

APPENDIX D

MIKE11 Structure Summary

TCC0049 - Eastern Alligator Creek Drainage Master Plan

MIKE11 Structures

Structure Group	Structure #	Structure ID	Config	u/s IL	d/s IL	u/s coords		d/s coords		Length	Structure Ch
						Easting	Northing	Easting	Northing		
Bruce Highway	1	WP01B	1200×600	10.74	10.67	497244.225	7855864.467	497237.811	7855884.849	21.60	10.80
	2	WP01E	4/1200×600	8.99	8.90	496958.992	7855766.286	496952.816	7855785.575	20.39	10.20
	3	WP01G	4/1200×600	9.30	9.01	496824.061	7855734.691	496822.635	7855751.272	16.80	8.40
	4	WP02B	3/1200×600	9.46	9.33	496638.411	7855728.871	496639.694	7855744.217	15.60	7.80
	5	WP02D	4/1200×600	9.90	9.81	496331.906	7855812.799	496337.655	7855828.905	16.80	8.40
	6	WP05B	2/1200×600	10.75	10.62	495981.28	7855949.279	495986.374	7855962.748	14.40	7.20
	7	WP06B	600×600	10.16	9.98	495790.08	7856021.419	495795.314	7856034.874	18.00	9.00
	8	WP07B	2/1200×1200	8.29	7.93	495586.281	7856098.026	495591.811	7856112.506	15.50	7.75
	9	BruceHwy_Bridge	Refer to 'as cons'							60.00	30.00
Northcoast Rail	10	NC_Ch1315.21	900×600	13.53	13.49	497548.82	7856124.291	497548.188	7856130.869	7.20	3.60
	11	NC_Ch1315.56	1200×450	8.70	8.65	497212.851	7856114.78	497212.851	7856121.993	7.20	3.60
	12	NC_Ch1315.58	1200×450	8.49	8.32	497180.038	7856113.908	497179.84	7856121.022	7.20	3.60
	13	NC_Ch1315.63	2/1200×450	8.33	8.11	497128.996	7856112.482	497129.155	7856119.615	7.20	3.60
	14	NC_Ch1315.64	2/1200×450	8.33	8.12	497121.341	7856112.39	497121.145	7856119.587	7.20	3.60
	15	NC_Ch1315.68	1200×450	8.38	7.99	497076.766	7856111.055	497077.004	7856118.268	7.20	3.60
	16	NC_Ch1315.71	600×450	8.54	8.51	497052.909	7856110.421	497053.068	7856116.999	7.20	3.60
	17	NC_Ch1315.81	900×450	8.67	8.64	496949.717	7856107.647	496949.954	7856113.433	7.20	3.60
	18	NC_Ch1316.10	1500×450	9.39	9.36	496660.031	7856100.752	496659.873	7856105.983	4.60	2.30
	19	NC_Ch1316.33	600×450	9.78	9.75	496411.639	7856093.064	496411.798	7856100.197	7.20	3.60
	20	NC_Ch1316.53	600×450	10.27	10.23	496227.683	7856088.625	496227.366	7856095.283	7.20	3.60
	21	NC_Bridge	Refer to 'as cons'							80.00	40.00
Williams Road	22	Williams_Ch447	1500×450	11.52	11.49	495509.956	7855656.876	495517.443	7855652.252	8.80	4.40
	23	Williams_Ch651	1500×450	11.98	11.94	495412.816	7855479.465	495405.329	7855484.089	8.80	4.40
Berrima Park	24	Corser_1	2/1200×450	10.75	10.65	495716.312	7855374.663	495722.536	7855385.618	13.20	6.60
	25	Litchfield_1	3/1200×600	10.57	10.46	495774.807	7855513.682	495781.078	7855523.914	12.00	6.00
	26	Berrima_DW01	1200×300	11.80	11.77	495483.42	7855496.885	495488.719	7855493.69	6.19	3.10
	27	Berrima_DW02	1200×300	11.63	11.62	495516.014	7855476.283	495519.177	7855474.393	3.69	1.85
	28	Berrima_DW03	1200×300	11.42	11.41	495567.194	7855463.074	495570.823	7855461.255	4.06	2.03
	29	Berrima_DW04	1200×300	11.08	11.09	495582.331	7855437.064	495586.156	7855435.156	4.27	2.13
	30	Berrima_DW05	1200×300	10.78	10.83	495740.619	7855358.363	495735.961	7855360.667	5.20	2.60
	31	Berrima_DW06	1200×300	10.72	10.76	495763.103	7855487.713	495765.563	7855491.942	4.89	2.44
	32	Berrima_DW07	1200×300	10.27	10.26	495813.228	7855511.286	495817.415	7855508.736	4.90	2.45
	33	Berrima_DW08	1200×300	10.17	10.09	495831.761	7855499.914	495836.188	7855497.069	5.26	2.63
	34	Berrima_DW09	1200×300	10.32	10.29	495823.664	7855481.081	495827.821	7855478.5	4.89	2.44
	35	Berrima_DW10	1200×300	9.91	9.88	495876.725	7855471.333	495880.848	7855468.81	4.83	2.42
	36	Berrima_DW11	1200×300	10.26	10.23	495900.242	7855436.337	495904.372	7855433.85	4.82	2.41
	37	Berrima_DW12	1200×300	10.17	10.17	495921.599	7855423.872	495926.135	7855422.043	4.89	2.44
Ashman Court	38	Ashman_1	750×450	13.05	13.02	495271.332	7855060.376	495270.086	7855070.062	9.77	4.88
Renwick Court	39	Renwick_1	1200×300	14.54	14.51	495333.134	7854597.503	495333.715	7854610.04	12.55	6.28
	40	Renwick_2	1200×300	13.85	13.76	495486.036	7854587.425	495486.46	7854595.259	7.85	3.93
Shady Lane	41	Shady_1	1050 Dia	12.44	12.29	495237.368	7854496.864	495245.322	7854506.117	12.20	6.10
Tindall Court	42	Tindall_Ch0014	900×450	10.17	10.07	497214.905	7855843.970	497228.766	7855848.681	14.64	7.32
	43	Tindall_Ch0147	750×450	13.66	13.61	497216.197	7855715.383	497206.535	7855716.765	9.76	4.88
	44	Tindall_Ch0344	1200×450	14.87	14.70	497189.321	7855522.292	497178.450	7855523.846	10.98	5.49
	45	Tindall_Ch0431	2/900×450	14.90	14.87	497168.112	7855437.010	497158.040	7855441.025	10.98	5.49
	46	Tindall_Ch0542	750×450	14.65	14.35	497111.168	7855340.895	497119.789	7855336.319	9.76	4.88
	47	Tindall_Ch0643	2/1200×600	13.82	13.70	497061.073	7855246.848	497069.694	7855242.272	9.76	4.88
	48	Tindall_Ch0743	2/1200×450	13.90	13.85	497024.749	7855155.753	497016.127	7855160.329	9.76	4.88
	49	Tindall_Ch0983	2/1200×600	14.05	14.02	496861.117	7854981.028	496854.971	7854990.126	10.98	5.49
	50	Tindall_Ch1090	2/750×600	14.21	14.18	496772.272	7854920.983	496766.124	7854930.080	10.98	5.49
	51	Tindall_Ch1384	3/1200×450	13.06	13.01	496527.454	7854756.917	496521.989	7854765.004	9.76	4.88

NOTES:

