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CIVIL ENGINEERING REPORT

FOR

ELECTRIC VEHICLE FAST-CHARGIN HUB & COFFEE DRIVE-THRU FACILITY AT TOOTENHILL, RATHCOOLE, CO. DUBLIN

SOUTH DUBLIN COUNTY COUNCIL
REG. REF.: SD22A/0114

ISSUED FOR COMPLIANCE CONDITION 10

P3644-Rep C000

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Document Control:

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Client:	**Petrogas Group Ltd**
Project No:	**3644**
Address:	**Electric Vehicle Fast-Charging Hub & Coffee Drive-Thru Facility at Tootenhill, Rathcoole, Co. Dublin**
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1 Introduction

JA Gorman Consulting Engineers Ltd were requested to deal with the civil engineering elements of the planning application (condition 10 compliance) for Electric Vehicle Fast-Charging Hub & Coffee Drive-Thru Facility at Tootenhill, Rathcoole, Co. Dublin

This report should be read in conjunction with all other planning documents and drawings.

2 Proposed storm water disposal system

Proposed storm water attenuation has been designed for the 100-year return period plus 20% increase in rainfall depth for climate change.

SuDS is a fundamental change in the overall approach to drainage design with the primary aim of replicating the natural processes. This involves incorporating source control techniques which endeavour to mimic the natural movement of storm water from a development, reducing flood risk downstream, enhancing water quality and provide an improved environment.

To achieve this, it is proposed that the following systems would be adopted as part of the scheme:

- Permeable Pavement – system A – total infiltration
- Shallow Infiltration Blanket – system A – total infiltration

For details, please refer to attached drawing PC3644-C004.

3 Met Eireann Return Period Rainfall Depths for sliding Durations

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 300924, Northing: 226418,

	Interval		Years									
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100
5 mins	2.7,	3.9,	4.5,	5.5,	6.2,	6.7,	8.4,	10.4,	11.8,	13.6,	15.4,	16.7
10 mins	3.7,	5.4,	6.3,	7.6,	8.6,	9.3,	11.7,	14.5,	16.4,	19.0,	21.4,	23.2
15 mins	4.4,	6.3,	7.4,	9.0,	10.1,	11.0,	13.8,	17.1,	19.3,	22.4,	25.2,	27.3
30 mins	5.8,	8.3,	9.7,	11.8,	13.2,	14.3,	18.0,	22.2,	25.0,	29.0,	32.6,	35.3
1 hours	7.7,	11.0,	12.8,	15.5,	17.3,	18.8,	23.5,	28.9,	32.5,	37.6,	42.1,	45.7
2 hours	10.2,	14.5,	16.8,	20.4,	22.7,	24.6,	30.7,	37.6,	42.3,	48.8,	54.6,	59.1
3 hours	12.1,	17.1,	19.8,	23.9,	26.7,	28.8,	35.9,	43.9,	49.3,	56.8,	63.5,	68.7
4 hours	13.6,	19.2,	22.2,	26.8,	29.8,	32.2,	40.1,	49.0,	54.9,	63.3,	70.7,	76.4
6 hours	16.0,	22.6,	26.1,	31.4,	35.0,	37.8,	46.9,	57.2,	64.1,	73.7,	82.2,	88.9
9 hours	18.9,	26.6,	30.7,	36.8,	41.0,	44.3,	54.8,	66.8,	74.7,	85.8,	95.7,	103.4
12 hours	21.3,	29.8,	34.4,	41.3,	45.9,	49.5,	61.3,	74.6,	83.3,	95.6,	106.6,	115.1
18 hours	25.1,	35.1,	40.4,	48.4,	53.8,	58.0,	71.7,	87.1,	97.2,	111.4,	124.1,	133.8
24 hours	28.2,	39.4,	45.4,	54.3,	60.3,	64.9,	80.1,	97.2,	108.4,	124.2,	138.2,	149.0
2 days	35.5,	48.1,	54.7,	64.4,	70.9,	75.9,	91.9,	109.6,	121.1,	137.1,	151.1,	161.8
3 days	41.5,	55.3,	62.4,	72.8,	79.7,	85.0,	101.8,	120.2,	132.1,	148.4,	162.7,	173.6
4 days	46.8,	61.6,	69.2,	80.2,	87.4,	93.0,	110.5,	129.6,	141.8,	158.6,	173.2,	184.2
6 days	56.2,	72.7,	81.1,	93.2,	101.0,	107.0,	125.8,	146.1,	159.0,	176.5,	191.7,	203.2
8 days	64.7,	82.7,	91.7,	104.6,	113.0,	119.4,	139.3,	160.6,	174.1,	192.4,	208.1,	220.0
10 days	72.5,	91.8,	101.4,	115.2,	124.0,	130.7,	151.7,	173.9,	187.9,	206.8,	223.0,	235.2
12 days	79.9,	100.4,	110.5,	125.0,	134.3,	141.3,	163.1,	186.2,	200.7,	220.2,	236.9,	249.4
16 days	93.7,	116.3,	127.5,	143.2,	153.2,	160.8,	184.2,	208.8,	224.1,	244.7,	262.2,	275.3
20 days	106.7,	131.2,	143.1,	160.0,	170.7,	178.8,	203.6,	229.5,	245.6,	267.1,	285.3,	299.0
25 days	122.1,	148.6,	161.5,	179.6,	191.1,	199.7,	226.1,	253.4,	270.4,	293.0,	312.0,	326.2

