SUDS Drainage Report

Re: D22A/0124
Citywise Science & Language Centre,
Durkan Centre,
Fortunestown Way,
Tallaght,
Dublin,
A94 YX22.

Client: Citywise Education

Date: 28th May 2021

Unit B19, KCR Estate,
Ravensdale Park,
Kimmage, Dublin 12.
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REV	DESCRIPTION	DATE	BY	APPROVED	DOCUMENT

1.0 Introduction:

With reference to Condition No.2 of the Additional Information requested, regarding the details of the Sustainable Drainage Systems (SUDS), and storm water management to be included in the proposed development.

The existing site is 0.43ha, has an existing building used for education purposes, with a footprint area of 800m^2.
The surface water drainage is currently serviced by a 300mm diameter public storm sewer which runs adjacent to the front/north boundary of the site, and a 225mm diameter public storm sewer to the rear/south-east of the site in Bawnlea Close.
The new development has impermeable roof area of 705m^2 and pavement area of 173m^2, the stormwater runoff of which is to be managed as parts of the SUDs plan for the new development.

All proposed developments must ensure that SUDS are incorporated into the development. SUDS requires that post development run-off rates be maintained at the equivalent to, or lower than, the predevelopment run-off levels. Thus, the development must be able to retain, within its boundaries, storm water volumes from extreme storm events up to and including a design for a 1 in 100year storm event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), while also allowing for climate change factors (+CC). Any new development must have physical capacity to retain storm water volumes as directed under the Greater Dublin Strategic Drainage Study (GDSDS) and, if necessary, release this attenuated surface water runoff before it enters a natural watercourse or into a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of storm water quality.

All hardstanding contributing areas (i.e. pavement and flat roof) are applied directly to the surface water network at the appropriate time of concentration

2.0 Site Specific SUDs Measures:

Sustainable Drainage Systems (SUDS) were considered for the site, in line with recommendations of Greater Dublin Strategic Drainage Strategy (GDSDS). SUDS are a method of replicating the natural characteristics of rainfall runoff from any site.

2.1 Soakaway:

Soakaways are below ground, rainwater infiltration structures, that can have different forms from the traditional stone filled excavations with a void ratio of 0.3 to those using modular geo-cellular units to form a below ground void, with a void ratio of 0.95.
Soakaways provide stormwater attenuation, stormwater treatment and ground water recharge.
In this development various types of SUDS systems were considered, but primarily due to the following factors; the Ground Water Table at approximately 1.4m below ground level, the flat topography of the site, and the relatively shallow invert levels of the existing outfall Storm Water Manholes, it was deemed that the most suitable SUDS measure to cater for the 'point' flows from the roof of the new development is use of a Soakaway structure, using a proprietary modular system with a high void ratio, i.e. 'Aquacells' to reduce area required.

2.2 Permeable/Pervious Paving:

It is also proposed to use a Type A [Total Infiltration] Permeable Pavement to receive the run-off from the majority of the new paved areas.

Permeable pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying structural layers, and also attenuates the rainwater beneath the overlying surface before infiltration. Pervious pavements are an efficient means of managing surface water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium.

3.0 Hydraulic Design:

3.1 Infiltration Rate Calculation:

The soil characteristics and suitability for infiltration were carried out in accordance with the procedure described in BRE Digest 365. This was carried out from the 27th to the 30th of July 2022. See attached photos #'s 01-06.

An infiltration rate (f) of 8.79×10^{-7}m/s was calculated*. With reference to CIRIA C753 SUDS Manual, a Factor of Safety of 5 was applied to give an Adjusted Soil Infiltration Rate (q) of 1.76×10^{-7}m/s, which was used for hydraulic calculations associated with the SUDS elements. See attached calculation sheet.

[* Trial pit was already empty after third fill when inspection of the -30th July 2022, therefore f value calculated is believed to be conservative].

After the initial excavation, ground water was noted at a depth of 1.5m below ground level. This was taken into consideration for SUDS measures design.

3.2 Attenuation Volume Design: (See attached calculation sheet):

Design Parameters:		**Ref.**
Max Run-off Rate	2L/s/ha	GDSDS & GDRCP
Storm Return Period	10yr.; 100yr.	
Storm Duration	60 in.; 30min	
Max Rainfall for Extreme Rainfall Return Period	20.9mm; 28mm	Met Eireann (Casement)
Impermeable area	846m^2	
Permeable area	208m^2	
Climate Change Factor	20%	

3.3 Outlet Flow Control Design: (See attached calculation sheet):

As noted above the maximum run-off/discharge rate from the site to watercourses/storm sewer is 2L/sec/ha as to replicate the movement of naturally infiltrated rainwater on the site prior to any development on the site. As a means of controlling the outflow from the development, a Perforated Riser is the proposed control structure to restrict the overflow from the Soakaway structure. With reference to the development area, the Perforated Riser located within a flow control chamber downstream of the proposed SUDS measures, has been designed in accordance with SUDS Handbook CIRIA C753 28.5.3 to have a Total Flow Capacity of 2L/sec/ha when connected to the existing stormwater sewer within the site.

