O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	PROSPECT HOUSE STOCKING LANE RATHFARNHAM	Micro Drainage
Date 22/04/2022 15:11 File MD_20220421.MDX	Designed by E.H Checked by M.K	
XP Solutions	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.900	Add Flow / Climate Change (%)	20
Ratio R	0.257	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	150	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-1.000	26.074	0.261	100.0	0.037	4.00	0.0	0.600	o	150	Pipe/Conduit	
S-1.001	12.067	1.109	10.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-1.002	3.539	0.035	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-1.003	25.325	0.253	100.0	0.005	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-2.000	43.181	0.654	66.0	0.052	4.00	0.0	0.600	o	150	Pipe/Conduit	
S-2.001	20.299	0.308	66.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-2.002	29.191	0.108	269.3	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-1.004	1.885	0.011	170.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-1.000	129.72	4.43	106.550	0.037	0.0	0.0	2.6	1.00	17.8	15.4
S-1.001	129.17	4.50	106.289	0.037	0.0	0.0	2.6	3.07	54.3	15.4
S-1.002	128.69	4.56	105.180	0.037	0.0	0.0	2.6	1.00	17.8	15.4
S-1.003	125.39	4.98	105.105	0.041	0.0	0.0	2.8	1.00	17.8	16.9
S-2.000	128.50	4.58	106.550	0.052	0.0	0.0	3.6	1.24	21.9	21.6
S-2.001	126.33	4.85	105.896	0.052	0.0	0.0	3.6	1.24	21.9	21.6
S-2.002	122.52	5.36	105.438	0.081	0.0	0.0	5.4	0.95	67.4	32.1
S-1.004	133.21	4.03	104.702	0.000	1.0	0.0	0.2	1.20	85.0	1.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S-1.005	11.718	0.069	170.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-3.000	2.978	0.107	27.8	0.032	4.00	0.0	0.600	o	150	Pipe/Conduit	
S-3.001	2.978	0.030	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-3.002	9.030	0.084	107.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-3.003	17.542	0.175	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S-1.006	14.313	0.143	100.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-1.007	17.603	1.079	16.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-1.008	41.763	1.175	35.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S-1.009	7.602	0.067	113.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S-1.005	131.78	4.19	104.691	0.000	1.0	0.0	0.2	1.20	85.0	1.2
S-3.000	133.21	4.03	105.382	0.032	0.0	0.0	2.3	1.92	33.9	13.9
S-3.001	132.77	4.08	105.275	0.032	0.0	0.0	2.3	1.00	17.8	13.9
S-3.002	131.42	4.23	105.245	0.032	0.0	0.0	2.3	0.97	17.1	13.9
S-3.003	128.98	4.52	105.161	0.032	0.0	0.0	2.3	1.00	17.8	13.9
S-1.006	127.75	4.67	104.622	0.032	1.0	0.0	2.4	1.57	111.1	14.5
S-1.007	127.16	4.75	104.479	0.032	1.0	0.0	2.4	3.91	276.5	14.5
S-1.008	125.12	5.01	103.400	0.032	1.0	0.0	2.4	2.65	187.0	14.5
S-1.009	124.34	5.11	102.225	0.032	1.0	0.0	2.4	1.23	48.8	14.5

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S-1.009	S-	103.413	102.158	102.233	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S-8, DS/PN: S-1.004, Volume (m³): 4.0

Unit Reference	MD-SHE-0054-1000-0451-1000
Design Head (m)	0.451
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	104.777
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.451	1.0	Kick-Flo®	0.303	0.8
Flush-Flo™	0.134	1.0	Mean Flow over Head Range	-	0.9

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	1.0	1.200	1.5	3.000	2.4	7.000	3.5
0.200	1.0	1.400	1.7	3.500	2.5	7.500	3.7
0.300	0.9	1.600	1.8	4.000	2.7	8.000	3.8
0.400	0.9	1.800	1.9	4.500	2.8	8.500	3.9
0.500	1.0	2.000	2.0	5.000	3.0	9.000	4.0
0.600	1.1	2.200	2.0	5.500	3.1	9.500	4.1
0.800	1.3	2.400	2.1	6.000	3.3		
1.000	1.4	2.600	2.2	6.500	3.4		

Storage Structures for Storm

Complex Manhole: S-4, DS/PN: S-1.003

Cellular Storage

Invert Level (m) 105.145 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00500 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.8	6.8	0.450	6.8	6.8

Cellular Storage

Invert Level (m) 105.595 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00500 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	74.4	74.4	0.450	74.4	74.4

Filter Drain Manhole: S-5, DS/PN: S-2.000

Infiltration Coefficient Base (m/hr)	0.00500	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00500	Pipe Depth above Invert (m)	0.150
Safety Factor	2.0	Number of Pipes	1
Porosity	0.40	Slope (1:X)	5000.0
Invert Level (m)	106.550	Cap Volume Depth (m)	0.550
Trench Width (m)	0.5	Cap Infiltration Depth (m)	0.550
Trench Length (m)	35.9		

Complex Manhole: S-7, DS/PN: S-2.002

Cellular Storage

Invert Level (m) 105.438 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Cellular Storage

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.8	6.8	0.450	6.8	6.8

Cellular Storage

Invert Level (m) 105.438 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	90.0	90.0	0.450	90.0	90.0

Infiltration Trench Manhole: S-12, DS/PN: S-3.002

Infiltration Coefficient Base (m/hr)	0.00500	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.00500	Trench Length (m)	9.0
Safety Factor	2.0	Slope (1:X)	200.0
Porosity	0.40	Cap Volume Depth (m)	0.900
Invert Level (m)	105.245	Cap Infiltration Depth (m)	0.900

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.257
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	18.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 100
Climate Change (%)	20, 20

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.
S-1.000	S-1	15 minute 100 year Winter I+20%	107.200	106.688	-0.012	0.000	0.99
S-1.001	S-2	15 minute 100 year Winter I+20%	107.200	106.350	-0.089	0.000	0.34
S-1.002	S-3	360 minute 100 year Winter I+20%	106.080	105.758	0.428	0.000	0.24
S-1.003	S-4	360 minute 100 year Winter I+20%	106.210	105.757	0.502	0.000	0.21
S-2.000	S-5	15 minute 100 year Winter I+20%	107.200	106.703	0.003	0.000	1.00
S-2.001	S-6	15 minute 100 year Winter I+20%	107.200	106.053	0.007	0.000	1.02
S-2.002	S-7	360 minute 100 year Winter I+20%	107.200	105.838	0.100	0.000	0.12
S-1.004	S-8	360 minute 100 year Winter I+20%	106.730	106.102	1.100	0.000	0.03
S-1.005	S-9	15 minute 100 year Winter I+20%	106.640	104.724	-0.267	0.000	0.02
S-3.000	S-10	15 minute 100 year Summer I+20%	106.032	105.504	-0.028	0.000	0.73
S-3.001	S-11	15 minute 100 year Winter I+20%	106.175	105.425	0.000	0.000	1.37
S-3.002	S-12	15 minute 100 year Summer I+20%	106.175	105.365	-0.030	0.000	0.99
S-3.003	S-13	15 minute 100 year Winter I+20%	106.061	105.272	-0.039	0.000	0.90
S-1.006	S-14	15 minute 100 year Winter I+20%	105.929	104.706	-0.216	0.000	0.17

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S-1.000	S-1	1.1	16.8	OK
S-1.001	S-2	2.5	16.7	OK
S-1.002	S-3	0.4	2.9	SURCHARGED
S-1.003	S-4	0.5	3.5	SURCHARGED
S-2.000	S-5	1.4	21.3	SURCHARGED
S-2.001	S-6	1.3	21.1	SURCHARGED
S-2.002	S-7	0.4	7.5	SURCHARGED
S-1.004	S-8	0.5	1.4	SURCHARGED
S-1.005	S-9	0.5	1.3	OK*
S-3.000	S-10	1.2	14.9	OK
S-3.001	S-11	0.8	14.8	SURCHARGED*
S-3.002	S-12	1.0	14.9	OK
S-3.003	S-13	1.1	14.9	OK
S-1.006	S-14	1.0	16.0	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.
S-1.007	S-15	15 minute 100 year Winter I+20%	105.529	104.530	-0.249	0.000	0.07
S-1.008	S-16	15 minute 100 year Winter I+20%	104.450	103.461	-0.239	0.000	0.09
S-1.009	S-17	15 minute 100 year Winter I+20%	103.275	102.329	-0.120	0.000	0.44

PN	US/MH Name	Maximum Velocity (m/s)	Pipe Flow (l/s)	Status
S-1.007	S-15	2.0	16.0	OK
S-1.008	S-16	1.6	16.1	OK
S-1.009	S-17	0.9	16.2	OK

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APPENDIX C. WASTEWATER VOLUMETRIC CALCULATIONS

JOB NAME:	JOB NO:	DATE:
Prospect House, Stocking Lane, Rathfarnham	S627	11/04/2019
TITLE:	**CALCS BY:**	**CHECK'D:**
Wastewater Flow	FS	NMM

Zone	No. of Units (nr)	Occupancy (nr/m^2)	Population	Flow (l/unit/day)	BOD (g/unit/day)	Infiltration (% of flow)	Total Flow (m^3/day)	Total BOD (kg/day)	DWF (l/s)	Peak Factor	Peak Flow (l/s)
Residential											
Apartments	26	2.7	70.2	150	60	10%	11.6	4.21	0.13	6.0	0.80

Residential Occupancy rates from Appendix C of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)

Flow rates from Appendix D of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)

Infiltration rates from Appendix C of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)

BOD loading rates from EPA Wastewater Treatment Manual, For Small Communities..., Table 3

Peaking Factor from Appendix C of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)

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APPENDIX D. WASTEWATER DRAINAGE DESIGN CALCULATIONS

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	PROSPECT HOUSE STOCKING LANE RATHFARNHAM	
Date 22/04/2022 15:12 File MD_20220421.MDX	Designed by E.H Checked by M.K	
XP Solutions	Network 2020.1.3	

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Unit

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.000
Calculation Method	EN 752	Maximum Backdrop Height (m)	0.000
Frequency Factor	0.50	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-1.000	18.470	0.250	73.9	0.000	120.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.001	6.384	0.043	150.0	0.000	130.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.002	26.891	0.207	129.9	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.003	2.760	0.018	150.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-2.000	1.997	0.033	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
F-1.004	22.196	0.160	138.7	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.005	14.947	0.679	22.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-3.000	11.207	0.125	89.7	0.000	40.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-1.000	106.475	0.000	0.0	120.0	0.0	49	0.86	1.34	53.1	5.5
F-1.001	106.225	0.000	0.0	250.0	0.0	70	0.74	0.94	37.2	7.9
F-1.002	106.182	0.000	0.0	250.0	0.0	68	0.78	1.01	40.0	7.9
F-1.003	105.975	0.000	0.0	250.0	0.0	70	0.74	0.94	37.2	7.9
F-2.000	106.300	0.000	0.0	0.0	0.0	0	0.00	1.13	20.0	0.0
F-1.004	105.957	0.000	0.0	250.0	0.0	69	0.76	0.97	38.7	7.9
F-1.005	105.797	0.000	0.0	250.0	0.0	43	1.47	2.45	97.5	7.9
F-3.000	105.500	0.000	0.0	40.0	0.0	39	0.68	1.21	48.2	3.2

Network Design Table for Foul - Unit

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F-3.001	33.499	0.650	51.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-3.002	19.789	0.099	200.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.006	16.043	0.101	158.8	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.007	16.298	0.700	23.3	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.008	43.623	1.250	34.9	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
F-1.009	17.614	0.750	23.5	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F-3.001	105.375	0.000	0.0	40.0	0.0	34	0.83	1.60	63.7	3.2
F-3.002	104.725	0.000	0.0	40.0	0.0	48	0.51	0.81	32.2	3.2
F-1.006	104.626	0.000	0.0	290.0	0.0	74	0.74	0.91	36.2	8.5
F-1.007	104.525	0.000	0.0	290.0	0.0	46	1.48	2.38	94.8	8.5
F-1.008	103.825	0.000	0.0	290.0	0.0	51	1.28	1.95	77.4	8.5
F-1.009	102.575	0.000	0.0	290.0	0.0	46	1.47	2.37	94.4	8.5

Free Flowing Outfall Details for Foul - Unit

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F-1.009	F-	102.800	101.825	0.000	0	0

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APPENDIX E. WATER VOLUMETRIC CALCULATIONS

JOB NAME:	JOB NO:	DATE:
Prospect House, Stocking Lane, Rathfarnham	S627	11/04/2019
TITLE:	**CALCS BY:**	**CHECK'D:**
Water Demand	FS	NMM

Zone	No. of Units (nr)	Occupancy (nr/m^2)	Population	Flow (l/unit/day)	Total Flow (m^3/day)	Average (l/s)	AvDay/PkWeek (Factor)	AvDay/PkWeek (l/s)	Pipe Sizing (Factor)	Pipe Sizing (l/s)
Residential										
Apartments	26	2.7	70.2	150	10.5	0.122	1.25	0.152	5.0	0.76

Flow rates from Appendix D of IW Code of Practice for Wastewater Infrastructure, December 2017 (IW-CDS-5030-03)

