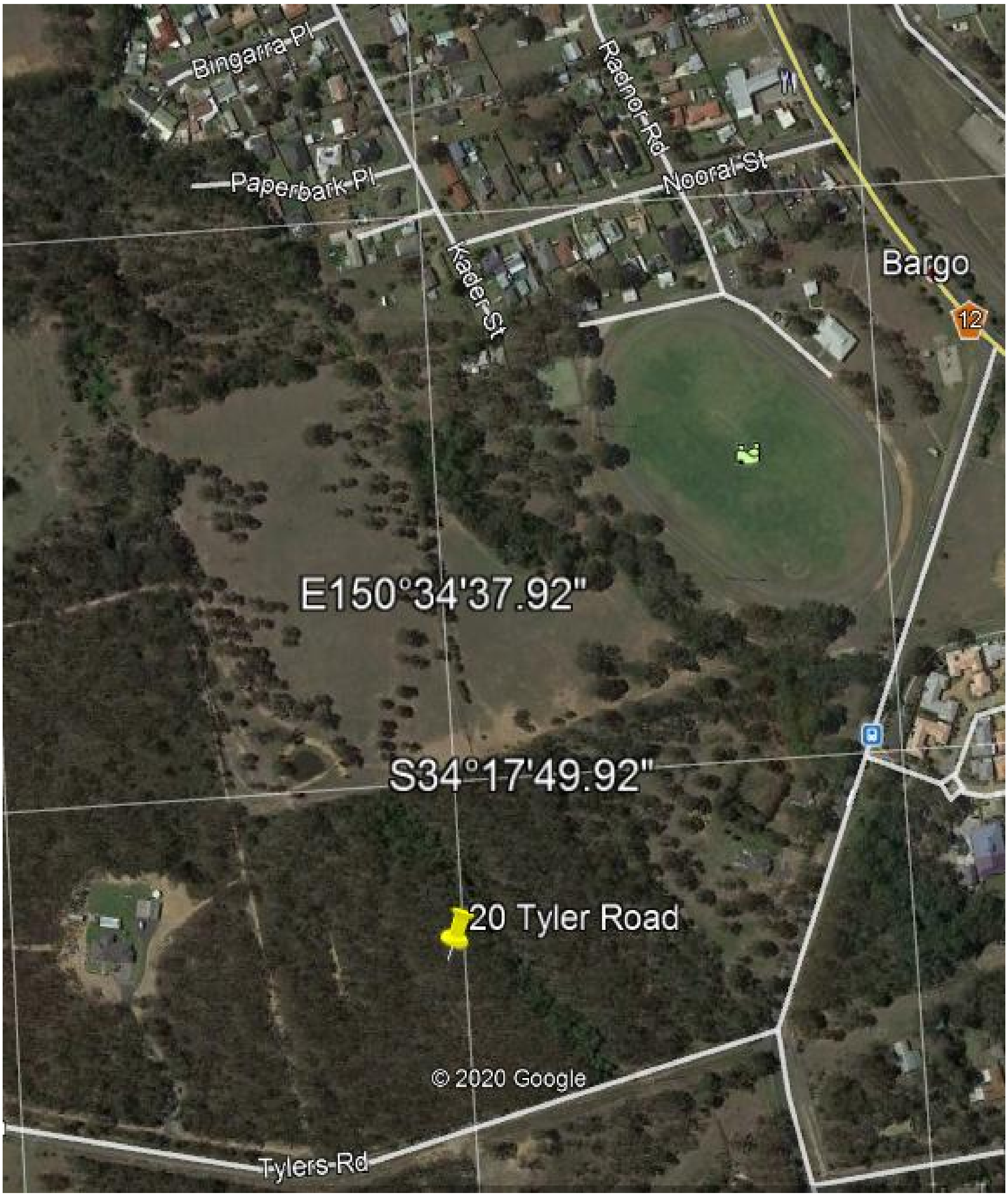
20 TYLERS ROAD, BARGO NSW

FLOOD STUDY



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1. INTRODUCTION

The subject site described as 20 Tylers Road is titled as Lot2 DP 270325 and is proposed to be subdivided into 2 allotments. The area of the allotment is approximately 9.41 hectares.

The western portion is zoned ‘E2’ (Environmental Conservation) and the eastern triangular section is zoned ‘SP2’ (Infrastructure) and is currently subject to a rezoning application.

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Council has requested additional information with respect to the extent affected by flooding;

“***Two watercourses traverse through the site and there is likely to be an issue with flooding due to the land being relatively flat and the amount of water generated by these water courses. Therefore a Flood Study for the proposed residential land is required.***

The flood study will need to map the 1% AEP event and define the flood planning area (area below the flood planning level). Also due to the location of the site between the two watercourses and the risk of the roads being flooded either side, the flood study should also show the extent of the PMF and access to land above the PMF.”

2. CATCHMENT DESCRIPTION

Two watercourses traversing the site and henceforth nominated as the eastern and western catchments. These flow paths combine at a confluence point immediate to the Cul-de-sac of Bingara Close and represent a catchment area of approximately 355 hectares (3.55 square kilometres).

The catchment area to the site for the Western Catchment is 91.5 hectares and the area of the Eastern Catchment to the site is 213.7 hectares.

Catchment areas have been determined from the NSW Governments Spatial Services, Elevation and Depth – Foundatation Spatial Data site (ELVIS) by the downloading of 1 metre grid.

Interrogation of catchment topography has been undertaken using QGIS Geographic Information System.

Initial catchment extractions included areas immediate to the railway corridor and Remembrance Driveway towards the south eastern region. Field reconnaissance revealed that only a small portion of the area was flowing towards the subject site and flows were redirected via conduits under the railway.

Within the site there are two minor flow paths immediately north of the existing dwelling and represent a total catchment area of 3.1 hectares and divided into 1.65 and 1.45 hectares sub-catchments.

3. LAND USEAGE/ZONINGS

Land zoning adopted have been extracted from GIS data from the Department of Environment and Planning's portal.

Council's Engineering Design Specification 2016 guide line has nominated impervious fractions for specified land use in Table D5.1

Land Use	% Impervious
Residential (450 to 699m²)	60%
Residential (700 to 1499m²)	50%
Residential (1500 to 4000m²)	40%
Rural Residential	30%
Industrial/Commercial	90%
Road Reserve	70%
Public Recreation Area	10%

Table D5.1

Zonings extracted from the Department of Planning shows the catchment contains land use categories;

SP2 – Infrastructure
RU1 – Primary Production
RU2 – Rural Landscape
R2 – Low Density Residential
R5 – Large Lot Residential
RE1 – Public recreation
RE2 – Private Recreation
E2 – Environmental Conservation

The majority of the catchment is mainly 'RU1 - Primary production' zoning with some 'R2 - Low Density Residential' and 'R5'- Large Lot residential immediately upstream of the eastern flow path to the site.

Allotment sizes vary significantly from 0.8 and 3 hectare immediately adjacent to Remembrance Driveway and larger 20 hectare properties surrounding Carlise Street. The smaller 0.8 ha site have average roof areas of 800 square metres (10% impervious), and similar roof areas in the 3 ha sites (3%).

The larger 10 ha plus sites vary from having nominal 1,000 square metre to 2.5 ha sheds. A nominal 2% has been added for 'RU1 – Primary Production'.

A sensitivity assessment will be undertaken for a 2% and 5% impervious fraction for the main RU1 zonings.

4. HYDROLOGY

Wollondilly Shire Council's Design Specification 2016 provides tabulated Intensity-Frequency-Duration Data (IFD) for various locations in tabulated form and draws attention to the availability of data being extracted from the Bureau of meteorology site.

The longitude and latitude for the centroid of the catchment area contributing to the confluence point adjacent to Bingara Close has been used to extract IFD data from the Bureau of meteorology in accordance with ARR 2016.

Downloaded data is included in Appendix B

4.1 RAFTS Model

The catchment has been assessed using the RAFTS Storage Routing Model attached to the Drains Software package.

The drains package produces Hydrographs, calculated from rainfall temporal patterns or ensembles using a hydrograph-producing program such as Horton (ILSAX), ERM, the ARR 2019 IL-CL model, storage routing models (RORB, RAFTS and WBNM) and other rainfall-runoff models.

Intensity-Frequency-Duration (IFD) was obtained from the Bureau of Meteorology and used for the estimation of design rainfall intensities.

Council's Design Specification nominated in Section D5.07 clause 4 lists Initial and Continuing Losses (I.L. & C.L.) as tabulated below.

Initial Loss		**Continuing Loss**	
Impervious	1 mm	Impervious	0 mm/hr
Pervious	10 mm	Pervious	2.5 mm/hr

Bureau of Meteorology Hub nominates I.L. as 33 mm and a C.L. of 4.5 mm/hr.

Catchment delineation has been extracted using QGIS spatial tools and the configuration is shown in Figure 1 (Appendix A).

The tabular data required for RAFTS in shown below in Table 4.1.

Sub catchment links have been ass as lag times based on assessed average velocities.

Table 4.1 – RAFTS Catchment Data

Catchment link No.	**Area (ha)**	**Average catchment Slope (%)**	**Roughness**	Link/Lag Length (m)	**Average Slope (%)**	**Lag Time (minutes)**
1.00	38.648	2.11	0.05	1,400	1.0%	15
2.00	69.983	2.15	0.05	366	1.26%	4.1
1.01	52.888	2.48	0.05	300	0.91%	3.6
Western Site Sub-Total	**91.536**					
1.02	4.955	3.5	0.05	785	0.87%	8.7
1.03	16.283	1.0	0.05	10	1%	1
3.00	69.258	1.7	0.05	500	0.96%	5.5
4.00	14.464	1.54	0.05	800	1.54%	8.9
Dummy	0.01			500	0.96%	5.5
3.01	59.977	1.0	0.05	91	1.00%	1
Eastern Site	**213.68**					
3.02	0.776	1.0	0.05	900	1%	10
3.03	27.804	1.0	0.05	10	1%	1
Outlet	**355.035**			0.01	1%	1

The impervious percentages have been determined using Land zoning extracted from GIS data from the Department of Environment and Planning's portal as described in section.

Sub-catchment percentage imperviousness has been determined via spread sheet and is presented in Tables 4.2 and 4.3 for the primary Land Zoning 'RU1' having an impervious percentage of 2% and 5% respectively.

Table 4.2 – Catchment Percentage Impervious with RU1 – 2%

Catchment link No.	Area (ha)	Land Zonings (ha)								
			SP2	RU1	RU2	R2	R5	RE1	RE2	E2
		Uiz	50%	2%	0%	60%	40%	0%	0%	0%
1.00	38.648	6.24%	3.397	35.251						
1.01	52.888	2%		52.888						
Western - Site Sub-Total	**91.536**									
1.02	4.955	0.1%		0.256	0.298					4.401
1.03	16.283	0%			14.014					2.269
2.00	69.983	2%		69.983						
3.00	69.258	4.9%	4.253	65.005						
4.00	14.464	2%		14.464						
3.01	59.977	31.5%	4.804	16.80		14.526	18.578		3.793	1.476
Eastern – Site Sub Total	**213.68**									
3.02	0.776	0%	0.77							
3.03	27.804	20%		4.637		9.105		12.357		1.706
Outlet Total	**355.035**									

SP2 – Infrastructure
RU1 – Primary Production
RU2 – Rural Landscape
R2 – Low Density Residential
R5 – Large Lot Residential
RE1 – Public recreation
RE2 – Private Recreation
E2 – Environmental Conservation

Table 4.3 – Catchment Percentage Impervious with RU1 – 5%

Catchment link No.	Area (ha)	Uiz	Land Zonings (ha)							
			SP2	RU1	RU2	R2	R5	RE1	RE2	E2
			0% & 50%	5%	0%	60%	40%	0%	0%	0%
1.00	38.648	9.0%	3.397	35.251						
1.01	52.888	5%		52.888						
Western - Site Sub-Total	**91.536**									
1.02	4.955	0.3%		0.256	0.298					4.401
1.03	16.283	0%			14.014					2.269
2.00	69.983	5%		69.983						
3.00	69.258	7.8%	4.253	65.005						
4.00	14.464	5%		14.464						
3.01	59.977	32.3%	4.804	16.80		14.526	18.578		3.793	1.476
Eastern – Site Sub Total	**213.68**									
3.02	0.776	0%	0.776							
3.03	27.804	20.5%		4.637		9.105		12.357		1.706
Outlet Total	**355.035**		**13.232**	**259.284**	**14.312**	**23.631**	**18.578**	**12.357**	**3.793**	**9.852**

4.2 REGIONAL FREQUENCY ESTIMATION MODEL

Calculation of flood flows by the Regional Frequency Estimation Model is presented in Appendix 'B' and has produced estimated flows for the 1% AEP event of 47 cubic metre per second with 5% and 95% confidence limits of 17.2 and 130 cubic metres per second respectively.

4.3 RAFTS CALIBRATION TO RFEM

With the absence of stream gauging stations for small catchments, the calibration of the model is to produces flows predicted by the rural flows predicted by the Regional Frequency Estimation model.

The Bureau of meteorology provides recommended initial and continuing loss rates of 33mm and 4.5mm/hour respectively however these loss rates are only recommended for the rural catchment.

A rural roughness coefficient of 0.025 has been adopted for the rural catchment.

Bx values of 2.0, 1.0, 0.8, 0.7 and 0.65 with BOM I.L. and C.L. have been used to produce rural catchment flows of 18.6, 26.5, 43.3, 45.6 and 47.5 cubic metres per second respectively.

A value of 0.65 produces good correlation to Regional Frequency Estimation model predicted values for the 1% and 5% AEP events.

Council's Design Specification nominates the use of Initial and Continuing Loss rates that are significantly less than those recommended by the Bureau of Meteorology. Table 4.4 collates the resulting catchment flows for the existing catchment conditions with the additional impervious areas introduced into the rural catchment.

Table 4.5 collates the generated catchment flows using the BOM Initial and Continuing loss rates.

Table 4.4 – Catchment Outflow Flow Summary at Bingara Close Calibrated model & Existing Catchment State With Council's Specification Loss Rates.

Flood Frequency (Recurrence Interval)	Regional Flood Frequency	RAFTS Flows (m^3/sec) Bingara Close Confluence		
		Rural Catchment State (33mm, 4.5mm/hr)	Existing Catchment State (Ru1 – 2% Uiz) (10mm, 2.5mm/hr)	Existing Catchment State (Ru1 – 5% Uiz) (10mm, 2.5mm/hr)
5% (1:20)	22.3	21.6	45.8	48.9
1% (1:100)	47.0	47.5	71.8	77.7
PMF (1:2000)		86.1	110.0	118.0

Table 4.5 – Catchment Outflow Flow Summary at Bingara Close Calibrated model & Existing Catchment State with BOM Loss Rates.

Flood Frequency (Recurrence Interval)	**Regional Flood Frequency**	**RAFTS Flows (m³/sec) Bingara Close Confluence**		
		Rural Catchment State (Losses – IL: 33mm, CL: 4.5mm/hr)	Existing Catchment State (Ru1 – 2% Uiz) (Losses – IL: 33mm, CL: 4.5mm/hr)	Existing Catchment State (Ru1 – 5% Uiz) (Losses – IL: 33mm, CL: 4.5mm/hr)
5% (1:20)	22.3	21.6	27.0	30.3
1% (1:100)	47.0	47.5	47.6	52.8
PMF (1:2000)		86.1	85.9	93.1

4.4 SITE AND CATCHMENT FLOWS

Noting that the catchment is primarily a rural catchment with the majority of the land being zoned 'RU1 – primary production', the use of the nominal loss rates of Council produces flows considered to be excessive and flows produced using the BOM loss rates have been adopted.

Flows from the site have been assessed using two levels of imperviousness within the major Lad Zoning 'RU1'.

Generated flows, immediately upstream of the site at the two flow paths have been generated for the 5%, 1% and PMF events have been collated in Table 4.6.

Generated flows through the catchment are collated in Table 4.7.

Table 4.6 – Upstream Site Flow Summary and comparison for BOM loss rates and varying RU1 imperviousness.

Flood Frequency (Recurrence Interval)	**RAFTS Flows (m^3/sec) Immediately Upstream of site**					
	Rural State		Existing State (RU1 – 2% Uiz)		Existing State (RU1 – 5% Uiz)	
	1.01	**3.01**	**1.01**	**3.01**	**1.01**	**3.01**
	(33mm, 4.5mm/hr)				**(Adopted)**	
5% (1:20)	13.8	11.6	12.4	12.8	14.3	13.6
(I.L.,C.L,)	(10mm, 2.5mm/hr)		21.0	21.6	23.5	22.6
	(33mm, 4.5mm/hr)				**(Adopted)**	
1% (1:100)	25.4	19.6	22.4	22.3	25.5	24.0
(I.L.,C.L,)	(10mm, 2.5mm/hr)		34.3	33.6	38.0	35.6
	(33mm, 4.5mm/hr)				**(Adopted)**	
PMF (1:2000)	45.9	36.7	40.0	39.5	45.2	43.3
(I.L.,C.L,)	(10mm, 2.5mm/hr)		52.8	51.6	58.4	53.1

1.01 - Link immediately upstream site, Western Flow Path
3.01 - Link immediately upstream site, Eastern Flow Path

Table 4.7 – Upstream Site, Flow Summary and comparison for loss rates at Site

Catchment Link No.	Median Peak Flows (m^3/sec)								
	Rural			(Ru1 – 2% Uiz)			(Ru1 – 5% Uiz)		
	5% AEP	1% AEP	PMF	5% AEP	1% AEP	PMF	5% AEP	1% AEP	PMF
1.00	3.7	7.12	13.1	4.46	8.64	15.4	4.74	9.24	16.1
1.01	6.23	9.81	18.0	4.53	8.48	15	5.57	9.72	17.8
2.00	5.08	11.5	21.6	5.55	10.7	18.9	5.96	11.5	20.3
U/S Site	13.5	25	45.2	12.2	21.9	41.4	14	25	44.4
1.02	0.66	1.33	2.15	0.66	1.33	2.2	0.66	1.34	2.16
D/S Site	13.8	25.4	45.9	12.4	22.4	41.7	14.3	25.5	45.2
1.03	1.41	2.6	4.9	1.41	2.6	4.9	1.41	2.6	4.9
Western	14.7	26.9	48.2	13.4	24.1	43.7	15.4	27	48.1
Outlet									
3.00	5.72	10.5	20.1	6.83	13	23.6	7.41	14.4	24.5
4.00	1.46	2.83	5.08	1.56	3.04	5.36	1.69	3.26	5.74
	3.96	13.1	25.0	8.37	15.7	29	9.09	17.4	29.7
3.01	4.43	8.04	14.3	9.6	17.4	26.7	9.7	17.5	26.7
U/S Site	11.6	19.6	36.7	12.8	22.3	40.5	13.6	24	43.3
3.02	0.1	0.19	0.33	0.1	.15	0.27	0.01	0.15	0.27
D/S Site	11.7	19.7	36.8	12.9	22.4	40.7	13.6	24.2	43.5
3.03	2.18	4.02	7.69	3.66	7.13	11.8	3.87	7.24	11.8
Eastern	13.2	23.3	43.1	14.3	25.3	45.1	15.3	26.5	47.7
Outlet									
Bingara Close	28.9	47.5	86.1	27	47.6	86	30.3	52.8	93.1
Confluence									

5. HYDRAULICS

The determination of water surface elevations has been undertaken using the U.S. Army Corps of Engineers' River Analysis (HEC-RAS). It is software that allows the water surface assessments for;

- One dimensional steady river flow hydraulics.
- One and Two dimensional unsteady flow river flow hydraulics.
- Quasi Unsteady and full unsteady flow sediment transport-mobile bed modelling.
- Water temperature analysis.
- Generalised water quality modelling.

