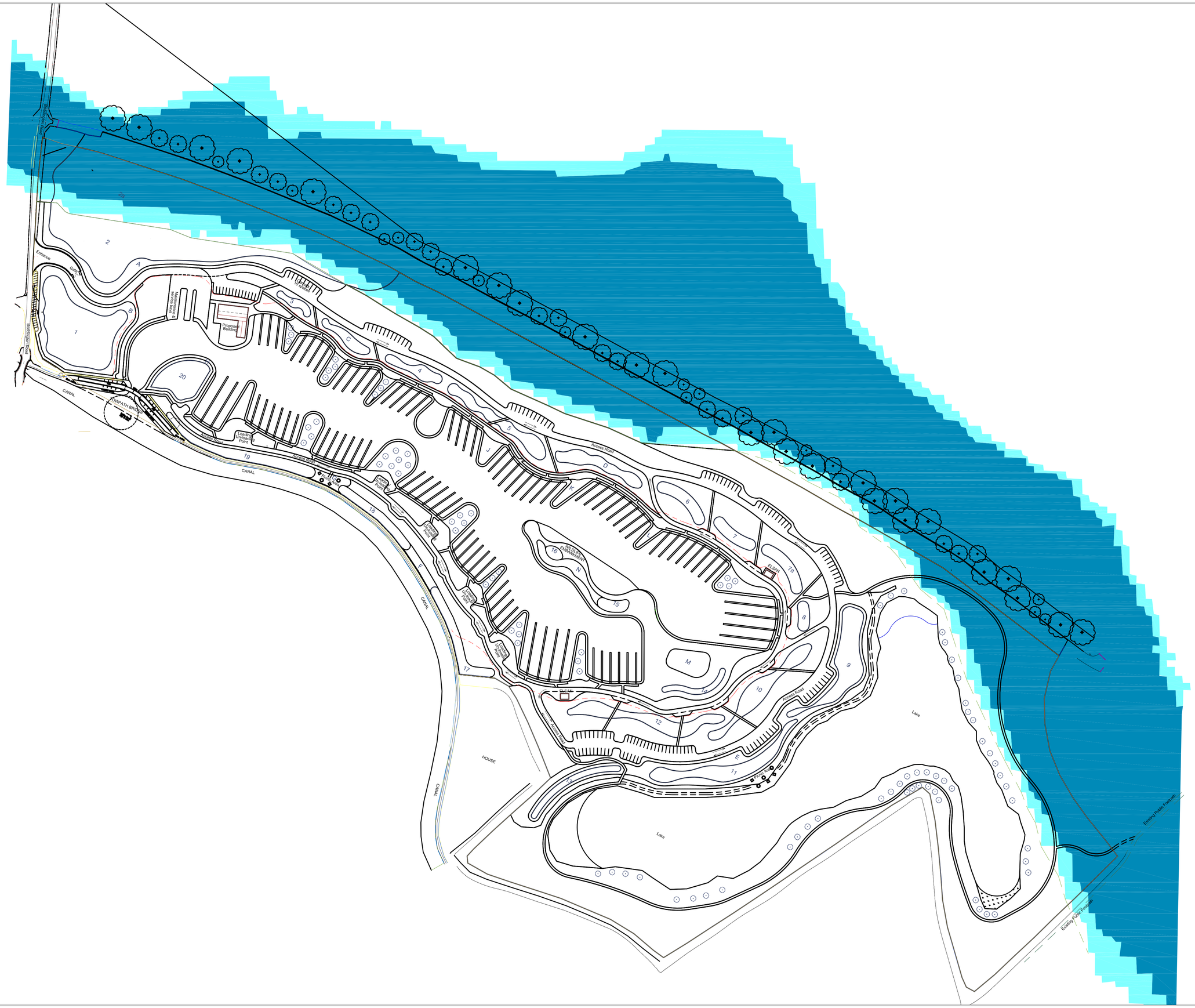
Appendix F – Flood Map Overlay with Proposed Development



KEY:

🟦	FLOOD ZONE 2 FROM EA FLOOD MAP FOR PLANNING
🟦	FLOOD ZONE 3 FROM EA FLOOD MAP FOR PLANNING

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777

www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

CLAYDON MARINA
CHERWELL

TITLE:

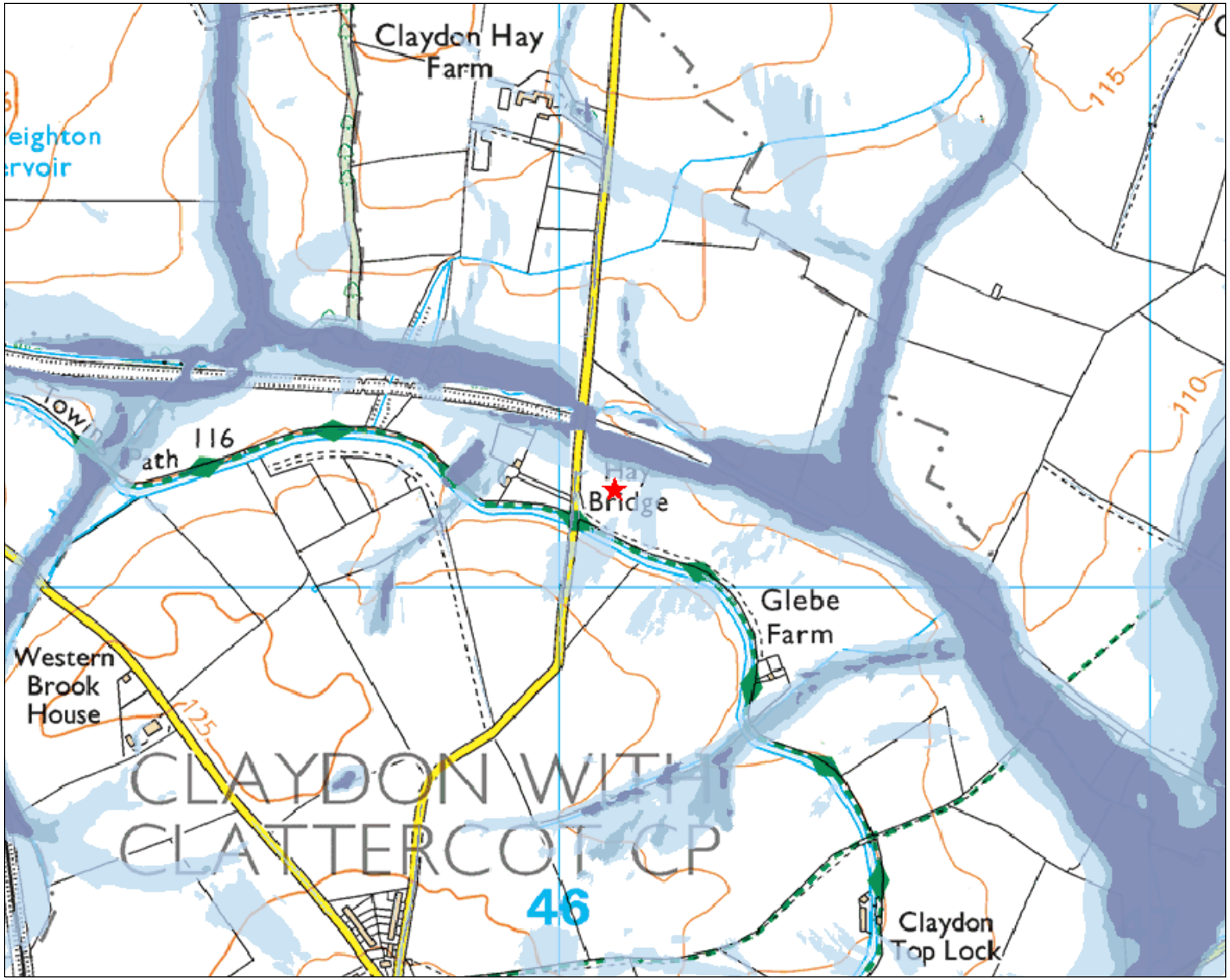
EA FLOOD MAP FOR PLANNING
FLOOD ZONES OVERLAY

