

Civil



TaylorThomsonWhitting

Flood Risk Assessment for Development Application for Proposed Luxury Resort, Wolgan Valley

for Emirates

September 2005

TTW Job No: 051349 P

Taylor Thomson Whitting (NSW) Pty Ltd Consulting Engineers ACN 113 578 377
48 Chandos Street St Leonards NSW 2065 PO Box 738 Crows Nest 1585
T 61 2 9439 7288 F 61 2 9439 3146 ttwsyd@ttw.com.au www.ttw.com.au

This document is copyright and is the property of Taylor Thomson
Whitting (NSW) Pty Ltd and must not be used without authorisation



Quality
Endorsed
Company
ISO 9001

SYDNEY

CANBERRA

MELBOURNE

QEC 22375

Table of Contents

	Page
1.0 INTRODUCTION	1
2.0 EXISTING SITE CONDITIONS.....	1
3.0 PROPOSED DEVELOPMENT	1
4.0 STORMWATER DRAINAGE SYSTEM ANALYSIS AND OVERLAND FLOW ISSUES	2
4.1 WOLGAN RIVER AND CARNE CREEK'S CATCHMENT	2
4.2 ANALYSIS AND RESULTS.....	2
5.0 CONCLUSION AND RECOMMENDATIONS	4

ATTACHMENTS:

Appendix A	(i) Proposed Sites
Appendix B	(i) Wolgan River/Carne Creek Catchment Plan including XP-RAFTS Nodes.
Appendix C	(i) -HEC-RAS Model Layout -100-year ARI Flood Extent and Flood Levels (ii) HEC-RAS Flow Profiles (Long Sections) (iii) Typical Creek Sections. (iv) HEC-RAS Detailed Output 100-year ARI storm event

1.0 INTRODUCTION

This report is submitted by Engineering Consultancy firm, Taylor Thomson Whitting (TTW) who have been engaged by Clifton Coney Group. It contains an hydrologic investigation to determine peak river flows and an hydraulic investigation to determine the flooding extent for the proposed development at Wolgan Valley.

2.0 EXISTING CONDITIONS

The existing catchment is 18,525 hectares of primarily bushland escarpment which flows north through Wolgan River and Carne Creek.

Wolgan River and Carne Creek flow through the Wolgan Valley property which contains the site for the proposed development.

The Wolgan Valley property has been used mainly as a cattle grazing property since it was established. The property has distinct areas of undulating pasture, river and creek bank flat pasture and steep bushland escarpment.

The Webb brothers who have owned the Wolgan Valley property reported that there have been previous major flood events in 1990, 1986 and 1978. The last flood event washed away the bridge link from the access road to the existing House sites.

3.0 PROPOSED DEVELOPMENT

The proposed development site is located adjacent to Wolgan River and Carne Creek's confluence zone and in an area close to the existing house sites which have not been flooded during the three major historical events.

The proposed development involves the construction of a luxury hotel, villas, units, helicopter pad, maintenance buildings, staff accommodation and their associated works such as pedestrian pathways, road works and bridgeworks. The location of the proposed sites is shown on **Appendix A(i)**.

TTW have investigated the extent of inundation caused by the 1 in 100yr average recurrence interval (ARI) event and how the 1 in 100yr ARI flood can be safely passed through the site in the long and short term without being affected by the development and providing safe access for the 100 year flood event development.

In the developed areas of the site, it is proposed that for buildings and the designated egress route the minimum freeboard above the 1 in 100 year ARI flood level calculated shown in **Table 1** below be adopted:

	FREEBOARD (mm)
Building's Habitable Floor Levels	500
Flood Egress Roads	300
Flood Egress Bridge Decks	300

Flood Egress Footpaths	150

Table 1: Minimum Freeboards

For proposed non designated egress paths the bridge and path levels will remain above the 2 year flood level.

4.0 STORMWATER DRAINAGE SYSTEM ANALYSIS AND OVERLAND FLOW ISSUES

4.1 Wolgan River and Crane Creek's Catchment

At the subject site, Wolgan River and Crane Creek has a combined upstream catchment area of 18,525 hectares with a catchment consisting of steep rocky escarpment bushland and some grazed pasture.

4.2 Analysis and Results

Hydrological modelling for the study has been undertaken using XP RAFTS, and HEC-RAS has been used to model hydraulics using the steady-state one-dimensional method.

The catchment was divided into smaller sub-catchments to reflect watershed boundaries and obtain peak flows at desired locations for the purposes of hydraulic modelling. Nodes and associated sub-catchments for the site are shown in **Appendix B (i)**.

TTW have undertaken a catchment analysis to determine the flow regime along the creek system. A rainfall runoff model has been prepared for the catchment and analysed through XP Rafts to determine the peak discharges for the 2,5,10,20,50 and 100-year storm events.

Peak flows generated by the upstream catchment at each node for the respective storm events are shown in **Table 2** below.

