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CONSULTING ENGINEERS
CIVIL | STRUCTURAL | PROJECT MANAGEMENT

SERVICES REPORT

Including :
Proposed Road layout
Proposed Surface Water Discharge
Proposed Foul Water Discharge
Proposed Water Suppy

Project Reference: Proposed Housing Project At Poulavone, Ballincollig

Client: Cork City Council

Project No.: 541000

Design By: B.A. & D.T.

Date:Jan 2020

List of Contents

Appendices:-

-BRE365 report with appendices by Tim O'Connor Engineering

Introduction

The subject lands of the application are located to the southwest of the Poulavone roundabout on the eastern end of Ballincollig village. The site is a greenfield vacant site covered by scrub vegetation.

The estate known as Inniscarra view is immediately to the west of the site. There are two cul de sacs in Inniscarra view, Hawthorn Avenue to the north and Sweet Briar Lane to the south, which are proposed to service this development.

The storm sewers serving Inniscarra View are too high to permit connection by gravity from the proposed site. There is a storm sewer along the N22 to the east of the site but permission to connect to this sewer has not been forthcoming from TII. Therefore it is proposed to dispose of the surface water on site by means of a large soak away.

The foul sewers serving Inniscarra View are also to high to permit connection by gravity from the proposed site. It is proposed to install a type 3 pumping station in the north east corner of the proposed site and pump the foul sewage to a new discharge manhole at the end of Hawthorn Avenue. From there it will discharge by gravity to the existing foul sewer in Inniscarra View.

It is proposed to connect to the new watermain to existing watermains in Inniscarra View, at both Sweet Briar Lane and Hawthorn Avenue.

The roads network for the proposed development are designed in accordance with the DMURS Manual.

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Project				Job Ref.	
Proposed Housing at Ballincollig, Cork				0541000	
Section				Sheet no./rev	
Surface Water Disposal					
Calc. By	Date	Chck'd by	Date	App'd by	Date
d.t.	Sept'19	BA	Jan 20		

Surface water runoff

Exercise in looking at surface water drainage "effective area" runoff for each storm water pipe length.
Areas to be included in the "effective area" are surface areas of roofs, paths, roads, parking bays, lawns, gardens & green surfaces.

An Impermeabilty factor of 1.0 is used for each surface:

Manhole sections	Total Effective Runoff Area
S01-S02	1590 m^2
S02-S03	192 m^2
S03-SO4	1642 m^2
S04-S05	2000 m^2
S06-S05	1616 m^2
S05-S07	2282 m^2
S07-S08	779 m2
S09-S10	1020 m2
S10-S11	148 m2
S11-S12	1127 m2
S12-S08	330 m2
S8-S13	840 m2
S13-S Tank	112 m2

Overall Effective Runoff = Total Impermeable area = Ap = = **13,678 m2**

Proposed to use Infiltration The Pluvial Cube system which consists of modular polypropylene units, low flow maintenance and self-cleaning channels.

Note prior to discharge to the soakaway, the rainwater runoff from the proposed overall development is proposed to go through a hydrocarbon interceptor & silt trap.

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d.t.	Sept'19	BA	Jan 20		

Sewers carrying domestic surface water from this proposed housing developments shall have a sewer minimum sewer size of 225mm and the gradients are to achieve self cleansing velocities.

The soakaway design in accordance with BRE365 is as follows:-

The proposed soakaway is designed for a 100yr storm plus a 10% allowance for climate change. The required depth of the soakaway is 881mm, **therefore a 900mm deep system** is selected to allow for a build-up of two modular crates 450mm deep each.

The soil infiltration rate is taken from the site testing in accordance with BRE365 undertaken by Tim O'Connor Engineering. The site testing report and appendices is appended to this report. Soil conditions encountered were similar across the testing on the site. The infiltration rate of 0.822×10^{-3} is the average infiltration rate across four 1.4m deep BRE tests.

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Design rainfall intensity

Location of catchment area;	Cork
Impermeable area drained to the system;	A = **13678.0** m^2
Return period;	Period = **100** yr
Ratio 60 min to 2 day rainfall of 5 yr return period;	r = **0.220**
5-year return period rainfall of 60 minutes duration;	M5_60min = **17.1** mm
Increase of rainfall intensity due to global warming;	$p_{climate}$ = **10** %

Soakaway / infiltration trench details

Soakaway type;	Rectangular
Minimum depth of pit (below incoming invert);	d = **881** mm
Width of pit;	w = **23000** mm
Length of pit;	l = **23000** mm
Percentage free volume;	V_{free} = **95** %
Soil infiltration rate;	f = **822.□10^{-6}** m/s
Wetted area of pit 50% full;	a_{s50} = l □ d + w □ d = **40545777** mm^2

Table equations

Inflow (cl.3.3.1);	I = M100 □ A
Outflow (cl.3.3.2);	O = a_{s50} □ f □ D
Storage (cl.3.3.3);	S = I - O

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5;	0.30;	5.6;	1.80;	10.1;	137.69;	10.00;	127.69

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Project				Job Ref.	
Proposed Housing at Ballincollig, Cork				0541000	
Section				Sheet no./rev	
Surface Water Disposal					
Calc. By	Date	Chck'd by	Date	App'd by	Date
d.t.	Sept'19	BA	Jan 20		

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
10;	0.44;	8.3;	1.87;	15.5;	211.54;	19.99;	191.55
15;	0.55;	10.3;	1.91;	19.7;	269.27;	29.99;	239.29
30;	0.74;	13.9;	1.97;	27.3;	373.70;	59.97;	313.73
60;	1.00;	18.8;	2.02;	38.0;	519.84;	119.95;	399.89
120;	1.32;	24.8;	2.01;	49.9;	682.86;	239.89;	442.96
240;	1.75;	32.9;	1.95;	64.1;	876.48;	479.79;	396.69
360;	2.14;	40.3;	1.89;	76.0;	1039.49;	719.68;	319.81
600;	2.55;	47.9;	1.83;	87.5;	1196.93;	1199.47;	0.00
1440;	3.52;	66.1;	1.70;	112.5;	1538.30;	2878.72;	0.00

Required storage volume; S_{req} = **442.96** m^3

Soakaway storage volume; $S_{act} = l \square d \square w \square V_{free}$ = **442.96** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume; $t_{s50} = S_{req} \square 0.5 / (a_{s50} \square f)$; = 1hr 50min 48s

PASS - Soakaway discharge time less than or equal to 24 hours

Cl/SfB (29)

NSAI Agrément

IRISH AGRÉMENT BOARD CERTIFICATE NO. 18/0401

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Email: info@alderburgh.com

Pluvial Cube Attenuation and Infiltration Systems

Stürmen Sie Wasser Leitung System

NSAI Agrément (Irish Agrément Board) is designated by Government to carry out European Technical Approvals.

NSAI Agrément Certificates establish proof that the certified products are **'proper materials'** suitable for their intended use under Irish site conditions and in accordance with the **Building Regulations 1997 to 2017.**

PRODUCT DESCRIPTION:
This Certificate relates to the Pluvial Cube attenuation and infiltration system which comprises of modular polypropylene units which, in conjunction with a satisfactory civil engineering design, will act as either an attenuation or infiltration vessel as part of a sustainable drainage system.

The Pluvial Cube system consists of modular polypropylene units, low flow maintenance and self-cleaning channels.

USE:
The product is used as a subsurface stormwater management system, used for sub-surface water storage or as a soakaway to manage rain water run-off from impermeable surfaces. Subject to site conditions and restraints, the Pluvial Cube system modules can be built up to create the volumetric capacity required for

- Attenuation system
- Infiltration system.
- Or a combined attenuation/infiltration system.

MANUFACTURE AND MARKETING:
The product is manufactured and marketed by:

Alderburgh Ltd.
Solution House,
Dane Street,
Rochdale,
OL11 4EZ.
Tel: +44(0)1706 374416 Fax: 01706376785
Email:info@alderburgh.com

Readers are advised to check that this Certificate has not been withdrawn or superseded by a later issue by contacting NSAI Agrément, NSAI, Santry, Dublin 9 or online at http://www.nsai.ie

NSAI Agrément

Part One / Certification 1

1.1 ASSESSMENT

In the opinion of NSAI Agrément, the Pluvial Cube system, if used in accordance with this Certificate, meets the requirements of the Building Regulations 1997 - 2017 as indicated in Section 1.2 of this Certificate.

1.2 BUILDING REGULATIONS 1997 to 2017

REQUIREMENT:

Part A – Structure

A1 - The Pluvial Cube system, as certified in this Certificate, can be designed to ensure that the combined dead and imposed loads are sustained and transmitted to the ground in compliance with CIRIA C737 *Structural and geotechnical design of modular geocellular drainage systems.*

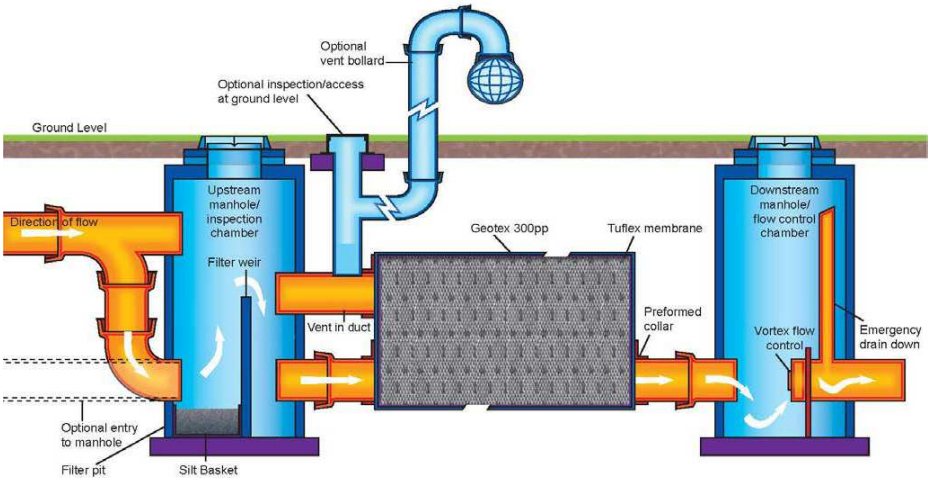
Part D - Materials & Workmanship

D3 – The Pluvial Cube system, as certified in this Certificate, is comprised of proper materials fit for their intended use (See Part 4 of this Certificate).

