B.1.8 Design Flows for Small Catchments

The Flood Studies Supplementary Report (FSSR) No 16 method was used to assist in the selection of the most appropriate flow estimation method for small catchments.

Hourly rainfall data from 1st November 2015 until 30 December 2015 recorded at Moore Park was applied using the FSSR16 module of Flood Modeller Pro to simulated flows at each HEP. Figure B.11-7 presents the recorded rainfall data and simulated flows at OW3, as example and Table B.11-10 presents peak flows at each HEP.

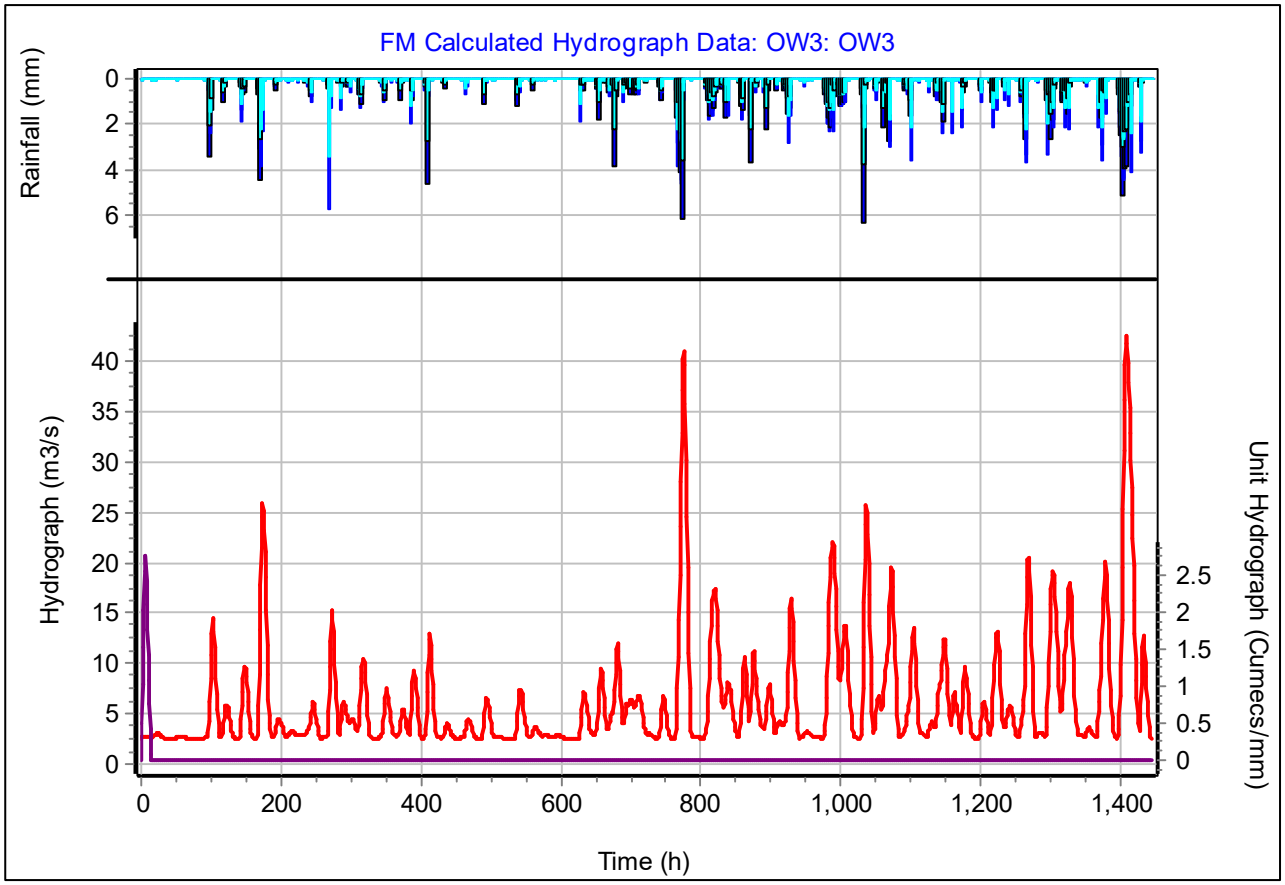

Figure B.11-7 FSSR16 module output for the December 2015 event

Table B.11-10 Peak flows derived from FSSR16 method for Winter 2015 event

HEP Location	Peak Flow Winter 2015 Flood (m^3/s)
Bal1	1.17
DG3	17.22
DG4	27.90
DG6	29.28
EL1	5.84
GL1	8.00
HAG2	4.85
OAT1	2.81
OAT3	6.30
OW3	42.52

HEP Location	Peak Flow Winter 2015 Flood
	(m^3/s)
OW4	43.68
OW5	13.28
OW6	55.27
OW7	55.16
OW8	55.74
OW9	58.16
OW10	87.32

Flows derived using the FSSR16 method for the Winter 2015 event (as presented in Table B.11-10) were then compared to the range of potential design flows based on the FSU Method. The corresponding return period was then estimated at each HEP and findings are presented in Table B.11-11.

Table B.11-11 Severity estimation for event-based flows for each HEP based on the FSU derived design flows

HEP	FSSR 16 Peak Flow Winter 2015 flood	Severity when compared to FSU flows	FSU derived flows (m^3/s) Return Period (1i n _ years)							
