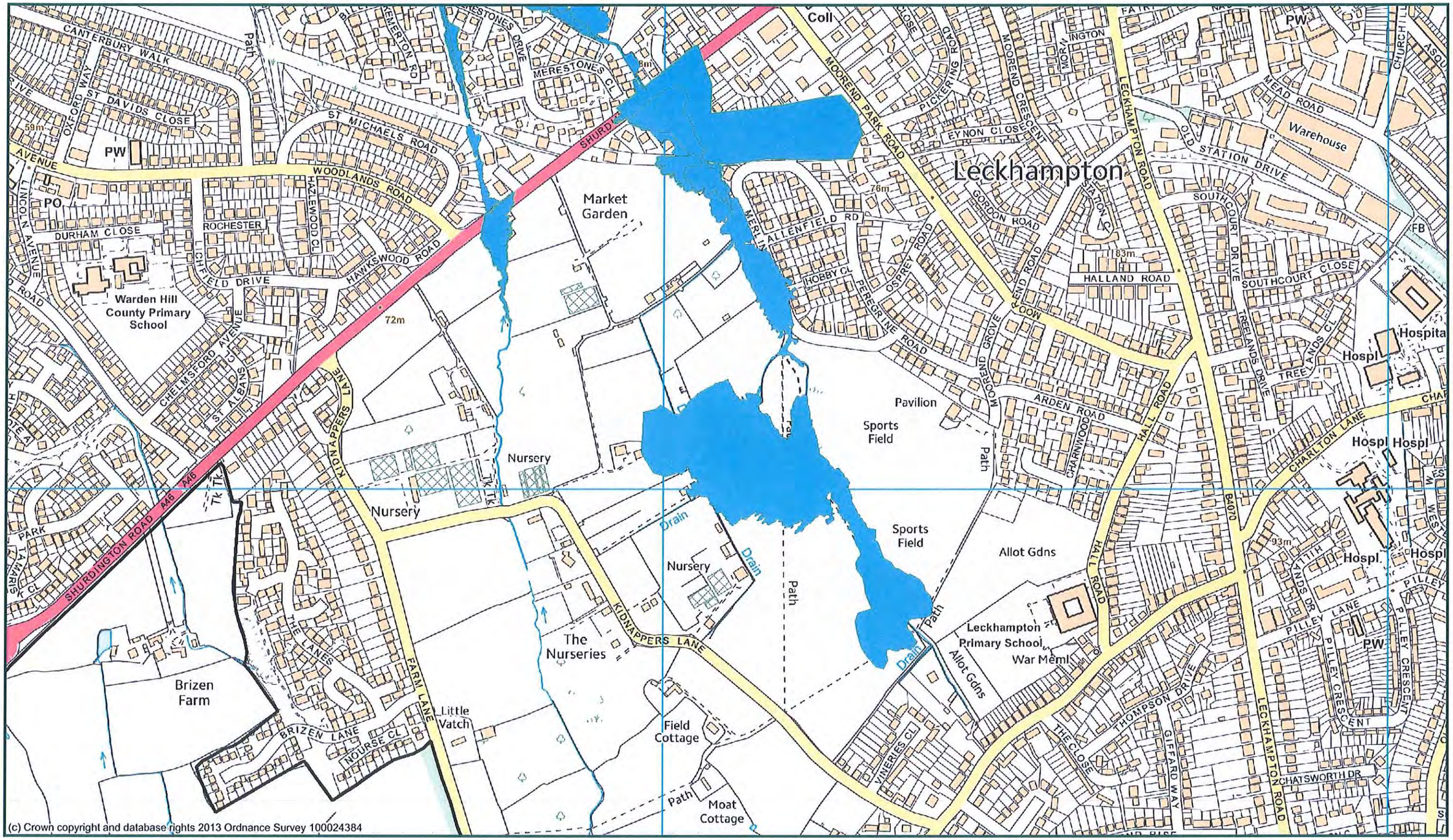
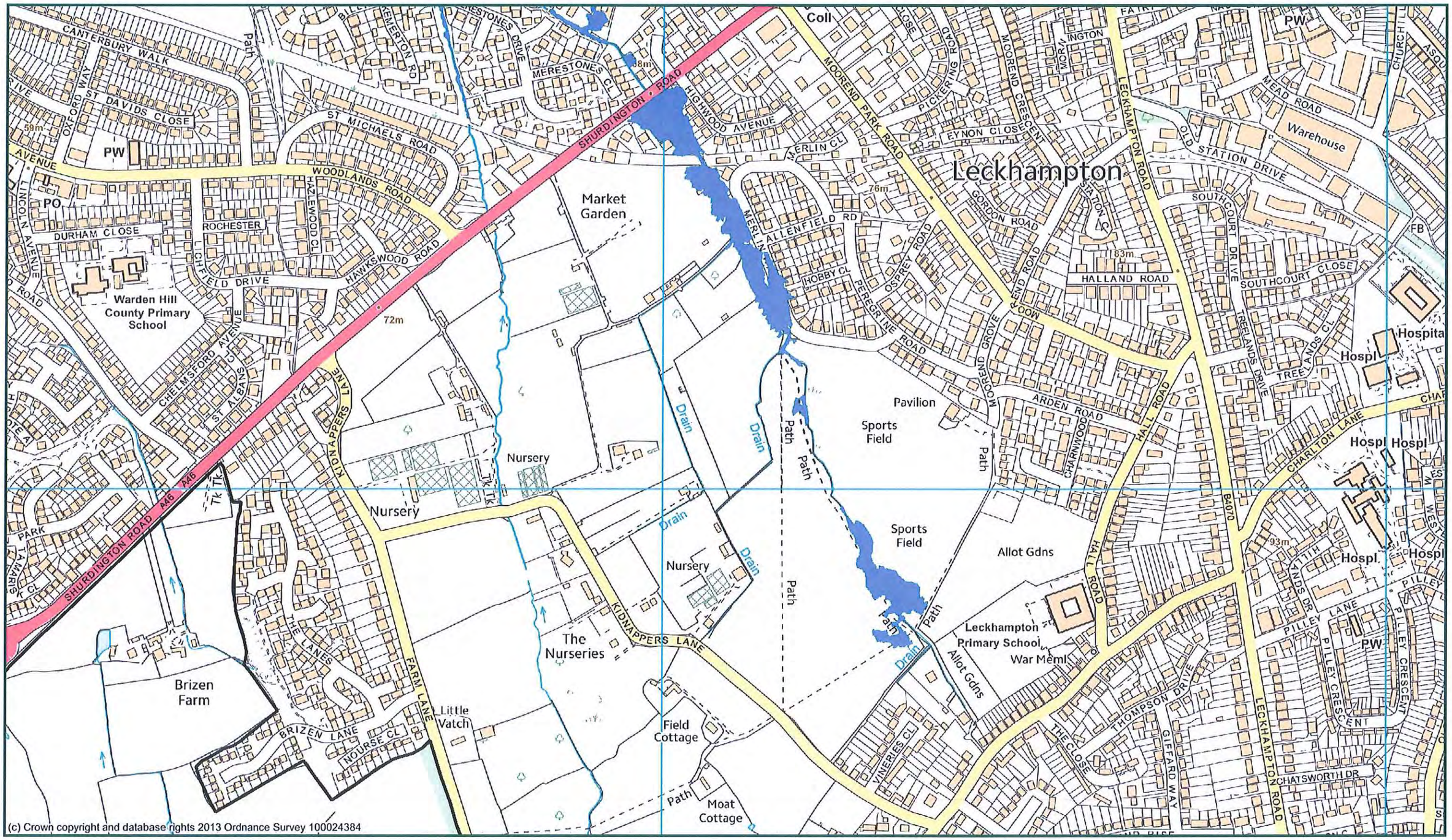


