Lake Lane, Barnham, Bognor Regis PO22 0AJ 04 October 2024

SuDS Drainage Technical Note

1. GTA Civils and Transport Ltd. was commissioned to prepare a SuDS Technical Note. This should be read in conjunction with the Stage 2 FRA report, prepared by GTA C&T, 3rd Issue dated 19 April 2024.

2. This Technical Note provides responses to the Lead Local Flood Authority's (LLFA) list of comments (objections) contained in the memorandum dated 01 May 2024.

3. The outstanding items were discussed during an online meeting conducted between the Client, architect and Paul Cann, the LLFA engineer - on 12 August 2024.

4. The items that were discussed were as follows:
    1. Paul Cann mentioned at the outset that he is familiar with this site – having walked over it about 9-10 years ago. There is a spring close to the NW corner that was buried by the previous owner. This is denoted on the topographic survey as a man-made ditch spur running south – north – shown in Figure 1 below.
    2. The layout should be amended such that any flows from this area are able to flow without risk of flooding the units.
    3. Condition of the culverted watercourse to the NW, immediately downstream of the site– specifically; this flows through Kilkenny's demise.
    4. Attenuation tank: the LLFA want to ensure that the effects of buoyancy have been accounted for in the design.

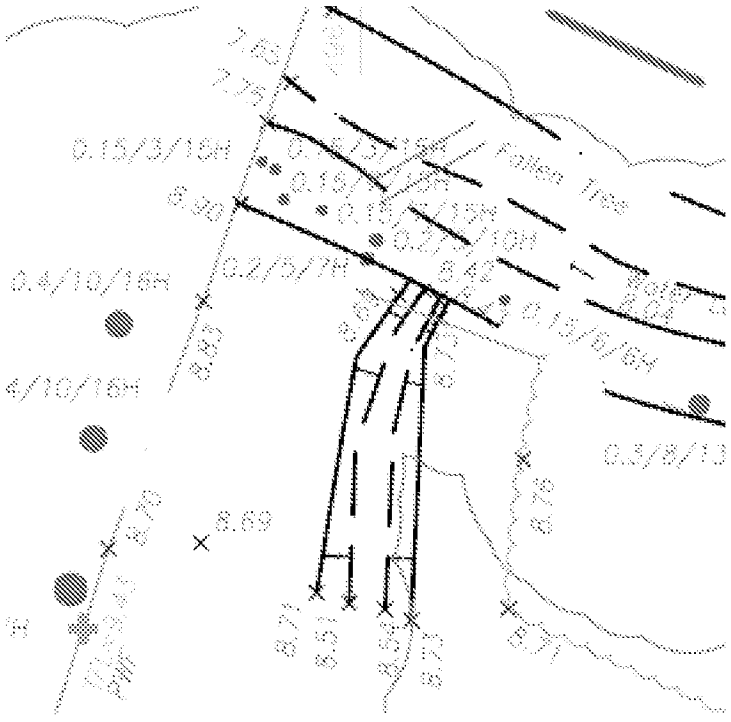


Figure 1: Man-made Ditch Spur Conveying Spring Water to the Established Watercourse

5. Spring and man-made ditch spur. The Applicant has confirmed that this area is no more than a localised depression – not a fully formed ditch as such.

6. GTA stated that they would action a CCTV survey as soon as possible. This was done on 03/09 by Eyes on Drainage – refer to the report in Appendix A.

7. The owner of Kilkenny did not allow the surveyor to enter his property, meaning that the condition of the culvert pipe is still unknown. The LLFA acknowledges that the culvert is free-flowing and that the owner (Kilkenny) has a maintenance regime. The post-development runoff rate will be restricted to Qbar, meaning that the runoff rate will be reduced in all storm scenarios greater than the mean (approximately 1 in 2 years).

8. The drainage and levels strategies have been amended to satisfy the LLFA's stated need for lowering the site's levels and to confirm as much of the downstream watercourse's condition as possible. CV values have been increased to 1; the drainage has been designed with level soffits, not inverts; the 33.3% (1 in 30 years) calculation has added – refer to Appendix C. 10% allowance for Urban Creep has been added to the drainage calculations – refer to the catchment areas layout (in Appendix B) and calculations in Appendix C.

9. Land drains have been added – to convey any underground spring water to the NW corner between Plots 6 and 7.

10. The attenuation tank's invert level is set at 8.20m AOD. The existing ground level in this area is 8.76m - 9.04m AOD, so the tank's invert is only 560mm below the lowest local level. The proposed ground levels are now raised slightly higher at 9.3m, thereby providing additional cover. Buoyancy calculations are shown in Appendix D: these prove that both the tank and pond will work with an anticipated groundwater table level at the lowest point on the site.

Conclusion:

It is contended that all the LLFA's outstanding items of contention have been addressed – in full. Although the condition of the culvert has not been confirmed by CCTV survey, this is not in question – as the LLFA have stated that its owner has been maintaining it satisfactorily.