Peaking Factors from IW Code of Practice for Water Infrastructure, December 2017 (IW-CDS-5020-03)

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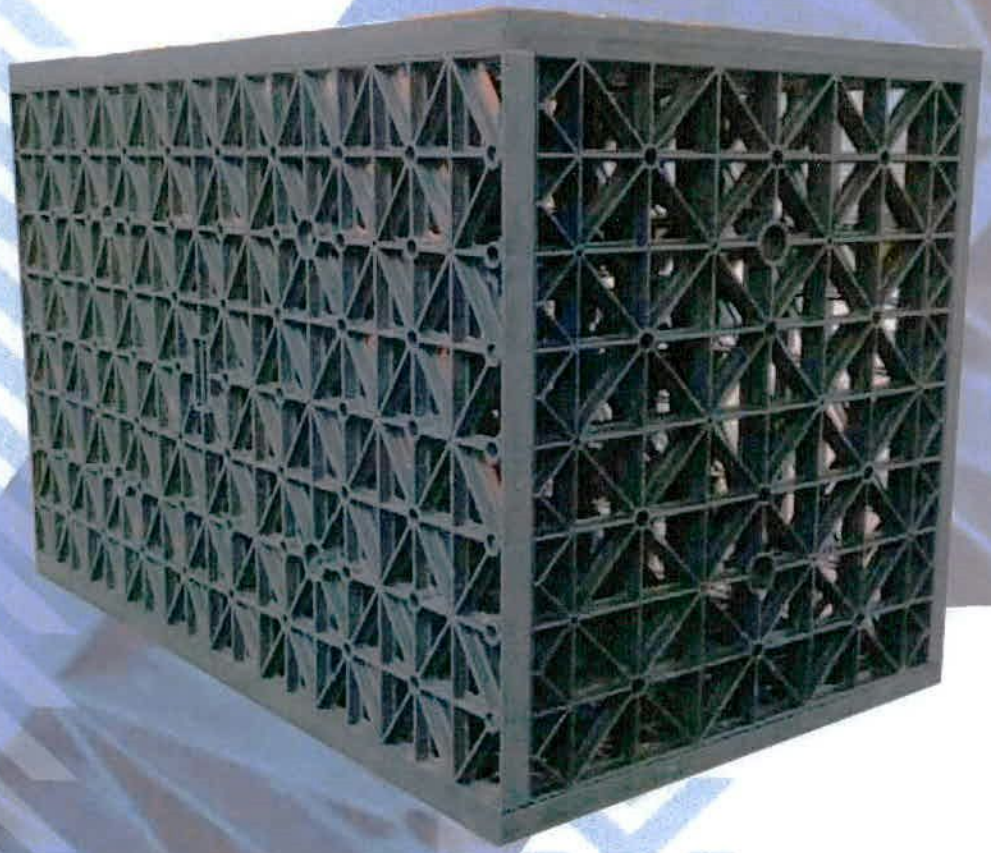
APPENDIX F. ATTENUATION SYSTEM DETAILS

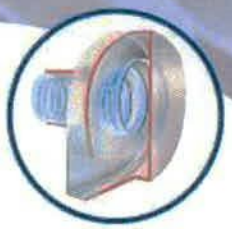
Modular Geo-Void Systems

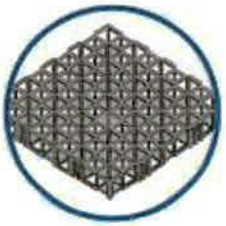
Total Water Management

ESS EcoCell

Ecological Tank Systems







ENVIRONMENTAL SUSTAINABLE SOLUTIONS LTD

Environmental Sustainable Solutions

Welcome to Environmental Sustainable Solutions; specialist suppliers and designers of geocomposites and water re-use systems. Environmental Sustainable Solutions can help you achieve innovative results for all your requirements:-

- Stormwater Management
- Gas Barrier Protection
- Stormwater Attenuation
- Contaminated Land Development
- Stormwater Drainage
- Ground Stabilisation
- Rainwater Recycling Management
- Structural Waterproofing
- Gas Venting Systems
- Damp-proofing projects

Over the last 12 years Environmental Sustainable Solutions, and associated companies, have designed and installed thousands of water recycling, drainage and attenuation tank systems for schools, car parks, retail parks, offices and sports arenas throughout Ireland, UK, Europe and the Middle East.

Our wide range of environmental protection products, surface water drainage modules and modular water storage tank systems provides maximum design flexibility for engineers and architects working on even the most demanding of storm water storage and recycling projects.

Stormwater Management And Design

Stormwater is the phrase used to describe the excess rainwater that flows from rooftops, roads, car parks and other buildings. This water can contain many pollutants picked up from roofs and highways. In extreme weather conditions sudden heavy downpours of rain can cause major environmental disasters. Using our Rainmanager products; stormwater can not only safely be removed, but it can be stored and recycled for commercial and domestic use.

How it works - ESS Attenuation Tank

Stormwater enters the attenuation tank via the inlet manhole, which incorporates a silt collection sump and a galvanised leaf collection basket. Water passes through the tank and exits through the outlet manhole, which contains an AquaBrake flow control device.
This flow control device regulates the release rate of water from the tank, and in so doing, enables the tank to fill. As a result of water entering the tank at a greater rate than it can exit, the void space then fills with water. While the tank fills, air is vented from the tank.
The Inlet/Outlet pipe will act as a flushing channel. This perforated pipe is wrapped completely in High Flow Filtering Geotextile, which prevents silt entering the block area. As the tank continues to empty at a pre-determined rate, air re-enters the tank via the same air vent system. The roof of the completed tank must be lower than the lowest gully trap on site.

Benefits

- 100% sealed tank
- Full installation service provided
- 12 years experience as market leader
- Quick installation – reduce site access delays
- Increased land usage – tanks are sub surface
- Economical – generally more cost efficient than any other equivalent sealed tank
- Cost effective – reduced costs for excavation and disposal of material
- Modular – easy to create any shape
- Strong – designed to support shear loading
- Lightweight – no cranes required
- Determinate volume – one cubic metre of matrix tank modules contain 950 litres of water, whereas stone fill will only provide 300 litres of storage per cubic metre.

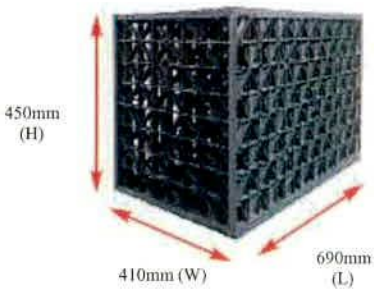
Soakaway

The soakaway is normally best built as a long narrow structure.
The inlet pipe comes in at roof level and faces downwards so that the water can percolate into the tank.
The blocks are wrapped in Geotextile, to protect them and also to keep clay from filling up the void.
An air vent pipe is installed on the highest point with a cowl on top or vented back to an inlet manhole.
There is no outlet from a soakaway, therefore no flow control unit is required.

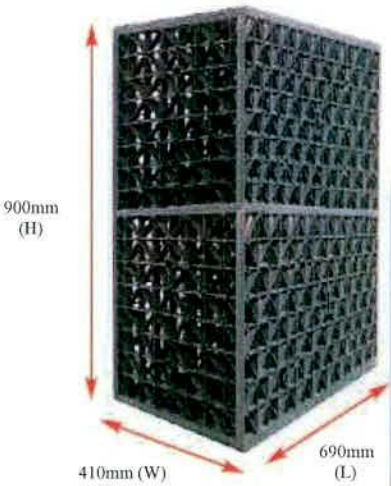
Protecting the Environment

Stormwater Storage Tank

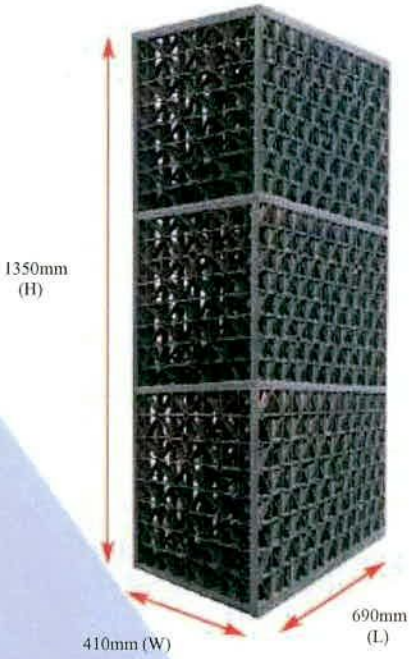
SUITABLE FOR USE UNDER:
- Roadways
- Car parks
- Green areas



Single
8 Modules/m3
Flowrate - 2300 l/min



Double
4 Modules/m3
Flowrate - 4600 l/min



Triple
2.6 Modules/m3
Flowrate - 6900 l/min

Notes:
Blocks must be positioned in the correct orientation.
See opposite above

SPECIFICATION (SINGLE)

Weight (maximum)	9.17kg
Crush Strength (up to)	400kN/m2
Lateral Strength	80kN/m2
Minimum Cover (green areas)	500mm
(trafficked areas)	650mm
Maximum Cover	3m
Material	Polypropylene
Void Ratio (Internal)	>95%

Design Requirements:

Tank storage capacity (m3)
Depth restrictions
Location (Road, Car Park, Green Area)
Design constraints on site

A set of loading calculations specific to the site requirement will be done by ESS and submitted on all tanks

DESIGN CRITERIA

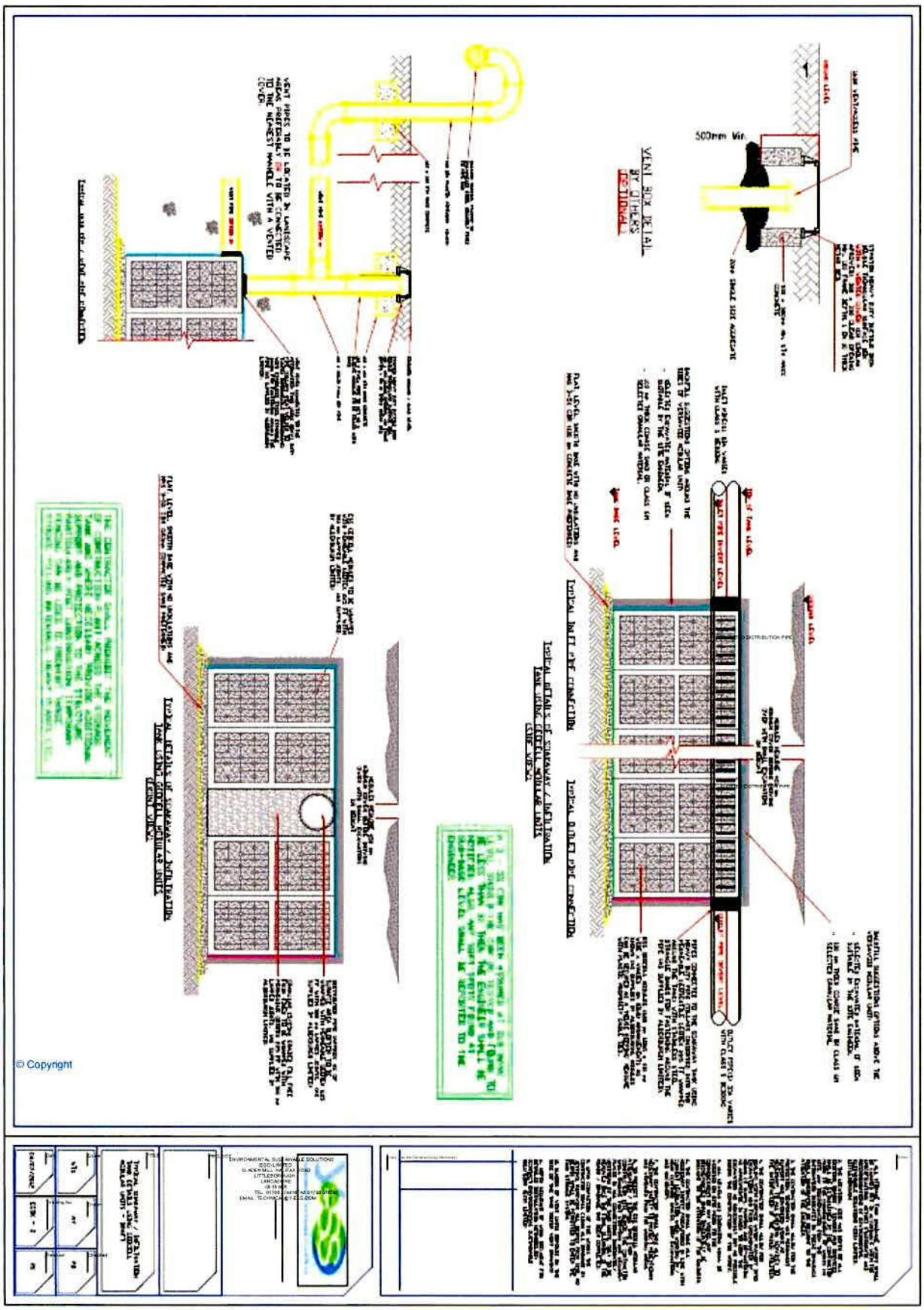
The attenuation tank is constructed using matrix module blocks. These blocks can take passing loads of up to 40 tonnes/m2. The void ratio of each block is 95%. The blocks are made from polypropylene.

