



COWRA BYPASS FLOOD MODELLING HYDROLOGIC and HYDRAULIC ASSESSMENT

Final Report Rev1

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PREPARATION, REVIEW AND AUTHORISATION

Revision #	Date	Prepared by	Reviewed by	Approved for Issue by
1 (Draft)	13/05/15	C. Koutsellis	C. Katsoulas	B. Butturini
2 (Draft)	21/07/15	E. Xu	E. Xu C. Katsoulas	
3 (Draft)	27/07/15	E. Xu	C. Katsoulas	B. Butturini
4 (Draft)	08/12/15	C. Koutsellis	C. Katsoulas	B. Butturini
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1 (Final)	30/11/16	C. Koutsellis	C. Katsoulas	A.Deen

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SMEC COMPANY DETAILS

SMEC	Australia Pty Ltd				
PO BO	PO BOX 1052, North Sydney, NSW 2059				
Tel:	02 9925 5555				
-					

Fax: 02 9925 5566

www.smec.com

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CONTACT DETAILS

SMEC Australia Pty Ltd | www.smec.com

Level 7, 76 Berry Street North Sydney NSW 2060 Tel: 02 9925 5555 Fax: 02 9925 5566

Representative: Con Katsoulas

- P: 02 9925 5412
- E: con.katsoulas@smec.com

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1. INTRODUCTION

Geolyse Pty Ltd engaged SMEC Australia Pty Ltd to carry out a hydrologic and hydraulic assessment to determine the impacts of the proposed Cowra Bypass road alignment on the flooding behaviour of the Lachlan River.

SMEC Australia Pty Ltd utilised a MIKE-11 quasi-2D model for the Cowra and Gooloogong Floodplain Risk Management Study and Plan in December 2006. This model was used as the basis for assessing the impacts of the proposed road alignment on the existing flooding behaviour.

2. HYDROLOGY AND HYDRAULICS (OPTION A)

The scope of the current study was to provide a flood assessment addressing the flood impacts from a newly proposed road at Cowra, NSW. The study focuses on the proposed bridge crossing of the Lachlan River that is located approximately 36 metres upstream of the railway line.

The proposed road alignment crosses Wagoola Creek and then runs in a north-south direction parallel to Waugoola Creek adjacent to Campbell Street, then follows Campbell Street and the main railway line to the Lachlan River, crosses the railway line near the Lachlan River to run north of the railway line and in an east-west direction, then follows Boundary Road and Airport Road to the corner of Grenfell Road and Airport Road (refer Figure 1).



Figure 1: Layout of Proposed Road Alignment

The data provided by Geolyse Pty Ltd included the road alignment, cadastre, 2m topographic contours, aerial photo, and preliminary longitudinal sections along the proposed route.

Figure 2 below shows the alignment of the proposed bridge over the Lachlan River, approximately 40m upstream of the railway line.



Figure 2: Road Alignment near Lachlan River

The proposed road alignment and bridge are shown in red in Figure 2. The vertical alignment has been set from the concept design plans attached in Appendix I.

The existing levels provided on the longitudinal sections were estimates based on 2m contour data. No details were provided of the river's invert levels, soffit levels, piers, and abutments to the bridge. In the absence of this data assumptions were made for the bridge geometry based on the 2m contours, and design strings supplied. The bridge deck top level is at 290.08m. The creek cross section at the proposed bridge crossing was estimated by interpolating from the existing MIKE-11 cross sections. The bridge was modelled using a simplified design since no bridge data was made available.

Once the detailed design of the bridge is available, the MIKE-11 model will need to be re-run.

The geometry of the proposed bridge section was based on the following assumptions:

- Road horizontal and vertical alignment as per the plans in Appendix G
- A bridge span of 107 metres

Figure 3 depicts the assumed bridge geometry adopted in the updated MIKE-11 model





The hydraulic model used for the study was a MIKE11 quasi2d unsteady flow model utilised for the Cowra and Gooloogong Floodplain Risk Management Study and Plan by SMEC December 2006.

No changes were made to the hydrology with flows provided in the MIKE11 model being unaltered. The 1%AEP event had a peak inflow rate of 6,700m³/s at the Lachlan River and 247m³/s at the Waugoola River. For the PMF event the peak inflow rate at the Lachlan River was 19,000m³/s and at the Waugoola River 571m³/s.

The proposed road alignment potentially affected the MIKE-11 cross sections at Lachlan River and at Waugoola Creek. It was decided to adopt the Energy Equation method to model the bridge for the concept design of the bridge. Typical loss factors of 0.3 and 0.5 were used to model the bridge contraction and expansion losses respectively. A manning's n of 0.02 was used to represent the bridge resistance. No blockage was applied to the waterway under the bridge deck. A 1.3m bridge handrail was included in the analysis and it was assumed to be fully blocked.

The road crossing at Walgoola Creek is located beyond the extent of the model and it was not practical to extrapolate the cross sections to this point to provide reliable results and was therefore not included in the model.



Figure 4: MIKE11 cross sections

A validation of the model results was required to check the performance of the MIKE-11 model. The validation was undertaken by re-running the MIKE11 model (with existing conditions – no changes) and comparing flood level results with the previous version of MIKE-11. The model runs indicated that the 1%AEP flood levels along the Lachlan River were within +-0.02m and were therefore the latest version of MIKE-11 was appropriate to be used for the current study. However, the 1% AEP flood levels at the Waugoola Creek cross sections experienced a difference in levels of +-0.8m that is a significant change. This was due to backwater from the Lachlan River but was deemed not to have any hydraulic impact on the Lachlan River model results.

Model runs incorporating the hydraulic structure included the full range of different sized flood events including the 5%, 2%, 1%, 0.5% AEP and PMF events. The modelling indicated an insignificant increase in flood levels downstream of the proposed road crossing site. However, the levels upstream of the proposed road increased by up to 2.33m for the 1% AEP event. For the other events, flood levels increased by up to 0.66m, 1.59m, 2.91m and 4.49m for the 5%, 2%, 0.5% AEP and PMF events respectively with the maximum increases occurring immediately upstream of the road crossing. These increases also impact on levels in Waugoola Creek with increases of approximately 0.27m, 0.55m, 1.09m, 1.55m and 3.29m for the 5%, 2%, 1%, 0.5% AEP and PMF events respectively. More detailed results of the flood modelling are presented in Appendix C and D.

The increases to flood levels (afflux) extend to beyond the upstream end of the model. The assessment of the extent of afflux and flood affected properties upstream of the model area can only be made by extending the model upstream with additional survey not available for the current study.

