

 STRUCTURAL CALCULATIONS Kurt Robbins CEng, MStructE	Project Residential Development, Caversham				Job Ref. E0119	
	Section				Sheet no./rev. 14	
	Calc. by KR	Date	Chk'd by	Date	App'd by	Date

SW DRAINAGE

The proposed residential site is to be located on a brownfield site which was part of a wider industrial site. The site originally included buildings and hardstanding and was positively drained with connections to the main drainage via the wider industrial site.
Site Area = 695m²

The existing site comprised 360m² impermeable / 335m² permeable area.

For small development less than 200 hectares, the run-off rates can be calculated in accordance with EN 752-4:1997.

$$Q = \Psi i A$$

Where:

Q is the peak flow rate, in litres per second;

Ψ is the run-off coefficient (taken conservatively as 1.0),

i is the rainfall intensity, in litres per second per m²;

A is the area receiving rainfall (m²)

For the Reading area, the rainfall intensity can be taken as 0.016l/s as stated in diagram 2 of Approved Document H H3 section 2.4. Therefore, the peak flow rate that should not be exceeded is shown to be;

$$Q = 360\text{m}^2 * 1.0 * 0.016\text{l/s/m}^2 = 5.76 \text{ l/s}$$

The area of the development that is positively drained is listed below;

Roof area = 204m²

Impervious Hardstanding = 271m²

Total = 475m²

This strategy is based on the assumption that attenuation will be required to restrict run-off to 2.5l/s from the site to the Thames Water surface water sewer for all events up to the 1 in 100 year plus climate change rainfall event, a greater than 50% reduction in existing flow.

The attenuation required to limit flows to this rate was calculated as 10.81m³ to the 1 in 30 year return period storm event and 16.07m³ (i.e. an additional 5.26m³) to the 1 in 100 year return period event including climate change allowance.

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Climate change was set to +30% on peak rainfall intensities. This is based upon a design life for commercial units to the years 2055-2085 in accordance with the Technical Guidance to the National Planning Policy Framework.

It is proposed to provide the attenuation via proprietary surface water storage crates underneath the parking area.

The tank is proposed to accommodate 16.6m³ of below ground storage.

Outflow from the site will be limited to 2.5 l/s by provision of a flow restrictor in the downstream manhole.

ATTENUATION TANK

Site Area = 695m²

Impermeable Area = 475m²

(Inc. Roof Area = 204m²)

Permeable Area = 220m²

(Grass)

Design Attenuation For Upto 1 In 100 Year Storm +30% Climate Change Allowance.

See following sheet for tank sizing.

GENERAL DATA

site location: **England and Wales**

60 min rainfall depth of 5 year return period 'R' [mm] = **20**

M5-60 to M5-2d rainfall ratio 'r' = **0.42**

proposed discharge rate 'v₁' [litre/s] = **2.50**

proposed discharge rate 'v₂' [litre/s] = **2.50**

allowance for climate change: **30%**

SUMMARY OF CALCULATIONS

required storage volume for discharge rate 'v₁' = **16.07** m³

required storage volume for discharge rate 'v₂' = **10.81** m³

AREA DATA

impermeability
[%]

effective area
[m²]

impermeable area 'A₁' [m²] = **475**

100.00

475

landscaping and/or green roof area 'A₂' [m²] = **0**

80.00

0

other partially permeable area 'A₃' [m²] = **0**

20.00

0

AREA DRAINED TO ATTENUATION TANK = 475 m²

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v₁

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M1-D			M30-D			M100-D			outflow from attenuation tank [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.38	7.60	0.61	6.07	2.89	1.46	14.42	6.85	1.85	18.30	8.69	0.75	7.94
10	0.53	10.60	0.61	8.42	4.00	1.49	20.59	9.78	1.92	26.45	12.56	1.50	11.06
15	0.64	12.80	0.62	10.24	4.87	1.51	25.14	11.94	1.95	32.53	15.45	2.25	13.20
30	0.81	16.20	0.62	13.16	6.25	1.53	32.24	15.31	2.00	42.11	20.00	4.50	15.50
60	1.00	20.00	0.64	16.64	7.90	1.54	40.13	19.06	2.03	52.78	25.07	9.00	16.07
120	1.20	24.00	0.66	20.47	9.72	1.54	47.90	22.75	2.01	62.84	29.85	18.00	11.85
240	1.42	28.40	0.67	24.87	11.81	1.52	56.11	26.65	1.98	73.20	34.77	36.00	0.00
360	1.57	31.40	0.68	27.87	13.24	1.51	61.51	29.22	1.96	79.96	37.98	54.00	0.00
600	1.74	34.80	0.69	31.20	14.82	1.49	67.45	32.04	1.93	87.39	41.51	90.00	0.00
1440	2.16	43.20	0.71	39.67	18.84	1.45	81.53	38.73	1.86	104.70	49.73	216.00	0.00