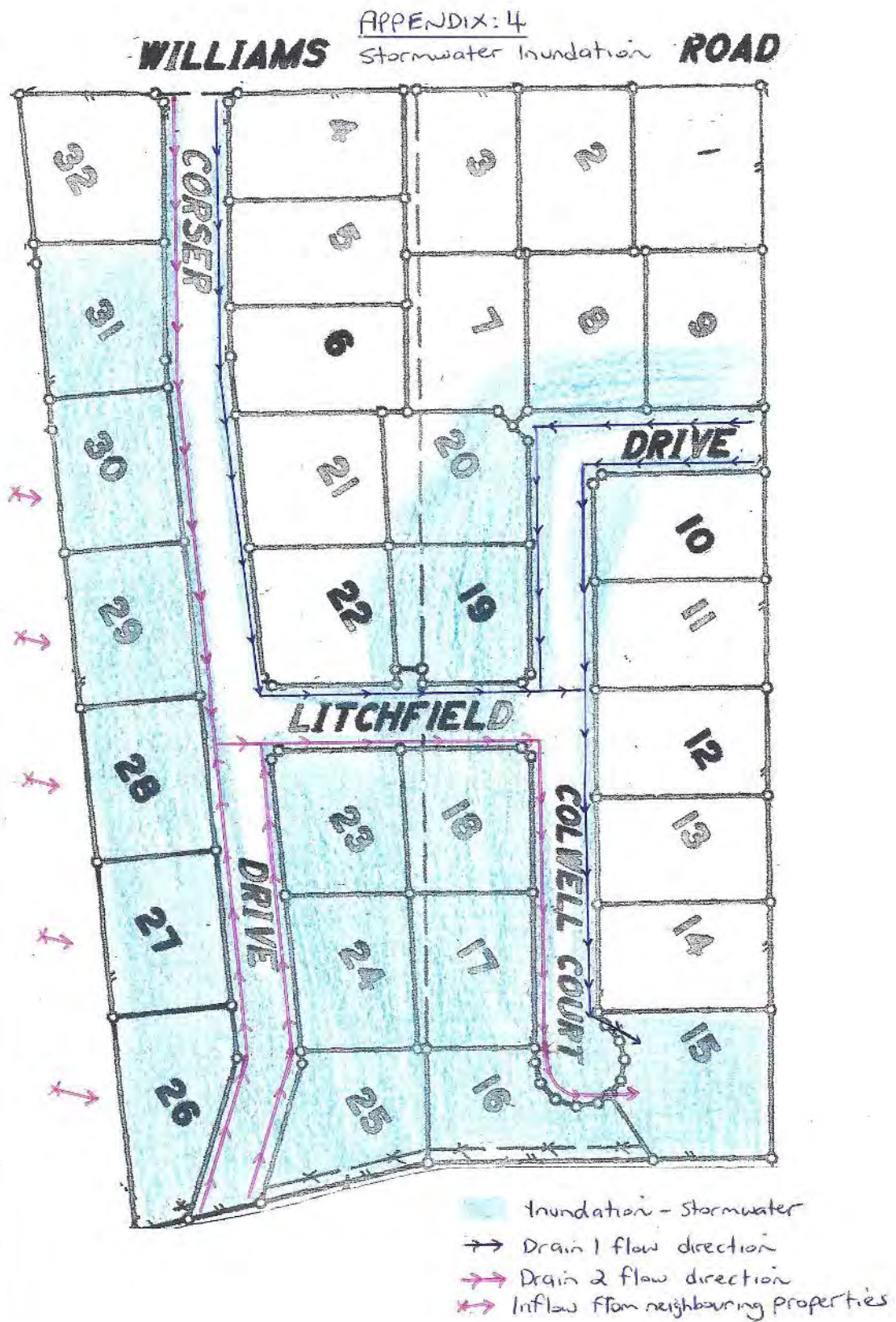
- Yellow cells represent structures whose inverts have been estimated from LiDAR in the absence of surveyed levels.
- Green cells represent structures whose coordinates have been estimated from available data.

APPENDIX E

Berrima Park 13/04/14 Flood Event Photos &
Sketch Plan (Residents' Submission)

APPENDIX 4(a)

Map showing areas of Stormwater Inundation during the last major rain event on 13/4/14



APPENDIX 4(b)

Photographs taken during the last major rain event on 13/4/14



PIC 1: From Lot 18 looking towards Lot 19.
Water flowing over Litchfield Road from Lot 18 into Lot 19.



PIC 2: From Lot 18 looking towards Lot 13 and 14. Driveway crossovers inaccessible.



PIC 3: From Lot 18 looking towards Lot 23 and 22.



PIC 4: From Lot 10 looking towards Lot 19 and 20 about 2hrs after rain stopped.



PIC 5: Lot 15 – Retention basin about 2hrs after rain stopped.



PIC 6: From Colwell Court looking towards Lot 18 about 2hrs after rain stopped.



PIC 7: Septic outflow pipes submerged and entire tank covered. About 2hrs after rain stopped.



PIC 8: From Lot 28 looking towards Corser/Litchfield intersection about 2hrs after rain stopped.



PIC 9: From Lot 28 looking towards Lots 28 and 29 about 2hrs after rain stopped.



PIC 10: From Corser Drive looking towards Lot 27 about 2hrs after rain stopped.



PIC 11: From Corser Drive looking towards Lots 28 about 2hrs after rain stopped.



PIC 12: From Corser Drive looking towards Lot 24 about 2hrs after rain stopped.



PIC 13: From Corser Drive looking towards Lot 30 about 2hrs after rain stopped.



PIC 14: From Corser Drive looking towards Lot 28 about 2hrs after rain stopped.

APPENDIX F

Flood Frequency Analysis – AMS Data

Table F-1. Annual Maximum Series for Discharge at DNRM Station 118106A

Year	Q_{max} (m³/s)
1974	Not available
1975	59
1976	217.125
1977	379.991
1978	888.838
1979	Not available
1980	Not available
1981	Not available
1982	Not available
1983	Not available
1984	Not available
1985	18.014
1986	102.705
1987	170.949
1988	256.617
1989	153.04
1990	415.162
1991	302.583
1992	58.78
1993	Not available
1994	Not available
1995	Not available
1996	Not available
1997	Not available
1998	356.316
1999	240.231
2000	365.203
2001	19.684
2002	Not available
2003	Not available
2004	Not available
2005	Not available
2006	171.641
2007	258.78
2008	263.124
2009	259.014
2010	215.402
2011	251.064
2012	199.796
2013	101.424
2014	547.887

APPENDIX G

Flood Frequency Analysis – FLIKE Reports

TUFLOW FLIKE program version 4.50
TUFLOW FLIKE file version 3.00

Title:

Input Data for Flood Frequency Analysis for Model: GEV

Results from TUFLOW FLIKE are subject to terms and conditions as described in:
http://www.tuflow.com/Download/Licensing/TUFLOW%20Products%20Licence%20Agreement.pdf
For further information please contact support@tuflow.com.

