SURFACE WATER RUN-OFF: PRE AND POST DEVELOPMENT

KANE DESIGN
15 Winchester Way, Gresford
Wrexham LL12 8HH
Tel: 01 9788 855888

Project **PLAS POWER ESTATE COEDPOETH**

Scheme number **1292**
DATE 17-Feb-16
Engineer **A Kane**
Sheet 1 of 7

DESIGN BRIEF

The Code of Practise for Sustainable Urban Development requires the following information:

Site pre-development surface water run-off rate
Site pre-development surface water run-off volume
Site post-development surface water run-off rate
Site post-development surface water run-off volume

The above are to be computed for storms up to 100 year return, 6 hour duration, and are to include a factor for climate change.

The difference between pre-development and post development is to be calculated,

DOCUMENTS USED:

Code for Sustainable Homes: Technical Guide: May 2009 Version A
Institute of Hydrology Report 124 (IH 124): Flood Assessment for Small Catchments: (1994)
Institute of Hydrology Report: Flood Studies Supplementary Report FSSR 16 (1985)
Wallingford Procedure (1993)
CIRIA Report 697: THE SUDS Manual (2007)
HMSO: Planning Policy Statement 25 (PPS25)

FORMULA USED:

			source	
Existing (Pre):	Greenfield run-off rate		IH124	Annual peak flow=Qbar-rural
			FSSR16	Ratio Q/Qbar-rural
	Greenfield run-off volume:		FSSR 16 Run-off model:	
				Fixed percentage run-off= PR rural
	Brown	Wallingford Procedure		Modified Rational Method
Post:	Development run-off rate:		W.P.	Modified Rational Method
	(Green portion)		W.P.	Fixed Wallingford Procedure
				UK run-off = PR urban
	Development run-off volume:			Q = area v rate
Climate change:			PPS25	Table B2

CALCULATION INDEX: Page

2 Site specific details
3 A: Existing Surface Water run-off rate: Greenfield
4 B: Existing Surface Water run-off : Brown
4 C: Existing Surface Water run-off Volume : Brown
5 D: Existing Surface Water run-off Volume : Green
6 E: Post-development run-off rate
6 F: Post-development run-off Volume
7 Summary

NOTES

PIMP	Percentage Impermeable Area
SOIL	Soil type taken from Wallingford maps and FSR Report
SAAR	Standard Average Annual Rainfall from F.E.H CD for the catchment
UCWI	Urban Catchment Wetness Index (evaluated form Fig 9.7, Wallington Procedure)
CWI	Catchment Wetness Index

SURFACE WATER RUN-OFF: PRE AND POST DEVELOPMENT

KANE DESIGN
15 Winchester Way, Gresford
Wrexham LL12 8HH
Tel: 01 9788 855888

Project **PLAS POWER ESTATE COEDPOETH**

Scheme number **1292**
DATE 17-Feb-16
Engineer **A Kane**
Sheet 2 of 7

SITE SPECIFIC DETAILS DRAWING REFERENCE: SITE PLAN SUPPLIED 4 February 2015
Construction of 16 residential property

Location
Postcode **CH7 3PJ**

Site **EXISTING DETAILS**

Site area (m2)	22432	Calculated from drawing		
PIMP (%)	28.65	Greenfield		
Site Impermeable Area (m2)	6426	Brownfield		
Site permeable area	16006	m2	28.65%	brownfield
PROPOSED:	9391	m2	41.86%	Impermeable (developed) area

Input data

1. **Catchment Data** **[proportion of each soil type estimated from Site Investigation Report]**

1a) Soil Data WRAP : = Soil Winter Rainfall potential (FSSR 16)

Prop S1	0
Prop S2	0
Prop S3	0.3
Prop S4	0.7
Prop S5	0

Soil type = [sum of soil = 0.15 S1 x 0.3 S2 x 0.4 S3 x 0.45 S4 x 0.5 S5 = 0.435
Soil Percentage Runoff (SPR) = 10 S1 x 30 S2 x 37 S3 x 47 S4 x 53 S5 = 44

1 b) Remainder catchment of data

Region number	9	From CIRIA 696
SAAR	900	From FSSR rainfall maps
CWI	125	From FSSR Figure A7.5
UCWI	108	From CIRIA 697 Figure 4.6