D1 – The Pluvial Cube system, as certified in this Certificate, meets the requirements of the building regulations for workmanship.

Part H – Drainage and waste water disposal.

H1 - The Pluvial Cube system, as certified in this Certificate, meets the requirements of the building regulations for the adequate disposal of surface water from the building.



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Project				Job Ref.	
Proposed Housing at Ballincollig, Cork				0541000	
Section				Sheet no./rev	
Surface Water Disposal					
Calc. By	Date	Chck'd by	Date	App'd by	Date
d.t.	Sept'19	BA	Jan 20		

Design of collection system

The proposed surface water drainage proposal includes a gravity surface water collection system which incorporates an underground drainage pipe network.

All proposed drainage works is designed to comply with and be carried out in accordance with the current edition of the *Recommendations for site development works for Housing Areas* published by the *Department of Environment and Local Government.*
Drainage works also shall comply with Irish Water/Local Authority requirements.

[1]Job 054100	Proposed Housing at Ballincollig	
DATE: Oct 2019	SHEET NO. 1	MADE BY: D.T.

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Pipe Section	Area m^2 Contributing	Area m^2 Cumulative	Flow Rate (L/sec)50/60X6 0.0139	Pipe Size (mm)	Invert Start	Invert End	Length (m)	Gradient 1 in	Flow Rate Capacity (L/sec)
S01-S02	1590 m^2	1590	22.08	225	28.32	27.87	18	40	105
S02-S03	192 m^2	1782	24.75	225	27.87	27.67	8	40	105
S03-SO4	1642m^2	3424	47.56	225	27.67	27.20	70	150	52
S04-S05	2000 m^2	5424	75.33	225	27.20	25.35	75	43	101
S06-S05	1616 m^2	1616	22.44	225	26.00	25.35	26	40	105
S05-S07	2282 m2	9322	129.47	375	25.35	25.00	50	143	206
S07-S08	779 m2	10101	140.29	375	25.00	24.68	23	80	279
S09-S10	1020 m2	1020	14.17	225	27.10	26.65	17	48	95
S10-S11	148 m2	1168	16.22	225	26.65	26.48	7	40	105
S11-S12	1127m2	2295	31.88	225	26.48	25.00	59	40	105
S12-S08	330 m2	2625	36.46	225	25.00	24.68	48	150	52
S08-S13	840 m2	13566	188.42	375	24.68	24.50	26	144	201
S13- S14	112 m2	13678	189.97	375	24.50	24.35	16	106.	241
S14- oil interceptor/ soakaway	0 m2	13678	189.97	375	24.50	24.35	16	106.	241

Proposed Foul Wastewater discharge

The new site proposal includes 70 dwellings.

There is an existing 225mm sewer in Hawthorn Avenue serving the Inniscarra View estate. The existing sewers in Inniscarra View are too high to permit connection using gravity flow, therefore it is proposed to construct a type 3 pumping station in the northeast corner of the proposed development and install a rising main back to the existing 225mm sewer in Hawthorn Avenue. This is subject to Irish Water approval .Please refer to proposed drainage layout 03. A pre-connection enquiry has been completed to Irish Water and they have confirmed feasibility of a connection to the proposed site.

Sewers carrying domestic wastewater from this proposed housing developments should be designed to carry a minimum wastewater volume of six times dry weather flows (6DWF).

Dry weather flows (DWF) is taken as 600 litres per dwelling (three persons per house and a per capita wastewater flow of 200 litres per head per day).

Total Dry weather flow (DWF) = 70 x 600/24/60/60 = 0.486l/s

Foul Pipe Network is designed to carry a minimum wastewater volume of six times dry weather flows (6DWF).

6 DWF = 6 x 0.49 = 2.95 l/s

Typical Organic Loading :

TABLE 1: INFLOW WASTEWATER CHARACTERISTICS* FROM EPA STUDY (DOMESTIC SOURCES)

Parameter	Mean	Standard Deviation
SS	163	136
BOD_5	168	127
COD	389	310
$O\text{-}PO_4$	7.1	4.2
Total-N	40.6	19.0
NH_3-N	31.5	15.6
NO_3-N	0.25	0.41
NO_2-N	0.04	0.06
pH	7.5	0.5
Total-coli	1×10^8	2×10^8
E-coli	4×10^7	5×10^7

* all results in mg/l, except bacterial counts which are expressed in colony forming units, CFU per 100 ml

TABLE 2.2 TYPICAL CHARACTERISTICS OF URBAN WASTE WATER

Parameter	Concentration mg/l
BOD	100 - 300
COD	250 - 800
Suspended solids	100 - 350
Total nitrogen (as N)	20 - 85
Ammonia (NH_3 as N)	10 - 30
Organic phosphorus (as P)	1 - 2
Inorganic phosphorus (as P)	3 - 10
Oils, fats and grease	50 - 100
Total inorganic constituents (Na, Cl, Mg, S, Ca, K, Si, Fe)	100
Heavy metals (Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn)	<1mg/l each

Proposed Water Supply.

The new site proposal includes 70 dwellings. It is proposed to connect to existing watermains within the Inniscarra View estate.
Please refer to proposed watermain layout.

The water demand includes : Average domestic daily demand in the development is established based on daily per-capita consumption, house occupancy, number of properties. For design purposes the average daily domestic demand is be based on a per-capita consumption of 150 l/person/day and an average occupancy ratio of 2.7 persons per dwelling.

70 dwellings :70x150x2.7

Total average daily demand = 28350 liters

The average day/peak week demand should be taken a 1.25 times the average daily domestic demand.
Total average day/peak demand = 28350x 1.25 = 35437 liters

The peak demand for sizing of the pipe network will normally be 2.1 times the average day, peak week demand.
Total average day/peak demand = 28350x 2.1 = 59535 l/day or 0.689 l/sec

Proposed roads and traffic calming design

This proposed new development is directly to the west of the existing estate Inniscarra View on the eastern side of Ballincollig Village. The proposed development is intended to be served by extending two cul de sacs on Inniscarra View into the site and creating a loop.
Please find attached aerial photo of the site.

The proposal is for 70 dwellings.
Please refer to proposed roads and roads details layout.

There are existing roads Inniscarra View already in place adjacent to the site .
It is proposed to connect the new development to the existing road and footpath network.

All proposed roads to comply with and be carried out in accordance with the current edition of the *Recommendations for site development works for Housing Areas* published by the *Department of Environment and Local Government.* Road works also shall comply with Local Authority requirements.

Proposed traffic calming details have been included and are proposed to be agreed with the Local Authority. Proposed roads and footpaths are to be in line

with DMURS(Design Manual for Urban Roads and Streets).
The internal access roadways to serve the proposed overall development is to be 5.5m and the footpath widths to be 2.0m.
Road alignments and vertical deflections are incorporated as to limit vehicle speeds and facilitate pedestrian movement. Tactile paving is to be provided at uncontrolled crossings.
Turning bays are proposed to be provided.

Car Parking shall be provided. There are 162 car spaces provided in the proposed development broken down as follows:-

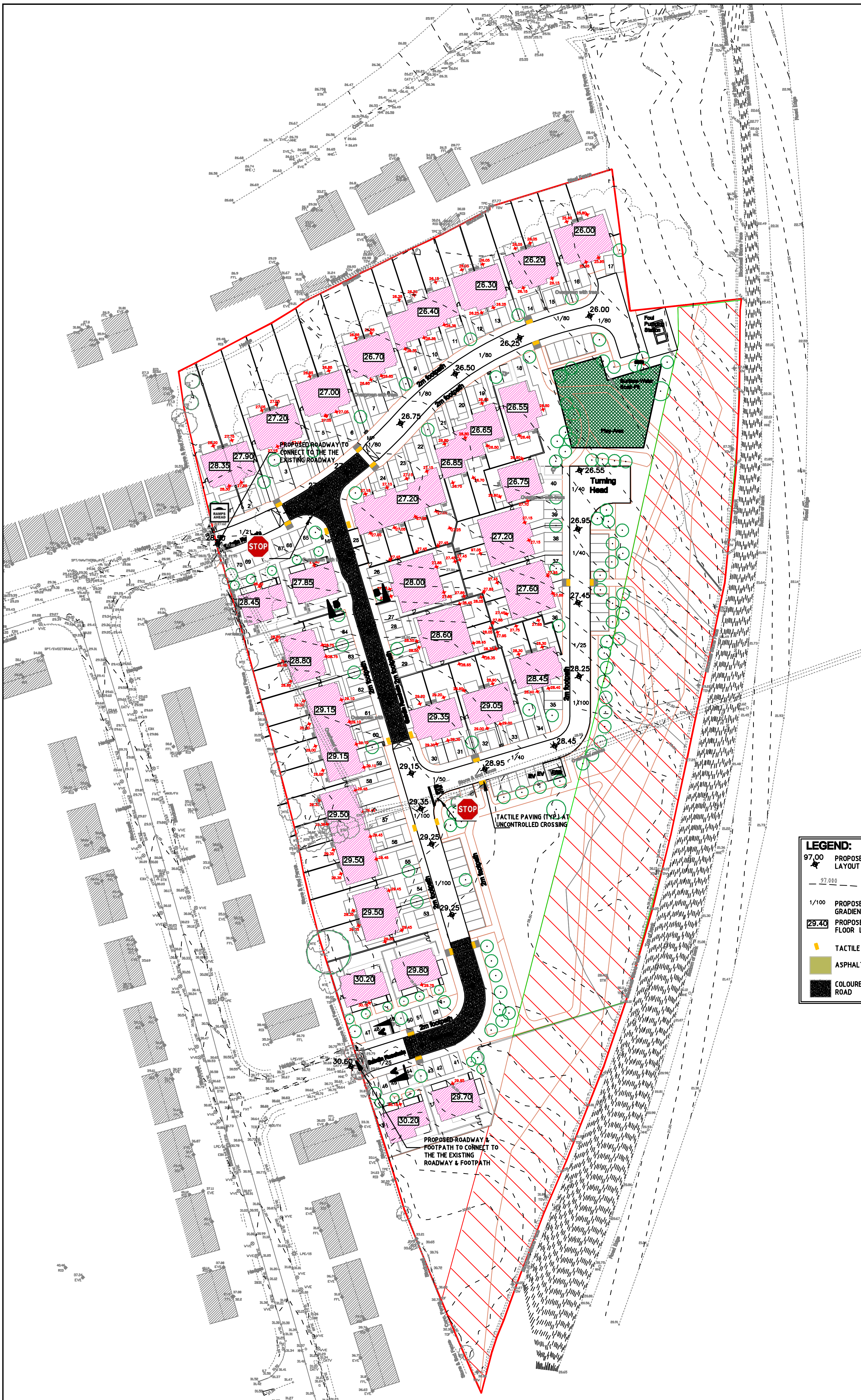
Regular parking space	112	
Disabled p'king space	5	2No. Private & 3 Public
Visitors parking space	32	Including accessible and future provision for 2No. EV charging points
Total dedicated parking		**149**

