

Planning: Drainage Calculations

Seagull Lane,
Emsworth



Document Information

Project no.	12933
Project title	Seagull Lane, Emsworth
Client	The Trustees of The Alitex DBSSASS Scheme
Document title	Planning: Drainage Calculations

Issue Status

Rev	Date	By	Approved	Description
-	06/11/2024	CB	CJB	First issue

Offices

Romsey	Old Brewery House, Portersbridge St, Romsey, Hampshire, SO51 8DJ
Bath	27 Gay St, Bath, Somerset, BA1 2PD

Drainage Strategy Statement

Location & Details

Project Name: Seagull Lane

Site address: 2-6 Seagull Lane, Emsworth, PO10 7QH

Grid ref: SU 74966 06190

Non-technical summary

The existing site in question is a developed industrial site comprising a large steel portal frame building on the north of the site, and a paved access yard and car park to the south. The site is fully impermeable and benefits from a piped network to convey the surface water and roof runoff to a public sewer. The surface runoff is collected by a combination of gullies and channels before passing through a bypass separator and into the sewer. The public sewer runs perpendicular through the site near the southern boundary.

The planning application proposes additional storage units to be erected in the area of the existing access yard and car park. Due to the function and fully developed nature of the site there are few opportunities to include surface level SuDS, so the proposed drainage strategy utilises the same outfall to the public sewer, but incorporates SuDS in the form of attenuation storage for the proposed buildings. Staged storage has been implemented by using geocellular attenuation crates for each building, prior to discharge to the sewer.

Development Description

With grateful reference to *pwp Architects' Planning, Design and Access Statement*;

The application site comprises a 0.27 hectare plot containing a number of buildings largely now unoccupied. These are mostly large industrial units (2 Seagull Lane and warehouses 1,2&4) that have received small ad-hoc additions over time. There is also a small 2 storey building (no.6 Seagull Lane) that has most recently been serving as an office space.

The layout of the site has largely been determined by the accessibility of heavy goods vehicles and allowing them to pass freely through the site whilst maintaining the existing no.6 seagull lane as it is not economically viable to demolish and replace the unit.

The new units will be situated towards the south and west of the site and oriented to address the access road. An additional single unit will take the location of the existing building 2a and is served by its own private entrance way. The existing no.6 Seagull Lane is retained and refurbished forming a central hub in the development with parking assigned to each unit in the centre of the plot and along the eastern boundary. Additionally, there will be a bin store for communal use and provision for secure cycle storage.

The grounds of the site are to benefit from the introduction of planted areas to soften the site. Whilst the parking areas and roadway will be newly surfaced to provide a smooth and even site for vehicular movement.

Layout & Topography

The existing topography of the site is presented on drawing 5807 1000, by *pwp Architects*. The topography shows a fall from West to East, from a high point of 7.02 AOD and falling to a low spot of 4.45 in the South-East corner. A less prominent fall exists from North to South.

The proposed layout of the site is presented on drawing 5807 1010, by *pwp Architects*.

The proposed drainage and external works are presented on AWA drawings 13505-100 to 13505-106.

Site Geology

A Phase II site investigation was carried out by Messers *Ground & Water*. The summary of encountered strata is reproduced below:

Summary of Strata Encountered (BH01 – BH02)			
Strata	Top Depth (m bgl)	Base Depth (m bgl)	Thickness (m)
MADE GROUND: Concrete	GL	0.10-0.30	0.10-0.30
MADE GROUND: Dark brown black slightly sandy gravelly CLAY/ gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded flint, glass, Ash, brick and concrete. Strong hydrocarbon odour in WS1 and WS5. To see the percentage of various fragments within the Made Ground, please refer to logs found within Appendix D.	0.10-0.30	1.00 – 1.60	0.80 – 1.45
HEAD DEPOSITS (WS1, WS2, WS4, WS5): Light brown very sandy gravelly CLAY/ sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse sub-angular to sub-rounded flint.	1.00 – 1.60	2.20->5.00	1.10->4.00
RIVER TERRACE DEPOSITS (WS3 Only): Brown, grey, orange, slightly gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint.	1.10	2.50	1.40
LONDON CLAY FORMATION: Mottled grey, brown, slightly gravelly CLAY with selenite crystals. Gravel is fine sub-angular to sub-rounded flint.	2.20-3.40	>5.00	>1.60 – >2.80

Ground water strikes were noted during the intrusive works and monitored on return visits, as summarised below:

Groundwater Depth	
Trial Hole	Groundwater Depth (m bgl)
WS1	0.90
WS2	None
WS3	1.23
WS4	0.70
WS5	1.12

Groundwater Observations			
Date	Trial Hole	Water Level	Final Well Depth
26/05/2023	WS1	0.60	3.50
	WS3	0.50	4.40
	WS5	0.30	4.60
08/06/2023	WS1	0.70	3.40
	WS3	0.90	4.40
	WS5	0.40	4.60

Due to the depth to ground water a strategy for infiltration was discounted as impractical, and specific site soakage tests were not carried out.

Flood Risk

An assessment of flood risk on the site was carried out by *pwp Architects* and the eastern aspect of the site is assessed as being at risk of flooding from Rivers and Seas due to the proximity of the River Ems. The design of the buildings has responded to this risk and mitigation is achieved by an elevated floor level in the affected units.

SuDS Strategy & Hierarchy

The drainage strategy and SuDS for the development have been selected with consideration of the function of the site, discharge hierarchies, the underlying strata and depth to ground water.

The site currently comprises a series of light industrial buildings and concrete hard standings and is considered fully impermeable. Due to the topography of the site, no run-off discharges to the existing surface water sewer in Seagull Lane. All flows pass into the existing below ground drainage before conveyance to the foul sewer to the East of the site. The existing connection is therefore a combined sewer, although Southern Water do not recognise it as such.

As previously mentioned, the high water table precludes the use of infiltration techniques, so run-off must be directed off site. Although the River Ems lies within 50m, it is not practical to discharge directly, as this would involve crossing third-party land or a public highway. Therefore connection will be made to public sewer.

An attenuated discharge was sought, utilising the existing combined connection, but was rejected by the undertaker. It is therefore necessary to alter the existing site levels to reverse the fall to the North and allow a connection to the surface water sewer in Seagull Lane, which is very shallow. To account for the shallow discharge point, the strategy leverages permeable paving as a means of draining the hard standings and roofs, and generally offering capture at or near source, with treatment and attenuation to the run-off. Preliminary enquiries with Southern Water indicate a new connection to the surface water sewer is fine in principle, subject to agreement of discharge rates.

Allowance has been made for HGV access to the site by way of an impermeable concrete access way, draining to the adjacent parking bays. This allows the bays to function as storage zones without risking damage via heavy trafficking. The storage is achieved by lining the sub-base zone under the bays, and the use of shallow geocellular sub-base replacement units (*Permavoid*), which have a higher void ratio than normal granular fill. The discharge rate is controlled to QBar via shallow flow control chambers with orifice plates; a number of these chambers control the discharge in different zones around the site. All flow control chambers have a mesh screened orifice, and an overflow weir to act as a final safety against blockage.

Water quality was previously achieved on the site by way of a by-pass interceptor to accommodate the flows from the access yard and car park area, which connected to the foul sewer. The new flows from the buildings will pass through silt traps to capture fine sediments and block larger debris. The *Silt Blok* units have an integral, macro/micro porous fine plastic mesh filter which will protect the attenuation matrix against siltation. An additional sump unit is provided at the inlet to the *Permavoid* matrices, meaning protection of the downstream orifices within the flow control chamber, and ensure simple maintenance at ground level.

The run-off from adjacent hard standings onto the permeable parking bays will be filtered through the upper sub-base layer (choker course) and hydro carbons retained on *Permafilter* geotextile, where the pollution is broken down by aerobic means.

Therefore, the SuDS hierarchy as defined in the NPPG has been followed:

	SuDS Hierarchy	Used	Comment
1	Into the ground (infiltration)	X	High water table, contamination risks
2	To a surface water body;	X	River Ems 48m away; outfall would require crossing 3 rd party land and additional consents to achieve
3	To a surface water sewer, highway drain or another drainage system	✓	Existing public surface water sewer runs parallel to the site in Seagull Lane. Agreement with Southern Water required.
4	To a combined sewer	N/A	N/A

Existing runoff

Although a brownfield site, as the discharge was previously made to the foul sewer, the runoff rates for the development are calculated as Greenfield, in line with current best practice. When using the *Greenfield runoff tool* at www.uksuds.com for the purposes of assessing surface water runoff from an impermeable site, the soil characteristics have been altered to reflect this. The run-off rates are presented below:

Q_{BAR} (l/s):	0.53	1.82
1 in 1 year (l/s):	0.45	1.55
1 in 30 years (l/s):	1.22	4.18
1 in 100 year (l/s):	1.69	5.8
1 in 200 years (l/s):	1.98	6.8

The total proposed discharge from site will be limited to Q_{Bar} at 1.82l/s. This is split between the East and West of the site as shown in Table 1.