Measurement Error Data

Group	Error coefficient of variation	Lower bound rated flow
-------	-----------------------------------	---------------------------

1	0.000	0.00
---	-------	------

Gauged Annual Maximum Discharge Data

Obs	Discharge	Year	Incremental error zone	Error coefficient of variation	Cunnane ARI, yrs*
-----	-----------	------	---------------------------	-----------------------------------	----------------------

1	888.84	1978	1	0.000	42.00
2	547.89	2014	1	0.000	15.75
3	415.16	1990	1	0.000	9.69
4	379.99	1977	1	0.000	7.00
5	365.20	2000	1	0.000	5.48
6	356.32	1998	1	0.000	4.50
7	302.58	1991	1	0.000	3.82
8	263.12	2008	1	0.000	3.32
9	259.01	2009	1	0.000	2.93
10	258.78	2007	1	0.000	2.62
11	256.62	1988	1	0.000	2.38
12	251.06	2011	1	0.000	2.17
13	240.23	1999	1	0.000	2.00
14	217.12	1976	1	0.000	1.85
15	215.40	2010	1	0.000	1.73
16	199.80	2012	1	0.000	1.62
17	171.64	2006	1	0.000	1.52
18	170.95	1987	1	0.000	1.43
19	153.04	1989	1	0.000	1.35
20	102.70	1986	1	0.000	1.29
21	101.42	2013	1	0.000	1.22
22	59.00	1975	1	0.000	1.17
23	58.78	1992	1	0.000	1.12
24	19.68	2001	1	0.000	1.07
25	18.01	1985	1	0.000	1.02

Note: Cunnane plotting position is based on gauged flows only

Posterior Parameter Results

Data file: D:\websites\TUFLOW-Prev\FlikeUploads/TCC0049 FFA GEV_1011151

Flood model: GEV

>>> Fitting algorithm: Global probabilistic search

Parameter	Lower bound	Upper bound
-----------	-------------	-------------

1	-452.42452	785.49215
2	2.51601	7.12119
3	-2.50000	2.50000

>>> PENALTIES were added to log-posterior density <<<

Incremental error model: Log-normal

Solution PROBABLY found in 2491 iterations

Maximized log-posterior density = -161.215

No	Parameter	Initial value	Most probable value
1	Location u	166.53381	168.60874
2	loge (Scale a)	4.81860	4.82963
3	Shape k	-0.09599	-0.07703

 zero flow threshold: 0.0000
 Number of gauged flows at or below flow threshold = 0

 Parameter Moments based on Multi-normal Approximation to Posterior Distribution

No	Most probable	Std dev	Correlation
1	168.60874	28.40231	1.000
2	4.82963	0.16849	0.467 1.000
3	-0.07703	0.14885	0.346 0.213 1.000

Note: Parameters are roughly normally distributed.
 This approximation improves with sample size.

Summary of Posterior Moments from Importance Sampling

No	Mean	Std dev	Correlation
1	166.63242	30.70078	1.000
2	4.90422	0.18159	0.459 1.000
3	-0.14116	0.17279	0.266 0.071 1.000

Note: Posterior expected parameters are the most accurate in the mean-squared-error sense.
 They should be used in preference to the most probable parameters

Lower bound = -788.718

Recurrence Stdev(log10(q)) interval yrs	Exp parameter quantile	Monte Carlo 90% quantile	Mean(log10(q)) probability limits
--	---------------------------	--------------------------	--------------------------------------

0.2665	1.100	55.68	4.72	94.7	1.6952
0.1329	1.250	104.56	58.88	147.8	1.9978
0.0878	1.500	154.03	106.62	203.9	2.1785
0.0765	1.750	189.24	138.95	245.2	2.2713
0.0718	2.000	217.36	163.98	279.2	2.3331
	3.000	296.47	231.96	380.5	2.4707

TCC0049 FFA GEV_101115101413_out.txt

0.0673	5.000	391.92	306.77	521.1	2.5942
0.0721	10.000	523.85	400.26	765.4	2.7231
0.0896	20.000	664.23	486.56	1110.9	2.8293
0.1143	50.000	868.47	593.61	1760.6	2.9502
0.1530	100.000	1040.12	667.07	2470.3	3.0323
0.1852	200.000	1228.83	736.66	3449.1	3.1087
0.2192	500.000	1507.90	819.49	5343.5	3.2033
0.2662	1000.000	1744.15	878.47	7416.7	3.2711
0.3029	2000.000	2004.61	934.03	10241.5	3.3364
0.3406	5000.000	2390.38	1001.63	15606.0	3.4195
0.3916	10000.000	2717.19	1049.08	21568.6	3.4804
0.4310	20000.000	3077.58	1093.61	29644.0	3.5398
0.4709	50000.000	3611.46	1149.18	44665.1	3.6166
0.5245	100000.000	4063.76	1187.15	61446.8	3.6735
0.5655					

Expected Probability Flood based on
Monte Carlo samples = 20000
Probability weight = 1.000
Scaling factor = 2.500

Flood magnitude	Expected probability	<-----ARI----->		
		yrs	95% limits	
55.68	0.09915	1.11	1.11	1.11
104.56	0.20827	1.26	1.26	1.26
154.03	0.33950	1.51	1.51	1.52
189.24	0.43250	1.76	1.76	1.77
217.36	0.50217	2.01	2.00	2.01
296.47	0.66544	2.99	2.98	3.00
391.92	0.79735	4.93	4.91	4.96
523.85	0.89668	9.68	9.61	9.74
664.23	0.94583	18.46	18.28	18.64
868.47	0.97496	39.94	39.35	40.54
1040.12	0.98495	66.44	65.21	67.73
1228.83	0.99040	104.22	101.88	106.67
1507.90	0.99430	175.58	170.75	180.70
1744.15	0.99599	249.26	241.46	257.60
2004.61	0.99709	343.29	331.25	356.23
2390.38	0.99802	504.74	484.61	526.62
2717.19	0.99849	660.14	631.44	691.57
3077.58	0.99882	849.29	809.36	893.36
3611.46	0.99914	1160.21	1100.32	1227.00
4063.76	0.99931	1449.38	1369.57	1539.07

 TUFLOW FLIKE program version 4.50
 TUFLOW FLIKE file version 3.00

Title:

Input Data for Flood Frequency Analysis for Model: Log Pearson III

Results from TUFLOW FLIKE are subject to terms and conditions as described in:
<http://www.tuflow.com/Download/Licensing/TUFLOW%20Products%20Licence%20Agreement.pdf>
 For further information please contact support@tuflow.com.

Measurement Error Data

Group	Error coefficient of variation	Lower bound rated flow
-------	-----------------------------------	---------------------------

1	0.000	0.00
---	-------	------

Gauged Annual Maximum Discharge Data

Obs	Discharge	Year	Incremental error zone	Error coefficient of variation	Cunnane ARI, yrs*
-----	-----------	------	---------------------------	-----------------------------------	----------------------

1	888.84	1978	1	0.000	42.00
2	547.89	2014	1	0.000	15.75
3	415.16	1990	1	0.000	9.69
4	379.99	1977	1	0.000	7.00
5	365.20	2000	1	0.000	5.48
6	356.32	1998	1	0.000	4.50
7	302.58	1991	1	0.000	3.82
8	263.12	2008	1	0.000	3.32
9	259.01	2009	1	0.000	2.93
10	258.78	2007	1	0.000	2.62
11	256.62	1988	1	0.000	2.38
12	251.06	2011	1	0.000	2.17
13	240.23	1999	1	0.000	2.00
14	217.12	1976	1	0.000	1.85
15	215.40	2010	1	0.000	1.73
16	199.80	2012	1	0.000	1.62
17	171.64	2006	1	0.000	1.52
18	170.95	1987	1	0.000	1.43
19	153.04	1989	1	0.000	1.35
20	102.70	1986	1	0.000	1.29
21	101.42	2013	1	0.000	1.22
22	59.00	1975	1	0.000	1.17
23	58.78	1992	1	0.000	1.12
24	19.68	2001	1	0.000	1.07
25	18.01	1985	1	0.000	1.02

Note: Cunnane plotting position is based on gauged flows only

 Posterior Parameter Results

Data file: D:\websites\TUFLOW-Prev\FlikeUploads/TCC0049 FFA LP3_1011151

Flood model: Log Pearson III

>>> Fitting algorithm: Global probabilistic search

Parameter	Lower bound	Upper bound
-----------	-------------	-------------

1	0.60285	9.83195
2	-2.38281	2.22236
3	-5.00000	5.00000

>>> PENALTIES were added to log-posterior density <<<

Incremental error model: Log-normal

Solution PROBABLY found in 2237 iterations

Maximized log-posterior density = -161.224

No	Parameter	Initial value	Most probable value
1	Mean (log _e flow)	5.21740	5.21739
2	log _e [Std dev (log _e flow)]	-0.08022	-0.13025
3	Skew (log _e flow)	-1.16146	-0.81121

Zero flow threshold: 0.0000
 Number of gauged flows at or below flow threshold = 0

Parameter Moments based on Multi-normal Approximation to Posterior Distribution					
No	Most probable	Std dev	Correlation		
1	5.21739	0.18379	1.000		
2	-0.13025	0.19178	-0.548	1.000	
3	-0.81121	0.36223	0.124	-0.653	1.000

Note: Parameters are roughly normally distributed.
 This approximation improves with sample size.