CHELTENHAM
BOROUGH COUNCIL

1:5000

25 September 2015

ZONE 2

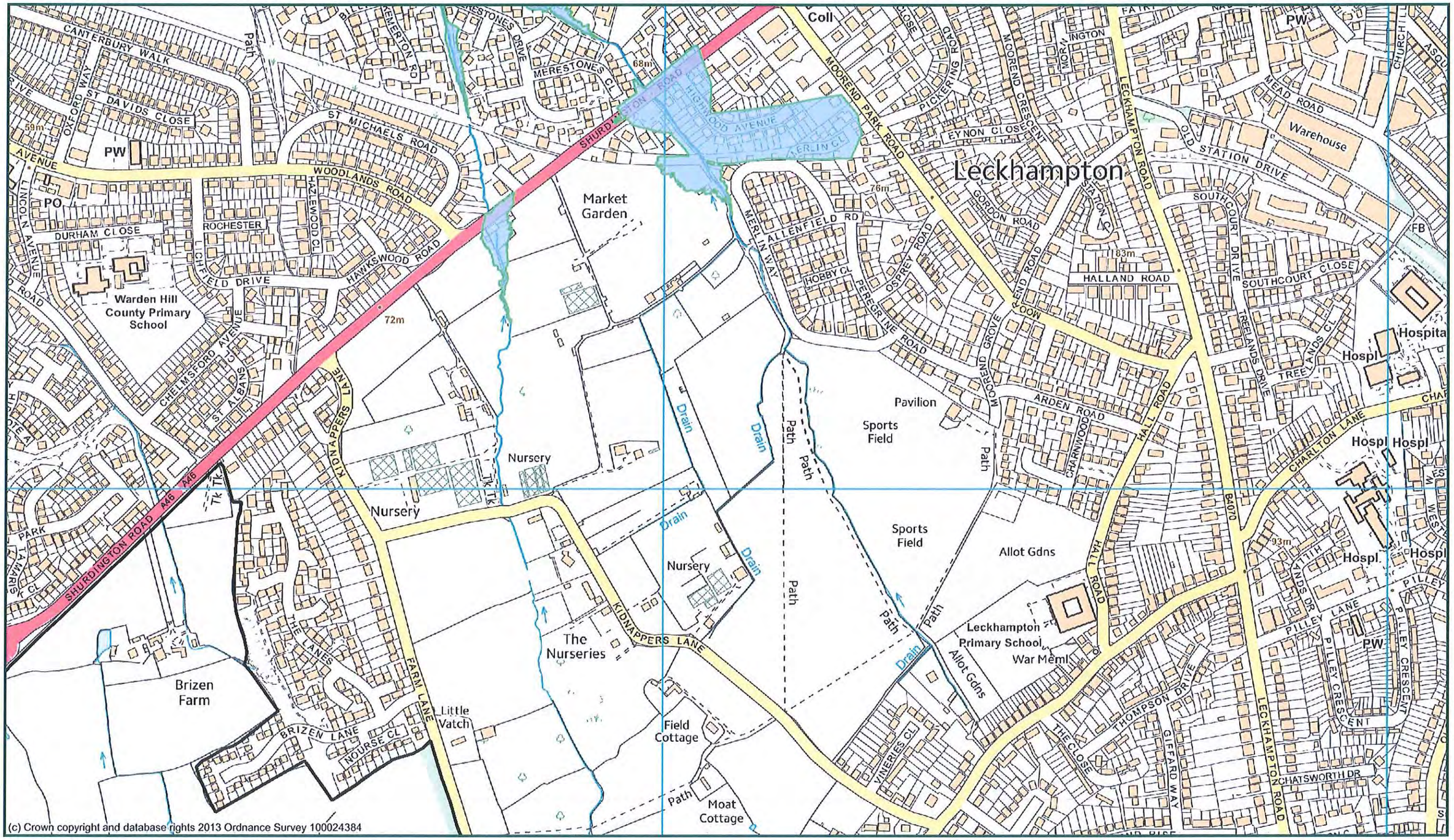


CHELTENHAM
BOROUGH COUNCIL

1:5000

25 September 2015

ZONE 3



CHELTENHAM
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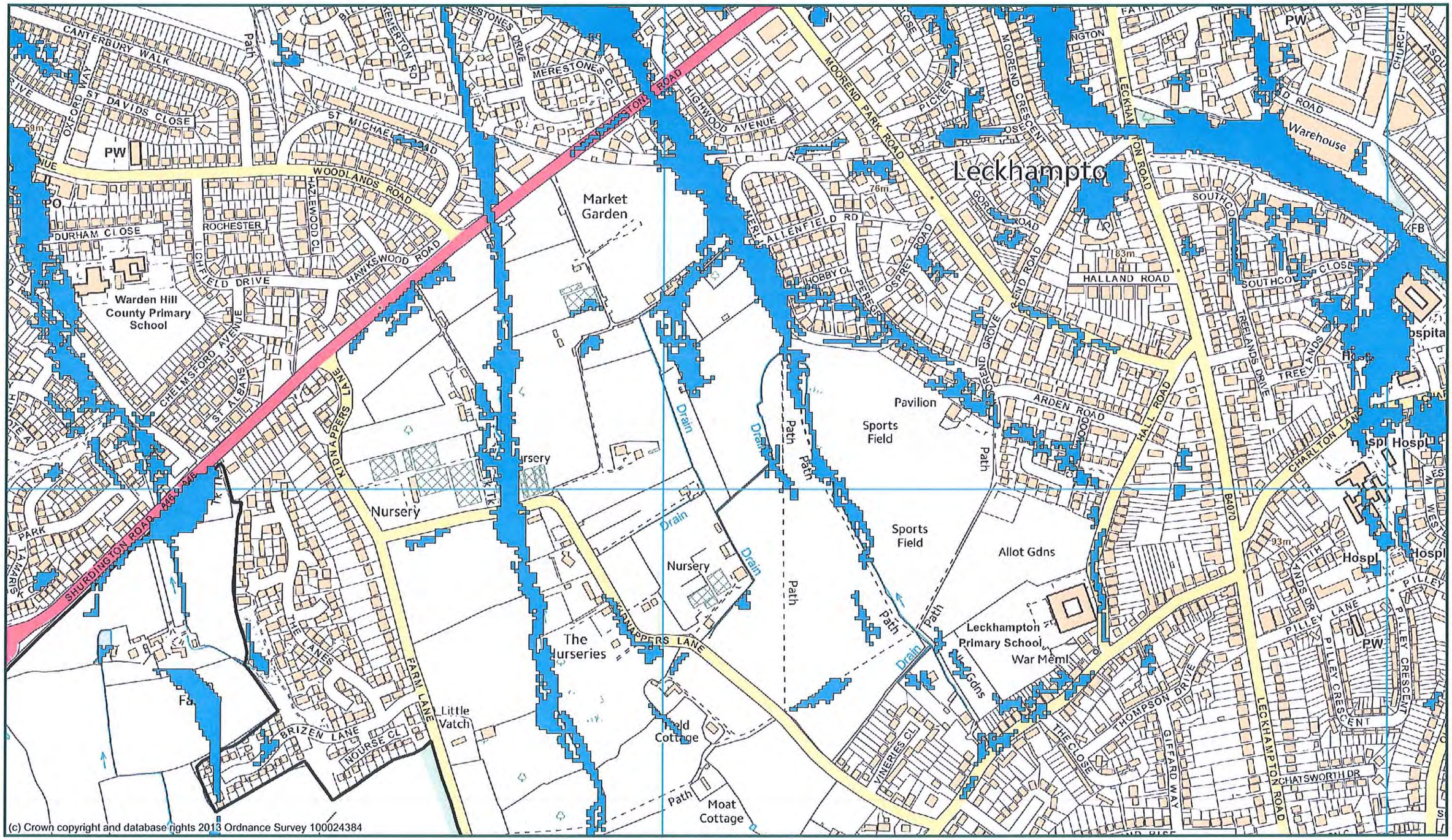
1:5000

