HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 2 (after 2 years planting)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 1.83 sq. km
Length of mainstream, L = 2.36 km
Percentage developed, = 30.00 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
2.36	40.00	1.69	3.07
2.36	40.00	1.69	3.07

s = SQR{ E (li * SQRT si) / E (li) }

$$= \frac{3.07\ ^2}{2.36\ ^2}$$

= 1.69 %

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 2 years (HP # 1)

2. Tc = {1.286 x L} / {A^0.223 x S^0.263}

$$= \frac{\{1.286 \times 2.36\}}{\{1.83\ ^{0.223} \times 1.694915254\ ^{0.263}\}}$$

= 2.31 hours

= 138.52 mins

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 2 years.

x (T , 0.5) = 75.00 mm
x (T , 3) = 120.00 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 2.31 hours
and T = 2 years.
x (2, 2.31) = 74.15 mm
x (20, 2.31) = 129.77 mm
x (T , 2.31) = 113.42 mm

8. Confidence limits

D = x (20) - x (2)
= 129.76644 - 74.152253
= 55.61419
0.43 D = 23.914101 mm

9. Max x 2) = x (T) + 0.43 D
[T = 2] = 113.42128 + 23.914101
= 137.34 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (2) = 137.33539 mm
Therefore, i (2) = x (100) = 137.33539

Tc = 2.3086625

= 59.49 mm/hr

2. From Figure 4 with,

Region = 4

T = 2 years.

C10 = 0.38

Ct / C10 = 0.712

Therefore Ct = 0.27

3. Percentage developed = 30 %

Land use factor, F = 1.05

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A

= 8.60 cu. m /s

E. DETERMINATION OF THE FLOOD WATER LEVEL AND VELOCITY

1. Plot cross-section of the river.
2. consider the recorded flood level as our first trial
3. Divide into sub-section
4. Stream slope at bridge site,

From the river survey plan :

Number of Part = 4 Section

Part	BedL1	BedL2	Length	Slope
1	6.880	6.544	60.000	0.006
2	6.544	6.067	25.000	0.019
3	6.067	6.037	25.000	0.001
4	6.037	5.604	20.000	0.022
5				
6				
7				

Average Slope, So 0.0118825

5. Calculation of Vm and Qc

Vi = Ri^(2/3) x So^(1/2) / ni

TRY Flood Level = 7.700 m OK

Sc.	Level (m)	Chng. (m)	Roughness ni	Area, A Sq.ft	Wetted perimeter (pi)(m)	Hydraulic Radius Ri=Ai/Pi (m)	Velocity vi (m/s)	Q=Vi Ai (cu.m)
0	9.200	0.000	0.045					
1	7.000	4.000	0.045	-1.600	4.565	-0.350	#NUM!	
2	6.741	18.000	0.045	11.613	14.002	0.829	2.138	24.832
3	5.857	23.100	0.045	7.145	5.176	1.380	3.003	21.458
4	5.792	27.000	0.045	7.314	3.901	1.875	3.684	26.944
5	5.272	33.600	0.045	14.309	6.620	2.161	4.049	57.941
6	6.344	38.000	0.045	8.325	4.529	1.838	3.635	30.261
7	6.659	42.500	0.045	5.393	4.511	1.196	2.729	14.717
8	7.000	50.500	0.045	6.964	8.007	0.870	2.207	15.370
9	9.200	54.000	0.045					
10								
			TOTAL	59.4634			TOTAL	191.52328

Type of bed material (Code) = 7 Rock

CODE	BED
1	Clay
2	Sandy Clay
3	Very fine sand
4	Fine sand
5	Fine Gravel
6	Rocky soil
7	Rock
8	Grass-lined

Therefore,

Mean velocity, Vm = E (Vi Ai)/ E (Ai)

= 191.523277 / 59.4634

= 3.220859839 < 5.18 m/sec

Therefore OK

Discharge capacity, Qc = Vm x E (Ai)

= 191.523277 > 8.59747 cu.m

Therefore OK

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 2(after 2 years planting)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 1.83 sq. km
Length of mainstream, L = 2.36 km
Percentage developed, = 30.00 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
1.08	20.00	1.85	1.47
1.08	20.00	1.85	1.47

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{1.47\ ^2}{1.08\ ^2}$$
$$= 1.85\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 5 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 2.36\}}{\{1.83^{0.223} \times 1.851851852^{0.263}\}}$$