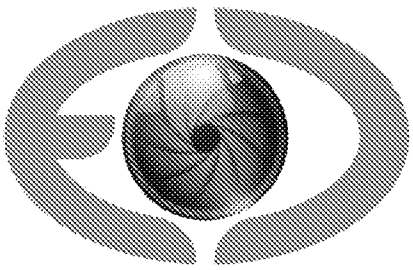
- End of Technical Note -

Appendix A

CCTV Drainage Survey Report

Project

Project Name:	Park Rd Culvert - Barnham
Project Description:	Culvert Survey
Project Status:	Complete
Project Date:	18/08/2024
Inspection Standard:	MSCC5 Sewers & Drainage GB (SRM5 Scoring)



EYES ON DRAINAGE

CCTV-Trace-Plot-Map-Repair

EYES ON DRAINAGE

Eyes On Drainage Services Ltd
Bines Green, Horsham
[redacted]

Table of Contents

Project Name	Project Number	Project Date
Park Rd Culvert - Barnham		18/08/2024

Eyes On Drainage Services Ltd
Bines Green, Horsham
[redacted]

Project Information

Project Name	Project Number	Project Date
Park Rd Culvert - Barnham		18/08/2024

Client

Company: Folkes Architects
Department: The Old Forge
Street: 6 Church St
Town or City: Storrington
County: West sussex
Post Code: RH20 4LA

Site

Description: North of Lake Lane
Department: Kilkenny
Street: Park Rd
Town or City: Barnham
County: West Sussex
Post Code: PO22 0AJ

Contractor

Company: Eyes On Drainage Services Ltd
Contact: Jay Young
Department: Merrion House
Street: Bines Green
Town or City: Horsham
County: West Sussex
Post Code: RH13 8EH
Phone: 01403 710971
Mobile: 077111 84951
Email: info@eyesondrainage.co.uk

EYES ON DRAINAGE

Eyes On Drainage Services Ltd
Bines Green, Horsham
[redacted]

Project Information

Project Name	Project Number	Project Date
Park Rd Culvert - Barnham		18/08/2024

Project Drawing, Page 'Park Rd Culvert - Barnham'

Scoring Summary

Project Name	Project Number	Project Date
Park Rd Culvert - Barnham		18/08/2024

Structural Defects

Section	PLR	Grade	Description
All inspected pipes are in an acceptable structural condition (< grade 3).			

Service / Operational Condition

Section	PLR	Grade	Description
All inspected pipes are in an acceptable service condition (< grade 3).			

Abandoned Surveys

Section	PLR	Description
All inspections complete, none are abandoned.		

Information

These scoring summaries are based on the SRM grading from the WRc.

Section Profile

Project Name	Project Number	Project Date
Park Rd Culvert - Barnham		18/08/2024

Circular, 450 mm

Item No.	Upstream Node	Downstream Node	Date	Road	Material	Total Length	Inspected Length
1	HW1	HW2	18/08/2024	Park Rd	Concrete	55.00 m	55.00 m

Total: 1 Inspection x Circular 450 mm, 0 mm = 55.00 m Total Length and 55.00 m Inspected Length

Total: 1 Inspection = 55.00 m Total Length and 55.00 m Inspected Length

EYES ON DRAINAGE

Eyes On Drainage Services Ltd
Bines Green, Horsham
[redacted]

Section Summary

Project Name	Project Number	Project Date
Park Rd Culvert - Barnham		18/08/2024

Number of sections	1
Total length of sections	55.00 m
Total length of inspected sections	55.00 m
Total length of not inspected sections	0.00 m
Number of abandoned inspections	0
Number of section inspection photos	4
Number of section inspection videos	0
Number of section inspection scans	0
Number of section inclination measurements	0

PLR:	HW1X	**Upstream Node:**	HW1
Inspection Direction:	Downstream	**Downstream Node:**	HW2
Inspected Length:	55.00 m	**Dia/Height:**	450 mm
Total Length:	55.00 m	**Material:**	Concrete

No.	m+	Code	Observation
1	0.00	OF	Start node, outfall, reference: HW1, Located within private grounds
2	0.00	WL	Water level, 0% of the vertical dimension
3	0.00	WL	Water level, 70% of the vertical dimension
4	55.00	OFF	Finish node, outfall, reference: HW2, Unable to carry out full CCTV survey due to permissions.

EYES ON DRAINAGE

Eyes On Drainage Services Ltd
[redacted]

Section Inspection - 18/08/2024 - HW1X

Item No.	Insp. No.	Date	Time	Client`s Job Ref	Weather	Pre Cleaned	PLR
1	1	18/08/24	7:51	Not Specified	No Rain Or Snow	No	HW1X

Operator	Vehicle	Camera	Preset Length	Legal Status	Alternative ID
JY	BV21 CDX	Not Specified	Not Specified	Watercourse	Not Specified

Town or Village:	Barnham	**Inspection Direction:**	Downstream	**Upstream Node:**	HW1
Road:	Park Rd	**Inspected Length:**	55.00 m	**Upstream Pipe Depth:**	
Location:	Gardens (private)	**Total Length:**	55.00 m	**Downstream Node:**	HW2
Surface Type:	Various	**Joint Length:**		**Downstream Pipe Depth:**	

Use:	Culverted watercourse	**Pipe Shape:**	Circular
Type of Pipe:	Gravity drain/sewer	**Dia/Height:**	450 mm
Flow Control:	No flow control	**Material:**	Concrete
Year Constructed:	Not Specified	**Lining Type:**	No Lining
Inspection Purpose:	Routine inspection	**Lining Material:**	No Lining