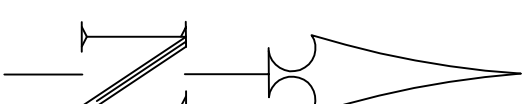
* Z2 is a growth factor from M5 rainfalls

REQUIRED STORAGE VOLUME PER RAINFALL DURATION FOR DISCHARGE RATE v₂

rainfall duration [min]	rainfall factor Z1	M5-D rainfalls [mm]	M10-D			M20-D			M30-D			outflow from attenuation tank [m ³]	required storage [m ³]
			Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]	Z2	rainfalls [mm]	inflow [m ³]		
5	0.38	7.60	1.21	11.91	5.66	1.39	13.69	6.50	1.46	14.42	6.85	0.75	6.10
10	0.53	10.60	1.22	16.84	8.00	1.41	19.48	9.25	1.49	20.59	9.78	1.50	8.28
15	0.64	12.80	1.23	20.49	9.73	1.43	23.74	11.28	1.51	25.14	11.94	2.25	9.69
30	0.81	16.20	1.24	26.11	12.40	1.44	30.38	14.43	1.53	32.24	15.31	4.50	10.81
60	1.00	20.00	1.24	32.24	15.31	1.45	37.70	17.91	1.54	40.13	19.06	9.00	10.06
120	1.20	24.00	1.24	38.69	18.38	1.44	44.99	21.37	1.54	47.90	22.75	18.00	4.75
240	1.42	28.40	1.23	45.28	21.51	1.43	52.66	25.01	1.52	56.11	26.65	36.00	0.00
360	1.57	31.40	1.22	49.63	23.57	1.41	57.74	27.42	1.51	61.51	29.22	54.00	0.00
600	1.74	34.80	1.21	54.54	25.91	1.40	63.37	30.10	1.49	67.45	32.04	90.00	0.00
1440	2.16	43.20	1.18	66.47	31.57	1.37	76.78	36.47	1.45	81.53	38.73	216.00	0.00

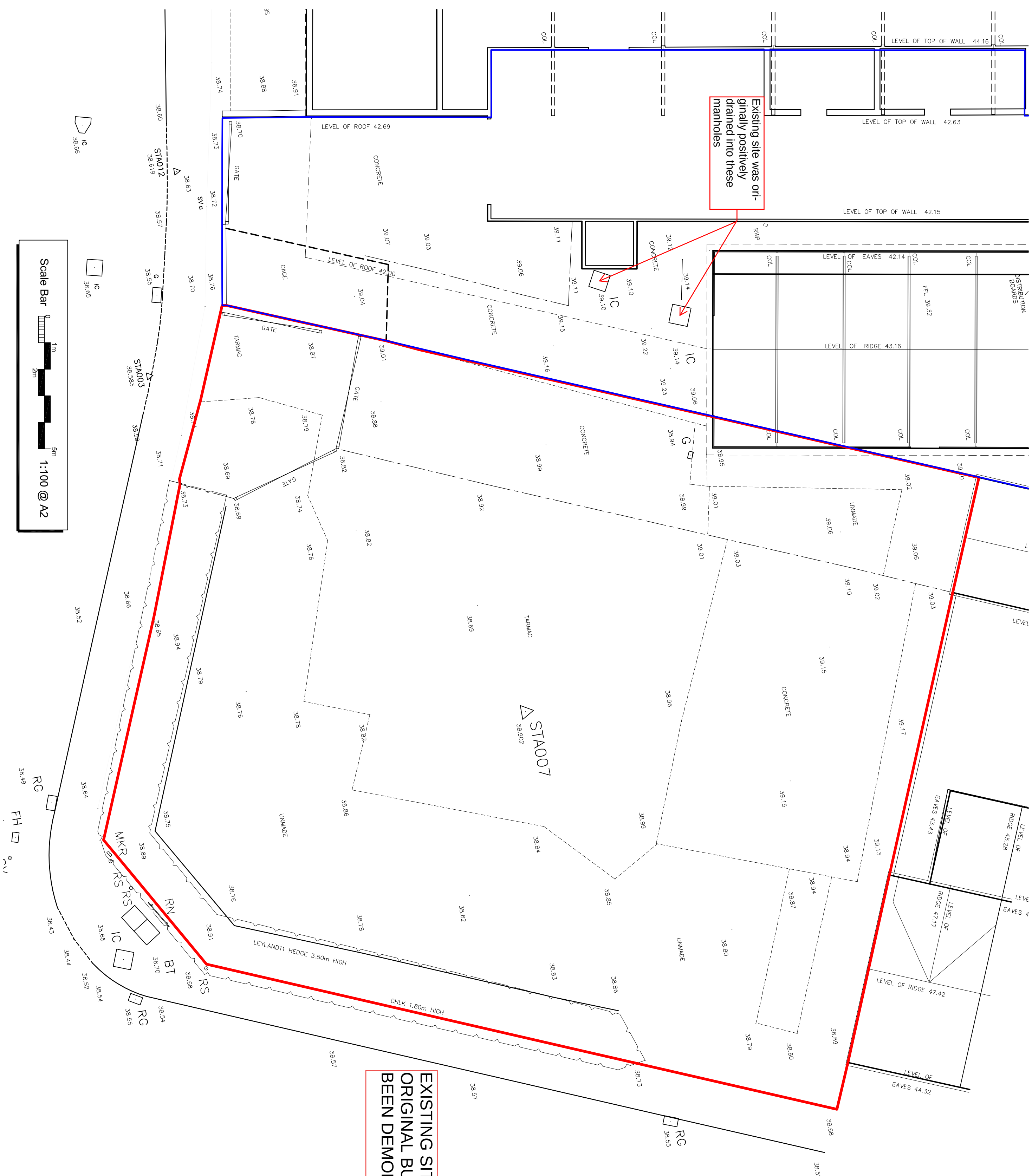
* Z2 is a growth factor from M5 rainfalls

