

stephen penfold

structural engineer

unit 8, northam business centre, princes street, northam
southampton, hants. so14 5rp

e-mail: stephen@spse.ltd james@spse.ltd tel: (023) 8098 2073

Project No: 21539

Sheet No: 5/01

Date: Sept '21

By: SP

Project: 21 Park Avenue

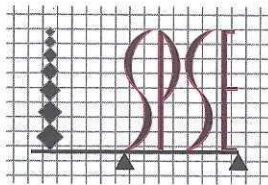
Sakany Dergh:-

Rainfall Rate:- water/laavke mS-ba = 20mm
r = 0.35.

<u>D</u>	<u>Z1</u>	<u>Z2</u>	<u>Water D</u>	<u>+30% Chiate</u>
10	0.50	1.91	19.1mm	24.8mm
15	0.62	1.95	24.2mm	31.5mm
30	0.80	2.00	32.0mm	41.6mm
60	1.00	2.03	40.6mm	52.8mm
120	1.23	2.01	49.5mm	64.4mm
240	1.55	1.97	61.1mm	79.4mm
360	1.65	1.94	64.0mm	83.2mm
600	1.90	1.90	72.2mm	93.9mm
1440	2.50	1.81	90.5mm	117.7mm

Average Rainfall Intensities, i:-

10	$24.8 \times \frac{60}{10} = 148.8 \text{mm/hour}$
15	$31.5 \times \frac{60}{15} = 126.0 \text{mm/hour}$
30	$41.6 \times \frac{60}{30} = 83.2 \text{mm/hour}$
60	$52.8 \times \frac{60}{60} = 52.8 \text{mm/hour}$
120	$64.4 \times \frac{60}{120} = 32.2 \text{mm/hour}$
240	$79.4 \times \frac{60}{240} = 19.9 \text{mm/hour}$



stephen penfold

structural engineer

unit 8, northam business centre, princes street, northam
southampton, hants. so14 5rp

e-mail: stephen@spse.ltd james@spse.ltd tel: (023) 8098 2073

Project No:

21539

Sheet No:

5/02

Date:

Sept '21

Project:

21 Park Avenue

By:

SP

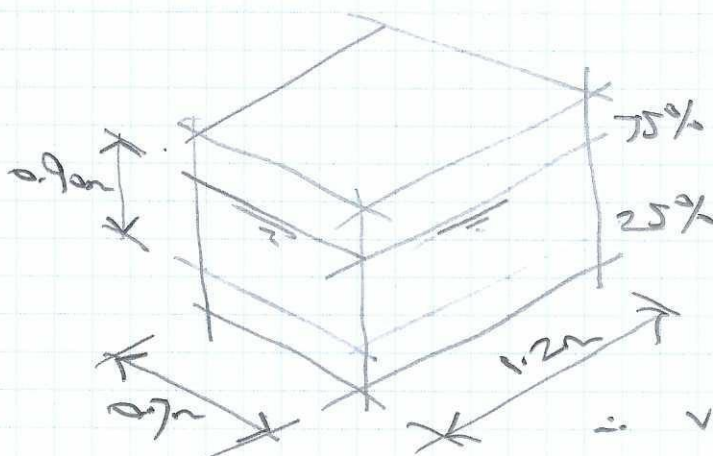
$$360 \quad 83.2 \times \frac{60}{360} = 13.9 \text{ mm/hour}$$

$$600 \quad 93.9 \times \frac{60}{600} = 9.4 \text{ mm/hour}$$

$$1440 \quad 117.7 \times \frac{60}{1440} = 4.9 \text{ mm/hour}$$

Soil Hydration Rate :-

(i) Flow :-



$$\text{Test 1} = 1 \text{ hr } 32 \text{ min}$$

$$\text{Test 2} = 1 \text{ hr } 40 \text{ min}$$

$$\text{Test 3} = 1 \text{ hr } 50 \text{ min}$$

$$\underline{5 \text{ hr } 2 \text{ min}}$$

$$\text{Average} = \frac{1 \text{ hr } 41 \text{ min}}{(101 \text{ min})}$$

$$\therefore V_p = 1.2 \text{ m} \times 0.7 \text{ m} \times 0.9 \text{ m} \\ = \underline{0.76 \text{ m}^3}$$

$$A_{ps} = 2(0.7 \text{ m} + 1.2 \text{ m})0.9 \text{ m} + (1.2 \text{ m} \times 0.7 \text{ m}) \\ = \underline{4.26 \text{ m}^2}$$

$$\therefore \text{Soil Hydration Rate} = \frac{0.76}{4.26 \times 101 \times 60} = \underline{2.94 \times 10^{-5} \text{ m/s}}$$