Road works are proposed to comply with the requirements of "Specification for Road Works" and Cork County Council roads and estates department requirements.

Original Drawing Size A1

Notes

1. This drawing is to be read in conjunction with all relevant engineers and architects drawings and specifications.
2. Do not scale drawings. Use figured dimensions only. All dimensions to be checked on site.
3. All dimensions are in millimetres (mm).
4. Any discrepancies to be reported immediately to the consulting engineer.



LEGEND:

97.00	PROPOSED LEVELS LAYOUT
97.000	EXISTING CONTOUR LAYOUT
1/100	PROPOSED ROAD GRADIENT
29.40	PROPOSED FINISH FLOOR LEVEL
	TACTILE PAVING
	ASPHALT ROAD
	COLOURED ASPHALT ROAD

PROPOSED ROAD & LEVELS LAYOUT
SCALE 1:500

Rev	Date	Drawn	Description	Ch'k'd
PL1	Jan'20	[illegible]	Issued for Planning	BA
T	Mar'19	DT	Issued for Tender	
PL	Oct'19	DT	Issued for Planning	
A	May'19	DT	Issued for Costing	

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Client: Cork City Council

Project: Gairdín Ruachain, Carrigrohane, Ballincollig, Co. Cork

Drawing Title: Proposed Road & Levels Layout

Designed:	Drawn: D.T.	Date: April'19	
Eng Chk:	Dwg. Chk:	Scale: 1:500 @ A1	
Project. No: 0541000			
Drawing No: 01		Status: Planning	Rev: PL1

Original Drawing Size A1

Notes

1. This drawing to be read in conjunction with relevant Architectural, Mechanical/Electrical and Engineers drawings and specifications.
2. All dimensions are in millimetres (mm).
3. All levels refer to Malin Head Datum.
4. Use figured dimensions only. Do not scale from this drawing. All dimensions to be checked on site.
5. Report any discrepancies to Engineer immediately.
6. Surface Water Drainage works should comply with:
   (i) Requirements of BS 8005: Part 1 and IS 332.
   (ii) "Recommendations for Site Development Works for Housing Areas" by Department of the Environment and Local Government 1998.
   (iii) The existing City Council Engineer's Requirements on Site Development Works.
7. Pipes shall be laid with a minimum cover of 1.2m in roads and driveways, 0.9 m in open spaces and footpaths not adjacent to carriageway and 0.9 m in gardens. Where it is not possible to achieve these minimum covers, pipes shall be bedded and surrounded in concrete 150 mm thick subject to the Engineer's approval.
8. Surface Water Drains shall be tested by the following methods:
   (i) Water test
   Surface water sewers shall be tested for a minimum of 30 minutes and the test head of water shall be not less than 1 meter over the crown at the high point and not more than 2 metres of water over the crown at low points of the line under test. Acceptance criteria for the maximum allowable loss of water per hour per 100 lineal metres of pipe shall be as given in Table 7 unless otherwise approved.

   Where the surface water drains fail the appropriate tests, remedial work shall be subject to approval.

   (ii) Air test
   Air shall be pumped into the section of drain under test until a pressure of 100 mm of water is indicated on a U-tube connected to the system. The air pressure shall not fall to less than 75 mm head of water during a period of 5 minutes without further pumping, after a period of stabilisation.

   Failure to pass this test is not conclusive and, when failure does occur, a water test as specified in (i) shall be carried out. Acceptance or rejection of the line under test shall be based on the results of this water test.
9. A CCTV survey of the public storm/foul sewerage systems in the vicinity of the proposed development shall be undertaken prior to commencement and again on completion. The scope of the surveys shall be agreed in writing in advance, with the relevant authorities.
10. No public storm/foul sewer shall be damaged as a result of the proposed development.
11. All drainage shall be separated throughout.
12. Foul sewers shall be tested in accordance with Section 4.10 of Irish Water Code of Practice for Wastewater Infrastructure Connections and Developer Services Document IW-CDS-5030-03.
13. All pipes and fittings to be laid to Irish Water Standards. Please refer to Irish Water Wastewater Infrastructure Standard Details Connections and Developer Services Document Number IW-CDS-5030-01 and Irish Water Code of Practice for Wastewater Infrastructure Connections and Developer Services Document IW-CDS-5030-03.

PROPOSED DRAINAGE LAYOUT

SCALE 1:500

Rev	Date	Drawn	Description	Chk'd
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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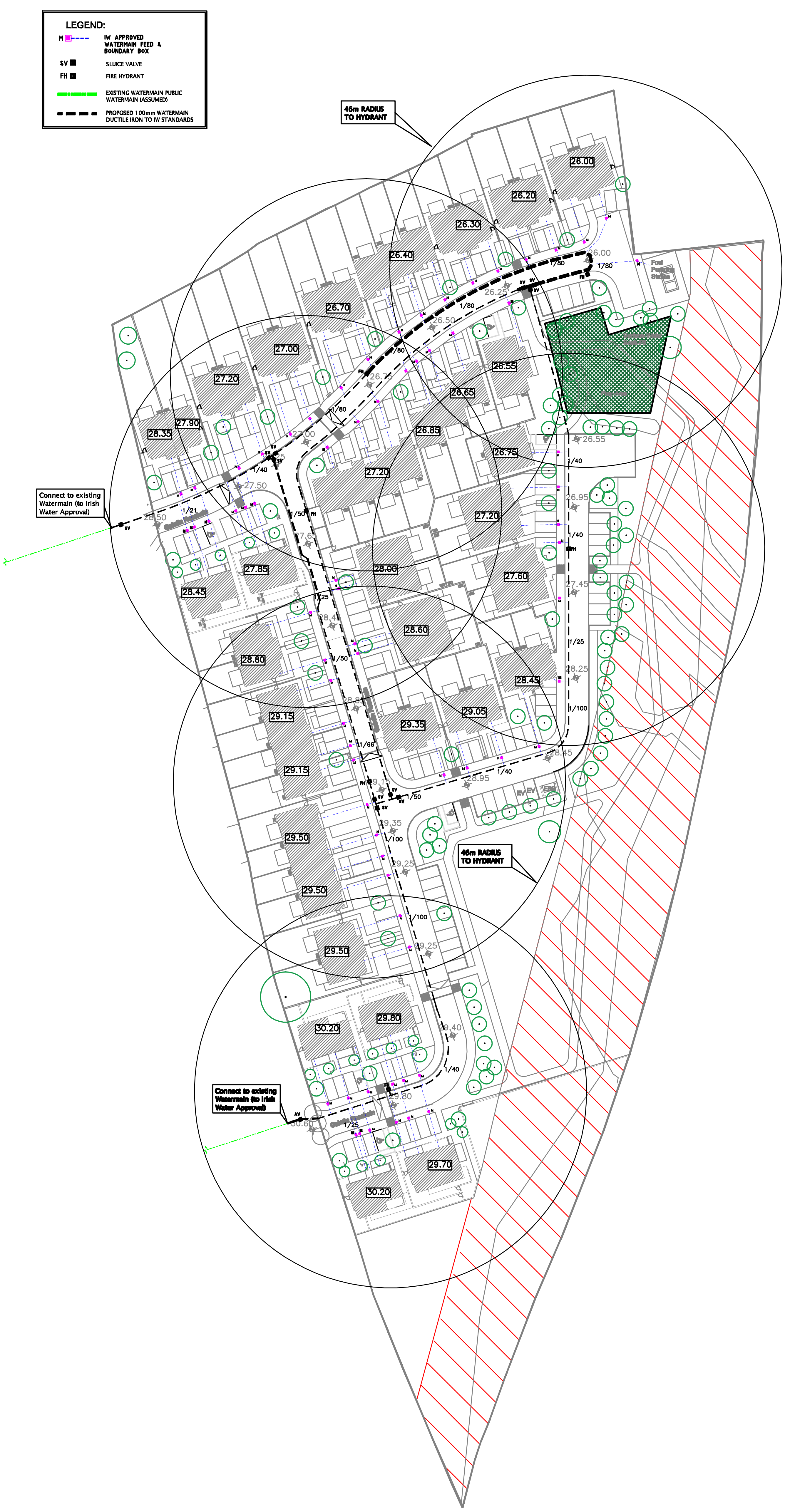
Client: Cork City Council