25 September 2015

HISTORIC



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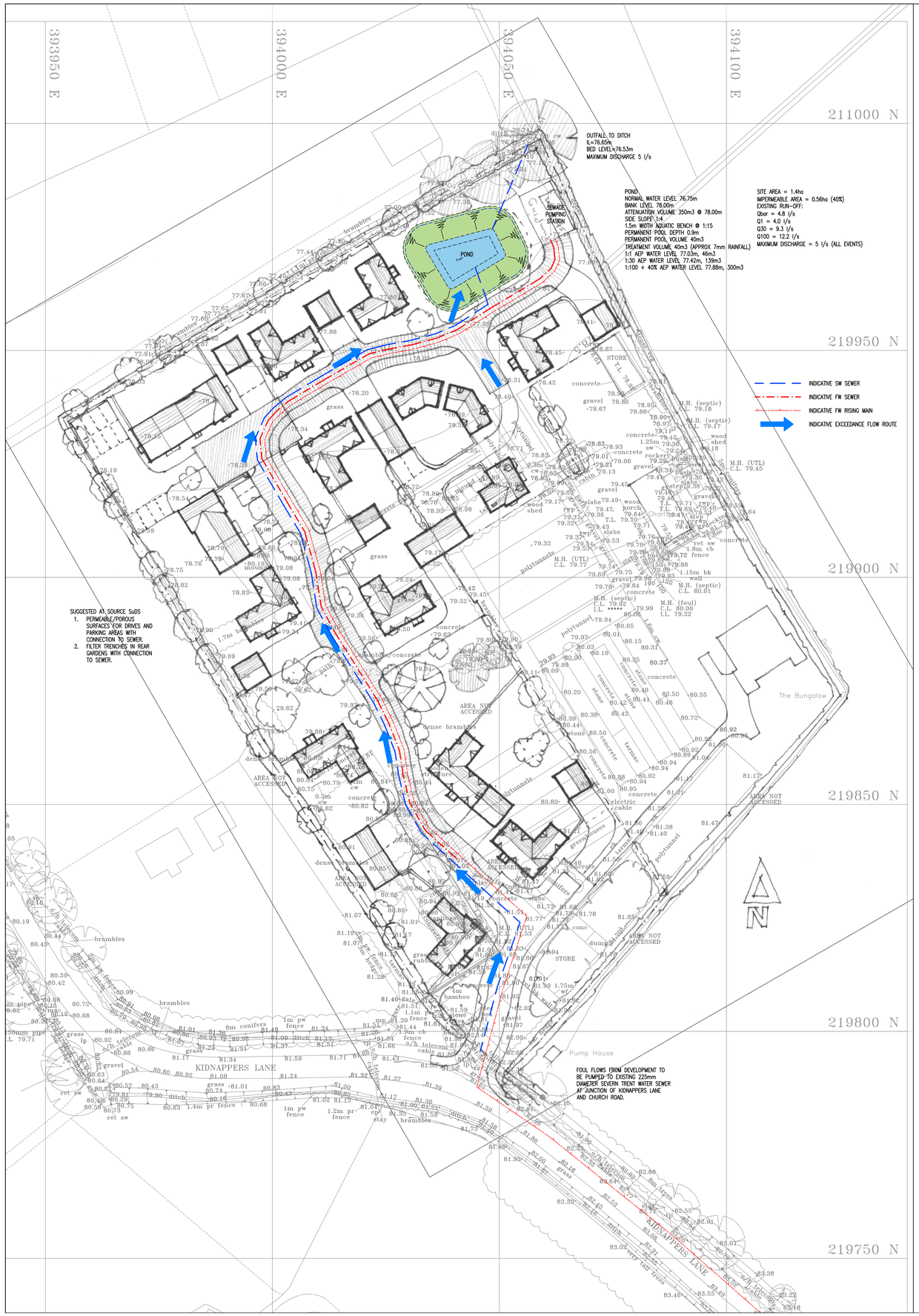
1:5000

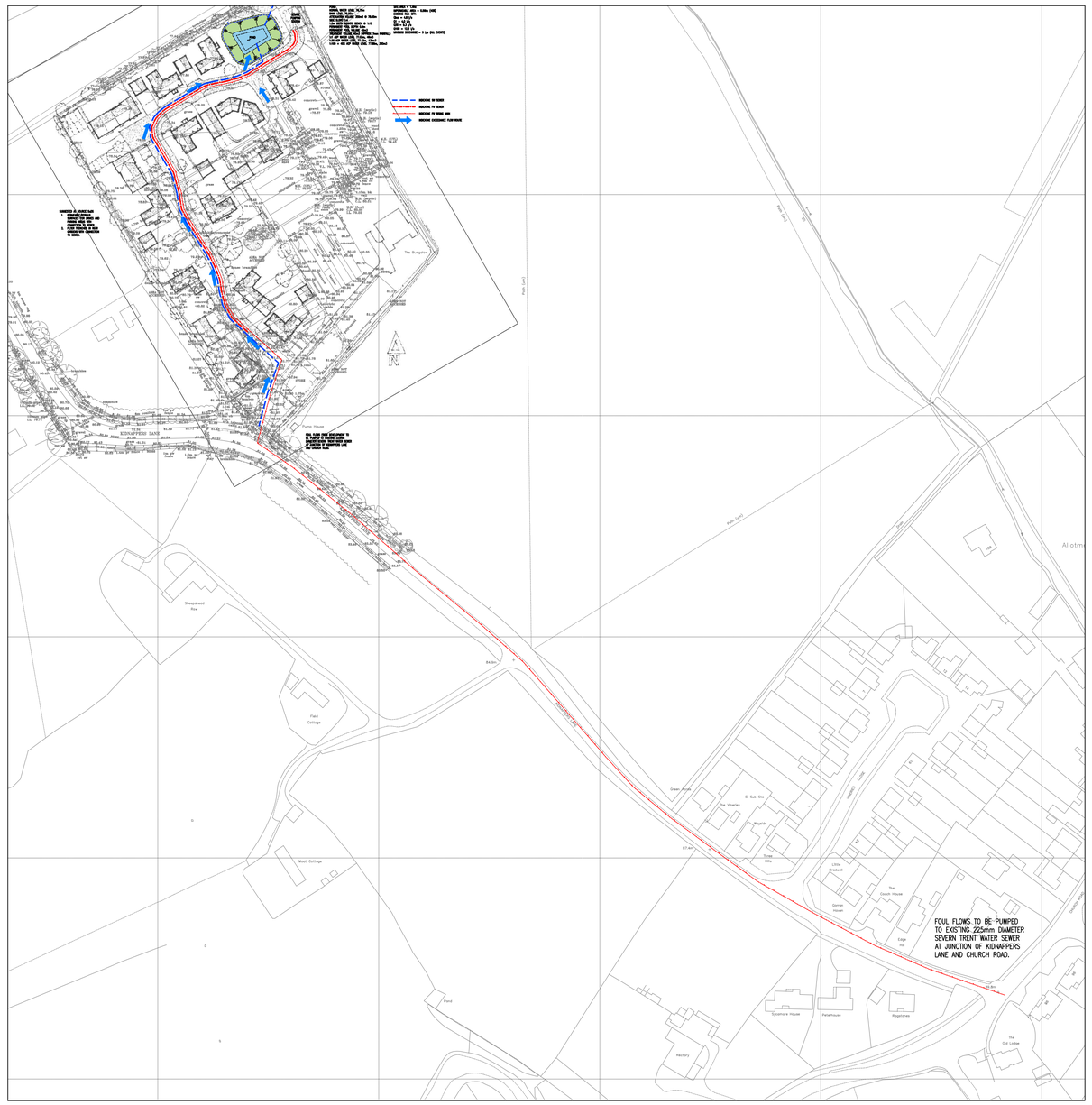
25 September 2015

SURFACE WATER

Appendix F

Drawing 421-200 – Drainage Strategy





FOUL CONNECTION TO EXISTING SEWER IN JUNCTION OF KIDNAPPERS LANE AND CHURCH ROAD (1:1,250)

Revisions

Project: Land off Kidnappers Lane
Leckhampton, Cheltenham

Client: Robert Hitchins
The Complete Development Solution

Drawing: Drainage Strategy

Scale: 1:500 & 1:1,250 @ A1
Date: 21/01/2019
Drawn by: P.A.