4 Storm water hydraulic calculations – Infiltration Blanket

Infiltration rate:	0.00030	m / sec	=	1.080	m / h
n - total porosity				0.50	
q - infiltration coefficient:				1.080	m / h
A_D - area to be drained (effective area):				1,001.0	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				50.0	m^2
R - drainage ratio = A_D/A_b				18.02	

$H_{max} = (D \times (R \times I - q))/n$

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 300924, Northing: 226418	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0200	0.2405	0.542
0.2	0.0278	0.1670	0.643
0.3	0.0328	0.1310	0.641
0.5	0.0424	0.0847	0.446
1.0	0.0548	0.0548	- 0.184
2.0	0.0709	0.0355	- 1.764
3.0	0.0824	0.0275	- 3.509
4.0	0.0917	0.0229	- 5.336
6.0	0.1067	0.0178	- 9.116
9.0	0.1241	0.0138	- 14.969
12.0	0.1381	0.0115	- 20.943
18.0	0.1606	0.0089	- 33.094
24.0	0.1788	0.0075	- 45.397
48.0	0.1942	0.0040	- 96.683
72.0	0.2083	0.0029	- 148.013
96.0	0.2210	0.0023	- 199.395
144.0	0.2438	0.0017	- 302.253
192.0	0.2640	0.0014	- 405.206
240.0	0.2822	0.0012	- 508.229
288.0	0.2993	0.0010	- 611.295
384.0	0.3304	0.0009	- 817.535
480.0	0.3588	0.0007	- 1,023.870
600.0	0.3914	0.0007	- 1,281.894

From table above, H_{max} is: 0.643 m

Half - emptying time check T = (n x Hmax) / (2 x q) 0.15 hour

5 Storm water hydraulic calculations – Permeable Pavement – E-car bays

Infiltration rate:	0.00030	m / sec	=	1.080 m / h
n - total porosity				0.30
q - infiltration coefficient:				1.080 m / h
A_D - area to be drained (effective area):				126.3 m^2
R - Run-off Co-efficient:				0.90
A_b - base area of infiltration system:				83.3 m^2
R - drainage ratio = A_D/A_b				1.36