Project: Gairdín Ruachain, Carrigrohane, Ballincollig, Co. Cork

Drawing Title: Proposed Drainage Layout

Designed:	Drawn: D.T.	Date: April'19	
Eng Chk:	Dwg. Chk:	Scale: 1:500 @ A1	
Project. No: 0541000			
Drawing No: 02		Status: Planning	Rev: PL1



Notes

1. Do not scale drawing. Use figured dimensions only.
2. Report any discrepancies immediately to the Design Team.
3. This drawing to be read in conjunction with all other relevant Architectural, Mechanical/Electrical and Engineering Drawings.
4. All works carried out must comply with the relevant parts of the current Building Regulations and Technical Guidance Documents, ensuring the works are carried out using 'proper materials which are fit for use for which they are intended and for the conditions in which they are used'.
5. All materials used shall be marked in accordance with the EU Construction Product Regulations (CPR) (No. 305/2011). Refer to Annex IV of the Regulations for the list of applicable products.
6. Details of the treatment of all existing water services to the site, shall be agreed with Irish Water.
7. Number of fire hydrants to be agreed with the Fire Officer.
8. All valves, 100mm or greater, shall be anti-clockwise closing.
9. All road and footway water fitting covers, shall be marked to indicate what is underneath.
10. Marker plates shall be installed for all existing and new watermain fittings, on or adjoining the site, to the satisfaction of Irish Water.
11. All watermains and fittings to be laid in accordance with Irish Water Infrastructure Standard Details Document Number IW-CDS-5020-01 and Irish Water Code of Practice for Water Infrastructure Document IW-CDS-5020-03.

Original Drawing Size A1

PROPOSED WATERMAIN LAYOUT

SCALE 1:500

Rev	Date	Drawn	Description	Ch'k'd
T	Nov'19	DT	Issued for Tender	
PL	Oct'19	DT	Issued for Planning	
A	May'19	DT	Issued for Costing	

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W: www.rka.ie

Client: Cork City Council

Project: Gairdín Ruachain, Carrigrohane, Ballincollig, Co. Cork

Drawing Title: Proposed Watermain Layout

Designed:	Drawn: D.T.	Date: April'19
Eng Chk:	Dwg. Chk:	Scale: 1:500 @ A1
Project. No: 0541000		
Drawing No: 03	Status: Planning	Rev: PL1

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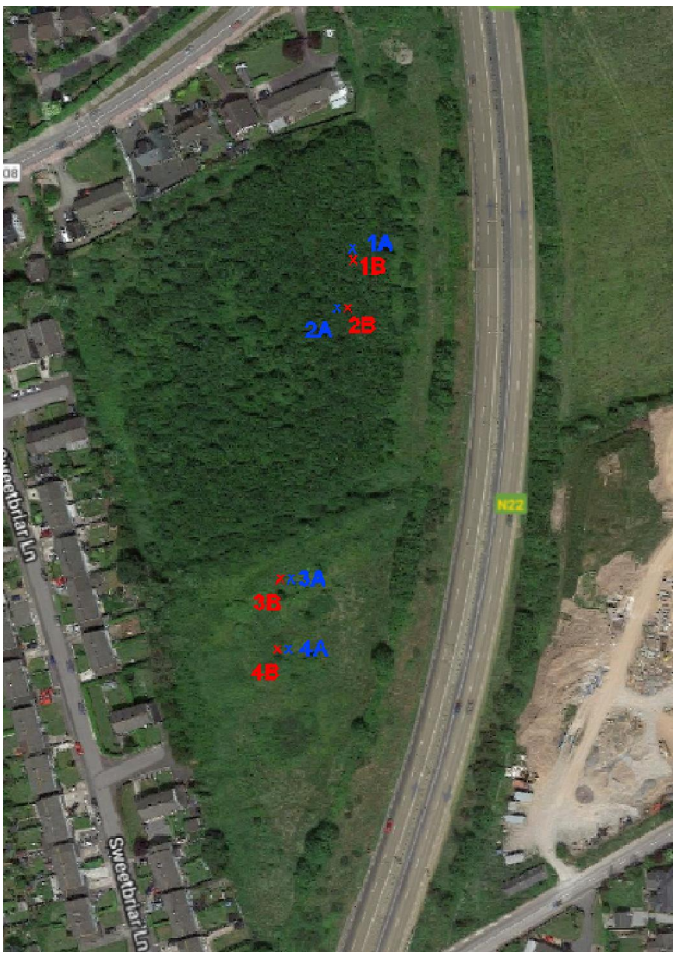
BRE365 Test Report



Client: RKA Consulting Engineers & Cork City Council

Site Address: Poulavane, Ballincollig, Co. Cork

Investigation Date: 28/08/2019

Table of Contents

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1 Scope

In August 2019, Tim O'Connor Engineering Services Limited on behalf of their Clients, RKA Consulting Engineers and Cork City Council, were commissioned to undertake site investigations at Poulavane, Ballincollig, Co. Cork. The site is considered a greenfield site which has become quite overgrown. The purpose of this investigation was to assess the drainage and infiltration characteristics of the site for soakaway design to be completed by others. It is proposed to construct a residential development and associated works at the subject site.

The scope of the task included:

1. Create temporary access from main road to Ballincollig, close to poulavane Roundabout. Restore to previous condition on completion of works.
2. Carry out 4 No. infiltration tests in accordance with BRE365 at depths of 0.9m and 4 No. infiltration tests in accordance with BRE365 at depths of 2.5m (or to top of rock if shallower than 2.5m). Infiltration tests were carried out at the locations depicted on the drawing provided.
3. Prepare a report with the infiltration test result for each trial pit.

2 Desk Study

GSI (Geological Survey of Ireland) Data indicate that a DPUL (Dinantian Pure Unbedded Limestone) Formation underlies the site. A few hundered meters to the Southeast a DPBL (Dinantian Pure Bedded Limestone) Formation is present. The presence of limestone indicates the possibility of karst features. Please refer to Fig. 1 - Appendix D (Desk Study Maps).

GSI Data indicate that the subsoil underlying the site is TDSc (Till derived from Devonian Sandstones). Please refer to Fig. 2 - Appendix D (Desk Study Maps).

GSI Data indicate that the soil (topsoil) underlying the site is AminDW (Acid Brown Earths, Brown Podzolics - Deep Well Drained Mineral - Mainly Acidic). Please refer to Fig. 3 - Appendix D (Desk Study Maps).

3 On-Site Field Works

The on-site field works were completed on the 28th of August 2019 using a 20 ton tracked excavator and a 12m^3 water tanker. The field works were carried out in general accordance with BS 5930 (1999) - Code of Practice for Site Investigation and Part 9 of BS 1377 (1990) - Method of Tests for Soil for Civil Engineering Purposes, *in situ* Tests.

No assessment of levels or elevations was undertaken. No survey of the 'as excavated' trial pits was undertaken and the locations are provided below for reference only.

4 BRE365 Infiltration Tests

3 No. trail pits (1A, 2A & 3A) were excavated to depths of 0.9m bgl (below existing ground level). Under the instruction of Brendan Ahern on-site (RKA Consulting Engineers, trial pit 4A was excavated to a depth of 0.75m bgl. 4 No. trail pits (1B, 2B, 3B & 4B) were excavated to a depth where bedrock was encountered. The depth to bedrock was consistent for each trial pit excavated varying between 1350mm bgl and 1400m bgl across the site. The purpose of excavating the trial pits was to undertake soakaway testing in general accordance with BRE Digest 365 (2007) - Soakaway Design Standards.

Each trial pit was filled with water, to 400mm over the base of the pit, and allowed to drain until almost empty. The time taken for the water to fall from 75% effective depth (300mm over base) to 25% effective depth (100mm over base) was noted. This procedure was repeated three times for each trial pit.

5 On-Site Ground and Groundwater Conditions

Ground conditions encountered on-site were dry and firm under foot. The site was very overgrown with trees, bushes and other vegetation.

Limestone bedrock was encountered at a depth of between 1350mm bgl and 1400mm bgl in the trial pits excavated at the site. The bedrock was overlain by a subsoil and topsoil layer.

No groundwater was encountered in any of the trial pits over the duration of the fieldworks. It should be noted that the duration of fieldwork did not permit the recording of equilibrium groundwater levels for any groundwater water strike. Groundwater conditions observed in the pits are only those over the period of the on-site investigations. Groundwater levels may be subject to seasonal and climatic variations.

6 Infiltration Test Results

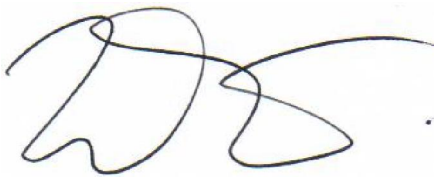
The infiltration test results calculated for each of the trial pits is summarised in Table 1 below. This table should be read in conjunction with Dwg. 1 and Dwg. 2 of Appendix C (Drawings).