HEC-RAS 5.0 (2015) has been issued incorporating 'RAS Mapper' which permits spatial data and mapping tools.

The first version of HEC-RAS version 1.0 was issued in 1995 and has been developed through to version 4.1.

Spatial data has been downloaded from ICSM's (Intergovernmental Committee on Surveying and mapping) ELVIS - (Elevation and Depth – Foundation Spatial Data).

1 metre tiles over the site are available for the periods of May 2014, July 2016 and June 2019. The most recent series cover the site but does not cover the total catchment. Tiles for the 2019 period have been adopted.

Immediate survey of the site describing Tylers Road crown centre line and culver features has been provided by Rein Warry and Co.'s Plan Series 7211 dated 14/7/2020.

The general topography and elevation of the area would allude to the streams being independent with no flow transmittal between the flow paths except towards the immediate confluence junction. A 1-D model is considered appropriate.

Profiles have been determined for the 5%, 1% AEP and PMF events for the nominated Western and Eastern Flow paths. The tabulated profiles are collated in Appendix A. The extent of coverage is provided in Appendix A.
The flow paths general contain the flows generated by each of their catchment.

With respect to the Western Flow path, flows in in the order of the 1% AEP and greater overtop the watershed confines in the vicinity of Cross Sections 528-439 and flow into the Eastern Flow path.
Silica Road intersection with Tylers Road acts as a watershed/catchment boundary. Flows in the order of the PMF, immediately downstream of the watershed boundary will flow eastward into Eastern Flow path through the nominated 'Site_minor_west' sub-catchment.

The quantification of flows and the extent of flooding in the Site's local catchments have not been assessed in this assessment as the catchment flows are considered minor (approximately 0.8 cubic metres per second for 3 hectares), the determination of not required as part of the brief and the assessment would require a detailed evaluation using the 2 Dimensional evaluation with point source rainfall evaluation.

Use of the tabulated water surface profile values downstream of the subject suite towards the confluence are only to be viewed as guides to providing a starting water level for the determination through the subject site. These levels are not to be used as definite advice to these land owners.

6. SUMMARY

RAFTS modelling has been undertaken to determine catchment flows for the two flow paths through the site as directed by Council, for the 1% and PMF events. Calibration of the RAFTS model for the Rural catchment state was to flow rates generated by Australian Rainfall & Runoff (4th edition) – Regional Flood Frequency Model.

The extent of increased impervious areas was determined from Land Use Zonings extracted from GIS data from the Department of Environment and Planning's portal and uiz. Required by Council in their Design Specification 2016.

HEC-RAS 5.0 has been used to determine 1 Dimensional water profile assessment for the two flow paths through the subject site and extended to the confluence of the two sub-catchments at the cul-de-sac head at Bingara Close. The extension was considered appropriate to provide a sufficiently confident assessment of a starting water surface level appropriate for the site.

Water surface profiles and the extent of inundation has been determined for the 5%, 1% and PMF events.

The site consists of the two nominated flow paths with their associated local watershed areas to these flow paths. Additional to these flow paths is a local sub-catchment and associated flow path. It is located central to the site, being sourced at the southern end, immediate to Tylers Road reserve at the intersection with Silica Road and flows to the northern boundary of the site. The extent of inundation for this 3 hectare catchment has not been assess as flows are minor (approximately 0.8 cumecs) and was not discovered until this detailed evaluation was undertaken.

With respect to the western flow path, flows up to 1% event flows approaching the value of the PMF are generally confined to the immediate area to the flow stream. Flows at the value of the PMF breach the water shed at the southern end of the site adjacent to the intersection of Silica and Tylers Roads. Flows will breach and flow eastward into the central local sub-catchment.

Approximately 130 metres downstream of the site, flows in the order of the 1% event and greater will flow eastward and join with the eastern flow path, essentially covering all lands between the two flow paths.

With respect to the eastern flow path through the site, the e5% AEP flows are confined to the immediate area of the stream however flows from the flows less frequent 1% AEP and rarer PMF events inundate a significant proportion of the proposed area to be subdivided.

I trust this information is satisfactory. Should you require any further information please contact office.

Sincerely

Gary Murphy B.E.

RPEQ 7141

(Director)

Appendix 'A'

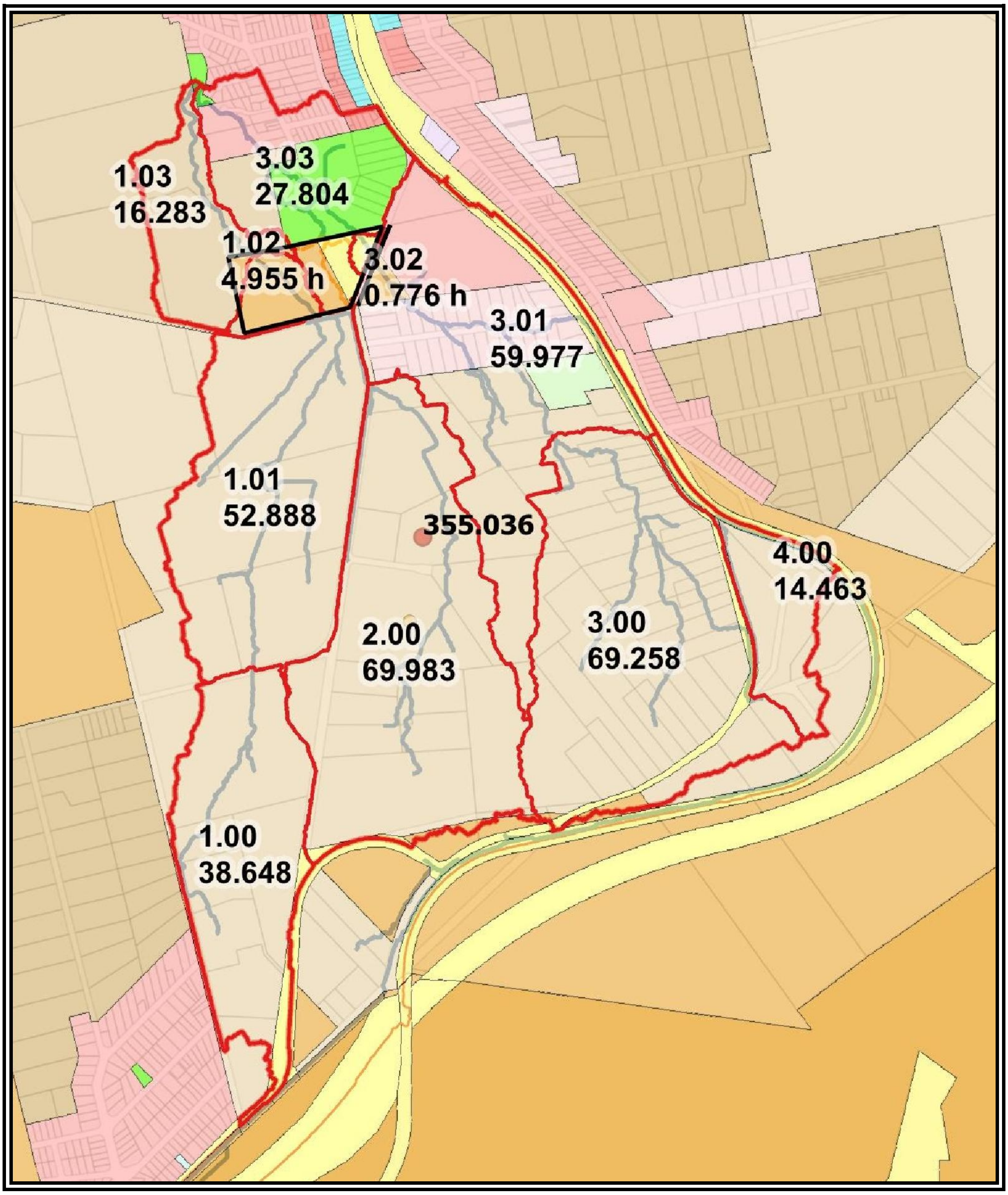


Figure 1 – RAFTS Catchment layout, Catchment Areas and Land Zoning. Scale 1:20,000

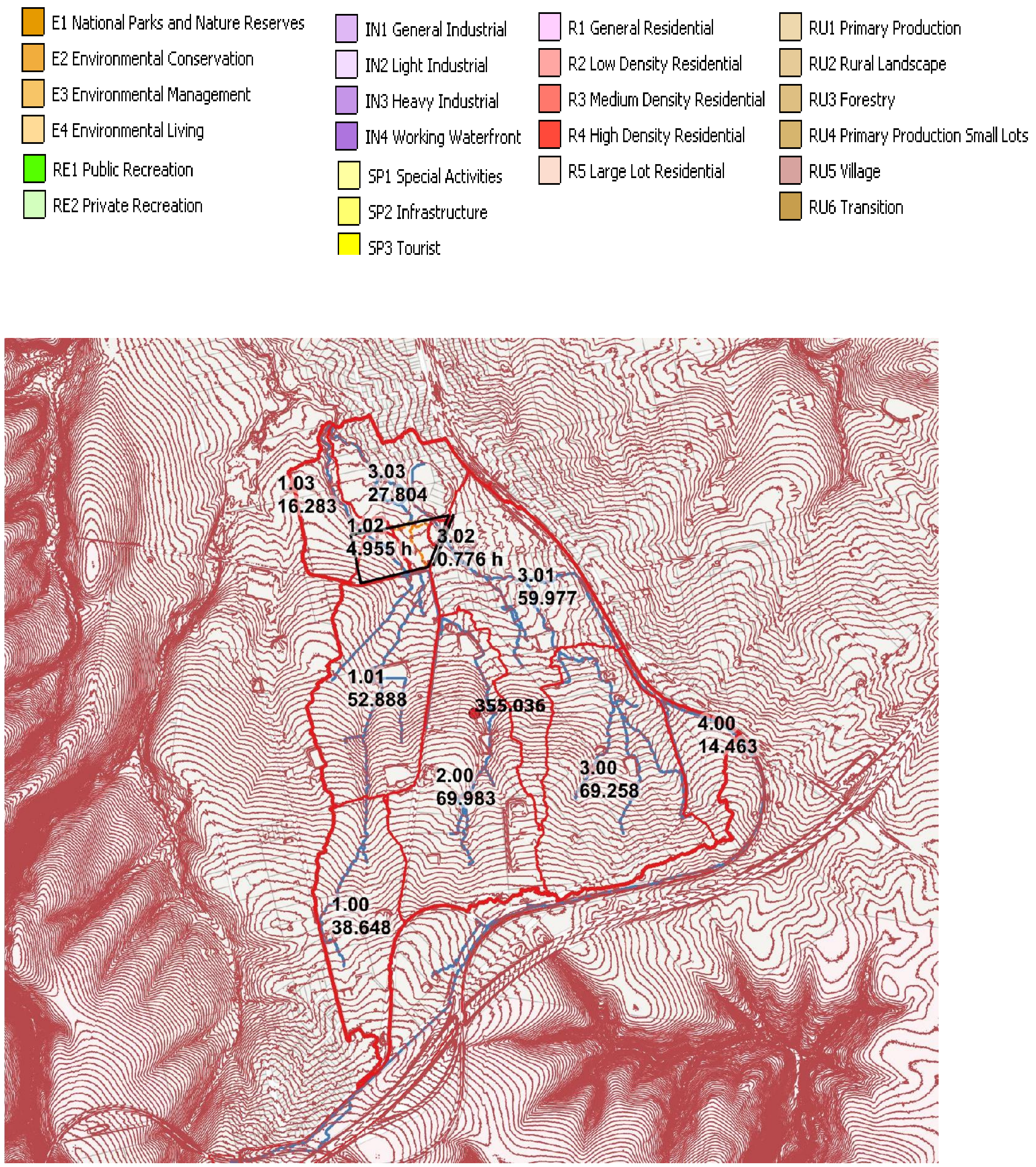


Figure 2 – RAFTS Catchment layout, Catchment Areas and 1m Contours.

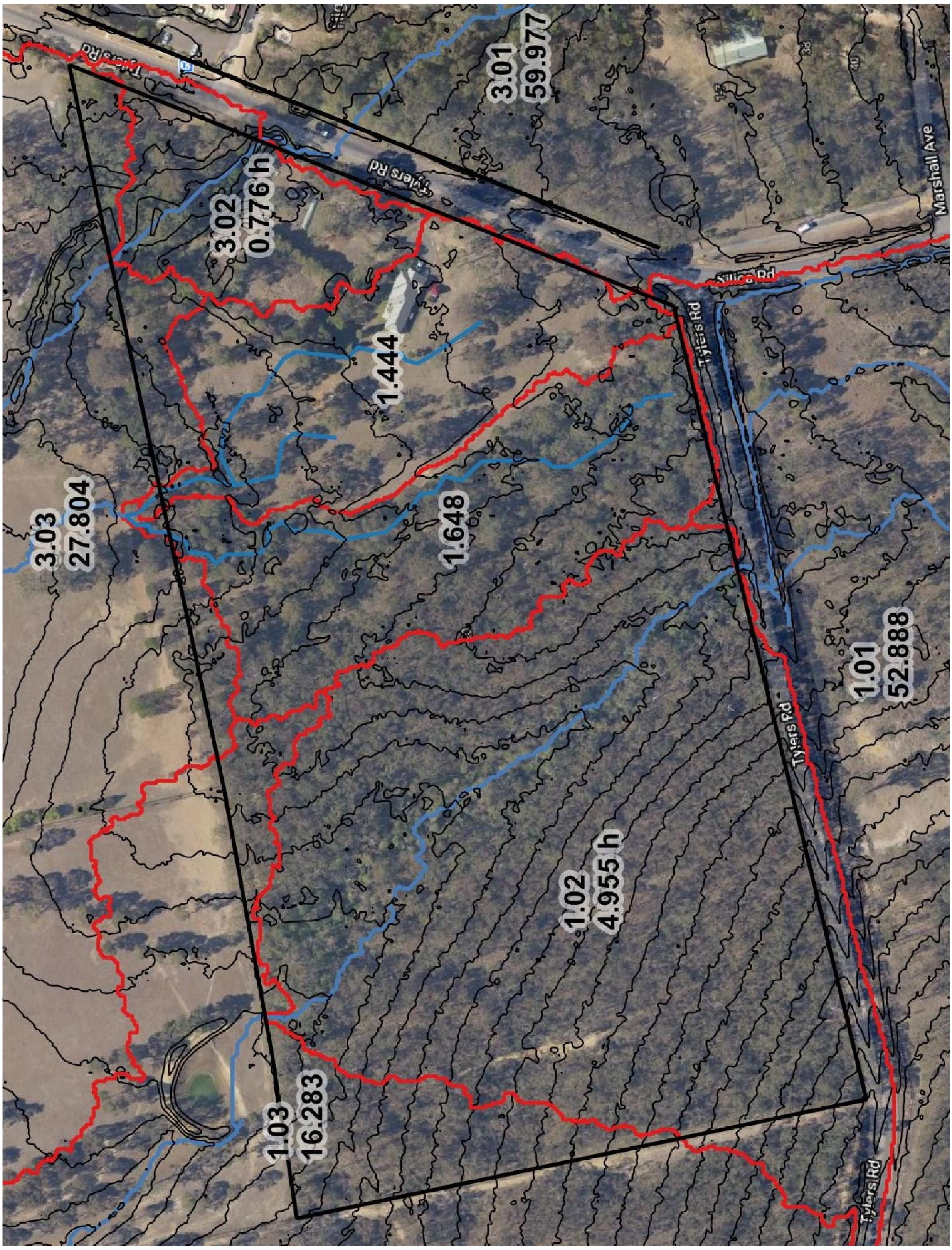


Figure 3 – Local Catchment layout, Catchment Areas and 1m Contours. Scale 1:2,500