= 2.26 hours

= 135.33 mins

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 5 years.

x (T , 0.5) = 98.94 mm
x (T , 3) = 176.59 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 2.2555161 hours
and T = 5 years.

x (2, 2.26) = 73.63 mm
x (20, 2.26) = 128.86 mm
x (T , 2.26) = 164.23 mm

8. Confidence limits

D = x (20) - x (2)
= 128.85657 - 73.632327
= 55.224245
0.43 D = 23.75 mm

9. Max x 5) = x (T) + 0.43 D
[T = 5] = 164.23015 + 23.746425
= 187.98 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (5) = 187.97658 mm
Therefore, i (10) = x (100) = 187.97658
Tc 2.2555161
= 83.34 mm / hr

2. From Figure 4 with,

Region = 4
T = 5 years.

C10 = 0.38
Ct / C10 = 0.88

Therefore Ct = 0.3344

3. Percentage developed = 30 %
Land use factor, F = 1.05

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 14.89 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 2 (after 2 years planting)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 1.83 sq. km
Length of mainstream, L = 2.36 km
Percentage developed, = 30.00 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
2.36	40.00	1.69	3.07
2.36	40.00	1.69	3.07

s = SQR{ E(li * SQRT si) / E(li) }
= 3.07 ^2
2.36 ^2
= 1.69 %

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 10 years (HP # 1)

2. Tc = {1.286 x L} / {A^0.223 x S^0.263}

= {1.286 x 2.36 }
{ 1.83 ^0.223 x 1.694915254 ^0.263}

= 2.31 hours

= 138.52 mins

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 10 years.

x (T , 0.5) = 114.79 mm
x (T , 3) = 214.06 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 2.3086625 hours
and T = 10 years.

x (2, 2.31) = 74.15 mm
x (20, 2.31) = 129.77 mm
x (T , 2.31) = 199.55 mm

8. Confidence limits

D = x (20) - x (2)
= 129.76644 - 74.152253
= 55.61419
0.43 D = 23.91 mm

9. Max x (10) = x (T) + 0.43 D
[T = 10] = 199.54758 + 23.914101
= 223.46 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (10) = 223.46168 mm
Therefore, i (10) = x (100) = 223.46168
Tc 2.3086625
= 96.79 mm / hr

2. From Figure 4 with,

Region = 4
T = 10 years.

C10 = 0.38
Ct / C10 = 1

Therefore Ct = 0.38

3. Percentage developed = 30 %
Land use factor, F = 1.05

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 19.65 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 2 (after 2 years planting)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 1.83 sq. km
Length of mainstream, L = 2.36 km
Percentage developed, = 30.00 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
2.36	40.00	1.69	3.07
2.36	40.00	1.69	3.07

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{3.07\ ^2}{2.36\ ^2}$$
$$= 1.69\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 20 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 2.36\}}{\{1.83^{0.223} \times 1.694915254^{0.263}\}}$$

= 2.31 hours

= 138.52 mins

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 20 years.

x (T , 0.5) = 130.00 mm
x (T , 3) = 250.00 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 2.3086625 hours
and T = 20 years.

x (2, 2.31) = 74.15 mm
x (20, 2.31) = 129.77 mm
x (T , 2.31) = 232.46 mm

8. Confidence limits

D = x (20) - x (2)
= 129.76644 - 74.152253
= 55.61419
0.43 D = 23.91 mm

9. Max x (20) = x (T) + 0.43 D
[T = 20] = 232.45676 + 23.914101
= 256.37 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (20) = 256.37086 mm
Therefore, i (20) = x (100) = 256.37086
Tc 2.3086625
= 111.05 mm / hr

2. From Figure 4 with,

Region = 4
T = 20 years.