3. NEW BRIDGE GEOMETRY MODELLING (OPTION B)

On 15 July 2015 Geolyse Pty Ltd requested that a hydraulic assessment be conducted for an alternative bridge scenario. The new bridge geometry to be adopted for the analysis is as follows:

- Road level as per the previous model
- Deck thickness of 1.0m
- Pier spacing of 18m (even through the river)
- Pier width 1.0m
- Bridge handrail 1.3m high

A schematic of the proposed bridge geometry for Option B is shown below.





30012410-SMEC [COWRA BYPASS FLOOD MODELLING HYDROLOGIC and HYDRAULIC ASSESSMENT]: Final Report Rev1 Page 6 To distinguish between the two different bridge geometries, the previous bridge geometry in section 2 is named Option A.

The Energy Equation method was adopted to model the bridge for the concept design of the bridge. The energy method provides a simplified method using a blockage percentage of the waterway opening as opposed to a detailed pier analysis. This method was chosen due the conceptual nature of the assessment. A detailed pier analysis could be performed once the final design of the bridge is known.

Typical loss factors of 0.3 and 0.5 were used to model the bridge contraction and expansion losses respectively. A manning's n of 0.02 was used to represent the bridge resistance. A blockage of 8% was applied to the bridge waterway to account for the pier blockage. A 1.3m bridge handrail was included in the analysis and it was assumed to be fully blocked.

Model runs incorporating the new bridge geometry included the full range of different sized flood events including the 5%, 2%, 1%, 0.5% AEP and PMF events as was done for Option A.

Option B Model Results

The modelling indicated an insignificant decrease in flood levels downstream of the proposed bridge. However, the levels upstream of the proposed bridge increased by up to 1.39m for the 1% AEP event. For the other events, flood levels increased by up to 0.28m, 0.81m, 1.90m and 3.42m for the 5%, 2%, 0.5% AEP and PMF events respectively with the maximum increases occurring immediately upstream of the bridge. These increases also impact on levels in Waugoola Creek with increases of approximately 0.17m, 0.18m, 0.51m, 0.83m and 2.39m for the 5%, 2%, 1%, 0.5% AEP and PMF events respectively.

Location	Difference in Flood Level Option A - Option B (m)				
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF
Bridge Upstream	0.39	0.78	0.93	1.01	1.07
Waugoola Creek	0.10	0.37	0.58	0.71	0.90

Table 1 – Difference in Flood Level

Tabulated results of the flood modelling are presented in Appendix E and F.

4. NEW BRIDGE GEOMETRY MODELLING (OPTION C)

In November 2015 Geolyse Pty Ltd requested that a hydraulic assessment be conducted for a new alternative bridge scenario. The new bridge geometry to be adopted for the analysis includes:

- A revised design with a road level of 286.23 m AHD at the bridge crossing;
- 1m deep bridge deck;
- 1.3m high crash barrier;
- 1.0m width piers at 18m spacing;
- No fill on the western side of Young Rd;
- Abutments located at Chainage 4166.612 and 4260.

A cross section along the proposed bridge crossing is shown in Figure 6 below. (Source: Geolyse, 2015). Note: the natural surface is based on LiDAR topographic data.

Figure 6: Proposed Bridge Geometry



Option C Model Results

The MIKE11 model was run for the full range of design events including the 5%, 2%, 1%, 0.5% AEP and PMF events.

The modelling indicated that compared to existing flood levels, the proposed road alignment will increase flood levels upstream of the proposed bridge by 1.07m in the 1%AEP event, with increases in flood levels extending to the upstream end of the hydraulic model as noted in Figure 7. At Chainage 0 of the Lachlan River levels increases by 0.35m in the 1%AEP event. The flood affectation is likely to extend to properties further upstream on the current available study area.



Figure 7: 1% AEP Water Surface Level along Lachlan River

Figure 8: PMF Water Surface Level along Lachlan River



In the 5%AEP event levels along Lachlan River increase by 0.52m upstream of the proposed bridge, and 0.23m at Chainage 0.

It is noted that the proposed bridge crossing is inundated even in frequent events with over 3.2m of flooding over the bridge deck level in the 5%AEP, 6.1m in the 1%AEP, and 11.2m in the PMF.

Along Waugoola Creek, in the vicinity of Lachlan River, the MIKE11 model results indicate increases of 0.35m and 0.23m in the 1%AEP event and 5%AEP event respectively.

Table 2 – Existing Flood Level

Location		Existing Flood Level (m)					
	Chainage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
Lachlan River	0	290.92	292.41	293.54	294.71	298.57	
Lachlan River	4678	288.93	290.35	291.46	292.62	297.03	
Lachlan River	5050	288 77	289 99	290 94	291 87	294 97	
 Immediately downstream of existing bridge 	5050	200.77	203.33	230.31	231.07	251.57	
Waugoola Creek	0	290.88	292.34	293.50	294.70	298.74	
Waugoola Creek	1480	290.87	292.34	293.50	294.70	298.74	

Table 3 – Increase in Flood Level as a result of Option C Proposed Road Alignment

Location		Increase in Flood Level (m) - Option C					
	Chainage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
Lachlan River – Upstream end	0	0.23	0.41	0.33	0.24	0.37	
Lachlan River –Upstream of proposed bridge	4678	0.52	1.36	1.07	0.87	0.72	
Lachlan River –Immediately downstream of existing bridge	5050	0.07	-0.01	-0.02	-0.02	0.03	
Waugoola Creek	0	0.23	0.44	0.35	0.26	0.38	
Waugoola Creek	1480	0.23	0.44	0.35	0.26	0.38	

As noted in Table 1 the Probable Maximum Flood results in an increase of 0.72m upstream of the proposed Lachlan River Bridge, and 0.38m along Waugoola Creek.

It is noted that the depth of flow at Chainage 4986 ranges from 13.1m (5%AEP) to 20.6m (PMF). At the same location the 1%AEP flood depth is approximately 15.3m.

Tabulated results of post developed flood levels and afflux are presented in Appendix G and H.

5. CONCLUSION

The MIKE11 hydrodynamic model previously utilised for the Cowra and Gooloogong Floodplain Risk Management Study and Plan was used to provide an initial assessment of the flooding impacts of the proposed Cowra bypass. The model was run for the existing and post developed cases and flood levels and afflux were reported for the full range of flood events including the 5%, 2%, 1%, 0.5% and PMF event.

An initial validation run was carried out for the 1% AEP event and the existing flood levels from the Cowra and Gooloogong Floodplain Risk Management Study and Plan (SMEC, 2006) were able to be reproduced within +-20mm for the Lachlan River.