Comments:
Recommendations:

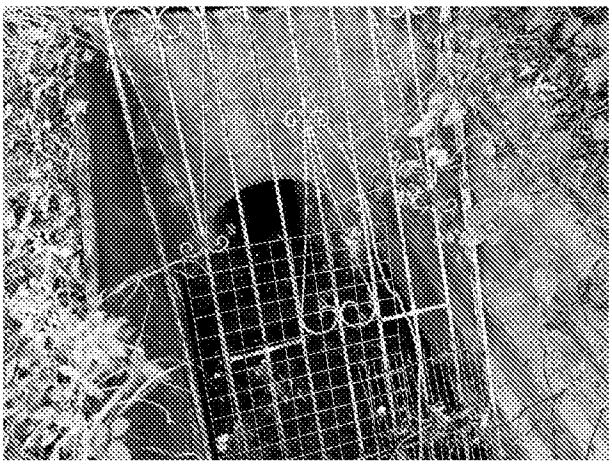
Scale: 1:477

Position [m]	Code	Observation	MPEG	Photo	Grade
		Depth: m			
		HW1			
0.00	OF	Start node, outfall, reference: HW1: Located within private grounds		1, 2	
0.00	WL	Water level, 0% of the vertical dimension			
0.00	WL	Water level, 70% of the vertical dimension	00:00:01		
55.00	OFF	Finish node, outfall, reference: HW2: Unable to carry out full CCTV survey due to permissions.		3, 4	
		HW2			
		Depth: m			

Construction Features					Miscellaneous Features				
Structural Defects					Service & Operational Observations				
STR No. Def	**STR Peak**	**STR Mean**	**STR Total**	**STR Grade**	**SER No. Def**	**SER Peak**	**SER Mean**	**SER Total**	**SER Grade**
0	0.0	0.0	0.0	1.0	0	0.0	0.0	0.0	1.0

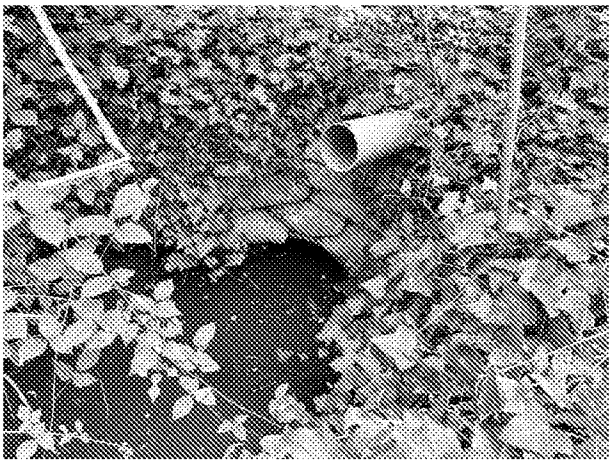
Section Pictures - 18/08/2024 - HW1X

Item No.	Inspection Direction	PLR	Client`s Job Ref	Contractor`s Job Ref
1	Downstream	HW1X		



1, 0.00 m
Start node, outfall, reference: HW1, Located within private grounds

2, 0.00 m
Start node, outfall, reference: HW1, Located within private grounds



3, 55.00 m
Finish node, outfall, reference: HW2, Unable to carry out full CCTV survey due to permissions.

4, 55.00 m
Finish node, outfall, reference: HW2, Unable to carry out full CCTV survey due to permissions.

Disclaimer

Although every effort has been made to produce a thorough and precise report, Eyes On Drainage Services Ltd cannot be held liable for any descrepencies or omissions.
Furthermore Eyes On Drainage Services Ltd cannot be held responsible for any actions taken based on the information supplied within this report.

Appendix B

Drainage Strategy and Catchment Areas Layouts

GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

2. Prior to commencement of works the contractor shall provide co-ordinated and dimensioned installation drawings and calculations and allow 10 working days for gta's checking procedure prior to proceeding with those works or the ordering of materials.

3. Tender or billing drawings shall not be used for construction or the ordering of materials.

4. Do not scale. All dimensions and levels to be site confirmed.

5. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements

6. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.

7. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

KEY

- Existing foul water drain
- Surface water drain
- Land drain
- Foul drain
- Foul rising main
- Filter drain
- ExFSMH — Existing foul sewer manhole
- FMH — Foul manhole
- SCP — Surface water catchpit manhole
- FIC — Foul inspection chamber
- SIC — Surface water inspection chamber
- PPCP — Surface water catchpit inspection chamber
- RG — Road gully
- Cellular Storage
- Overland flow route for exceedance events

ABBREVIATIONS

BL	BASE LEVEL
CL	COVER LEVEL
ExFSMH	EXISTING FOUL SEWER MANHOLE
FIC	FOUL INSPECTION CHAMBER
FFL	FINISHED FLOOR LEVEL
FMH	FOUL MANHOLE
FWD	FOUL DRAIN
IL	INVERT LEVEL
LLFA	LEAD LOCAL FLOOD AUTHORITY
MH	MANHOLE
PN	PIPE NUMBER
PPCP	PLASTIC CATCHPIT
RG	ROAD GULLY
SIC	SURFACE WATER INSPECTION CHAMBER
SL	SUMP LEVEL
SWD	SURFACE WATER DRAIN
TL	TOP LEVEL