SCALE @ A1:	DESIGN+DRAWN:	DATE:
1:1250	MC	18/07/2019

PROJECT No:	DRAWING No:
1319	SK09 – REV A

Appendix G – Surface Water Map

Risk of flooding from Surface Water



Environment Agency

Scale 1:10,001

N W E S

Likelihood of flooding from Surface Water

- High
- Medium
- Low
- Very Low

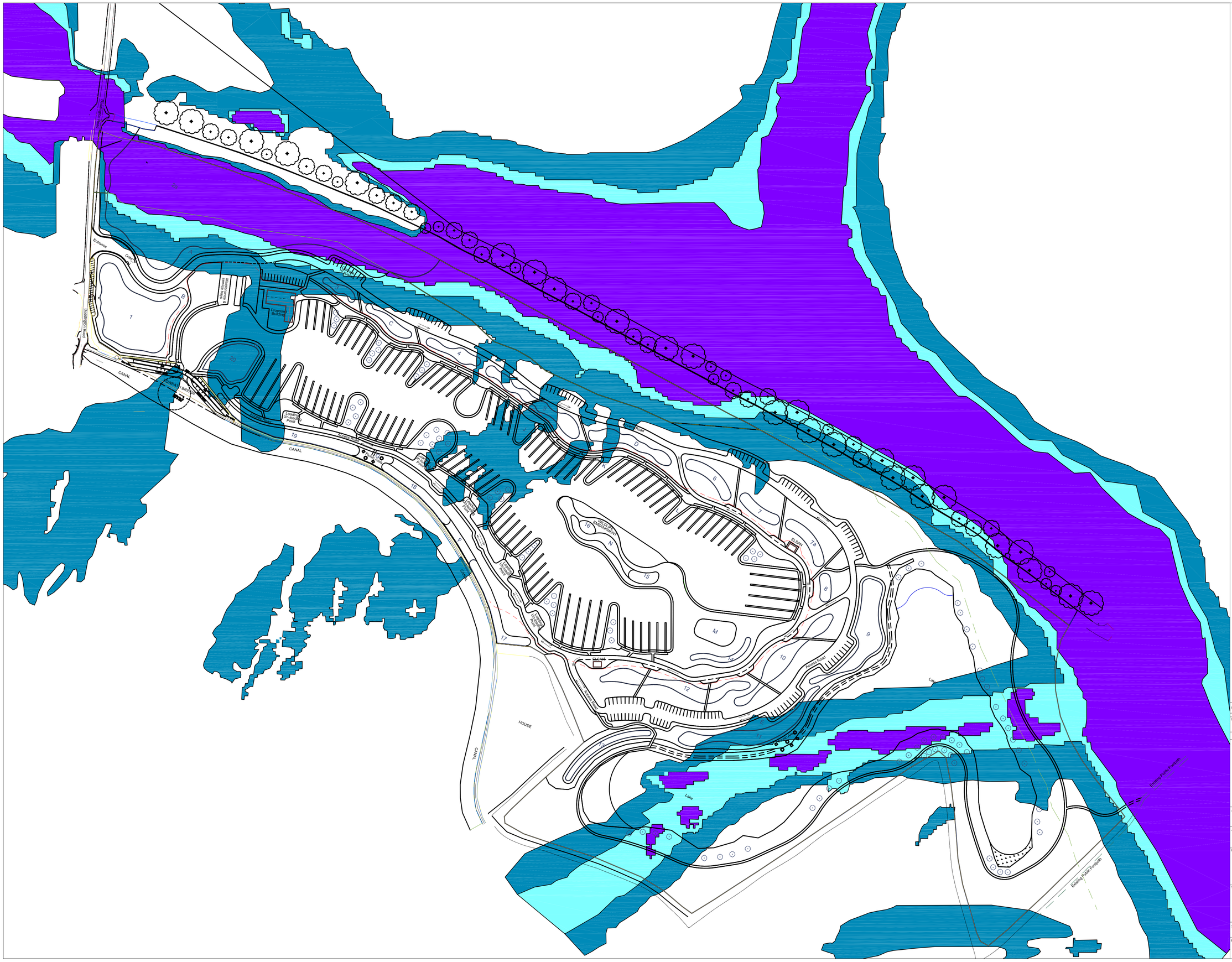
Likelihood of flooding from Surface Water

High:	Greater than or equal to 1 in 30 (3.3%) chance in any given year
Medium:	Less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year
Low:	Less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year
Very Low:	Less than 1 in 1,000 (0.1%) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on our website.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Appendix H – Surface Water Map Overlay with Proposed Development



KEY:

LIKELIHOOD OF FLOODING DUE TO SURFACE WATER

■ HIGH

■ MEDIUM

■ LOW

□ VERY LOW

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

EAS
Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777

www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

CLAYDON MARINA
CHERWELL

TITLE:

EA SURFACE WATER
FLOOD RISK MAPPING OVERLAY

SCALE @ A1: 1:1250
DESIGN-DRAWN: MC
DATE: 18/07/2019
PROJECT No: 1319
DRAWING No: SK03 – REV E

Appendix I – Canals and Rivers Trust Confirmation

Canal & River Trust

Keeping people, nature & history connected

16th March 2017

Mrs E Elwood
emma.elwood@eastp.co.uk

Our Ref OX-067
Your Ref

Dear Mrs Elwood

RE: FLOOD RISK ASSESSMENT - Boddington Road, Claydon, OX17 1HB

Further to your email of 10th March, I have checked our records and have spoken to the supervisor responsible for this stretch of waterway and can confirm the following:

- At this location on the Oxford Canal, the Canal and River Trust is not aware of any records of overtopping from or breaches of this section of the waterway.