Trial Pit No.	Pit Depth (m)	Infiltration Rate (m/s)
1A	0.9	7.06×10^{-4}
1B	1.4	1.61×10^{-4}
2A	0.9	1.54×10^{-3}
2B	1.4	1.32×10^{-3}
3A	0.9	6.29×10^{-4}
3B	1.35	6.96×10^{-4}
4A	0.75	2.22×10^{-3}
4B	1.4	1.11×10^{-3}

Table 1. Infiltration Rate Summary

The results of the infiltration tests for each of the trial pits above indicates that infiltration rates were all very high in relative terms. This indicates a very high permeability of the soil and underlying bedrock. In some cases it was difficult to fill the trail pits, using a 150mm diameter hose from the water tanker, as the water was percolating from the trial pits at such a fast rate. Due to the fact that the underlying bedrock formation is limestone, it is likely that the existence of karst features, in the underlying bedrock, contributed towards the high infiltration rates encountered.

According to SuDS Manual C753 (2015), infiltration viability should be given full consideration where an infiltration rate of 10^{-6} m/s or greater exists on the site (subject to geotechnical and contamination considerations). The values measured at the site are considerably better than this limit. Suitability for the construction of soakaways to control surface (storm) water will be dependent on the areas to be drained and the size available plan area for the proposed soakaways.

Signed: 

Date: 29 August 2019

Tim O' Connor BEng CEng MIEI CEM MSc
Tim O' Connor engineering Services limited

Appendix A - Limitations and Exclusions

1. No responsibility can be held by Tim O' Connor Engineering Services Limited for ground conditions between or outside of exploratory locations.

2. Planning permission and other building control matters are not considered. Inspections do not cover legal rights of ownership of the site on which the dwelling is located.

3. The scope of the works has been defined by others. Tim O' Connor Engineering Services Limited have provided for the interpretation of this information. Additional works may form part of a more detailed investigation. This report may be subject to change where further information becomes available.

4. No account has been taken of potential subsidence or ground movement due to mineral extraction, mining works or karstification below or in proximity to the site, unless specifically addressed.

5. No formal enquiries or investigations were conducted with regard to the potential contamination of the site or neighbouring land.

6. Reports issued shall be for the private and confidential use of the clients for whom the report is undertaken and shall not be reproduced in whole or in part or relied upon by third parties for any use without our express written agreement from Tim O' Connor Engineering Services Limited. Tim O' Connor Engineering Services Limited accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Appendix B - Photographic Record

Trial Pit 1A

Trial Pit 1B

Trial Pit 2A

Trial Pit 2B

Trial Pit 3A

Trial Pit 3B

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Trial Pit 4A

Trial Pit 4B

Appendix C - Drawings

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Original Drawing Size A1

Notes

1. This drawing to be read in conjunction with relevant Architectural, Mechanical/Electrical and Engineers drawings and specifications.
2. All dimensions are in millimetres (mm).
3. All levels refer to Malin Head Datum.
4. Use figured dimensions only. Do not scale from this drawing. All dimensions to be checked on site.
5. Report any discrepancies to Engineer immediately.
6. Surface Water Drainage works should comply with:
   (A) Requirements of IS EN65: Part 1 and IS EN.
   (B) "Recommendations for Site Development Works for Housing Areas" by Department of the Environment and Local Government 1998.
   (C) The existing City Council Engineer's Requirements on Site Development Works.
7. Pipes shall be laid with a minimum cover of 1.2m to roads and driveways. 0.9 m in open spaces and footpaths not adjacent to carriageway and 0.6 m in gardens. Where it is not possible to achieve these minimum covers, pipes shall be bedded and surrounded in concrete 150 mm thick subject to the Engineer's approval.
8. Surface Water Drains shall be tested by the following methods:
   (A) Water test
   Surface water sewers shall be tested for a minimum of 30 minutes and the test head of water shall be not less than 1 meter over the crown at the high point and not more than 2 metres of water over the crown at low points of the line under test. Acceptance criteria for the maximum allowable loss of water per hour per 100 lineal meters of pipe shall be as given in Table 7 unless otherwise approve.

   Where the surface water drains fail the appropriate test, remedial work shall be subject to approval.

   (B) Air test
   Air shall be pumped into the section of drain under test until a pressure of 100 mm of water is indicated on a U-tube connected to the system. The air pressure shall not fall to less than 75-mm head of water during a period of 5 minutes without further pumping, after a period of stabilization.

   Failure to pass this test is not conclusive and, when failure does occur, a water test as specified in (A) shall be carried out. Acceptance or rejection of the line under test shall be based on the results of the water test.
9. A CCTV survey of the public storm/foul sewerage systems in the vicinity of the proposed development shall be undertaken prior to commencement and again on completion. The scope of the surveys shall be agreed in writing in advance, with the relevant authorities.
10. No public storm/foul sewer shall be damaged as a result of the proposed development.
11. All drainage shall be separated throughout.
12. Foul sewers shall be tested in accordance with Section 4.10 of Irish Water Code of Practice for Wastewater Infrastructure Connections and Developer Service Document IW-CDS-5020-03.
13. All pipes and fittings to be laid to Irish Water Standards. Please refer to Irish Water Wastewater Infrastructure Standard Details Connections and Developer Services Document Number IW-CDS-5020-04 and Irish Water Code of Practice for Wastewater Infrastructure Connections and Developer Services Document IW-CDS-5020-03.

SOAKWAY TEST TYPE A LOCATIONS TO BRE 365

SOAKWAY TEST TYPE B LOCATIONS TO BRE 365 @ 0.4m DEPTH FOR PERMEABLE PAVING

NOTE:
MINIMUM 1.5m OR TOP OF ROCK FOR TEST PIT DEPTH FOR SOAKWAY TEST TYPE A.

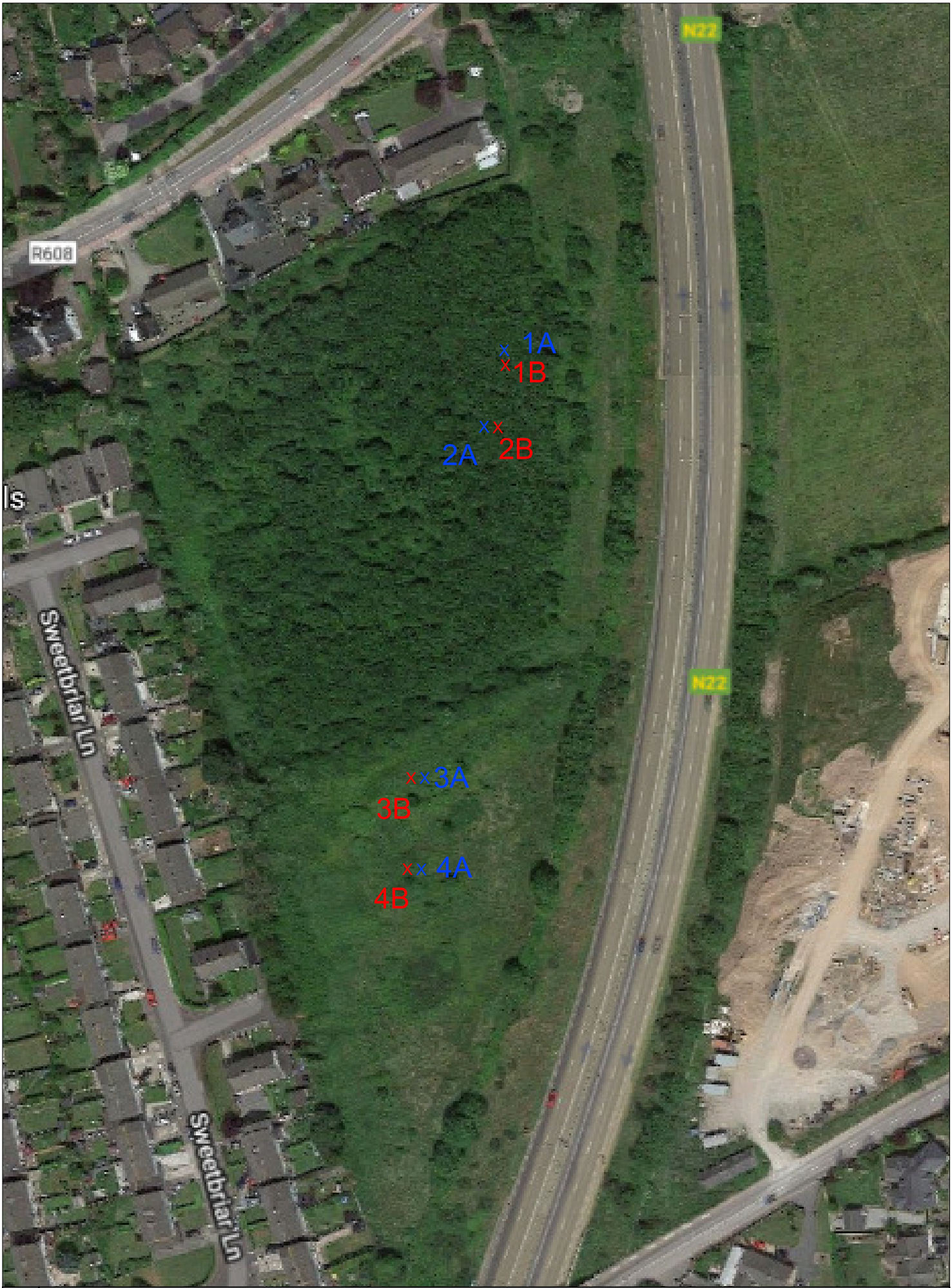
Rev	Date	Drawn	Description	Ch'kd
0	24.07.19	ME	Issued for Information	BA

Client: Cork City Council

Project: Gaelán Beacháin, Carigrohane, Ballincollig, Co. Cork

Drawing Title: Proposed Soakway Location

Designed:	Drawn: ME	Date: July 2019	
Eng Chk:	Dwg Chk: BA	Scale: 1:500 @ A1	1:1000 @ A3
Project No: 0541609			
Drawing No: 100		Status: Information	Rev: 0