DESIGN NOTES

1. STORAGE DESIGN BASED ON 1 IN 100 YR STORM + 45%.

2. CONTRACTOR TO ESTABLISH LOCATIONS OF ALL EXISTING SERVICES PRIOR TO COMMENCING.

3. EXISTING TREES TO BE PROTECTED WHERE EXCAVATIONS RUN CLOSE.

4. CONTRACTOR TO ALLOW FOR NEW FOUL WATER SEWER CONNECTION INTO PUBLIC SEWER.

DESIGN ADDITIONS TO REDUCE IMPACTS ON THE LIDSEY WASTE WATER CATCHMENT

1. WATER BUTTS TO BE INSTALLED ON RAINWATER DOWNPIPES.

2. USE OF JOINT SEALANT OR MASS CONCRETE CHAMBER SURROUNDS TO PREVENT INFILTRATION.

3. USE OF BOLT DOWN SEALED CHAMBER COVERS TO PREVENT SURFACE WATER INUNDATION.

Rev	Amendments	Date	Dsn	Chk
P4	Updated to latest site layout. Ditch shown with easement. Land drainage shown	20.09.24	JR	MR
P3	NOTES ON WATER BUTTS AND SEALED SEWERS ADDED.	04.03.24	JR	MR
P2	REVISED TO LATEST SITE PLAN. DISCHARGE POINT TO DITCH CHANGED.	23.02.24	JR	MR
P1	INITIAL ISSUE	15.12.23	AE	MR

Status: PRELIMINARY

Client: PROPERTY SPHERE LTD

Architect: FOLKES ARCHITECTS

Project: LAKE LANE BARNHAM

Title: DRAINAGE STRATEGY

Date: DECEMBER 2023 | Scale @ A0: 1:200

Clients Ref. | Project Ref.: 12188

gta Civils & Transport
Maple House, 192-198 London Road,
Burgess Hill, West Sussex, RH15 9RD
Tel.01444 871444 Web: www.gtaciwils.co.uk

Drawing Number: 12188-1101 | Rev.: P4

GENERAL NOTES

1. The location, size, depth and identification of existing services that may be shown or referred to on this drawing have been assessed from non intrusive observations , record drawings or the like. The contractor shall safely carry out intrusive investigations, trial holes or soundings prior to commencing work to satisfy himself that it is safe to proceed and that the assessments are accurate. any discrepancies shall be notified to gta prior to works commencing.

2. Prior to commencement of works the contractor shall provide co-ordinated and dimensioned installation drawings and calculations and allow 10 working days for gta's checking procedure prior to proceeding with those works or the ordering of materials.

3. Tender or billing drawings shall not be used for construction or the ordering of materials.

4. Do not scale. All dimensions and levels to be site confirmed.

5. This drawing shall be read in conjunction with all relevant architects, consultants drawings and specifications, together with H&S plan requirements

6. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.

7. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

KEY

94.82m² - 2.000
UC 10%

Catchment area with pipe reference
UC = Urban Creep

N

Kilkenny
Holmwood
Pipits
Clanwilliam
Daylesford
arsden
ds
The
Drive
Ridgeway
awne
ottages
10
Pipkins
St Annes
Lynton
South
View
Laurels
Smallfield
Harvest
Cottage
Trevone
Cox's
Farm
LAKE LANE

Plot 7
Plot 6
Plot 5
Plot 4
Plot 3
Plot 1
Plot 2

23.94m² - 3.000
95.36m² - 3.000
UC 10%
27.14m² - 3.000
95.36m² - 3.000
UC 10%
37.29m² - 1.007
172.10m² - 1.006
104.12m² - 1.008
95.36m² - 1.006
UC 10%
54.58m² - 1.005
95.32m² - 1.004
UC 10%
114.58m² - 1.005
133.28m² - 1.004
82.41m² - 1.004
94.82m² - 2.000
UC 10%
22.69m² - 1.003
89.34m² - 1.003
22.99m² - 1.003
21.35m² - 1.003
160.93m² - 1.003
UC 10%
114.69m² - 1.003
UC 10%
118.58m² - 1.002
126.07m² - 1.001
136.09m² - 1.000

P3	Updated to latest site layout and UC added	20.09.24	JR	MR
P2	REVISED TO LATEST DRAINAGE NETWORK	23.02.24	JR	MR
P1	INITIAL ISSUE	14.12.23	AE	JR
Rev	Amendments	Date	Dsn	Chk

Status: PRELIMINARY

Client: PROPERTY SPHERE LTD

Architect: FOLKES ARCHITECTS

Project: LAKE LANE
BARNHAM

Title: CATCHMENT PLAN

Date	Scale @ A0
DECEMBER 2023	1:200
Clients Ref.	Project Ref.
	12188

gta Civils & Transport
Maple House, 192-198 London Road,
Burgess Hill, West Sussex, RH15 9RD
Tel.01444 871444 Web: www.gtacivils.co.uk

Drawing Number	Rev.
12188-1102	P3

Appendix C

Drainage Calculations & Anti-Buoyancy Calculation

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	0.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	0.0	Include Intermediate Ground	x
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	1.000		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	499	1350	749	1500	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Barrels	1	Auto Increment (mm)	75	Follow Ground	x