Location	(m^3/s)	(1 in _ years)	2	5	10	25	50	100	200	1000
Bal1	1.17	97	0.4	0.6	0.7	0.8	1.0	1.2	1.3	1.8
DG3	17.22	5	13.0	17.2	20.0	23.5	30.7	34.6	40.2	52.9
DG4	27.90	31	14.4	199.2	22.3	26.1	34.2	38.5	44.7	58.8
DG6	29.28	31	15.0	20.0	23.2	27.2	35.6	40.1	46.6	61.3
EL1	5.84	39	2.8	3.7	4.3	5.0	6.5	7.4	8.5	11.2
GL1	8.00	12	5.1	6.7	7.8	9.2	12.0	13.5	15.7	20.7
HAG2	4.85	197	1.6	2.1	2.4	2.9	3.7	4.2	4.9	6.4
OAT1	2.81	675	0.8	1.0	1.2	1.4	1.8	2.0	2.4	3.1
OAT3	6.30	606	1.8	2.3	2.7	3.2	4.2	4.7	5.4	7.1
OW3	42.52	20	25.0	33.2	38.6	45.3	59.2	66.7	77.5	101.9
OW4	43.68	22	25.2	33.5	38.9	45.6	59.6	67.2	78.0	102.7
OW5	13.28	23	7.5	10.0	11.6	13.6	17.8	20.0	23.3	30.6
OW6	55.27	24	30.7	40.8	47.5	55.7	72.8	81.9	95.2	125.3
Location	(m^3/s)	(1 in _ years)	2	5	10	25	50	100	200	1000
OW7	55.16	24	30.8	40.9	47.6	55.9	73.0	82.2	95.5	125.7
OW8	55.74	23	31.4	41.7	48.5	56.9	74.4	83.8	97.4	128.1
OW9	58.16	26	31.7	42.2	49.1	57.6	75.3	84.8	98.5	129.6
OW10	87.32	32	44.4	59.1	68.7	80.6	105.3	118.6	137.8	181.3

The severity of flows ranges from 1 in 3-year return period to 1 in 675-year return when compared to flows derived using the FSU method.

The flood review report (Arup, June 2016) estimated the Winter 2015 flood to be of an approximate severity of circa 1 in 10 to 1 in 20 years and flows estimated for the majority of HEPs correspond to a comparable return period. Return periods for HEPs Bal1, HAG2, OAT1 and OAT3 were found to be significantly higher when based on the FSU derived flows.