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Dwg. 2 - Trial Pit Locations

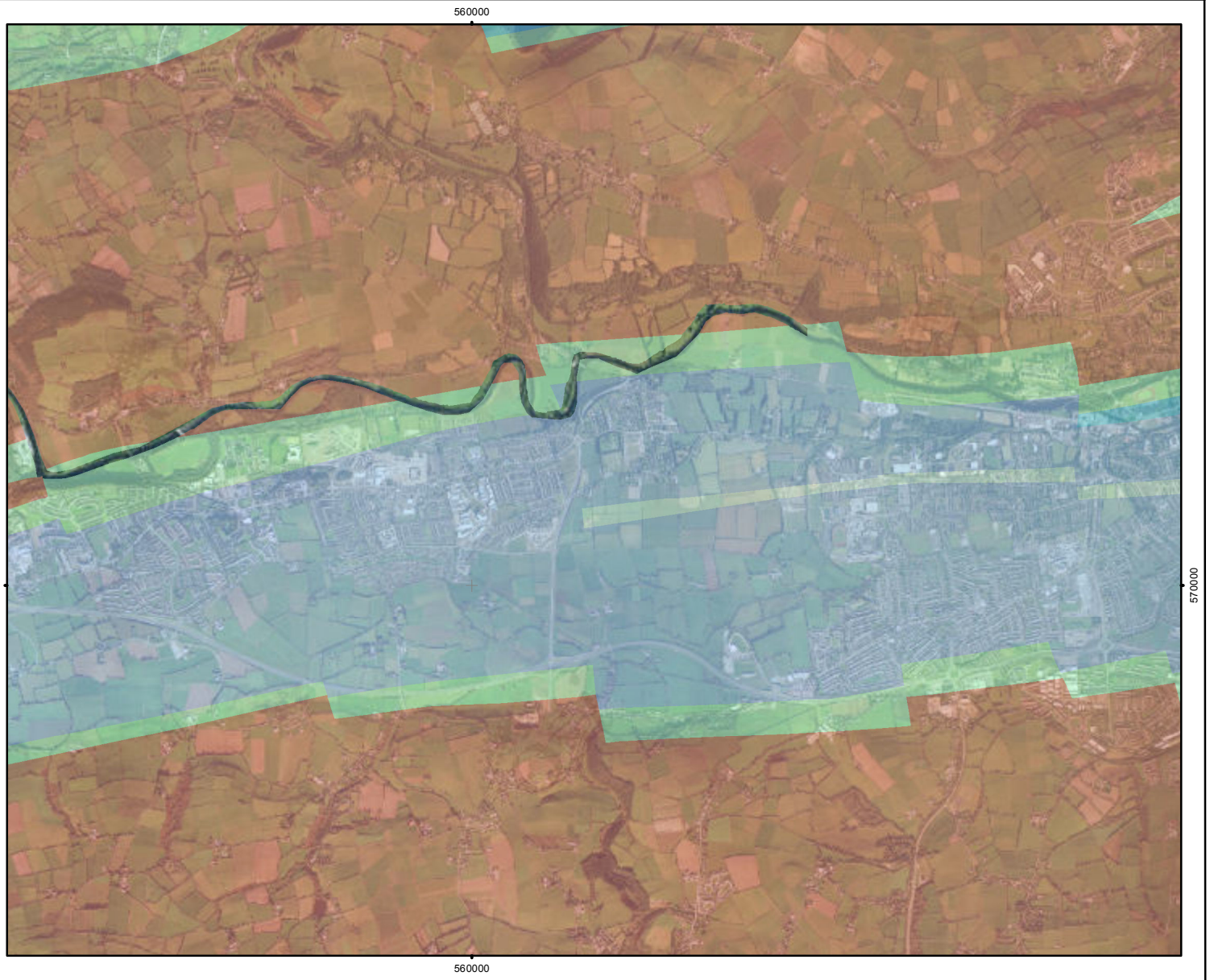
Scale : 1 to 500 @A3

BRE365 testing at Poulavane,
Ballincollig, Co. Cork

Appendix D - Desk Study Maps

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Bedrock Map - Ballincollig Area



Legend

Groundwater Rock Units

- Dinantian Pure Bedded Limestones
- Dinantian Pure Unbedded Limestones
- Dinantian Lower Impure Limestones
- Dinantian Mudstones and Sandstones (Cork Group)
- Devonian Old Red Sandstones

Fig. 1

Scale: 1:50,000

Geological Survey Ireland

N W E S

0 0.35 0.7 1.4 mi
0 0.5 1 2 km

Map Centre Coordinates (ITM) 561,004 570,782
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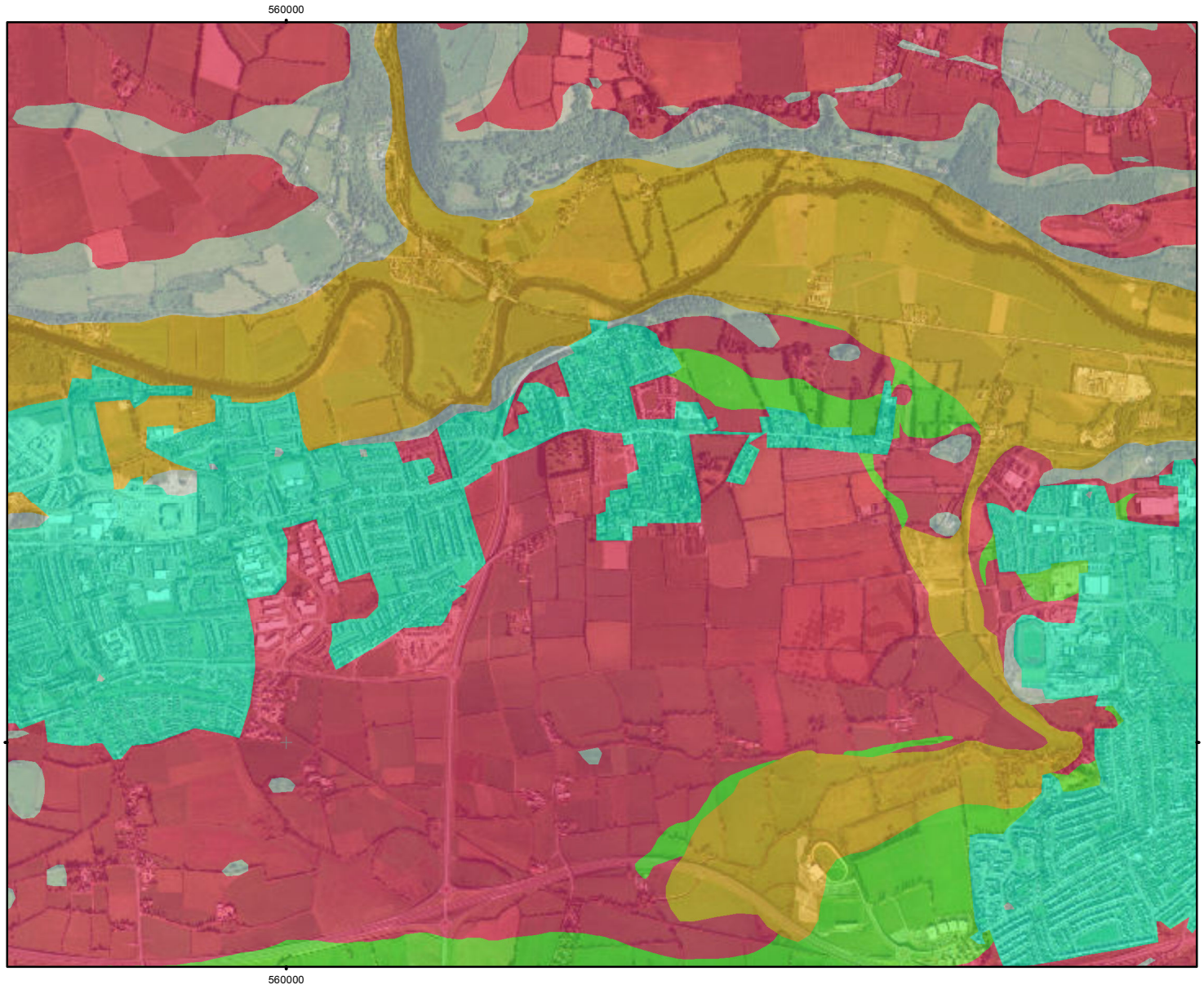
Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Subsoil Map



Legend

Quaternary Sediments

- A, Alluvium
- GDSs, Gravels derived from Devonian sandstones
- Rck, Bedrock outcrop or subcrop
- TDSs, Till derived from Devonian sandstones
- Urban