Summary – XP RAFTS Flows (cubic metres per second)											
Node# →	Node 9	Node 8	Node 7	Node 4	Node 6	Node 5	Node 3	Confluence	Node 2	Out	Duration (mins)
2 yr ARI	4.46	7.54	32.79	33.25	9.97	32.1	34.22	66.4	73.14	85.29	540
5 yr ARI	5.07	13.59	57.16	57.82	17.79	55.51	58.23	113.76	120.35	137.25	540
10 yr ARI	10.34	17.67	72.85	73.67	22.81	71.71	74.64	146.15	152.05	172.55	540
20 yr ARI	13.8	23.36	94.77	95.81	30.49	93.73	97.33	191.5	199.01	221.55	540

50 yr ARI	18.96	32.22	125.39	127.82	42.39	126.11	130.5	258.36	267.26	289.93	540
100 yr ARI	23.26	39.74	151.99	155.57	51.39	153.76	159.5	315.37	325.27	349.06	540

Table 2: Peak Flows for 2,5,10,20,50 and 100-year storm events

The 100-year ARI XP-RAFTS result at Node Out has been checked using Rational Method as per the Institution of Engineers Australia, AR&R (1987)-Book 4. The parameters used and results are summarised below in **Table 3**:

Catchment Area (A), (km ²)	187.2 km ²
Time of Concentration ($t_c = 0.76A^{0.38}$)	5.55 hrs or 333 minutes
Intensity for the site with $t_c=5.5$ hrs	22mm/hr
C_{100}	0.31
Peak Flow for 1 in 100-year ARI	350 m³/s

Table 3 : Rational Method parameters and results

As can be seen above for both the Rational Method and XP-Rafts analysis, the peak flow result for the 1 in 100-year ARI at Node Out is identical with Peak flow of approximately 350 m³/s

HEC-RAS has been used to model hydraulics using the steady-state one-dimensional method and a terrain model of the existing creek was prepared in '12D' (an earthworks terrain software package) using detailed and aerial survey.

This was reconciled with site inspections to ensure the significant sections, hydraulic controls and geomorphic features of the creek, including natural creek bed scour, natural creek pools, in the detailed study zone were included in the hydraulic model.

This enabled detailed cross-sections to be taken at regular intervals for the HEC-RAS hydraulic modelling.

Flow rates shown in **Table 2** were used to calculate the likely flood levels during the 2, 20 and 100-year ARI storm event using a HEC-RAS model.

Flow profiles were generated along Wolgan River and Carne Creek that provided an estimate of overland flow and flood levels that are likely to occur.

The layout of the flow model, flood levels and typical sections are shown in **Appendix C (i)-(iii)** for the 100-year ARI storm event.

The detailed HEC-RAS output for Wolgan River/Carne Creek model have been included in **Appendix D(i)** of this report.

The ground floor levels for the proposed development structures will be above the 1 in 100 year storm event flood levels

An escape path will be provided through the road network from the proposed development to Wolgan Road for storm events up to the 100 year flood.

Overland flow paths will be provided between and around proposed buildings of the development to ensure nuisance ponding from minor flow path drainage in major storms is minimised.

5.0 CONCLUSION AND RECOMMENDATIONS

Based on our calculations, it is our opinion that:

- The proposed development will not restrict flow through the Wolgan Valley property or make the existing flow regime any worse for downstream properties
- The proposed building layout will not be affected by the 100 year flood event.
- the hydraulics results show that the Q100 is able to be safely conveyed by the Wolgan River and Carne Creek without any impact on the development area.
- in the event of the 1 in 100 year storm the proposed development will be above the 100 year flood levels with freeboard at rages between 0.15m-0.5m.
- Flood escape routes are provided by the road network for the proposed development to Wolgan Road for the 100 year Flood event.

Our recommendation is as follows:

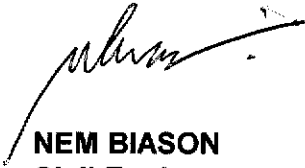
1. Minimum freeboard for each type of proposed structure to be adopted as per the table below.

	FREEBOARD (mm)
Building's Habitable Floor Levels	500
Flood Egress Roads	300
Flood Egress Bridge Decks	300
Flood Egress Footpaths	150