For further advice on flood risk assessments we have included some generic guidance (see appendix A).

Please note that we are unable to comment on the flood risk to individual properties or developments and interpretation of the information provided in this letter is your responsibility.

I suggest you consult the Environment Agency's website which gives the flood risk associated with the streams and rivers adjacent to the above property.

We trust this reply is satisfactory, however if you do require any further information please do not hesitate to contact the undersigned.

Yours sincerely

E J Kearsey
Principal Water Engineer – South

South East Waterways
Canal & River Trust First Floor North Station House 500 Elder Gate Milton Keynes MK9 1BB
T 0303 040 4040 **E** enquiries.southeast@canalrivertrust.org.uk www.canalrivertrust.org.uk

Appendix A - **Guidance Note for Flood Risk Assessments**

The main incidents of uncontrolled loss of water from our waterways are overtopping and breaching as a result of inundation from adjacent water courses, vandalism or structural failure.

The Canal and River Trust maintains water levels using reservoirs, feeders and boreholes, and thereafter manages the water by transferring it within the canal system. The level of the water in canals is normally determined predominantly by the level and size of weirs. Water levels in river navigations are affected by the flow in the river and will fluctuate more widely than canals.

When surface water enters our waterways, the level of the water rises. Eventually the water level will reach a point where it discharges from our waterways through control structures. Where the capacity of these control structures is exceeded, overtopping may result.

Breaches which may lead to flooding can occur on our waterways. There can be a number of causes for these including: culvert collapse, animal burrowing and overtopping. The Canal and River Trust operates a comprehensive asset management system which enables us to manage the risks of such events occurring.

Breaches occur on average at a rate of three per year over the whole of the Trust owned canal network (that's over 2,000 miles of canal).

Appendix J - Greenfield Runoff Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	700	Region Number	Region 4

Results	**l/s**
QBAR Rural	4.4
QBAR Urban	4.4
Q100 years	11.3
Q1 year	3.6
Q30 years	8.6
Q100 years	11.3

Appendix K – Proposed Drainage Layout

0.5m DEEP DETENTION BASIN WITH BASE AREA OF 40m² AND SURFACE AREA OF 100m² WITH 1:3 SIDE SLOPES SIZED TO PROVIDE ADEQUATE ATTENUATION FOR RAINFALL EVENTS UP TO AND INCLUDING A 1 IN 100YR +40%CC STORM

26mm ORIFICE PLATE TO RESTRICT OUTFALL FROM DETENTION BASIN TO 1.0 l/s

CL: 113.300
IL: 112.700
40.0m 1:40 150ø
CL: 112.00
IL: 111.70
CL: 112.00
IL: 111.50
45.0m 1:100 150ø
CL: 112.50
IL: 111.05
45.0m 1:100 150ø
CL: 111.75
IL: 110.60
45.0m 1:100 150ø
CL: 111.750
IL: 110.106
36.7m 1:87 150ø
39.5m 1:100 150ø
CL: 111.000
IL: 109.684
27.5m 100mmØ 1:10
CL: 112.750
IL: 110.30
25.1m 100mmØ 1:3

OUTFALL TO BROOK VIA A PRE-CAST CONCRETE HEADWALL. ASSUMED INVERT LEVEL TBC

LINEAR DRAIN TO COLLECT SURFACE WATER RUNOFF FROM CONCRETE ACCESS ROAD

ALL ROOF AREAS AND HARDSTANDINGS WITHIN INSIDE OF MARINA BASIN DAM TO BE DIRECTED TO MARINA BASIN AT GROUND LEVEL

PERMEABLE GRAVEL CAR PARK AND ACCESS ROADS. SURFACE WATER TO BE RUNOFF TO FRENCH DRAIN

FRENCH DRAIN TO TAKE RUNOFF FROM ACCESS ROADS AND CAR PARKING

ALL ROOF AREAS AND HARDSTANDINGS WITHIN INSIDE OF MARINA BASIN DAM TO BE DIRECTED TO MARINA BASIN AT GROUND LEVEL

SEE SK12 REV A

Boddington Road

Maintenance & service bays

Propose Building

Carpark 10 spaces

FOUL WATER PACKAGE TREATMENT PLANT

FOUL WATER PUMPING STATION

RISING MAIN

OUTLET IL: 113.

REED BED

CANAL

TOWPATH BRIDGE

Existing level of edge of canal

Path

Concrete surface

Stone surface

Bridge

Access Road

Loading/ Un-loading Point

Picnic Area

OXFORD CANAL

1 2 2a 4 5 18 19 20 A B C G H J

KEY:

- FLOOD ZONE 2 FROM EA FLOOD MAP FOR PLANNING
- FLOOD ZONE 3 FROM EA FLOOD MAP FOR PLANNING
- GRAVEL ACCESS ROADS AND CAR PARK TO DRAIN TO FRENCH DRAIN (6873m²)
- CONCRETE ACCESS ROAD TO DRAIN TO SMALL DETENTION BASIN VIA LINEAR DRAIN (640m²)
- CONCRETE ACCESS ROAD TO DRAIN TO FRENCH DRAIN (350m²)
- HARDSTANDING AND CONCRETE FOOTPATH TO DRAIN TO FRENCH DRAIN (416m²)
- GRAVEL ACCESS ROADS AND CAR PARK TO DRAIN TO MARINA BASIN (3610m²)
- CONCRETE ACCESS ROAD TO DRAIN TO DRAIN TO MARINA BASIN (745m²)
- HARDSTANDING AND CONCRETE FOOTPATH TO DRAIN TO MARINA BASIN (1555m²)
- SURFACE WATER DRAINAGE
- FOUL WATER DRAINAGE
- FRENCH DRAIN USED FOR ATTENUATION
- FRENCH DRAIN USED FOR CONVEYANCE ONLY DUE TO STEEP GRADIENTS
- IMPERMEABLE AREA & ROOF AREA DIRECTED TO MARINA BASIN VIA FALLS IN SURFACING
- CLAY LINED MARINA BASIN

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777
www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

CLAYDON MARINA
CHERWELL

TITLE:

PROPOSED SuDS LAYOUT

SCALE @ A1:	DESIGN-DRAWN:	DATE:
1:500	MC	24/07/2019
PROJECT No:	DRAWING No:	
1319	SK11 REV B	

ACCESS DRAINS TO BE LOCATED EVERY 90m ALONG FRENCH DRAIN TO ALLOW ACCESS FOR FRENCH DRAIN TO BE JETTED AND CLEANED

FRENCH DRAIN TO TAKE RUNOFF FROM ACCESS ROADS AND CAR PARKING

612m LONG x 0.8m WIDE x 1.2m DEEP FRENCH DRAIN WITH 30% POROSITY SIZED TO PROVIDE ADEQUATE ATTENUATION FOR RAINFALL EVENTS UP TO AND INCLUDING A 1 IN 100YR +40%CC STORM

0.55m DEEP DETENTION BASIN WITH BASE AREA OF 1200m² AND SURFACE AREA OF 1500m² WITH 1:3 SIDE SLOPES SIZED TO PROVIDE ADEQUATE ATTENUATION FOR RAINFALL EVENTS UP TO AND INCLUDING A 1 IN 100YR +40%CC STORM

ALL ROOF AREAS AND HARDSTANDINGS WITHIN INSIDE OF MARINA BASIN DAM TO BE DIRECTED TO MARINA BASIN AT GROUND LEVEL

SEE SK11 REV A

120mm ORIFICE PLATE TO RESTRICT OUTFALL FROM FILTER DRAIN TO 31.3 l/s

122mm ORIFICE PLATE TO RESTRICT OUTFALL FROM FILTER DRAIN TO 33.1 l/s

47mm ORIFICE PLATE TO RESTRICT OUTFALL FROM FILTER DRAIN TO 3.3 l/s

ALL ROOF AREAS AND HARDSTANDINGS WITHIN INSIDE OF MARINA BASIN DAM TO BE DIRECTED TO MARINA BASIN AT GROUND LEVEL

282m LONG x 0.8m WIDE x 1.2m DEEP FRENCH DRAIN WITH 30% POROSITY SIZED TO PROVIDE ADEQUATE ATTENUATION FOR RAINFALL EVENTS UP TO AND INCLUDING A 1 IN 100YR +40%CC STORM

FRENCH DRAIN TO TAKE RUNOFF FROM ACCESS ROADS AND CAR PARKING

ACCESS DRAINS TO BE LOCATED EVERY 90m ALONG FRENCH DRAIN TO ALLOW ACCESS FOR FRENCH DRAIN TO BE JETTED AND CLEANED

Access Road
Access Road
Access Road
Loading/ Un-loading Point
Loading/ Un-loading Point
Loading/ Un-loading Point
WILDLIFE EMBANKMENT
ELSAN
ELSAN
Picnic Area
CANAL
CANAL
HOUSE
Lake
5
J
D
K
6
7
7a
L
16
N
15
F
8
9
M
17
14
10
12
E
11
13

KEY:

- FLOOD ZONE 2 FROM EA FLOOD MAP FOR PLANNING
- FLOOD ZONE 3 FROM EA FLOOD MAP FOR PLANNING
- GRAVEL ACCESS ROADS AND CAR PARK TO DRAIN TO FRENCH DRAIN (6873m²)
- CONCRETE ACCESS ROAD TO DRAIN TO SMALL DETENTION BASIN VIA LINEAR DRAIN (640m²)
- CONCRETE ACCESS ROAD TO DRAIN TO FRENCH DRAIN (350m²)
- HARDSTANDING AND CONCRETE FOOTPATH TO DRAIN TO FRENCH DRAIN (416m²)
- GRAVEL ACCESS ROADS AND CAR PARK TO DRAIN TO MARINA BASIN (3610m²)
- CONCRETE ACCESS ROAD TO DRAIN TO DRAIN TO MARINA BASIN (745m²)
- HARDSTANDING AND CONCRETE FOOTPATH TO DRAIN TO MARINA BASIN (1555m²)
- SURFACE WATER DRAINAGE
- FOUL WATER DRAINAGE
- FRENCH DRAIN USED FOR ATTENUATION
- FRENCH DRAIN USED FOR CONVEYANCE ONLY DUE TO STEEP GRADIENTS
- IMPERMEABLE AREA & ROOF AREA DIRECTED TO MARINA BASIN VIA FALLS IN SURFACING
- CLAY LINED MARINA BASIN

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS:

Unit 23, The Maltings, Stanstead Abbotts, Hertfordshire, SG12 8HG
Tel: 01920 871777
www.eastp.co.uk

CLIENT:

ARCHITECT:

PROJECT:

CLAYDON MARINA
CHERWELL

TITLE:

PROPOSED SuDS LAYOUT

SCALE @ A1:	DESIGN-DRAWN:	DATE:
1:500	MC	17/07/2019

PROJECT No:	DRAWING No:
1319	SK11 REV A

Appendix L – WINDES MicroDrainage Results

Cascade Summary of Results for Bottom Section Filter Drain rev a.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Detention Basin.srcx	(None)

Half Drain Time : 28 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	110.690	0.890	0.0	28.3	28.3	58.5	O K
30 min Summer	110.845	1.045	0.0	30.8	30.8	69.0	Flood Risk
60 min Summer	110.862	1.062	0.0	31.1	31.1	70.2	Flood Risk
120 min Summer	110.754	0.954	0.0	29.4	29.4	62.9	Flood Risk
180 min Summer	110.636	0.836	0.0	27.4	27.4	54.9	O K
240 min Summer	110.532	0.732	0.0	25.4	25.4	47.8	O K
360 min Summer	110.370	0.570	0.0	22.2	22.2	36.8	O K
480 min Summer	110.266	0.466	0.0	19.8	19.8	28.7	O K
600 min Summer	110.197	0.397	0.0	18.0	18.0	22.4	O K
720 min Summer	110.147	0.347	0.0	16.6	16.6	17.7	O K
960 min Summer	110.078	0.278	0.0	14.5	14.5	11.1	O K
1440 min Summer	109.998	0.198	0.0	11.5	11.5	5.2	O K
2160 min Summer	109.951	0.151	0.0	8.6	8.6	2.8	O K
2880 min Summer	109.930	0.130	0.0	6.8	6.8	2.0	O K
4320 min Summer	109.906	0.106	0.0	4.9	4.9	1.3	O K
5760 min Summer	109.891	0.091	0.0	3.9	3.9	1.0	O K
7200 min Summer	109.880	0.080	0.0	3.2	3.2	0.8	O K
8640 min Summer	109.872	0.072	0.0	2.8	2.8	0.6	O K
10080 min Summer	109.868	0.068	0.0	2.4	2.4	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	140.177	0.0	81.5	21
30 min Summer	91.381	0.0	106.2	31
60 min Summer	56.713	0.0	131.9	48
120 min Summer	34.011	0.0	158.2	80
180 min Summer	24.892	0.0	173.6	114
240 min Summer	19.835	0.0	184.5	146
360 min Summer	14.348	0.0	200.2	208
480 min Summer	11.406	0.0	212.1	270
600 min Summer	9.539	0.0	221.8	328
720 min Summer	8.239	0.0	229.9	388
960 min Summer	6.534	0.0	243.1	506
1440 min Summer	4.706	0.0	262.6	740
2160 min Summer	3.384	0.0	283.3	1100
2880 min Summer	2.676	0.0	298.6	1448
4320 min Summer	1.920	0.0	321.3	2148
5760 min Summer	1.515	0.0	338.2	2904
7200 min Summer	1.260	0.0	351.6	3552
8640 min Summer	1.084	0.0	362.9	4288
10080 min Summer	0.954	0.0	372.7	5112