All drainage designs have been carried out with reference to the Arun and Western Streams peak rainfall allowances:

3.3% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	35%
2070s	25%	40%

1% annual exceedance rainfall event

Epoch	Central allowance	Upper end allowance
2050s	20%	45%
2070s	25%	45%

The existing site run-off depths for the 6 Hour event, along with a comparison of discharge volumes, are also presented.

DISCHARGE RATES

Site Zone	Catchment Area (m ²)	Discharge rate (l/s)
West; Unit 8 and associated parking	352	0.27
East; Units 1-7, parking and access routes	2373	1.55

EXISTING SITE RUN-OFF SUMMARY

Return Period	6 Hour rainfall run-off depth (mm)	Site run-off volume (m ³)
1:100	64.26	175.11
1:100 + 45% climate change	93.18	253.91

DISCHARGE VOLUMES

Return Period	6 Hour site run-off volume (m ³) Existing	6 Hour site run-off volume (m ³) Proposed
1:1 year (100% AEP)	60.50	39.86
1:30 (3.3% AEP) + 40% climate change	195.94	44.34
1:100 (1% AEP) + 45% climate change	253.91	44.34

Table 1

Risk and Exceedance

The exceedance routes for the development are shown on AWA drawing 13505-100. Storage requirements have been calculated using the 1:100yr return + 45% allowance for climate change. Residual risk from events beyond the design limits are managed by overflows on the flow control devices and the routing of over land flows, which are directed away from buildings and towards non-critical areas of the site. An overflow gully has been set 50mm above ground level in the North-East corner of the site, with a direct connection beyond the final flow control chamber.

Foul Drainage

The existing foul drainage will be removed and re-laid to suit the revised building layouts, utilising the existing connection to the foul sewer to the East. The usage and foul load will not change from the existing situation, with the number of units and users staying the same.

Drainage Plans

The site and drainage layouts are fully detailed on AWA drawings 13505-100 to 13505-106.

Calculated by:	Craig Bobbett
Site name:	Seagull Lane
Site location:	Emsworth

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.85038° N
Longitude:	0.93628° W
Reference:	2711769871
Date:	May 10 2024 16:39

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	0.2725
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Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	2	5
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.53

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	739	739
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

Q_{BAR} (l/s):	0.53	1.82
1 in 1 year (l/s):	0.45	1.55
1 in 30 years (l/s):	1.22	4.18
1 in 100 year (l/s):	1.69	5.8
1 in 200 years (l/s):	1.98	6.8

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

SEAGULL LANE

Tarmac

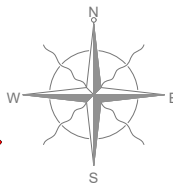
Total site area: 2724.7m²

Total Site 2724.7m²

Ex public sewer DN225 at 195

Ex public sewer

Garages



Ramp
45.0m²

Low level paving

Bin Store

East Catchment
2372.6m²
1.55l/s discharge

West Catchment
352.0m²
0.27l/s discharge

Paving : 156.1m²

277.3m²

Paving : 249.4m²

218.6m²

Suite : 67.9m²

Office Suite

357.5m²

Aco 142.1m²

Unit 1,2&3 : 253.8m²

Unit 4&5 : 170.9m²

Unit 8

Unit 8 : 113.0m²

Unit 8

Unit 8

Unit 8

Unit 7

Unit 7&6 : 190.2m²

Unit 6

Unit 7

Unit 7

Unit 7

Unit 7

Unit 6

Unit 6

Unit 6

Unit 6

Unit 6

Disabled

Disabled

Unit 5

Unit 4&5 : 34.5m²

Unit 5

Unit 5

Unit 5

Unit 4

Unit 3

Unit 2

Unit 1

Visitor

Unit 4

Unit 4

Bays: 150.1m²

Unit 4

Unit 3

Unit 3

Unit 3

Unit 2

Unit 2

Unit 2

Unit 1

Unit 1

Unit 1

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SITE RUN-OFF & RAINFALL (The Wallingford Procedure)

Job Name:	Seagull Lane, Emsworth	Job No.	13505	By:	CJB
Element:	Site Run-off & rainfall	Date:	14/05/2024	Chk:	
Site Address:	6 Seagull Lane, Emsworth	Link:	Click for Google Map		
RAINFALL & AREA DATA					
Data Location:	Emsworth	Concrete and roofs		M5 60min	20mm
Site area:	2725 m²			Ratio	0.34
Co-efficient of run-off:	1				
Drained area:	2725 m²				

Event Duration (mins)	1:1 year event			
	Rainfall rate (mm/hr)	Rainfall (mm)	Run-off (l/s)	Run-off as volume (m ³)
5	47.62	3.97	36.05	10.81
10	36.60	6.10	27.70	16.62
15	30.17	7.54	22.84	20.55
30	19.67	9.84	14.89	26.80
60	12.40	12.40	9.39	33.79
120	7.83	15.66	5.93	42.67
240	4.81	19.24	3.64	52.43
360	3.70	22.20	2.80	60.50
600	2.60	26.00	1.97	70.85
1440	1.42	34.08	1.07	92.87

Event Duration (mins)	1:30 year event				40% climate change	
	Rainfall rate (mm/hr)	Rainfall (mm)	Run-off (l/s)	Run-off as volume (m ³)	Rainfall (mm)	Run-off as volume (m ³)
5	111.21	9.27	84.18	25.25	12.97	35.36
10	91.45	15.24	69.22	41.53	21.34	58.15
15	75.39	18.85	57.07	51.36	26.39	71.90
30	49.93	24.97	37.79	68.03	34.95	95.24
60	31.48	31.48	23.83	85.78	44.07	120.10
120	19.57	39.14	14.81	106.66	54.80	149.32
240	11.66	46.64	8.83	127.09	65.30	177.93
360	8.56	51.36	6.48	139.96	71.90	195.94
600	5.87	58.70	4.44	159.96	82.18	223.94
1440	3.03	72.72	2.29	198.16	101.81	277.43

Event Duration (mins)	1:100 year event				45% climate change	
	Rainfall rate (mm/hr)	Rainfall (mm)	Run-off (l/s)	Run-off as volume (m ³)	Rainfall (mm)	Run-off as volume (m ³)
5	137.47	11.46	104.06	31.22	16.61	45.26
10	114.61	19.10	86.75	52.05	27.70	75.48
15	94.48	23.62	71.52	64.36	34.25	93.33
30	63.13	31.57	47.79	86.01	45.77	124.72
60	39.80	39.80	30.13	108.46	57.71	157.26
120	24.83	49.66	18.79	135.32	72.01	196.22
240	14.65	58.60	11.09	159.69	84.97	231.54
360	10.71	64.26	8.11	175.11	93.18	253.91
600	7.28	72.80	5.51	198.38	105.56	287.65
1440	3.73	89.52	2.82	243.94	129.80	353.72

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 8 PVI&2	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:1 year	Ratio	0.34	
Climate Change allowance:	0% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	6.37 m	Length is the flow direction of the paving subbase
Sub-base replacement:	150 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	29.302 m ²	
Eff Depth:	0.15 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 8	57 m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	1.635 m ³

TOTAL DRAINED AREA	29.30 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	1000	Pipe to orifice ratio (B)	0.0000
Pipe Capacity	1.940 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	l/s	Orifice diameter:	0.0000 mm
Discharge coefficient	0.61	Orifice area (A)	0.00000 mm ²

Outflow factors:	0.001940265 m ³ /s	0.116415893 m ³ /m	6.9849536 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	0.39	0.12
10	0.30	0.18
15	0.25	0.22
30	0.16	0.29
60	0.10	0.36
120	0.06	0.46
240	0.04	0.56
360	0.03	0.65
600	0.02	0.76
1440	0.01	1.00

Unit 8 Point inflow (l/s)	Unit 8 Point inflow (m³)
0.754	0.226
0.580	0.348
0.478	0.430
0.311	0.561
0.196	0.707
0.124	0.893
0.076	1.097
0.059	1.265
0.041	1.482
0.022	1.943