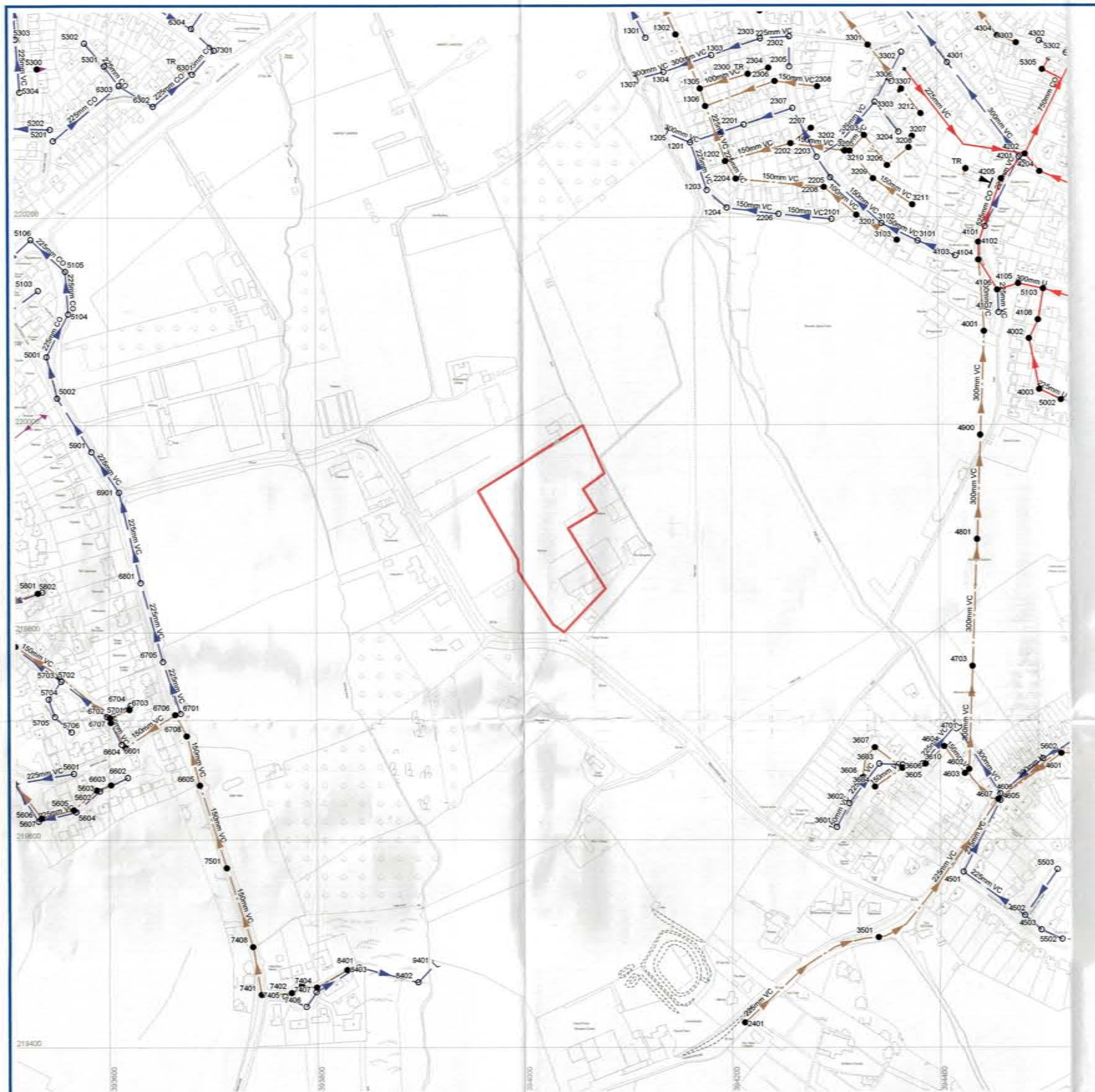
Drawing No: 421-200
Rev: -

PHOENIX DESIGN Partnership Ltd.
Unit 9, Westway Garage, Marksbury, Bath. BA2 9HN
tel. 01761 479950
Titan House, Lewis Road, Cardiff. CF24 5BS
tel. 029 2049 0771
email. enquiries@phoenixdp.co.uk www.phoenixdp.co.uk