Cascade Summary of Results for Bottom Section Filter Drain rev a.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	110.804	1.004	0.0	30.2	30.2	66.3	Flood Risk
30 min Winter	110.986	1.186	0.0	33.0	33.0	78.6	Flood Risk
60 min Winter	110.993	1.193	0.0	33.1	33.1	79.0	Flood Risk
120 min Winter	110.822	1.022	0.0	30.5	30.5	67.4	Flood Risk
180 min Winter	110.648	0.848	0.0	27.6	27.6	55.7	O K
240 min Winter	110.505	0.705	0.0	24.9	24.9	46.0	O K
360 min Winter	110.303	0.503	0.0	20.7	20.7	31.8	O K
480 min Winter	110.191	0.391	0.0	17.9	17.9	21.9	O K
600 min Winter	110.120	0.320	0.0	15.8	15.8	15.1	O K
720 min Winter	110.070	0.270	0.0	14.2	14.2	10.4	O K
960 min Winter	110.003	0.203	0.0	11.7	11.7	5.5	O K
1440 min Winter	109.952	0.152	0.0	8.6	8.6	2.9	O K
2160 min Winter	109.923	0.123	0.0	6.2	6.2	1.8	O K
2880 min Winter	109.906	0.106	0.0	4.9	4.9	1.4	O K
4320 min Winter	109.886	0.086	0.0	3.5	3.5	0.9	O K
5760 min Winter	109.873	0.073	0.0	2.8	2.8	0.6	O K
7200 min Winter	109.866	0.066	0.0	2.3	2.3	0.5	O K
8640 min Winter	109.862	0.062	0.0	2.0	2.0	0.5	O K
10080 min Winter	109.859	0.059	0.0	1.8	1.8	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	140.177	0.0	91.3	21
30 min Winter	91.381	0.0	119.0	32
60 min Winter	56.713	0.0	147.7	50
120 min Winter	34.011	0.0	177.1	86
180 min Winter	24.892	0.0	194.5	120
240 min Winter	19.835	0.0	206.6	152
360 min Winter	14.348	0.0	224.2	216
480 min Winter	11.406	0.0	237.6	276
600 min Winter	9.539	0.0	248.4	336
720 min Winter	8.239	0.0	257.5	392
960 min Winter	6.534	0.0	272.2	504
1440 min Winter	4.706	0.0	294.1	736
2160 min Winter	3.384	0.0	317.3	1092
2880 min Winter	2.676	0.0	334.5	1468
4320 min Winter	1.920	0.0	359.9	2172
5760 min Winter	1.515	0.0	378.7	2904
7200 min Winter	1.260	0.0	393.8	3560
8640 min Winter	1.084	0.0	406.5	4296
10080 min Winter	0.954	0.0	417.4	4968

Cascade Rainfall Details for Bottom Section Filter Drain rev a.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.417	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.310

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.100	4	8	0.100	8	12	0.110

Cascade Model Details for Bottom Section Filter Drain rev a.srcx

Storage is Online Cover Level (m) 111.000

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	282.0
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.225
Safety Factor	2.0	Pipe Depth above Invert (m)	0.100
Porosity	0.30	Slope (1:X)	1000.0
Invert Level (m)	109.800	Cap Volume Depth (m)	0.000
Trench Width (m)	0.8	Cap Infiltration Depth (m)	0.000

Orifice Outflow Control

Diameter (m) 0.122 Discharge Coefficient 0.600 Invert Level (m) 109.800

Cascade Summary of Results for Top Section Filter Drain rev a.srcx

Upstream Structures	Outflow To	Overflow To
(None)	Detention Basin.srcx	(None)

Half Drain Time : 44 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	116.637	0.837	0.0	26.5	26.5	94.6	O K
30 min Summer	116.773	0.973	0.0	28.7	28.7	115.1	Flood Risk
60 min Summer	116.821	1.021	0.0	29.5	29.5	122.1	Flood Risk
120 min Summer	116.779	0.979	0.0	28.8	28.8	115.9	Flood Risk
180 min Summer	116.710	0.910	0.0	27.7	27.7	105.7	Flood Risk
240 min Summer	116.644	0.844	0.0	26.6	26.6	95.7	O K
360 min Summer	116.538	0.738	0.0	24.8	24.8	78.2	O K
480 min Summer	116.458	0.658	0.0	23.2	23.2	64.1	O K
600 min Summer	116.393	0.593	0.0	21.9	21.9	52.8	O K
720 min Summer	116.337	0.537	0.0	20.8	20.8	43.7	O K
960 min Summer	116.247	0.447	0.0	18.7	18.7	30.5	O K
1440 min Summer	116.124	0.324	0.0	15.5	15.5	15.7	O K
2160 min Summer	116.024	0.224	0.0	12.2	12.2	6.8	O K
2880 min Summer	115.970	0.170	0.0	9.9	9.9	3.7	O K
4320 min Summer	115.935	0.135	0.0	7.1	7.1	2.2	O K
5760 min Summer	115.917	0.117	0.0	5.7	5.7	1.6	O K
7200 min Summer	115.904	0.104	0.0	4.7	4.7	1.3	O K
8640 min Summer	115.896	0.096	0.0	4.0	4.0	1.1	O K
10080 min Summer	115.887	0.087	0.0	3.6	3.6	0.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	140.177	0.0	119.3	22
30 min Summer	91.381	0.0	155.6	33
60 min Summer	56.713	0.0	193.1	52
120 min Summer	34.011	0.0	231.6	86
180 min Summer	24.892	0.0	254.3	120
240 min Summer	19.835	0.0	270.2	154
360 min Summer	14.348	0.0	293.1	218
480 min Summer	11.406	0.0	310.7	280
600 min Summer	9.539	0.0	324.8	340
720 min Summer	8.239	0.0	336.6	400
960 min Summer	6.534	0.0	356.0	520
1440 min Summer	4.706	0.0	384.6	754
2160 min Summer	3.384	0.0	414.9	1104
2880 min Summer	2.676	0.0	437.4	1468
4320 min Summer	1.920	0.0	470.6	2152
5760 min Summer	1.515	0.0	495.2	2872
7200 min Summer	1.260	0.0	515.0	3672
8640 min Summer	1.084	0.0	531.5	4336
10080 min Summer	0.954	0.0	545.8	5000