Available Diameters (mm)

100 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
PS1	0.014	5.00	10.168	600	496889.952	104683.005	1.008
PS2	0.013	5.00	10.268	450	496898.756	104711.816	1.535
PS3	0.012	5.00	9.978	450	496906.735	104740.574	1.444
PS4	0.035	5.00	9.633	450	496914.791	104760.740	1.318
PS5	0.010	5.00	9.450	450	496925.103	104766.769	1.206
PS6			8.814	600	496937.311	104780.896	0.679
Headwall 2	0.009	5.00	8.700	450	496938.131	104783.756	0.583

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
Headwall 1			8.700	450	496943.630	104797.400	0.600
PS9	0.024	5.00	9.231	450	496913.996	104837.170	0.748
PS10	0.013	5.00	9.293	450	496941.267	104828.813	1.075
PS15	0.003	5.00	9.000	450	496950.440	104822.685	0.847
Headwall 4	0.010	5.00	8.700	450	496950.335	104820.715	0.559
Headwall 3			8.700	450	496945.502	104802.389	0.600
PS16	0.009	5.00	9.262	180	496918.066	104780.528	0.812
PS17	0.031	5.00	9.334	450	496923.887	104778.637	1.111
PS18			9.136	600	496934.438	104801.560	1.061
PS7			9.100	1200	496944.558	104799.948	1.085
Outfall			9.000	450	496947.039	104799.760	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)
1.000	PS1	PS2	30.126	0.600	9.160	8.783	0.377	79.9	150	0.00
1.001	PS2	PS3	29.844	0.600	8.733	8.534	0.199	150.0	150	0.00
1.002	PS3	PS4	21.716	0.600	8.534	8.390	0.144	150.8	150	0.00
1.003	PS4	PS5	11.945	0.600	8.315	8.244	0.071	168.2	225	0.00
1.004	PS5	PS6	18.671	0.600	8.244	8.135	0.109	171.3	225	0.00
1.005	PS6	Headwall 2	2.975	0.600	8.135	8.117	0.018	165.3	225	0.00

Name	Vel (m/s)	Cap (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.125	19.9	0.850	1.335	0.014	0.0	0	0.000
1.001	0.818	14.5	1.385	1.294	0.027	0.0	0	0.000
1.002	0.816	14.4	1.294	1.033	0.039	0.0	0	0.000
1.003	1.005	40.0	1.050	0.981	0.074	0.0	0	0.000
1.004	0.996	39.6	0.981	0.454	0.084	0.0	0	0.000
1.005	1.014	40.3	0.454	0.258	0.084	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)
1.006	Headwall 2	Headwall 1	14.711	0.600	8.117	8.100	0.017	865.4	225	0.00
1.007	Headwall 1	PS7	2.711	0.600	8.100	8.015	0.085	31.9	225	0.00
2.000	PS9	PS10	28.523	0.600	8.483	8.293	0.190	150.1	150	0.00
2.001	PS10	PS15	11.031	0.600	8.218	8.153	0.065	169.7	225	0.00
2.002	PS15	Headwall 4	1.973	0.600	8.153	8.141	0.012	164.4	225	0.00
2.003	Headwall 4	Headwall 3	18.952	0.600	8.141	8.100	0.041	462.2	225	0.00
2.004	Headwall 3	PS7	2.618	0.600	8.100	8.015	0.085	30.8	225	0.00
3.000	PS16	PS17	6.120	0.600	8.450	8.298	0.152	40.3	150	0.00
3.001	PS17	PS18	25.234	0.600	8.223	8.075	0.148	170.5	225	0.00
3.002	PS18	PS7	10.248	0.600	8.075	8.015	0.060	170.8	225	0.00
1.008	PS7	Outfall	2.488	0.600	8.015	8.000	0.015	165.9	225	0.00

Name	Vel (m/s)	Cap (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.006	0.437	17.4	0.858	0.875	0.093	0.0	0	0.000
1.007	2.324	92.4	0.875	0.880	0.093	0.0	0	0.000
2.000	0.818	14.4	0.598	0.650	0.024	0.0	0	0.000
2.001	1.001	39.8	0.850	0.622	0.037	0.0	0	0.000
2.002	1.017	40.4	0.622	0.334	0.040	0.0	0	0.000
2.003	0.602	23.9	0.824	0.575	0.050	0.0	0	0.000
2.004	2.366	94.1	0.575	0.880	0.050	0.0	0	0.000
3.000	1.590	28.1	0.652	0.846	0.009	0.0	0	0.000
3.001	0.998	39.7	0.696	0.636	0.040	0.0	0	0.000
3.002	0.997	39.7	0.836	0.880	0.040	0.0	0	0.000
1.008	1.012	40.2	0.850	0.775	0.183	0.0	0	0.000

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	60	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160	2880	4320	5760	7200	8640

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	45	0	0
30	0	0	0				

Node PS7 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	8.015	Product Number	CTL-SHE-0048-1100-1085-1100
Design Depth (m)	1.085	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.1	Min Node Diameter (mm)	1200

Node Headwall 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	8.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	16.8	0.0	0.200	37.6	0.0	0.400	60.5	0.0	0.600	85.4	0.0
0.100	26.8	0.0	0.300	48.8	0.0	0.500	72.7	0.0	0.601	85.4	0.0