Drg.Status: FOR APPROVAL

Appendix G

Severn Trent Water Correspondence



Sewer Node / **Sewer Pipe Data**

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SO93195601	78.13	76.73	73.13	S	VC	C	225	nil	16.08	nil
SO93195602	80.53	78.77	77.00	F	VC	C	150	nil	18.42	nil
SO93195603	80.80	79.06	77.22	S	VC	C	225	nil	18.57	nil
SO93195604	78.83	77.22	74.68	S	VC	C	225	nil	14.61	nil
SO93195605	78.78	76.90	74.44	F	VC	C	150	nil	13.02	nil
SO93195606	77.05	74.65	73.05	S	VC	C	225	nil	26.70	nil
SO93195607	77.05	74.39	72.74	F	VC	C	150	nil	27.27	nil
SO93195701	80.04	78.52	76.05	S	VC	C	150	nil	22.51	nil
SO93195702	78.13	75.88	73.40	S	VC	C	225	nil	23.06	nil
SO93195703	77.96	76.42	73.20	F	VC	C	150	nil	16.11	nil
SO93195704	77.09	76.00	75.90	S	VC	C	225	nil	208.10	nil
SO93195705	77.50	76.96	76.07	S	VC	C	150	nil	20.26	nil
SO93195706	78.99	77.94	77.00	S	VC	C	150	nil	23.33	nil
SO93195801	76.19	74.67	71.51	S	VC	C	150	nil	16.52	nil
SO93195802	75.92	74.15	70.77	F	VC	C	150	nil	13.66	nil
SO93195901	75.95	74.10	73.44	S	VC	C	225	nil	93.32	nil
SO93196601	80.42	79.22	78.60	S	VC	C	150	nil	49.05	nil
SO93196602	81.05	79.55	79.07	S	VC	C	225	nil	62.44	nil
SO93196603	80.79	78.85	78.78	F	VC	C	150	nil	212.43	nil
SO93196604	80.56	78.22	77.99	F	VC	C	150	nil	120.78	nil
SO93196605	81.85	80.17	78.98	F	VC	C	150	nil	41.18	nil
SO93196701	80.13	78.72	77.69	S	VC	C	225	nil	51.27	nil
SO93196702	80.05	77.89	76.49	F	VC	C	150	nil	44.63	nil
SO93196703	79.92	78.14	77.91	F	VC	C	150	nil	89.65	nil
SO93196704	79.89	79.00	78.69	S	VC	C	150	nil	82.26	nil
SO93196705	79.15	77.85	75.81	S	VC	C	225	nil	42.85	nil
SO93196706	80.12	78.71	78.22	F	VC	C	150	nil	117.73	nil
SO93196707	80.14	77.99	77.94	F	VC	C	150	nil	102.00	nil
SO93196708	80.52	78.97	78.71	F	VC	C	150	nil	91.19	nil
SO93196801	77.35	75.79	74.73	S	VC	C	225	nil	84.43	nil
SO93196901	76.30	74.70	74.10	S	VC	C	225	nil	78.12	nil
SO93197401	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO93197402	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO93197403	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO93197404	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO93197405	nil	nil	nil	S	nil	nil	nil	nil	0.00	nil
SO93197406	nil	nil	nil	S	nil	nil	nil	nil	0.00	nil
SO93197407	nil	nil	nil	S	nil	nil	nil	nil	0.00	nil
SO93197408	84.83	82.26	81.39	F	VC	C	150	nil	91.97	nil
SO93197501	83.53	81.38	80.17	F	VC	C	150	nil	69.11	nil
SO93198401	nil	nil	nil	S	nil	nil	nil	nil	0.00	nil
SO93198402	nil	nil	nil	S	nil	nil	nil	nil	0.00	nil
SO93198403	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO93205001	74.45	72.69	71.83	S	CO	C	225	nil	53.57	nil
SO93205002	75.32	73.43	72.72	S	VC	C	225	nil	58.07	nil
SO93205103	72.61	71.09	70.23	S	VC	C	150	nil	40.70	nil
SO93205104	73.54	71.82	71.12	S	CO	C	225	nil	58.73	nil
SO93205105	72.58	71.11	70.00	S	CO	C	225	nil	40.79	nil
SO93205106	71.68	69.36	67.65	S	CO	C	900	nil	28.13	nil
SO93205201	70.71	69.15	68.69	S	CO	C	225	nil	178.98	nil
SO93205202	70.36	69.39	68.01	S	VC	C	225	nil	14.80	nil
SO93205301	70.39	68.84	68.68	S	CO	C	225	nil	147.50	nil
SO93205302	70.24	69.12	68.84	S	CO	C	225	nil	103.82	nil
SO93205303	67.89	66.42	65.80	S	VC	C	225	nil	98.50	nil
SO93205304	68.25	66.83	66.45	S	VC	C	225	nil	134.63	nil
SO93206301	70.15	68.28	68.12	S	CO	C	225	nil	194.63	nil
SO93206302	70.72	68.80	68.28	S	CO	C	225	nil	153.25	nil
SO93206303	70.49	68.68	68.61	S	CO	C	225	nil	551.29	nil
SO93206304	69.48	67.48	66.97	S	CO	C	300	nil	107.14	nil
SO93207301	69.95	68.11	67.48	S	CO	C	225	nil	48.27	nil
SO94192401	91.34	90.04	88.15	F	VC	C	225	nil	82.69	nil
SO94193501	91.32	88.14	nil	F	VC	C	225	nil	0.00	nil
SO94193601	87.97	87.09	86.40	S	VC	C	150	nil	37.59	nil
SO94193602	87.48	86.38	85.88	S	VC	C	225	nil	95.60	nil
SO94193603	86.66	85.82	85.70	S	VC	C	225	nil	183.50	nil
SO94193604	87.22	86.14	85.43	F	VC	C	150	nil	44.54	nil
SO94193605	86.55	85.41	85.24	F	VC	C	150	nil	131.53	nil
SO94193606	86.59	85.68	85.61	S	VC	C	225	nil	271.86	nil
SO94193607	86.41	85.62	85.45	F	VC	C	150	nil	192.94	nil
SO94193608	86.99	85.93	85.87	F	VC	C	150	nil	337.00	nil
SO94193609	86.66	85.86	85.62	F	VC	C	150	nil	53.04	nil
SO94193610	86.40	85.20	85.00	F	VC	C	150	nil	123.80	nil
SO94193611	86.37	85.58	85.37	S	VC	C	225	nil	226.24	nil
SO94194501	89.15	87.68	86.98	S	VC	C	225	nil	86.48	nil
SO94194502	92.80	90.22	87.91	S	VC	C	225	nil	31.35	nil
SO94194503	93.72	92.36	91.53	S	VC	C	225	nil	25.61	nil
SO94194601	87.33	86.37	85.86	S	VC	C	300	nil	129.90	nil
SO94194602	86.95	84.45	82.94	F	VC	C	300	nil	85.85	nil
SO94194603	86.96	84.67	84.56	F	VC	C	150	nil	51.45	nil
SO94194604	86.09	84.99	84.70	F	VC	C	150	nil	113.10	nil
SO94194605	87.42	86.95	85.99	S	VC	C	225	nil	6.25	nil
SO94194606	87.25	85.64	nil	S	VC	C	300	nil	0.00	nil
SO94194607	86.01	nil	84.45	F	nil	nil	nil	nil	0.00	nil
SO94194703	nil	82.94	81.08	F	VC	C	300	nil	85.70	nil
SO94194801	nil	81.08	79.55	F	VC	C	300	nil	85.76	nil
SO94194900	nil	79.55	78.03	F	VC	C	300	nil	85.83	nil
SO94195502	94.23	93.06	92.40	S	VC	C	225	nil	33.23	nil
SO94195503	nil	nil	90.29	S	nil	nil	nil	nil	0.00	nil
SO94195602	87.51	85.86	nil	F	VC	C	225	nil	0.00	nil
SO94201201	71.42	70.14	70.05	S	VC	C	300	nil	229.11	nil
SO94201202	72.75	70.48	69.85	F	VC	C	225	nil	89.37	nil
SO94201203	72.20	70.82	70.21	S	VC	C	225	nil	79.84	nil
SO94201204	72.98	71.49	70.83	S	VC	C	225	nil	38.64	nil
SO94201301	70.09	68.84	68.25	S	VC	C	150	nil	81.86	nil
SO94201302	70.55	68.46	67.59	F	VC	C	225	nil	54.83	nil

Sewer Node / **Sewer Pipe Data**

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
SO94201303	71.42	70.21	69.19	S	VC	C	300	nil	47.75	nil
SO94201304	70.59	69.16	69.10	S	VC	C	300	nil	380.00	nil
SO94201305	71.72	69.47	68.48	F	VC	C	225	nil	57.43	nil
SO94201306	71.85	69.83	69.51	F	VC	C	225	nil	55.38	nil
SO94202101	75.91	74.85	73.70	S	VC	C	150	nil	44.56	nil
SO94202201	72.68	70.96	70.16	S	VC	C	300	nil	78.16	nil
SO94202202	74.40	72.49	70.54	F	VC	C	150	nil	33.46	nil
SO94202203	75.37	73.73	72.74	S	VC	C	225	nil	52.86	nil
SO94202204	73.20	71.22	70.52	F	VC	C	225	nil	28.17	nil
SO94202205	75.71	74.16	73.74	S	VC	C	225	nil	56.79	nil
SO94202206	75.01	73.66	71.56	S	VC	C	150	nil	23.98	nil
SO94202207	75.27	73.72	72.52	F	VC	C	100	nil	20.83	nil
SO94202208	75.85	74.12	71.26	F	VC	C	150	nil	29.85	nil
SO94202300	nil	72.60	69.55	F	VC	C	100	nil	22.61	nil
SO94202302	74.26	72.82	72.05	S	VC	C	225	nil	36.45	nil
SO94202303	73.24	72.04	70.24	S	VC	C	225	nil	27.58	nil
SO94202304	74.00	72.60	69.55	F	VC	C	100	nil	22.61	nil
SO94202305	74.58	73.38	72.94	S	VC	C	150	nil	65.91	nil
SO94202306	nil	nil	69.88	F	nil	nil	nil	nil	0.00	nil
SO94202307	74.74	72.67	70.90	S	VC	C	225	nil	28.05	nil
SO94202308	75.33	73.72	nil	F	VC	C	150	nil	0.00	nil
SO94203101	77.72	76.45	75.58	S	VC	C	150	nil	43.72	nil
SO94203102	78.76	75.58	74.18	S	VC	C	150	nil	47.72	nil
SO94203103	77.40	76.03	74.98	F	VC	C	100	nil	43.61	nil
SO94203201	76.55	74.95	74.16	F	VC	C	100	nil	52.04	nil
SO94203202	75.83	74.01	73.74	S	VC	C	225	nil	99.74	nil
SO94203203	76.79	74.82	nil	F	VC	C	150	nil	0.00	nil
SO94203204	77.04	75.93	74.54	S	VC	C	150	nil	26.63	nil
SO94203205	76.21	nil	74.43	F	nil	nil	nil	nil	0.00	nil
SO94203206	77.42	75.36	74.85	F	PF	C	150	nil	71.37	nil
SO94203207	77.49	76.28	75.90	F	VC	C	100	nil	30.00	nil
SO94203208	77.44	75.88	75.38	F	VC	C	100	nil	55.14	nil
SO94203209	nil	nil	nil	F	nil	C	nil	nil	0.00	nil
SO94203210	76.13	74.37	72.57	F	VC	C	150	nil	29.15	nil
SO94203211	77.59	75.98	nil	F	VC	C	150	nil	0.00	nil
SO94203212	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO94203301	75.81	74.30	72.35	F	VC	C	150	nil	57.52	nil
SO94203302	76.46	75.29	74.85	S	VC	C	150	nil	68.20	nil
SO94203303	76.49	74.48	74.01	S	VC	C	225	nil	108.70	nil
SO94203306	nil	nil	nil	S	VC	C	150	nil	0.00	2008
SO94203307	nil	nil	nil	F	nil	nil	nil	nil	0.00	nil
SO94204001	80.23	78.03	77.29	F	VC	C	300	nil	93.49	nil
SO94204002	nil	nil	nil	C	nil	C	nil	nil	0.00	nil
SO94204003	82.18	80.46	nil	C	VC	C	225	nil	0.00	nil
SO94204101	79.48	79.02	77.69	S	VC	C	225	nil	226.33	nil
SO94204102	79.47	77.17	76.80	C	CO	C	525	nil	113.77	nil
SO94204103	78.93	77.60	76.50	S	VC	C	150	nil	35.12	nil
SO94204104	79.52	77.29	77.19	C	VC	C	300	nil	170.00	nil
SO94204105	80.25	78.46	78.17	C	VC	C	300	nil	72.00	nil
SO94204106	79.87	78.17	77.56	C	VC	C	300	nil	55.95	nil
SO94204107	79.88	78.50	78.34	S	VC	C	225	nil	137.63	nil
SO94204108	nil	nil	79.07	C	nil	nil	nil	nil	0.00	nil
SO94204201	79.32	77.64	75.53	S	VC	C	300	nil	53.84	nil
SO94204202	79.40	76.28	75.72	C	CO	C	750	nil	179.68	nil
SO94204203	79.45	77.78	77.67	S	VC	C	300	nil	71.00	nil
SO94204204	79.71	76.89	76.29	C	CO	C	525	nil	38.10	nil
SO94204205	79.27	76.57	76.28	C	CO	C	525	nil	114.82	nil
SO94204301	77.21	75.51	73.44	S	VC	C	300	nil	51.09	nil
SO94204302	77.96	76.52	76.42	S	VC	C	225	nil	286.40	nil
SO94204303	77.85	76.09	75.76	F	VC	C	225	nil	58.52	nil
SO94204304	77.52	75.74	74.92	F	VC	C	225	nil	59.04	nil
SO94205002	82.54	80.78	80.48	C	U	C	225	nil	77.53	nil
SO94205103	80.77	79.00	78.48	C	U	C	300	nil	47.15	nil
SO94205302	78.51	76.40	nil	S	U	C	225	nil	0.00	nil
SO94205305	nil	nil	nil	C	VC	C	150	nil	0.00	nil