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	1.14	0.34	0.58	0.00	0:00:00	0:05:00
10	0.88	0.53	1.16	0.00	0:00:00	0:10:00
15	0.72	0.65	1.75	0.00	0:00:00	0:15:00
30	0.47	0.85	3.49	0.00	0:00:00	0:30:00
60	0.30	1.07	6.98	0.00	0:00:00	1:00:00
120	0.19	1.35	13.97	0.00	0:00:00	2:00:00
240	0.12	1.66	27.94	0.00	0:00:00	4:00:00
360	0.09	1.92	41.91	0.00	0:00:00	6:00:00
600	0.06	2.24	69.85	0.00	0:00:00	10:00:00
1440	0.03	2.94	167.64	0.00	0:00:00	24:00:00

Drain down rate (l/s)
1.14
0.88
0.72
0.47
0.30
0.19
0.12
0.09
0.06
0.03

Storage Required	0.00 m³
Actual storage	5.811 m³
Time to half empty sub-base	0:00:00 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 8 Gravel Sub-Base	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:1 year	Ratio	0.34	
Climate Change allowance:	0% increase			

PERMEABLE AREA

Plan Width:	6.53 m	Width is perpendicular to the flow direction
Plan Length:	14.38 m	Length is the flow direction of the paving subbase
Depth of sub-base:	375 mm	Type 3 or equal open graded granular sub-base
Void ratio of stone:	0.3	
Base:	93.9014 m ²	
Eff Depth:	0.375 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
PV1 & PV2	m ²	Area of contributing point flows

TOTAL DRAINED AREA	93.90 m ²	summation of permeable and impermeable areas
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Sub-base hydraulic gradient (i)	1 300
k (Hazen's Formula)	0.5 m/s
Cross Section of paving (A)	2.44875 m ²
Q = Aki (Darcy's Law)	0.00408125 m ³ /s
Sub-base flow rate	4.08125 l/s

Outlet pipe diameter	100 mm
Outlet pipe fall 1:	100
Pipe Capacity	6.136 l/s
Applied discharge rate:	0.27 l/s
Discharge coefficient	0.6

gravity (g)	9.81 m/sec ²
Pipe to orifice ratio (B)	0.1430
Expansion coefficient (Y)	1.0
Orifice diameter:	14.2974 mm
Orifice area (A)	0.00016 mm ²

Outflow factors:	0.000162 m ³ /s	0.00972 m ³ /m	0.5832 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	1.24	0.37
10	0.95	0.57
15	0.79	0.71
30	0.51	0.92
60	0.32	1.16
120	0.20	1.47
240	0.13	1.81
360	0.10	2.08
600	0.07	2.44
1440	0.04	3.20

PV1 & PV2 Point inflow (l/s)	PV1 & PV2 Point inflow (m³)
2.28	0.68
1.75	1.05
1.45	1.30
0.94	1.70
0.59	2.14
0.38	2.70
0.23	3.32
0.18	3.83
0.12	4.49
0.07	5.88

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	3.53	1.06	0.05	1.01	0:51:54	1:48:48
10	2.71	1.63	0.10	1.53	1:18:38	2:47:15
15	2.23	2.01	0.15	1.86	1:35:54	3:26:48
30	1.46	2.62	0.29	2.33	1:59:50	4:29:40
60	0.92	3.30	0.58	2.72	2:20:00	5:39:59
120	0.58	4.17	1.17	3.01	2:34:41	7:09:22
240	0.36	5.13	2.33	2.79	2:23:46	8:47:32
360	0.27	5.92	3.50	2.42	2:04:21	10:08:41
600	0.19	6.93	5.83	1.10	0:56:26	11:52:52
1440	0.11	9.08	14.00	0.00	0:00:00	24:00:00

Drain down rate (l/s)
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.11

Storage Required	3.01 m³
Actual storage	21.878 m³
Time to half empty sub-base	2:34:41 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	15 mm

OK - Sub-base storage is greater than required
OK - Less than 24hrs
No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 7 PV3	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:1 year	Ratio	0.34	
Climate Change allowance:	0% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	4.25 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	19.55 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	
Unit 7	95 m ²	
Ramp	45 m ²	
Total	140 m ²	Area of contributing point flows

TOTAL DRAINED AREA	0.00 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	20	Pipe to orifice ratio (B)	0.3187
Pipe Capacity	13.720 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.2 l/s	Orifice diameter:	31.8709 mm
Discharge coefficient	0.61	Orifice area (A)	0.00080 mm ²

Outflow factors:	0.000732 m ³ /s	0.04392 m ³ /m	2.6352 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow m³	Storage m³	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	1.85	0.56	0.22	0.34	0:03:49	0:12:39
10	1.42	0.85	0.44	0.41	0:04:43	0:19:27
15	1.17	1.06	0.66	0.40	0:04:31	0:24:03
30	0.76	1.38	1.32	0.06	0:00:41	0:31:21
60	0.48	1.74	2.64	0.00	0:00:00	1:00:00
120	0.30	2.19	5.27	0.00	0:00:00	2:00:00
240	0.19	2.69	10.54	0.00	0:00:00	4:00:00
360	0.14	3.11	15.81	0.00	0:00:00	6:00:00
600	0.10	3.64	26.35	0.00	0:00:00	10:00:00
1440	0.06	4.77	63.24	0.00	0:00:00	24:00:00

Drain down l/s
0.73
0.73
0.73
0.73
0.48
0.30
0.19
0.14
0.10
0.06

Storage Required	0.41 m³
Actual storage	5.572 m³
Time to half empty sub-base	0:04:43 hr:mm:ss
Additional storage req'd	N/A m³

OK - Sub-base storage is greater than required

OK - Less than 24hrs

Additional storage provided in connecting pipework

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 4&5 PV4	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:1 year	Ratio	0.34	
Climate Change allowance:	0% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	7.08 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	32.568 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 4 & 5	171 m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	1.817 m ³

TOTAL DRAINED AREA	32.57 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	20	Pipe to orifice ratio (B)	0.3187
Pipe Capacity	13.720 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.2 l/s	Orifice diameter:	31.8709 mm
Discharge coefficient	0.61	Orifice area (A)	0.00080 mm ²

Outflow factors:	0.000732 m ³ /s	0.04392 m ³ /m	2.6352 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	0.43	0.13
10	0.33	0.20
15	0.27	0.25
30	0.18	0.32
60	0.11	0.40
120	0.07	0.51
240	0.04	0.63
360	0.03	0.72
600	0.02	0.85
1440	0.01	1.11

Unit 4 & 5 Point inflow (l/s)	Unit 4 & 5 Point inflow (m³)
2.262	0.679
1.739	1.043
1.433	1.290
0.934	1.682
0.589	2.120
0.372	2.678
0.228	3.290
0.176	3.796
0.124	4.446
0.067	5.828

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	2.69	0.81	0.22	0.59	0:06:42	0:18:24
10	2.07	1.24	0.44	0.80	0:09:08	0:28:16
15	1.71	1.54	0.66	0.88	0:09:59	0:34:58
30	1.11	2.00	1.32	0.68	0:07:48	0:45:35
60	0.70	2.52	2.64	0.00	0:00:00	1:00:00
120	0.44	3.19	5.27	0.00	0:00:00	2:00:00
240	0.27	3.92	10.54	0.00	0:00:00	4:00:00
360	0.21	4.52	15.81	0.00	0:00:00	6:00:00
600	0.15	5.29	26.35	0.00	0:00:00	10:00:00
1440	0.08	6.94	63.24	0.00	0:00:00	24:00:00

Drain down rate (l/s)
0.73
0.73
0.73
0.73
0.70
0.44
0.27
0.21
0.15
0.08

Storage Required	0.88 m³
Actual storage	11.099 m³
Time to half empty sub-base	0:09:59 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Central Bay PV5	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth
Return Period:	1:1 year
Climate Change allowance:	0% increase

M5 60min	20	mm/h
Ratio	0.34	

PERMEABLE AREA

Plan Width:	5.436 m
Plan Length:	24.795 m
Sub-base replacement:	300 mm
Void ratio:	0.94
Base:	134.78562 m ²
Eff Depth:	0.165 m

Width is perpendicular to the flow direction

Length is the flow direction of the paving subbase

Permavoid or equal geocellular units

ADDITIONAL INFLOWS

Are there point flows?	Yes
Unit 6	95 m ²
PV3	1.2 l/s
PV4	1.2 l/s
Units 1 - 3	254
Central Aco	142
Total Point Inflows	491 m ²

from diffuser points

Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	7.521 m ³

IMPERMEABLE AREA

Adjacent impermeable area:	277 m ²	areas that drain onto the permeable area
Impermeable area type:	Concrete	
Run-off coefficient:	1	reduction factor for adjacent impermeable area