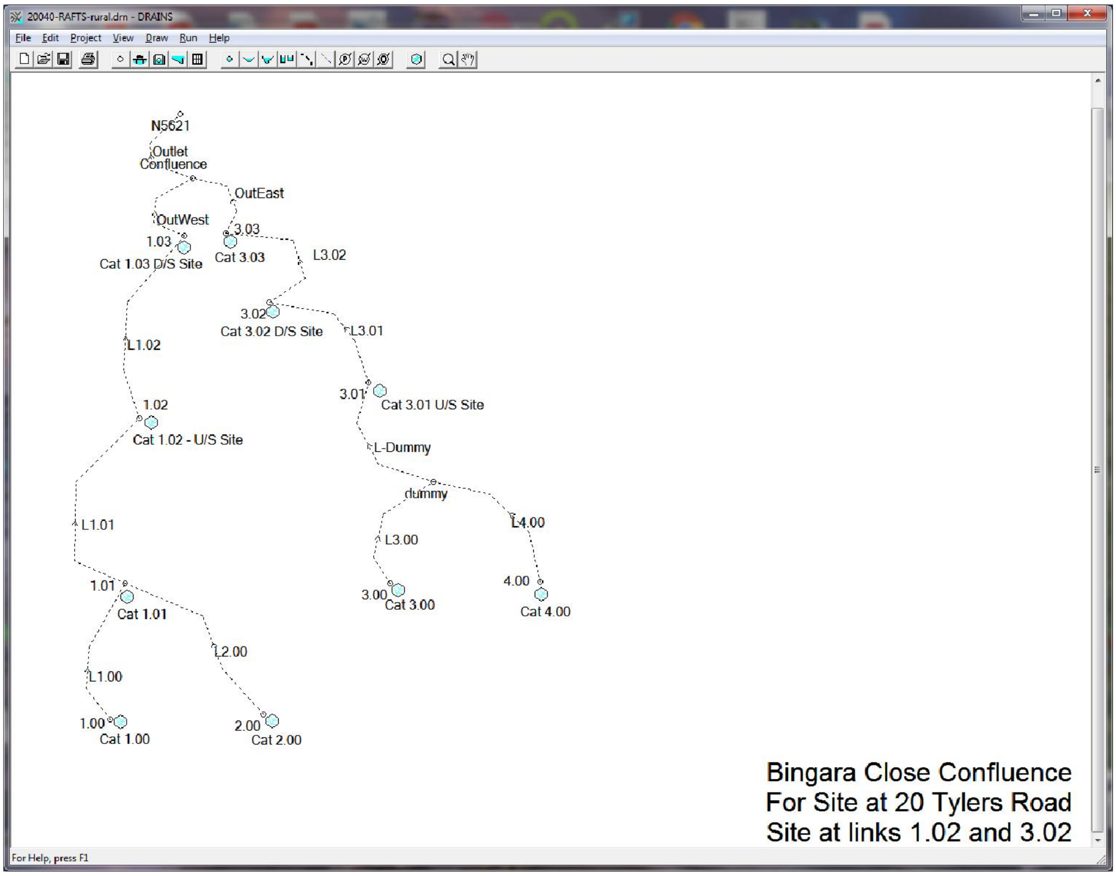


Plate – C1 – Catchment Layout

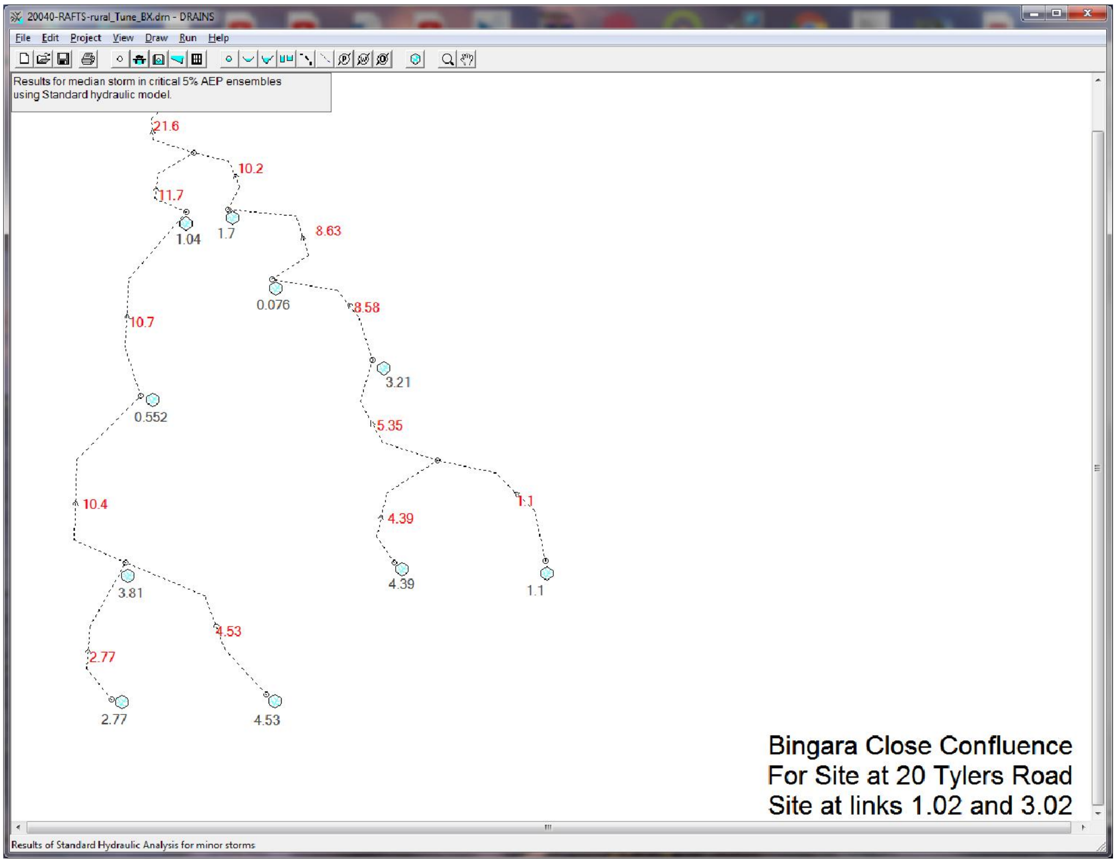


Plate R1-A: Rural Catchmnet Condition - 5% AEP Catchment & Sub-catchment Flows.

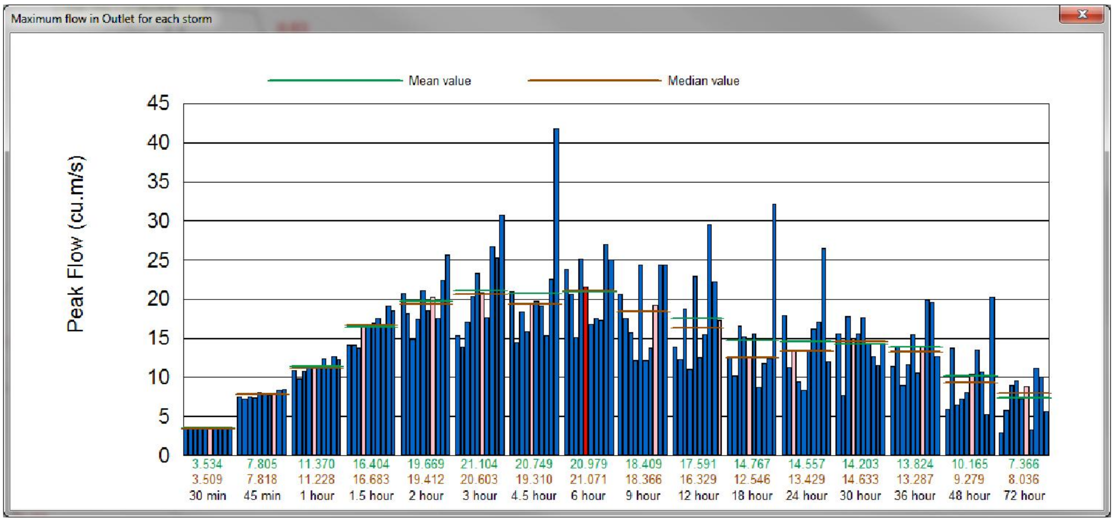


Plate R1-B: Rural Catchmnet Condition - 5% AEP Catchment Outlet Envelope Flows

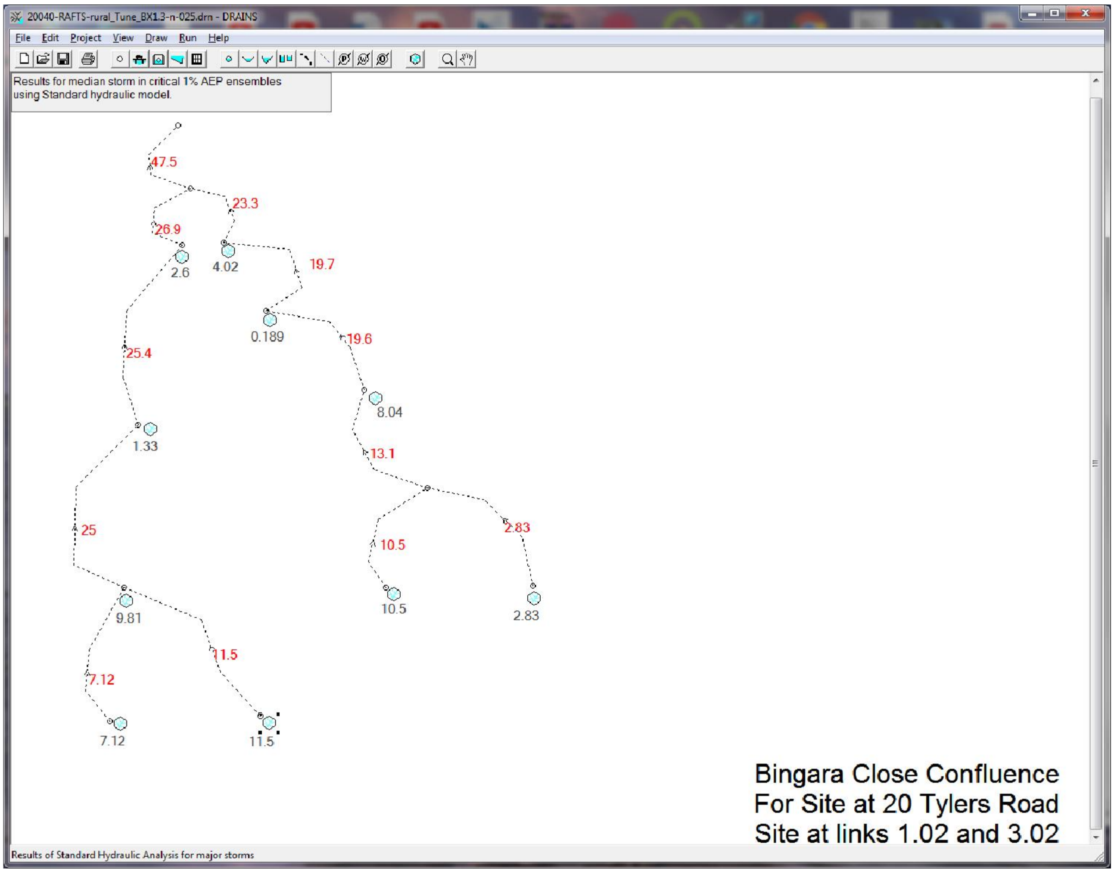


Plate R2-A: Rural Catchmnet Condition - 1% AEP Catchment & Sub-catchment Flows.

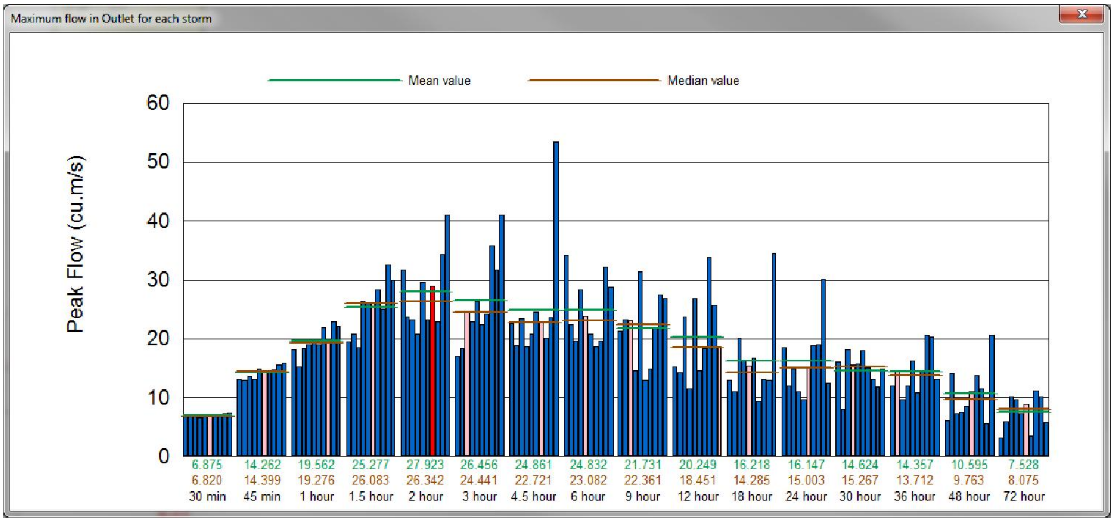


Plate R2-B: Rural Catchmnet Condition - 1% AEP Catchment Outlet Envelope Flows.

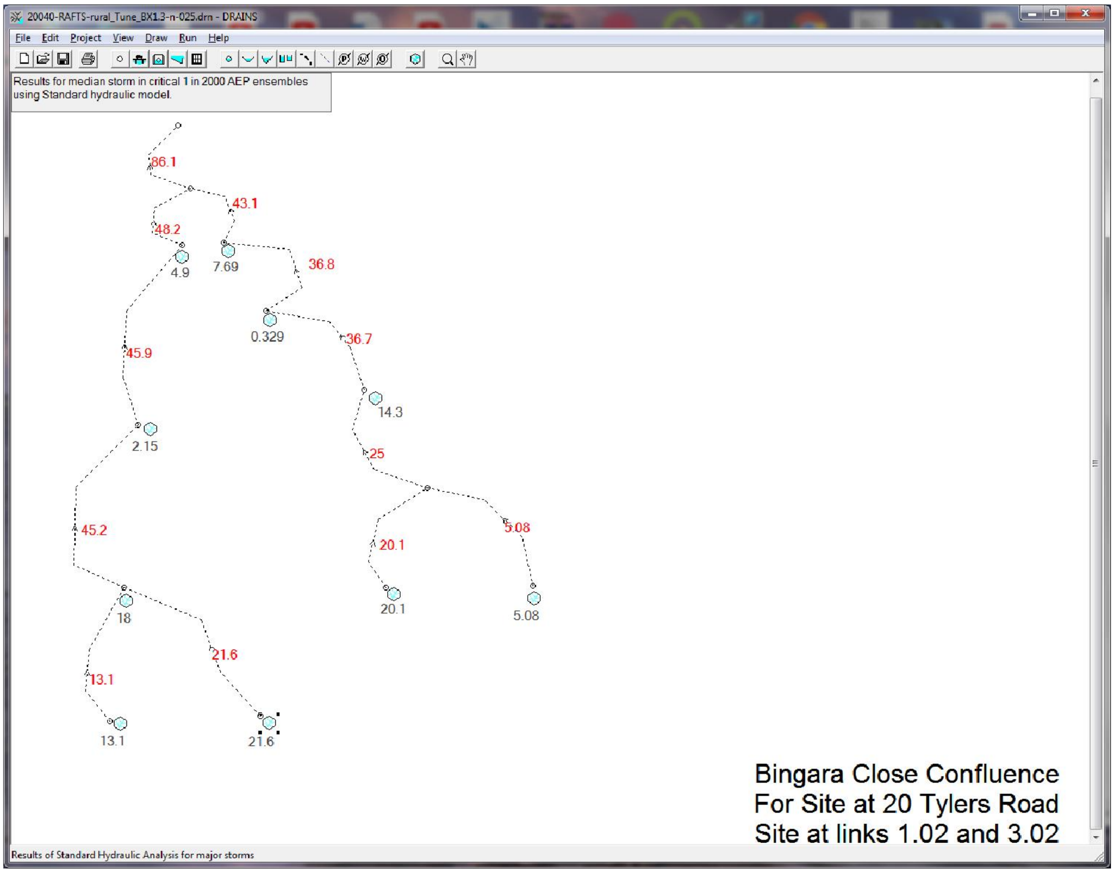


Plate R3-A: Rural Catchmnet Condition – PMF (1:2,000) Catchment & Sub-catchment Flows.