Signed:_____Date:_____

Marty Wardick
Chartered Engineer

Appendix A - Photos

#01 – Trial pit excavation for percolation test – 27th July 2022.

#02 – Trial pit before 1st fill, 27th July 2022.

#03 – Immediately after 1st Fill, 27th July 2022.

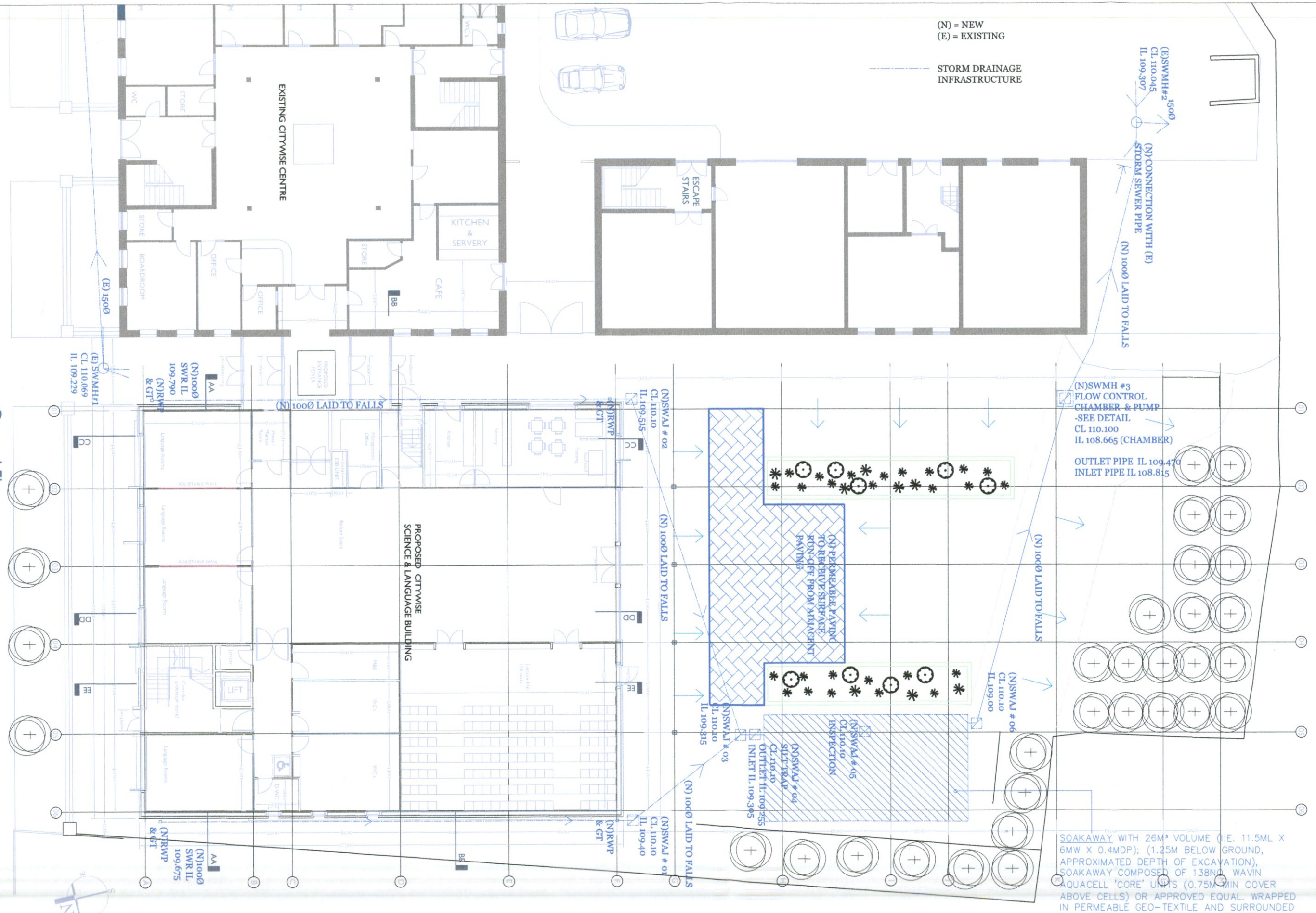
#04 – Immediately after 3rd fill, 29th July 2022.