TOTAL DRAINED AREA	411.79 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	1000	Pipe to orifice ratio (B)	0.0000
Pipe Capacity	1.940 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	l/s	Orifice diameter:	0.0000 mm
Discharge coefficient		Orifice area (A)	0.00000 mm ²

Outflow factors:	0.001940265 m ³ /s	0.116415893 m ³ /m	6.9849536 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	5.45	1.63
10	4.19	2.51
15	3.45	3.11
30	2.25	4.05
60	1.42	5.11
120	0.90	6.45
240	0.55	7.92
360	0.42	9.14
600	0.30	10.71
1440	0.16	14.03

Total Point Inflows (l/s)	Total Point Inflows (m³)
6.49	1.95
0.97	0.58
0.80	0.72
0.52	0.93
0.33	1.18
0.21	1.49
0.13	1.83
0.10	2.11
0.07	2.47
0.04	3.24

PV3 + PV4 (l/s)	PV3 + PV4 (m³)
1.46	0.44
1.46	0.88
1.46	1.32
1.46	2.64
1.18	4.26
0.75	5.38
0.46	6.61
0.35	7.63
0.25	8.93
0.14	11.71

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	13.41	4.02	0.58	3.44	0:14:46	0:34:33
10	6.62	3.97	1.16	2.81	0:12:03	0:34:06
15	5.71	5.14	1.75	3.39	0:14:35	0:44:09
30	4.23	7.62	3.49	4.13	0:17:44	1:05:27
60	2.93	10.54	6.98	3.56	0:15:17	1:30:35
120	1.85	13.32	13.97	0.00	0:00:00	2:00:00
240	1.14	16.36	27.94	0.00	0:00:00	4:00:00
360	0.87	18.88	41.91	0.00	0:00:00	6:00:00
600	0.61	22.11	69.85	0.00	0:00:00	10:00:00
1440	0.34	28.98	167.64	0.00	0:00:00	24:00:00

Drain down rate (l/s)
1.94
1.94
1.94
1.94
1.94
1.85
1.14
0.87
0.61
0.34

Storage Required	4.13 m³
Actual storage	20.905 m³
Time to half empty sub-base	0:17:44 hr:mm:ss

OK - Sub-base storage is greater than required
OK - Less than 24hrs

Linked to PV6 where additional storage is provided

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Central Bay PV6	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:1 year	Ratio	0.34	
Climate Change allowance:	0% increase			

PERMEABLE AREA

Plan Width:	5.31 m	Width is perpendicular to the flow direction
Plan Length:	14.16 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	75.1896 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	No	from diffuser points
PV5	m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	4.196 m ³

TOTAL DRAINED AREA	75.19 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	150 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	150	Pipe to orifice ratio (B)	0.2415
Pipe Capacity	14.677 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.55 l/s	Orifice diameter:	36.2218 mm
Discharge coefficient	0.61	Orifice area (A)	0.00103 mm ²

Outflow factors:	0.0009455 m ³ /s	0.05673 m ³ /m	3.4038 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	0.99	0.30
10	0.76	0.46
15	0.63	0.57
30	0.41	0.74
60	0.26	0.93
120	0.16	1.18
240	0.10	1.45
360	0.08	1.67
600	0.05	1.95
1440	0.03	2.56

PV5 Point inflow (l/s)	PV5 Point inflow (m³)
1.940	0.582
1.940	1.164
1.940	1.746
1.940	3.492
1.940	6.985
1.850	13.317
1.136	16.361
0.874	18.878
0.614	22.109
0.335	28.980

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	2.93	0.88	0.28	0.60	0:05:16	0:15:31
10	2.70	1.62	0.57	1.06	0:09:18	0:28:36
15	2.57	2.31	0.85	1.46	0:12:53	0:40:47
30	2.35	4.23	1.70	2.53	0:22:18	1:14:36
60	2.20	7.92	3.40	4.51	0:39:47	2:19:34
120	2.01	14.49	6.81	7.69	1:07:45	4:15:29
240	1.24	17.81	13.62	4.19	0:36:57	5:13:54
360	0.95	20.55	20.42	0.12	0:01:06	6:02:11
600	0.67	24.06	34.04	0.00	0:00:00	10:00:00
1440	0.37	31.54	81.69	0.00	0:00:00	24:00:00

Drain down rate (l/s)
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.67
0.37

Storage Required	7.69 m³
PV6 storage	25.625 m³
PV5 storage	20.905 m³
Total Storage	46.530 m³
Time to half empty sub-base	1:07:45 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required
OK - Less than 24hrs
No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	East Bays PV7	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:1 year	Ratio	0.34	
Climate Change allowance:	0% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	31.06 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio of unit:	0.94	
Base:	142.876 m ²	
Eff Depth:	0.3 m	

IMPERMEABLE AREA

Adjacent impermeable area:	575 m ²	areas that drain onto the permeable area
Impermeable area type:	Concrete	
Run-off coefficient:	1	reduction factor for adjacent impermeable area

TOTAL DRAINED AREA	717.88 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	150 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	150	Pipe to orifice ratio (B)	0.2415
Pipe Capacity	14.677 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.55 l/s	Orifice diameter:	36.2218 mm
Discharge coefficient	0.61	Orifice area (A)	0.00103 mm ²

Outflow factors:	0.0009455 m ³ /s	0.05673 m ³ /m	3.4038 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	47.62	3.97
10	36.6	91.45	114.61	36.60	6.10
15	30.17	75.39	94.48	30.17	7.54
30	19.67	49.93	63.13	19.67	9.84
60	12.4	31.48	39.8	12.40	12.40
120	7.83	19.57	24.83	7.83	15.66
240	4.81	11.66	14.65	4.81	19.24
360	3.7	8.56	10.71	3.70	22.20
600	2.6	5.87	7.28	2.60	26.00
1440	1.42	3.03	3.73	1.42	34.08

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow m³	Storage m³	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	9.50	2.85	0.28	2.57	0:22:36	0:50:13
10	7.30	4.38	0.57	3.81	0:33:36	1:17:11
15	6.02	5.41	0.85	4.56	0:40:13	1:35:27
30	3.92	7.06	1.70	5.36	0:47:14	2:04:27
60	2.47	8.90	3.40	5.50	0:48:27	2:36:55
120	1.56	11.24	6.81	4.43	0:39:05	3:18:10
240	0.96	13.81	13.62	0.20	0:01:44	4:03:28
360	0.74	15.94	20.42	0.00	0:00:00	6:00:00
600	0.52	18.66	34.04	0.00	0:00:00	10:00:00
1440	0.28	24.47	81.69	0.00	0:00:00	24:00:00

Drain down l/s
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.74
0.52
0.28

Storage Required	5.50 m³
Bay Storage	40.291 m³
Additional Storage	
Plan Width:	2.478 m
Plan Length:	10.62 m
Sub-base replacement:	300 mm
Void ratio of unit:	0.95
Base:	26.31636 m²
Eff Depth:	0.3 m
Additional Volume	7.500 m³

OK - Storage is greater than required

Total PV7 Storage	47.791 m³
Time to half empty sub-base	0:48:27 hr:mm:ss

OK - Total storage is greater than required

OK - Less than 24hrs

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 8 PVI&2	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	6.37 m	Length is the flow direction of the paving subbase
Sub-base replacement:	150 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	29.302 m ²	
Eff Depth:	0.15 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 8	57 m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	1.635 m ³

TOTAL DRAINED AREA	29.30 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	1000	Pipe to orifice ratio (B)	0.0000
Pipe Capacity	1.940 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	l/s	Orifice diameter:	0.0000 mm
Discharge coefficient	0.61	Orifice area (A)	0.00000 mm ²

Outflow factors:	0.001940265 m ³ /s	0.116415893 m ³ /m	6.9849536 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	1.27	0.38
10	1.04	0.63
15	0.86	0.77
30	0.57	1.02
60	0.36	1.29
120	0.22	1.61
240	0.13	1.91
360	0.10	2.11
600	0.07	2.41
1440	0.03	2.98

Unit 8 Point inflow (l/s)	Unit 8 Point inflow (m³)
2.465	0.740
2.027	1.216
1.671	1.504
1.107	1.992
0.698	2.512
0.434	3.123
0.258	3.722
0.190	4.099
0.130	4.684
0.067	5.803

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	3.73	1.12	0.58	0.54	0:02:19	0:09:37
10	3.07	1.84	1.16	0.68	0:02:55	0:15:49
15	2.53	2.28	1.75	0.53	0:02:17	0:19:34
30	1.68	3.02	3.49	0.00	0:00:00	0:30:00
60	1.06	3.80	6.98	0.00	0:00:00	1:00:00
120	0.66	4.73	13.97	0.00	0:00:00	2:00:00
240	0.39	5.64	27.94	0.00	0:00:00	4:00:00
360	0.29	6.21	41.91	0.00	0:00:00	6:00:00
600	0.20	7.09	69.85	0.00	0:00:00	10:00:00
1440	0.10	8.79	167.64	0.00	0:00:00	24:00:00