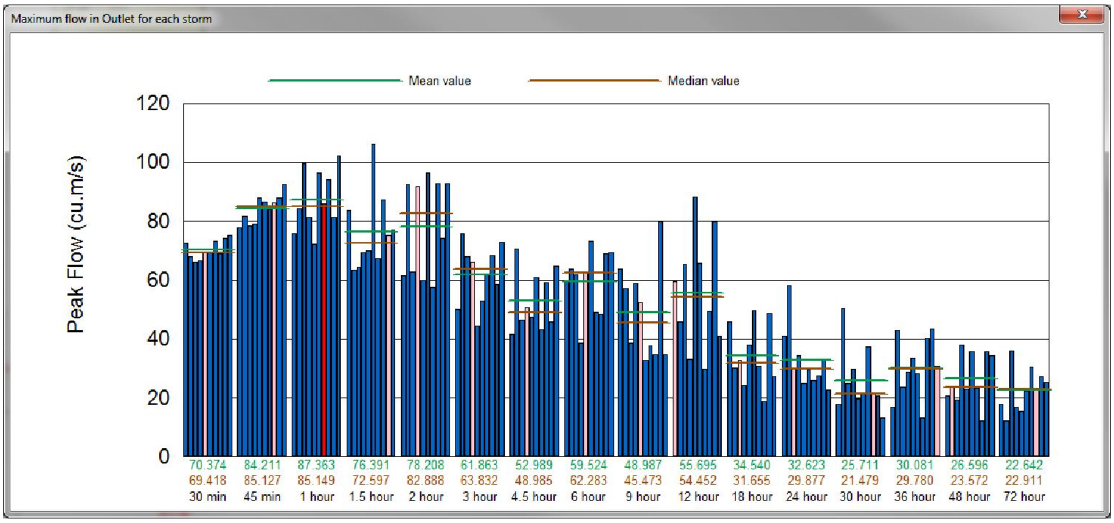


Plate R3-B: Rural Catchmnet Condition - PMF (1:2,000) Catchment Outlet Envelope Flows

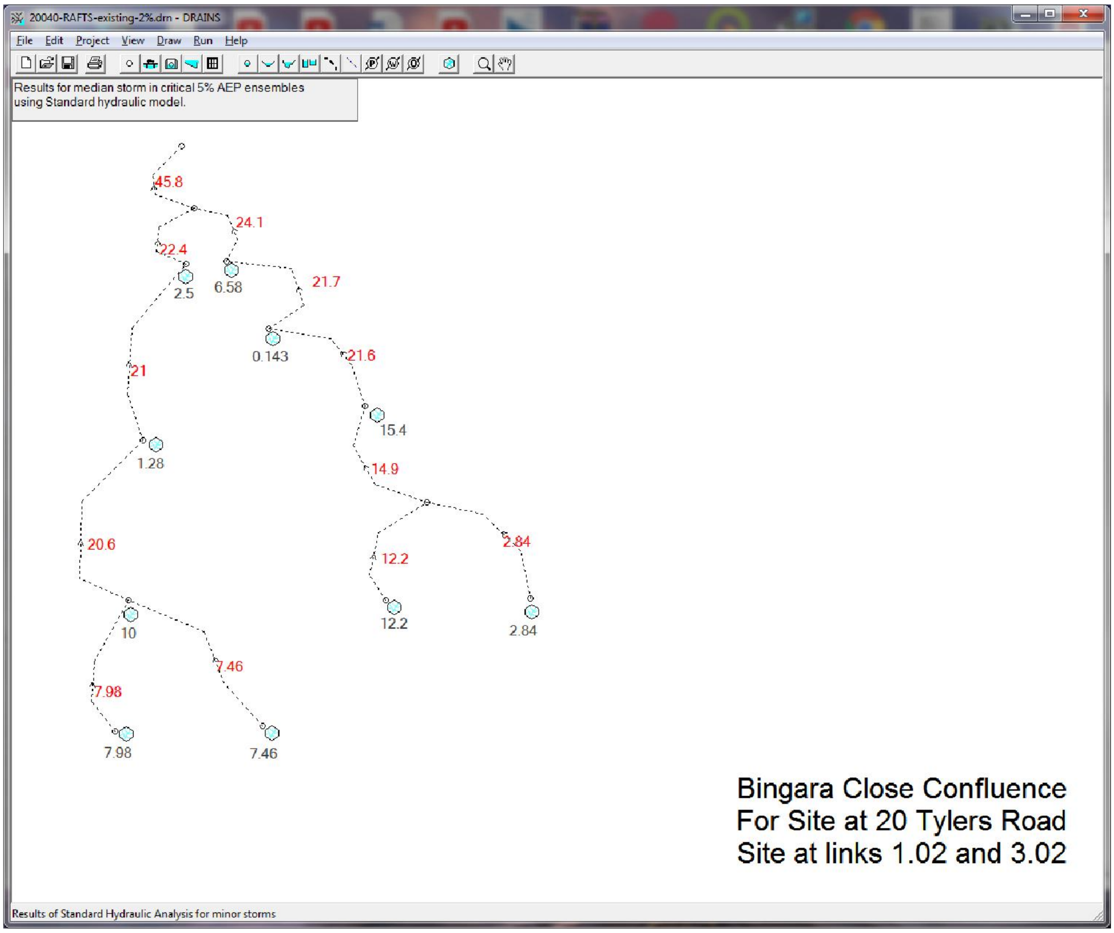


Plate E1-A: Existing Catchmnet Conditions (RU - 2%) - 5% AEP Catchment & Sub-catchment Flows

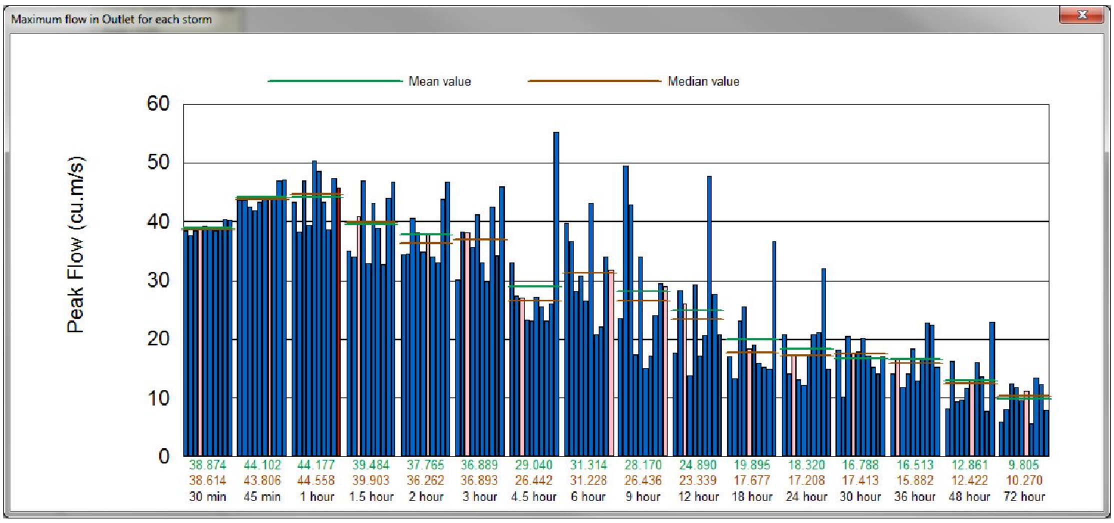


Plate E1-B: Existing Catchmnet Conditions (RU - 2%) - 5% AEP Catchment Outlet Envelope Flows

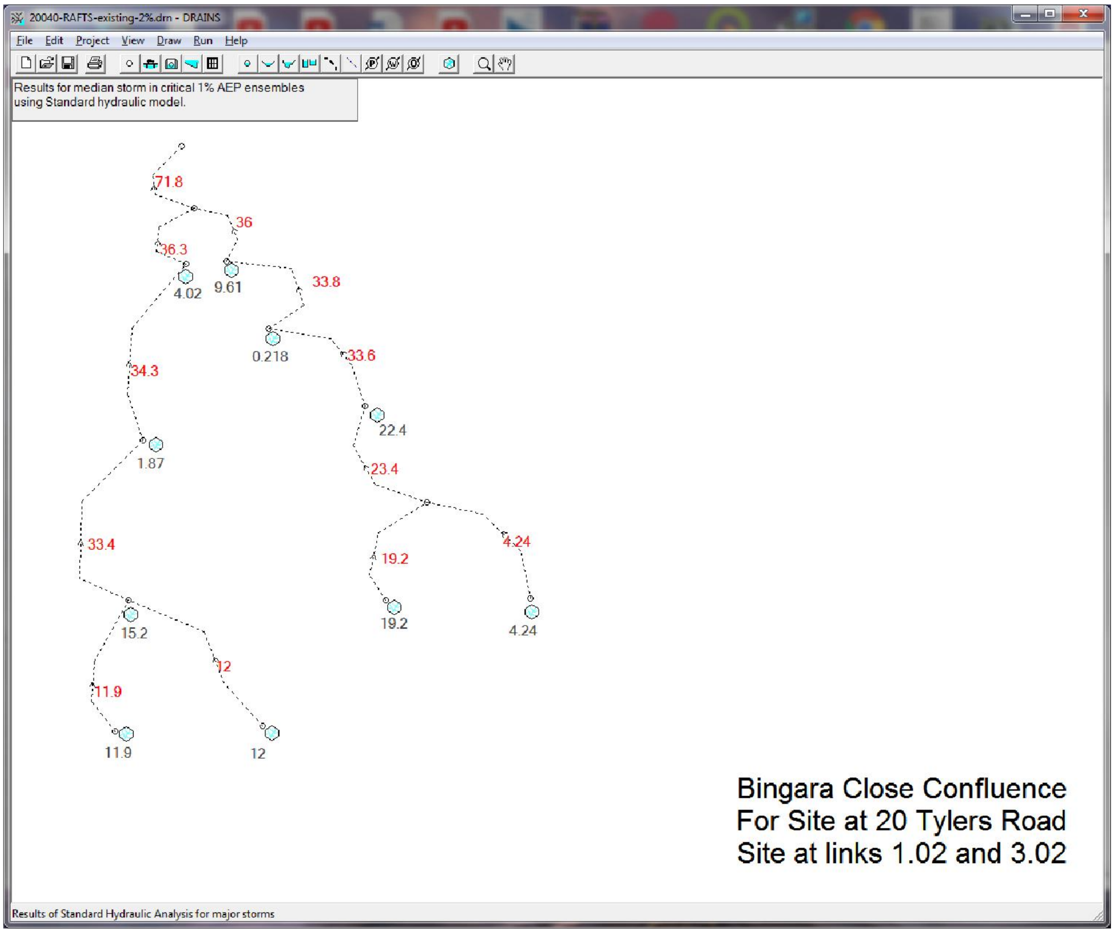


Plate E2-A: Existing Catchmnet Conditions (RU - 2%) - 1% AEP Catchment & Sub-catchment Flows.

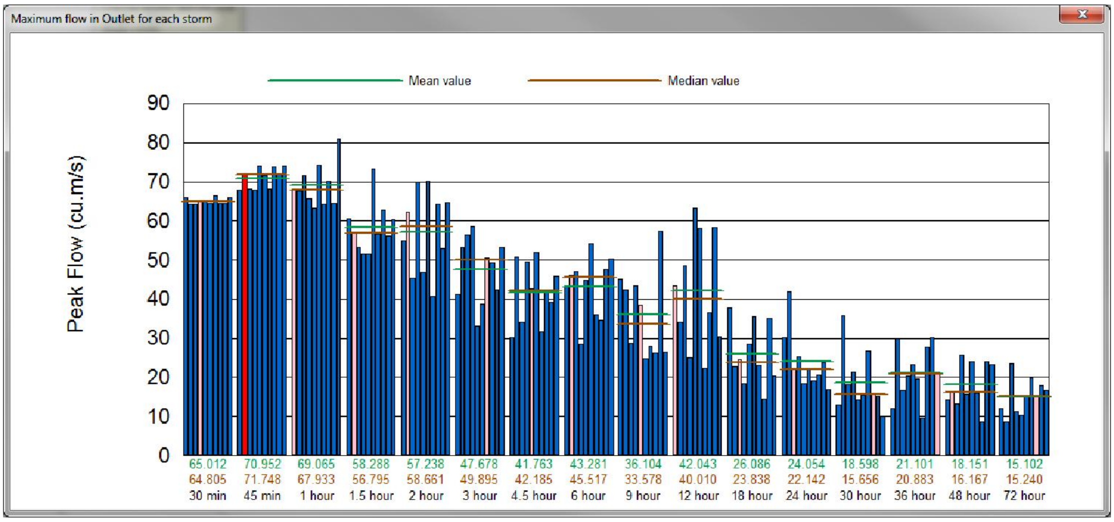


Plate E2-B: Existing Catchmnet Conditions (RU - 2%) 1% AEP Catchment Outlet Envelope Flows.

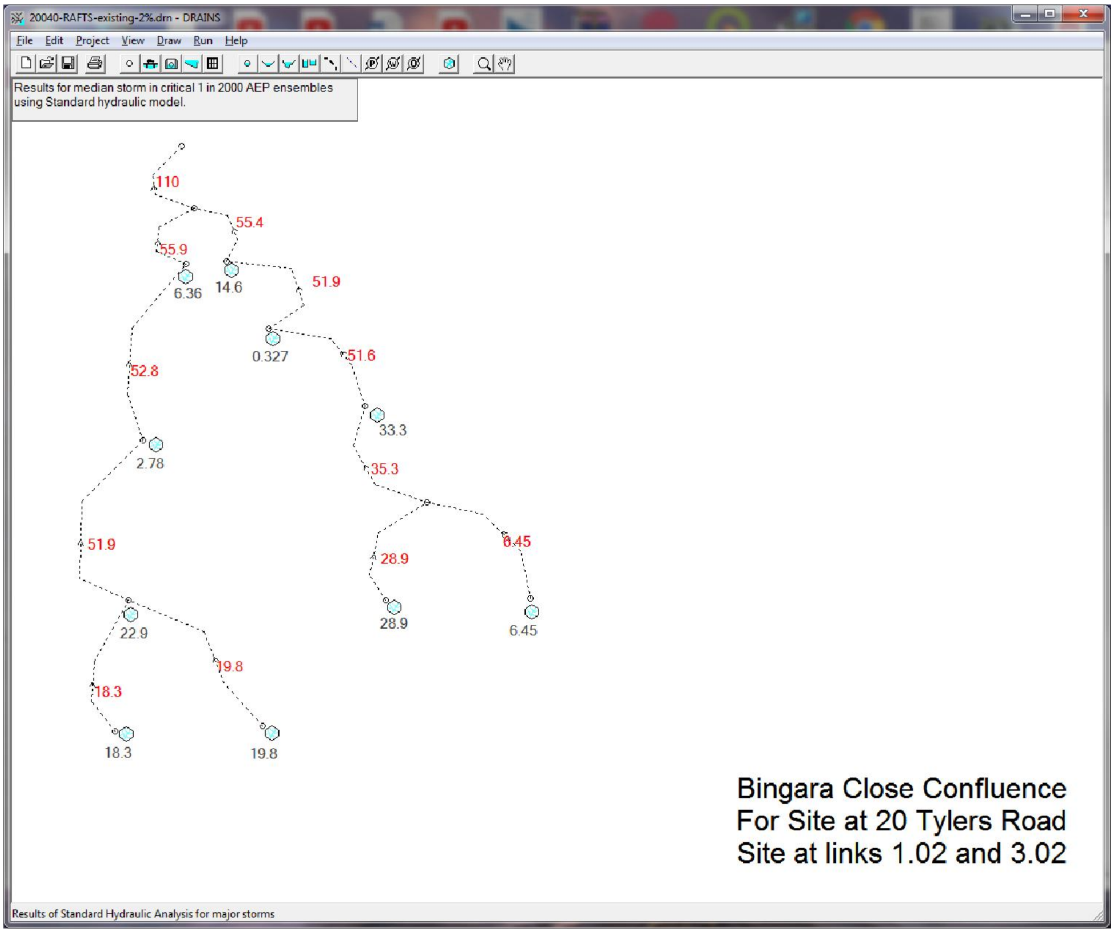


Plate E3-A: Existing Catchmnet Conditions (RU - 2%) - 1:2,000 (PMF) Catchment & Sub-catchment Flows.

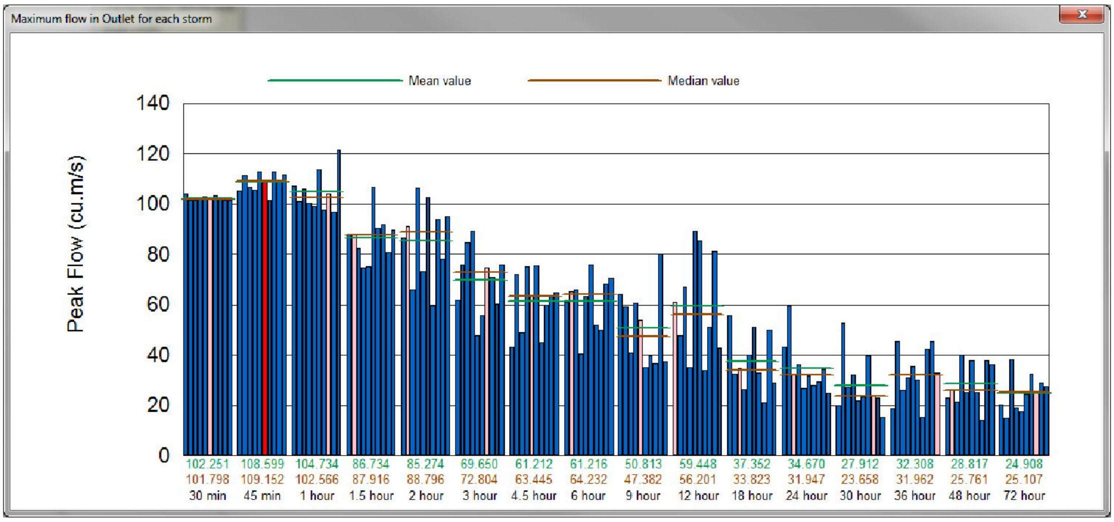


Plate E3-B: Existing Catchmnet Conditions (RU - 2%) - 1:2,000 (PMF) Catchment Outlet Envelope Flows.