Summary of Posterior Moments from Importance Sampling					
No	Mean	Std dev	Correlation		
1	5.20521	0.19218	1.000		
2	-0.06408	0.16925	-0.442	1.000	
3	-0.68132	0.33633	0.025	-0.290	1.000

Note: Posterior expected parameters are the most accurate in the mean-squared-error sense.
 They should be used in preference to the most probable parameters

Upper bound = 2859.74

Recurrence Stdev(log ₁₀ (q)) interval yrs	Exp parameter quantile	Monte Carlo 90% quantile	Mean(log ₁₀ (q)) probability limits
---	---------------------------	--------------------------	---

0.3006	1.010	12.98	3.49	29.8	1.0938
0.1599	1.100	48.95	25.00	79.5	1.6834
0.1181	1.250	86.71	53.37	127.8	1.9357
0.0961	1.500	133.78	91.13	186.2	2.1264
0.0875	1.750	171.14	121.99	234.0	2.2344
	2.000	202.54	147.77	274.4	2.3081

TCC0049 FFA LP3_101115101428_out.txt

0.0831	3.000	294.81	222.84	397.3	2.4721
0.0774	5.000	407.13	311.20	552.8	2.6128
0.0777	10.000	554.60	421.48	785.6	2.7476
0.0849	20.000	696.70	521.02	1061.5	2.8473
0.0973	50.000	875.89	639.39	1476.0	2.9480
0.1187	100.000	1004.51	714.24	1864.8	3.0089
0.1369	200.000	1126.94	779.38	2302.3	3.0605
0.1561	500.000	1279.15	852.00	2978.0	3.1183
0.1819	1000.000	1387.01	897.01	3557.5	3.1558
0.2016	2000.000	1488.70	931.16	4205.7	3.1893
0.2212	5000.000	1613.91	966.43	5188.7	3.2284
0.2468	10000.000	1701.91	991.44	6065.4	3.2547
0.2659	20000.000	1784.35	1005.43	7017.7	3.2788
0.2846	50000.000	1885.22	1021.14	8347.6	3.3076
0.3089	100000.000	1955.72	1028.58	9530.9	3.3275
0.3269					

Expected Probability Flood based on
Monte Carlo samples = 20000
Probability weight = 1.000
Scaling factor = 2.500

Flood magnitude	Expected probability	<-----ARI----->		
		yr	95% limits	
12.98	0.01391	1.01	1.01	1.01
48.95	0.09458	1.10	1.10	1.11
86.71	0.20105	1.25	1.25	1.25
133.78	0.33190	1.50	1.49	1.50
171.14	0.42577	1.74	1.74	1.74
202.54	0.49633	1.99	1.98	1.99
294.81	0.66146	2.95	2.94	2.96
407.13	0.79416	4.86	4.84	4.88
554.60	0.89432	9.46	9.40	9.53
696.70	0.94474	18.09	17.92	18.27
875.89	0.97508	40.12	39.54	40.72
1004.51	0.98519	67.53	66.24	68.86
1126.94	0.99036	103.74	101.33	106.26
1279.15	0.99387	163.26	158.67	168.12
1387.01	0.99537	215.81	209.04	223.04
1488.70	0.99635	273.67	264.26	283.78
1613.91	0.99719	356.43	342.91	371.07
1701.91	0.99763	422.41	405.37	440.96
1784.35	0.99796	490.22	469.35	513.03
1885.22	0.99828	581.22	554.94	610.11
1955.72	0.99846	650.14	619.57	683.88

 TUFLOW FLIKE program version 4.50
 TUFLOW FLIKE file version 3.00

Title:

Input Data for Flood Frequency Analysis for Model: 2-parameter Log Normal

Results from TUFLOW FLIKE are subject to terms and conditions as described in:
<http://www.tuflow.com/Download/Licensing/TUFLOW%20Products%20Licence%20Agreement.pdf>
 For further information please contact support@tuflow.com.

Measurement Error Data

Group	Error coefficient of variation	Lower bound rated flow
-------	-----------------------------------	---------------------------

1	0.000	0.00
---	-------	------

Gauged Annual Maximum Discharge Data

Obs	Discharge	Year	Incremental error zone	Error coefficient of variation	Cunnane ARI, yrs*
-----	-----------	------	---------------------------	-----------------------------------	----------------------

1	888.84	1978	1	0.000	42.00
2	547.89	2014	1	0.000	15.75
3	415.16	1990	1	0.000	9.69
4	379.99	1977	1	0.000	7.00
5	365.20	2000	1	0.000	5.48
6	356.32	1998	1	0.000	4.50
7	302.58	1991	1	0.000	3.82
8	263.12	2008	1	0.000	3.32
9	259.01	2009	1	0.000	2.93
10	258.78	2007	1	0.000	2.62
11	256.62	1988	1	0.000	2.38
12	251.06	2011	1	0.000	2.17
13	240.23	1999	1	0.000	2.00
14	217.12	1976	1	0.000	1.85
15	215.40	2010	1	0.000	1.73
16	199.80	2012	1	0.000	1.62
17	171.64	2006	1	0.000	1.52
18	170.95	1987	1	0.000	1.43
19	153.04	1989	1	0.000	1.35
20	102.70	1986	1	0.000	1.29
21	101.42	2013	1	0.000	1.22
22	59.00	1975	1	0.000	1.17
23	58.78	1992	1	0.000	1.12
24	19.68	2001	1	0.000	1.07
25	18.01	1985	1	0.000	1.02

Note: Cunnane plotting position is based on gauged flows only

 Posterior Parameter Results

Data file: D:\websites\TUFLOW-Prev\FlikeUploads/TCC0049 FFA Log-normal_

Flood model: 2-parameter Log Normal

>>> Fitting algorithm: Global probabilistic search

Parameter	Lower bound	Upper bound
1	0.60285	9.83195
2	-2.38281	2.22236

Incremental error model: Log-normal

Solution PROBABLY found in 920 iterations

Maximized log-posterior density = -163.393

No	Parameter	Initial value	Most probable value
1	Mean (loge flow)	5.21740	5.21740
2	loge [Std dev (loge flow)]	-0.08022	-0.10063

Zero flow threshold: 0.0000
Number of gauged flows at or below flow threshold = 0

Parameter Moments based on Multi-normal Approximation to Posterior Distribution				
No	Most probable	Std dev	Correlation	
1	5.21740	0.18076	1.000	
2	-0.10063	0.14135	0.000	1.000

Note: Parameters are roughly normally distributed.
This approximation improves with sample size.