Abandoned Sewer
Private Combined Gravity Sewer
Private Foul Gravity Sewer
Private Surface Water Gravity Sewer
Public Combined Gravity Sewer
Public Foul Gravity Sewer
Public Surface Water Gravity Sewer
Trunk Combined Gravity Sewer
Trunk Foul Use Gravity Sewer
Trunk Surface Water Gravity Sewer
Combined Use Pressurised Sewer
Foul Use Pressurised Sewer
Surface Water Pressurised Sewer
Highway Drain
Combined Lateral Drain (SS)
Foul Lateral Drain (SS)
Surface Water Lateral Drain (SS)

Cable, Earthing
Cable Junction
Cable, Optical Fibre/Instrumentation
Cable, Low Voltage
Cable, High Voltage
Cable, Other
B Housing, Building
K Housing, Kiosk
Disposal Site
STW Sewage Treatment Works
Housing, Other
Pipe Support Structure
Sewage Pumping Facility
Sewer Facility Connection Inlet / Outlet

Blind Shaft
Combined Use Manhole
Flushing Chamber
Foul Use Manhole
Grease Trap
Head Node
Hydrobrake
Lamphole
Outfall
Overflow
Penstock
Petrol Interceptor

Sewer Chemical Injection Point
Sewer Junction
Sewerage Air Valve
Sewerage Hatch Box Point
Sewerage Isolation Valve
Soakaway
Surface Water Manhole
Vent Column
Waste Water Storage
Culverted Watercourse
Pre-1937 Properties

MATERIALS

AC - ASBESTOS CEMENT
BR - BRICK
CC - CONCRETE BOX CULVERT
CI - CAST IRON
CO - CONCRETE
CSB - CONCRETE SEGMENTS (BOLTED)
CSU - CONCRETE SEGMENTS (UNBOLTED)
DI - DUCTILE IRON
GRC - GLASS REINFORCED CONCRETE
MAC - MASONRY IN REGULAR COURSES
MAR - MASONRY RANDOMLY COURSED
PE - POLYETHLENE
PF - PITCH
PP - POLYPROPYLENE
PSC - PLASTIC STEEL COMPOSITE
PVC - POLYVINYL CHLORIDE
RPM - REINFORCED PLASTIC MATRIX
SI - SPUN (GREY) IRON
XXX - OTHER

All Private Sewers are shown in magenta
All section 104 sewers are shown in green
All Sewers that have been transferred to Severn Trent Water after the 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water are shown in orange

CATEGORIES

W - WEIR
C - CASCADE
DB - DAMBOARD
SE - SIDE ENTRY
FV - FLAP VALVE
BD - BACK DROP
S - SIPHON
HD - HIGHWAY DRAIN
S104 - SECTION 104

SHAPE

C - CIRCULAR
E - EGG SHAPED
O - OTHER
R - RECTANGLE
S - SQUARE
T - TRAPEZOIDAL
U - UNKNOWN

TABULAR KEY

A. Sewer pipe data refers to downstream sewer pipe.
B. Where the node bifurcates (splits) X and Y indicates downstream sewer pipe.
C. Gradient is stated a 1 in...

PURPOSE

C - COMBINED
E - FINAL EFFLUENT
F - FOUL
L - SLUDGE
S - SURFACE WATER

N
W E
S

SEVERN TRENT WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0845 601 6616

SEWER RECORD (TABULAR)

O/S Map scale: 1:2500
Date of issue: 12.08.15
Sheet No. 1 of 1

This map is centred upon:
O / S Grid reference:
x: 394017
y: 219877

Severn Trent Water

Severn Trent Water Ltd
Regis Road
Wolverhampton
WV6 8RU

Tel: 01902 793871
Fax: 01902 793971

www.stwater.co.uk
net.dev.west@severntrent.co.uk

Contact: Dave Hadley

Your ref:
Our ref: 8191186

Robert Hitchins Ltd
The Manor
Boddington
Cheltenham
Gloucestershire
GL51 0TJ
FAO Michael Atkins

12 August 2015

Dear Sirs,

Proposed Development of approximately 45 dwellings at Land off Kidnappers Lane, Cheltenham GL53 0NP

I refer to your 'Development Enquiry Request' in respect of the above site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes which refer to surface water disposal from development sites.

Foul Water Drainage

As you can see from the sewer records supplied there are no public sewers indicated in the immediate vicinity. It would be necessary for the developer to undertake a detailed drainage survey here to see where the existing properties drain their foul water to. My guess is the local properties drain to septic tanks or cesspits.

To look at this independently of any other development would involve connecting to either the 225mm diameter foul water sewer to the south east at the junction of Kidnappers Lane/Church Road or across third party land to the east (300mm FWS) or to the west (150mm FWS). The developer could requisition a sewer to be constructed by Severn Trent across third party land or a route via the road network might be possible. I confirm that the average foul flow from 45 properties estimated to be 0.7 l/s at 2 DWF, should not have a significant impact on the existing network. A connection is therefore acceptable to the Company subject to formal S106 approval (see later). Applications to have the development sewers adopted by the Water Company under S104 of the 1991 Water

Severn Trent Water

Industry Act should be made separately from any S106 sewer connection application. An application form and associated guidance notes can be viewed/download from www.stwater.co.uk.

It would be much more practical and beneficial for all parties if this site could be linked into any adjacent development as this would avoid the need for lengthy off site sewers and the potential need for a pumping station.

Surface Water Drainage

There are a number of watercourses near to the development and it is noted that you will be utilising SUDS and not connecting to our network. This is welcomed and we would advise that all surface water matters should be agreed with the Lead Local Flood Authority who in this case is Gloucestershire County Council.

New Connections

For any new connections (including the re-use of existing connections) to the public sewerage system, the developer will need to submit Section 106 application forms. Our New Connections department are responsible for handling all such enquiries and applications. To contact them for an application form and associated guidance notes please call 0800 7076600 or download from www.stwater.co.uk.

Please quote 8191186 in any future correspondence (including e-mails) with STW Limited. Please note that 'Development Enquiry' responses are only valid for 6 months from the date of this letter.