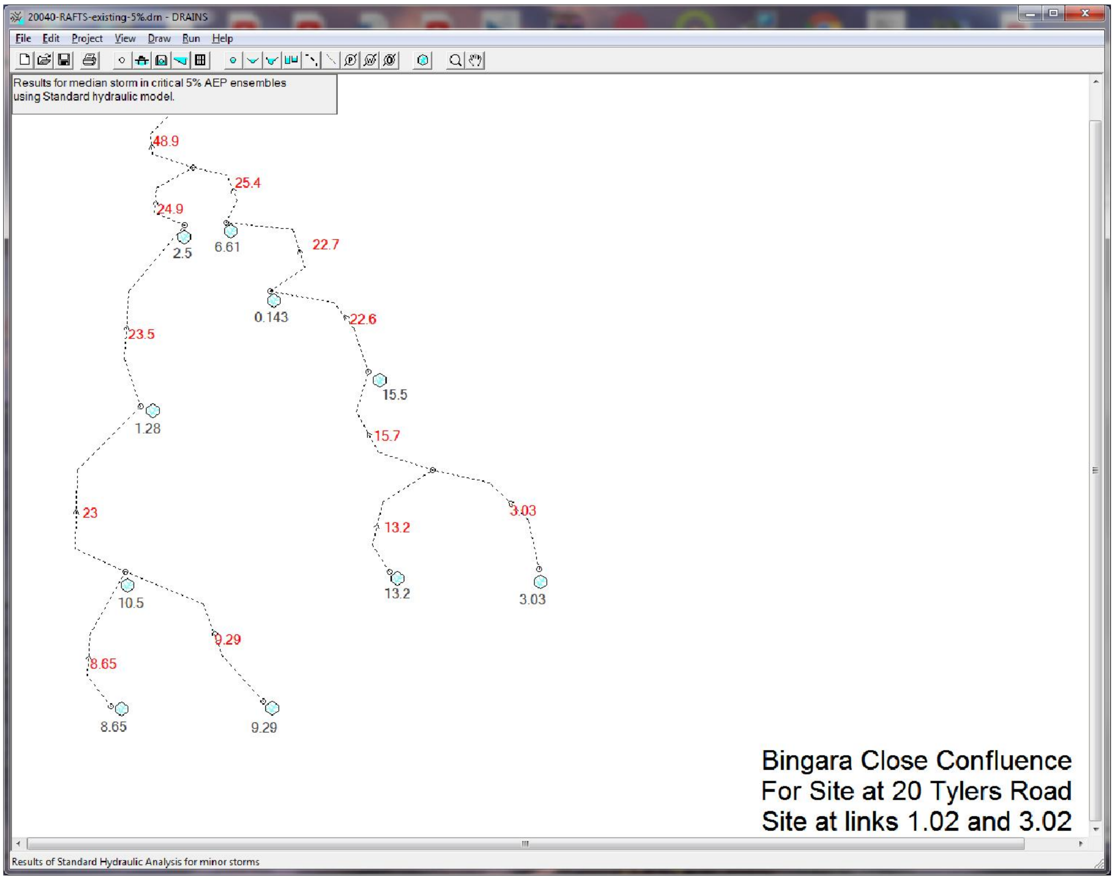


Plate E4-A: Existing Catchmnet Conditions (RU - 5%) - 5% AEP Catchment & Sub-catchment Flows.

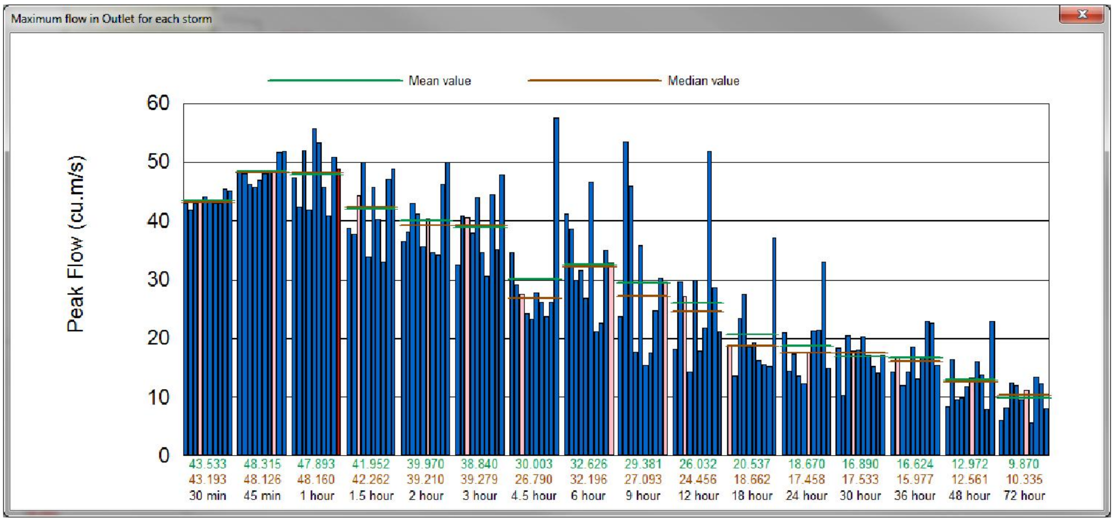


Plate E4-B: Existing Catchmnet Conditions (RU - 5%) - 5% AEP Catchment Outlet Envelope Flows.

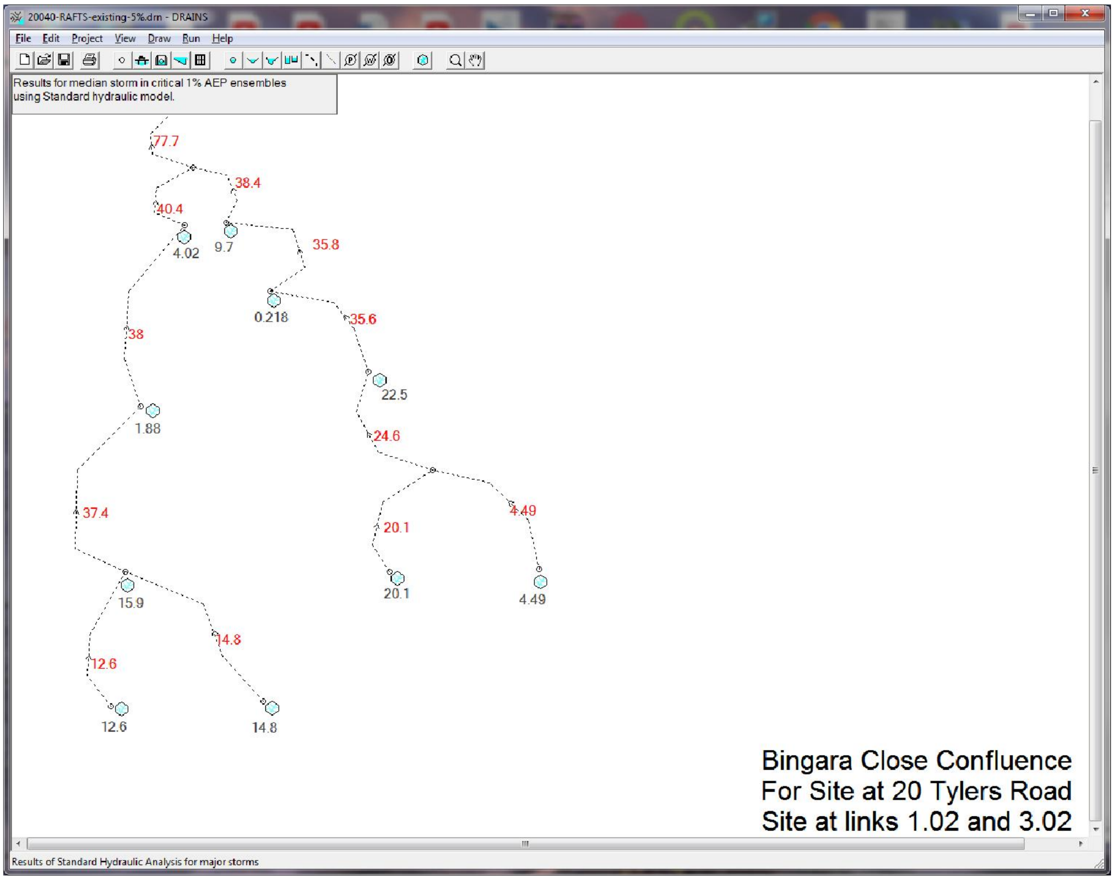


Plate E5-A: Existing Catchmnet Conditions (RU - 5%) - 1% AEP Catchment & Sub-catchment Flows.

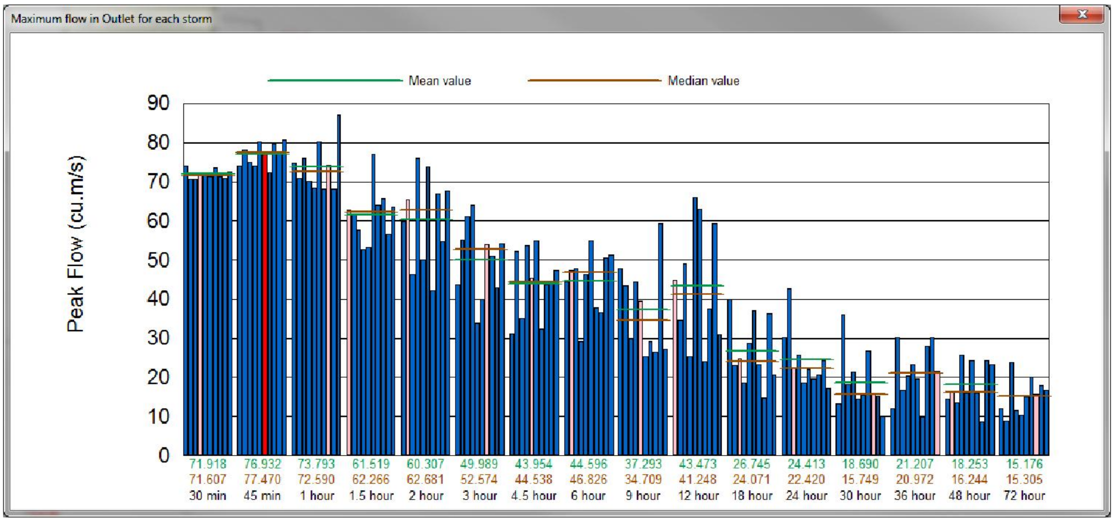


Plate E5-B: Existing Catchmnet Conditions (RU - 5%) - 1% AEP Catchment Outlet Envelope Flows.

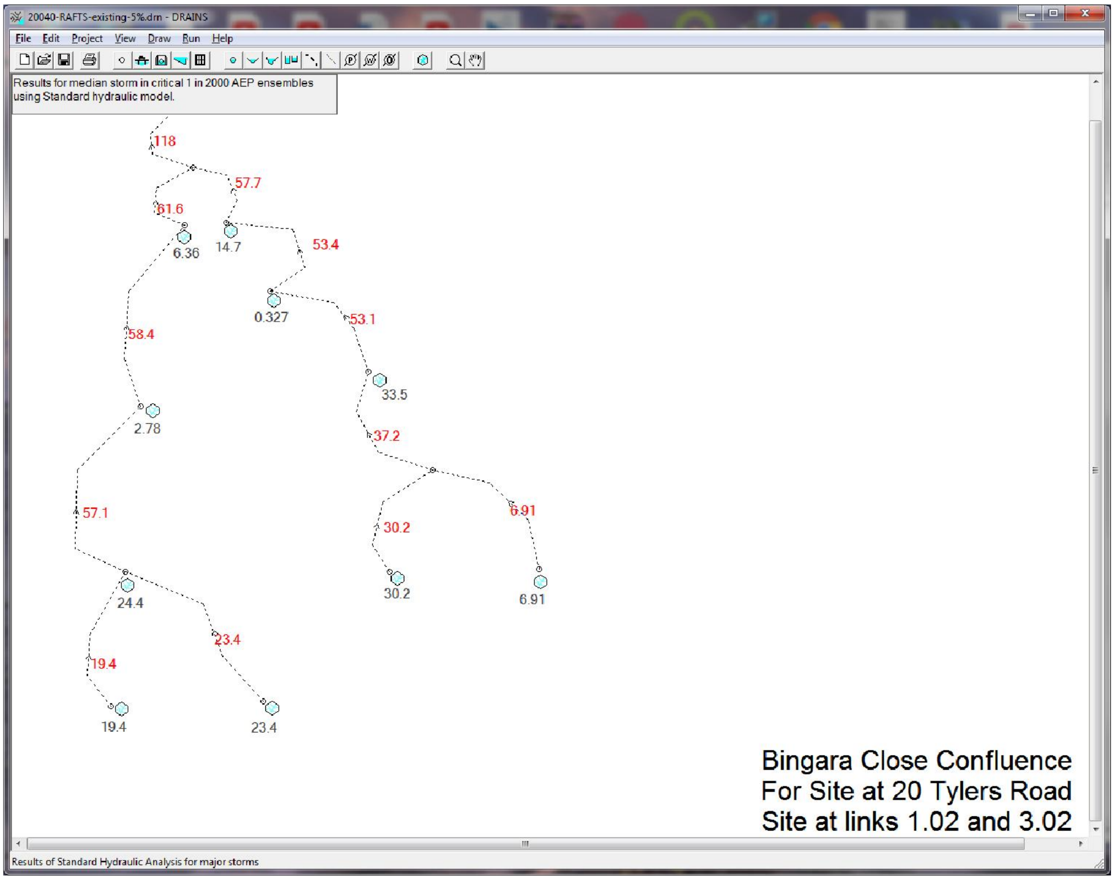


Plate E6-A: Existing Catchmnet Conditions (RU - 5%) - 1:2,000 (PMF) Catchment & Sub-catchment Flows.

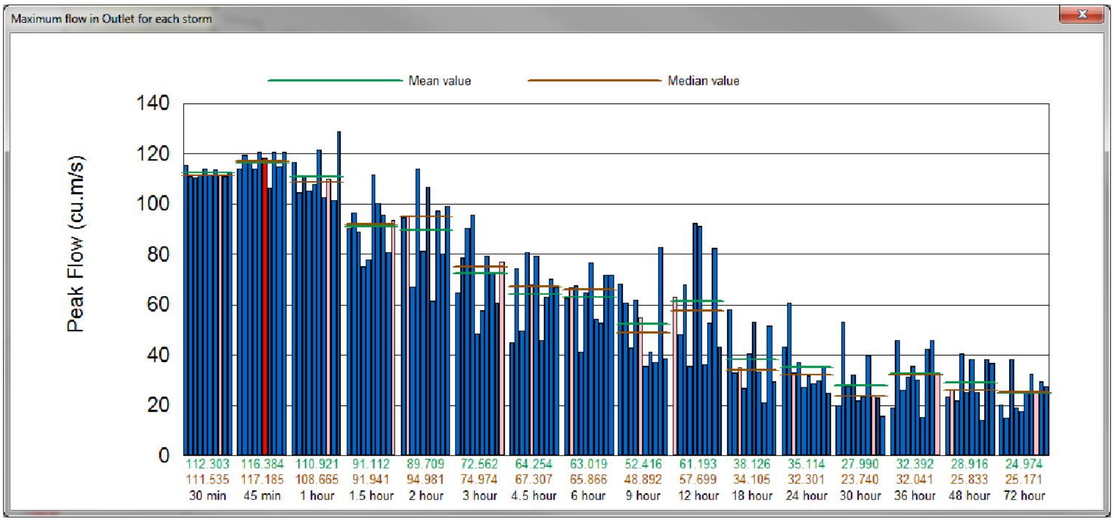


Plate E6-B: Existing Catchmnet Conditions (RU - 5%) - 11:2,000 (PMF) Catchment Outlet Envelope Flows.

Table TE1 – Easten Flow Path - PMF

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Eastern PMF River: Bingara_Close_E Reach: Eastern_Flow Profile: PF 1 | Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Eastern_Flow	1140	PF 1	43.30	338.85	340.01		340.18	0.015359	1.94	24.65	45.32	0.74
Eastern_Flow	1110	PF 1	43.30	338.69	339.52		339.68	0.017900	2.10	25.33	53.86	0.80
Eastern_Flow	1080	PF 1	43.30	338.31	339.13		339.25	0.011525	1.77	30.01	59.34	0.65
Eastern_Flow	1050	PF 1	43.30	337.85	338.91		339.00	0.005980	1.51	35.45	57.44	0.49
Eastern_Flow	1022	PF 1	43.30	337.67	338.69		338.81	0.008027	1.73	33.89	87.20	0.57
Eastern_Flow	971	PF 1	43.30	337.05	338.33	337.84	338.37	0.008139	1.00	53.62	72.48	0.30
Eastern_Flow	913	PF 1	43.30	336.65	337.45		337.54	0.031164	1.45	34.34	61.18	0.54
Eastern_Flow	861	PF 1	43.30	335.95	337.21	336.87	337.26	0.002342	1.12	48.32	95.19	0.38
Eastern_Flow	846		Culvert									
Eastern_Flow	839	PF 1	43.30	334.95	337.21		337.23	0.006300	0.70	62.98	150.58	0.18
Eastern_Flow	811	PF 1	43.30	334.91	336.83	336.24	336.90	0.025200	1.27	40.54	52.78	0.35
Eastern_Flow	750	PF 1	43.50	334.29	336.07	335.71	336.10	0.008494	0.68	55.67	136.14	0.20
Eastern_Flow	681	PF 1	43.50	333.79	335.16	335.04	335.23	0.020485	0.82	37.48	106.40	0.29
Eastern_Flow	629	PF 1	43.50	333.62	334.47		334.54	0.008608	0.33	42.33	101.65	0.17
Eastern_Flow	564	PF 1	43.50	333.53	334.05		334.13	0.009383	0.28	41.04	113.26	0.17
Eastern_Flow	524	PF 1	43.50	332.57	333.79		333.82	0.007801	0.41	55.02	148.84	0.17
Eastern_Flow	452	PF 1	43.50	332.15	332.88		332.95	0.019631	0.64	40.09	121.98	0.27
Eastern_Flow	403	PF 1	43.50	330.89	332.24		332.28	0.009336	0.74	47.42	95.93	0.21
Eastern_Flow	336	PF 1	43.50	330.14	331.81		331.84	0.004842	0.87	51.79	85.88	0.23
Eastern_Flow	290	PF 1	43.50	329.87	331.45		331.51	0.011976	1.20	46.03	113.30	0.36
Eastern_Flow	245	PF 1	43.50	329.72	331.06		331.10	0.006858	0.97	56.48	101.24	0.27
Eastern_Flow	213	PF 1	43.50	329.56	330.75		330.84	0.010602	1.05	49.77	97.34	0.33
Eastern_Flow	184	PF 1	43.50	329.00	330.54		330.57	0.007712	1.09	67.82	126.89	0.30
Eastern_Flow	151	PF 1	43.50	328.76	330.32		330.35	0.006151	0.97	68.35	102.87	0.26
Eastern_Flow	124	PF 1	43.50	328.53	330.10		330.15	0.009025	1.24	52.46	95.20	0.32
Eastern_Flow	95	PF 1	43.50	328.61	329.66		329.73	0.027253	1.47	39.67	79.26	0.51
Eastern_Flow	63	PF 1	43.50	327.99	329.33		329.37	0.007579	0.94	52.63	58.52	0.28
Eastern_Flow	32	PF 1	43.50	327.44	329.10		329.16	0.007083	1.11	44.62	36.11	0.29
Eastern_Flow	11	PF 1	47.70	327.12	328.89	328.15	328.97	0.010004	1.38	38.87	28.24	0.35

Total flow in cross section.