#05 – Immediately after 3rd fill, 29th July 2022, Top of Water to Ground Level – 980mm.

#06 – Day after 3rd fill, 30th July 2022.

Appendix B

- Drainage Layout Plan - Drawing D-01 Rev B
- Drainage Details – Drawing D-02
- Infiltration Rate Calculation Sheet
- Soakaways Calculations Sheet – 10 Year Storm
- Soakaways Calculations Sheet – 100 Year Storm
- Perforated Riser Flow Control Calculation Sheet



DRAINAGE PLAN – PROPOSED

MSW & Associates Ltd.,
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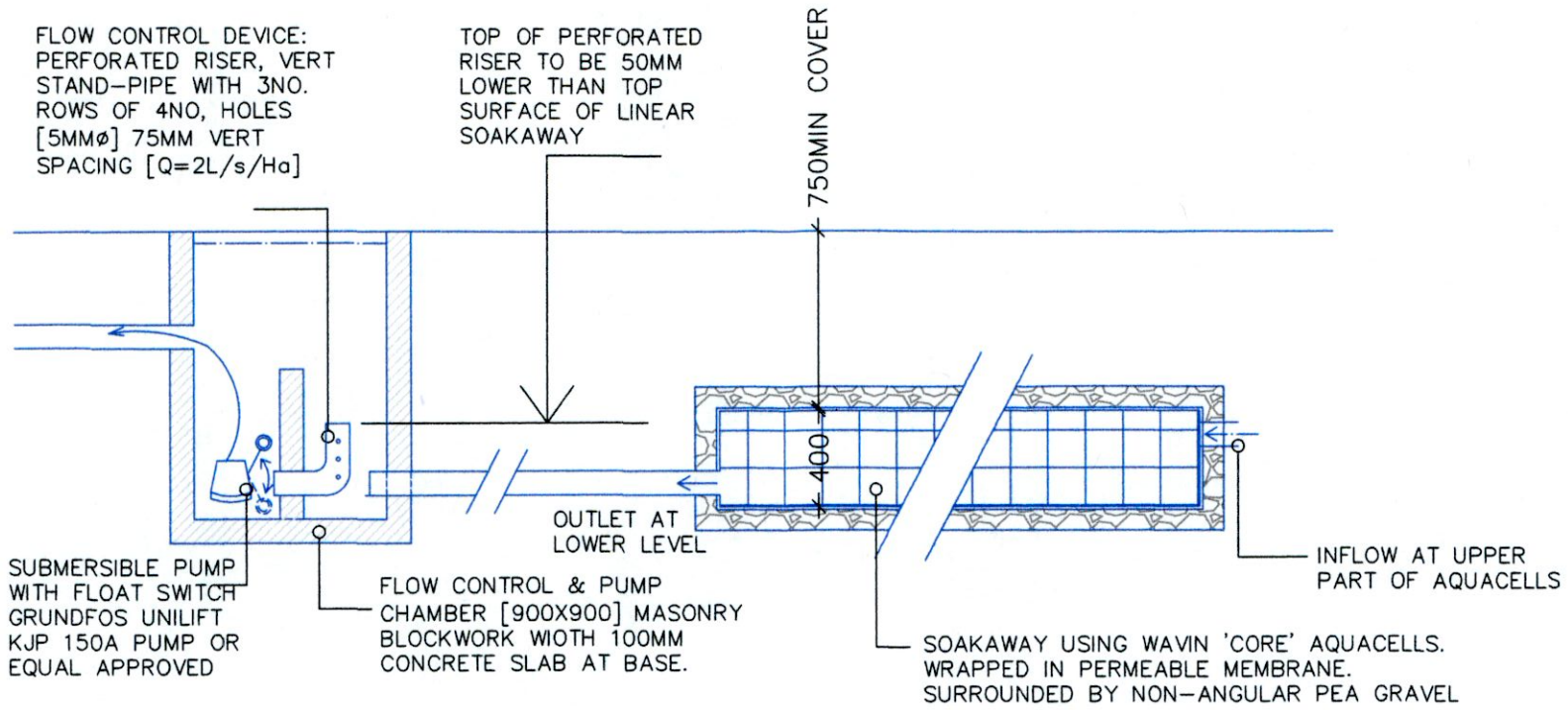
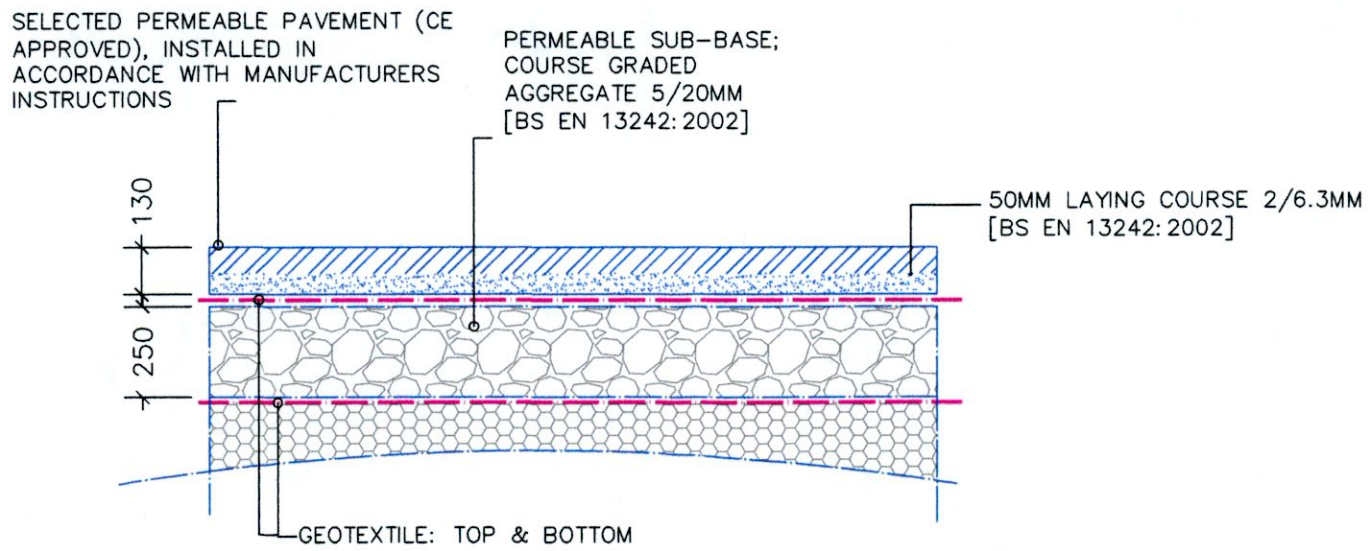
Project:
Citywise,
Durkan Centre,
Fortunestown Way,
Jobstown, Dublin 24.