1 c) rainfall data

M5-60 min rainfall	17	From FSSR rainfall maps			
Ratio "r"	0.35	From FSSR rainfall maps			
Climate Change % (C	30	From PPS 25 Table B2			
Storm duration for peak run -off (min)	15	Selected [for post development]			
Z1	1.69		From BRE 365 Table 1	[r = .35 duration =360 mins]	
M5 - 60	28.73		,=Z1 x M5-60	Calculated	= P1 year
Z2	1.525	30 year	Wallingford Vol 4 Table A1		
Therefore M30 year 360 min	43.81	mm/hr	,=Z1 x M5-60	Calculated	= P30 year
Z2	1.97	100 year	Wallingford Vol 4 Table A1		
Therefore M100 year 360 min	56.60	mm/hr	,=Z1 x M5-60	Calculated	= P100 year

SURFACE WATER RUN-OFF: PRE AND POST DEVELOPMENT

KANE DESIGN
15 Winchester Way, Gresford
Wrexham LL12 8HH
Tel: 01 9788 855888

Project **PLAS POWER ESTATE COEDPOETH**

Scheme number **1292**
DATE 17-Feb-16
Engineer **A Kane**
Sheet 3 of 7

NOTES

A: Calculation

Existing (pre-development) Surface Water run-off rate: GREENFIELD

Use : Annual peak flow = Q bar-rural = 0.00108Area [Km2] ^0.89 x SAAR ^1.17 X SOIL^2.17 m3 / sec

Area (m2)= 16006

Growth Factors: Table 4.3 CIRIA 696
Region number 9

Return Period	Growth
1	0.82
30	1.77
100	2.18
Calculated 100 +C/C	2.834

Q bar-rural: = 0.2738 m3/s [Based on equation default 50 Ha: Max area for equation]
Q bar-rural: (Actual) = 0.00877 m3/s Ratio, Q/Qbar as FSSR 16

ESTIMATED GREENFIELD RUN-OFF:

Storm Return period (y	1	30	100	100+CC
Growth (from above)	0.82	1.77	2.18	2.83
Peak run-off rate(m3	**0.00719**	**0.01552**	**0.01911**	**0.02484**
(Litres/s)	**7.19**	**15.52**	**19.11**	**24.84**

(Q bar actual x growth)

SURFACE WATER RUN-OFF: PRE AND POST DEVELOPMENT

KANE DESIGN
15 Winchester Way, Gresford
Wrexham LL12 8HH
Tel: 01 9788 855888

Project **PLAS POWER ESTATE**
COEDPOETH

Scheme number **1292**
DATE 17-Feb-16
Engineer **A Kane**
Sheet 4 of 7

NOTES

B: Calculation **Existing (pre-development) Surface Water run-off rate:**
BROWN PORTION OF SITE

Use: Modified Ration Method:Q = 2.78C x Rainfall x Area Where C = Cv (PR urban/100) x Cr

PR (%) Impermeable area	(PIMP)	28.65%	from previous
		6426.00	
Therefore	Cv =	0.750	Recommended Wallingford value for impermeable
	Cr=	1.30	fixed equation value

Rainfall intensity: Wallingford Procedure: 15 min Storm: Wallingford Vol 4 Table A1

Storm Return period (y	15 min	1	30	100	100+CC
Z1	0.617				
M5-D	10.489				
Z2		0.61	1.52	1.93	2.51
Rainfall intensity:		25.59	63.77	80.98	105.27

ESTIMATED BROWN POST-DEVELOPMENT RUN-OFF:

Storm Return period (y	1	30	100	100+CC
Rainfall intensity (15 mins)	25.59	63.77	80.98	105.27
Run-off rate l/s	44.58	111.08	141.04	183.35

(Peak Flow) Q= 2.78 Cv X Cr x Rainfall intensity x Area

C: Calculation Existing (pre-development) Surface Water run-off Volume:
BROWN PORTION OF SITE

Use: Modified Ration Method: Q = 2.78 C x Rainfall x Area Where C = Cv (PR/100) x Cr
volume = V = Q A

Storm Return period (years)	100	100+CC	
Z1			360 mins
M5-D			
Z2	1.97		
Rainfall intensity: (mm/hr)	56.60	73.58	
Run-off rate, Q (litres / s)	98.58	128.15	
VOLUME V (m3)= Q/A: 360 mins	2129.34	2768.15	

KANE DESIGN
15 Winchester Way, Gresford
Wrexham LL12 8HH
Tel: 01 9788 855888

Project **PLAS POWER ESTATE**
COEDPOETH

Scheme number **1292**
DATE 17-Feb-16
Engineer **A Kane**
Sheet 5 of 7

D: Calculation

Existing (pre-development) Surface Water run-off Volume:
SITE GREENFIELD :