The proposed Cowra Bypass also crosses Waugoola Creek however this was not assessed due to the following reasons:

- The crossing location was beyond the extent of the MIKE11 model and river cross sections could not be reliably extrapolated;
- There was a lack of available ground level data at the crossing location to be able to produce adequate cross sections to model the flooding at this location.

However flood levels along Waugoola Creek were extracted from cross sections close to the Lachlan River and compared against the preliminary design drawings by GHD dated November 2012 in a preliminary assessment. These levels indicated that the proposed road is subject to flooding in the 1%AEP flood event and the post road alignment will need to be amended to prevent inundation in the 1%AEP event.

The preliminary MIKE11 flood modelling undertaken in the current study indicate 1%AEP increases in flood levels immediately upstream of the proposed Lachlan River crossing of 2.33, 1.39, and 1.07m for the Option A, B and C respectively. Therefore the modelling has indicated that of the three options Option C has the least impact on surrounding areas.

For all these three options the proposed road alignment is overtopped in events more frequent than the 5%AEP. In the latest Option C results, flood depths of 3.2m, 6.1m, and 11.2m occur in the 5%AEP, 1%AEP, and PMF events respectively. Flood levels immediately upstream of the proposed bridge increase by 0.52m, 1.36m, 1.07m, 0.87m and 0.72m in the 5%AEP, 2%AEP, 1%AEP, 0.5%AEP and PMF respectively (Option C results).

Again in Option C the results at chainage 0 show flood level increases of 0.33m in the 1%AEP indicating that the afflux is likely to extend beyond the extent of the model. Downstream of the proposed bridge there are only minor increases, generally less than 0.02m. At Waugoola Creek, in the vicinity of Lachlan River, flood levels increase as a result of the proposed Lachlan River crossing with increases of about 0.35m in the 1%AEP flood event.

The backwater resulting from the proposed bridge may impact on several properties situated upstream of the proposed bridge crossing and it is recommended that floodmaps highlighting these increases in levels should be prepared prior to detailed design of the Cowra bypass. The risk to these properties was not part of the scope of this report and the floor levels would need to be surveyed to be able to assess the flooding impact.



GHD (2012), Cowra Traffic Relief Route - Plan and Longitudinal Sections, Cowra Shire Council.

SMEC (2006), Cowra and Gooloogong Floodplain Risk Management Study and Plan Vol1,Cowra Shire Council.

SMEC (2006), Cowra and Gooloogong Floodplain Risk Management Study and Plan Vol2,Cowra Shire Council.

APPENDIX A –CROSS SECTIONS AND PROPOSED ROAD



WAUGOOLA -Chainage 0



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WAUGOOLA -Chainage 0.912

WAUGOOLA -Chainage 1.48



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LACHLAN - Chainage 4.658

APPENDIX B: EXISTING FLOOD LEVELS

Lachlan River - Existing Flood Levels

Chainaga	Flood Level (m)					
Chanage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
0	290.92	292.41	293.55	294.71	298.57	
428	290.87	292.34	293.50	294.70	298.74	
428	290.87	292.34	293.50	294.70	298.74	
697.5	290.76	292.19	293.32	294.52	298.57	
967	290.63	292.02	293.14	294.30	298.36	
1458	290.36	291.64	292.64	293.68	297.62	
1917	290.17	291.55	292.61	293.72	297.84	
2204.5	290.10	291.52	292.58	293.70	297.87	
2492	290.00	291.45	292.53	293.66	297.85	
2904	289.87	291.35	292.43	293.56	297.78	
3316	289.77	291.25	292.32	293.45	297.69	
3728	289.59	291.08	292.15	293.29	297.56	
4187	289.37	290.82	291.90	293.05	297.36	
4678	288.93	290.35	291.46	292.62	297.03	
4986	288.80	290.06	291.03	292.09	296.36	
5050	288.77	289.99	290.94	291.87	294.97	
5300	288.66	289.82	290.72	291.62	294.57	
5300	288.66	289.82	290.72	291.62	294.57	
5517	288.55	289.68	290.57	291.43	294.31	
5826	288.38	289.45	290.29	291.11	293.88	
5826	288.38	289.45	290.29	291.11	293.88	
6127	288.24	289.28	290.13	290.96	293.78	
6127	288.24	289.28	290.13	290.96	293.78	
6444	288.00	289.01	289.85	290.67	293.46	
6444	288.00	289.01	289.85	290.67	293.46	
6836	287.89	288.86	289.68	290.47	293.20	
6836	287.89	288.86	289.68	290.47	293.20	
6886	287.86	288.85	289.66	290.43	293.10	
6902	287.79	288.76	289.57	290.37	293.08	
6937	287.75	288.72	289.54	290.34	293.10	
6937	287.75	288.72	289.54	290.34	293.10	
7166	287.68	288.60	289.40	290.20	292.96	

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Chainage	Flood Level (m)					
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
7166	287.68	288.60	289.40	290.20	292.96	
7443	287.55	288.43	289.23	290.03	292.82	
7720	287.34	288.19	288.97	289.78	292.63	
7720	287.34	288.19	288.97	289.78	292.63	
8203	287.02	287.86	288.70	289.55	292.51	
8203	287.02	287.86	288.70	289.55	292.51	
8492	286.86	287.74	288.60	289.48	292.51	
8781	286.73	287.65	288.52	289.40	292.46	
8781	286.73	287.65	288.52	289.40	292.46	
9080.5	286.64	287.55	288.43	289.33	292.41	
9380	286.43	287.39	288.29	289.20	292.30	

Waugoola Creek- Existing Flood Levels

Chainage	Flood Level (m)					
Unantage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
0	290.88	292.34	293.50	294.70	298.74	
456	290.87	292.34	293.50	294.70	298.74	
912	290.87	292.34	293.50	294.70	298.74	
1196	290.87	292.34	293.50	294.70	298.74	
1480	290.87	292.34	293.50	294.70	298.74	

Left_Runner - Existing Flood Levels

Chainage	Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	288.00	289.42	290.30	291.12	293.80		
300	287.71	289.17	290.17	291.04	293.77		
300	287.71	289.17	290.17	291.04	293.77		
585	287.44	289.04	290.06	290.92	293.73		
585	287.44	289.04	290.06	290.92	293.73		
720	287.14	288.98	289.96	290.81	293.62		
720	287.14	288.98	289.96	290.81	293.62		
870	287.14	288.90	289.84	290.65	293.40		