All dimensions are to be checked on site before work commences.
Figured dimensions to be taken in preference to scaled dimensions.
If in doubt please ask.
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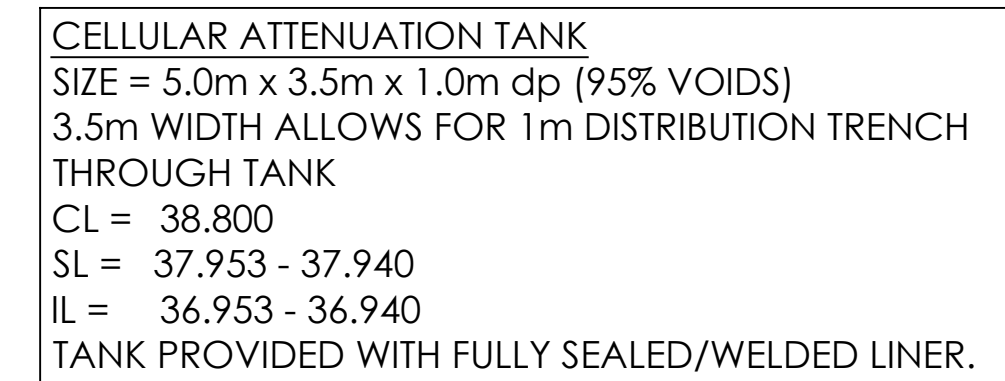


Rev	Notes	Date	Initial
Status	Notes	Date	Initial
Consultant:  robert higby architects 42 Portman Road, Reading, Berks RG30 1EA Telephone: 0118 95770 10 Fax: 0118 95770 19 E-Mail: enquiries@higbyarchitects.com			
Project: REDEVELOPMENT OF LAND AT THE CORNER OF MEADOW ROAD & ADDISON ROAD, CAVERS HAM, READING			
Client: MR & MRS BELCHER			
Drawing Title: SITE SURVEY			
Scale:	1:100 @A2	Dwg. No.:	Rev.:
Drawn by:	RAJ	1322-100	
Date:	01-13		