Use: FSSR16: Fixed Percentage Run-off Model 360 minute storm 100 year

Run-off Volume = PR X AREA [Km2] X Rainfall depth
wh PR = Percentage run-off = SPR + DPRcwi +DPR rain
Where D= Dynamic contribution
and
DPRcwi = 0.25 x (CWI-125)
DPR rain = 0.45 x (P-40)^0.7 Where P is greater than 40

SPR =	44
DPRcwi =	0
DPR rain =	3.216
Therefore PR =	47.216

Peak Run-off Volume (m3)	599.45
With climate change	779.29

	SURFACE WATER RUN-OFF: PRE AND POST DEVELOPMENT		
KANE DESIGN		Scheme number	**1292**
15 Winchester Way, Gresford	Project **PLAS POWER ESTATE**	**DATE**	17-Feb-16
Wrexham LL12 8HH	**COEDPOETH**	Engineer	**A Kane**
Tel: 01 9788 855888		**Sheet 6 of 7**	

E: Calculation **Post development Surface Water run-off RATE:**

Use: Modified Ration Method:Q = 2.78C x Rainfall x Area Where C = Cv (PR/100) x Cr

Where PR urban = (%) percentage run-off area = =0.829 PIMP +25SOIL+0.078 UCWI-20.7

[Fixed Wallingford Procedure] USES WHOLE CATCHMENT DATE (GREEN/BROWN)

PR (%) Impermeable area	(PIMP)	41.86%	from previous	(or use 'min PIMP 40%')
	PR urban =	33.30		
Therefore	Cv =	0.333		
	Cr=	1.30	fixed equation value	

Rainfall intensity: Wallingford Procedure: 15 min Storm: Wallingford Vol 4 Table A1

Storm Return period (y	15 min	1	30	100	100+CC
Z1	0.617				
M5-D	10.489				
Z2		0.61	1.535	1.93	2.51
Rainfall intensity:		25.59	64.40	80.98	105.27

ESTIMATED POST-DEVELOPMENT RUN-OFF:

Storm Return period (years)	1	30	100	100+CC
Rainfall intensity (15 mins)	25.59	64.40	80.98	105.27
Run-off rate l/s	69.10	173.88	218.63	284.22

(Peak Flow) Q= 2.78 Cv X Cr x Rainfall intensity x Area

F: Calculation **Post development Surface Water run-off VOLUME:**

360min storm

Use: Modified Ration Method: Q = 2.78 C x Rainfall x Area Where C = Cv (PR/100) x Cr

volume = V = Q A

Storm Return period (years)	1	30	100	100+CC	
Z1					360 mins
M5-D					
Z2			1.97		
Rainfall intensity: (mm/hr)			56.60	73.58	
Run-off rate, Q (litres / s)			152.81	198.66	

VOLUME V (m3)= Q/A:	360 mins	3300.77	4291.00
		Post development run-off volume	

SURFACE WATER RUN-OFF: PRE AND POST DEVELOPMENT

KANE DESIGN
15 Winchester Way, Gresford
Wrexham LL12 8HH
Tel: 01 9788 855888

Project **PLAS POWER ESTATE COEDPOETH**

Scheme number **1292**
DATE 17-Feb-16
Engineer **A Kane**
Sheet 7 of 7

SUMMARY: SURFACE WATER

RUN-OFF — PRE-DEVELOPMENT

		Storm Return	1	30	100	100+CC	
A	GREENFIELD		7.188	15.52	19.11	24.84	
B	BROWN		44.58	111.08	141.04	183.35	
		TOTAL	51.77	126.59	160.15	208.19	LITRES /S

VOLUME

			100	100+CC	360 min	
C	GREENFIELD		599.45	779.29		
D	BROWN		2129.34	2768.15		
		TOTAL	2728.80	3547.43		m3

RUN-OFF — POST DEVELOPMENT

	Storm Return	1	30	100	100+CC	
E		69.10	173.88	218.63	284.22	LITRES /S

VOLUME

		100	100+CC	360 min	
F		3300.77	4291.00		m3

		PRE-DEVELOPMENT	POST-DEVELOPMENT	ADDITIONAL
SITE AREA	m3	22432	22432	
IMPERMEABLE	m3	6426	9391	2965
PERMEABLE	m3	16006	13041	-2965
100 year +climate change (litres/s)				
	RUN-OFF	**208.19**	**284.22**	**76.02**
100 year +climate change (m3)				
	VOLUME	**3547.43**	**4291.00**	**743.56**

ADDITIONAL FLOW DUE TO NEW DEVELOPMENT 76.02 Litres / s
ADDITIONAL VOLUME DUE TO NEW DEVELOPMENT 743.56 m3

EXISTING PEAK DISCHARGE RATES=

208.19	100 year +cc
126.59	30 year
51.77	1 year