Node Headwall 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	8.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	14.4	0.0	0.200	34.3	0.0	0.400	57.3	0.0	0.600	83.1	0.0
0.100	23.9	0.0	0.300	45.4	0.0	0.500	69.8	0.0	0.601	83.1	0.0

Node PS18 Lined Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Ring Diameter (m)	1.000	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	8.100	Pit Width (m)	9.000	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)		Pit Length (m)	24.000	Number Required	1

Results for 2 year Critical Storm Duration. Lowest mass balance: 92.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	PS1	11	9.197	0.037	2.6	0.0103	0.0000	OK
15 minute summer	PS2	11	8.793	0.060	5.0	0.0095	0.0000	OK
15 minute summer	PS3	11	8.610	0.076	7.1	0.0121	0.0000	OK
15 minute summer	PS4	11	8.411	0.096	13.3	0.0153	0.0000	OK
15 minute summer	PS5	11	8.344	0.100	15.2	0.0158	0.0000	OK
30 minute summer	PS6	19	8.264	0.129	13.7	0.0365	0.0000	OK
30 minute summer	Headwall 2	19	8.252	0.135	15.4	0.0214	0.0000	OK
360 minute winter	Headwall 1	344	8.230	0.130	6.0	2.7021	0.0000	OK
15 minute summer	PS9	11	8.541	0.058	4.5	0.0091	0.0000	OK
15 minute summer	PS10	10	8.282	0.064	6.8	0.0102	0.0000	OK
15 minute summer	PS15	11	8.244	0.091	7.3	0.0145	0.0000	OK
15 minute summer	Headwall 4	11	8.238	0.097	9.0	0.0154	0.0000	OK
360 minute winter	Headwall 3	344	8.230	0.130	6.1	3.0629	0.0000	OK
15 minute summer	PS16	10	8.476	0.026	1.7	0.0006	0.0000	OK
15 minute summer	PS17	10	8.295	0.072	7.6	0.0115	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	PS1	1.000	PS2	2.5	0.771	0.128	0.0991	
15 minute summer	PS2	1.001	PS3	4.9	0.644	0.339	0.2323	
15 minute summer	PS3	1.002	PS4	7.0	0.800	0.488	0.1911	
15 minute summer	PS4	1.003	PS5	13.4	0.806	0.334	0.1980	
15 minute summer	PS5	1.004	PS6	15.2	0.763	0.383	0.3716	
15 minute summer	PS6	1.005	Headwall 2	15.0	0.653	0.372	0.0710	
15 minute summer	Headwall 2	1.006	Headwall 1	16.4	1.044	0.946	0.3083	
30 minute summer	Headwall 1	1.007	PS7	22.5	0.792	0.244	0.0753	
15 minute summer	PS9	2.000	PS10	4.4	0.714	0.303	0.1749	
15 minute summer	PS10	2.001	PS15	6.8	0.577	0.170	0.1334	
15 minute summer	PS15	2.002	Headwall 4	7.2	0.488	0.178	0.0310	
15 minute summer	Headwall 4	2.003	Headwall 3	8.8	0.836	0.368	0.2962	
30 minute winter	Headwall 3	2.004	PS7	18.2	0.728	0.193	0.0686	
15 minute summer	PS16	3.000	PS17	1.7	0.854	0.060	0.0120	
15 minute summer	PS17	3.001	PS18	7.5	1.072	0.189	0.1871	

Results for 2 year Critical Storm Duration. Lowest mass balance: 92.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	PS18	344	8.230	0.155	5.9	26.8738	0.0000	OK
360 minute winter	PS7	344	8.230	0.215	13.5	0.2434	0.0000	OK
360 minute winter	Outfall	344	8.023	0.023	0.9	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	PS18	3.002	PS7	-14.2	-0.643	-0.358	0.2254	
360 minute winter	PS7	1.008	Outfall	0.9	0.400	0.022	0.0055	19.5