$H_{max} = (D \times (R \times I - q))/n$

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 300924, Northing: 226418	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 30% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0200	0.2405	- 0.209
0.2	0.0278	0.1670	- 0.473
0.3	0.0328	0.1310	- 0.751
0.5	0.0424	0.0847	- 1.607
1.0	0.0548	0.0548	- 3.351
2.0	0.0709	0.0355	- 6.877
3.0	0.0824	0.0275	- 10.425
4.0	0.0917	0.0229	- 13.983
6.0	0.1067	0.0178	- 21.115
9.0	0.1241	0.0138	- 31.836
12.0	0.1381	0.0115	- 42.572
18.0	0.1606	0.0089	- 64.070
24.0	0.1788	0.0075	- 85.587
48.0	0.1942	0.0040	- 171.917
72.0	0.2083	0.0029	- 258.253
96.0	0.2210	0.0023	- 344.595
144.0	0.2438	0.0017	- 517.291
192.0	0.2640	0.0014	- 689.999
240.0	0.2822	0.0012	- 862.716
288.0	0.2993	0.0010	- 1,035.439
384.0	0.3304	0.0009	- 1,380.898
480.0	0.3588	0.0007	- 1,726.368
600.0	0.3914	0.0007	- 2,158.220

From table above, H_{max} is: - 0.209 m

Half - emptying time check T = (n x Hmax) / (2 x q) - 0.03 hour

6 Storm water hydraulic calculations – Permeable Pavement – at Drive-Thru Building

Infiltration rate:	0.00030	m / sec	=	1.080	m / h
n - total porosity				0.30	
q - infiltration coefficient:				1.080	m / h
A_D - area to be drained (effective area):				287.0	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				200.9	m^2
R - drainage ratio = A_D/A_b				1.29	

$H_{max} = (D \times (R \times I - q))/n$

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 300924, Northing: 226418	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 30% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0200	0.2405	- 0.214
0.2	0.0278	0.1670	- 0.481
0.3	0.0328	0.1310	- 0.760
0.5	0.0424	0.0847	- 1.618
1.0	0.0548	0.0548	- 3.365
2.0	0.0709	0.0355	- 6.896
3.0	0.0824	0.0275	- 10.447
4.0	0.0917	0.0229	- 14.007
6.0	0.1067	0.0178	- 21.143
9.0	0.1241	0.0138	- 31.868
12.0	0.1381	0.0115	- 42.608
18.0	0.1606	0.0089	- 64.112
24.0	0.1788	0.0075	- 85.634
48.0	0.1942	0.0040	- 171.968
72.0	0.2083	0.0029	- 258.307
96.0	0.2210	0.0023	- 344.653
144.0	0.2438	0.0017	- 517.355
192.0	0.2640	0.0014	- 690.069
240.0	0.2822	0.0012	- 862.790
288.0	0.2993	0.0010	- 1,035.517
384.0	0.3304	0.0009	- 1,380.984
480.0	0.3588	0.0007	- 1,726.462
600.0	0.3914	0.0007	- 2,158.322

From table above, H_{max} is: - 0.214 m

Half - emptying time check $T = (n \times Hmax) / (2 \times q)$ - 0.03 hour

7 Storm water hydraulic calculations – Permeable Pavement – Parking

Infiltration rate:	0.00030	m / sec	=	1.080	m / h
n - total porosity				0.30	
q - infiltration coefficient:				1.080	m / h
A_D - area to be drained (effective area):				139.0	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				97.3	m^2
R - drainage ratio = A_D/A_b				1.29	
$H_{max} = (D \times (R \times I - q))/n$					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 300924, Northing: 226418	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 30% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0200	0.2405	- 0.214
0.2	0.0278	0.1670	- 0.481
0.3	0.0328	0.1310	- 0.760
0.5	0.0424	0.0847	- 1.618
1.0	0.0548	0.0548	- 3.365
2.0	0.0709	0.0355	- 6.896
3.0	0.0824	0.0275	- 10.447
4.0	0.0917	0.0229	- 14.007
6.0	0.1067	0.0178	- 21.143
9.0	0.1241	0.0138	- 31.868
12.0	0.1381	0.0115	- 42.608
18.0	0.1606	0.0089	- 64.112
24.0	0.1788	0.0075	- 85.634
48.0	0.1942	0.0040	- 171.968
72.0	0.2083	0.0029	- 258.307
96.0	0.2210	0.0023	- 344.653
144.0	0.2438	0.0017	- 517.355
192.0	0.2640	0.0014	- 690.069
240.0	0.2822	0.0012	- 862.790
288.0	0.2993	0.0010	- 1,035.517
384.0	0.3304	0.0009	- 1,380.984
480.0	0.3588	0.0007	- 1,726.462
600.0	0.3914	0.0007	- 2,158.322