Client: Citywise Education
Drawing Title: Drainge Plan
Scale: 1:200 [A3]
Drawing No.: D–01 Rev B
Date: Aug. 2022



PERFORATED RISER
FLOW CONTROL CHAMBER-OUTFALL



PERMEABLE PAVEMENT [TYPE A : TOTAL INFILTRATION]- SECTION/DETAIL

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Project:
Citywise Science & Language Centre,
Durkan Centre,
Fortunestown Way,
Dublin 24.

Client: Citywise Education
Drawing Title: SUDS Details
Scale: NTS
Drawing No.: D-02
Date: August 2022

Soil Infiltration Rate Calculation:
Project: *New Citywise Science & Language Centre*
Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

Trial Pit

Dimensions:				
Length (l) =	0.6 m	1st filling:		27-Jul-22
Width (w) =	0.875 m	2nd filling:		28-Jul-22
Hole Depth=	1.5 m	3rd filling:		29-Jul-22
Depth of water (d1) =	0.520 m		15.35 pm	29-Jul-22
Depth of water (d2) =	0.00 m		12.30 pm	30-Jul-22
Depth delta =	0.52 m	[use 24hr clck]		
Initial Volume of Water	0.273 m3			
Final Volume of Water	0 m3			

Soil Infiltration Rate (f) = Vp(75-25) / Ap50 x tp(75-25)
as per BRE 365

tp (75-25)

Time delta =	1257 minutes	20.95 hrs
	75420 secs	

Vp(75-25) 0.1365 m3
Volume delta

50% percolation in 24hrs test
percentage drop in volume of water in 24 hours
100.00%
OK percolation voumne greater than 50% in24hrs

Ap50= 2.059 m2
Ap50= [(l+w) x2 x delta d] + [l x w]

Soil Infiltration Rate (f) =	**8.79E-07 m/s**	
	0.00316441 m/hr	
Safety Factor (1.5 - 10)	5	Ref SUDS Manual C697 4-30
Adjusted Soil Infitration Rate (q)	**1.758E-07 m/s**	
	0.00063288 m/hr	