Scale: 1:25,000

Geological Survey Ireland

N W E S

0 0.175 0.35 0.7 mi
0 0.275 0.55 1.1 km

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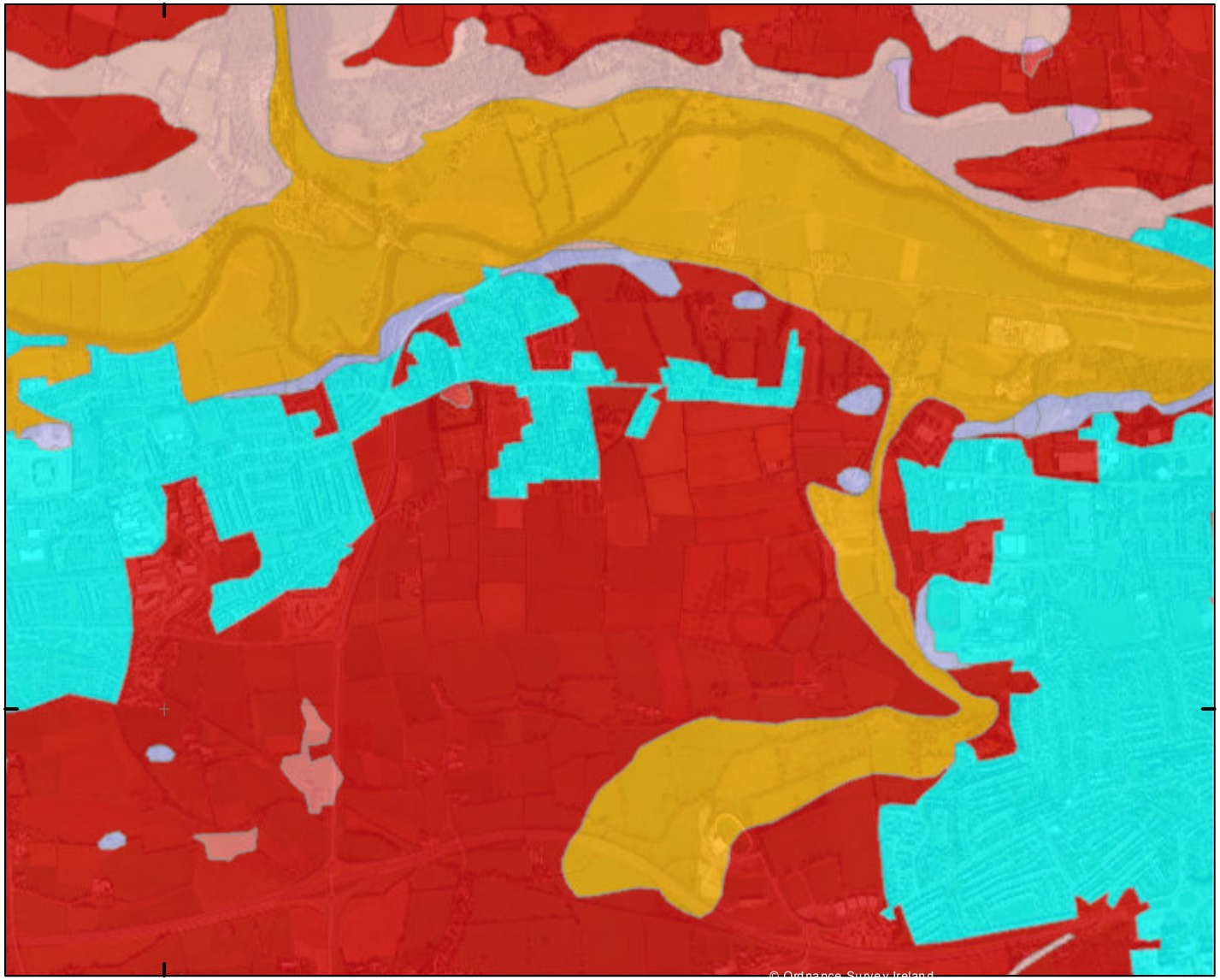
Fig. 2

Soil Map - Ballincollig Area



Scale: 1:25,000

Geological Survey Ireland

PSI Licence

0 0.175 0.35 0.7 mi

0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 561,721 570,846

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Legend

Teagasc Soils

- AminDW - Deep well drained mineral (Mainly acidic)
- AminPD - Mineral poorly drained (Mainly acidic)
- AminPDPT - Peaty poorly drained mineral (Mainly acidic)
- AminSW - Shallow well drained mineral (Mainly acidic)
- AminSP - Shallow poorly drained mineral (Mainly acidic)
- AminSPPT - Shallow peaty poorly drained mineral (Mainly acidic)
- AminSRPT - Shallow, rocky, peaty/non-peatymi... complexes (Mainly acidic)
- BminDW - Deep well drained mineral (Mainly basic)
- BminPD - Mineral poorly drained (Mainly basic)
- BminPDPT - Peaty poorly drained mineral (Mainly basic)
- BminSW - Shallow well drained mineral (Mainly basic)
- BminSP - Shallow poorly drained mineral (Mainly basic)
- BminSPPT - Shallow peaty poorly drained mineral (Mainly basic)
- BminSRPT - Shallow, rocky, peaty/non-peatymi... complexes (Mainly basic)
- BktPt - Blanket peat
- FenPt - Fen peat
- RsPt - Raised Peat
- Cut - Cutover/cutaway peat
- AlluvMIN - Alluvial (mineral)
- AlluvMRL - Alluvial (marl)
- Lac - Lacustrine type soils
- Scree - Scree
- AeoUND - Aeolian undifferentiated
- MarSands - Marine sand and gravel
- MarSed - Marine/estuarine sediments
- Made - Made ground
- Water - Water
- Unclass

Fig. 3

Appendix E - Calculations

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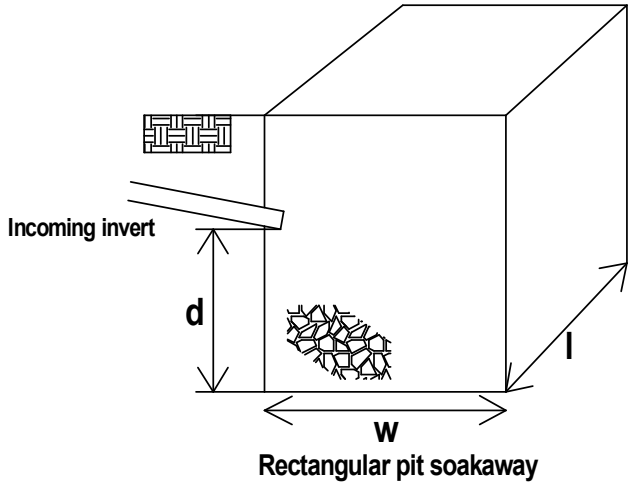
BRE DIGEST 365 - Trial Pit No. 1A



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 3000 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 2.64 min

Test 2 - time to fall from 75% depth to 25% T2 = 2.53 min

Test 3 - time to fall from 75% depth to 25% T3 = 3.08 min

Longest time to fall from 75% depth t t_{lg} = max(T1, T2, T3) = 3.08 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.60 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 4.60 m^2

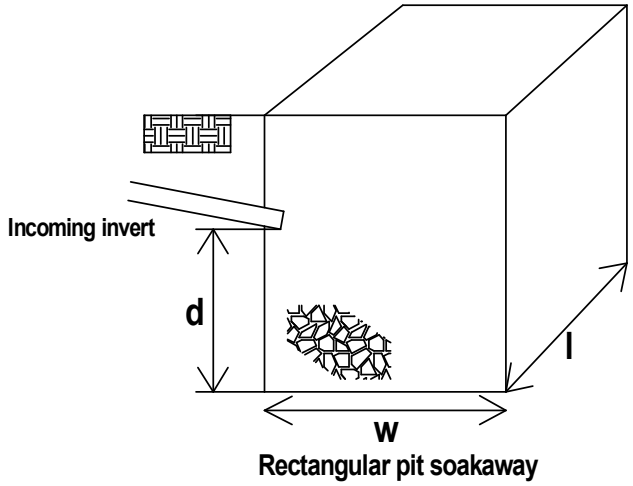
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.60 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 7.06E-04 m/s

Trial Pit No:	1A
Pit Depth	900
Pit Length	3000
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
1.57	1.07		1.32	**2.64**
1.1	1.43		1.27	**2.53**
1.4	1.68		1.54	**3.08**

BRE DIGEST 365 - Trial Pit No. 1B



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2700 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 8.43 min

Test 2 - time to fall from 75% depth to 25% T2 = 13.18 min

Test 3 - time to fall from 75% depth to 25% T3 = 13.36 min

Longest time to fall from 75% depth t t_{lg} = max(T1, T2, T3) = 13.36 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.54 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 4.18 m^2

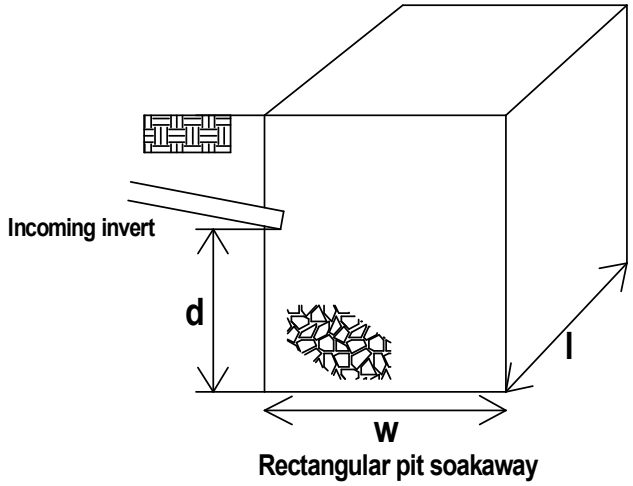
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.48 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 1.61E-04 m/s

Trial Pit No:	1B
Pit Depth	1400
Pit Length	2700
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
5.18	3.25		4.22	**8.43**
6.93	6.25		6.59	**13.18**
7.24	6.12		6.68	**13.36**

BRE DIGEST 365 - Trial Pit No. 2A



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2400 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 1.33 min

Test 2 - time to fall from 75% depth to 25% T2 = 1.38 min

Test 3 - time to fall from 75% depth to 25% T3 = 1.36 min

Longest time to fall from 75% depth t $t_{lg} = \max(T1, T2, T3)$ = 1.38 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.48 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 3.76 m^2