(ii) Reef :-

$$\text{Test 1} = 1 \text{ hr } 40 \text{ min}$$

$$\text{Test 2} = 1 \text{ hr } 55 \text{ min}$$

$$\text{Test 3} = 1 \text{ hr } 55 \text{ min}$$

$$\underline{5 \text{ hr } 30 \text{ min}}$$

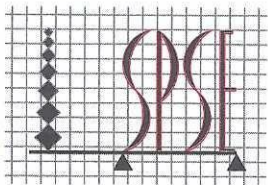
$$75\% = 1.275 \text{ m}$$

$$25\% = 0.425 \text{ m}$$

$$L = 1.2 \text{ m}$$

$$b = 0.7 \text{ m}$$

$$\therefore \text{Average} = \underline{1 \text{ hr } 50 \text{ min. (110 min.)}}$$



stephen penfold

structural engineer

unit 8, northam business centre, princes street, northam
southampton, hants. so14 5rp

e-mail: stephen@spse.ltd james@spse.ltd tel: (023) 8098 2073

Project No:

21539

Sheet No:

5/03

Date:

Sept '21

By:

SP

Project:

21 Park Avenue.

$$\therefore y = 1.2m \times 0.7m \times 0.85m = 0.71m^3$$

$$a_{ps} = 2(1.2m + 0.7m) \times 0.85m + (1.2m \times 0.7m) \\ = 4.07m^2$$

$$\therefore \text{Soil Hydration Rate} = \frac{0.71}{4.07 \times 110 \times 60} = \frac{2.64 \times 10^{-5} m/s}{}$$

Impermeable Areas

(i) Front - $(17m \times 10.5m) = 179m^2$

Side = $190m^2$

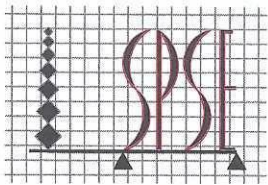
(ii) Rear - $(11m \times 10.5m) = 116m^2$

Side = $130m^2$

Inflow, I - for various storm durations

(i) Front -

<u>D</u>	<u>I</u>
10	$190 \times \frac{148.8}{10^3} \times \frac{10}{60} = 4.7m^3$
15	$190 \times \frac{126.0}{10^3} \times \frac{15}{60} = 6.0m^3$
30	$190 \times \frac{83.2}{10^3} \times \frac{30}{60} = 7.9m^3$
60	$190 \times \frac{52.8}{10^3} \times \frac{60}{60} = 10.0m^3$
120	$190 \times \frac{32.2}{10^3} \times \frac{120}{60} = 12.2m^3$
240	$190 \times \frac{19.9}{10^3} \times \frac{240}{60} = 15.1m^3$
360	$190 \times \frac{13.9}{10^3} \times \frac{360}{60} = 15.8m^3$



stephen penfold

structural engineer

unit 8, northam business centre, princes street, northam
southampton, hants. so14 5rp

e-mail: stephen@spse.ltd james@spse.ltd tel: (023) 8098 2073

Project No: 21539

Sheet No: 5/29

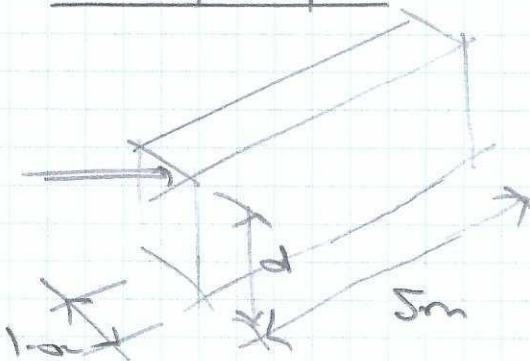
Date: Sep '21

Project: 21 Park Avenue.

By: SP

$$\begin{array}{l} 600 \\ 1440 \end{array} \quad \begin{array}{l} 190 \times \frac{9.4}{10^3} \times \frac{600}{60} = 17.9m^3 \\ 190 \times \frac{9.9}{10^3} \times \frac{1440}{60} = 22.3m^3 \end{array}$$

Overflow, D:-



Using $5m \times 1.2m \times d$ deep.

$$\begin{aligned} \text{area} &= 2(5m + 1.2m) \times \frac{d}{2} \\ &= 6d \end{aligned}$$

$$f = \frac{2.94 \times 10^{-5} m/s}{}$$

$$\begin{aligned} D &= 6d \times 2.94 \times 10^{-5} \times (5 \times 60) \\ &= 0.011 dD \end{aligned}$$

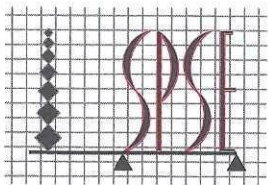
Storage, S:-

Using crates with 94% void

$$\begin{aligned} S &= (1.2m \times 5.0m \times d) 0.94 \\ &= 4.75d \end{aligned}$$

$$I - D = S$$

<u>D</u>	<u>d</u>	<u>I - D = S</u>	<u>d.</u>
10	0.11d	$4.7 - 0.11d = 4.75d$	0.97m
15	0.17d	$6.0 - 0.17d = 4.75d$	1.22m
30	0.33d	$7.9 - 0.33d = 4.75d$	1.56m
60	0.66d	$10.0 - 0.66d = 4.75d$	1.85m
120	1.32d	$12.2 - 1.32d = 4.75d$	2.00m



stephen penfold

structural engineer

unit 8, northam business centre, princes street, northam
southampton, hants. so14 5rp

e-mail: stephen@spse.ltd james@spse.ltd tel: (023) 8098 2073

Project No: 21539

Sheet No: 5/05

Date: Sept '21

By: FR

Project: 21 Park Avenue.