The tank is sealed with a layer of Tuflex membrane, which is fully welded together to form a 100% seal. All pipe penetrations are fully sealed to the membrane. The Tuflex membrane is protected by a layer of heavy duty protection geotextile, to prevent damage from construction or backfilling. A number of air extraction vents/flushing points are placed in the roof of the tank.

Note:
It is vital that the underground tanks are fully sealed, otherwise ground water and silt particles may enter the void space and use up capacity. Preferably, the base of the tank should be 500mm above the ground water level. Otherwise ground water relief measures should be implemented.

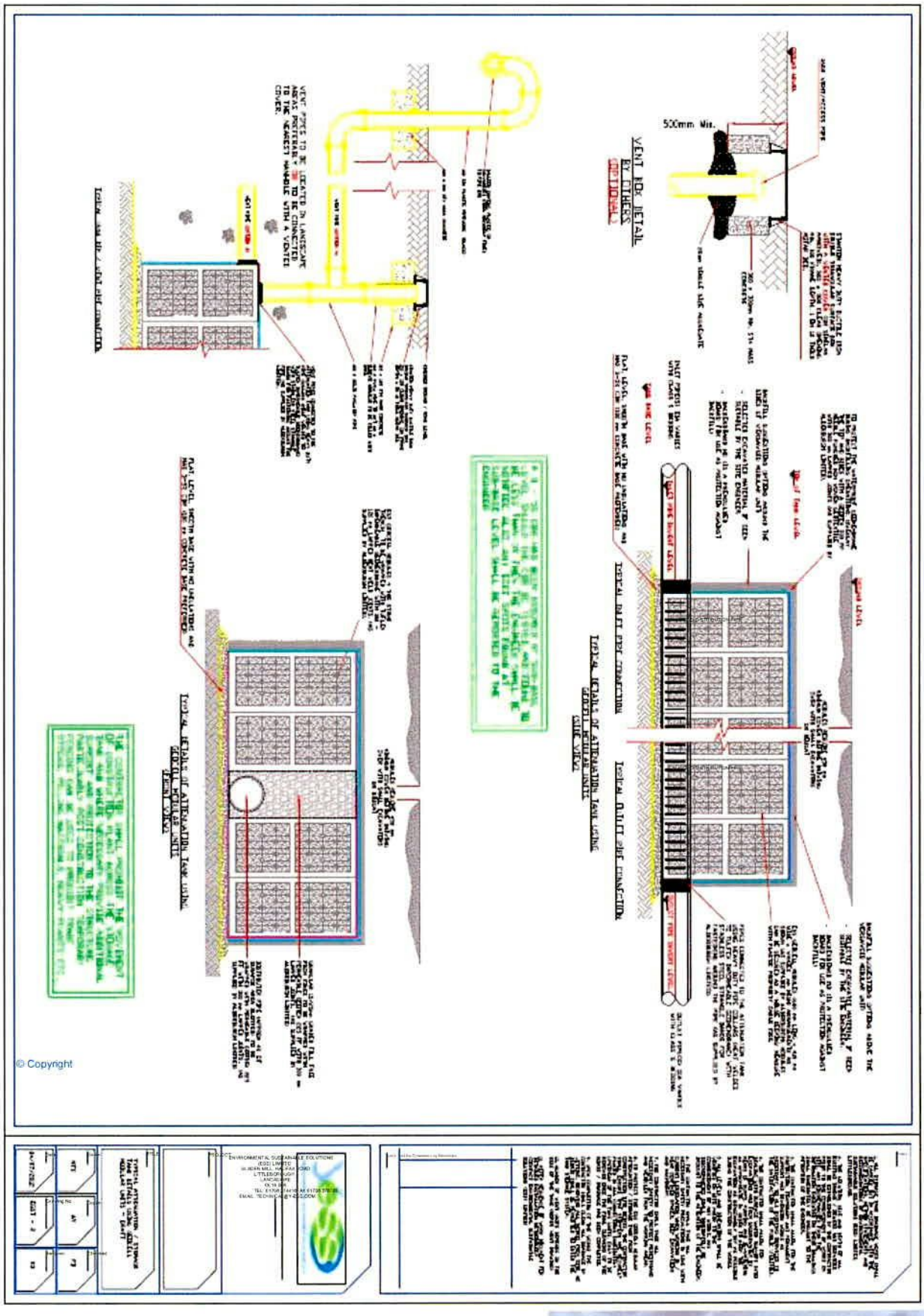
Infiltration System

Typical arrangement using ESS Ecological Tank System for water quality



Retention System

Typical on site collection and recycling arrangement using ESS Ecological Tank System



Infiltration Swales & Underground Channels

Please refer to separate data sheets for the following products

Modular VersaVoid System

Benefits

G **Quick**
Reduce site access delays

G **Lightweight**
No cranes required

G **Strong**
Designed for maximum anticipated loads

G **Maintenance Free Tank**
All debris and sediment is pre-filtered

G **Determinate Volume**
One cubic metre of Tank modules contain 950 litres of water

G **Cost Effective**
Reduces excavation and disposal by up to 5 x compared with conventional soak wells

G **High Infiltration**
98% void surface area

G **Totally Modular**
For greatest flexibility designed to cope. Units start at 300mm deep for shallow inverts to 3050mm+ deep in 250mm increments.

G **Designed by Engineers for Engineers** – to specify with confidence.

G **Designing out Problems**
with such systems (access, maintenance, loading etc.)

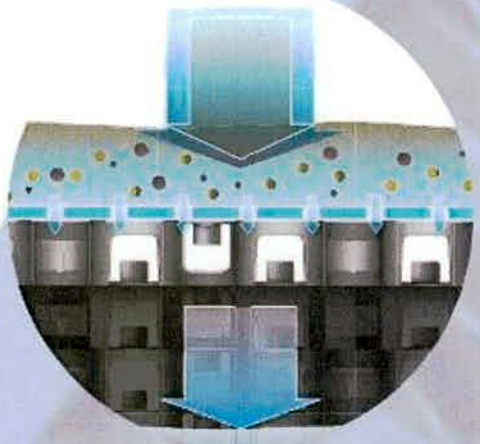
G **Designing in Answers**
to design requirements.

G **Total 3D Access**
For total maintenance with total confidence.

G **Structurally Designed**
with built in safety factor to carry all loads with complete confidence.
16 clear vertical access chambers per m2.

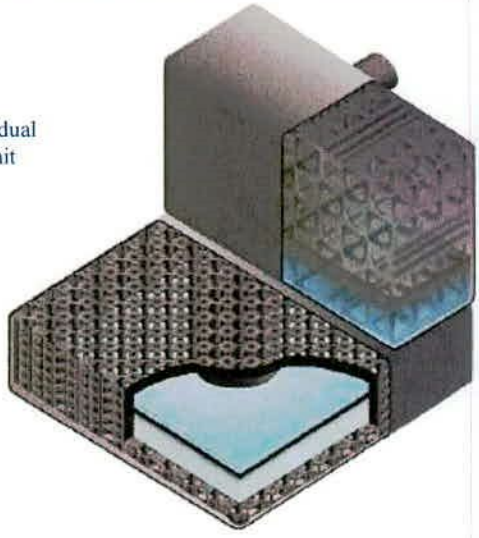
G **Total Void Creation**
With the greatest strength from any modular systems.

Oil Filtration



Benefits

G Source control designed to handle catastrophic spillages
G Capture, filter and break down residual hydrocarbons - all in one compact unit
G Self-maintaining ecosystems decompose hydrocarbon compounds and clean filters
G Load bearing, modular components provide up to 200t/m² loading capacity



Aquabrake

Benefits

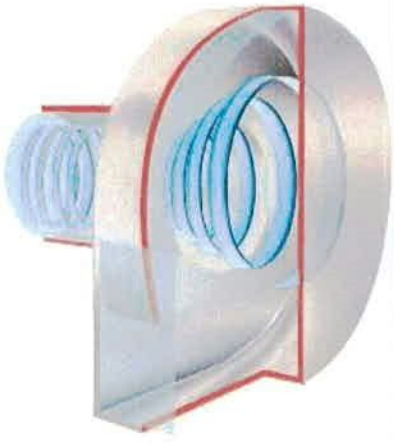
G Cost Savings
Can reduce upstream storage requirements by up to 30%.

G Durability
Corrosion resistant stainless steel.

G No energy requirements
Self-activating solution with no moving parts.

G Clog Resistant
AquaBrake design prevents blockages likely to occur in traditional orifices.

G Flexible Design
Several options for attachment available.



The ESS CombiSwale

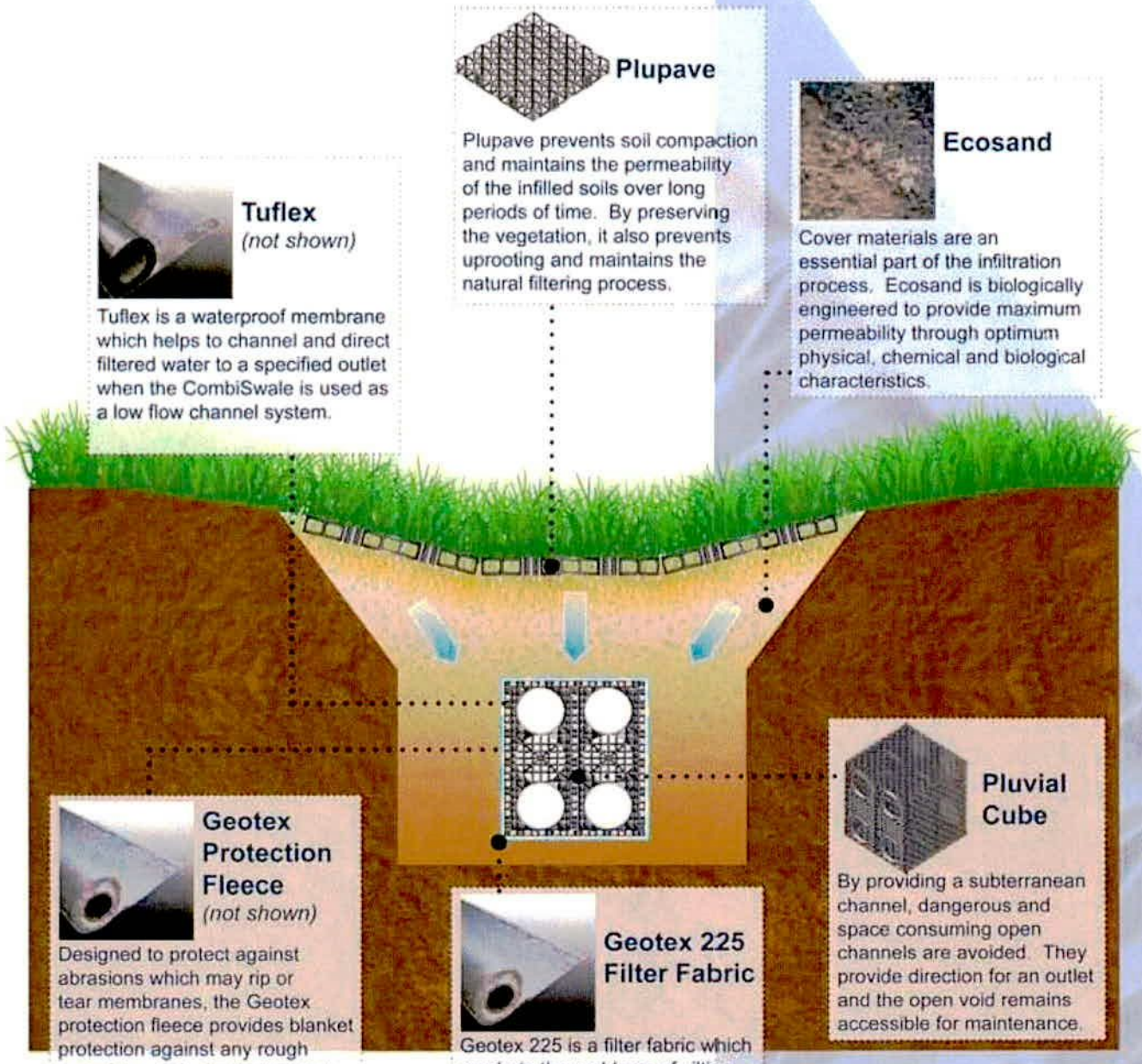
Please refer to separate data sheets for the following products

Water Sensitive Urban Channels

Surface and Sub-Surface Water Treatment

By combining surface and sub-surface channeling and treatment solutions, ESS has created the ideal in bioswale water management.

The CombiSwale system includes the addition of permeable sub-surface waterways that further restore water quality and recharge the natural environment. The sub-surface ESS channel system provides a unique way of working with nature to solve the enormous problems currently associated with open concrete channels and swales.



Plupave

Plupave prevents soil compaction and maintains the permeability of the infilled soils over long periods of time. By preserving the vegetation, it also prevents uprooting and maintains the natural filtering process.