Summary of Posterior Moments from Importance Sampling				
No	Mean	Std dev	Correlation	
1	5.22041	0.19079	1.000	
2	-0.05911	0.14701	-0.011	1.000

Note: Posterior expected parameters are the most accurate in the mean-squared-error sense.
They should be used in preference to the most probable parameters

Recurrence Stdev(log10(q)) interval yrs	Exp parameter quantile	Monte Carlo 90% quantile Mean(log10(q)) probability limits		
--	---------------------------	---	--	--

0.1685	1.010	20.58	10.03	35.1	1.3028
0.1183	1.100	52.56	32.04	77.1	1.7146
0.0986	1.250	83.69	55.75	116.2	1.9189
0.0874	1.500	123.27	86.87	167.1	2.0889
0.0837	1.750	156.14	112.84	211.5	2.1927
0.0829	2.000	185.01	135.33	252.1	2.2672
0.0869	3.000	277.66	203.68	391.2	2.4455
0.0977	5.000	409.00	293.22	612.2	2.6155
0.1147	10.000	619.18	424.50	1006.4	2.7976

	TCC0049 FFA Log-normal_101115101441_out.txt	
20.000	872.05	570.39
0.1315		1527.2
50.000	1282.12	789.22
0.1522		2453.8
100.000	1657.76	976.22
0.1667		3381.1
200.000	2097.26	1186.68
0.1805		4545.6
500.000	2788.79	1499.36
0.1975		6511.8
1000.000	3405.89	1769.37
0.2096		8376.0
2000.000	4113.62	2060.21
0.2211		10640.2
5000.000	5204.56	2501.18
0.2357		14352.6
10000.000	6160.75	2863.60
0.2462		17831.7
20000.000	7242.21	3270.62
0.2564		21841.5
50000.000	8885.01	3862.97
0.2692		28342.9
100000.000	10306.17	4347.92
0.2786		34265.1
		4.0324

Expected Probability Flood based on
Monte Carlo samples = 20000
Probability weight = 1.000
Scaling factor = 2.500

Flood magnitude	Expected probability	<-----ARI----->		
		yrs	95% limits	
20.58	0.01416	1.01	1.01	1.01
52.56	0.09679	1.11	1.11	1.11
83.69	0.20368	1.26	1.25	1.26
123.27	0.33486	1.50	1.50	1.51
156.14	0.42906	1.75	1.75	1.75
185.01	0.49986	2.00	2.00	2.00
277.66	0.66493	2.98	2.98	2.99
409.00	0.79625	4.91	4.89	4.93
619.18	0.89435	9.46	9.40	9.53
872.05	0.94388	17.82	17.67	17.97
1282.12	0.97475	39.61	39.14	40.08
1657.76	0.98581	70.48	69.47	71.51
2097.26	0.99184	122.58	120.48	124.75
2788.79	0.99594	246.51	241.26	252.00
3405.89	0.99755	408.54	398.37	419.24
4113.62	0.99850	664.49	645.34	684.82
5204.56	0.99919	1230.57	1187.88	1276.45
6160.75	0.99948	1924.62	1848.23	2007.59
7242.21	0.99966	2964.79	2830.72	3112.18
8885.01	0.99981	5135.89	4861.48	5443.13
10306.17	0.99987	7664.00	7201.23	8190.34

 TUFLOW FLIKE program version 4.50
 TUFLOW FLIKE file version 3.00

Title:

Input Data for Flood Frequency Analysis for Model: Gumbel

Results from TUFLOW FLIKE are subject to terms and conditions as described in:
<http://www.tuflow.com/Download/Licensing/TUFLOW%20Products%20Licence%20Agreement.pdf>
 For further information please contact support@tuflow.com.

Measurement Error Data

Group	Error coefficient of variation	Lower bound rated flow
-------	-----------------------------------	---------------------------

1	0.000	0.00
---	-------	------

Gauged Annual Maximum Discharge Data

Obs	Discharge	Year	Incremental error zone	Error coefficient of variation	Cunnane ARI, yrs*
-----	-----------	------	---------------------------	-----------------------------------	----------------------

1	888.84	1978	1	0.000	42.00
2	547.89	2014	1	0.000	15.75
3	415.16	1990	1	0.000	9.69
4	379.99	1977	1	0.000	7.00
5	365.20	2000	1	0.000	5.48
6	356.32	1998	1	0.000	4.50
7	302.58	1991	1	0.000	3.82
8	263.12	2008	1	0.000	3.32
9	259.01	2009	1	0.000	2.93
10	258.78	2007	1	0.000	2.62
11	256.62	1988	1	0.000	2.38
12	251.06	2011	1	0.000	2.17
13	240.23	1999	1	0.000	2.00
14	217.12	1976	1	0.000	1.85
15	215.40	2010	1	0.000	1.73
16	199.80	2012	1	0.000	1.62
17	171.64	2006	1	0.000	1.52
18	170.95	1987	1	0.000	1.43
19	153.04	1989	1	0.000	1.35
20	102.70	1986	1	0.000	1.29
21	101.42	2013	1	0.000	1.22
22	59.00	1975	1	0.000	1.17
23	58.78	1992	1	0.000	1.12
24	19.68	2001	1	0.000	1.07
25	18.01	1985	1	0.000	1.02

Note: Cunnane plotting position is based on gauged flows only

 Posterior Parameter Results

Data file: D:\websites\TUFLOW-Prev\FlikeUploads/TCC0049 FFA Gumbel_1011

Flood model: Gumbel

>>> Fitting algorithm: Global probabilistic search

Parameter	Lower bound	Upper bound
1	0.00000	887.95746
2	2.66751	7.27268

Incremental error model: Log-normal

Solution PROBABLY found in 825 iterations

Maximized log-posterior density = -161.377

No	Parameter	Initial value	Most probable value
1	Location u	167.75458	174.07393
2	loge (Scale a)	4.97010	4.85927

Zero flow threshold: 0.0000
Number of gauged flows at or below flow threshold = 0

Parameter Moments based on Multi-normal Approximation to Posterior Distribution				
No	Most probable	Std dev	Correlation	
1	174.07393	27.07008	1.000	
2	4.85927	0.15804	0.306	1.000

Note: Parameters are roughly normally distributed.
This approximation improves with sample size.

Summary of Posterior Moments from Importance Sampling				
No	Mean	Std dev	Correlation	
1	173.49171	28.98281	1.000	
2	4.90581	0.16237	0.269	1.000

Note: Posterior expected parameters are the most accurate in the mean-squared-error sense.
They should be used in preference to the most probable parameters

Recurrence Stdev(log10(q)) interval yrs	Exp parameter quantile	Monte Carlo 90% quantile Mean(log10(q)) probability limits		
--	---------------------------	---	--	--

1.100	55.36	-0.65	98.2	1.6952
0.2897				
1.250	109.21	60.34	151.6	2.0173
0.1379				
1.500	160.79	114.11	206.5	2.1985
0.0814				
1.750	195.87	148.57	246.5	2.2874
0.0683				
2.000	223.00	173.67	278.6	2.3451
0.0630				
3.000	295.42	237.20	367.2	2.4690
0.0576				
5.000	376.09	303.91	469.2	2.5747
0.0569				
10.000	477.45	385.91	598.9	2.6788
0.0578				
20.000	574.68	463.62	724.9	2.7595
0.0590				

	TCC0049 FFA Gumbel_101115101455_out.txt	
50.000	700.53	562.17
0.0605		889.0
100.000	794.84	636.32
0.0614		1012.8
200.000	888.81	709.71
0.0621		1135.9
500.000	1012.78	806.05
0.0630		1298.0
1000.000	1106.47	878.63
0.0635		1421.3
2000.000	1200.13	951.86
0.0640		1544.4
5000.000	1323.91	1048.16
0.0645		1707.1
10000.000	1417.54	1120.66
0.0649		1831.3
20000.000	1511.17	1193.14
0.0652		1954.4
50000.000	1634.94	1288.94
0.0656		2117.3
100000.000	1728.57	1361.74
0.0658		2240.7

Expected Probability Flood based on
Monte Carlo samples = 20000
Probability weight = 1.000
Scaling factor = 2.500