240	2.64d	$15.1 - 2.64d = 4.75d$	2.04m*
360	3.96d	$15.8 - 3.96d = 4.75d$	1.81m
600	6.60d	$17.9 - 6.60d = 4.75d$	1.58m

= Use 5.0m x 1.0m x 2.0m deep below
lowest rising pipe in Wavin
Agracell Plus Crates.

(ii) Rear:-

$$\left[\frac{13m^2}{190m^2} = 0.68 \right]$$

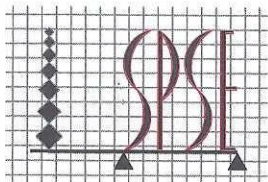
<u>D</u>	<u>I</u>
10	$4.7m^2 \times 0.68 = 3.2m^2$
15	$6.0m^2 \times 0.68 = 4.1m^2$
30	$7.9m^2 \times 0.68 = 5.4m^2$
60	$10.0m^2 \times 0.68 = 6.8m^2$
120	$12.2m^2 \times 0.68 = 8.3m^2$
240	$15.1m^2 \times 0.68 = 10.3m^2$
360	$15.8m^2 \times 0.68 = 10.7m^2$
600	$17.9m^2 \times 0.68 = 12.2m^2$
1440	$22.3m^2 \times 0.68 = 15.2m^2$

Overflow, O:-

Using 4.0m x 2.0m x d deep

$$area = 2(4m + 2m) \times \frac{d}{2}$$

$$= 8d.$$



stephen penfold

structural engineer

unit 8, northam business centre, princes street, northam
southampton, hants. so14 5rp

e-mail: stephen@spse.ltd james@spse.ltd tel: (023) 8098 2073

Project No: 21539

Sheet No: 5/06

Date: Sept '21

By: SP.

Project: 21 Park Avenue.

$$q = 2.64 \times 10^{-5} \text{ m/s.}$$

$$\therefore Q = 8d \times 2.64 \times 10^{-5} \times (D \times 60) \\ = 0.013 d D.$$

Storage, S: $S = (2.0 \times 4.0 \times d) 0.95$
 $= 7.6 d.$

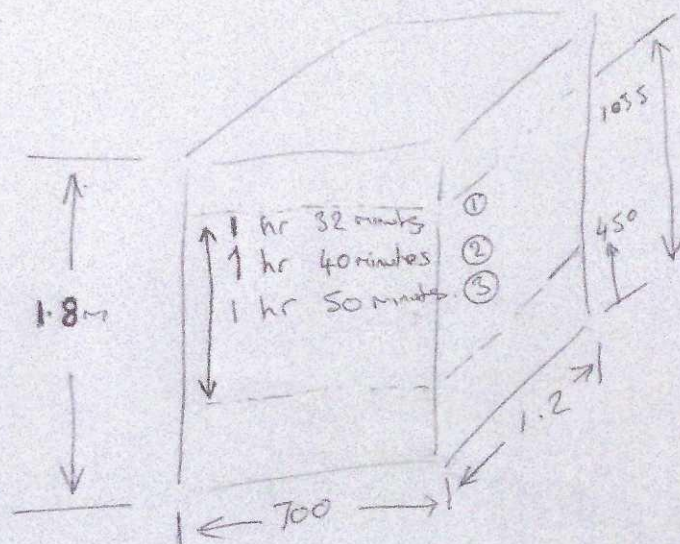
$$I - Q = S.$$

<u>D</u>	<u>Q</u>	<u>I - Q = S</u>	<u>d.</u>
10	0.13d	3.2 - 0.13d = 7.6d.	0.41m
15	0.20d	4.1 - 0.20d = 7.6d.	0.53m
30	0.39d	5.4 - 0.39d = 7.6d.	0.68m
60	0.78d	6.8 - 0.78d = 7.6d.	0.81m
120	1.56d	8.3 - 1.56d = 7.6d.	0.91m
240	3.12d	10.3 - 3.12d = 7.6d.	0.96m*
360	4.68d	10.7 - 4.68d = 7.6d.	0.87m

= Use 4.0m x 2.0m x 1.2m deep
below lowest rising pipe in Wavin
AgroCell Plastic Crates.

Test

Front



BACK