Drain down rate (l/s)
1.94
1.94
1.94
1.68
1.06
0.66
0.39
0.29
0.20
0.10

Storage Required	0.68 m³
Actual storage	5.811 m³
Time to half empty sub-base	0:02:55 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 8 Gravel Sub-Base	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	6.53 m	Width is perpendicular to the flow direction
Plan Length:	14.38 m	Length is the flow direction of the paving subbase
Depth of sub-base:	375 mm	Type 3 or equal open graded granular sub-base
Void ratio of stone:	0.3	
Base:	93.9014 m ²	
Eff Depth:	0.375 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
PV1 & PV2	m ²	Area of contributing point flows

TOTAL DRAINED AREA	93.90 m ²	summation of permeable and impermeable areas
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Sub-base hydraulic gradient (i)	1 300
k (Hazen's Formula)	0.5 m/s
Cross Section of paving (A)	2.44875 m ²
Q = Aki (Darcy's Law)	0.00408125 m ³ /s
Sub-base flow rate	4.08125 l/s

Outlet pipe diameter	100 mm
Outlet pipe fall 1:	100
Pipe Capacity	6.136 l/s
Applied discharge rate:	0.27 l/s
Discharge coefficient	0.6

gravity (g)	9.81 m/sec ²
Pipe to orifice ratio (B)	0.1430
Expansion coefficient (Y)	1.0
Orifice diameter:	14.2974 mm
Orifice area (A)	0.00016 mm ²

Outflow factors:	0.000162 m ³ /s	0.00972 m ³ /m	0.5832 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	4.06	1.22
10	3.34	2.00
15	2.75	2.48
30	1.82	3.28
60	1.15	4.14
120	0.71	5.15
240	0.43	6.13
360	0.31	6.75
600	0.21	7.72
1440	0.11	9.56

PV1 & PV2 Point inflow (l/s)	PV1 & PV2 Point inflow (m³)
3.88	1.16
3.88	2.33
3.88	3.49
3.35	6.03
2.11	7.61
1.31	9.46
0.78	11.27
0.57	12.41
0.39	14.18
0.20	17.57

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	7.94	2.38	0.05	2.33	2:00:03	4:05:07
10	7.22	4.33	0.10	4.23	3:37:50	7:25:41
15	6.63	5.97	0.15	5.82	4:59:37	10:14:13
30	5.17	9.31	0.29	9.02	7:44:09	15:58:18
60	3.26	11.75	0.58	11.16	9:34:11	20:08:23
120	2.03	14.60	1.17	13.44	11:31:12	25:02:25
240	1.21	17.40	2.33	15.07	12:55:09	29:50:18
360	0.89	19.16	3.50	15.66	13:25:44	32:51:29
600	0.61	21.90	5.83	16.07	13:46:37	37:33:14
1440	0.31	27.13	14.00	13.14	11:15:42	46:31:24

Drain down rate (l/s)
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16

Storage Required	16.07 m³
Actual storage	21.878 m³
Time to half empty sub-base	13:46:37 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	15 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 7 PV3	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	4.25 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	19.55 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	
Unit 7	95 m ²	
Ramp	45 m ²	
Total	140 m ²	Area of contributing point flows

TOTAL DRAINED AREA	0.00 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	20	Pipe to orifice ratio (B)	0.3187
Pipe Capacity	13.720 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.2 l/s	Orifice diameter:	31.8709 mm
Discharge coefficient	0.61	Orifice area (A)	0.00080 mm ²

Outflow factors:	0.000732 m ³ /s	0.04392 m ³ /m	2.6352 m ³ /h
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Rainfall Intensity (mm/h) FSR rainfall data					
Event Duration (mins)	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	Design Rainfall (mm)
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow m³	Storage m³	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	6.05	1.82	0.22	1.60	0:18:11	0:41:21
10	4.98	2.99	0.44	2.55	0:29:01	1:08:01
15	4.10	3.69	0.66	3.04	0:34:33	1:24:07
30	2.72	4.89	1.32	3.58	0:40:42	1:51:25
60	1.71	6.17	2.64	3.53	0:40:15	2:20:29
120	1.07	7.67	5.27	2.40	0:27:20	2:54:40
240	0.63	9.14	10.54	0.00	0:00:00	4:00:00
360	0.47	10.07	15.81	0.00	0:00:00	6:00:00
600	0.32	11.51	26.35	0.00	0:00:00	10:00:00
1440	0.16	14.25	63.24	0.00	0:00:00	24:00:00

Drain down l/s
0.73
0.73
0.73
0.73
0.73
0.73
0.63
0.47
0.32
0.16

Storage Required	3.58 m³
Actual storage	5.572 m³
Time to half empty sub-base	0:40:42 hr:mm:ss
Additional storage req'd	N/A m³

OK - Sub-base storage is greater than required

OK - Less than 24hrs

Additional storage provided in connecting pipework

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 4&5 PV4	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	7.08 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	32.568 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 4 & 5	171 m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	1.817 m ³

TOTAL DRAINED AREA	32.57 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	20	Pipe to orifice ratio (B)	0.3187
Pipe Capacity	13.720 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.2 l/s	Orifice diameter:	31.8709 mm
Discharge coefficient	0.61	Orifice area (A)	0.00080 mm ²

Outflow factors:	0.000732 m ³ /s	0.04392 m ³ /m	2.6352 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	1.41	0.42
10	1.16	0.69
15	0.95	0.86
30	0.63	1.14
60	0.40	1.44
120	0.25	1.78
240	0.15	2.13
360	0.11	2.34
600	0.07	2.68
1440	0.04	3.32

Unit 4 & 5 Point inflow (l/s)	Unit 4 & 5 Point inflow (m³)
7.395	2.219
6.081	3.649
5.013	4.512
3.320	5.977
2.093	7.536
1.301	9.370
0.775	11.166
0.569	12.296
0.390	14.053
0.201	17.409

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	8.80	2.64	0.22	2.42	0:27:34	1:00:08
10	7.24	4.34	0.44	3.90	0:44:27	1:38:54
15	5.97	5.37	0.66	4.71	0:53:39	2:02:18
30	3.95	7.11	1.32	5.80	1:06:00	2:42:00
60	2.49	8.97	2.64	6.34	1:12:08	3:24:16
120	1.55	11.15	5.27	5.88	1:06:59	4:13:59
240	0.92	13.29	10.54	2.75	0:31:19	5:02:39
360	0.68	14.64	15.81	0.00	0:00:00	6:00:00
600	0.46	16.73	26.35	0.00	0:00:00	10:00:00
1440	0.24	20.72	63.24	0.00	0:00:00	24:00:00

Drain down rate (l/s)
0.73
0.73
0.73
0.73
0.73
0.73
0.73
0.68
0.46
0.24

Storage Required	6.34 m³
Actual storage	11.099 m³
Time to half empty sub-base	1:12:08 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Central Bay PV5	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	5.436 m	Width is perpendicular to the flow direction
Plan Length:	24.795 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.94	
Base:	134.78562 m ²	
Eff Depth:	0.165 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 6	95 m ²	Area of contributing point flows
PV3	1.2 l/s	
PV4	1.2 l/s	
Units 1 - 3	254	
Central Aco	142	
Total Point Inflows	491 m ²	

Depth granular over	0.186 m
Voids	0.3
Additional storage	7.521 m ³

IMPERMEABLE AREA

Adjacent impermeable area:	277 m ²	areas that drain onto the permeable area
Impermeable area type:	Concrete	
Run-off coefficient:	1	

TOTAL DRAINED AREA	411.79 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	1000	Pipe to orifice ratio (B)	0.0000
Pipe Capacity	1.940 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	l/s	Orifice diameter:	0.0000 mm
Discharge coefficient		Orifice area (A)	0.00000 mm ²

Outflow factors:	0.001940265 m ³ /s	0.116415893 m ³ /m	6.9849536 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)	Total Point Inflows (l/s)	Total Point Inflows (m³)	PV3 + PV4 (l/s)	PV3 + PV4 (m³)
5	17.81	5.34	21.23	6.37	1.46	0.44
10	14.64	8.79	3.38	2.03	1.46	0.88
15	12.07	10.87	2.79	2.51	1.46	1.32
30	8.00	14.39	1.84	3.32	1.46	2.64
60	5.04	18.15	1.16	4.19	1.46	5.27
120	3.13	22.56	0.72	5.21	1.46	10.54
240	1.87	26.89	0.43	6.20	1.37	19.68
360	1.37	29.61	0.32	6.83	1.14	24.70
600	0.94	33.84	0.22	7.81	0.78	28.23
1440	0.49	41.92	0.11	9.67	0.40	34.98