Cascade Summary of Results for Top Section Filter Drain rev a.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	116.721	0.921	0.0	27.9	27.9	107.4	Flood Risk
30 min Winter	116.885	1.085	0.0	30.4	30.4	131.4	Flood Risk
60 min Winter	116.944	1.144	0.0	31.3	31.3	140.1	Flood Risk
120 min Winter	116.879	1.079	0.0	30.3	30.3	130.6	Flood Risk
180 min Winter	116.776	0.976	0.0	28.8	28.8	115.4	Flood Risk
240 min Winter	116.676	0.876	0.0	27.1	27.1	100.6	O K
360 min Winter	116.524	0.724	0.0	24.5	24.5	75.7	O K
480 min Winter	116.416	0.616	0.0	22.4	22.4	56.8	O K
600 min Winter	116.330	0.530	0.0	20.6	20.6	42.6	O K
720 min Winter	116.259	0.459	0.0	19.0	19.0	32.2	O K
960 min Winter	116.152	0.352	0.0	16.2	16.2	18.7	O K
1440 min Winter	116.030	0.230	0.0	12.4	12.4	7.3	O K
2160 min Winter	115.959	0.159	0.0	9.1	9.1	3.2	O K
2880 min Winter	115.936	0.136	0.0	7.2	7.2	2.3	O K
4320 min Winter	115.910	0.110	0.0	5.2	5.2	1.5	O K
5760 min Winter	115.896	0.096	0.0	4.1	4.1	1.1	O K
7200 min Winter	115.884	0.084	0.0	3.4	3.4	0.9	O K
8640 min Winter	115.876	0.076	0.0	2.9	2.9	0.7	O K
10080 min Winter	115.870	0.070	0.0	2.6	2.6	0.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	140.177	0.0	133.6	22
30 min Winter	91.381	0.0	174.2	34
60 min Winter	56.713	0.0	216.3	54
120 min Winter	34.011	0.0	259.4	92
180 min Winter	24.892	0.0	284.8	128
240 min Winter	19.835	0.0	302.6	164
360 min Winter	14.348	0.0	328.3	230
480 min Winter	11.406	0.0	348.0	292
600 min Winter	9.539	0.0	363.8	352
720 min Winter	8.239	0.0	377.0	412
960 min Winter	6.534	0.0	398.7	526
1440 min Winter	4.706	0.0	430.7	752
2160 min Winter	3.384	0.0	464.6	1100
2880 min Winter	2.676	0.0	489.9	1468
4320 min Winter	1.920	0.0	527.1	2196
5760 min Winter	1.515	0.0	554.7	2848
7200 min Winter	1.260	0.0	576.8	3568
8640 min Winter	1.084	0.0	595.3	4304
10080 min Winter	0.954	0.0	611.3	5112

Cascade Rainfall Details for Top Section Filter Drain rev a.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.417	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.454

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.151	4	8	0.151	8	12	0.152

Cascade Model Details for Top Section Filter Drain rev a.srcx

Storage is Online Cover Level (m) 117.000

Filter Drain Structure

Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	612.0
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Diameter (m)	0.225
Safety Factor	2.0	Pipe Depth above Invert (m)	0.100
Porosity	0.30	Slope (1:X)	1000.0
Invert Level (m)	115.800	Cap Volume Depth (m)	0.000
Trench Width (m)	0.8	Cap Infiltration Depth (m)	0.000

Orifice Outflow Control

Diameter (m) 0.120 Discharge Coefficient 0.600 Invert Level (m) 115.800

Cascade Summary of Results for Detention Basin.srcx

Upstream Structures	Outflow To	Overflow To
Top Section Filter Drain rev a.srcx	(None)	(None)
Bottom Section Filter Drain rev a.srcx		

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	109.635	0.185	1.9	230.8	O K
30 min Summer	109.688	0.238	2.1	300.3	O K
60 min Summer	109.741	0.291	2.4	372.0	Flood Risk
120 min Summer	109.795	0.345	2.6	445.2	Flood Risk
180 min Summer	109.825	0.375	2.7	487.5	Flood Risk
240 min Summer	109.846	0.396	2.8	516.5	Flood Risk
360 min Summer	109.872	0.422	2.9	553.7	Flood Risk
480 min Summer	109.887	0.437	3.0	575.1	Flood Risk
600 min Summer	109.897	0.447	3.0	589.4	Flood Risk
720 min Summer	109.904	0.454	3.0	599.1	Flood Risk
960 min Summer	109.911	0.461	3.0	609.6	Flood Risk
1440 min Summer	109.912	0.462	3.1	610.8	Flood Risk
2160 min Summer	109.906	0.456	3.0	603.0	Flood Risk
2880 min Summer	109.899	0.449	3.0	593.0	Flood Risk
4320 min Summer	109.882	0.432	2.9	568.1	Flood Risk
5760 min Summer	109.863	0.413	2.9	540.2	Flood Risk
7200 min Summer	109.843	0.393	2.8	512.5	Flood Risk
8640 min Summer	109.824	0.374	2.7	485.8	Flood Risk
10080 min Summer	109.806	0.356	2.7	460.8	Flood Risk
15 min Winter	109.656	0.206	2.0	258.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	140.177	0.0	130.4	111
30 min Summer	91.381	0.0	154.8	136
60 min Summer	56.713	0.0	297.6	164
120 min Summer	34.011	0.0	337.6	206
180 min Summer	24.892	0.0	358.1	244
240 min Summer	19.835	0.0	370.9	280
360 min Summer	14.348	0.0	386.6	372
480 min Summer	11.406	0.0	396.2	490
600 min Summer	9.539	0.0	402.0	608
720 min Summer	8.239	0.0	405.3	726
960 min Summer	6.534	0.0	406.9	964
1440 min Summer	4.706	0.0	398.4	1392
2160 min Summer	3.384	0.0	712.5	1716
2880 min Summer	2.676	0.0	714.0	2084
4320 min Summer	1.920	0.0	680.8	2904
5760 min Summer	1.515	0.0	975.2	3712
7200 min Summer	1.260	0.0	1007.8	4544
8640 min Summer	1.084	0.0	1027.0	5360
10080 min Summer	0.954	0.0	1026.5	6152
15 min Winter	140.177	0.0	140.8	119