Ecosand

Cover materials are an essential part of the infiltration process. Ecosand is biologically engineered to provide maximum permeability through optimum physical, chemical and biological characteristics.

Tuflex *(not shown)*

Tuflex is a waterproof membrane which helps to channel and direct filtered water to a specified outlet when the CombiSwale is used as a low flow channel system.

Geotex Protection Fleece *(not shown)*

Designed to protect against abrasions which may rip or tear membranes, the Geotex protection fleece provides blanket protection against any rough materials within the backfill that may cause the membrane to tear. Only needed when Tuflex is used.

Geotex 225 Filter Fabric

Geotex 225 is a filter fabric which combats the problems of silting and clogging, by allowing water to pass into the sub-surface system, but preventing the movement of subsoils.

Pluvial Cube

By providing a subterranean channel, dangerous and space consuming open channels are avoided. They provide direction for an outlet and the open void remains accessible for maintenance.

All products are manufactured to the highest quality, being subject to rigid quality control. However, the company cannot control conditions of application and use of its products, thus any warranty, written or implied, is given in good faith for materials only. ESS Ltd will not accept any responsibility for damage or injury arising from storage handling, misapplication or misuse of its products All transactions are subject to our standard condition of sale, copies of which are available on request.

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APPENDIX B. SURFACE WATER DRAINAGE DESIGN CALCULATIONS

UISCE ÉIREANN : IRISH WATER

Legend

- Pump Stations
- Irish Water
- Private
- Irish Water
- Non IW
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

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APPENDIX A. IW RECORDS

7.5 Access

The site has been designed in accordance with the *Design Manual for Urban Roads and Streets (DMURS)*. All footpaths provided with a minimum with of 1.8m and junction radii have been reduced in line with section 4.3.3 of the *DMURS.* The addition of the proposed development will result in additional footpaths along the western edge of Stocking Lane along the proposed development site where there are currently no pedestrian facilities. The roads and footpath layout associated with the proposed development can be seen in the layout S627-OCSC-XX-XX-DR-C-0100 issued with this application.

The provision of roads and footpaths were agreed with South Dublin County Council Assistant Engineer Robert Roche in the Land Use Planning and Transportation Department in June 2019 prior to the submission of this application.

This proposal allows for a good degree of car storage at the site which in turn will prevent any additional pressure on local public parking infrastructure. The slight reduction from the maximum standard set out in the development plan will help to facilitate sustainable travel by other modes than the private car.

This reduction of the maximum car parking rate set out within the development plan is also in accordance with the Sustainable Urban Housing: Design Standards for New Apartments, of which Section 4.21 that states *"In suburban/urban locations served by public transport of close to town centres or employment areas and particularly for housing schemes with more than 45 dwellings per hectare net (18 per acre), planning authorities must consider a reduced overall car parking standard and apply an appropriate maximum car parking standard."*

Cycle parking is proposed to be provide in line with the development plan standards. The South Dublin County Development Plan 2016-2022 recommends a minimum of 1 no. cycle parking space per 5 apartments for long term stay and 1 no. cycle parking space per 10 apartments for short term stay.

The above equates to a minimum of 7 no. cycle parking spaces. It is proposed to provide 40 no. cycle parking spaces in total to serve the proposed the development. This is well in excess of the recommended minimum as per the development plan standard, this will help to ensure a modal shift to more sustainable modes of transport such as cycling. It is proposed to place cycle parking spaces in the basement with the designed cycle parking area with bicycle parking for the gatehouse and main house will be accommodated within their private curtilages.

7.4 Parking

The provision of car parking at the proposed development will be in line with the South Dublin County Council Development Plan 2016-2022. This carries an associated maximum car parking allowance for residential developments. Parking rates are divided into two main categories:

- Zone 1: General rate applicable throughout the County
- Zone 2 (Residential): More restrictive rates for application within town and village centres, within 400 metres of a high quality public transport service (includes a train station, Luas station or bus stop with a high quality service).

The proposed development site is considered to be within Zone 1 as set out previously as it is not within 400m of a high quality public transport service. Therefore based on the above, the development plans sets out the following maximum parking rates for residential apartments.

- 1 car parking space per 1 bed unit
- 1.25 car parking space per 2 bed unit
- 1.5 car parking spaces per 3+ bed unit

Based on the above figures, the South Dublin County Development Plan 2016-2022 recommends a maximum of 28 no. car parking spaces (including 1 no. disabled space) to serve the proposed development

In this instance, it is proposed to provide 27 no. standard car parking spaces in total on site which equates to 1.13 spaces per unit. It is also proposed to provide 2 no. motorcycle spaces at the basement level. Of the proposed 27 no. standard car parking spaces , 23 no. car parking spaces at basement level (including 1 no. disabled parking space), 2 no. car parking spaces at gate lodge and 2 no. car parking spaces at Prospect House.

Taking the nature, location and size of the development into consideration a, it is felt that the proposed development does not meet any of the sub-threshold criteria outlined earlier. As a result, further detailed assessment is not deemed necessary and the potential traffic impact is considered minimal.

- Traffic to and from the development exceeds 10% of the traffic flow on the adjoining road;
- Traffic to and from the development exceeds 5% of the traffic flow on the adjoining road where congestion exists or the location is sensitive;
- Residential development in excess of 200 dwellings.

As outlined previously, the proposed development consists of just 24 residential units which is below the above threshold. In addition, the trip generation estimates are expected to be well below the additional thresholds identified due to the highly accessible nature of the development site. In addition, car parking provided at the site is expected to primarily fulfil a storage role as commuters use alternate means available to travel in the majority of instances.

Table 2.3 of the NRA guidelines also sets out sub-thresholds that provide guidance on the need for detailed analysis when the aforementioned limits are not met and where national roads are not impacted. A development is required to meet two or more of the following criteria to fall into this category:

- The character and total number of trips in / out combined per day are such that as to cause concern;
- The site is not consistent with national guidance or local plan policy or accessibility criteria contained in the Development Plan;
- The development is part of incremental development that will have significant transport implications;
- The development may generate traffic at peak times in a heavily trafficked/ congested area or near a junction with a main traffic route;
- The development may generate traffic, particularly heavy vehicles in a residential area;
- There are concerns over the development's potential effects on road safety;
- The development is in a tourist area with potential to cause congestion;
- The planning authority considers that the proposal will result in a material change in trips patterns or raises other significant transport implications

- The potential for construction staff to be brought to the site in vans/minibuses will be investigated. This would serve to reduce the overall trip generation potential of the construction period;
- Delivery vehicles travelling to and from the site will be spread across the course of the working day meaning the number of HGV's travelling during the peak hours will be relatively low.

To minimise any potential impact, a *Construction Management Plan* will be prepared and agreed with the Local Authority prior to the commencement of any construction works. The plan will ultimately include details on the following:

- Daily and weekly working hours;
- Agreed haul routes for incoming materials;
- Licensed hauliers to be used;
- Disposal sites;
- Travel arrangements for construction personnel;
- Temporary construction entrances to be provided;
- Wheel wash facilities if required;
- Road cleaning and sweeping measures to be put in place if required;
- Temporary construction signage to be put in place and maintained;
  Any proposed traffic management measures such as temporary traffic lights and signage on any public roads.

7.3 Operational Traffic Impact

As noted, the development site borders Stocking Lane which is classified as a regional roads (R115). The *Traffic and Transport Assessment Guidelines* (Transport Infrastructure Ireland, 2014) provides guidance as to when a detailed assessment should be carried out. *Table 2.1* of this document highlights the thresholds where a Transport Assessment is required, as taken from *Table 1.4* of the *Traffic Management Guidelines* (DoT/DoEHLG/DTO, 2003). The relevant thresholds from this table are as follows:

In terms of pedestrian access, footpaths will be provided along the boundary of the site on Stocking Lane, this can be seen in OCSC layout **S627-OCSC-XX-XX-DR-C-0100**. There is existing high quality footpath along stocking lane, the provision of additional footpaths on the eastern side of Stocking Lane will greatly improve pedestrian access along Stocking Lane.

The proposed development includes an access on Stocking Lane which provides sole access to all car parking. A sightlines assessment of this entrance has been carried out and is shown on Drawing No. **S627-OCSC-XX-XX-DR-C-0101**.

7.2 Construction Traffic Impact

The construction period will be temporary in nature. Construction traffic is expected to consist of the following categories:

- Private vehicles owned and driven by site construction staff and by full time site supervisory staff and occasional professional supervisory staff i.e. design team members and supervisory staff from utility companies;
- Materials delivery and removal vehicles.

It is difficult to assess the exact quantum of traffic that will be generated during the construction period however, based on experience from similar developments, the following points are noted with regard to construction traffic:

- In general, the construction day will begin and end outside of peak travel hours. As a result the majority of workers travelling to and from the site will arrive before the a.m. peak hour and depart after the p.m. peak hour;
- Limited on-site parking will be provided to encourage staff to travel by more sustainable means including public transport and/or car sharing. There is also limited potential for off-site parking due to the high associated costs;
- Adequate on-site compounding will be provided to prevent any potential overflow onto the local transport network;

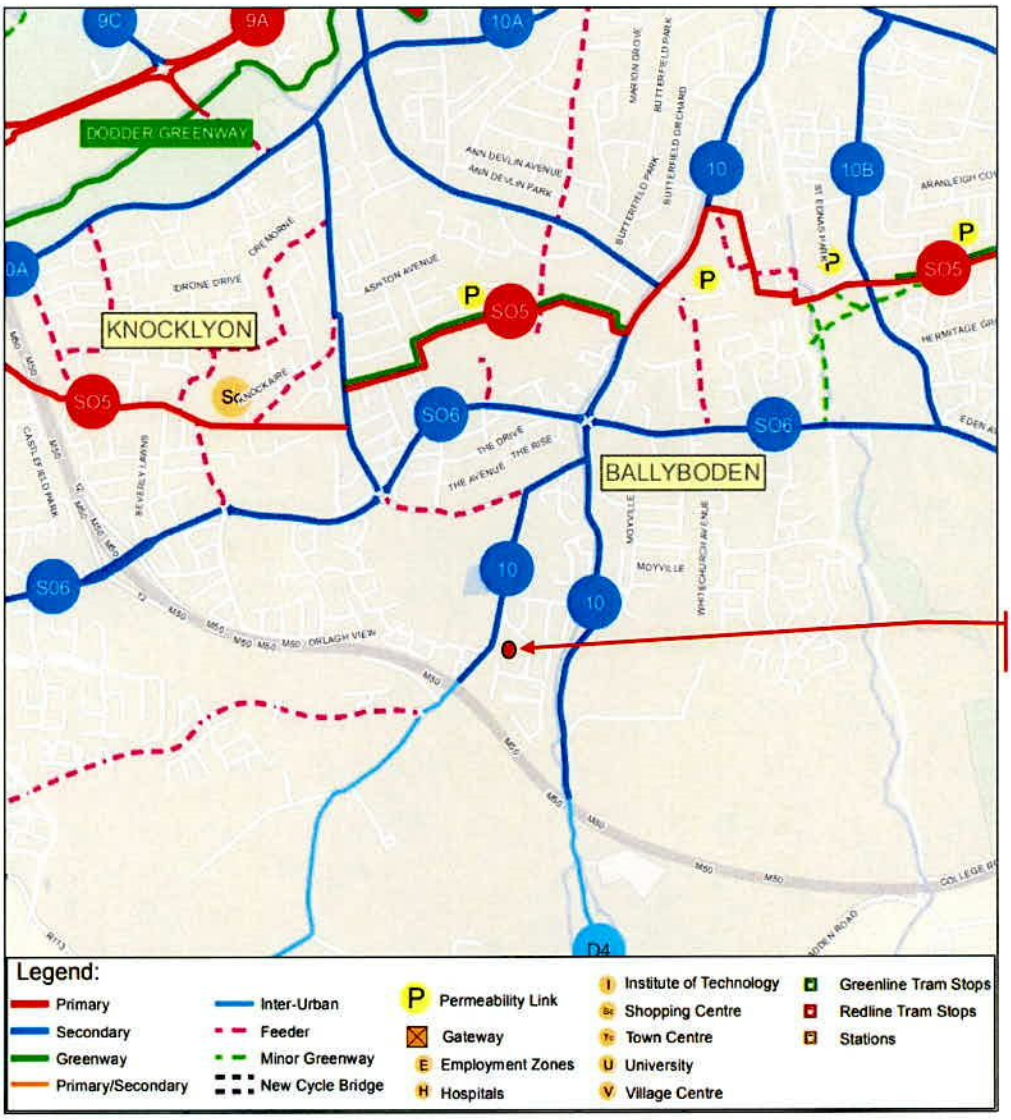

Figure 7.1.2: Local Cycle Infrastructure

As can be seen in the above *Figure 7.1.2* a proposed secondary cycle route is proposed for Stocking Lane directly outside the proposed development and further along stocking lane, this will provide convenient access to the wider cycle infrastructure network and make it easier to use sustainable modes of transport. As noted above in *Figure 7.1.2* some of this secondary route is already in place but it should be stressed that further improvements as per the above *Figure 8* are proposed.

Figure 7.1.1: Existing Cycle Pedestrian Infrastructure Opposite Site

Further improvements planned by the NTA for the Greater Dublin Area can also be seen in their Greater Dublin Area Cycle Network Plan, section of this can be seen below in *Figure 7.1.2*.