C10 = 0.38
Ct / C10 = 1.128

Therefore Ct = 0.43

3. Percentage developed = 30 %
Land use factor, F = 1.05

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= 25.43 cu. m /s

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 2(after 2 years planting)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 1.83 sq. km
Length of mainstream, L = 2.36 km
Percentage developed, = 30 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
2.36	40.00	1.69	3.07
2.36	40.00	1.69	3.07

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \frac{3.07\ ^2}{2.36\ ^2}$$
$$= 1.69\ \%$$

B. LOCATION OF BRIDGE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 50 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 2.36\}}{\{1.83^{0.223} \times 1.694915254^{0.263}\}}$$

$$= 2.31 \text{ hours}$$

$$= 138.52 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 50 years.

x (T , 0.5) = 149.68 mm
x (T , 3) = 296.52 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 2.3086625 hours
and T = 50 years.

x (2, 2.31) = 74.15 mm
x (20, 2.31) = 129.77 mm
x (T , 2.31) = 275.05 mm

8. Confidence limits

D = x (20) - x (2)
= 129.76644 - 74.152253
= 55.61419
0.43 D = 23.914101 mm

9. Max x (50) = x (T) + 0.43 D
[T = 50] = 275.05432 + 23.914101
= 298.97 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (50) = 298.96842 mm
Therefore, i (50) = x (100) = 298.96842
Tc 2.3086625
= 129.50 mm / hr

2. From Figure 4 with,

Region = 4
T = 50 years.

C10 = 0.38
Ct / C10 = 1.296

Therefore Ct = 0.49

3. Percentage developed = 30 %
Land use factor, F = 1.05

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= **34.07 cu. m /s**

HYDROLOGICAL CALCULATION RATIONAL METHOD (HP # 5 - 1989)

PROJECT : catchment 2(after 2 years planting)
Tabung Haji, Pahang

A. CATCHMENT CHARACTERISTICS

From Topo Map sheets :
Area of catchment, Ac = 1.83 sq. km
Length of mainstream, L = 2.36 km
Percentage developed, = 30 % (Land use factor)

Weighted mean slope, s

li(km)	^h (m)	si=^h/li (%)	li*SQRT si
2.36	40.00	1.69	3.07
2.36	40.00	1.69	3.07

$$s = SQR\{ E(li * SQRT\ si) / E(li) \}$$
$$= \left(\frac{3.07}{2.36} \right)^2$$
$$= 1.69\ \%$$

B. LOCATION OF SITE

From Topo Sheet No :

	o	'	"	
Longitude	102	18	0	E
Latitude	4	12	0	N

From figure 1 of HP # 5
Region No 4

Note : Region 1 - Perlis, Kedah, Perak
Region 2 - Kuala Lumpur
Region 3 - Johor
Region 4 - Kelantan, Terengganu, Pahang

C. ESTIMATION OF THE DESIGN RAINSTORM

1. Adopt return period, T = 100 years (HP # 1)

2. $Tc = \{1.286 \times L\} / \{A^{0.223} \times S^{0.263}\}$

$$= \frac{\{1.286 \times 2.36\}}{\{1.83^{0.223} \times 1.694915254^{0.263}\}}$$

$$= 2.31 \text{ hours}$$

$$= 138.52 \text{ mins}$$

3. Values of x (T,t)
(N.B. values of t is to envelope the value of Tc)

From Fig. 1 to 8 of HP # 1 :
x (2, 0.5) = 40 mm
x (20, 0.5) = 70 mm
x (2, 3) = 80 mm
x (20, 3) = 140 mm

4. Plot those values above on graph Figure 10 0f HP # 1

5. Read off values, with T = 100 years.

x (T , 0.5) = 164.43 mm
x (T , 3) = 331.38 mm

6. Plot values obtained in steps 3 and 5 on graph Fig. 9 of HP # 1.

7. Read off values :

With Tc = 2.31 hours
and T = 100 years.

x (2, 2.31) = 74.15 mm
x (20, 2.31) = 129.77 mm
x (T , 2.31) = 306.98 mm

8. Confidence limits

D = x (20) - x (2)
= 129.76644 - 74.152253
= 55.61419
0.43 D = 23.91 mm

9. Max x (100) = x (T) + 0.43 D
[T = 100] = 306.9752 + 23.914101
= 330.89 mm

D. FLOOD ESTIMATION

1. From step C,

Max x (100) = 330.89 mm
Therefore, i (100) = $\frac{x\ (100)}{T\ c}$ = $\frac{330.8893}{2.3086625}$
= 143.33 mm / hr

2. From Figure 4 with,

Region = 4
T = 100 years.

C10 = 0.38
Ct / C10 = 1.46

Therefore Ct = 0.5548

3. Percentage developed = 30 %
Land use factor, F = 1.05

THEREFORE

Q max = F x 0.278 x Ct x i (T) x A
= **42.48 cu. m /s**