From table above, H_{max} is: - 0.214 m

Half - emptying time check T = (n x Hmax) / (2 x q) - 0.03 hour

8 Storm water pipe network hydraulic calculations

Rainfall Intensity roof =	75	mm/hr	RSDW, DOE, 1998, 3.4
Rainfall Intensity paved =	50	mm/hr	RSDW, DOE, 1998, 3.4
Storm Return Period =	5	years	RSDW, DOE, 1998, Table 3.1
Self cleansing Velocity =	0.8-3	m/s	RSDW, DOE, 1998, 3.4
Roof Vol. run-off coeffiecient =		0.9	
Paved Vol. run-off coeffiecient =		0.9	
Pipe Roughness K_s =	0.6	mm	

Pipe No.	Impermeable Area (A_p)		Gradient	Diameter	Actual Rate of Flow	Accumulative Rate of Flow	Discharge Velocity	Capacity Full bore flow	Full Bore Velocity	Proportional flow	Discharge Velocity	Proportional Depth
	Roof (A_{p1})	Paved (A_{p2})			Q	Q_t	v	Q_p	v_p	Q/Q_p		
	m^2	m^2	1 in	mm	l/s	l/s	m/s	l/s	m/s	OK?	OK?	OK?
S1-S2-S3	225	500	60	225	10.5	10.5	1.24	67.2	1.69	OK	OK	OK
S4-S5		276	20	225	3.5	3.5	1.32	116.7	2.94	OK	OK	OK

9 Storm water pipe network levels

STRUCTURE ID	COVER LEVEL	ENTRY INVERT LEVEL	INVERT LEVEL	DISTANCE	FALL	PIPE INTERNAL DIAMETER	STRUCTURE DEPTH
(X)	m	m	m	m	1: x	mm	m
S1	126.771		125.371				1.400
S2	126.778	125.016	125.016	21.3	60	225	1.762
S3	125.700	124.959	124.700	3.4	60	225	1.000
S4	126.400	124.959	124.700	17.2	ZERO	225	1.700
S5	126.841		125.409				1.432
S4	126.400	124.959	124.700	9.0	20	225	1.700

10 Proposed Roadstone Cluse 505 type B filter material (or similar approved) with min 50% free volume / voids volume for Infiltration Blanket

DETERMINATION OF LOOSE/COMPACTED BULK DENSITY EN 1097-3: 1998

Sample Ref.	:	Cl. 505 Type B Filter material
Supplier	:	Roadstone - Ryans Quarry Ennis
Mass of sample tested	:	20160.0g
Artificially heated before test	:	Unknown
Method of Test	:	EN 1097-3: 1998

Results:

Loose Bulk Density	;	1.36 Mg/m^3
Voids content	;	50 %

Appendix A – BRE Digest 365 Infiltration Test

JA Gorman
consulting engineers
project managers

Infiltration Test Result

Project No. 3644
Site Applegreen Rathcoole
Re: Infiltration Test
Date 07 December 2023
Engineer Aidan O'Donoghue, BE MIEI CEng

The infiltration test was carried out in accordance with BRE Digest 365 "Soakaway Design".
3 no. tests were completed on site and the slowest time for water to drop was used in the calculations.

Test Pit Geometry

Test Depth (m BGL)		1.5	m
Length of Test Pit	*lp*	0.350	*m*
Width of Test Pit	*wp*	0.350	*m*
Depth of Test Pit	*dp*	0.600	*m*

Ground Water Level — Not observed at 2.5m bfgl.

Workings:

Effective Storage Volume of Test Pit	*Vp75-25*	0.037	m^3	*(Lp x Wp x Dp) x 0.5*
Effective Internal Surface Area of Test Pit	*Ap50*	0.910	m^2	*(2(Lp + Wp) x Dp x 0.5)+(Lp x Dp)*
Time for Drop in Water Level thru Effective Depth	*Tp75-25*	135	*s*	*(slowest of Field Observations)*

Soil Infiltration Rate — *f* — **0.00030** *m/s* — *[(Vp75-25) / (Ap50 x Tp75-25)]*

Site Photos