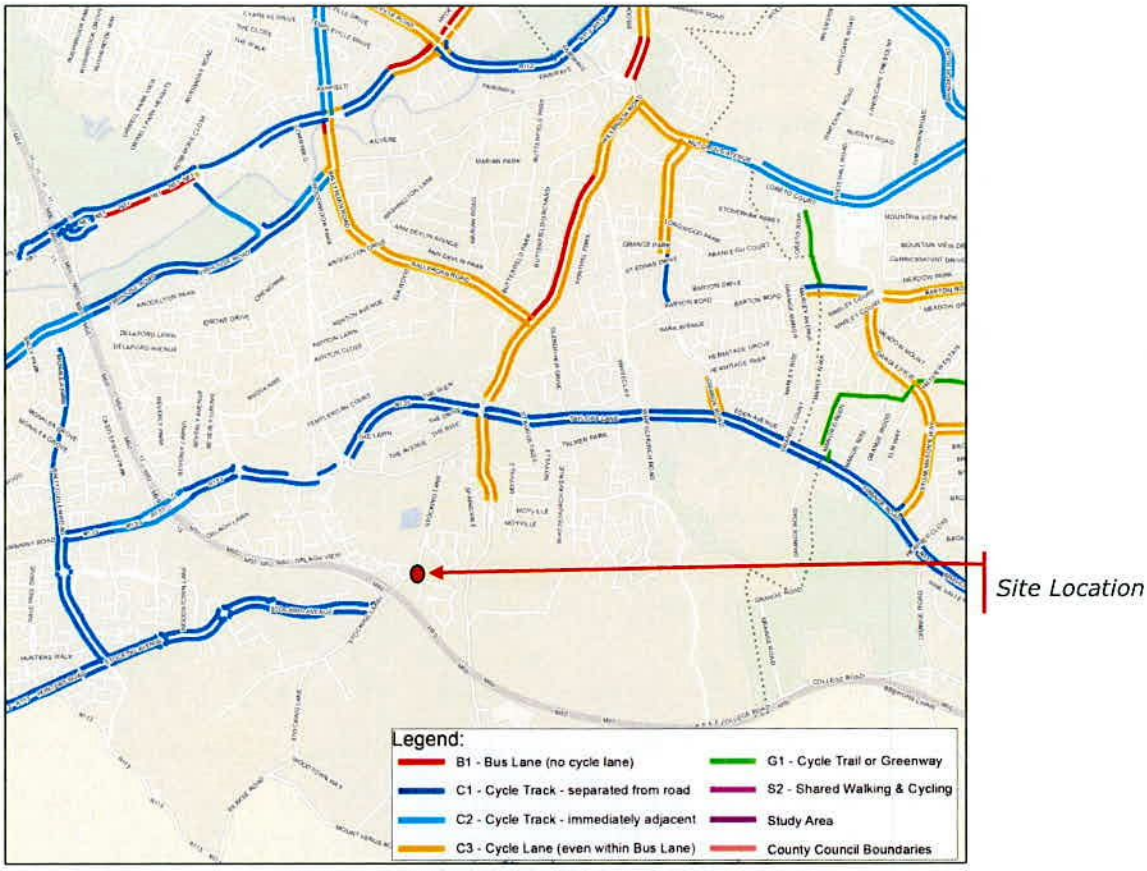

Figure 7.1: Local Cycle Infrastructure

As can be seen in the above *Figure 7.1*, there is a segregated cycle lane along the Scholarstown Road that is a short distance (500m) from the proposed development site, there is also existing cycle infrastructure on the Edmonstown Road as shown above. Although not shown on the above NTA Cycle Network Plan there is existing high quality cycle track/footpath infrastructure along the front of the site on the opposite side of the road from the site on Stocking Lane, this can be seen in the below *Figure 7.1.1.*

7 TRAFFIC AND TRANSPORTATION

7.1 Site Accessibility

The development site is located directly adjacent a bus stop on Stocking Lane, a bus stop is located on either side of the road directly adjacent to the development site at its south west corner. The bus services adjacent to the proposed development site are summarised following:

Route	Description
15b	Ringsend Rd. (Barrow Street). – Stocking Avnue

Table 6: Local Bus Services

There are also additional services located on the Edmonsdtown Road that is located 850m (10 min walk) from the development site. these services that are a short walk away are summarized in the following table:

Route	Description
61	Eden Quay – Whitechurch
161	Rockbrook – Whitechurch – Nutgrove - Dundrum

Table 7: Local Bus Services

Existing cycle infrastructure, as published by the National Transport Authority (NTA) in their Greater Dublin Area Cycle Network Plan, is shown in *Figure 7.1* overleaf with the development site circled in red.

6.5 Confirmation of Feasibility

A Pre-Connection Enquiry Form was submitted to Irish Water, with a Confirmation of Feasibility yet to be received.

6 POTABLE WATER SUPPLY

6.1 Overview

There is an existing 4 Asbestos 1973 watermain in the public road, Stocking Lane, on the west boundary of the subject site. It is proposed to connect the proposed watermain system to the existing public watermain at the west boundary.

The proposed watermain network will consist of HDPE DN100mm SDR 17 PE100 mains. The network will include hydrants as per Irish Water requirements. Hydrants have been provided at locations to ensure that no dwelling within the subject site will be farther than 46m from a hydrant and a hydrant shall not be closer than 6m to a property. The proposed watermains layout is shown on drawing **S627-OCSC-XX-XX-DR-C-0550**. The proposed watermain infrastructure is designed in accordance with Irish Water's *Code of Practice for Water Infrastructure* (IW-CDS-5020-03).

6.2 Connection to the Existing Network

The proposed watermain system connects to the existing public watermain uPVC 150mm-diameter in the public road, Stocking Lane, on the west boundary. The proposed development is residential and consists of 22nr apartments. The water volumetric calculations are contained in ***Appendix E***.

6.3 Water Saving Devices

In accordance with best practice, new water saving devices (low water usage appliances and aerated taps etc.) will be fitted within the subject site.

6.4 Water Meters

In accordance with the South Dublin County Council and Irish Water regulation a bulk water meter will be fitted at the proposed connection to the existing watermain. Individual water meters for each apartment will be provided inside the building.

5 WASTEWATER DRAINAGE

5.1 Overview

The proposed wastewater network in Prospect House discharge to the existing 225mm-diameter unknown material wastewater sewer network approximately 50-100 metres northwest from the site on the Prospect Drive.

Ground levels across the site generally fall from a high point in the south to a low point in the north. The proposed sewers within the development site will comprise 150mm–diameter and 225mm-diameter pipes. The proposed wastewater drainage infrastructure is designed in accordance with Irish Water's *Code of Practice for Wastewater Infrastructure* (IW-CDS-5030-03). The proposed foul drainage layout is shown on drawing **S627-OCSC-XX-XX-DR-C-0500** and the proposed basement drainage layout is shown on drawing **S627-OCSC-XX-B1-DR-C-0501**.

5.2 Calculations

Wastewater (volumetric) calculations have been compiled in accordance with Irish Water Code of Practice Wastewater Infrastructure and are included in ***Appendix C***. Pipe design calculations have been compiled using MicroDrainage software and are included in ***Appendix D***. Design flow has been calculated using the Discharge Unit method described in I.S. EN 752. The calculations demonstrate that conveyance capacity is provided for all development of zoned lands within the catchment, that self-cleansing velocity will be achieved with the expected design flow rates and that the flow velocities will not exceed the upper limit of 3.0m/s.

5.3 Confirmation of Feasibility

A Pre-Connection Enquiry Form was submitted to Irish Water, with a Confirmation of Feasibility yet to be received.

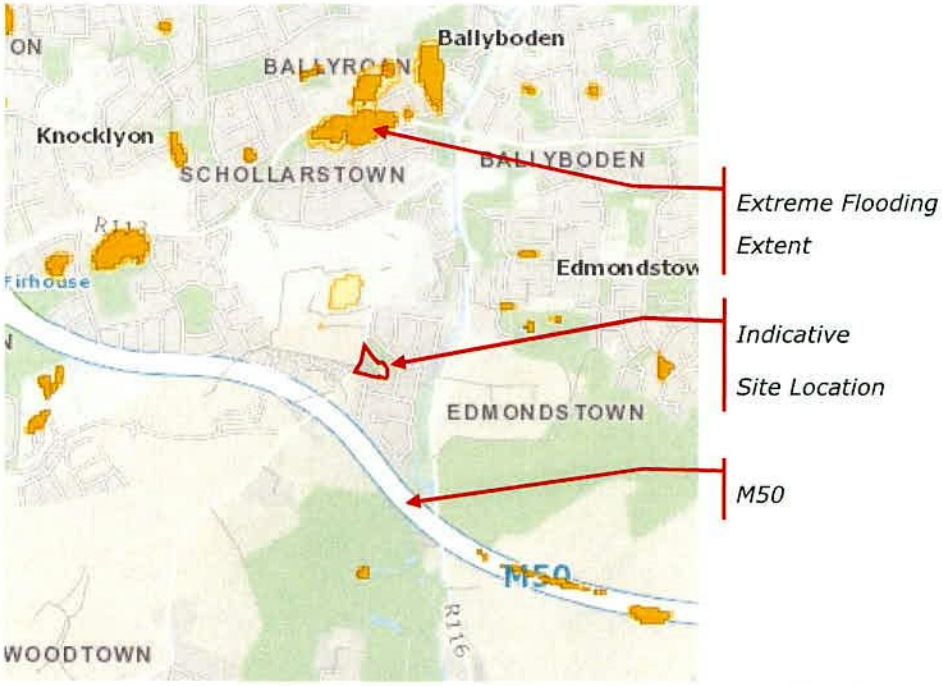

Figure 4.8: OPW Pluvial Flood Risk Mapping (excerpt from www.myplan.ie)

As detailed within *Section 3* of this report, the proposed surface water drainage network as part, of this development, has been designed to ensure that no flooding is experienced during design rainfall events up to and including the 1% AEP including an additional 20% intensity for climate change projections.

The above ensures that pluvial flooding is not considered a significant risk to the proposed the development, nor as a result of the proposed development.

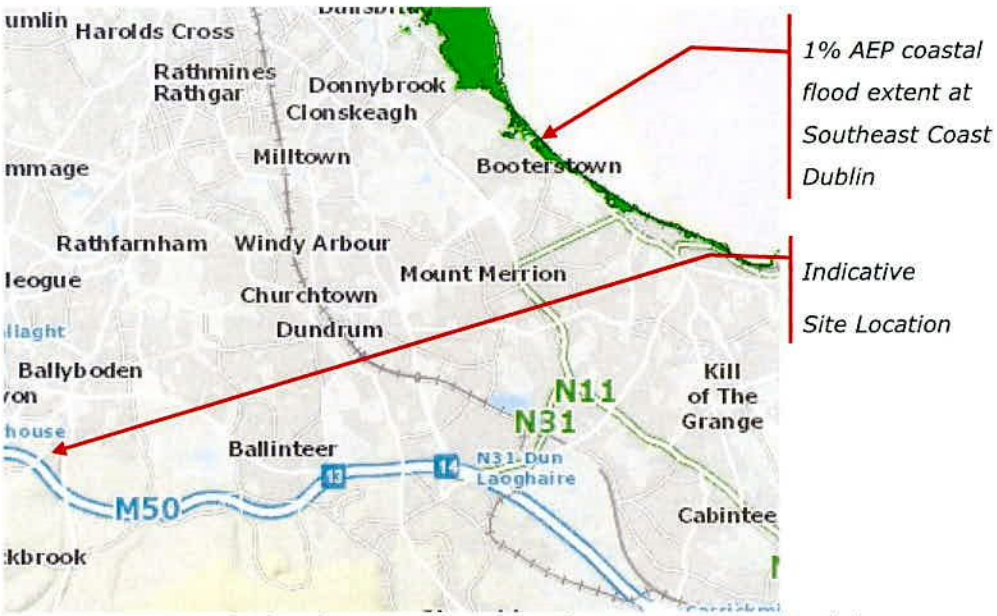

Figure 4.7: Coastal Flood extent (excerpt from www.myplan.ie)

Therefore, the proposed development is not considered to be at risk of coastal flooding.

4.8 Pluvial Flooding

A review the OPW's online pluvial flood risk mapping indicates that the proposed development does not appear to be at risk from pluvial flooding due to offsite influences – see *Figure 4.8.*

A review of the OPWs Catchment Flood Risk Assessment Mapping indicates that there is no predicted flooding from this watercourse or in the vicinity of the subject site.

Figure 4.6: OPW Fluvial Flood Risk Mapping (excerpt from www.floodinfo.ie)

Therefore, the proposed development is not considered at risk of fluvial flooding from the River Owenadoher, Whitechurch Stream or the watercourse along its eastern boundary and is deemed acceptable for use.

4.7 Coastal Flooding

The proposed development located approximately 8km from the north eastern coast and located approximately 150m-200m from a section of the River Owenadoher which is affected by tidal changes. The proposed development is located outside of the extent of the predicted 1% AEP flood zone for coastal flooding. Refer to *Figure 4.7* for details.