Chainage	Flood Level (m)					
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
870	287.14	288.90	289.84	290.65	293.40	
1190	287.07	288.60	289.50	290.32	293.08	
1190	287.07	288.60	289.50	290.32	293.08	
1298	287.07	288.54	289.40	290.22	293.06	
1298	287.07	288.54	289.40	290.22	293.06	
1403	287.07	288.52	289.36	290.17	292.95	
1403	287.07	288.52	289.36	290.17	292.95	
1860	286.90	288.12	288.94	289.75	292.62	
1860	286.90	288.12	288.94	289.75	292.62	
2339	286.55	287.87	288.74	289.61	292.58	
2339	286.55	287.87	288.74	289.61	292.58	
2622	286.53	287.75	288.63	289.51	292.52	

FarLeft_Run - Existing Flood Levels

Chainage	Increase in Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	289.32	289.32	289.32	290.10	293.15			
270	287.94	287.99	288.92	289.96	293.01			
270	287.94	287.99	288.92	289.96	293.01			
380	287.19	287.94	288.91	289.94	292.93			
380	287.19	287.94	288.91	289.94	292.93			
790	286.78	287.90	288.81	289.71	292.61			
790	286.78	287.90	288.81	289.71	292.61			
1260	286.55	287.87	288.74	289.61	292.58			

APPENDIX C: OPTION A FLOOD LEVELS

Chainage	Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	291.19	292.92	294.59	296.20	301.89		
428	291.14	292.89	294.59	296.24	302.03		
428	291.14	292.89	294.59	296.24	302.03		
697.5	291.04	292.78	294.50	296.15	301.98		
967	290.92	292.67	294.38	296.05	301.92		
1458	290.69	292.40	294.07	295.74	301.63		
1917	290.58	292.42	294.15	295.85	301.78		
2204.5	290.58	292.42	294.16	295.87	301.79		
2492	290.52	292.40	294.14	295.85	301.79		
2904	290.40	292.33	294.09	295.81	301.76		
3316	290.26	292.26	294.04	295.76	301.73		
3728	290.10	292.20	293.99	295.72	301.69		
4187	289.93	292.09	293.90	295.64	301.62		
4678	289.59	291.95	293.79	295.53	301.52		
4986	288.87	290.03	290.99	292.06	296.30		
5050	288.84	289.96	290.90	291.84	294.96		
5300	288.72	289.78	290.69	291.59	294.52		
5300	288.72	289.78	290.69	291.59	294.52		
5517	288.60	289.65	290.54	291.41	294.26		
5826	288.43	289.42	290.26	291.08	293.83		
5826	288.43	289.42	290.26	291.08	293.83		
6127	288.29	289.27	290.11	290.95	293.74		
6127	288.29	289.27	290.11	290.95	293.74		
6444	288.05	288.99	289.83	290.66	293.43		
6444	288.05	288.99	289.83	290.66	293.43		
6836	287.94	288.85	289.67	290.47	293.17		
6836	287.94	288.85	289.67	290.47	293.17		
6886	287.92	288.85	289.64	290.43	293.07		
6902	287.85	288.75	289.55	290.37	293.04		
6937	287.81	288.71	289.53	290.35	293.06		
6937	287.81	288.71	289.53	290.35	293.06		
7166	287.74	288.60	289.39	290.20	292.93		
7166	287.74	288.60	289.39	290.20	292.93		

Lachlan River - Option A Flood Levels

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7443	287.58	288.42	289.21	290.02	292.78
7720	287.38	288.17	288.95	289.76	292.59
7720	287.38	288.17	288.95	289.76	292.59
8203	287.07	287.85	288.69	289.54	292.47
8203	287.07	287.85	288.69	289.54	292.47
8492	286.92	287.70	288.56	289.44	292.46
8781	286.81	287.63	288.51	289.40	292.42
8781	286.81	287.63	288.51	289.40	292.42
9080.5	286.68	287.53	288.42	289.32	292.38
9380	286.45	287.36	288.28	289.19	292.26

Waugoola Creek- Option A Flood Levels

Chainage	Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	291.15	292.89	294.60	296.24	302.03			
456	291.14	292.89	294.60	296.24	302.03			
912	291.14	292.89	294.59	296.24	302.03			
1196	291.14	292.89	294.59	296.24	302.03			
1480	291.14	292.89	294.59	296.24	302.03			

Left_Runner - Option A Flood Levels

Chainaga	Flood Level (m)							
Chanage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	288.00	289.37	290.27	291.10	293.75			
300	287.71	289.12	290.15	291.02	293.73			
300	287.71	289.12	290.15	291.02	293.73			
585	287.44	289.00	290.04	290.91	293.68			
585	287.44	289.00	290.04	290.91	293.68			
720	287.26	288.94	289.94	290.79	293.58			
720	287.26	288.94	289.94	290.79	293.58			
870	287.24	288.87	289.82	290.64	293.36			
870	287.24	288.87	289.82	290.64	293.36			
1190	287.15	288.58	289.48	290.32	293.05			
1190	287.15	288.58	289.48	290.32	293.05			
1298	287.14	288.51	289.38	290.22	293.03			
1298	287.14	288.51	289.38	290.22	293.03			

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

Chainage	Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
1403	287.14	288.49	289.35	290.17	292.91			
1403	287.14	288.49	289.35	290.17	292.91			
1860	286.96	288.10	288.92	289.74	292.58			
1860	286.96	288.10	288.92	289.74	292.58			
2339	286.64	287.85	288.73	289.60	292.55			
2339	286.64	287.85	288.73	289.60	292.55			
2622	286.56	287.72	288.61	289.49	292.48			

FarLeft_Run - Option A Flood Levels

Chainage	Increase in Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	289.32	289.32	289.32	290.09	293.11			
270	287.87	287.98	288.90	289.94	292.98			
270	287.87	287.98	288.90	289.94	292.98			
380	287.23	287.91	288.89	289.92	292.89			
380	287.23	287.91	288.89	289.92	292.89			
790	286.78	287.88	288.80	289.69	292.57			
790	286.78	287.88	288.80	289.69	292.57			
1260	286.64	287.85	288.73	289.60	292.55			