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)	Drain down rate (l/s)
5	40.51	12.15	0.58	11.57	0:49:42	1:44:23	1.94
10	19.49	11.69	1.16	10.53	0:45:13	1:40:26	1.94
15	16.32	14.69	1.75	12.94	0:55:36	2:06:11	1.94
30	11.30	20.35	3.49	16.86	1:12:24	2:54:47	1.94
60	7.67	27.61	6.98	20.62	1:28:34	3:57:08	1.94
120	5.32	38.31	13.97	24.34	1:44:33	5:29:05	1.94
240	3.66	52.77	27.94	24.83	1:46:40	7:33:19	1.94
360	2.83	61.14	41.91	19.23	1:22:37	8:45:13	1.94
600	1.94	69.88	69.85	0.03	0:00:08	10:00:17	1.94
1440	1.00	86.57	167.64	0.00	0:00:00	24:00:00	1.00

Storage Required	24.83 m³
Actual storage	20.905 m³
Time to half empty sub-base	1:46:40 hr:mm:ss

Sub-base storage is inadequate
OK - Less than 24hrs

Linked to PV6 where additional storage is provided

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Central Bay PV6	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	5.31 m	Width is perpendicular to the flow direction
Plan Length:	14.16 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	75.1896 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	No	from diffuser points
PV5	m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	4.196 m ³

TOTAL DRAINED AREA	75.19 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	150 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	150	Pipe to orifice ratio (B)	0.2415
Pipe Capacity	14.677 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.55 l/s	Orifice diameter:	36.2218 mm
Discharge coefficient	0.61	Orifice area (A)	0.00103 mm ²

Outflow factors:	0.0009455 m ³ /s	0.05673 m ³ /m	3.4038 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	3.25	0.98
10	2.67	1.60
15	2.20	1.98
30	1.46	2.63
60	0.92	3.31
120	0.57	4.12
240	0.34	4.91
360	0.25	5.41
600	0.17	6.18
1440	0.09	7.65

PV5 Point inflow (l/s)	PV5 Point inflow (m³)
1.940	0.582
1.940	1.164
1.940	1.746
1.940	3.492
1.940	6.985
1.940	13.970
1.940	27.940
1.940	41.910
1.940	69.850
1.002	86.573

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	5.19	1.56	0.28	1.27	0:11:14	0:27:27
10	4.61	2.77	0.57	2.20	0:19:24	0:48:48
15	4.14	3.73	0.85	2.88	0:25:23	1:05:45
30	3.40	6.12	1.70	4.42	0:38:57	1:47:53
60	2.86	10.30	3.40	6.89	1:00:46	3:01:32
120	2.51	18.09	6.81	11.28	1:39:26	5:18:53
240	2.28	32.85	13.62	19.23	2:49:31	9:39:03
360	2.19	47.32	20.42	26.89	3:57:02	13:54:04
600	2.11	76.03	34.04	41.99	6:10:06	22:20:11
1440	1.09	94.23	81.69	12.54	1:50:30	27:40:59

Drain down rate (l/s)
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95

Storage Required	41.99 m³
PV6 storage	25.625 m³
PV5 storage	20.905 m³
Total Storage	46.530 m³
Time to half empty sub-base	6:10:06 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required
OK - Less than 24hrs
No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	East Bays PV7	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:30 year	Ratio	0.34	
Climate Change allowance:	40% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	31.06 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio of unit:	0.94	
Base:	142.876 m ²	
Eff Depth:	0.3 m	

IMPERMEABLE AREA

Adjacent impermeable area:	575 m ²	areas that drain onto the permeable area
Impermeable area type:	Concrete	
Run-off coefficient:	1	reduction factor for adjacent impermeable area

TOTAL DRAINED AREA	717.88 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	150 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	150	Pipe to orifice ratio (B)	0.2415
Pipe Capacity	14.677 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.55 l/s	Orifice diameter:	36.2218 mm
Discharge coefficient	0.61	Orifice area (A)	0.00103 mm ²

Outflow factors:	0.0009455 m ³ /s	0.05673 m ³ /m	3.4038 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	155.69	12.97
10	36.6	91.45	114.61	128.03	21.34
15	30.17	75.39	94.48	105.55	26.39
30	19.67	49.93	63.13	69.90	34.95
60	12.4	31.48	39.8	44.07	44.07
120	7.83	19.57	24.83	27.40	54.80
240	4.81	11.66	14.65	16.32	65.30
360	3.7	8.56	10.71	11.98	71.90
600	2.6	5.87	7.28	8.22	82.18
1440	1.42	3.03	3.73	4.24	101.81

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow m³	Storage m³	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	31.05	9.31	0.28	9.03	1:19:35	2:44:11
10	25.53	15.32	0.57	14.75	2:10:01	4:30:01
15	21.05	18.94	0.85	18.09	2:39:27	5:33:54
30	13.94	25.09	1.70	23.39	3:26:08	7:22:17
60	8.79	31.64	3.40	28.23	4:08:51	9:17:42
120	5.46	39.34	6.81	32.53	4:46:42	11:33:24
240	3.26	46.87	13.62	33.26	4:53:08	13:46:16
360	2.39	51.62	20.42	31.20	4:34:57	15:09:54
600	1.64	59.00	34.04	24.96	3:39:58	17:19:56
1440	0.85	73.09	81.69	0.00	0:00:00	24:00:00

Drain down l/s
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.85

Storage Required	33.26 m³
Bay Storage	40.291 m³
Additional Storage	
Plan Width:	2.478 m
Plan Length:	10.62 m
Sub-base replacement:	300 mm
Void ratio of unit:	0.95
Base:	26.31636 m²
Eff Depth:	0.3 m
Additional Volume	7.500 m³

OK - Storage is greater than required

Total PV7 Storage	47.791 m³
Time to half empty sub-base	4:53:08 hr:mm:ss

OK - Total storage is greater than required
OK - Less than 24hrs

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 8 PVI&2	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:100 year	Ratio	0.34	
Climate Change allowance:	45% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	6.37 m	Length is the flow direction of the paving subbase
Sub-base replacement:	150 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	29.302 m ²	
Eff Depth:	0.15 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 8	57 m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	1.635 m ³

TOTAL DRAINED AREA	29.30 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	1000	Pipe to orifice ratio (B)	0.0000
Pipe Capacity	1.940 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	l/s	Orifice diameter:	0.0000 mm
Discharge coefficient	0.61	Orifice area (A)	0.00000 mm ²

Outflow factors:	0.001940265 m ³ /s	0.116415893 m ³ /m	6.9849536 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	1.62	0.49
10	1.35	0.81
15	1.12	1.00
30	0.75	1.34
60	0.47	1.69
120	0.29	2.11
240	0.17	2.49
360	0.13	2.73
600	0.09	3.09
1440	0.04	3.80

Unit 8 Point inflow (l/s)	Unit 8 Point inflow (m³)
3.156	0.947
2.631	1.579
2.169	1.952
1.449	2.609
0.914	3.289
0.570	4.104
0.336	4.843
0.246	5.311
0.167	6.017
0.086	7.399

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	4.78	1.43	0.58	0.85	0:03:39	0:12:19
10	3.98	2.39	1.16	1.23	0:05:16	0:20:32
15	3.28	2.96	1.75	1.21	0:05:12	0:25:23
30	2.19	3.95	3.49	0.46	0:01:58	0:33:56
60	1.38	4.98	6.98	0.00	0:00:00	1:00:00
120	0.86	6.21	13.97	0.00	0:00:00	2:00:00
240	0.51	7.33	27.94	0.00	0:00:00	4:00:00
360	0.37	8.04	41.91	0.00	0:00:00	6:00:00
600	0.25	9.11	69.85	0.00	0:00:00	10:00:00
1440	0.13	11.20	167.64	0.00	0:00:00	24:00:00

Drain down rate (l/s)
1.94
1.94
1.94
1.94
1.38
0.86
0.51
0.37
0.25
0.13

Storage Required	1.23 m³
Actual storage	5.811 m³
Time to half empty sub-base	0:05:16 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 8 Gravel Sub-Base	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth
Return Period:	1:100 year
Climate Change allowance:	45% increase