The proposed development comprises of 25 residential units and is considered in Flood Zone C. Therefore, the proposed development is considered ***Highly Vulnerable Development***.

4.5 Historical Flood

There is no reported incident of flooding in the vicinity of the site, as outlined on the OPW's online National Flood Hazard Mapping website www.floodmaps.ie – see *Figure 4.5*.

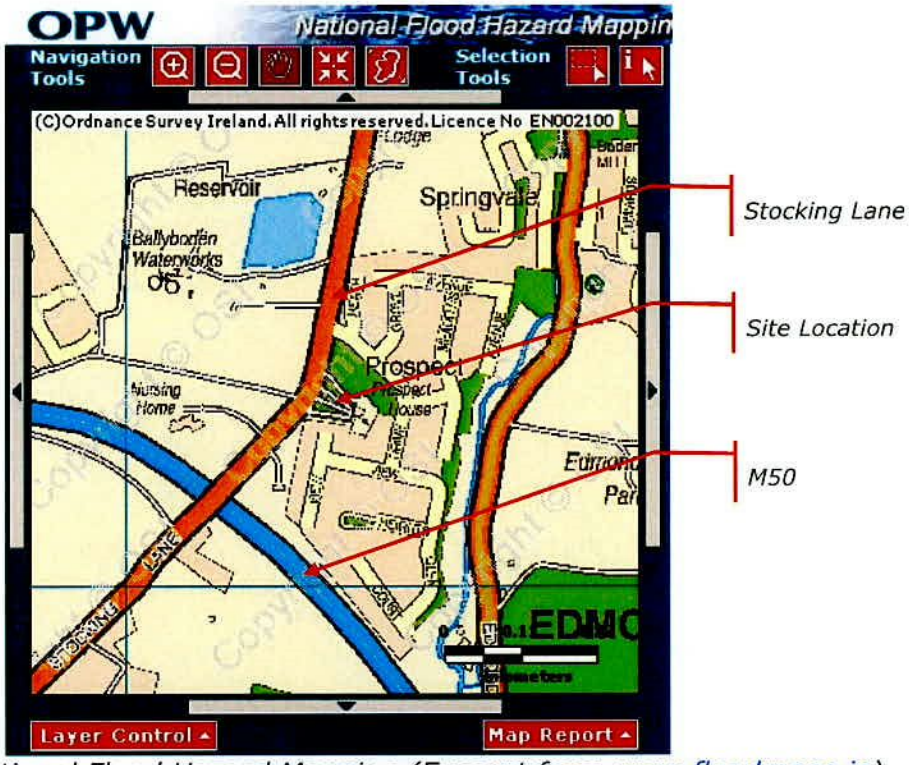

Figure 4.5: National Flood Hazard Mapping (Excerpt from www.floodmaps.ie)

4.6 Fluvial Flooding

The proposed development is located approximately 150m – 200m of the River Owenadoher and 1.25km – 1.50km of the Whitechurch Stream. A review of the OPW's Catchment Flood Risk Assessment Mapping (CFRAM) indicates that the proposed development is located outside of the predicted 1% AEP flood extent of the River Owenadoher and Whitechurch Stream, as outlined on the OPW's online National Flood Hazard Mapping website www.floodinfo.ie – see *Figure 4.6*.

Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

Table 4: Development Vulnerability Class

4.4 Development 'Appropriateness'

The *PSFRM Guidelines* define the zones in which each class of development is appropriate – this is summarised in *Table 5: "Appropriateness" Matrix*, below. The *PSFRM Guidelines* recognises that flood risks should not be the only deciding factor in zoning for development. They also recognise that circumstances will exist where development of a site within a floodplain is desirable; in order to achieve compact and sustainable development of the core of urban settlements. In order to allow consideration of such development, the *PSFRM Guidelines* provide a **Justification Test**, which establishes the criteria under which desirable development of a site in a floodplain may be warranted.

	Flood Zone A	**Flood Zone B**	**Flood Zone C**
Highly Vulnerable Development	Justification Test	Justification Test	Appropriate
Less Vulnerable Development	Justification Test	Appropriate	Appropriate
Water-compatible Development	Appropriate	Appropriate	Appropriate

Table 5: "Appropriateness" Matrix

i.e. without the inclusion of climate change factors (*PSFRM Guidelines paragraph 2.24*).

4.3 Development Vulnerability

The *PSFRM Guidelines* classify potential development in terms of its vulnerability to flooding. The types of development falling within each vulnerability class are described in *Table 3.1* of the *PSFRM Guidelines*, which is reproduced in *Table 4: Development Vulnerability Class*, below.

Vulnerability Class	Land uses and types of development which include:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; ***Dwelling houses***, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.

GDSDS and revised following later studies. These parameters are set out in *Table 2: Climate Change - Impact on Design Parameters*, below.

Design Category	Impact of Climate Change
Drainage	20% increase in rainfall
Fluvial (River)	20% increase in flood flow
Tidal/Coastal	Sea level rise of 500mm

Table 2: Climate Change - Impact on Design Parameters

4.2 Flood Risk Zones

The *PSFRM Guidelines* adopt a sequential approach to managing flood risk by reducing exposure to flooding through land-use planning. The approach adopted by the PSFRM Guidelines establishes three zones (*PSFRM Guidelines paragraph 2.23*) on a sliding scale of flood risk – refer to *Table 3: Flood Risk Zones*, below.

Zone A	**High Probability of Flooding** Where the annual probability of flooding is: greater than 1% for fluvial flooding or greater than 0.5% for coastal flooding
Zone B	**Moderate Probability of Flooding** Where the annual probability of flooding is: between 0.1% and 1% for fluvial flooding or between 0.1% and 0.5% for coastal flooding
Zone C	**Low Probability of Flooding** Where the annual probability of flooding is: less than 0.1% for fluvial flooding and less than 0.1% for coastal flooding

Table 3: Flood Risk Zones

Flood risk zones are determined on the basis of the probability of river and coastal flooding only (*PSFRM Guidelines paragraph 2.24*). Other sources of flooding (such as groundwater, infrastructure and pluvial) do not affect the delineation of flood risk zones. These other sources of flooding should be considered and mitigated in design. Flood risk zones are determined on the basis of the current flood risk,

4 FLOOD RISK ASSESSMENT

This section assesses the potential flood risks associated with the proposed development, as per the regulations and guidelines outlined in *Section 2*.

The risk of a flood event is a function of the probability of occurrence in any given year. Traditionally, this has been expressed as a return period (e.g. 1-in-100-year return period). However, this has led to misconceptions about the likelihood of repeat occurrences. A less ambiguous expression of probability is the *Annual Exceedance Probability* (AEP), which may be defined as the probability of a flood event being exceeded in any given year. A 1-in-100-year return period flood event is therefore expressed as a 1% AEP flood event. Likewise, a 1-in-1year return period flood event is expressed as a 100% AEP flood event.

The *Greater Dublin Strategic Drainage Study* (GDSDS), published by the Local Authorities in the Greater Dublin Region, and The *Planning System and Flood Risk Management Guidelines for Planning Authorities* (PSFRM) set out the best practice standards for flood risk in Ireland. These are summarised in *Table 1: Summary Level of Service*, below.

Flooding Source	Drainage	River	Tidal/Coastal
Residential	1% AEP	0.1% AEP	0.1% AEP
Commercial	1% AEP	1% AEP	0.5% AEP
Water-compatible	-	>1% AEP	>0.5% AEP

Table 1: Summary Level of Service

In addition, the *GDSDS* requires that ground floor levels of houses be provided with a 500mm freeboard over the 1% AEP fluvial flood level.

4.1 Climate Change

Both the *GDSDS* and *PSFRM* Guidelines require that account be taken of the effects of climate change over the design life of a development, typically 100 years. Design parameters to take account of climate change were established in the

in the 100-year return period storm event. Notwithstanding this, all roads within the proposed development have been designed to provide continuous overland flow routes through the development to avoid ponding at proposed houses. Therefore, the proposals satisfy Sub-Criterion 3.4.

3.12 Criterion 4 – River Flood Protection

Runoff from the site will be limited to the greenfield runoff rate calculated in accordance with IH124; the calculated greenfield flow rate is 2.4 l/s/ha, which equates to 1.2 l/s for the subject site. By limiting the runoff to this flow rate, this ensures that sufficient storm water runoff retention is achieved to protect the river during extreme events. Attenuation storage is provided for the 100-year return period storm event in the proposed and permitted attenuation facilities. Therefore, the proposals satisfy Criterion 4.

3.11 Criterion 3 – Level of Service (Flooding) Site

Four sub-criteria for Level of Service are considered, as follows:

(i) No flooding on site except where planned (30-year high intensity rainfall event);

(ii) No internal property flooding (100-year high intensity rainfall event);

(iii) No internal property flooding (100-year river event and critical duration for site) and;

(iv) No flood routing off site except where specifically planned (100-year high intensity rainfall event).

3.11.1 Sub-Criterion 3.1

The performance of the proposed drainage system in the 30-year return period storm event has been analysed. The analysis shows that no flooding is expected in the 30-year return period storm event. Therefore, the proposals satisfy Sub-Criterion 3.1. The performance of the system has been analysed for up to 1% AEP 20% CC using MicroDrainage by Innovyze. Refer to ***Appendix B*** for the Surface Water Drainage Design Calculations.

3.11.2 Sub-Criterion 3.2

The performance of the proposed drainage system in 100-year return period storm event has been analysed. The analysis show that no flooding is expected in the 100-year return period storm event. Therefore, the proposals satisfy Sub-Criterion 3.2.

3.11.3 Sub-Criterion 3.3

The ground levels in the subject lands vary from 108.5mAOD in the southwest to 105.5mAOD in the north. None of the site is in an area of coastal/tidal or fluvial flooding. The attenuation storage facilities proposed in the current planning application have been designed to provide at least 500mm freeboard to the FFLs within the subject site. Therefore, the proposals satisfy Sub-Criterion 3.3.

3.11.4 Sub-Criterion 3.4

The performance of the proposed drainage system in the 100-year return period storm events has been analysed. The analysis shows that no flooding is expected

3.7 Calculations

A computer model of the drainage systems has been developed using the MicroDrainage design software. Calculations for the design of surface drains have been compiled using the Modified Rational Method in accordance with I.S. EN 752. The performance of the proposed drainage systems has been assessed for 1-year, 30-year and 100-year return period storm events. Calculations generated by the MicroDrainage software are included for the surface water networks in ***Appendix B*** and discussed below in *Section 3.9*.

3.8 GDSDS Storm Water Review

The proposed storm water drainage system has been reviewed under the following four criteria:

(i) Criterion 1 – River Water Quality Protection;

(ii) Criterion 2 – River Regime Protection;

(iii) Criterion 3 – Level of Service (Flooding) site;

(iv) Criterion 4 – River Flood Protection.

3.9 Criterion 1 – River Water Protection

The drainage system for this development will contain a range of treatment methods for surface water as outlined earlier. The surface water runoff will pass through a Class 1 petrol interceptor. Low rainfall events and the first flush of higher rainfall events will be infiltrated to groundwater at the interception storage provided at the attenuation facility (subject to suitable ground conditions); this volume will infiltrate to groundwater and will not be discharged off site. The runoff from the proposed development will pass through the interception storage provided in the permitted drainage system, which provides 5mm rainfall interception storage.

3.10 Criterion 2 – River Regime Protection

Discharge will be limited to equivalent greenfield runoff rates, providing a total maximum discharge rate of 1.2 l/s for the entire landholding. This ensures that sufficient stormwater runoff retention is achieved to protect the river during extreme events.

period rainfall event within the designated storage area. A total of **75.3m³** to be provided, using ESS EcoCell or similar approved.

- Limiting Discharge will be achieved to ensure that the discharge rate is maintained at equivalent greenfield runoff rates. Greenfield runoff calculated in accordance with IH124 is 2.4 l/s/ha. The proposed site control attenuation facility is designed with flow control discharging 1.2 l/s.

- Interception Storage will be provided in pervious paving distributed around the subject site and at the proposed attenuation facility, where interception storage will cater for the first 5mm rainfall.

- Infiltration of runoff to groundwater will occur in pervious paving and at the site control attenuation facility.

- Pervious Paving will be provided to all carparking spaces in the proposed development. This will provide at source attenuation and slow run-off prior to entering the main surface water network.

- Class 1 Petrol Separators will be provided before connecting to the existing storm network.

- Class 2 Petrol Separators will be provided at the basement before connecting to the proposed foul network at the ground level.

3.5 Climate Change

The rainfall intensity levels have been increased by 20% as an allowance for climate change as per South Dublin County Council Development Plan.

3.6 Outfall Location

The proposed surface water drainage system outfalls to an existing surface public network to the north of the site on the Prospect Drive.

and the GDRCOP for Drainage Works, with minimum full bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been sized to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI event, with a projected climate change allowance of 20% increase in rainfall intensity.

3.3.6 Proposed Surface Water Attenuation Storage

Temporary underground attenuation is to be provided in order to restrict discharge rates from the development surface water network to the greenfield equivalent flow rate as detailed in *Section 3.2.3*. The attenuation has been designed to temporarily store the surface water runoff for design rainfall events up to, and including, the 1% AEP with a 20% increase in rainfall intensity; during rainfall events that results in flows exceeding the greenfield runoff.