APPENDIX D: OPTION A INCREASES TO FLOOD LEVELS

Lachlan	River ·	- Option	A	Increases	in	Flood Leve	ls
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Chainaga	Increase in Flood Level (m)							
Chainage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	0.26	0.51	1.04	1.49	3.32			
428	0.27	0.56	1.09	1.55	3.29			
428	0.27	0.56	1.09	1.55	3.29			
697.5	0.28	0.59	1.17	1.63	3.41			
967	0.30	0.66	1.24	1.75	3.56			
1458	0.34	0.76	1.43	2.06	4.01			
1917	0.42	0.87	1.54	2.13	3.93			
2204.5	0.48	0.91	1.58	2.16	3.92			
2492	0.52	0.94	1.62	2.19	3.94			
2904	0.53	0.98	1.66	2.24	3.98			
3316	0.50	1.02	1.72	2.31	4.04			
3728	0.51	1.12	1.84	2.43	4.13			
4187	0.55	1.27	2.00 2.58		4.26			
4678	0.66	1.59	2.33	2.33 2.91				
4986	0.07	-0.03	-0.04	-0.04	-0.06			
5050	0.07	-0.03	-0.03	-0.04	-0.01			
5300	0.06	-0.03	-0.03	-0.03	-0.04			
5300	0.06	-0.03	-0.03	-0.03	-0.04			
5517	0.05	-0.03	-0.03	-0.03	-0.05			
5826	0.05	-0.03	-0.03	-0.03	-0.05			
5826	0.05	-0.03	-0.03	-0.03	-0.05			
6127	0.06	-0.02	-0.01	-0.01	-0.04			
6127	0.06	-0.02	-0.01	-0.01	-0.04			
6444	0.05	-0.02	-0.02	-0.01	-0.03			
6444	0.05	-0.02	-0.02	-0.01	-0.03			
6836	0.05	0.00	-0.01	0.00	-0.03			
6836	0.05	0.00	-0.01	0.00	-0.03			
6886	0.06	0.02	-0.02	0.00	-0.03			
6902	0.06	0.00	-0.02	0.00	-0.04			
6937	0.06	0.00	-0.01	0.01	-0.04			
6937	0.06	0.00	-0.01	0.01	-0.04			
7166	0.05	0.00	-0.01	0.00	-0.03			

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

Chainago	Increase in Flood Level (m)							
Chanage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
7166	0.05	0.00	-0.01	0.00	-0.03			
7443	0.03	-0.01	-0.02	-0.01	-0.04			
7720	0.04	-0.02	-0.02	-0.01	-0.04			
7720	0.04	-0.02	-0.02	-0.01	-0.04			
8203	0.05	-0.02	-0.01	-0.01	-0.04			
8203	0.05	-0.02	-0.01	-0.01	-0.04			
8492	0.05	-0.05	-0.04	-0.04	-0.05			
8781	0.08	-0.02	-0.01	0.00	-0.04			
8781	0.08	-0.02	-0.01	0.00	-0.04			
9080.5	0.04	-0.03	-0.01	-0.01	-0.03			
9380	0.02	-0.03	-0.01	0.00	-0.04			

Waugoola Creek- Option A Increases in Flood Levels

Chainage	Increase in Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	0.27	0.55	1.09	1.54	3.29			
456	0.27	0.55	1.09	1.54	3.29			
912	0.27	0.55	1.09	1.55	3.29			
1196	0.27	0.56	1.09	1.55	3.29			
1480	0.27	0.56	1.09	1.55	3.29			

Left_Runner - Option A Increases in Flood Levels

Chainage	Increase in Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	0.00	-0.05	-0.03	-0.02	-0.04			
300	0.00	-0.05	-0.03	-0.02	-0.04			
300	0.00	-0.05	-0.03	-0.02	-0.04			
585	0.00	-0.04	-0.02	-0.02	-0.04			
585	0.00	-0.04	-0.02	-0.02	-0.04			
720	0.13	-0.04	-0.02	-0.01	-0.04			
720	0.13	-0.04	-0.02	-0.01	-0.04			
870	0.11	-0.04	-0.02	-0.01	-0.03			
870	0.11	-0.04	-0.02	-0.01	-0.03			

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
1190	0.08	-0.03	-0.01	-0.01	-0.03		
1190	0.08	-0.03	-0.01	-0.01	-0.03		
1298	0.08	-0.03	-0.02	0.00	-0.03		
1298	0.08	-0.03	-0.02	0.00	-0.03		
1403	0.07	-0.03	-0.01	0.00	-0.03		
1403	0.07	-0.03	-0.01	0.00	-0.03		
1860	0.06	-0.02	-0.02	-0.01	-0.04		
1860	0.06	-0.02	-0.02	-0.01	-0.04		
2339	0.09	-0.02	-0.01	-0.01	-0.03		
2339	0.09	-0.02	-0.01	-0.01	-0.03		
2622	0.03	-0.02	-0.02	-0.02	-0.04		

FarLeft_Run - Option A Increases in Flood Levels

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	0.00	0.00	0.00	-0.02	-0.04		
270	-0.07	-0.02	-0.02	-0.02	-0.03		
270	-0.07	-0.02	-0.02	-0.02	-0.03		
380	0.04	-0.03	-0.02	-0.02	-0.03		
380	0.04	-0.03	-0.02	-0.02	-0.03		
790	0.00	-0.03	-0.01	-0.01	-0.03		
790	0.00	-0.03	-0.01	-0.01	-0.03		
1260	0.09	-0.02	-0.01	-0.01	-0.03		

APPENDIX E: OPTION B FLOOD LEVELS

Chainage			Flood Level (m))	
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF
0	291.09	292.58	294.02	295.51	300.96
428	291.04	292.52	294.01	295.53	301.13
428	291.04	292.52	294.01	295.53	301.13
697.5	290.94	292.39	293.88	295.41	301.06
967	290.81	292.25	293.73	295.27	300.97
1458	290.57	291.91	293.34	294.86	300.60
1917	290.42	291.91	293.41	294.99	300.78
2204.5	290.41	291.91	293.42	295.00	300.80
2492	290.34	291.87	293.39	294.98	300.80
2904	290.19	291.77	293.31	294.91	300.76
3316	290.01	291.67	293.24	294.85	300.71
3728	289.83	291.56	293.16	294.79	300.67
4187	289.61	291.41	293.03	294.67	300.58
4678	289.20	291.17	292.85	294.52	300.45
4986	288.87	290.04	290.99	292.06	296.31
5050	288.84	289.97	290.90	291.84	294.96
5300	288.72	289.79	290.70	291.59	294.52
5300	288.72	289.79	290.70	291.59	294.52
5517	288.60	289.66	290.54	291.41	294.26
5826	288.43	289.43	290.26	291.08	293.83
5826	288.43	289.43	290.26	291.08	293.83
6127	288.29	289.28	290.12	290.95	293.74
6127	288.29	289.28	290.12	290.95	293.74
6444	288.05	289.00	289.83	290.66	293.43
6444	288.05	289.00	289.83	290.66	293.43
6836	287.94	288.86	289.67	290.47	293.17
6836	287.94	288.86	289.67	290.47	293.17
6886	287.92	288.83	289.64	290.43	293.07
6902	287.85	288.75	289.56	290.37	293.05
6937	287.82	288.72	289.53	290.35	293.07
6937	287.82	288.72	289.53	290.35	293.07
7166	287.74	288.60	289.39	290.20	292.93
7166	287.74	288.60	289.39	290.20	292.93