EXISTING SITE PLAN
ORIGINAL BUILDINGS HAVE
BEEN DEMOLISHED

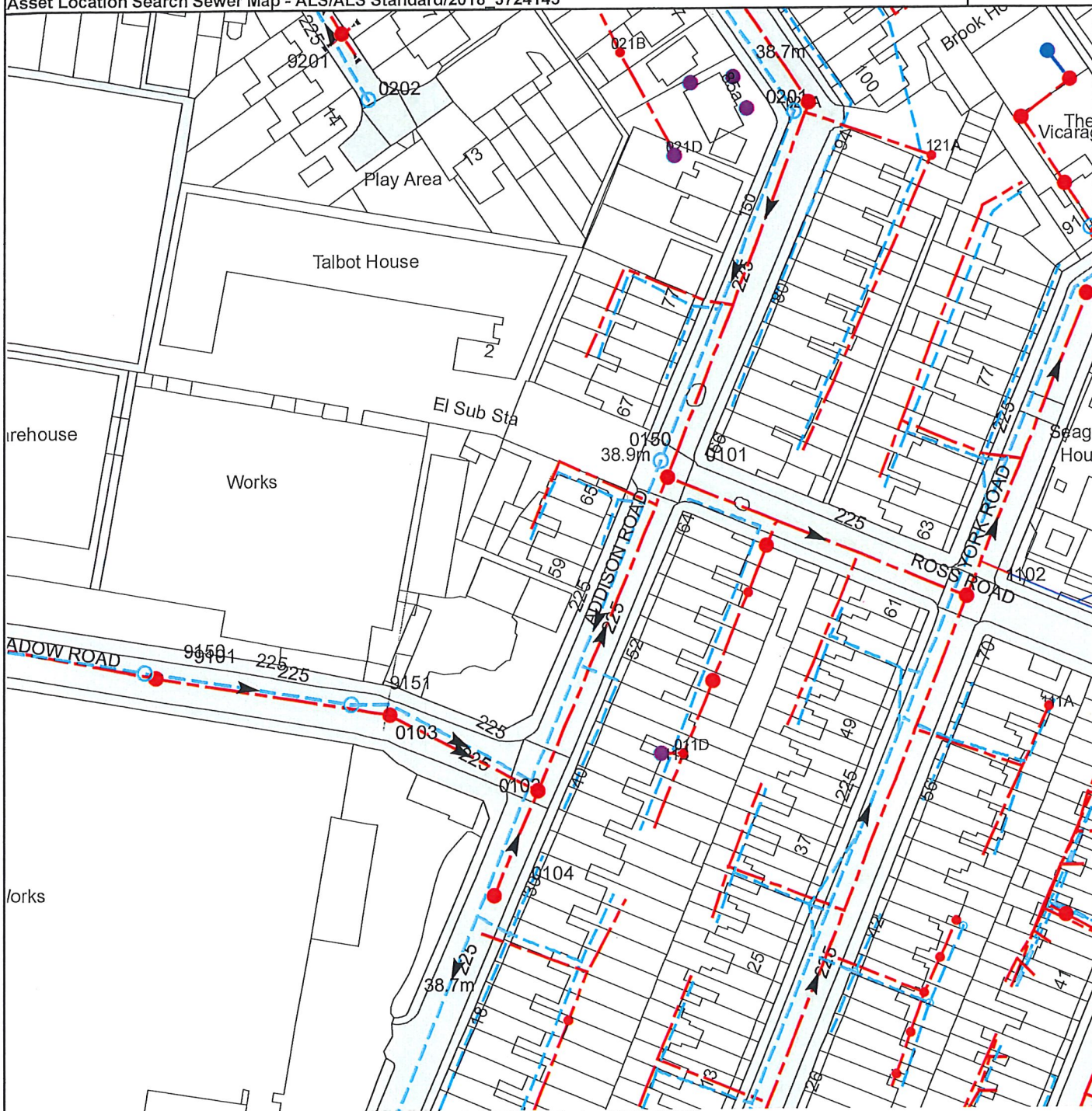


Existing site was originally positively drained into these manholes



Checked KR	Date MAY 2018	Scale 1:100	A1	Drawn KR
Drawing No		E0119-010		A

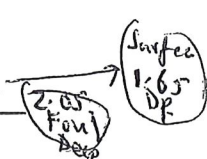
Asset Location Search Sewer Map - ALS/ALS Standard/2018_3724145



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 471034,174180
 The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.
 Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
001C	n/a	n/a
021G	n/a	n/a
1102	38.24	36.38
011E	n/a	n/a
0152	n/a	n/a
0101	38.8	36.46
0150	38.8	36.74
1202	38.19	36.28
12KH	n/a	n/a
12KD	n/a	n/a
12KJ	n/a	n/a
121A	n/a	n/a
021D	n/a	n/a
12KK	n/a	n/a
021A	n/a	n/a
021E	n/a	n/a
0201	38.75	36.59
12KL	n/a	n/a
12KM	n/a	n/a
021B	n/a	n/a
9101	38.7	36.71
9150	38.71	37.15
0202	n/a	n/a
9201	38.52	37.56
9151	38.68	37.03
0103	38.7	36.65
0104	38.74	36.66
0102	38.77	36.58
011B	n/a	n/a
011D	n/a	n/a
0153	n/a	n/a
0154	n/a	n/a
1105	n/a	n/a
111B	n/a	n/a
111A	n/a	n/a
112V	n/a	n/a
001B	n/a	n/a
001A	n/a	n/a
n/a	n/a	n/a
111D	n/a	n/a
111E	n/a	n/a
021F	n/a	n/a



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ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve
 Dam Chase
 Fitting
 Meter
 Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve
 Drop Pipe
 Ancillary
 Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol. Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall
 Undefined End
 Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station
 Change of characteristic indicator (C.O.C.I.)
 Invert Level
 Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement
 Operational Site
 Chamber
 Tunnel
 Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer
 Surface Water Sewer
 Combined Sewer
 Gully
 Culverted Watercourse
 Proposed
 Abandoned Sewer

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or 'U' on a manhole level indicates that data is unavailable.

- 6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.