Table TE2 – Eastern Flow Path – 1% AEP

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Eastern 1%AEP River: Bingara_Close_E Reach: Eastern_Flow Profile: PF 1 | Reload Data

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Eastern_Flow	1140	PF 1	24.00	338.85	339.82		339.93	0.015864	1.59	16.62	40.96	0.72
Eastern_Flow	1110	PF 1	24.00	338.69	339.37	339.31	339.48	0.014528	1.63	18.07	48.98	0.70
Eastern_Flow	1080	PF 1	24.00	338.31	338.90		339.01	0.017526	1.69	17.06	48.50	0.76
Eastern_Flow	1050	PF 1	24.00	337.85	338.66		338.72	0.005498	1.18	23.51	43.29	0.45
Eastern_Flow	1022	PF 1	24.00	337.67	338.44		338.53	0.008575	1.45	19.45	44.82	0.56
Eastern_Flow	971	PF 1	24.00	337.05	338.08	337.63	338.10	0.007341	0.80	36.28	62.75	0.27
Eastern_Flow	913	PF 1	24.00	336.65	337.24		337.31	0.034041	1.22	22.46	54.45	0.53
Eastern_Flow	861	PF 1	24.00	335.95	336.99	336.70	337.02	0.002319	0.92	30.17	67.54	0.36
Eastern_Flow	846		Culvert									
Eastern_Flow	839	PF 1	24.00	334.95	336.93		336.95	0.007640	0.67	35.12	65.52	0.19
Eastern_Flow	811	PF 1	24.00	334.91	336.60	335.98	336.64	0.016853	0.91	29.40	40.51	0.28
Eastern_Flow	750	PF 1	24.20	334.29	335.93	335.49	335.95	0.008460	0.63	37.95	125.50	0.20
Eastern_Flow	681	PF 1	24.20	333.79	335.04	334.93	335.09	0.020559	0.74	25.96	92.44	0.28
Eastern_Flow	629	PF 1	24.20	333.62	334.32		334.37	0.009238	0.25	28.19	87.42	0.16
Eastern_Flow	564	PF 1	24.20	333.53	333.92		333.97	0.008376	0.18	27.93	88.65	0.14
Eastern_Flow	524	PF 1	24.20	332.57	333.67		333.70	0.007550	0.34	38.24	140.95	0.16
Eastern_Flow	452	PF 1	24.20	332.15	332.75		332.81	0.021268	0.57	26.05	101.84	0.27
Eastern_Flow	403	PF 1	24.20	330.89	332.04		332.08	0.010659	0.70	30.01	77.84	0.22
Eastern_Flow	336	PF 1	24.20	330.14	331.59		331.62	0.004710	0.77	34.43	73.04	0.23
Eastern_Flow	290	PF 1	24.20	329.87	331.23		331.28	0.013419	1.11	26.87	62.07	0.36
Eastern_Flow	245	PF 1	24.20	329.72	330.82		330.86	0.006654	0.83	34.93	76.64	0.26
Eastern_Flow	213	PF 1	24.20	329.56	330.47		330.57	0.013115	0.94	26.83	69.19	0.35
Eastern_Flow	184	PF 1	24.20	329.00	330.22		330.25	0.008401	0.96	37.34	74.25	0.30
Eastern_Flow	151	PF 1	24.20	328.76	330.02		330.04	0.005483	0.78	42.25	67.20	0.24
Eastern_Flow	124	PF 1	24.20	328.53	329.83		329.87	0.007265	0.97	32.91	50.96	0.28
Eastern_Flow	95	PF 1	24.20	328.61	329.38		329.46	0.040086	1.38	21.41	53.49	0.58
Eastern_Flow	63	PF 1	24.20	327.99	328.93		328.96	0.010251	0.82	31.54	48.25	0.31
Eastern_Flow	32	PF 1	24.20	327.44	328.66		328.69	0.008438	0.95	28.89	34.03	0.30
Eastern_Flow	11	PF 1	26.50	327.12	328.44	327.92	328.49	0.010005	1.11	26.61	26.74	0.33

Calculated water surface from energy equation.

Table TE3 – Eastern Flow Path – 1% AEP

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Eastern_5%AEP River: Bingara_Close_E Reach: Eastern_Flow Profile: PF 1 | Reload Data

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Eastern_Flow	1140	PF 1	13.60	338.85	339.68		339.76	0.016736	1.32	11.11	36.07	0.70
Eastern_Flow	1110	PF 1	13.60	338.69	339.27	339.17	339.33	0.011996	1.28	12.98	44.85	0.61
Eastern_Flow	1080	PF 1	13.60	338.31	338.74	338.72	338.84	0.023980	1.55	10.11	39.64	0.83
Eastern_Flow	1050	PF 1	13.60	337.85	338.48		338.52	0.005513	0.97	15.97	38.82	0.43
Eastern_Flow	1022	PF 1	13.60	337.67	338.25		338.32	0.009789	1.25	12.30	32.99	0.56
Eastern_Flow	971	PF 1	13.60	337.05	337.89	337.50	337.90	0.006268	0.64	25.35	52.01	0.24
Eastern_Flow	913	PF 1	13.60	336.65	337.08		337.13	0.043401	1.08	14.14	49.16	0.57
Eastern_Flow	861	PF 1	13.60	335.95	336.81	336.55	336.83	0.002309	0.80	19.77	52.13	0.35
Eastern_Flow	846		Culvert									
Eastern_Flow	839	PF 1	13.60	334.95	336.68		336.70	0.009541	0.65	21.42	38.67	0.21
Eastern_Flow	811	PF 1	13.60	334.91	336.38	335.79	336.40	0.012235	0.67	21.48	30.92	0.23
Eastern_Flow	750	PF 1	13.60	334.29	335.79	335.29	335.81	0.008156	0.56	21.62	46.35	0.19
Eastern_Flow	681	PF 1	13.60	333.79	334.94	334.84	334.97	0.020120	0.66	17.26	74.65	0.27
Eastern_Flow	629	PF 1	13.60	333.62	334.21		334.24	0.009671	0.26	18.45	73.11	0.16
Eastern_Flow	564	PF 1	13.60	333.53	333.83		333.85	0.007402	0.11	19.74	80.98	0.12
Eastern_Flow	524	PF 1	13.60	332.57	333.57	333.42	333.59	0.008560	0.36	24.51	126.50	0.17
Eastern_Flow	452	PF 1	13.60	332.15	332.69	332.62	332.72	0.016422	0.45	20.00	95.45	0.23
Eastern_Flow	403	PF 1	13.60	330.89	331.82		331.86	0.018414	0.79	16.31	48.00	0.28
Eastern_Flow	336	PF 1	13.60	330.14	331.34		331.36	0.004008	0.61	21.41	36.34	0.20
Eastern_Flow	290	PF 1	13.60	329.87	331.01		331.05	0.013780	0.94	16.31	36.32	0.35
Eastern_Flow	245	PF 1	13.60	329.72	330.63		330.66	0.005769	0.67	21.77	59.58	0.24
Eastern_Flow	213	PF 1	13.60	329.56	330.29		330.38	0.013911	0.81	15.38	57.87	0.34
Eastern_Flow	184	PF 1	13.60	329.00	329.97		330.00	0.011647	0.95	20.80	56.17	0.33
Eastern_Flow	151	PF 1	13.60	328.76	329.76		329.78	0.004607	0.60	27.58	48.21	0.21
Eastern_Flow	124	PF 1	13.60	328.53	329.62		329.64	0.005452	0.74	23.69	40.06	0.24
Eastern_Flow	95	PF 1	13.60	328.61	329.25		329.30	0.043358	1.19	14.23	50.40	0.58
Eastern_Flow	63	PF 1	13.60	327.99	328.69		328.71	0.013033	0.70	20.23	44.70	0.32
Eastern_Flow	32	PF 1	13.60	327.44	328.36		328.39	0.009435	0.81	19.20	32.30	0.30
Eastern_Flow	11	PF 1	15.30	327.12	328.15	327.75	328.18	0.010001	0.92	18.79	26.28	0.31

Slope of the energy grade line at a cross section.

Table TW1 – Western Flow Path – PMF

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Western PMF River: Bingara_Close_W Reach: Western_Path Profile: PF 1 | Reload Data

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Western_Path	975	PF 1	44.40	337.77	338.83		338.86	0.011552	0.86	52.95	157.06	0.32
Western_Path	944	PF 1	44.40	337.40	338.51	338.32	338.54	0.009390	0.70	57.46	172.83	0.29
Western_Path	938		Culvert									
Western_Path	921	PF 1	44.40	337.22	338.50	338.07	338.52	0.019132	0.82	62.96	99.45	0.29
Western_Path	893	PF 1	44.40	336.78	338.11	337.46	338.14	0.010541	0.76	72.72	104.15	0.22
Western_Path	842	PF 1	44.40	336.01	337.54		337.57	0.011752	0.83	60.52	68.76	0.24
Western_Path	792	PF 1	44.40	335.54	336.93		336.96	0.012602	0.78	66.19	88.27	0.24
Western_Path	734	PF 1	44.40	335.05	336.15		336.17	0.014942	0.81	64.25	88.98	0.26
Western_Path	657	PF 1	44.40	333.98	334.92		334.98	0.015706	0.99	45.04	98.36	0.38
Western_Path	585	PF 1	44.40	332.80	334.07	333.85	334.16	0.008938	1.37	40.21	120.64	0.49
Western_Path	528	PF 1	44.40	332.28	333.56	333.47	333.64	0.009768	1.39	40.72	111.45	0.50
Western_Path	439	PF 1	45.20	331.32	332.81	332.61	332.85	0.007607	0.64	56.83	120.02	0.26
Western_Path	336	PF 1	45.20	330.70	331.92	331.65	331.96	0.011128	0.93	49.55	108.36	0.33
Western_Path	256	PF 1	45.20	329.46	331.03	330.52	331.09	0.011905	1.14	44.91	63.74	0.35
Western_Path	191	PF 1	45.20	328.81	330.56	329.90	330.59	0.004975	0.83	67.51	86.27	0.23
Western_Path	137	PF 1	45.20	327.98	330.23	329.47	330.27	0.006810	0.98	51.85	59.97	0.27
Western_Path	86	PF 1	45.20	327.74	329.78	329.16	329.85	0.011693	1.22	43.79	59.00	0.35
Western_Path	50	PF 1	48.10	327.59	329.39	328.64	329.46	0.010010	1.10	43.53	38.75	0.33

Total flow in cross section.

Table TW2 – Western Flow Path – 1% AEP

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Western 1% AEP River: Bingara_Close_W Reach: Western_Path Profile: PF 1 | Reload Data

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Western_Path	975	PF 1	25.00	337.77	338.70		338.73	0.009600	0.69	35.46	123.97	0.29
Western_Path	944	PF 1	25.00	337.40	338.35	338.15	338.38	0.013402	0.68	32.71	122.94	0.32
Western_Path	938		Culvert									
Western_Path	921	PF 1	25.00	337.22	338.23	337.95	338.25	0.025530	0.74	38.73	86.31	0.31
Western_Path	893	PF 1	25.00	336.78	337.79	337.30	337.81	0.010815	0.63	45.60	71.78	0.22
Western_Path	842	PF 1	25.00	336.01	337.24		337.26	0.010622	0.66	41.67	58.75	0.22
Western_Path	792	PF 1	25.00	335.54	336.67		336.69	0.012438	0.64	44.45	76.13	0.23
Western_Path	734	PF 1	25.00	335.05	335.90		335.92	0.014686	0.67	43.29	77.68	0.25
Western_Path	657	PF 1	25.00	333.98	334.79		334.82	0.013367	0.79	32.64	92.48	0.34
Western_Path	585	PF 1	25.00	332.80	333.84	333.64	333.92	0.012112	1.27	20.44	46.86	0.53
Western_Path	528	PF 1	25.00	332.28	333.53	333.16	333.56	0.003630	0.83	38.04	107.92	0.31
Western_Path	439	PF 1	25.50	331.32	332.33	332.33	332.58	0.123089	2.23	11.43	22.44	1.00
Western_Path	336	PF 1	25.50	330.70	331.72	331.43	331.77	0.015762	0.95	27.21	56.80	0.37
Western_Path	256	PF 1	25.50	329.46	330.78	330.33	330.81	0.009831	0.87	31.66	46.39	0.31
Western_Path	191	PF 1	25.50	328.81	330.26	329.65	330.29	0.006585	0.80	34.64	46.11	0.26
Western_Path	137	PF 1	25.50	327.98	329.91	329.14	329.94	0.006385	0.79	35.50	47.59	0.25
Western_Path	86	PF 1	25.50	327.74	329.40	328.87	329.47	0.015250	1.16	22.53	29.43	0.39
Western_Path	50	PF 1	27.00	327.59	328.98	328.43	329.03	0.010000	0.94	29.09	31.25	0.31

Total flow in cross section.

Table TW2 – Western Flow Path – 1% AEP

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: Western_5% AEP River: Bingara_Close_W Reach: Western_Path Profile: PF 1 | Reload Data

Reach	River Sta	Profile	Q Total (m3/s)	Min Ch El (m)	W.S. Elev (m)	Crit W.S. (m)	E.G. Elev (m)	E.G. Slope (m/m)	Vel Chnl (m/s)	Flow Area (m2)	Top Width (m)	Froude # Chl
Western_Path	975	PF 1	14.00	337.77	338.57		338.59	0.009984	0.60	22.86	71.97	0.28
Western_Path	944	PF 1	14.00	337.40	338.25	338.03	338.27	0.010233	0.53	22.36	92.70	0.27
Western_Path	938		Culvert									
Western_Path	921	PF 1	14.00	337.22	338.06	337.86	338.07	0.030251	0.64	24.37	75.68	0.32
Western_Path	893	PF 1	14.00	336.78	337.55	337.19	337.57	0.011837	0.53	29.62	61.51	0.21
Western_Path	842	PF 1	14.00	336.01	337.01		337.02	0.009607	0.52	28.82	51.26	0.20
Western_Path	792	PF 1	14.00	335.54	336.44		336.46	0.013663	0.53	28.59	61.68	0.23
Western_Path	734	PF 1	14.00	335.05	335.75		335.76	0.010643	0.49	32.41	70.39	0.20
Western_Path	657	PF 1	14.00	333.98	334.63		334.66	0.019943	0.78	19.01	76.43	0.39
Western_Path	585	PF 1	14.00	332.80	333.72	333.47	333.76	0.008787	0.92	15.35	37.68	0.44
Western_Path	528	PF 1	14.00	332.28	333.31	332.98	333.35	0.005927	0.89	15.99	34.08	0.37
Western_Path	439	PF 1	14.30	331.32	332.71	332.13	332.73	0.007891	0.65	22.14	35.57	0.26
Western_Path	336	PF 1	14.30	330.70	331.55	331.25	331.58	0.017009	0.83	17.61	48.23	0.37
Western_Path	256	PF 1	14.30	329.46	330.53	330.20	330.56	0.010250	0.73	21.04	39.90	0.30
Western_Path	191	PF 1	14.30	328.81	329.98	329.49	330.00	0.007044	0.66	22.55	40.22	0.25
Western_Path	137	PF 1	14.30	327.98	329.61	328.89	329.63	0.006881	0.70	20.50	28.36	0.25
Western_Path	86	PF 1	14.30	327.74	329.09	328.62	329.14	0.014276	0.96	14.94	20.63	0.36
Western_Path	50	PF 1	15.40	327.59	328.68	328.28	328.71	0.010004	0.82	19.95	28.71	0.30

Total flow in cross section.