Lachlan River - Option B Flood Levels

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

7443	287.58	288.43	289.21	290.02	292.79
7720	287.38	288.18	288.96	289.77	292.60
7720	287.38	288.18	288.96	289.77	292.60
8203	287.07	287.85	288.69	289.54	292.47
8203	287.07	287.85	288.69	289.54	292.47
8492	286.92	287.70	288.56	289.45	292.47
8781	286.81	287.64	288.51	289.40	292.43
8781	286.81	287.64	288.51	289.40	292.43
9080.5	286.68	287.53	288.42	289.32	292.38
9380	286.45	287.37	288.29	289.20	292.26

Waugoola Creek- Option B Flood Levels

Chainage	Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	291.04	292.52	294.01	295.53	301.13		
456	291.04	292.52	294.01	295.53	301.13		
912	291.04	292.52	294.01	295.53	301.13		
1196	291.04	292.52	294.01	295.53	301.13		
1480	291.04	292.52	294.01	295.53	301.13		

Left_Runner - Option B Flood Levels

Chainaga	Flood Level (m)						
Chanage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	288.00	289.39	290.27	291.10	293.76		
300	287.71	289.13	290.15	291.02	293.73		
300	287.71	289.13	290.15	291.02	293.73		
585	287.44	289.01	290.04	290.91	293.69		
585	287.44	289.01	290.04	290.91	293.69		
720	287.27	288.95	289.94	290.79	293.59		
720	287.27	288.95	289.94	290.79	293.59		
870	287.25	288.88	289.82	290.64	293.37		
870	287.25	288.88	289.82	290.64	293.37		
1190	287.15	288.59	289.48	290.32	293.05		
1190	287.15	288.59	289.48	290.32	293.05		
1298	287.15	288.52	289.39	290.22	293.03		
1298	287.15	288.52	289.39	290.22	293.03		

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

Chainage	Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
1403	287.14	288.50	289.35	290.17	292.91		
1403	287.14	288.50	289.35	290.17	292.91		
1860	286.96	288.11	288.92	289.74	292.58		
1860	286.96	288.11	288.92	289.74	292.58		
2339	286.64	287.86	288.73	289.60	292.55		
2339	286.64	287.86	288.73	289.60	292.55		
2622	286.56	287.73	288.61	289.49	292.48		

FarLeft_Run - Option B Flood Levels

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	289.32	289.32	289.32	290.09	293.11		
270	287.94	287.98	288.90	289.94	292.98		
270	287.94	287.98	288.90	289.94	292.98		
380	287.23	287.92	288.89	289.92	292.90		
380	287.23	287.92	288.89	289.92	292.90		
790	286.78	287.89	288.80	289.70	292.57		
790	286.78	287.89	288.80	289.70	292.57		
1260	286.64	287.86	288.73	289.60	292.55		

APPENDIX F: OPTION B INCREASES TO FLOOD LEVELS

Increase in Flood Level (m) Chainage **2%AEP 5%AEP 1%AEP** 0.5%AEP **PMF** 0 0.16 0.16 0.48 0.80 2.40 0.83 428 0.17 0.18 0.51 2.39 428 0.17 0.18 0.51 0.83 2.39 697.5 0.18 0.20 0.55 0.89 2.49 0.18 0.23 0.60 0.97 2.61 967 1458 0.21 0.27 0.70 1.18 2.98 1917 0.80 1.27 2.94 0.25 0.35 2204.5 0.31 0.39 0.84 1.30 2.93 2492 0.34 0.42 0.86 1.32 2.94 2904 0.32 0.42 0.89 1.35 2.98 3316 0.25 0.42 0.92 1.40 3.03 3728 0.24 1.50 0.49 1.02 3.11 0.24 0.58 1.62 3.22 4187 1.13 4678 0.28 1.39 1.90 3.42 0.81 -0.03 4986 0.07 -0.02 -0.03 -0.05 5050 0.07 -0.02 -0.03 -0.04 0.00 5300 0.06 -0.02 -0.03 -0.03 -0.04 5300 0.06 -0.02 -0.03 -0.03 -0.04 5517 0.05 -0.02 -0.02 -0.02 -0.04 5826 0.05 -0.02 -0.03 -0.03 -0.05 5826 0.05 -0.02 -0.03 -0.03 -0.05 6127 0.06 -0.01 -0.01 -0.01 -0.04 0.06 -0.01 -0.04 6127 -0.01 -0.01 6444 0.05 -0.01 -0.02 -0.01 -0.03 0.05 -0.01 6444 -0.01 -0.02 -0.03

Lachlan River – Option B Increases in Flood Levels

6836

6836 6886

6902

6937

6937

7166

0.05

0.05

0.06

0.06

0.06

0.06

0.05

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

0.01

0.01

-0.01

-0.02

-0.01

-0.01

0.01

-0.01

-0.01

-0.02

-0.01

-0.01

-0.01

-0.01

0.00

0.00

0.00

0.01

0.01

0.01

0.00

-0.03

-0.03

-0.03

-0.04

-0.03

-0.03

-0.03

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
7166	0.05	0.01	-0.01	0.00	-0.03		
7443	0.03	0.00	-0.02	-0.01	-0.03		
7720	0.04	-0.01	-0.02	-0.01	-0.03		
7720	0.04	-0.01	-0.02	-0.01	-0.03		
8203	0.05	-0.01	0.00	-0.01	-0.04		
8203	0.05	-0.01	0.00	-0.01	-0.04		
8492	0.06	-0.04	-0.04	-0.03	-0.04		
8781	0.08	-0.01	-0.01	0.00	-0.04		
8781	0.08	-0.01	-0.01	0.00	-0.04		
9080.5	0.04	-0.02	-0.01	0.00	-0.03		
9380	0.02	-0.02	-0.01	0.00	-0.04		

Waugoola Creek- Option B Increases in Flood Levels

Chainage	Increase in Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	0.17	0.18	0.51	0.83	2.39			
456	0.17	0.18	0.51	0.83	2.39			
912	0.17	0.18	0.51	0.83	2.39			
1196	0.17	0.18	0.51	0.83	2.39			
1480	0.17	0.18	0.51	0.83	2.39			

Left_Runner - Option B Increases in Flood Levels

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	0.00	-0.03	-0.03	-0.02	-0.04		
300	0.00	-0.03	-0.02	-0.02	-0.04		
300	0.00	-0.03	-0.02	-0.02	-0.04		
585	0.00	-0.03	-0.02	-0.01	-0.04		
585	0.00	-0.03	-0.02	-0.01	-0.04		
720	0.13	-0.03	-0.02	-0.01	-0.04		
720	0.13	-0.03	-0.02	-0.01	-0.04		
870	0.11	-0.02	-0.02	-0.01	-0.03		
870	0.11	-0.02	-0.02	-0.01	-0.03		