Project: *New Citywise Science & Language Centre*
Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

Total Area of Site 4348 m2

Area Data:	Area		Impermeability [%]	Effective Area [m2]
Impermeable area	846 m2	New Roof Area	100%	846 m2
Partial permable area	83 m2	Soakaway area	100%	83 m2
Other: Landscaped, green roof	0 m2		0%	0 m2
	929 m2			

Eff. Area drained to Soakway 929 m2
incl 20% CCA

Return Period Rainfall Depths [Ref. Met Eireann]
Location: Casement Aerodrome Dublin
10 year Return Period - 60 minute duration 20.9 mm

Design Rainfall [R10-60min]:
10 year storm - 60 min duration:
Inflow to Soakway [A x R10-60]: 19.4 m^3 Inflow

SUDS MEASURE #1 **SOAKAWAY**
Proposed Soakway - Dimensions:

Length:	11.5	m
Breadth:	6	m
Depth:	0.4	m

Total Volume of Soakway 27.6 m^3
Net Volume of Soakway **26.22** m^3 Free volume % 95% 138
[95% for 'Aquacells'; 30% for stone]

Outflow from Soakaways during storm (O) O=As50 x f x D SOAKAWAY

As50=	7.00	m2	Internal surface area (excl. base area) of soakway to 50% effective depth
f=	1.76E-07	m/s	Calculated Adjusted Infiltration Rate (FOS)
D=	21600	secs	Duration of storm

Outflow = 0.03 m^3

Inflow - Outflow = Storage Required [I-O=S] **19.39 m^3 Storage Required**

SOAKAWAY Storage Volume = **26.2** m^3
6.83 m^3 Surplus
Adequate free volume of soakway;greater than inflow

Project: *New Citywise Science & Language Centre*
Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

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Other: Landscaped, green roof	0 m2		0%	0 m2
	929 m2			

Eff. Area drained to Soakway 929 m2
incl 20% CCA

Return Period Rainfall Depths [Ref. Met Eireann]
Location: Casement Aerodrome Dublin
100 year Return Period - 30 minute duration 28 mm

Design Rainfall [R100-30min]:
100 year storm - 30 min duration:
Inflow to Soakway [A x R10-60]: **26.0 m^3** Inflow

SUDS MEASURE #1 **SOAKAWAY**
Proposed Soakway - Dimensions:

Length:	11.5	m
Breadth:	6	m
Depth:	0.4	m

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Net Volume of Soakway **26.22** m^3 Free volume % 95% 138
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Outflow from Soakaways during storm (O) O=As50 x f x D SOAKAWAY

As50=	7.00	m2	Internal surface area (excl. base area) of soakway to 50% effective depth
f=	1.76E-07	m/s	Calculated Adjusted Infiltration Rate (FOS)
D=	21600	secs	Duration of storm

Outflow = 0.03 m^3

Inflow - Outflow = Storage Required [I-O=S] **25.98 m^3** **Storage Required**

SOAKAWAY Storage Volume = **26.2** m^3
0.24 m^3 Surplus
Adequate free volume of soakway;greater than inflow

Project: *New Citywise Science & Language Centre*
Location: *Durkan Centre, Fortunstown Way, Tallaght, Dublin 24.*

Total Flow capacity
of **Perforated Riser** Q=Cp.2Ap.(2g)^1/2.(H^3/2)/3Hs m3/s

Ref.: CIRIA C753
28.5.3

Q= 0.000200236 m3/sec (using input below in blue)
2.00E-04 m3/sec = 0.20023568 L/sec

Q= discharge, m3/s	=		
Cp= discharge coeff (0.61 for perforations)	=	0.61	
Ap=Cross sectional area for all holes, m2	=	0.000942 m2	
radius of holes	=	5 mm	0.005 m
no of holes per row	=	4 no.	
no. of rows	=	3 no.	
Total no. of holes	=	12 no.	
g= gravity	=	9.81 m/s2	
Hs= Distance from S/2 below the lowest row of holes to S/2 above the top row,m	=	225 mm	0.225 m
S= distance between holes, m	=	75 mm	0.075 m
H= effective head, m	=	89 mm	0.089 m

Allowable flow= 2 L/s/ha= 0.0000002 m3/s/m2

Impermeable area receiving= 1000 m2 = 0.100 ha

therefore allowable flow for area= 0.0002 m3/sec
2.00E-04 m3/sec
0.2 L/sec