M5 60min	20	mm/h
Ratio	0.34	

PERMEABLE AREA

Plan Width:	6.53 m	Width is perpendicular to the flow direction
Plan Length:	14.38 m	Length is the flow direction of the paving subbase
Depth of sub-base:	375 mm	Type 3 or equal open graded granular sub-base
Void ratio of stone:	0.3	
Base:	93.9014 m ²	
Eff Depth:	0.375 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
PV1 & PV2	m ²	Area of contributing point flows

TOTAL DRAINED AREA	93.90 m ²	summation of permeable and impermeable areas
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Sub-base hydraulic gradient (i)	1 300
k (Hazen's Formula)	0.5 m/s
Cross Section of paving (A)	2.44875 m ²
Q = Aki (Darcy's Law)	0.00408125 m ³ /s
Sub-base flow rate	4.08125 l/s

Outlet pipe diameter	100 mm
Outlet pipe fall 1:	100
Pipe Capacity	6.136 l/s
Applied discharge rate:	0.27 l/s
Discharge coefficient	0.6

gravity (g)	9.81 m/sec ²
Pipe to orifice ratio (B)	0.1430
Expansion coefficient (Y)	1.0
Orifice diameter:	14.2974 mm
Orifice area (A)	0.00016 mm ²

Outflow factors:	0.000162 m ³ /s	0.00972 m ³ /m	0.5832 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	5.20	1.56
10	4.33	2.60
15	3.57	3.22
30	2.39	4.30
60	1.51	5.42
120	0.94	6.76
240	0.55	7.98
360	0.41	8.75
600	0.28	9.91
1440	0.14	12.19

PV1 & PV2 Point inflow (l/s)	PV1 & PV2 Point inflow (m³)
3.88	1.16
3.88	2.33
3.88	3.49
3.88	6.98
2.77	9.96
1.73	12.43
1.02	14.67
0.74	16.08
0.51	18.22
0.26	22.40

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	9.08	2.72	0.05	2.68	2:17:37	4:40:15
10	8.22	4.93	0.10	4.83	4:08:33	8:27:07
15	7.45	6.71	0.15	6.56	5:37:35	11:30:11
30	6.27	11.28	0.29	10.99	9:25:23	19:20:47
60	4.27	15.38	0.58	14.80	12:41:09	26:22:18
120	2.67	19.19	1.17	18.02	15:27:09	32:54:18
240	1.57	22.64	2.33	20.31	17:24:52	38:49:44
360	1.15	24.83	3.50	21.33	18:17:23	42:34:45
600	0.78	28.13	5.83	22.30	19:07:08	48:14:16
1440	0.40	34.59	14.00	20.60	17:39:30	59:19:00

Drain down rate (l/s)
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16
0.16

Storage Required	22.30 m³
Actual storage	21.878 m³
Time to half empty sub-base	19:07:08 hr:mm:ss
Additional storage req'd	0.42 m³
Surface storage	4.49 mm
Time to drain surface storage	21:41:54 (hr:mm:ss)
Kerb height	15 mm

Sub-base storage is inadequate
OK - Less than 24hrs

Maximum depth of surface water stored across permeable area

OK - Storage height less than kerb height

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 7 PV3	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:100 year	Ratio	0.34	
Climate Change allowance:	45% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	4.25 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	19.55 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	
Unit 7	95 m ²	
Ramp	45 m ²	
Total	140 m ²	Area of contributing point flows

TOTAL DRAINED AREA	0.00 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	20	Pipe to orifice ratio (B)	0.3187
Pipe Capacity	13.720 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.2 l/s	Orifice diameter:	31.8709 mm
Discharge coefficient	0.61	Orifice area (A)	0.00080 mm ²

Outflow factors:	0.000732 m ³ /s	0.04392 m ³ /m	2.6352 m ³ /h
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Rainfall Intensity (mm/h) FSR rainfall data					
Event Duration (mins)	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	Design Rainfall (mm)
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m ³)	Outflow m ³	Storage m ³	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)	Drain down l/s
5	7.75	2.33	0.22	2.11	0:23:58	0:52:57	0.73
10	6.46	3.88	0.44	3.44	0:39:09	1:28:17	0.73
15	5.33	4.79	0.66	4.14	0:47:05	1:49:10	0.73
30	3.56	6.41	1.32	5.09	0:57:57	2:25:54	0.73
60	2.24	8.08	2.64	5.44	1:01:59	3:03:57	0.73
120	1.40	10.08	5.27	4.81	0:54:46	3:49:32	0.73
240	0.83	11.90	10.54	1.36	0:15:26	4:30:51	0.73
360	0.60	13.04	15.81	0.00	0:00:00	6:00:00	0.60
600	0.41	14.78	26.35	0.00	0:00:00	10:00:00	0.41
1440	0.21	18.17	63.24	0.00	0:00:00	24:00:00	0.21

Storage Required	5.44 m ³
Actual storage	5.572 m ³
Time to half empty sub-base	1:01:59 hr:mm:ss
Additional storage req'd	N/A m ³

OK - Sub-base storage is greater than required

OK - Less than 24hrs

Additional storage provided in connecting pipework

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Unit 4&5 PV4	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:100 year	Ratio	0.34	
Climate Change allowance:	45% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	7.08 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	32.568 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	Yes	from diffuser points
Unit 4 & 5	171 m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	1.817 m ³

TOTAL DRAINED AREA	32.57 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	20	Pipe to orifice ratio (B)	0.3187
Pipe Capacity	13.720 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.2 l/s	Orifice diameter:	31.8709 mm
Discharge coefficient	0.61	Orifice area (A)	0.00080 mm ²

Outflow factors:	0.000732 m ³ /s	0.04392 m ³ /m	2.6352 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	1.80	0.54
10	1.50	0.90
15	1.24	1.12
30	0.83	1.49
60	0.52	1.88
120	0.33	2.35
240	0.19	2.77
360	0.14	3.03
600	0.10	3.44
1440	0.05	4.23

Unit 4 & 5 Point inflow (l/s)	Unit 4 & 5 Point inflow (m³)
9.468	2.840
7.894	4.736
6.507	5.857
4.348	7.827
2.741	9.868
1.710	12.313
1.009	14.530
0.738	15.933
0.501	18.051
0.257	22.196

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	11.27	3.38	0.22	3.16	0:36:00	1:16:59
10	9.40	5.64	0.44	5.20	0:59:11	2:08:23
15	7.75	6.97	0.66	6.31	1:11:52	2:38:45
30	5.18	9.32	1.32	8.00	1:31:04	3:32:08
60	3.26	11.75	2.64	9.11	1:43:45	4:27:29
120	2.04	14.66	5.27	9.39	1:46:53	5:33:45
240	1.20	17.30	10.54	6.76	1:16:55	6:33:50
360	0.88	18.97	15.81	3.16	0:35:56	7:11:52
600	0.60	21.49	26.35	0.00	0:00:00	10:00:00
1440	0.31	26.42	63.24	0.00	0:00:00	24:00:00

Drain down rate (l/s)
0.73
0.73
0.73
0.73
0.73
0.73
0.73
0.73
0.60
0.31

Storage Required	9.39 m³
Actual storage	11.099 m³
Time to half empty sub-base	1:46:53 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required

OK - Less than 24hrs

No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Central Bay PV5	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth
Return Period:	1:100 year
Climate Change allowance:	45% increase

M5 60min	20	mm/h
Ratio	0.34	

PERMEABLE AREA

Plan Width:	5.436 m
Plan Length:	24.795 m
Sub-base replacement:	300 mm
Void ratio:	0.94
Base:	134.78562 m ²
Eff Depth:	0.165 m

Width is perpendicular to the flow direction

Length is the flow direction of the paving subbase

Permavoid or equal geocellular units

ADDITIONAL INFLOWS

Are there point flows?	Yes
Unit 6	95 m ²
PV3	1.2 l/s
PV4	1.2 l/s
Units 1 - 3	254
Central Aco	142
Total Point Inflows	491 m ²

from diffuser points

Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	7.521 m ³

IMPERMEABLE AREA

Adjacent impermeable area:	277 m ²	areas that drain onto the permeable area
Impermeable area type:	Concrete	
Run-off coefficient:	1	

TOTAL DRAINED AREA	411.79 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	100 mm	gravity (g)	9.81 m/sec²	
Outlet pipe fall 1:	1000		Pipe to orifice ratio (B)	0.0000
Pipe Capacity	1.940 l/s		Expansion coefficient (Y)	1.0
Applied discharge rate:	l/s		Orifice diameter:	0.0000 mm
Discharge coefficient			Orifice area (A)	0.00000 mm²