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
1190	0.08	-0.02	-0.01	0.00	-0.03		
1190	0.08	-0.02	-0.01	0.00	-0.03		
1298	0.08	-0.02	-0.01	0.00	-0.03		
1298	0.08	-0.02	-0.01	0.00	-0.03		
1403	0.08	-0.02	-0.01	0.00	-0.03		
1403	0.08	-0.02	-0.01	0.00	-0.03		
1860	0.06	-0.02	-0.02	-0.01	-0.03		
1860	0.06	-0.02	-0.02	-0.01	-0.03		
2339	0.09	-0.01	-0.01	-0.01	-0.03		
2339	0.09	-0.01	-0.01	-0.01	-0.03		
2622	0.03	-0.02	-0.02	-0.02	-0.04		

FarLeft_Run - Option B Increases in Flood Levels

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	0.00	0.00	0.00	-0.01	-0.03		
270	0.00	-0.01	-0.02	-0.02	-0.03		
270	0.00	-0.01	-0.02	-0.02	-0.03		
380	0.04	-0.02	-0.02	-0.02	-0.03		
380	0.04	-0.02	-0.02	-0.02	-0.03		
790	0.00	-0.02	-0.01	-0.01	-0.03		
790	0.00	-0.02	-0.01	-0.01	-0.03		
1260	0.09	-0.01	-0.01	-0.01	-0.03		

APPENDIX G: OPTION C FLOOD LEVELS

Lachlan River – Option C Proposed Flood Levels

Chainage	Flood Level (m AHD)				
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF
0	291.15	292.82	293.87	294.95	298.94
428	291.10	292.78	293.85	294.96	299.12
428	291.10	292.78	293.85	294.96	299.12
697.5	291.00	292.66	293.70	294.81	298.98
967	290.88	292.54	293.55	294.61	298.81
1458	290.65	292.24	293.12	294.07	298.15
1917	290.52	292.26	293.19	294.20	298.41
2204.5	290.52	292.26	293.19	294.21	298.44
2492	290.46	292.23	293.16	294.18	298.42
2904	290.33	292.15	293.07	294.08	298.34
3316	290.18	292.08	292.99	293.99	298.25
3728	290.00	292.00	292.90	293.89	298.17
4187	289.82	291.88	292.74	293.72	298.00
4678	289.45	291.71	292.53	293.49	297.75
4954	289.45	291.67	292.37	293.26	297.40
4986	288.87	290.05	291.03	292.07	296.36
5050	288.84	289.98	290.92	291.85	295.00
5300	288.72	289.80	290.72	291.60	294.55
5300	288.72	289.80	290.72	291.60	294.55
5517	288.60	289.67	290.56	291.42	294.29
5826	288.43	289.44	290.29	291.09	293.86
5826	288.43	289.44	290.29	291.09	293.86
6127	288.29	289.28	290.15	290.96	293.77
6127	288.29	289.28	290.15	290.96	293.77
6444	288.05	289.01	289.88	290.67	293.46
6444	288.05	289.01	289.88	290.67	293.46
6836	287.94	288.87	289.68	290.48	293.20
6836	287.94	288.87	289.68	290.48	293.20
6886	287.92	288.84	289.65	290.43	293.10
6902	287.84	288.75	289.56	290.36	293.07
6937	287.81	288.72	289.54	290.35	293.09
6937	287.81	288.72	289.54	290.35	293.09
7166	287.73	288.61	289.41	290.21	292.96
7166	287.73	288.61	289.41	290.21	292.96

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Chainage	Flood Level (m AHD)					
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF	
7443	287.58	288.44	289.24	290.03	292.81	
7720	287.38	288.18	288.97	289.77	292.62	
7720	287.38	288.18	288.97	289.77	292.62	
8203	287.06	287.86	288.70	289.55	292.50	
8203	287.06	287.86	288.70	289.55	292.50	
8492	286.92	287.71	288.57	289.46	292.50	
8781	286.81	287.65	288.52	289.41	292.46	
8781	286.81	287.65	288.52	289.41	292.46	
9080.5	286.68	287.54	288.43	289.33	292.41	
9380	286.45	287.37	288.30	289.21	292.29	
9740	286.19	287.22	288.18	289.11	292.28	
10100	286.06	287.16	288.15	289.09	292.27	
10100	286.06	287.16	288.15	289.09	292.27	
10250	285.99	287.11	288.11	289.05	292.23	

Waugoola Creek- Option C Proposed Flood Levels

Chainage	Flood Level (m AHD)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	291.11	292.78	293.85	294.96	299.12		
456	291.11	292.78	293.85	294.96	299.12		
912	291.10	292.78	293.85	294.96	299.12		
1196	291.10	292.78	293.85	294.96	299.12		
1480	291.10	292.78	293.85	294.96	299.12		

Left_Runner – Option C Proposed Flood Levels

Chainage	Flood Level (m AHD)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	287.70	289.40	290.30	291.11	293.78		
300	287.42	289.15	290.18	291.03	293.76		
300	287.42	289.15	290.18	291.03	293.76		
585	287.34	289.02	290.07	290.91	293.71		
585	287.34	289.02	290.07	290.91	293.71		

30012410-SMEC [COWRA BYPASS FLOOD MODELLING

Chainaga	Flood Level (m AHD)						
Chanage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
720	287.27	288.96	289.97	290.80	293.61		
720	287.27	288.96	289.97	290.80	293.61		
870	287.25	288.89	289.86	290.65	293.39		
870	287.25	288.89	289.86	290.65	293.39		
1190	287.15	288.60	289.51	290.33	293.08		
1190	287.15	288.60	289.51	290.33	293.08		
1298	287.15	288.53	289.42	290.23	293.06		
1298	287.15	288.53	289.42	290.23	293.06		
1403	287.14	288.51	289.37	290.18	292.94		
1403	287.14	288.51	289.37	290.18	292.94		
1860	286.96	288.12	288.93	289.75	292.61		
1860	286.96	288.12	288.93	289.75	292.61		
2339	286.64	287.87	288.74	289.61	292.58		
2339	286.64	287.87	288.74	289.61	292.58		
2622	286.56	287.74	288.62	289.50	292.51		
2905	286.53	287.64	288.52	289.40	292.45		
2905	286.53	287.64	288.52	289.40	292.45		
3204.5	286.43	287.50	288.38	289.27	292.35		
3504	286.16	287.23	288.17	289.08	292.21		
3904	286.06	287.16	288.15	289.09	292.27		