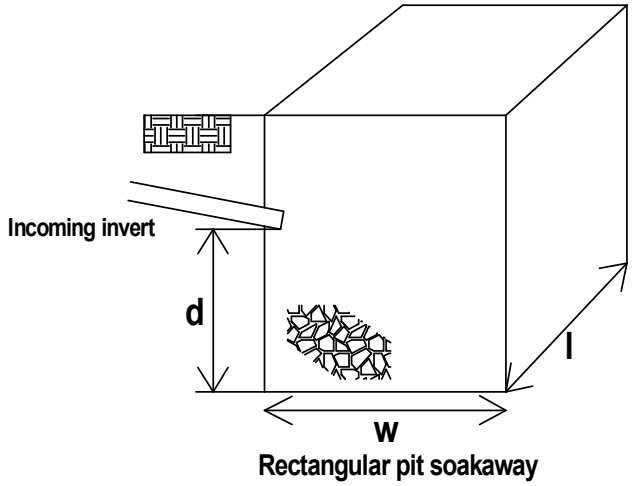
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.36 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 1.54E-03 m/s

Trial Pit No:	2A
Pit Depth	900
Pit Length	2400
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
0.7	0.63		0.67	**1.33**
0.75	0.63		0.69	**1.38**
0.74	0.62		0.68	**1.36**

BRE DIGEST 365 - Trial Pit No. 2B



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2600 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 1.40 min

Test 2 - time to fall from 75% depth to 25% T2 = 1.42 min

Test 3 - time to fall from 75% depth to 25% T3 = 1.62 min

Longest time to fall from 75% depth t t_{lg} = max(T1, T2, T3) = 1.62 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.52 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 4.04 m^2

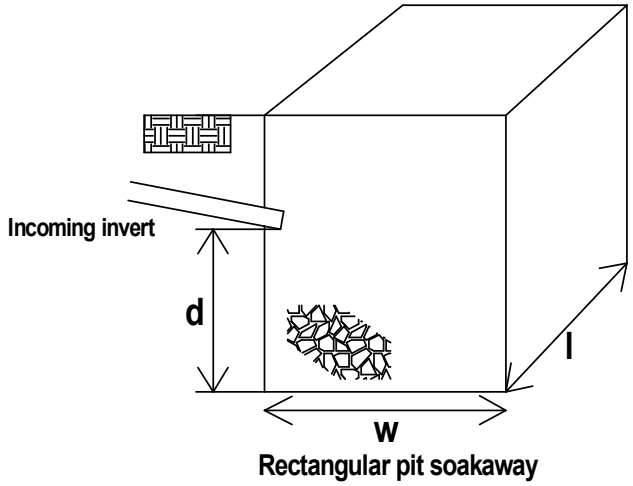
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.44 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 1.32E-03 m/s

Trial Pit No:	2B
Pit Depth	1400
Pit Length	2600
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
0.87	0.53		0.70	**1.40**
0.77	0.65		0.71	**1.42**
0.82	0.8		0.81	**1.62**

BRE DIGEST 365 - Trial Pit No. 3A



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2400 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 3.03 min

Test 2 - time to fall from 75% depth to 25% T2 = 3.25 min

Test 3 - time to fall from 75% depth to 25% T3 = 3.38 min

Longest time to fall from 75% depth t t_{lg} = max(T1, T2, T3) = 3.38 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.48 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 3.76 m^2

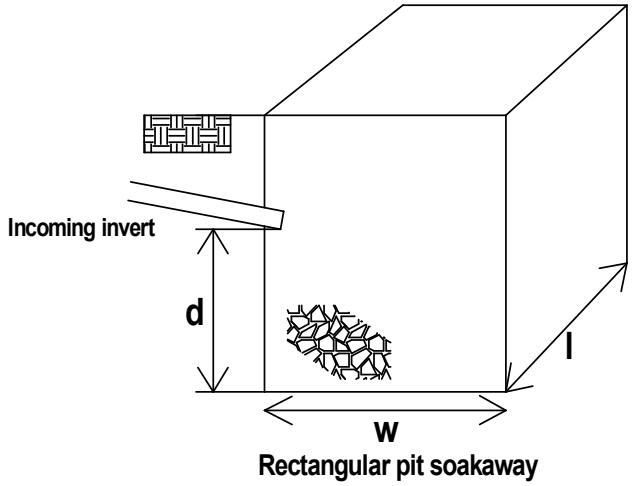
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.36 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 6.29E-04 m/s

Trial Pit No:	3A
Pit Depth	900
Pit Length	2400
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
1.3	1.73		1.52	**3.03**
1.53	1.72		1.63	**3.25**
1.6	1.78		1.69	**3.38**

BRE DIGEST 365 - Trial Pit No. 3B



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2600 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 3.08 min

Test 2 - time to fall from 75% depth to 25% T2 = 3.07 min

Test 3 - time to fall from 75% depth to 25% T3 = 2.87 min

Longest time to fall from 75% depth t t_{lg} = max(T1, T2, T3) = 3.08 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.52 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 4.04 m^2

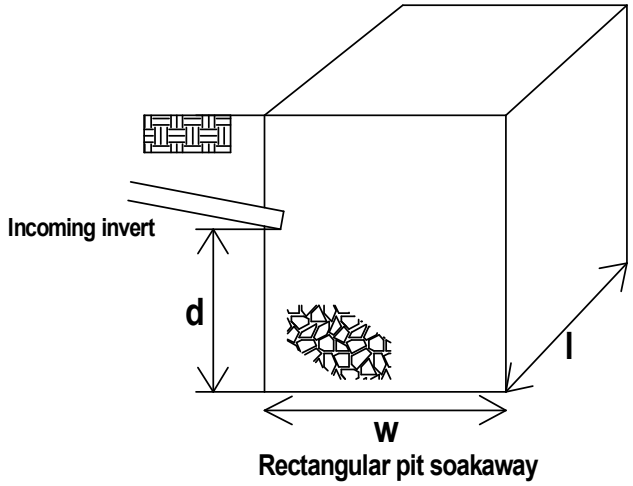
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.44 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 6.96E-04 m/s

Trial Pit No:	3B
Pit Depth	1350
Pit Length	2600
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
1.15	1.93		1.54	**3.08**
1.22	1.85		1.54	**3.07**
1.07	1.8		1.44	**2.87**

BRE DIGEST 365 - Trial Pit No. 4A



Rectangular pit soakaway

(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2200 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 0.88 min

Test 2 - time to fall from 75% depth to 25% T2 = 0.91 min

Test 3 - time to fall from 75% depth to 25% T3 = 0.95 min

Longest time to fall from 75% depth t $t_{lg} = \max(T1, T2, T3)$ = 0.95 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.44 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 3.48 m^2

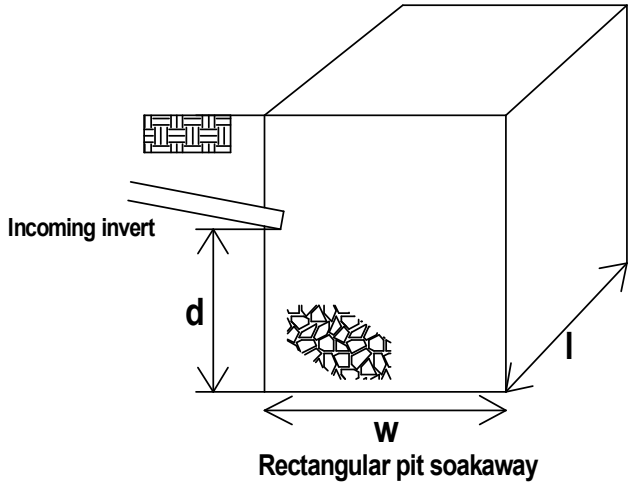
Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.28 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 2.22E-03 m/s

Trial Pit No:	4A
Pit Depth	750
Pit Length	2200
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
0.5	0.38		0.44	**0.88**
0.53	0.38		0.46	**0.91**
0.53	0.42		0.48	**0.95**

BRE DIGEST 365 - Trial Pit No. 4B



(1) Soil infiltration rate (BRE digest 365)

Length of trial pit; l_{trial} = 2800 mm Width of trial pit; b_{trial} = 1000 mm

Depth of trial pit (bel d_{trial} = 400 mm Free volume (if fill used); V_{trial} = 100 %;

75% depth of pit; $d_{75} = (d_{trial} \times 0.75)$ = 300 mm

50% depth of pit; $d_{50} = (d_{trial} \times 0.50)$ = 200 mm

25% depth of pit; $d_{25} = (d_{trial} \times 0.25)$ = 100 mm

Test 1 - time to fall from 75% depth to 25% T1 = 1.95 min

Test 2 - time to fall from 75% depth to 25% T2 = 1.50 min

Test 3 - time to fall from 75% depth to 25% T3 = 1.10 min

Longest time to fall from 75% depth t $t_{lg} = \max(T1, T2, T3)$ = 1.95 min

Storage volume from 75% to 25% de $V_{p75\_25} = (l_{trial} \times b_{trial} \times (d_{75} - d_{25})) \times V_{trial}$ = 0.56 m^3

Internal surface area to 50% depth; $a_{p50} = ((l_{trial} \times b_{trial}) + (l_{trial} + b_{trial}) \times 2 \times d_{50})$ = 4.32 m^2

Surface area of soakaway to 50% sto $A_{s50} = 2 \times (l_{trial} + b_{trial}) \times d_{trial} / 2$ = 1.52 m^2

Soil infiltration rate; $f = V_{p75\_25} / (a_{p50} \times t_{lg})$ = 1.11E-03 m/s

Trial Pit No:	4B
Pit Depth	1400
Pit Length	2800
Pit Width	1000
Tested Depth	400
25% - 75% of Tested Depth	200

Time to fall 100mm (minutes)			Average	Average
T1 (100mm)	T2 (100mm)		(100mm)	(75-25%)
0.6	1.35		0.98	**1.95**
0.65	0.85		0.75	**1.50**
0.45	0.65		0.55	**1.10**