Outflow factors:	0.001940265 m ³ /s	0.116415893 m ³ /m	6.9849536 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)	Total Point Inflows (l/s)	Total Point Inflows (m³)	PV3 + PV4 (l/s)	PV3 + PV4 (m³)
5	22.80	6.84	27.19	8.16	1.46	0.44
10	19.01	11.41	4.39	2.63	1.46	0.88
15	15.67	14.10	3.62	3.25	1.46	1.32
30	10.47	18.85	2.42	4.35	1.46	2.64
60	6.60	23.76	1.52	5.48	1.46	5.27
120	4.12	29.65	0.95	6.84	1.46	10.54
240	2.43	34.99	0.56	8.07	1.46	21.08
360	1.78	38.37	0.41	8.85	1.34	28.86
600	1.21	43.47	0.28	10.03	1.01	36.27
1440	0.62	53.45	0.14	12.33	0.52	44.60

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)	Drain down rate (l/s)
5	51.45	15.44	0.58	14.85	1:03:48	2:12:35	1.94
10	24.86	14.92	1.16	13.75	0:59:04	2:08:07	1.94
15	20.75	18.67	1.75	16.93	1:12:42	2:40:25	1.94
30	14.35	25.83	3.49	22.34	1:35:56	3:41:53	1.94
60	9.59	34.52	6.98	27.53	1:58:15	4:56:30	1.94
120	6.53	47.03	13.97	33.06	2:22:00	6:44:00	1.94
240	4.45	64.14	27.94	36.20	2:35:29	9:10:59	1.94
360	3.52	76.08	41.91	34.17	2:26:45	10:53:29	1.94
600	2.49	89.76	69.85	19.91	1:25:32	12:51:03	1.94
1440	1.28	110.38	167.64	0.00	0:00:00	24:00:00	1.28

Storage Required	36.20 m³
Actual storage	20.905 m³
Time to half empty sub-base	2:35:29 hr:mm:ss

Sub-base storage is inadequate
OK - Less than 24hrs

Linked to PV6 where additional storage is provided

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	Central Bay PV6	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:100 year	Ratio	0.34	
Climate Change allowance:	45% increase			

PERMEABLE AREA

Plan Width:	5.31 m	Width is perpendicular to the flow direction
Plan Length:	14.16 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio:	0.95	
Base:	75.1896 m ²	
Eff Depth:	0.3 m	

ADDITIONAL INFLOWS

Are there point flows?	No	from diffuser points
PV5	m ²	Area of contributing point flows

Depth granular over	0.186 m
Voids	0.3
Additional storage	4.196 m ³

TOTAL DRAINED AREA	75.19 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	150 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	150	Pipe to orifice ratio (B)	0.2415
Pipe Capacity	14.677 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.55 l/s	Orifice diameter:	36.2218 mm
Discharge coefficient	0.61	Orifice area (A)	0.00103 mm ²

Outflow factors:	0.0009455 m ³ /s	0.05673 m ³ /m	3.4038 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Area Run-off rate (l/s)	Area Inflow (m³)
5	4.16	1.25
10	3.47	2.08
15	2.86	2.58
30	1.91	3.44
60	1.21	4.34
120	0.75	5.41
240	0.44	6.39
360	0.32	7.01
600	0.22	7.94
1440	0.11	9.76

PV5 Point inflow (l/s)	PV5 Point inflow (m³)
1.940	0.582
1.940	1.164
1.940	1.746
1.940	3.492
1.940	6.985
1.940	13.970
1.940	27.940
1.940	41.910
1.940	69.850
1.278	110.379

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow (m³)	Storage (m³)	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	6.10	1.83	0.28	1.55	0:13:38	0:32:17
10	5.41	3.25	0.57	2.68	0:23:37	0:57:14
15	4.80	4.32	0.85	3.47	0:30:35	1:16:10
30	3.85	6.93	1.70	5.23	0:46:07	2:02:14
60	3.15	11.32	3.40	7.92	1:09:48	3:19:37
120	2.69	19.38	6.81	12.58	1:50:51	5:41:41
240	2.38	34.33	13.62	20.71	3:02:34	10:05:07
360	2.26	48.92	20.42	28.49	4:11:08	14:22:15
600	2.16	77.79	34.04	43.75	6:25:35	22:51:10
1440	1.39	120.14	81.69	38.45	5:38:52	35:17:44

Drain down rate (l/s)
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95

Storage Required	43.75 m³
PV6 storage	25.625 m³
PV5 storage	20.905 m³
Total Storage	46.530 m³
Time to half empty sub-base	6:25:35 hr:mm:ss
Additional storage req'd	N/A m³
Surface storage	N/A mm
Time to drain surface storage	N/A (hr:mm:ss)
Kerb height	100 mm

OK - Sub-base storage is greater than required
OK - Less than 24hrs
No surface storage required

PERMEABLE PAVING HYDRAULIC DESIGN TO BS7533-13 : 2009 - TYPE C (Attenuation)

Job Name:	Seagull Lane	Job No.	13505	By:	CJB
Element:	East Bays PV7	Date:	29/11/2024	Chk:	
Site Address:	50.850519332532265, -0.9365083395149222	Link:	Click for Google Map		

RAINFALL & AREA DATA

Data Location:	Emsworth	M5 60min	20	mm/h
Return Period:	1:100 year	Ratio	0.34	
Climate Change allowance:	45% increase			

PERMEABLE AREA

Plan Width:	4.6 m	Width is perpendicular to the flow direction
Plan Length:	31.06 m	Length is the flow direction of the paving subbase
Sub-base replacement:	300 mm	Permavoid or equal geocellular units
Void ratio of unit:	0.94	
Base:	142.876 m ²	
Eff Depth:	0.3 m	

IMPERMEABLE AREA

Adjacent impermeable area:	575 m ²	areas that drain onto the permeable area
Impermeable area type:	Concrete	
Run-off coefficient:	1	reduction factor for adjacent impermeable area

TOTAL DRAINED AREA	717.88 m ²	summation of permeable and impermeable areas
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Outlet pipe diameter	150 mm	gravity (g)	9.81 m/sec ²
Outlet pipe fall 1:	150	Pipe to orifice ratio (B)	0.2415
Pipe Capacity	14.677 l/s	Expansion coefficient (Y)	1.0
Applied discharge rate:	1.55 l/s	Orifice diameter:	36.2218 mm
Discharge coefficient	0.61	Orifice area (A)	0.00103 mm ²

Outflow factors:	0.0009455 m ³ /s	0.05673 m ³ /m	3.4038 m ³ /h
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Event Duration (mins)	Rainfall Intensity (mm/h) FSR rainfall data				Design Rainfall (mm)
	1:1 year	1:30 year	1:100 year	Design intensity (inc. climate change)	
5	47.62	111.21	137.47	199.33	16.61
10	36.6	91.45	114.61	166.18	27.70
15	30.17	75.39	94.48	137.00	34.25
30	19.67	49.93	63.13	91.54	45.77
60	12.4	31.48	39.8	57.71	57.71
120	7.83	19.57	24.83	36.00	72.01
240	4.81	11.66	14.65	21.24	84.97
360	3.7	8.56	10.71	15.53	93.18
600	2.6	5.87	7.28	10.56	105.56
1440	1.42	3.03	3.73	5.41	129.80

Event Duration (mins)	Total run-off rate (l/s)	Total Inflow Volume (m³)	Outflow m³	Storage m³	Half drain down time (hr:mm:ss)	Total event time (hr:mm:ss)
5	39.75	11.92	0.28	11.64	1:42:36	3:30:12
10	33.14	19.88	0.57	19.32	2:50:15	5:50:29
15	27.32	24.59	0.85	23.74	3:29:12	7:13:24
30	18.25	32.86	1.70	31.15	4:34:35	9:39:11
60	11.51	41.43	3.40	38.02	5:35:08	12:10:17
120	7.18	51.69	6.81	44.88	6:35:36	15:11:12
240	4.24	61.00	13.62	47.38	6:57:37	17:55:14
360	3.10	66.89	20.42	46.47	6:49:33	19:39:05
600	2.10	75.78	34.04	41.74	6:07:54	22:15:47
1440	1.08	93.18	81.69	11.49	1:41:17	27:22:34

Drain down l/s
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95
0.95

Storage Required	47.38 m³
Bay Storage	40.291 m³
Additional Storage	
Plan Width:	2.478 m
Plan Length:	10.62 m
Sub-base replacement:	300 mm
Void ratio of unit:	0.95
Base:	26.31636 m²
Eff Depth:	0.3 m
Additional Volume	7.500 m³

Bay storage is inadequate

Total PV7 Storage	47.791 m³
Time to half empty sub-base	6:57:37 hr:mm:ss

OK - Total storage is greater than required
OK - Less than 24hrs