Flood magnitude	Expected probability	<-----ARI----->		
		yr	95% limits	
55.36	0.09734	1.11	1.11	1.11
109.21	0.20481	1.26	1.26	1.26
160.79	0.33697	1.51	1.51	1.51
195.87	0.43137	1.76	1.76	1.76
223.00	0.50199	2.01	2.00	2.01
295.42	0.66585	2.99	2.98	3.00
376.09	0.79628	4.91	4.89	4.93
477.45	0.89461	9.49	9.43	9.55
574.68	0.94482	18.12	17.98	18.26
700.53	0.97616	41.94	41.53	42.36
794.84	0.98722	78.22	77.30	79.15
888.81	0.99308	144.46	142.49	146.49
1012.78	0.99688	320.35	315.08	325.80
1106.47	0.99827	578.79	567.91	590.09
1200.13	0.99903	1036.06	1013.90	1059.20
1323.91	0.99955	2205.83	2150.15	2264.47
1417.54	0.99974	3866.56	3756.19	3983.61
1511.17	0.99985	6718.50	6501.92	6950.00
1634.94	0.99993	13764.26	13243.84	14327.25
1728.57	0.99996	23450.75	22451.02	24543.66

 TUFLOW FLIKE program version 4.50
 TUFLOW FLIKE file version 3.00

Title:

Input Data for Flood Frequency Analysis for Model: Generalised Pareto

Results from TUFLOW FLIKE are subject to terms and conditions as described in:
<http://www.tuflow.com/Download/Licensing/TUFLOW%20Products%20Licence%20Agreement.pdf>
 For further information please contact support@tuflow.com.

Measurement Error Data

Group	Error coefficient of variation	Lower bound rated flow
-------	-----------------------------------	---------------------------

1	0.000	0.00
---	-------	------

Gauged Annual Maximum Discharge Data

Obs	Discharge	Year	Incremental error zone	Error coefficient of variation	Cunnane ARI, yrs*
-----	-----------	------	---------------------------	-----------------------------------	----------------------

1	888.84	1978	1	0.000	42.00
2	547.89	2014	1	0.000	15.75
3	415.16	1990	1	0.000	9.69
4	379.99	1977	1	0.000	7.00
5	365.20	2000	1	0.000	5.48
6	356.32	1998	1	0.000	4.50
7	302.58	1991	1	0.000	3.82
8	263.12	2008	1	0.000	3.32
9	259.01	2009	1	0.000	2.93
10	258.78	2007	1	0.000	2.62
11	256.62	1988	1	0.000	2.38
12	251.06	2011	1	0.000	2.17
13	240.23	1999	1	0.000	2.00
14	217.12	1976	1	0.000	1.85
15	215.40	2010	1	0.000	1.73
16	199.80	2012	1	0.000	1.62
17	171.64	2006	1	0.000	1.52
18	170.95	1987	1	0.000	1.43
19	153.04	1989	1	0.000	1.35
20	102.70	1986	1	0.000	1.29
21	101.42	2013	1	0.000	1.22
22	59.00	1975	1	0.000	1.17
23	58.78	1992	1	0.000	1.12
24	19.68	2001	1	0.000	1.07
25	18.01	1985	1	0.000	1.02

Note: Cunnane plotting position is based on gauged flows only

 Posterior Parameter Results

Data file: D:\websites\TUFLOW-Prev\FlikeUploads/TCC0049 FFA Generalised

Flood model: Generalised Pareto

>>> Fitting algorithm: Global probabilistic search

Parameter	Lower bound	Upper bound
-----------	-------------	-------------

1	20.00500	2000.49996
2	-3.00000	3.00000
3	0.00000	18.01300

>>> PENALTIES were added to log-posterior density <<<

Incremental error model: Log-normal

Solution PROBABLY found in 2948 iterations

Maximized log-posterior density = -160.644

No	Parameter	Initial value	Most probable value
1	Scale a	200.05000	278.60905
2	Shape k	0.04102	0.20406
3	Thresh	17.91400	18.01300

 zero flow threshold: 0.0000
 Number of gauged flows at or below flow threshold = 0

 Parameter Moments based on Multi-normal Approximation to Posterior Distribution
 No Most probable Std dev Correlation

1	278.60905	92.07160	1.000
2	0.20406	0.23838	0.818 1.000
3	18.01300	20.89621	-0.391 -0.198 1.000

Note: Parameters are roughly normally distributed.
 This approximation improves with sample size.

Summary of Posterior Moments from Importance Sampling
 No Mean Std dev Correlation

1	305.73590	82.65015	1.000
2	0.12862	0.21187	0.645 1.000
3	11.24176	4.82273	-0.138 -0.075 1.000

Note: Posterior expected parameters are the most
 accurate in the mean-squared-error sense.
 They should be used in preference to the most probable parameters

Upper bound = 2388.32

Recurrence Stdev(log10(q)) interval yrs	Exp parameter quantile	Monte Carlo 90% quantile probability limits	Mean(log10(q))
--	---------------------------	--	----------------

0.1849	1.010	14.28	5.35	20.6	1.1219
0.0919	1.100	40.20	27.24	55.2	1.5942
0.0927	1.250	78.50	54.02	109.1	1.8835
0.0934	1.500	132.03	90.26	184.2	2.1081
0.0923	1.750	176.32	120.72	245.3	2.2333
	2.000	213.99	147.56	295.9	2.3171

TCC0049 FFA Generalised Pareto_101115101511_out.txt

0.0909	3.000	324.48	227.22	438.0	2.4979
0.0869	5.000	455.71	324.42	607.4	2.6462
0.0858	10.000	620.55	452.48	872.4	2.7823
0.0935	20.000	771.33	561.73	1170.1	2.8795
0.1105	50.000	951.09	684.21	1648.2	2.9753
0.1415	100.000	1073.68	755.50	2092.2	3.0324
0.1686	200.000	1185.81	810.98	2645.9	3.0806
0.1975	500.000	1319.49	866.10	3535.8	3.1346
0.2371	1000.000	1410.66	891.01	4346.7	3.1700
0.2678	2000.000	1494.05	913.50	5275.9	3.2019
0.2990	5000.000	1593.46	934.83	6721.8	3.2397
0.3405	10000.000	1661.26	944.74	8086.5	3.2657
0.3722	20000.000	1723.27	953.10	9546.4	3.2899
0.4039	50000.000	1797.21	960.54	12327.9	3.3197
0.4461	100000.000	1847.62	968.06	14769.6	3.3409
0.4781					

Expected Probability Flood based on
Monte Carlo samples = 20000
Probability weight = 1.000
Scaling factor = 2.500

Flood magnitude	Expected probability	<-----ARI----->		
		yrs	95% limits	
14.28	0.01228	1.01	1.01	1.01
40.20	0.09594	1.11	1.11	1.11
78.50	0.20977	1.27	1.26	1.27
132.03	0.34602	1.53	1.53	1.53
176.32	0.44167	1.79	1.79	1.79
213.99	0.51265	2.05	2.05	2.06
324.48	0.67626	3.09	3.08	3.10
455.71	0.80586	5.15	5.13	5.18
620.55	0.90267	10.27	10.20	10.35
771.33	0.95042	20.17	19.95	20.40
951.09	0.97741	44.28	43.48	45.10
1073.68	0.98559	69.42	67.83	71.09
1185.81	0.98981	98.11	95.43	100.94
1319.49	0.99280	138.99	134.50	143.78
1410.66	0.99414	170.75	164.69	177.27
1494.05	0.99506	202.36	194.60	210.76
1593.46	0.99589	243.05	232.94	254.07
1661.26	0.99633	272.59	260.67	285.66
1723.27	0.99668	300.85	287.11	315.96
1797.21	0.99702	336.01	319.93	353.80
1847.62	0.99723	360.88	343.07	380.65