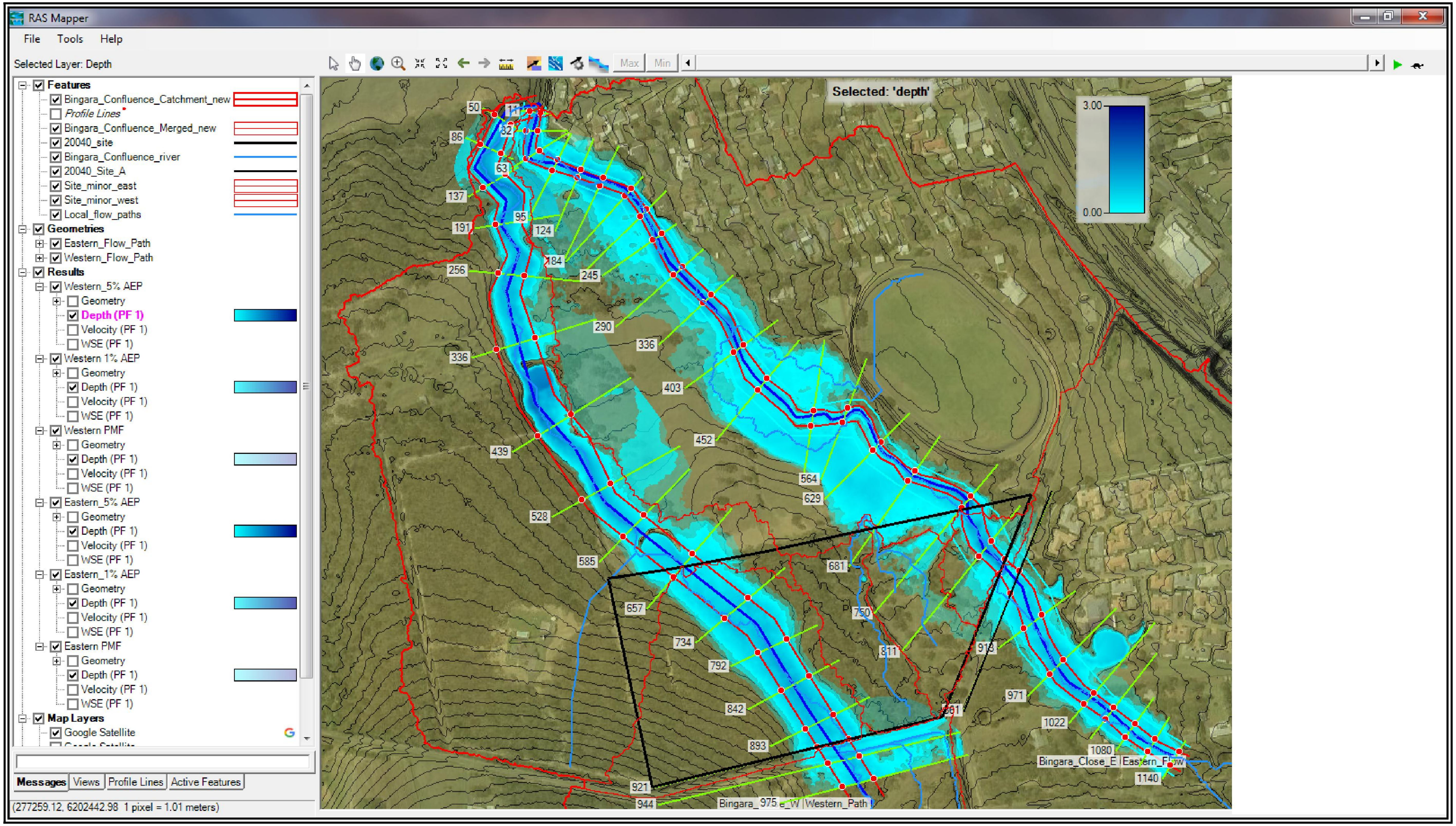


Figure FM1 - Site and downstream Flooding Extent

Figure FM2 - PMF Flood Extent

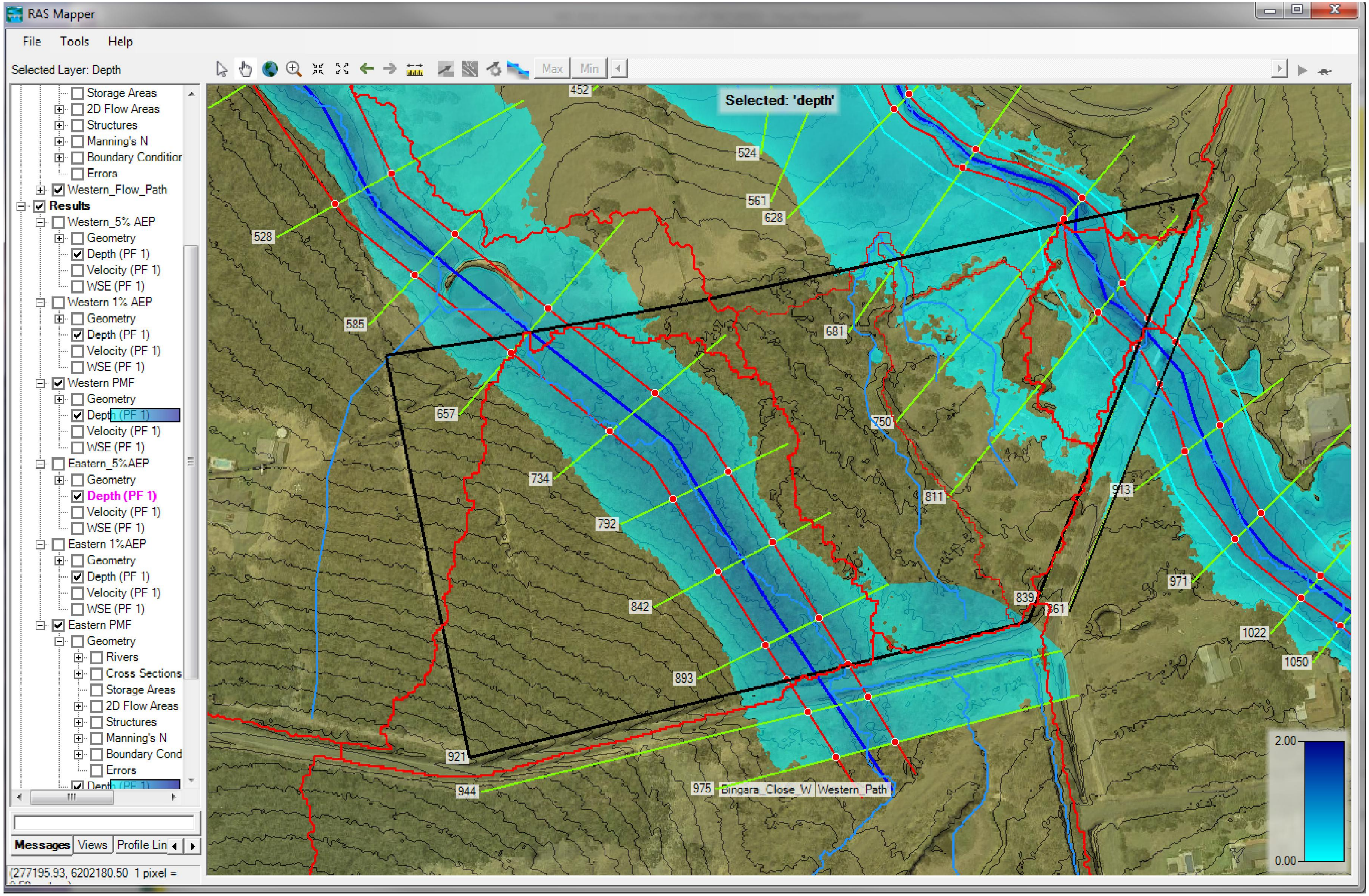


Figure FM3 - 1% AEP Flood Extent

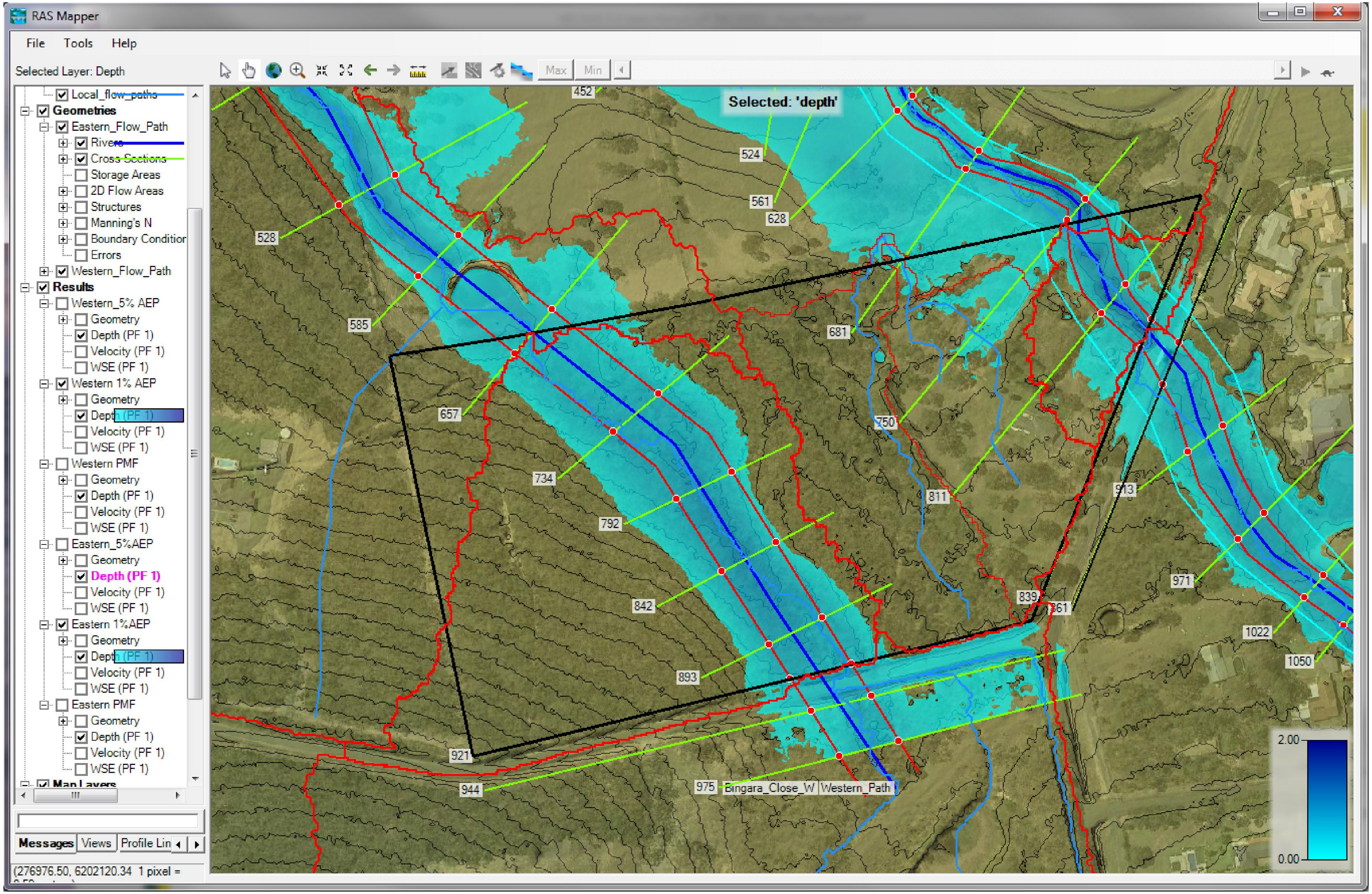


Figure FM4 - 5% AEP Flood Extent

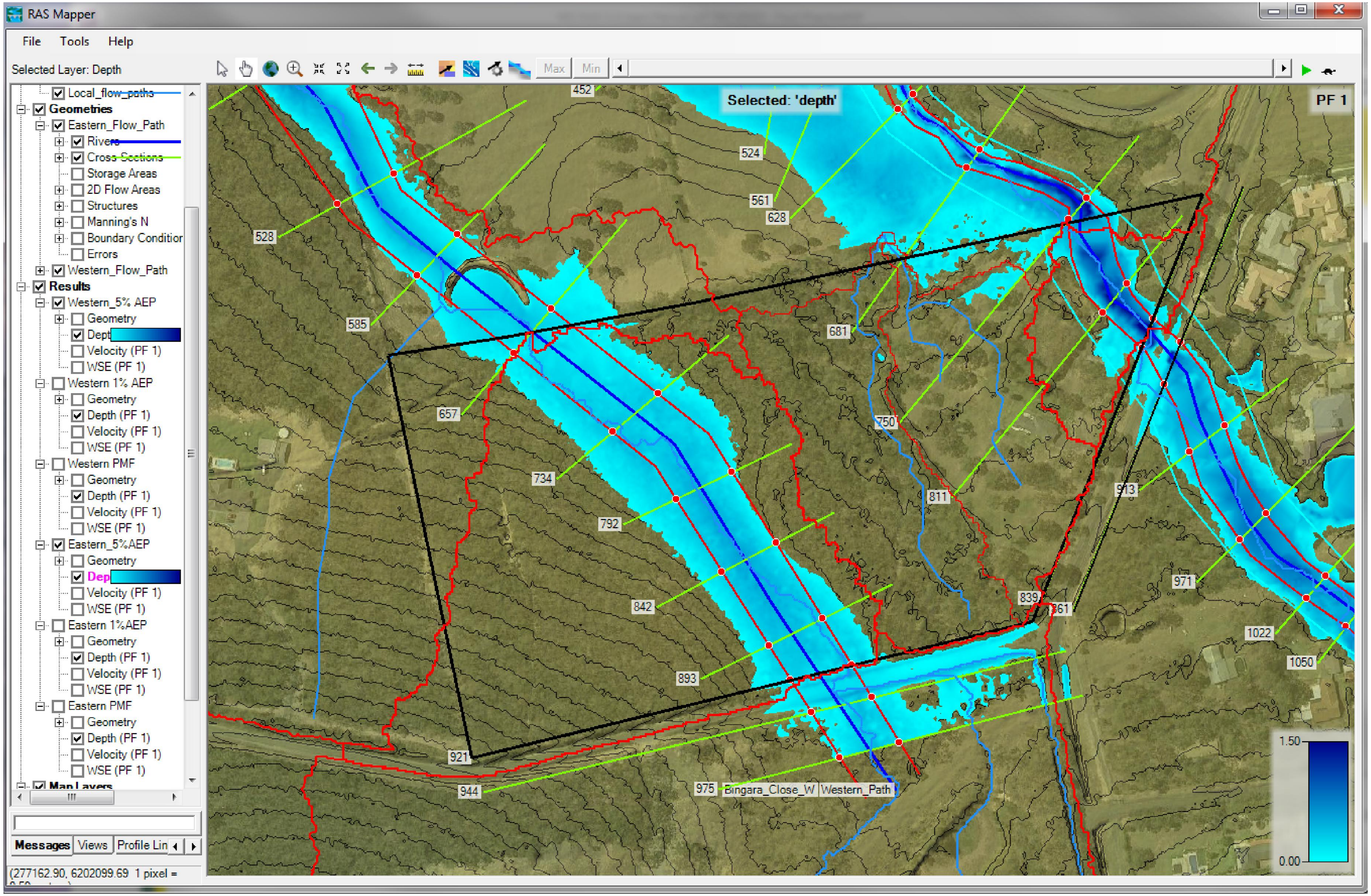
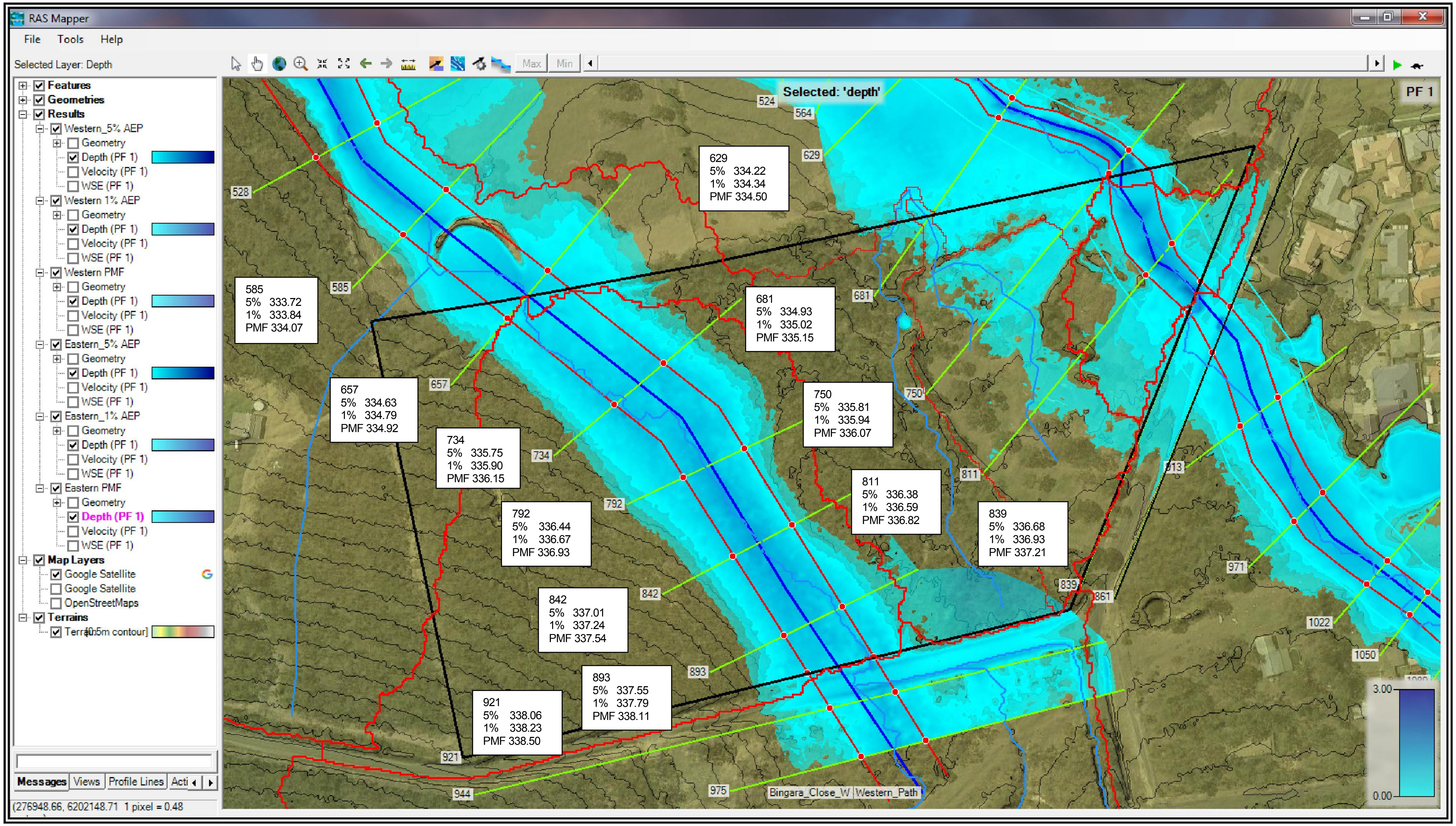


Figure FM5– 5%, 1% AEP and PMF Flood Levels



Appendix 'B'