The development's surface water network's primary attenuation, is to be provided in the form of a modular attenuation system providing 75.3m^3 of temporary storage, using ESS EcoCell or similar approved, under the green space within the development. The system has been sized to allow sufficient temporary storage of rainfall events up to and including the 1 in 100-year ARI (with a 20% allowance for climate change). Refer to ***Appendix F*** for attenuation system details.

3.4 Specific SuDS Measures Proposed

It is proposed to provide a Sustainable Drainage System (SuDS). Specific design requirements for SuDS components are established by the Construction Industry Research and Information Association's publication The SuDS Manual (C753). It is proposed that the following systems will be used:

- Attenuation Storage will be provided for runoff from all hardstanding surfaces to allow for the restriction of discharge rates to equivalent greenfield runoff rates. The proposed attenuation facility has capacity for the proposed development and accommodates the design 100-year return

3.3.3 Proposed Surface Water Catchment Areas

As discussed previously, the proposed development is to comprise of 22 residential units. For the purpose of the surface water network design simulation, we have considered all external (roads, pavement, driveways and roofs) areas as being 100% impermeable; giving a *winter* global runoff coefficient, C_v, of 0.84, in accordance with the HR Wallingford and Modified Rational Method for runoff.

3.3.4 Proposed Development Rainfall Runoff

It is proposed to reduce and restrict the rainfall runoff, discharging from the proposed development, to the greenfield equivalent, $QBAR_{RURAL}$, runoff rate, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than $25km^2$ in area; this is described in further detail, in *Section 3.2.3*.

This is to be achieved with the provision of a flow restrictor (Hydro-Brake Optimum by Hydro-International, or similar approved) prior to discharging to a public surface network which runs along the northern border, with the appropriate measures of attenuation provided. Associated attenuation is to be strategically provided, in order to maximise SuDS benefits and avail of the central open space for preliminary attenuation.

The $QBAR_{RURAL}$, which indicates the greenfield equivalent, was calculated by MicroDrainage Runoff Calculator for the development catchment and it shows a value of **1.2 l/s** (2.4 l/s/ha) along with the calculated runoff for varying Average Recurrence Intervals (ARI).

3.3.5 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving the proposed development, is to consist of a gravity sewer network that will convey runoff from the roofs and paved areas to the outfall location, which will discharge a controlled flow rate to a public network which runs along the northeast boundary.

The proposed piped-network has been designed in accordance with I.S. EN 752 and all new infrastructure is to be compliant with the requirements of the GDSDS

3.3.2 Proposed Surface Water Design Criteria

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in *Section 2,* using MicroDrainage network design software by Innovyze Inc. which simulated the performance of the integrated drainage network for varying rainfall return periods and storm durations.

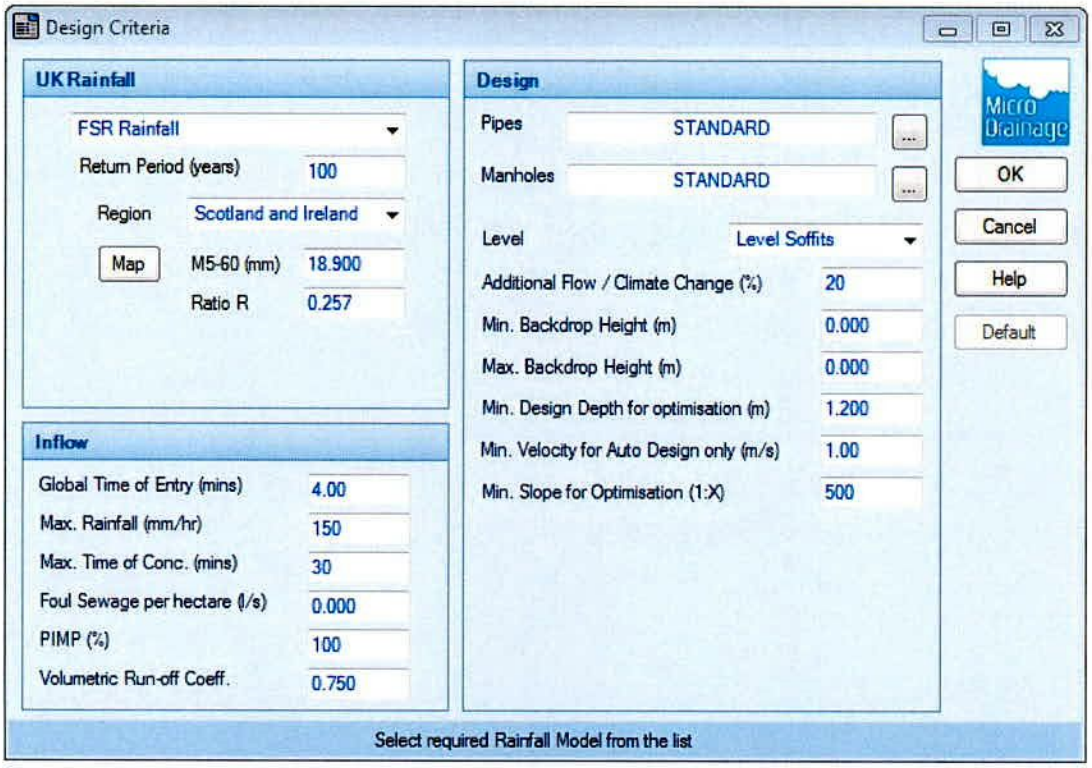

Figure 3.3.2: Surface Water Design Criteria (MicroDrainage Excerpt)

As indicated in *Figure 3.3.2*, the proposed network was designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change, in accordance with the South Dublin County Council Development Plan 2016 – 2022. The MicroDrainage network design software applies to the Flood Studies Report (FSR) methodology for analysis of the rainfall profiles; however, the input design parameters, as shown in *Figure 3.3.2*, are the latest available rainfall data sourced from the Flood Studies Update (FSU) data i.e. The return period rainfall depth for varying durations, which determine the M5-60 and R-values, and Standard Annual Average Rainfall (SAAR); as sourced from Met Éireann.

Figure 3.2.2: Existing *Drainage Infrastructure Records*

3.2.3 Existing Site Rainfall Runoff

The existing site currently drains naturally towards the north western boundary. Refer to *Section 1.4* for overview details of the existing site topography.

This information, along with the local standard annual average rainfall value of 900mm, as received from Met Eireann, was used to determine the rainfall runoff rate. Using the ICPSuDS Input, (Flood Studies Report (FSR)) Method, the rainfall runoff discharging from the greenfield site area that is to be developed in its existing condition has been estimated at $QBAR_{RURAL}$ = 1.2 l/s which is equivalent to 2.4 l/s/ha.

3.3 Proposed Surface Water Drainage Design Strategy

3.3.1 Proposed Surface Water Strategy Overview

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the adjacent local public surface network and public wastewater network respectively. Refer to *Section 5* for details of the proposed wastewater drainage design.

Figure 3.2.1: Existing Site, Aerial Overview (Google Earth)

3.2.2 Existing Surface Water Drainage Infrastructure

There is an existing surface water sewer with an unknown diameter within Airpark Close at western boundary of the site. There is also a 225mm diameter surface water sewer passing at Prospect Drive at eastern boundary of the site.

Refer to *Figure 3.2.2* for an excerpt from public drainage records, which are also provided in ***Appendix A***, for indicative locations of existing infrastructure.

3 SURFACE WATER DRAINAGE

3.1 Overview

Ground levels across the entire site generally fall from high points in the south to low points in the north. The proposed surface water network discharges to an existing 225mm-diameter unknown material surface network located to the north of the site at the Prospect Drive.

The surface water drainage system serving the proposed development will include source control in the form of pervious paving, a piped conveyance system and site control attenuation facility with interception storage. Prior to discharge to the receiving watercourse, all runoff from development on the landholding will pass through a Class 1 petrol interceptor. The basement car park drainage pass through a Class 2 petrol interceptor and will be pumped to the proposed wastewater network at ground level. Rainfall intensity has been increased by 20% as an allowance for Climate Change as per South Dublin County Council Development Plan.

The proposed surface water sewers within the development site will comprise 150mm-diameter to 225mm-diameter pipes designed in accordance with The Building Regulations – Technical Guidance Document Part H and the Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);

The proposed drainage layout is shown on drawing **S627-OCSC-XX-XX-DR-C-0500** and the proposed basement drainage layout is shown on drawing **S627-OCSC-XX-B1-DR-C-0501.**

3.2 Existing Site Drainage

3.2.1 Existing Site Catchment Areas

As detailed in *Section 1.4*, the existing 0.507-hectare site containing a single property located southeast of the site. Refer to *Figure 3.2.1* for aerial image of the proposed site, for context. The site currently grades towards an existing surface network along the west boundary, to which the site drains.

2 SCOPE OF SERVICES REPORT

This report was compiled following a review of available data from the Office of Public Works (OPW), Transport Infrastructure Ireland, the Department of Housing, Planning and Local Government, Irish Water, South Dublin County Council, the client and the wider design team. The report addresses the following services with respect to the proposed development:

- Surface Water Drainage;
- Flood Risk Assessment;
- Wastewater Drainage;
- Potable Water Supply and;
- Traffic and Transportation.

Engineering proposals have been designed with reference to the following:

- South Dublin County Council Development Plan (2016 – 2022);
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03;
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03;
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- The Office of Public Works, the Planning System and Flood Risk Management;
- South Dublin County Council's and Irish Water's Drainage and Watermain Records;
- The SuDS Manual (CIRA C753);
- Design Manual for Urban Roads and Streets (DMURS);
- National Cycle Manual;
- Traffic Signs Manual;
- Infiltration – Manual of Good Practice (CIRIA 156) and;
- The Planning System and Flood Risk Management, Office of Public Works, December 2009.

Figure 1: Site Location

1.4 Site Overview

The subject site comprises approximately 0.507ha and is accessed from the public road on the western boundary. The levels across the site vary with the ground generally sloping from 108.5mAOD in the southwest to 105.5mAOD in the north. The site is currently private property, containing a single house located on the southeast of the site, a road which runs from northeast to northwest of the site, connecting the property to Stocking Lane and the greenfield area to the north of the site.

1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin (OCSC) have been appointed by *MSJA Ltd.* to prepare an Engineering Services Report (ESR) for the proposed residential development at Prospect House, Stocking Lane, Dublin 16. The proposed development is residential and consists of the construction of 22 no. apartments, along with the renovation of the existing gatehouse and Prospect House with parking areas at the basement and communal open spaces.

1.2 Administrative Jurisdiction

The site is located within the administrative jurisdiction of South Dublin County Council and therefore the engineering services design was carried out with reference to the following:

- The South Dublin County Council Development Plan 2016 – 2022.
- Greater Dublin Strategic Drainage Strategy – GSDSD.
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works).

1.3 Site Location

The site is located at Prospect House, Stocking Lane, Dublin 16 and can be accessed via Stocking Lane by driving, walking or public transport. Refer to *Figure 1* for site location context. The site is immediately bound by:

- **North:** Greenfield that is an open area.
- **South:** Prospect View, Residential developments.
- **East:** Prospect Drive, Residential developments.
- **West:** The road Stocking Lane that gives access to the site.

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ENGINEERING SERVICES REPORT

18th May 2022

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NOTICE

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Multidisciplinary
Consulting Engineers

DOCUMENT CONTROL & HISTORY

OCSC Job No.: S627	Project Code	Originator	Zone Volume	Level	File Type	Role Type	Number	Status / Suitability Code	Revision
	S627	OCSC	XX	XX	RP	C	0001	S4	P03

Rev.	Status	Authors	Checked	Authorised	Issue Date
P03	**S4**	**EH**	**MK**	**MOR**	**18.05.2022**
P02	S4	EH	MK	MOR	05.05.2022
P01	S3	EH	MK	MOR	29.04.22

ENGINEERING SERVICES

REPORT

RESIDENTIAL DEVELOPMENT AT

PROSPECT HOUSE

for

MSJA Ltd.

OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

ENGINEERING SERVICES REPORT

RESIDENTIAL DEVELOPMENT AT

PROSPECT HOUSE

FOR MSJA Ltd.