APPENDIX H

Flood Frequency Analysis – Results

Figure H-1. GEV probability distribution

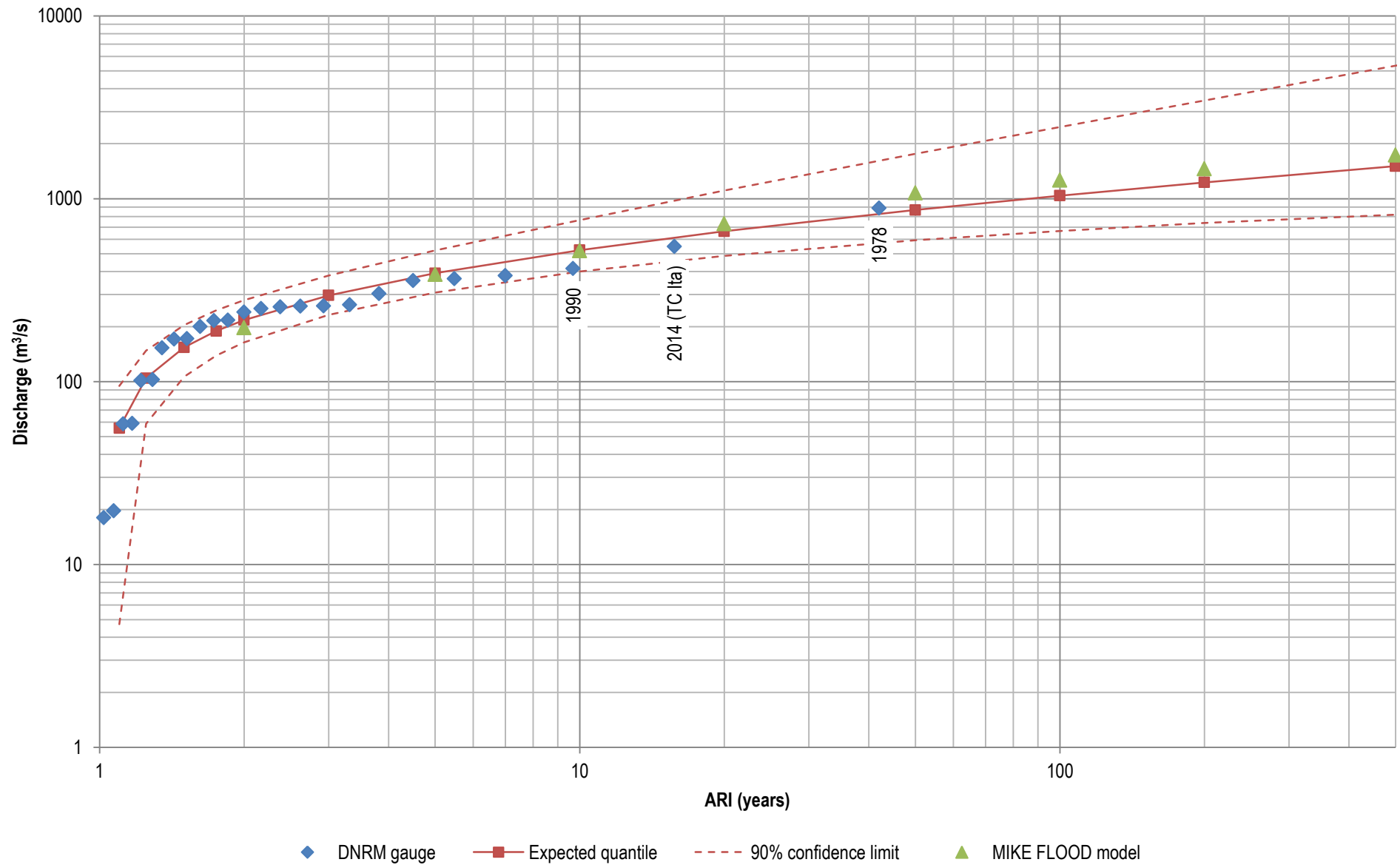


Figure H-2. LP3 probability distribution

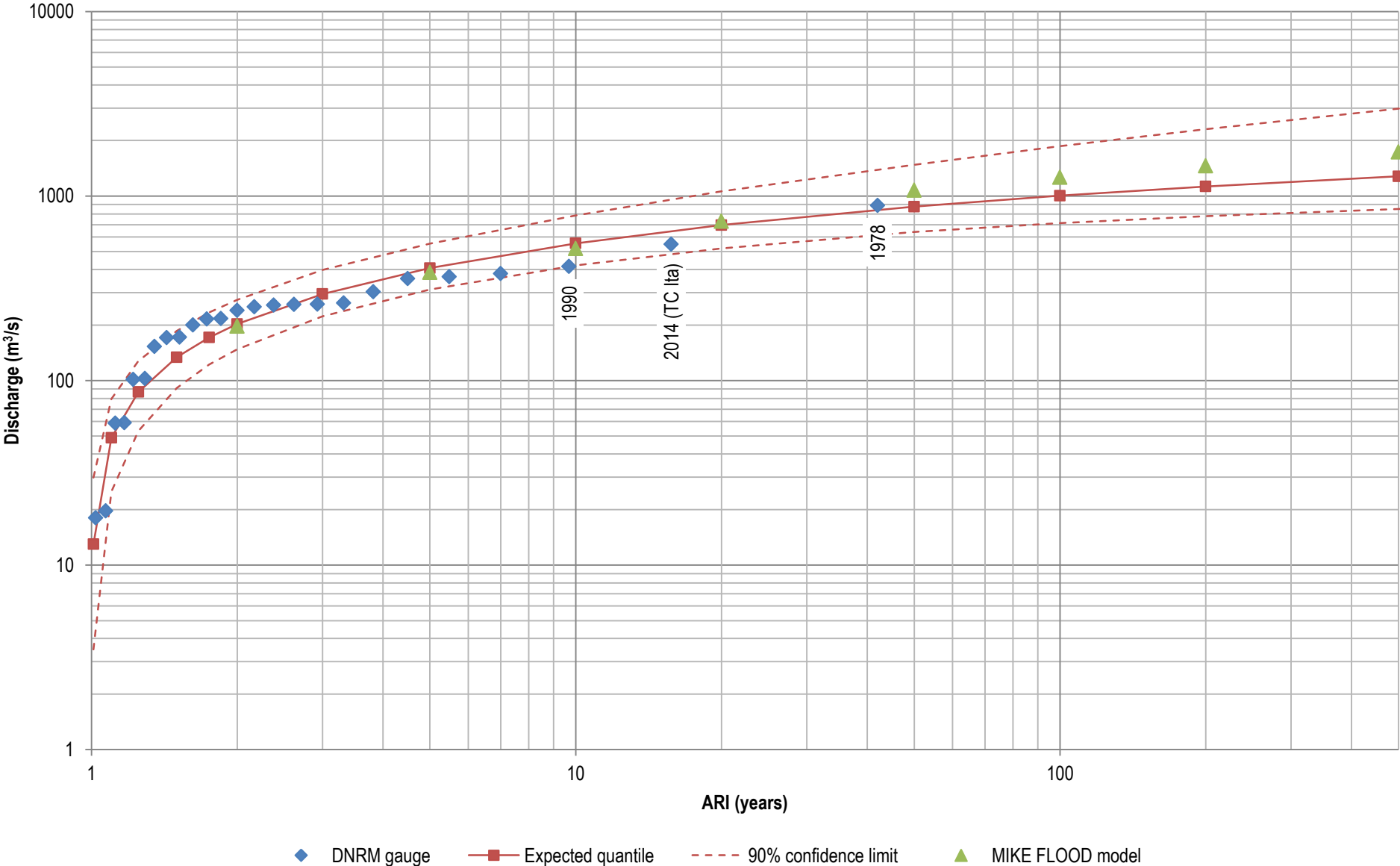