Results | Regional Flood Frequency Estimation Model

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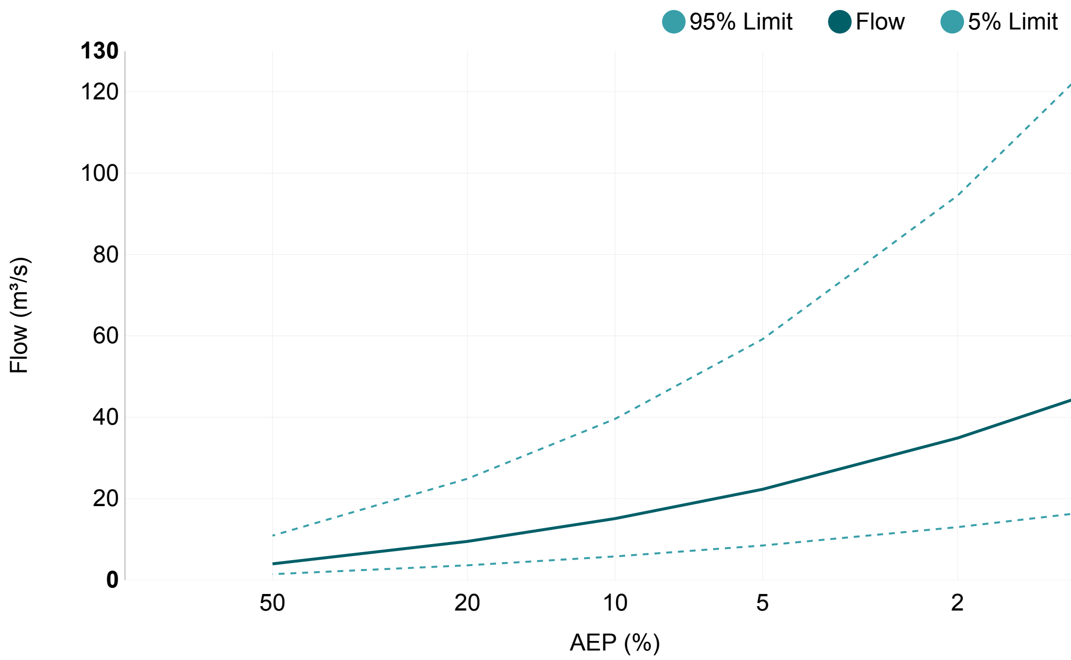


AEP (%)	Discharge (m^3/s)	Lower Confidence Limit (5%) (m^3/s)	Upper Confidence Limit (95%) (m^3/s)
50	3.97	1.43	10.9
20	9.49	3.61	24.9
10	15.1	5.79	39.6
5	22.3	8.48	59.2
2	34.9	13.0	94.5
1	47.0	17.2	130

Statistics

Variable	Value	Standard Dev
Mean	1.330	0.610
Standard Dev	0.995	0.179
Skew	0.077	0.028

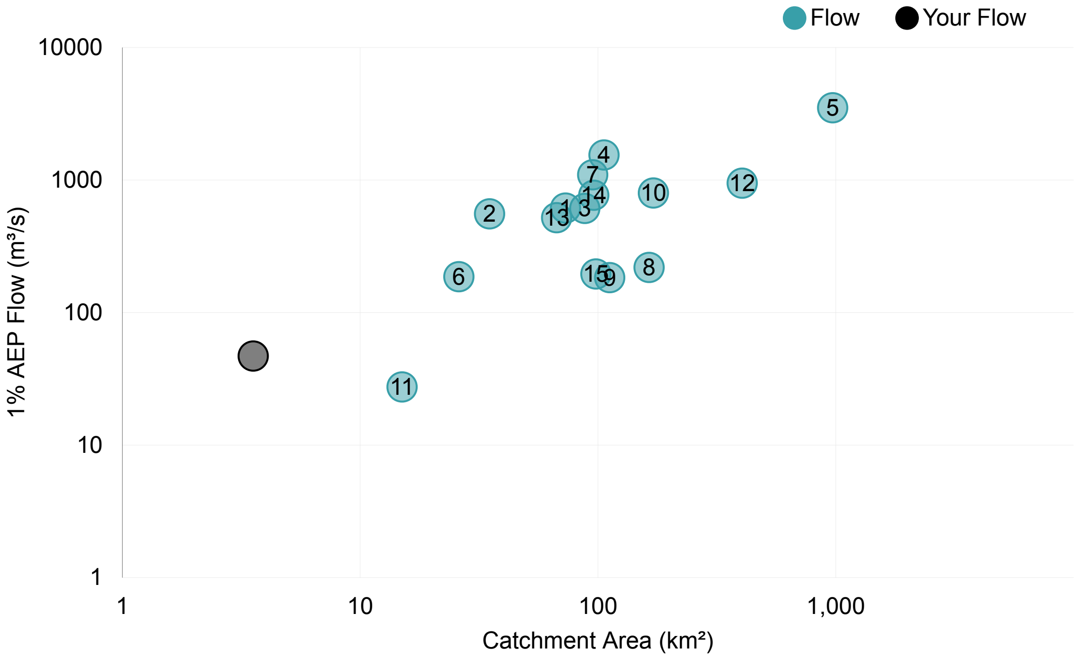
Note: These statistics come from the nearest gauged catchment. Details.

Correlation

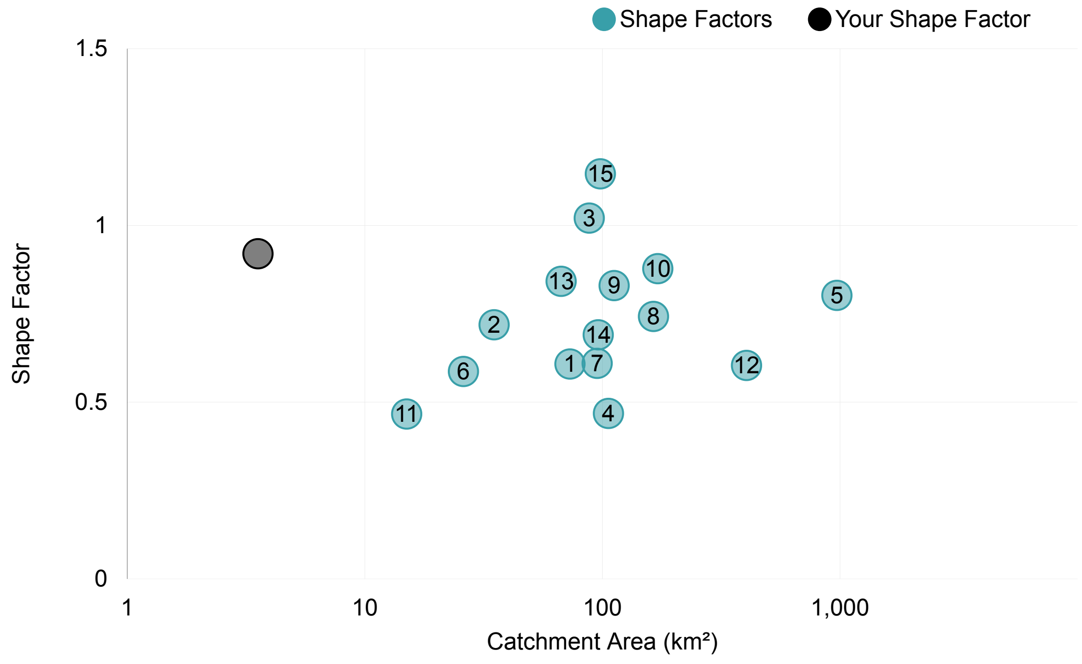
	Correlation	
1.000		
-0.330	1.000	
0.170	-0.280	1.000

Note: These statistics are common to each region. Details.

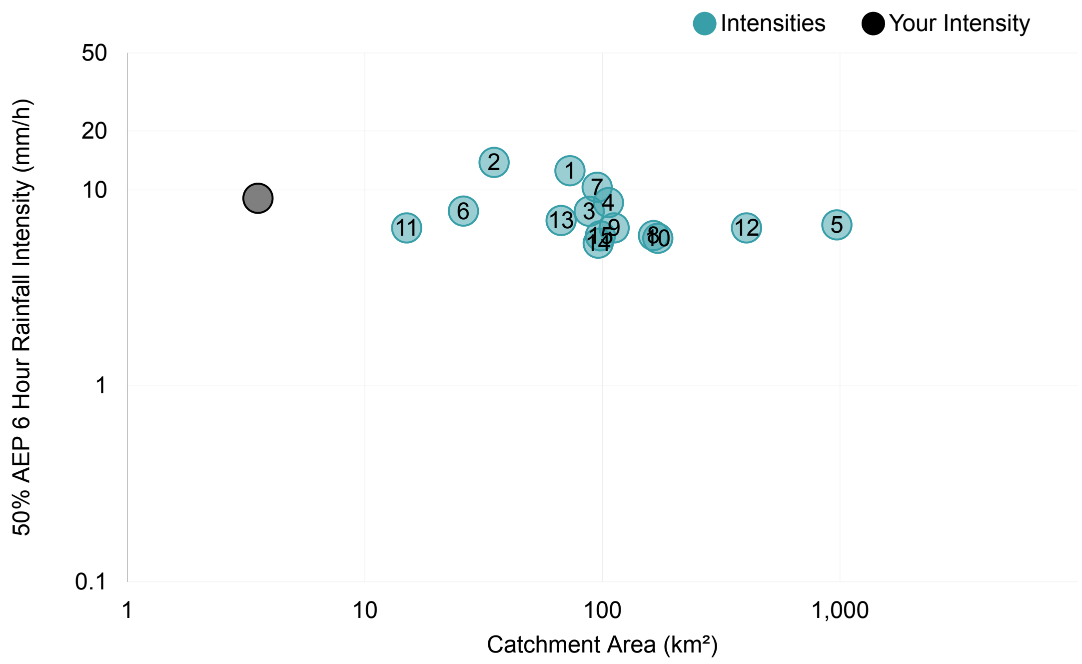
1% AEP Flow vs Catchment Area



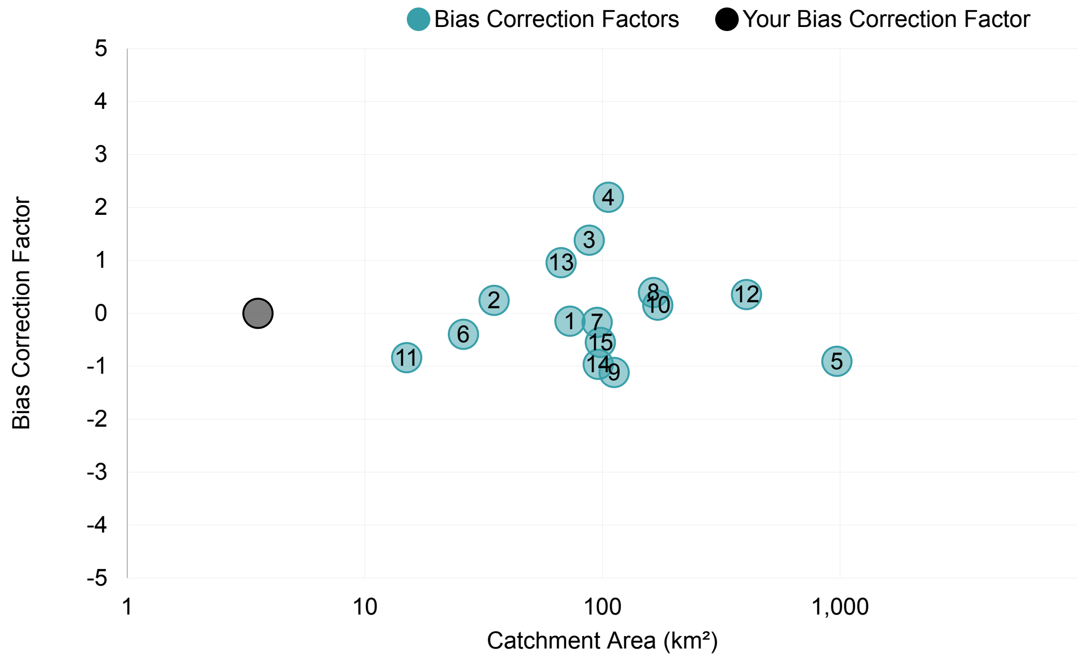
Shape Factor vs Catchment Area



Intensity vs Catchment Area



Bias Correction Factor vs Catchment Area



Download

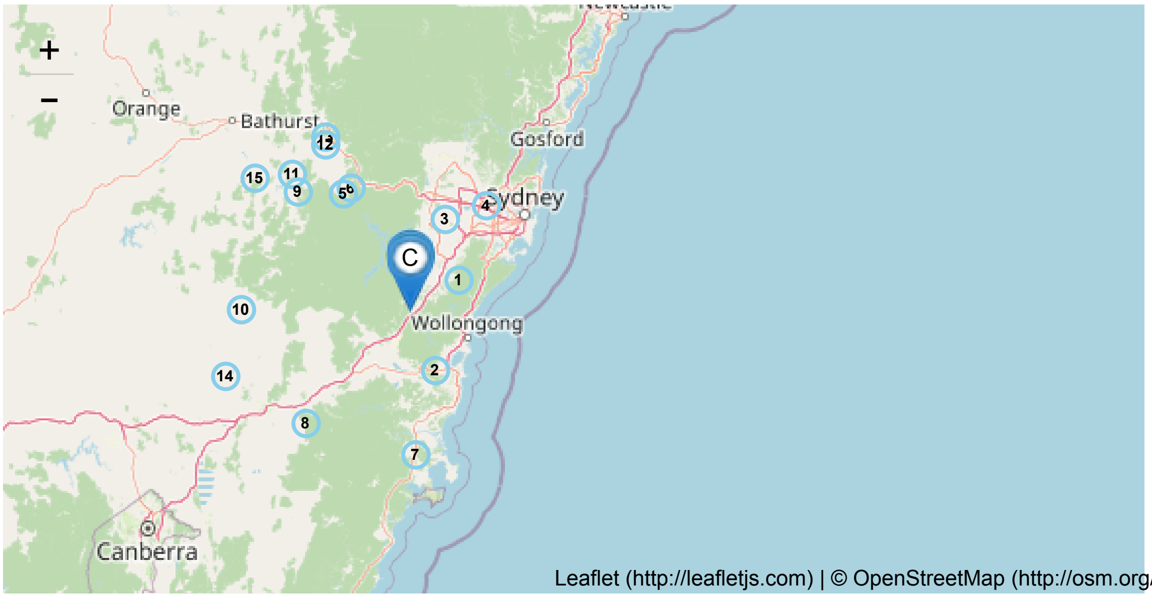
TXT Nearby JSON

Input Data

Date/Time	2020-09-11 14:34
Catchment Name	Bingara Place Confluence
Latitude (Outlet)	-34.293008
Longitude (Outlet)	150.574767
Latitude (Centroid)	-34.307652
Longitude (Centroid)	150.581242
Catchment Area (km^2)	3.55
Distance to Nearest Gauged Catchment (km)	28.2
50% AEP 6 Hour Rainfall Intensity (mm/h)	9.06607
2% AEP 6 Hour Rainfall Intensity (mm/h)	21.50473
Rainfall Intensity Source (User/Auto)	Auto
Region	East Coast

Input Data

Region Version	RFFE Model 2016 v1
Region Source (User/Auto)	Auto
Shape Factor	0.92
Interpolation Method	Natural Neighbour
Bias Correction Value	0.0



Method by Dr Ataur Rahman and Dr Khaled Haddad from Western Sydney University for the Australian Rainfall and Runoff Project. Full description of the project can be found at the project page (http://arr.ga.gov.au/revision-projects/project-list/projects/project-5) on the ARR website. Send any questions regarding the method or project here (mailto:admin@arr-software.org).

ENGINEERS AUSTRALIA (http://www.engineersaustralia.org.au)

WESTERN SYDNEY UNIVERSITY (http://www.uws.edu.au)

Location

Label: Not provided

Latitude: 34.2966 [Nearest grid cell: 34.2875 (S)]

Longitude: 150.5796 [Nearest grid cell: 150.5875 (E)]

IFD Design Rainfall Depth (mm)

Issued: 24 September 2020

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
FAQ for New ARR probability terminology

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	**63.2%**	**50%#**	**20%***	**10%**	**5%**	**2%**	**1%**
1 min	1.97	2.24	3.16	3.84	4.57	5.61	6.49
2 min	3.29	3.71	5.11	6.16	7.27	8.90	10.2
3 min	4.56	5.14	7.13	8.62	10.2	12.5	14.3
4 min	5.69	6.44	8.99	10.9	12.9	15.8	18.2
5 min	6.69	7.60	10.7	12.9	15.3	18.8	21.7
10 min	10.4	11.9	16.8	20.5	24.5	30.1	34.8
15 min	12.9	14.7	20.9	25.5	30.4	37.4	43.3
20 min	14.8	16.8	23.8	29.1	34.6	42.7	49.4
25 min	16.3	18.5	26.2	31.9	38.0	46.7	54.1
30 min	17.6	20.0	28.1	34.2	40.7	50.0	57.8
45 min	20.6	23.3	32.6	39.6	46.9	57.5	66.3
1 hour	22.9	25.9	36.1	43.7	51.7	63.1	72.6
1.5 hour	26.6	30.1	41.7	50.3	59.2	72.0	82.5
2 hour	29.6	33.5	46.4	55.9	65.6	79.4	90.6
3 hour	34.5	39.2	54.5	65.4	76.6	92.2	105
4.5 hour	40.6	46.3	64.7	77.7	90.8	109	123
6 hour	45.6	52.2	73.5	88.4	103	123	139
9 hour	53.9	62.1	88.4	107	125	149	168
12 hour	60.5	70.1	101	122	144	171	192
18 hour	70.9	82.5	120	147	174	207	233
24 hour	78.7	91.8	135	166	198	236	266
30 hour	84.8	99.1	147	181	217	259	292
36 hour	89.7	105	156	193	232	279	314
48 hour	97.1	114	170	212	256	308	348
72 hour	107	125	186	233	284	343	390
96 hour	113	131	196	246	299	362	411
120 hour	117	136	203	253	308	372	422

144 hour	120	140	208	259	313	377	427
168 hour	124	144	212	263	316	379	429

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD. Rather it corresponds to the 4.48 ARI.

This page was created at **17:54 on Thursday 24 September 2020 (AEST)**