Results for 30 year Critical Storm Duration. Lowest mass balance: 92.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	PS1	10	9.220	0.060	6.6	0.0170	0.0000	OK
15 minute summer	PS2	12	8.863	0.130	12.5	0.0207	0.0000	OK
15 minute summer	PS3	11	8.759	0.225	18.0	0.0357	0.0000	SURCHARGED
15 minute summer	PS4	11	8.572	0.257	32.3	0.0409	0.0000	SURCHARGED
15 minute summer	PS5	11	8.513	0.269	36.1	0.0428	0.0000	SURCHARGED
15 minute summer	PS6	12	8.414	0.279	34.2	0.0791	0.0000	SURCHARGED
30 minute summer	Headwall 2	20	8.388	0.271	35.8	0.0431	0.0000	SURCHARGED
480 minute winter	Headwall 1	472	8.387	0.287	6.5	8.2633	0.0000	SURCHARGED
15 minute summer	PS9	10	8.584	0.101	11.3	0.0161	0.0000	OK
480 minute winter	PS10	472	8.388	0.170	1.9	0.0271	0.0000	OK
480 minute winter	PS15	464	8.391	0.238	6.2	0.0379	0.0000	SURCHARGED
480 minute winter	Headwall 4	472	8.393	0.252	3.8	0.0400	0.0000	SURCHARGED
480 minute winter	Headwall 3	464	8.386	0.286	9.6	9.1038	0.0000	SURCHARGED
15 minute summer	PS16	10	8.492	0.042	4.3	0.0010	0.0000	OK
480 minute winter	PS17	472	8.387	0.164	2.1	0.0260	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	PS1	1.000	PS2	6.5	0.994	0.326	0.2304	
15 minute summer	PS2	1.001	PS3	12.3	0.789	0.850	0.5054	
15 minute summer	PS3	1.002	PS4	16.4	0.951	1.141	0.3823	
15 minute summer	PS4	1.003	PS5	31.4	0.910	0.787	0.4751	
15 minute summer	PS5	1.004	PS6	34.2	0.891	0.863	0.7426	
15 minute summer	PS6	1.005	Headwall 2	33.7	0.848	0.837	0.1183	
15 minute summer	Headwall 2	1.006	Headwall 1	37.3	1.199	2.150	0.5800	
30 minute summer	Headwall 1	1.007	PS7	26.3	0.817	0.284	0.1078	
15 minute summer	PS9	2.000	PS10	11.0	0.891	0.763	0.3527	
15 minute summer	PS10	2.001	PS15	16.9	0.662	0.424	0.3031	
15 minute summer	PS15	2.002	Headwall 4	18.0	0.568	0.446	0.0649	
15 minute winter	Headwall 4	2.003	Headwall 3	20.6	0.927	0.862	0.6366	
60 minute winter	Headwall 3	2.004	PS7	16.3	0.689	0.173	0.1032	
15 minute summer	PS16	3.000	PS17	4.3	1.094	0.152	0.0249	
15 minute summer	PS17	3.001	PS18	18.8	1.415	0.475	0.3937	

Results for 30 year Critical Storm Duration. Lowest mass balance: 92.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	PS18	472	8.387	0.312	6.2	59.0041	0.0000	SURCHARGED
480 minute winter	PS7	472	8.387	0.372	9.5	0.4205	0.0000	SURCHARGED
2880 minute winter	Outfall	2340	8.023	0.023	0.9	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	PS18	3.002	PS7	-36.0	-1.126	-0.908	0.3564	
2880 minute winter	PS7	1.008	Outfall	0.9	0.401	0.022	0.0055	117.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 92.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	PS1	12	9.901	0.741	12.0	0.2096	0.0000	FLOOD RISK
15 minute summer	PS2	12	9.829	1.096	21.8	0.1742	0.0000	SURCHARGED
15 minute summer	PS3	12	9.562	1.028	23.7	0.1635	0.0000	SURCHARGED
15 minute summer	PS4	12	9.125	0.810	49.3	0.1288	0.0000	SURCHARGED
15 minute summer	PS5	12	8.989	0.745	55.7	0.1184	0.0000	SURCHARGED
15 minute summer	PS6	12	8.733	0.598	54.1	0.1692	0.0000	FLOOD RISK
720 minute winter	Headwall 2	705	8.692	0.575	5.9	0.0914	0.0000	FLOOD RISK
720 minute winter	Headwall 1	705	8.692	0.592	7.4	27.3465	0.0000	FLOOD RISK
15 minute summer	PS9	11	8.921	0.438	20.6	0.0697	0.0000	SURCHARGED
720 minute winter	PS10	720	8.693	0.475	2.5	0.0755	0.0000	SURCHARGED
720 minute winter	PS15	705	8.695	0.542	2.6	0.0862	0.0000	SURCHARGED
720 minute winter	Headwall 4	720	8.694	0.553	3.3	0.0879	0.0000	FLOOD RISK
720 minute winter	Headwall 3	705	8.692	0.592	5.8	29.1332	0.0000	FLOOD RISK
720 minute winter	PS16	705	8.692	0.242	0.6	0.0060	0.0000	SURCHARGED
720 minute winter	PS17	705	8.691	0.468	2.6	0.0744	0.0000	SURCHARGED

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	PS1	1.000	PS2	11.1	1.019	0.556	0.5304	
15 minute summer	PS2	1.001	PS3	16.4	0.931	1.133	0.5254	
15 minute summer	PS3	1.002	PS4	24.3	1.378	1.683	0.3823	
15 minute summer	PS4	1.003	PS5	47.5	1.195	1.189	0.4751	
15 minute summer	PS5	1.004	PS6	54.1	1.361	1.367	0.7426	
15 minute summer	PS6	1.005	Headwall 2	53.8	1.353	1.335	0.1183	
15 minute summer	Headwall 2	1.006	Headwall 1	59.7	1.501	3.439	0.5851	
15 minute summer	Headwall 1	1.007	PS7	39.1	0.984	0.423	0.1078	
15 minute summer	PS9	2.000	PS10	19.0	1.081	1.317	0.5021	
15 minute summer	PS10	2.001	PS15	29.1	0.733	0.732	0.4387	
15 minute summer	PS15	2.002	Headwall 4	31.0	0.780	0.767	0.0785	
15 minute winter	Headwall 4	2.003	Headwall 3	36.1	0.995	1.507	0.7537	
60 minute winter	Headwall 3	2.004	PS7	15.3	0.680	0.162	0.1041	
60 minute summer	PS16	3.000	PS17	5.5	1.133	0.195	0.0631	
15 minute summer	PS17	3.001	PS18	34.2	1.609	0.861	0.7567	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 92.80%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	PS18	720	8.692	0.617	7.4	102.9993	0.0000	SURCHARGED
720 minute winter	PS7	705	8.692	0.677	9.4	0.7656	0.0000	SURCHARGED
960 minute winter	Outfall	390	8.023	0.023	0.9	0.0000	0.0000	OK