FarLeft_Run - Option C Proposed Flood Levels

Chainage	Flood Level (mAHD)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	289.32	289.32	289.32	290.10	293.14		
270	287.90	287.99	288.91	289.95	293.01		
270	287.90	287.99	288.91	289.95	293.01		
380	287.23	287.93	288.90	289.93	292.92		
380	287.23	287.93	288.90	289.93	292.92		
790	286.67	287.90	288.81	289.71	292.60		
790	286.67	287.90	288.81	289.71	292.60		
1260	286.64	287.87	288.74	289.61	292.58		

APPENDIX H: OPTION C INCREASES TO FLOOD LEVELS

Lachlan River – Option C Increases in Flood Levels

Chainaga	Increase in Flood Level (m)						
Chainage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	0.23	0.41	0.33	0.24	0.37		
428	0.23	0.44	0.35	0.26	0.38		
428	0.23	0.44	0.35	0.26	0.38		
697.5	0.24	0.47	0.38	0.29	0.41		
967	0.25	0.52	0.42	0.31	0.45		
1458	0.29	0.60	0.48	0.39	0.53		
1917	0.35	0.71	0.58	0.48	0.57		
2204.5	0.43	0.74	0.61	0.51	0.57		
2492	0.46	0.78	0.63	0.52	0.57		
2904	0.46	0.80	0.64	0.52	0.56		
3316	0.41	0.83	0.67	0.54	0.56		
3728	0.41	0.92	0.75	0.60	0.61		
4187	0.45	1.06	0.84	0.67	0.64		
4678	0.52	1.36	1.07	0.87	0.72		
4954							
4986	0.07	-0.01	0.00	-0.02	0.00		
5050	0.07	-0.01	-0.02	-0.02	0.03		
5300	0.06	-0.02	0.00	-0.02	-0.02		
5300	0.06	-0.02	0.00	-0.02	-0.02		
5517	0.05	-0.01	-0.01	-0.01	-0.02		
5826	0.05	-0.01	0.00	-0.02	-0.02		
5826	0.05	-0.01	0.00	-0.02	-0.02		
6127	0.06	0.00	0.02	0.00	-0.01		
6127	0.06	0.00	0.02	0.00	-0.01		
6444	0.05	0.00	0.03	0.00	0.00		
6444	0.05	0.00	0.03	0.00	0.00		
6836	0.06	0.02	0.01	0.01	0.00		
6836	0.06	0.02	0.01	0.01	0.00		
6886	0.06	0.02	0.00	0.00	0.00		
6902	0.05	0.01	0.00	0.00	-0.01		
6937	0.06	0.01	0.00	0.01	-0.01		
6937	0.06	0.01	0.00	0.01	-0.01		
7166	0.05	0.02	0.01	0.01	0.00		

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Chainaga	Increase in Flood Level (m)						
Chainage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
7166	0.05	0.02	0.01	0.01	0.00		
7443	0.03	0.01	0.01	0.00	-0.01		
7720	0.04	-0.01	0.00	-0.01	-0.01		
7720	0.04	-0.01	0.00	-0.01	-0.01		
8203	0.04	0.00	0.00	0.00	-0.01		
8203	0.04	0.00	0.00	0.00	-0.01		
8492	0.06	-0.03	-0.03	-0.02	-0.01		
8781	0.08	0.00	0.00	0.01	0.00		
8781	0.08	0.00	0.00	0.01	0.00		
9080.5	0.04	-0.01	0.00	0.01	0.00		
9380	0.02	-0.02	0.01	0.01	-0.01		
9740	-0.01	0.00	0.00	0.01	0.01		
10100	-0.04	-0.01	0.00	0.00	-0.01		
10100	-0.04	-0.01	0.00	0.00	-0.01		
10250	-0.01	-0.01	0.01	0.00	0.00		

Waugoola Creek- Option C Increases in Flood Levels

Chainage	Increase in Flood Level (m)						
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
0	0.23	0.44	0.35	0.26	0.38		
456	0.24	0.44	0.35	0.26	0.38		
912	0.23	0.44	0.35	0.26	0.38		
1196	0.23	0.44	0.35	0.26	0.38		
1480	0.23	0.44	0.35	0.26	0.38		

Left_Runner - Option C Increases in Flood Levels

Chainage	Increase in Flood Level (m)							
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF			
0	-0.30	-0.02	0.01	-0.01	-0.01			
300	-0.29	-0.02	0.01	-0.01	-0.01			
300	-0.29	-0.02	0.01	-0.01	-0.01			
585	-0.10	-0.02	0.01	-0.01	-0.02			

Chainaga	Increase in Flood Level (m)						
Chainage	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF		
585	-0.10	-0.02	0.01	-0.01	-0.02		
720	0.13	-0.02	0.01	0.00	-0.01		
720	0.13	-0.02	0.01	0.00	-0.01		
870	0.12	-0.01	0.02	0.00	-0.01		
870	0.12	-0.01	0.02	0.00	-0.01		
1190	0.08	0.00	0.02	0.01	0.00		
1190	0.08	0.00	0.02	0.01	0.00		
1298	0.08	-0.01	0.02	0.01	0.00		
1298	0.08	-0.01	0.02	0.01	0.00		
1403	0.08	-0.01	0.01	0.01	0.00		
1403	0.08	-0.01	0.01	0.01	0.00		
1860	0.06	0.00	-0.01	0.00	-0.01		
1860	0.06	0.00	-0.01	0.00	-0.01		
2339	0.09	0.00	0.00	0.00	0.00		
2339	0.09	0.00	0.00	0.00	0.00		
2622	0.06	-0.01	-0.01	-0.01	-0.01		
2905	0.13	-0.01	0.00	0.00	0.00		
2905	0.13	-0.01	0.00	0.00	0.00		
3204.5	0.13	0.00	0.00	0.00	0.00		
3504	0.06	0.00	0.00	-0.02	0.00		
3904	-0.04	-0.01	0.00	0.00	-0.01		

FarLeft_Run - Option C Increases in Flood Levels

Chainage	Increase in Flood Level (m)				
	5%AEP	2%AEP	1%AEP	0.5%AEP	PMF
0	0.00	0.00	0.00	0.00	-0.01
270	-0.04	0.00	-0.01	-0.01	0.00
270	-0.04	0.00	-0.01	-0.01	0.00
380	0.04	-0.01	-0.01	-0.01	-0.01
380	0.04	-0.01	-0.01	-0.01	-0.01
790	-0.11	0.00	0.00	0.00	-0.01
790	-0.11	0.00	0.00	0.00	-0.01
1260	0.09	0.00	0.00	0.00	0.00

APPENDIX I – DATA SUPPLIED







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