Yours sincerely

D. J. Hadley

D J Hadley
Asset Protection (Waste Water) West
Wholesale Operations

Appendix H

Micro Drainage Pond Calculations

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	76.880	0.130	4.4	28.9	O K
30 min Summer	76.911	0.161	4.6	36.6	O K
60 min Summer	76.939	0.189	4.8	43.6	O K
120 min Summer	76.958	0.208	4.8	48.4	O K
180 min Summer	76.966	0.216	4.9	50.3	O K
240 min Summer	76.968	0.218	4.9	51.0	O K
360 min Summer	76.966	0.216	4.9	50.4	O K
480 min Summer	76.958	0.208	4.8	48.3	O K
600 min Summer	76.948	0.198	4.8	45.9	O K
720 min Summer	76.939	0.189	4.8	43.4	O K
960 min Summer	76.920	0.170	4.7	38.7	O K
1440 min Summer	76.890	0.140	4.5	31.4	O K
2160 min Summer	76.865	0.115	4.0	25.4	O K
2880 min Summer	76.850	0.100	3.5	22.0	O K
4320 min Summer	76.833	0.083	2.8	18.1	O K
5760 min Summer	76.824	0.074	2.4	15.9	O K
7200 min Summer	76.817	0.067	2.0	14.5	O K
8640 min Summer	76.812	0.062	1.8	13.4	O K
10080 min Summer	76.809	0.059	1.6	12.6	O K
15 min Winter	76.895	0.145	4.5	32.5	O K
30 min Winter	76.930	0.180	4.7	41.3	O K
60 min Winter	76.962	0.212	4.8	49.5	O K
120 min Winter	76.982	0.232	4.9	54.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	27.071	0.0	31.1	23
30 min Summer	17.788	0.0	41.1	36
60 min Summer	11.376	0.0	53.3	62
120 min Summer	7.152	0.0	67.1	98
180 min Summer	5.427	0.0	76.5	132
240 min Summer	4.458	0.0	83.8	166
360 min Summer	3.377	0.0	95.2	236
480 min Summer	2.756	0.0	103.7	302
600 min Summer	2.352	0.0	110.6	368
720 min Summer	2.067	0.0	116.7	432
960 min Summer	1.686	0.0	126.9	558
1440 min Summer	1.266	0.0	142.8	794
2160 min Summer	0.951	0.0	161.5	1148
2880 min Summer	0.776	0.0	175.7	1504
4320 min Summer	0.582	0.0	197.4	2212
5760 min Summer	0.475	0.0	215.5	2944
7200 min Summer	0.406	0.0	230.1	3672
8640 min Summer	0.357	0.0	242.8	4408
10080 min Summer	0.321	0.0	254.0	5136
15 min Winter	27.071	0.0	34.9	24
30 min Winter	17.788	0.0	46.1	36
60 min Winter	11.376	0.0	59.8	62
120 min Winter	7.152	0.0	75.2	106

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	76.988	0.238	4.9	56.3	O K
240 min Winter	76.989	0.239	4.9	56.3	O K
360 min Winter	76.980	0.230	4.9	54.1	O K
480 min Winter	76.965	0.215	4.9	50.3	O K
600 min Winter	76.950	0.200	4.8	46.2	O K
720 min Winter	76.934	0.184	4.7	42.2	O K
960 min Winter	76.906	0.156	4.6	35.3	O K
1440 min Winter	76.870	0.120	4.2	26.6	O K
2160 min Winter	76.846	0.096	3.3	21.0	O K
2880 min Winter	76.833	0.083	2.8	18.0	O K
4320 min Winter	76.819	0.069	2.1	14.9	O K
5760 min Winter	76.811	0.061	1.8	13.1	O K
7200 min Winter	76.806	0.056	1.5	12.0	O K
8640 min Winter	76.802	0.052	1.3	11.1	O K
10080 min Winter	76.799	0.049	1.2	10.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	5.427	0.0	85.7	142
240 min Winter	4.458	0.0	93.9	180
360 min Winter	3.377	0.0	106.7	254
480 min Winter	2.756	0.0	116.1	326
600 min Winter	2.352	0.0	124.0	392
720 min Winter	2.067	0.0	130.7	458
960 min Winter	1.686	0.0	142.2	580
1440 min Winter	1.266	0.0	160.0	806
2160 min Winter	0.951	0.0	180.9	1160
2880 min Winter	0.776	0.0	196.8	1512
4320 min Winter	0.582	0.0	221.2	2212
5760 min Winter	0.475	0.0	241.3	2944
7200 min Winter	0.406	0.0	257.8	3680
8640 min Winter	0.357	0.0	272.0	4416
10080 min Winter	0.321	0.0	284.6	5144

Model Details

Storage is Online Cover Level (m) 78.000

Tank or Pond Structure

Invert Level (m) 76.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	208.0	0.300	281.0	0.600	363.0	0.900	454.0	1.100	520.0
0.100	231.0	0.400	307.0	0.700	392.0	0.950	470.0	1.200	555.0
0.200	256.0	0.500	335.0	0.800	423.0	1.000	487.0	1.250	572.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0104-5000-1100-5000
Design Head (m)	1.100
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	104
Invert Level (m)	76.750
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	5.0	Kick-Flo®	0.690	4.0
Flush-Flo™	0.323	5.0	Mean Flow over Head Range	-	4.4

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	3.5	1.200	5.2	3.000	8.0	7.000	12.0
0.200	4.8	1.400	5.6	3.500	8.6	7.500	12.4
0.300	5.0	1.600	6.0	4.000	9.2	8.000	12.7
0.400	5.0	1.800	6.3	4.500	9.7	8.500	13.1
0.500	4.8	2.000	6.6	5.000	10.2	9.000	13.5
0.600	4.6	2.200	6.9	5.500	10.7	9.500	13.8
0.800	4.3	2.400	7.2	6.000	11.1		
1.000	4.8	2.600	7.5	6.500	11.5		

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	77.125	0.375	5.0	65.3	O K
30 min Summer	77.211	0.461	5.0	84.4	O K
60 min Summer	77.284	0.534	5.0	102.2	O K
120 min Summer	77.336	0.586	5.0	115.5	O K
180 min Summer	77.349	0.599	5.0	118.9	O K
240 min Summer	77.348	0.598	5.0	118.7	O K
360 min Summer	77.337	0.587	5.0	115.7	O K
480 min Summer	77.322	0.572	5.0	111.8	O K
600 min Summer	77.305	0.555	5.0	107.4	O K
720 min Summer	77.287	0.537	5.0	102.8	O K
960 min Summer	77.249	0.499	5.0	93.6	O K
1440 min Summer	77.176	0.426	5.0	76.3	O K
2160 min Summer	77.077	0.327	5.0	55.1	O K
2880 min Summer	77.000	0.250	4.9	40.2	O K
4320 min Summer	76.907	0.157	4.4	23.7	O K
5760 min Summer	76.867	0.117	3.9	17.3	O K
7200 min Summer	76.850	0.100	3.4	14.6	O K
8640 min Summer	76.839	0.089	3.0	12.9	O K
10080 min Summer	76.831	0.081	2.7	11.7	O K
15 min Winter	77.163	0.413	5.0	73.5	O K
30 min Winter	77.257	0.507	5.0	95.3	O K
60 min Winter	77.338	0.588	5.0	116.0	O K
120 min Winter	77.400	0.650	5.0	132.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	66.235	0.0	69.1	22
30 min Summer	43.716	0.0	91.3	36
60 min Summer	27.653	0.0	115.9	64
120 min Summer	17.008	0.0	142.7	122
180 min Summer	12.671	0.0	159.4	180
240 min Summer	10.239	0.0	171.8	210
360 min Summer	7.537	0.0	189.7	272
480 min Summer	6.064	0.0	203.5	338
600 min Summer	5.120	0.0	214.8	406
720 min Summer	4.458	0.0	224.4	474
960 min Summer	3.580	0.0	240.3	608
1440 min Summer	2.625	0.0	264.2	868
2160 min Summer	1.922	0.0	290.4	1232
2880 min Summer	1.539	0.0	310.2	1584
4320 min Summer	1.125	0.0	339.8	2252
5760 min Summer	0.900	0.0	362.7	2944
7200 min Summer	0.756	0.0	381.1	3672
8640 min Summer	0.656	0.0	396.6	4408
10080 min Summer	0.582	0.0	410.1	5136
15 min Winter	66.235	0.0	77.5	21
30 min Winter	43.716	0.0	102.3	36
60 min Winter	27.653	0.0	129.9	64
120 min Winter	17.008	0.0	159.8	120