Cascade Summary of Results for Detention Basin.srcx

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
30 min Winter	109.715	0.265	2.3	335.9	Flood Risk
60 min Winter	109.774	0.324	2.5	416.3	Flood Risk
120 min Winter	109.833	0.383	2.8	498.2	Flood Risk
180 min Winter	109.866	0.416	2.9	545.6	Flood Risk
240 min Winter	109.889	0.439	3.0	578.1	Flood Risk
360 min Winter	109.920	0.470	3.1	622.4	Flood Risk
480 min Winter	109.937	0.487	3.1	647.8	Flood Risk
600 min Winter	109.949	0.499	3.2	664.8	Flood Risk
720 min Winter	109.957	0.507	3.2	676.6	Flood Risk
960 min Winter	109.966	0.516	3.2	690.6	Flood Risk
1440 min Winter	109.971	0.521	3.3	697.0	Flood Risk
2160 min Winter	109.961	0.511	3.2	683.0	Flood Risk
2880 min Winter	109.952	0.502	3.2	669.4	Flood Risk
4320 min Winter	109.927	0.477	3.1	632.9	Flood Risk
5760 min Winter	109.899	0.449	3.0	592.3	Flood Risk
7200 min Winter	109.871	0.421	2.9	552.2	Flood Risk
8640 min Winter	109.844	0.394	2.8	514.2	Flood Risk
10080 min Winter	109.819	0.369	2.7	479.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	91.381	0.0	166.1	145
60 min Winter	56.713	0.0	323.3	174
120 min Winter	34.011	0.0	365.0	218
180 min Winter	24.892	0.0	386.4	254
240 min Winter	19.835	0.0	399.6	290
360 min Winter	14.348	0.0	416.0	368
480 min Winter	11.406	0.0	425.9	482
600 min Winter	9.539	0.0	431.8	596
720 min Winter	8.239	0.0	435.1	712
960 min Winter	6.534	0.0	436.5	942
1440 min Winter	4.706	0.0	427.0	1384
2160 min Winter	3.384	0.0	776.0	1812
2880 min Winter	2.676	0.0	775.2	2224
4320 min Winter	1.920	0.0	736.9	3124
5760 min Winter	1.515	0.0	1091.6	4040
7200 min Winter	1.260	0.0	1126.1	4904
8640 min Winter	1.084	0.0	1143.9	5720
10080 min Winter	0.954	0.0	1133.5	6560

Cascade Rainfall Details for Detention Basin.srcx

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.417	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.150

Time (mins) From:	To:	Area (ha)
0	4	0.150

Cascade Model Details for Detention Basin.srcx

Storage is Online Cover Level (m) 110.000

Tank or Pond Structure

Invert Level (m) 109.450

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	0.550	1500.0	0.551	0.0

Orifice Outflow Control

Diameter (m) 0.047 Discharge Coefficient 0.600 Invert Level (m) 109.450

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	111.794	0.294	0.7	16.2	Flood Risk
30 min Summer	111.854	0.354	0.8	20.8	Flood Risk
60 min Summer	111.905	0.405	0.9	25.0	Flood Risk
120 min Summer	111.940	0.440	0.9	28.2	Flood Risk
180 min Summer	111.950	0.450	0.9	29.1	Flood Risk
240 min Summer	111.950	0.450	0.9	29.1	Flood Risk
360 min Summer	111.946	0.446	0.9	28.7	Flood Risk
480 min Summer	111.940	0.440	0.9	28.1	Flood Risk
600 min Summer	111.933	0.433	0.9	27.5	Flood Risk
720 min Summer	111.924	0.424	0.9	26.7	Flood Risk
960 min Summer	111.907	0.407	0.9	25.2	Flood Risk
1440 min Summer	111.873	0.373	0.8	22.3	Flood Risk
2160 min Summer	111.828	0.328	0.8	18.7	Flood Risk
2880 min Summer	111.789	0.289	0.7	15.9	Flood Risk
4320 min Summer	111.730	0.230	0.7	11.9	Flood Risk
5760 min Summer	111.686	0.186	0.6	9.2	O K
7200 min Summer	111.654	0.154	0.5	7.3	O K
8640 min Summer	111.629	0.129	0.5	6.0	O K
10080 min Summer	111.610	0.110	0.4	5.0	O K
15 min Winter	111.821	0.321	0.8	18.2	Flood Risk
30 min Winter	111.886	0.386	0.9	23.4	Flood Risk
60 min Winter	111.941	0.441	0.9	28.2	Flood Risk
120 min Winter	111.981	0.481	1.0	32.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	140.177	0.0	16.7	22
30 min Summer	91.381	0.0	21.8	36
60 min Summer	56.713	0.0	27.2	66
120 min Summer	34.011	0.0	32.6	124
180 min Summer	24.892	0.0	35.8	182
240 min Summer	19.835	0.0	38.0	228
360 min Summer	14.348	0.0	41.3	284
480 min Summer	11.406	0.0	43.7	348
600 min Summer	9.539	0.0	45.7	416
720 min Summer	8.239	0.0	47.4	484
960 min Summer	6.534	0.0	50.1	620
1440 min Summer	4.706	0.0	54.1	894
2160 min Summer	3.384	0.0	58.5	1280
2880 min Summer	2.676	0.0	61.6	1668
4320 min Summer	1.920	0.0	66.3	2380
5760 min Summer	1.515	0.0	69.8	3112
7200 min Summer	1.260	0.0	72.6	3816
8640 min Summer	1.084	0.0	74.9	4504
10080 min Summer	0.954	0.0	76.9	5248
15 min Winter	140.177	0.0	18.7	22
30 min Winter	91.381	0.0	24.4	36
60 min Winter	56.713	0.0	30.4	64
120 min Winter	34.011	0.0	36.5	122

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	111.993	0.493	1.0	33.2	Flood Risk
240 min Winter	111.995	0.495	1.0	33.4	Flood Risk
360 min Winter	111.988	0.488	1.0	32.7	Flood Risk
480 min Winter	111.981	0.481	1.0	32.0	Flood Risk
600 min Winter	111.971	0.471	1.0	31.0	Flood Risk
720 min Winter	111.960	0.460	0.9	30.0	Flood Risk
960 min Winter	111.936	0.436	0.9	27.8	Flood Risk
1440 min Winter	111.889	0.389	0.9	23.6	Flood Risk
2160 min Winter	111.826	0.326	0.8	18.6	Flood Risk
2880 min Winter	111.774	0.274	0.7	14.8	Flood Risk
4320 min Winter	111.697	0.197	0.6	9.8	O K
5760 min Winter	111.647	0.147	0.5	6.9	O K
7200 min Winter	111.614	0.114	0.4	5.2	O K
8640 min Winter	111.591	0.091	0.4	4.0	O K
10080 min Winter	111.575	0.075	0.4	3.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	24.892	0.0	40.1	178
240 min Winter	19.835	0.0	42.6	232
360 min Winter	14.348	0.0	46.2	300
480 min Winter	11.406	0.0	49.0	372
600 min Winter	9.539	0.0	51.2	448
720 min Winter	8.239	0.0	53.1	524
960 min Winter	6.534	0.0	56.1	674
1440 min Winter	4.706	0.0	60.6	956
2160 min Winter	3.384	0.0	65.5	1360
2880 min Winter	2.676	0.0	69.0	1736
4320 min Winter	1.920	0.0	74.2	2468
5760 min Winter	1.515	0.0	78.2	3168
7200 min Winter	1.260	0.0	81.3	3888
8640 min Winter	1.084	0.0	83.9	4576
10080 min Winter	0.954	0.0	86.1	5248