Link Event (Velocity)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	PS18	3.002	PS7	-52.7	-1.451	-1.328	0.4076	
960 minute winter	PS7	1.008	Outfall	0.9	0.401	0.022	0.0055	48.6

Project **Lake Lane, Barnham**

Project ref **12188**

Date **Sep-24**

GTA C&T LTD © **Tank -Flotation Calculation**

Tank ref:	**Calc 1**		
Tank Area at base (m2)	216.000		
Ground Level (m AOD)	9.200		
Top GW level(m AOD)	8.600		
Top of Tank Level (m AOD)	8.700		
Base of Tank level(m AOD)	8.200		
Depth of Tank (m)	0.500		
Depth of water table above tank (m)	0.000		
Depth of Tank within Water table (m)	0.400		
Depth of cover over tank (m)	0.500		
Displacement depth below water table(m)	0.400		
Volume for buoyancy (m^3)	86.400		
Tank Buoyancy force (kN)	847.6		
Total depth over tank (m)	0.500		
Fill soil downward force (kN)	1695.60		
Downward anchor forces (kN)	1695.60		
Net Buoyancy Force	848.02		
Factor of safety	2.0		
	OK		

Obtain groundwater level from soil report

Indicates field to be completed

9.81kN/m³ for water. Positive figure denotes uplift force, negative figure denotes downward force

Note: If a negative figure is shown above for tank buoyancy then no ballast is required

Density of Dry soil = 1600 Kg/m3 = 15.7kn/m3 (Adjust if different backfill)

Negative figure denotes uplift force, positive figure denotes downward force

minimum acceptable value: 1.1

Project **Lake Lane, Barnham**

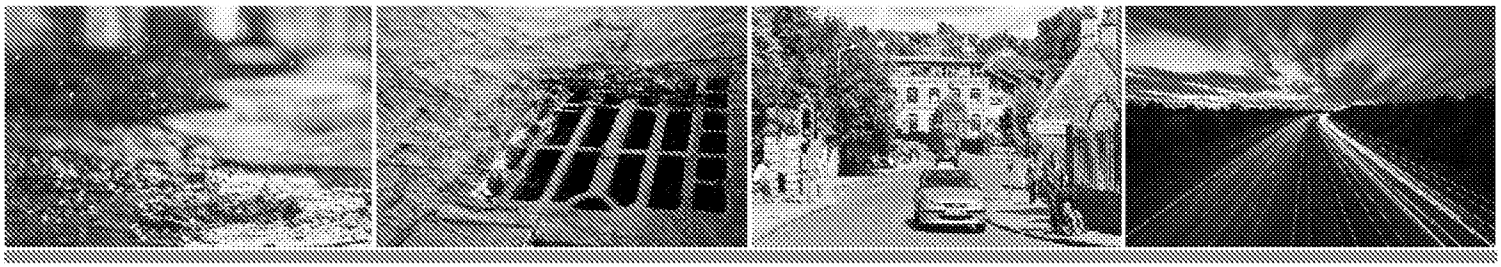
Project ref **12188**

Date **Sep-24**

GTA C&T LTD © **Pond Flotation Calculation**

Pond	**Calc 1**			
Pond Area at base (m2)	33.600			
Pond Area at highest GW level (m2)	167.000			*Calculate the area of the pond at the highest GW level*
Average Pond area (m2)	100.300			*average of area at highest GW level & area at base*
Top GW level(m AOD)	8.600			*Obtain groundwater level from soil report*
Pond base (m AOD)	7.985			
Depth GW- Base (m)	0.615			
Ballast thickness (m)	0.400			*Start with an assumed ballast depth, then adjust if FoS is less than 1.1*
Topsoil depth	0.150			
Overall depth (m)	1.165			*Bottom of ballast to top groundwater level*
Volume for buoyancy (m^3)	116.850			
Buoyancy uplift (kN)	1146.3			*9.81kN/m^3 for water. Positive figure denotes uplift force, negative figure denotes downward force*
				Note: If a negative figure is shown above for pond buoyancy then no ballast is required
Ballast construction depth (m)	0.400			
Assumed dry (liner below ballast) Ballast downward force (kN)	1245.15			*Unsaturated Clay = 1900Kg/m3 or 18.64kN/m3 - Saturated Clay = 2300Kg/m3 or 22.56kN/m3(Engineeringtoolbox.com)*
Topsoil depth (m)	0.150			
Topsoil downward force (kN))	79.13			*Density of Dry Topsoil = 1600 Kg/m3 = 15.7kn/m3*
Downward forces (kN)	1324.28			
Net Buoyancy Force	177.99			*Negative figure denotes uplift force, positive figure denotes downward force*
Factor of safety	1.2			*minimum acceptable value: 1.1*
	OK			

Indicates field to be completed



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