All of these HEPs are located on small catchments, and it is suggested that FSU flows underestimate the severity and therefore result in such high return periods when compared to the FSSR16 derived flows.

Both the IH124 and FSU4.2a method were then applied for HEPs on small catchments to re-evaluate the severity of the Winter 2015. Table B.11-12 presents findings for the IH124 derived flows.

Table B.11-12 Severity estimation for event-based flows for each HEP based on the IH124 derived design flows for small Catchments

HEP	FSSR 16 derived Peak Flow for Winter 2015 flood	Severity when compared to IH124 flows	IH 124 derived Flows (m^3/s) Return Period (1in _ years)						
Location	(m^3/s)	(1 in XX years)	2	5	10	25	50	100	200
Bal1	1.17	4	1.0	1.3	1.5	1.7	2.3	2.6	3.0
DG3	17.22								
DG4	27.90								
DG6	29.28								
EL1	5.84	31	3.0	4.0	4.7	5.5	7.1	8.0	9.3
GL1	8.00	18	4.7	6.3	7.3	8.6	11.2	12.7	14.7
HAG2	4.85	6	3.5	4.7	5.4	6.4	8.3	9.3	10.9
OAT1	2.81	10	1.8	2.4	2.8	3.3	4.3	4.9	5.7
OAT3	6.30	25	3.5	4.6	5.4	6.3	8.2	9.2	10.7
Location	(m^3/s)	(1 in XX years)	2	5	10	25	50	100	200
OW3	42.52								
OW4	43.68								
OW5	13.28	25	7.3	9.7	11.3	13.3	17.3	19.5	22.7
OW6	55.27								
OW7	55.16								
OW8	55.74								
OW9	58.16								
OW10	87.32								

Results show that the severity of HEPs on small catchments is between a 1 in 4 to 31-year return period, which is consistent with the estimated severity for other HEPs.

The same exercise was carried out using the more recent method for estimating flows on small catchments FSU 4.2a and Table B.11-13 presents findings.

Table B.11-13 Severity estimation for event-based flows for each HEP based on the FSU 4.2a derived design flows for small Catchments

HEP	FSSR 16 derived Peak Flow for Winter 2015 flood	Severity when compared to IH124 flows	FSU 4.2a derived Flows (m^3/s) Return Period (1in _ years)						
Location	**(m^3/s)**	**(1 in XX years)**	**2**	**5**	**10**	**25**	**50**	**100**	**200**
Bal1	1.17	20	0.7	0.9	1.1	1.2	1.6	1.8	2.11
DG3	17.22								
DG4	27.90								
DG6	29.28								
EL1	5.84	2	5.65	7.51	8.73	10.24	13.39	15.07	17.52
GL1	8.00	<2	8.3	11.1	12.9	15.1	19.8	22.3	25.89
HAG2	4.85	22	2.8	3.7	4.3	5.0	6.5	7.4	8.55
OAT1	2.81	6	2.0	2.7	3.2	3.7	4.8	5.4	6.32
OAT3	6.30	9	4.2	5.5	6.4	7.5	9.8	11.1	12.88
Location	**(m^3/s)**	**(1 in XX years)**	**2**	**5**	**10**	**25**	**50**	**100**	**200**
OW3	42.52								
OW4	43.68								
OW5	13.28	2	13.0	17.2	20.0	23.5	30.7	34.6	40.21
OW6	55.27								
OW7	55.16								
OW8	55.74								
OW9	58.16								
OW10	87.32								

Results show a severity of less than a 1 in 10-year return period for 5 of the 7 HEPs with 3 HEPs corresponding to a 1 in 2-year return period or less.

It is therefore suggested that the FSU 4.2a method provides an overly conservative design flow estimation, which in turn results in the relatively low return period of the Winter 2015 flood.

This analysis provides confidence in selecting the IH124 method for flow estimation for HEPs located on small catchments.