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
180 min Winter	77.419	0.669	5.0	138.3	O K
240 min Winter	77.422	0.672	5.0	139.0	O K
360 min Winter	77.404	0.654	5.0	134.0	O K
480 min Winter	77.384	0.634	5.0	128.5	O K
600 min Winter	77.360	0.610	5.0	121.9	O K
720 min Winter	77.333	0.583	5.0	114.7	O K
960 min Winter	77.276	0.526	5.0	100.1	O K
1440 min Winter	77.162	0.412	5.0	73.2	O K
2160 min Winter	77.018	0.268	4.9	43.6	O K
2880 min Winter	76.925	0.175	4.6	26.9	O K
4320 min Winter	76.858	0.108	3.7	15.9	O K
5760 min Winter	76.838	0.088	3.0	12.8	O K
7200 min Winter	76.828	0.078	2.5	11.1	O K
8640 min Winter	76.821	0.071	2.2	10.1	O K
10080 min Winter	76.816	0.066	1.9	9.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	12.671	0.0	178.6	178
240 min Winter	10.239	0.0	192.4	232
360 min Winter	7.537	0.0	212.5	296
480 min Winter	6.064	0.0	228.0	368
600 min Winter	5.120	0.0	240.6	444
720 min Winter	4.458	0.0	251.3	518
960 min Winter	3.580	0.0	269.1	660
1440 min Winter	2.625	0.0	295.9	924
2160 min Winter	1.922	0.0	325.3	1276
2880 min Winter	1.539	0.0	347.4	1588
4320 min Winter	1.125	0.0	380.6	2212
5760 min Winter	0.900	0.0	406.2	2944
7200 min Winter	0.756	0.0	426.8	3672
8640 min Winter	0.656	0.0	444.3	4360
10080 min Winter	0.582	0.0	459.4	5096

Model Details

Storage is Online Cover Level (m) 78.000

Tank or Pond Structure

Invert Level (m) 76.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	136.0	0.300	197.0	0.600	267.0	0.900	346.0	1.200	434.0
0.100	156.0	0.400	219.0	0.700	292.0	1.000	374.0	1.250	450.0
0.200	176.0	0.500	243.0	0.800	319.0	1.100	404.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0102-5000-1250-5000
Design Head (m)	1.250
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	102
Invert Level (m)	76.750
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.250	5.0	Kick-Flo®	0.772	4.0
Flush-Flo™	0.370	5.0	Mean Flow over Head Range	-	4.4

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	3.4	1.200	4.9	3.000	7.5	7.000	11.2
0.200	4.7	1.400	5.3	3.500	8.1	7.500	11.6
0.300	5.0	1.600	5.6	4.000	8.6	8.000	12.0
0.400	5.0	1.800	5.9	4.500	9.1	8.500	12.3
0.500	4.9	2.000	6.2	5.000	9.6	9.000	12.7
0.600	4.7	2.200	6.5	5.500	10.0	9.500	13.0
0.800	4.1	2.400	6.8	6.000	10.4		
1.000	4.5	2.600	7.0	6.500	10.9		

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	77.357	0.607	5.0	121.1	O K
30 min Summer	77.493	0.743	5.0	159.8	O K
60 min Summer	77.615	0.865	5.0	198.9	O K
120 min Summer	77.715	0.965	5.0	234.1	Flood Risk
180 min Summer	77.758	1.008	5.0	249.9	Flood Risk
240 min Summer	77.777	1.027	5.0	257.1	Flood Risk
360 min Summer	77.782	1.032	5.0	258.8	Flood Risk
480 min Summer	77.771	1.021	5.0	254.8	Flood Risk
600 min Summer	77.757	1.007	5.0	249.7	Flood Risk
720 min Summer	77.743	0.993	5.0	244.4	Flood Risk
960 min Summer	77.715	0.965	5.0	234.1	Flood Risk
1440 min Summer	77.660	0.910	5.0	214.2	O K
2160 min Summer	77.572	0.822	5.0	184.6	O K
2880 min Summer	77.464	0.714	5.0	151.2	O K
4320 min Summer	77.264	0.514	5.0	97.0	O K
5760 min Summer	77.107	0.357	5.0	61.4	O K
7200 min Summer	77.001	0.251	4.9	40.4	O K
8640 min Summer	76.933	0.183	4.6	28.3	O K
10080 min Summer	76.892	0.142	4.3	21.4	O K
15 min Winter	77.412	0.662	5.0	136.1	O K
30 min Winter	77.557	0.807	5.0	180.0	O K
60 min Winter	77.688	0.938	5.0	224.4	O K
120 min Winter	77.799	1.049	5.0	265.5	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	119.757	0.0	125.2	22
30 min Summer	79.807	0.0	167.0	37
60 min Summer	50.812	0.0	213.2	66
120 min Summer	31.320	0.0	262.8	126
180 min Summer	23.299	0.0	293.3	184
240 min Summer	18.779	0.0	315.2	242
360 min Summer	13.732	0.0	345.7	360
480 min Summer	11.005	0.0	369.4	450
600 min Summer	9.261	0.0	388.6	506
720 min Summer	8.039	0.0	404.8	570
960 min Summer	6.425	0.0	431.3	696
1440 min Summer	4.677	0.0	470.9	972
2160 min Summer	3.399	0.0	513.7	1388
2880 min Summer	2.706	0.0	545.4	1764
4320 min Summer	1.960	0.0	592.4	2468
5760 min Summer	1.557	0.0	627.9	3120
7200 min Summer	1.302	0.0	656.1	3816
8640 min Summer	1.124	0.0	679.9	4496
10080 min Summer	0.993	0.0	700.3	5144
15 min Winter	119.757	0.0	140.3	22
30 min Winter	79.807	0.0	187.0	36
60 min Winter	50.812	0.0	238.8	66
120 min Winter	31.320	0.0	294.4	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	77.848	1.098	5.0	285.0	Flood Risk
240 min Winter	77.872	1.122	5.0	294.7	Flood Risk
360 min Winter	77.884	1.134	5.0	299.9	Flood Risk
480 min Winter	77.880	1.130	5.0	298.0	Flood Risk
600 min Winter	77.865	1.115	5.0	292.1	Flood Risk
720 min Winter	77.846	1.096	5.0	284.4	Flood Risk
960 min Winter	77.813	1.063	5.0	271.2	Flood Risk
1440 min Winter	77.739	0.989	5.0	242.7	Flood Risk
2160 min Winter	77.612	0.862	5.0	198.1	O K
2880 min Winter	77.445	0.695	5.0	145.7	O K
4320 min Winter	77.143	0.393	5.0	69.1	O K
5760 min Winter	76.962	0.212	4.7	33.3	O K
7200 min Winter	76.881	0.131	4.2	19.6	O K
8640 min Winter	76.859	0.109	3.7	16.1	O K
10080 min Winter	76.847	0.097	3.3	14.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	23.299	0.0	328.5	180
240 min Winter	18.779	0.0	353.0	238
360 min Winter	13.732	0.0	387.2	352
480 min Winter	11.005	0.0	413.7	462
600 min Winter	9.261	0.0	435.2	564
720 min Winter	8.039	0.0	453.3	604
960 min Winter	6.425	0.0	483.1	744
1440 min Winter	4.677	0.0	527.3	1054
2160 min Winter	3.399	0.0	575.4	1512
2880 min Winter	2.706	0.0	610.9	1904
4320 min Winter	1.960	0.0	663.6	2552
5760 min Winter	1.557	0.0	703.2	3120
7200 min Winter	1.302	0.0	734.9	3744
8640 min Winter	1.124	0.0	761.5	4408
10080 min Winter	0.993	0.0	784.4	5136