PROJECT NO. S627

18th May 2022

OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

ENGINEERING SERVICES REPORT

RESIDENTIAL DEVELOPMENT AT

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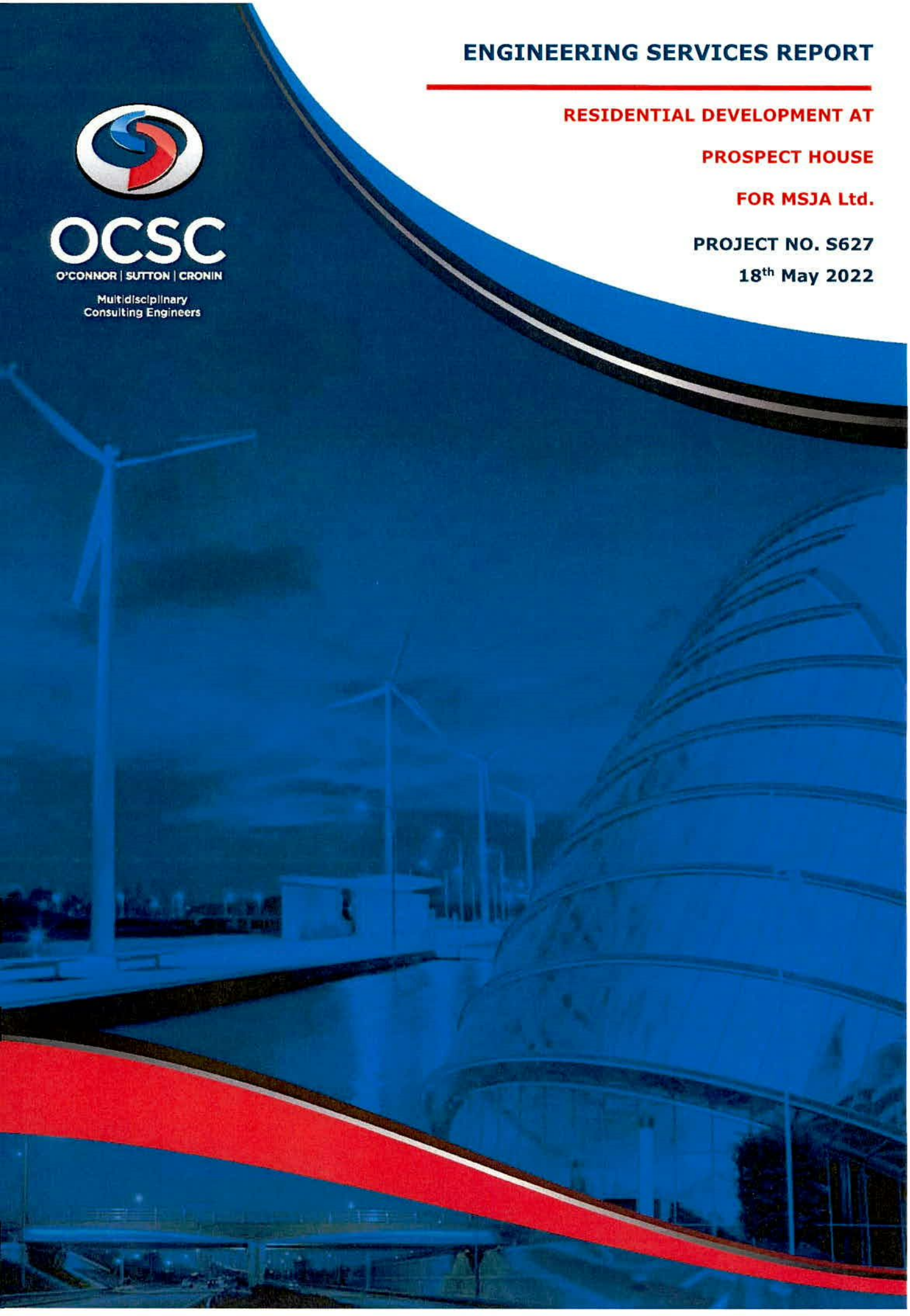
18th May 2022



)0215-PD-22 - Planning Tree Works Schedule

0215 - Prospect House

CHARLES MCCORKELL
ARBORICULTURAL CONSULTANCY

	No. / Species	BS5837 Category	Purpose of works Recommended works	Status
3	1 *Aesculus hippocastanum* Horse Chestnut	B2	To facilitate development Lift low canopy - Specified extent. to 4m above ground level.	Proposed
			Good arboricultural practice Reduce crown by - Specified extent. by 1-1.5m all over.	Proposed
=9	1 *Acer pseudoplatanus* Sycamore	B2	To facilitate development Lift low canopy - Specified extent. to 4m above ground level.	Proposed
			Good arboricultural practice Reduce crown by - Specified extent. 1m lateral reduction, 2m height reduction	Proposed
1	1 *Acer pseudoplatanus* Sycamore	C2	Good arboricultural practice Reduce crown by - Specified extent. 1m lateral reduction, 2m height reduction	Proposed
2	1 *Acer pseudoplatanus* Sycamore	C2	Good arboricultural practice Reduce crown by - Specified extent. 1m lateral reduction, 2m height reduction	Proposed
3	1 *Laburnum anagyroides* Common Laburnum (Golden Chain)	C2	To facilitate development Fell - Ground level.	Proposed
6	1 *Acer pseudoplatanus* Sycamore	C2	To facilitate development Lift low canopy - Specified extent. to 4m above ground level.	Proposed
			Good arboricultural practice Reduce crown by - Specified extent. 1m lateral reduction and 2m height reduction.	Proposed
77	1 *Cornus sp.* Dogwood sp.	C1	To facilitate development Fell - Ground level.	Proposed
	2 *Euonymus sp.* Spindle			
	1 *Fagus sylvatica* Common Beech			
78	1 *Fagus sylvatica f. purpurea* Purple Beech	B1/B2	To facilitate development Fell - Ground level.	Proposed
79	1 *other* Other	C1	To facilitate development Fell - Ground level.	Proposed
	1 *Griselinia sp.*			
	1 *Malus sp.* Apple sp.			
	1 *Rhus typhina* Stag's Horn Sumach			

Table 1 of BS5837 (2012) **Cascade chart for tree quality assessment**

Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention (see note)				
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	* Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) * Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline * Trees infected with pathogens of significance to health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve; see 4.5.7			**RED**
	1 Mainly arboricultural qualities	**2 Mainly landscape qualities**	**3 Mainly cultural values, including conservation**	
Trees to be considered for retention				
Category A **Trees of high quality** with an estimated remaining life expectancy of at least 40 years	Tree that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue).	Trees, groups or woodlands of particular visual importance as arboricutural and/or landscape features.	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture).	**GREEN**
Category B **Trees of moderate quality** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation.	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality.	Trees with material conservation or other cultural value.	**BLUE**
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories.	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits.	Trees with no material conservation or other cultural value.	**GREY**

Tree ID	No.	Species	Height (m)	Stem diameter (cm)	No. of Stems	CROWN SPREAD (m) N	NE	E	SE	S	SW	W	NW	Crown clearance (m)	L.B. (m)	Life stage	Condition Notes	Survey date	RPA (m^2)	RPR (m)	Life expectancy (yrs)	BS Category
Group G120	1	Cotoneaster sp. (Tree Cotoneaster)	4.5	15 AVE	1									0.0		Early Mature	Structural condition Fair. Physiological condition Fair. No significant faults observed. Height and stem diameter are average for group. Mixed group of shrubs located off-site but overhang boundary.	27/04/2022	10.2	1.8	20-40	C1
	1	Ligustrum sp. (Privet sp.)																				
	1	Laurus nobilis (Bay/Bay Laurel/Poets Laurel)																				
Hedge H121	40	Lonicera nitida (Boxleaf Honeysuckle)	2.0	10 AVE	1									0.0		Early Mature	Structural condition Fair. Physiological condition Good. Hedgerow - Neglected / overgrown. Height and stem diameter are average for group.	27/04/2022	4.5	1.2	20-40	C2

Stem **green** Estimated value
Stem **AVE** Average stem diameter for tree groups
Stem **COM** Combined stem diameter in accordance with BS5837
L.B. Height of lowest branch attachment (m) - where relevant

The survey information in this schedule has been gathered following a BS5837 survey for planning purposes. Where hazardous trees have been noted recommendations for works may have been made but this survey cannot be relied upon as a full health and safety assessment of the trees.

Tree ID	No.	Species	Height (m)	Stem diameter (cm)	No. of Stems	CROWN SPREAD (m) N	NE	E	SE	S	SW	W	NW	Crown clearance (m)	L.B. (m)	Life stage	Condition Notes	Survey date	RPA (m^2)	RPR (m)	Life expectancy (yrs)	BS Category
Tree T115	1	Aesculus hippocastanum (Horse Chestnut)	8.0	22	1		5.0		3.0		3.0		3.5	3.0		Early Mature	Structural condition Poor. Physiological condition Poor. Bark exudation. Die-back - Throughout crown. Decline - Evident / observed. Decay / structural defect in crown limb / limbs - Extensive. Decay / structural defect - Principal stems. Ivy or climbing plant. Pruning wounds - Historic. Structural impact - Potential. Weak live growth. Tree is not tagged as located in neighbouring property. Branches overhang into property. Stem approx. 0.5m from wall. Bleeding canker of horse chestnut.	27/04/2022	21.9	2.6	0-10	U
Tree T116	1	Betula pendula (Silver Birch)	16.0	35	1	4.0		3.0		3.0		3.0		4.5		Early Mature	Structural condition Fair. Physiological condition Fair. Branch weight - Heavy. Competition - Adjacent trees. Ivy or climbing plant. Tree is not tagged as located in neighbouring property.	27/04/2022	55.4	4.2	20-40	C2
Tree T117	1	Betula pendula (Silver Birch)	14.0	25	1		5.0		3.5		4.5		4.0	2.5		Early Mature	Structural condition Fair. Physiological condition Good. Competition - Adjacent trees. Ivy or climbing plant. Tree is not tagged as located in neighbouring property.	27/04/2022	28.3	3.0	20-40	C2
Tree T118	1	Betula pendula (Silver Birch)	12.0	19	1	3.0		3.0		2.0		3.0		4.5		Early Mature	Structural condition Fair. Physiological condition Fair. Competition - Adjacent trees. Tree is not tagged as located in neighbouring property.	27/04/2022	16.3	2.3	20-40	C2
Tree T119	1	Betula pendula (Silver Birch)	13.0	25	1	3.0		3.0		3.0		3.0		3.0		Early Mature	Structural condition Fair. Physiological condition Fair. Competition - Adjacent trees. Tree is not tagged as located in neighbouring property.	27/04/2022	28.3	3.0	20-40	B2

Stem **green** Estimated value
Stem **AVE** Average stem diameter for tree groups
Stem **COM** Combined stem diameter in accordance with BS5837
L.B. Height of lowest branch attachment (m) - where relevant

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Tree ID	No.	Species	Height (m)	Stem diameter (cm)	No. of Stems	CROWN SPREAD (m) N	NE	E	SE	S	SW	W	NW	Crown clearance (m)	L.B. (m)	Life stage	Condition Notes	Survey date	RPA (m^2)	RPR (m)	Life expectancy (yrs)	BS Category
Tree T109	1	Aesculus hippocastanum (Horse Chestnut)	9.0	32	1		5.0		4.0		5.0		5.0	4.0		Early Mature	Structural condition Fair. Physiological condition Fair. Pruning wounds - Historic. Structural impact - Potential. Tree is not tagged as located in neighbouring property. Branches overhang into property. Stem approx. 0.5m from wall.	27/04/2022	46.3	3.8	20-40	C2
Tree T110	1	Betula pendula (Silver Birch)	12.0	28	1		4.5		3.5		2.0		3.0	3.0		Early Mature	Structural condition Fair. Physiological condition Fair. Competition - Adjacent trees. Deadwood - Minor. Tree is not tagged as located in neighbouring property.	27/04/2022	35.5	3.4	20-40	B2
Tree T111	1	Aesculus hippocastanum (Horse Chestnut)	10.0	22	1		4.5		2.5		2.5		2.5	3.0		Early Mature	Structural condition Fair. Physiological condition Fair. Ivy or climbing plant. Pruning wounds - Historic. Structural impact - Potential. Tree is not tagged as located in neighbouring property. Branches overhang into property. Stem approx. 0.5m from wall.	27/04/2022	21.9	2.6	20-40	C2
Tree T112	1	Betula pendula (Silver Birch)	9.0	15	1		2.0		2.0		2.0		2.0	5.0		Early Mature	Structural condition Fair. Physiological condition Fair. Competition - Adjacent trees. Deadwood - Minor. Ivy or climbing plant. Suppressed crown - Minor. Tree is not tagged as located in neighbouring property.	27/04/2022	10.2	1.8	10-20	C2
Tree T113	1	Aesculus hippocastanum (Horse Chestnut)	9.0	22	1		3.0		3.0		2.0		3.0	2.0		Early Mature	Structural condition Fair. Physiological condition Fair. Decay / structural defect in crown limb / limbs - Minor. Ivy or climbing plant. Pruning wounds - Historic. Structural impact - Potential. Tree is not tagged as located in neighbouring property. Branches overhang into property. Stem approx. 0.5m from wall.	27/04/2022	21.9	2.6	10-20	C2
Tree T114	1	Betula pendula (Silver Birch)	8.0	22	1	4.0		2.0		2.0		3.0		2.5		Early Mature	Structural condition Fair. Physiological condition Fair. Competition - Adjacent trees. Ivy or climbing plant. Leaning trunk - Minor. Tree is not tagged as located in neighbouring property.	27/04/2022	21.9	2.6	20-40	C2

Stem **green** Estimated value
Stem **AVE** Average stem diameter for tree groups
Stem **COM** Combined stem diameter in accordance with BS5837
L.B. Height of lowest branch attachment (m) - where relevant

The survey information in this schedule has been gathered following a BS5837 survey for planning purposes. Where hazardous trees have been noted recommendations for works may have been made but this survey cannot be relied upon as a full health and safety assessment of the trees.

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