Figure H-3. Log-normal probability distribution

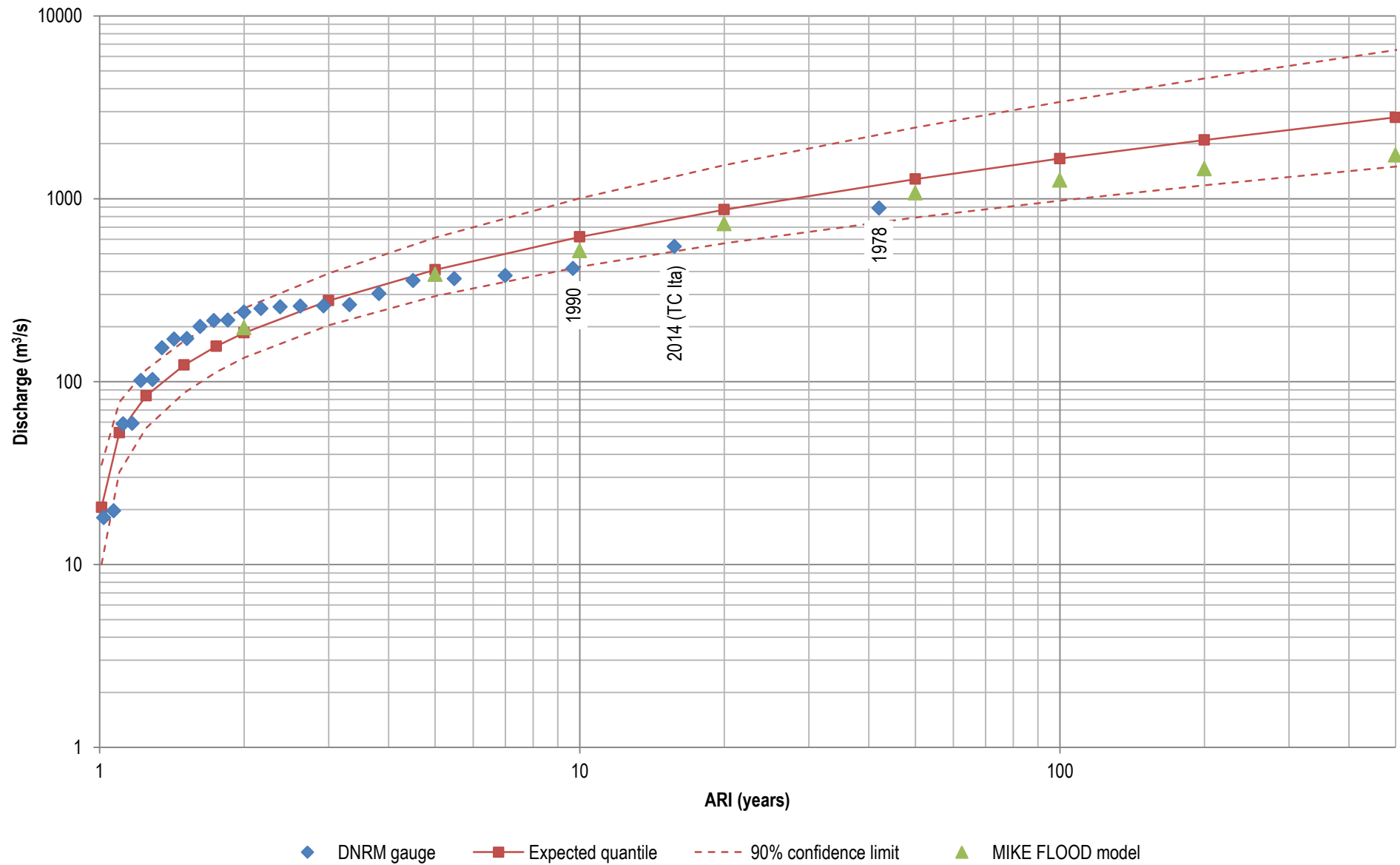


Figure H-4. Gumbel probability distribution

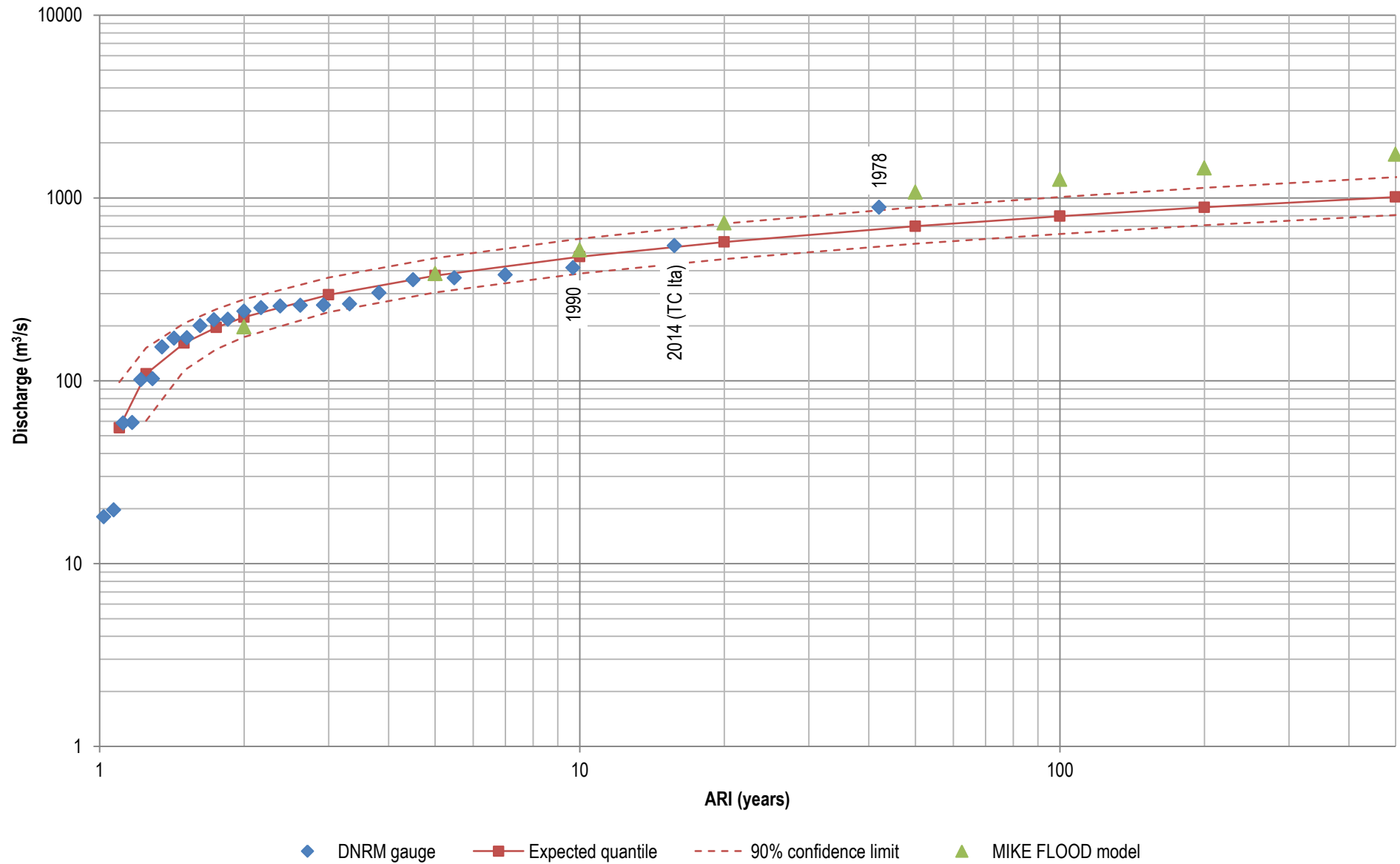


Figure H-5. Generalised Pareto probability distribution