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.417	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.064

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.032	4	8	0.032

Model Details

Storage is Online Cover Level (m) 112.000

Tank or Pond Structure

Invert Level (m) 111.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.0	0.500	100.0	0.501	0.0

Orifice Outflow Control

Diameter (m) 0.026 Discharge Coefficient 0.600 Invert Level (m) 111.500

Summary of Results for 100 year Return Period (+40%)

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Volume (m³)	Status
15 min Summer	113.805	0.005	155.3	O K
30 min Summer	113.807	0.007	202.5	O K
60 min Summer	113.808	0.008	251.4	O K
120 min Summer	113.810	0.010	301.5	O K
180 min Summer	113.811	0.011	331.0	O K
240 min Summer	113.812	0.012	351.7	O K
360 min Summer	113.813	0.013	381.6	O K
480 min Summer	113.813	0.013	404.4	O K
600 min Summer	113.814	0.014	422.8	O K
720 min Summer	113.815	0.015	438.2	O K
960 min Summer	113.815	0.015	463.4	O K
1440 min Summer	113.817	0.017	500.7	O K
2160 min Summer	113.818	0.018	540.0	O K
2880 min Summer	113.819	0.019	569.4	O K
4320 min Summer	113.820	0.020	612.6	O K
5760 min Summer	113.821	0.021	644.7	O K
7200 min Summer	113.822	0.022	670.4	O K
8640 min Summer	113.823	0.023	691.9	O K
10080 min Summer	113.824	0.024	710.5	O K
15 min Winter	113.806	0.006	174.0	O K
30 min Winter	113.808	0.008	226.8	O K
60 min Winter	113.809	0.009	281.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	140.177	0.0	27
30 min Summer	91.381	0.0	42
60 min Summer	56.713	0.0	72
120 min Summer	34.011	0.0	132
180 min Summer	24.892	0.0	192
240 min Summer	19.835	0.0	252
360 min Summer	14.348	0.0	372
480 min Summer	11.406	0.0	492
600 min Summer	9.539	0.0	612
720 min Summer	8.239	0.0	732
960 min Summer	6.534	0.0	972
1440 min Summer	4.706	0.0	1452
2160 min Summer	3.384	0.0	2172
2880 min Summer	2.676	0.0	2892
4320 min Summer	1.920	0.0	4332
5760 min Summer	1.515	0.0	5776
7200 min Summer	1.260	0.0	7216
8640 min Summer	1.084	0.0	8656
10080 min Summer	0.954	0.0	10096
15 min Winter	140.177	0.0	27
30 min Winter	91.381	0.0	42
60 min Winter	56.713	0.0	72

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Volume (m³)	Status
120 min Winter	113.811	0.011	337.7	O K
180 min Winter	113.812	0.012	370.7	O K
240 min Winter	113.813	0.013	393.9	O K
360 min Winter	113.814	0.014	427.4	O K
480 min Winter	113.815	0.015	453.0	O K
600 min Winter	113.816	0.016	473.5	O K
720 min Winter	113.816	0.016	490.8	O K
960 min Winter	113.817	0.017	519.0	O K
1440 min Winter	113.819	0.019	560.7	O K
2160 min Winter	113.820	0.020	604.9	O K
2880 min Winter	113.821	0.021	637.7	O K
4320 min Winter	113.823	0.023	686.1	O K
5760 min Winter	113.824	0.024	722.0	O K
7200 min Winter	113.825	0.025	750.8	O K
8640 min Winter	113.826	0.026	774.9	O K
10080 min Winter	113.827	0.027	795.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
120 min Winter	34.011	0.0	132
180 min Winter	24.892	0.0	192
240 min Winter	19.835	0.0	252
360 min Winter	14.348	0.0	372
480 min Winter	11.406	0.0	492
600 min Winter	9.539	0.0	612
720 min Winter	8.239	0.0	732
960 min Winter	6.534	0.0	972
1440 min Winter	4.706	0.0	1452
2160 min Winter	3.384	0.0	2172
2880 min Winter	2.676	0.0	2892
4320 min Winter	1.920	0.0	4332
5760 min Winter	1.515	0.0	5776
7200 min Winter	1.260	0.0	7216
8640 min Winter	1.084	0.0	8656
10080 min Winter	0.954	0.0	10096

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.417	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.591

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.197	4	8	0.197	8	12	0.197

Model Details

Storage is Online Cover Level (m) 115.300

Tank or Pond Structure

Invert Level (m) 113.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	30000.0	1.500	30000.0	1.501	0.0

Appendix M – Foul Discharge Calculations

Claydon Facilities Building Discharge Calculations

192 boats each with own toilet and shower

Calculated using Flows and Loads – 4
Calculation based on peak season usage March -October
Facilities Building will be open from 8am – 8pm
During peak season 50% of boats are out cruising the network
Of the remaining 96 boats we have assumed 25% occupancy = 24 boats with an average of two people per boat = 48 boaters assumed in marina

Facilities Building contains:

Flat with 2 bedrooms (4P) 4 x 150L **= 600L**

Office - 2 staff but these will be the staff occupying the flat

Laundry – 2 x domestic style washing machines

Average cycle time = 2 hrs
Average washing machine uses 110L per cycle

Allowing for 2 loads per machine per day (2 x 2 x 110) **= 440L**

Showers x 4 (40L per use)
Boaters have their own showers but allowing for each
Shower to be used 3 x a day = 12 x 40L **= 480L**

Toilets

Gents
4 x urinals (5L per use) 40 x 5L **= 200L**
2 x WCs (10L per use) 10 x 10L **= 100L**
Ladies
5 x WCs (10L per use) 50 x 10L **= 500L**
1 x Disabled WC (10L per use) 4 x 10L **= 40L**

Assuming 48 boaters, 50% male, 50% female all use the toilets at least once a day plus 4 additional disabled guests

TOTAL **= 2360L per day**
= 2.36m³per day