2. Bridges will be designed to withstand an appropriate debris impact and for larger storm events

Prepared by:
**TAYLOR THOMSON WHITTING
(NSW) PTY LTD**

Authorised by:
**TAYLOR THOMSON WHITTING
(NSW) PTY LTD**



NEM BIASON
Civil Engineer

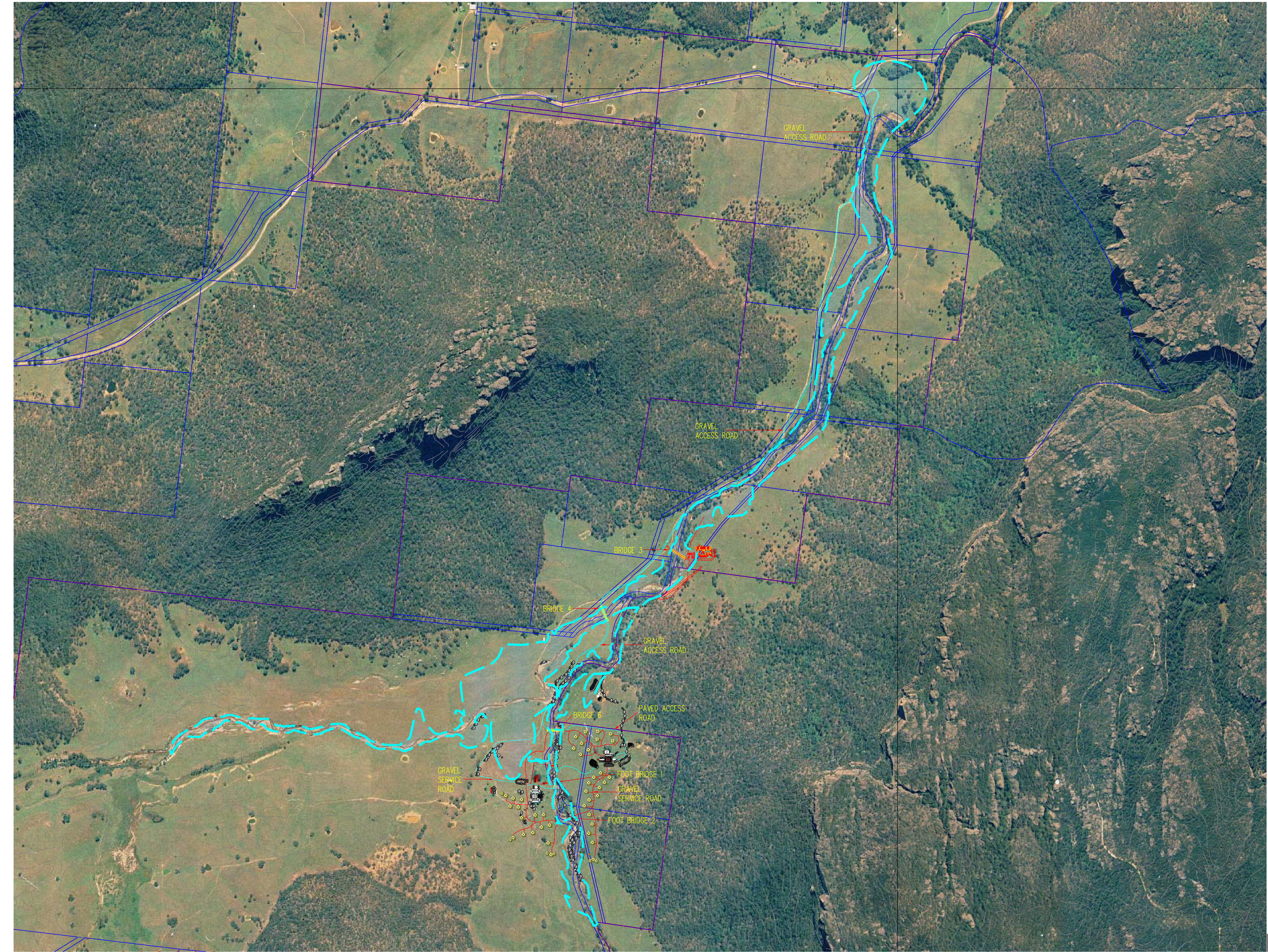


STEPHEN BRAIN
Associate Director - Civil

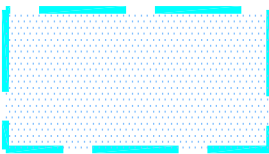
P:\2005\0513\051349\Reports\Flood Study\050805 Flood Assessment Report.doc

APPENDIX A

(i) Proposed Sites



LEGEND



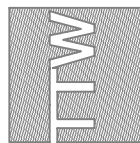
1 in 100 Year ARI Flood Extent

PRELIMINARY

A1 0 1 2 3 4 5 6 7 8 9 10

P5	DA	KH	SB	29.09.05					
P4	DA	KH	SB	28.09.05					
P3	DA	KH	SB	08.09.05					
P2	DA	KH	SB	26.08.05					
P1	PRELIMINARY	SB	DH	12.08.05					
Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date

Architect
CONYBEARE MORRISON
INTERNATIONAL
Level 1/ 52 -58 William St East Sydney NSW 2010



TaylorThomsonWhitting
Consulting Engineers
48 Chandos Street St Leonards NSW 2065
T: +61 2 9439 7288 F: +61 2 9439 3146 ttwsyd@ttw.com.au
Taylor Thomson Whitting (NSW) Pty Ltd A/C.N. 113 578 377

Project
EMIRATES RESORT, LITHGOW

Sheet Subject
ROAD ALIGNMENT

Scale : A1 1:8000	Drawn KH	Authorised —
Job No 051349	Drawing No SKC03	Revision P5

APPENDIX B

(i) Wolgan River/Carne Creek Catchment Plan including XP-RAFTS Nodes



LEGEND:

① - xP Rapt Node.

① - Extent of Catchment.

P1	ISSUE FOR INFORMATION	NB	NB	27.07.05
No	AMENDMENT	ENG	DRAFT	DATE

PROJECT
EMIRATES LUXURY RESORT -
FLOOD STUDY
WOLGAN VALLEY

SHEET SUBJECT
CATCHMENT AND FLOW PLAN

CLIENT
EMIRATES

TAYLOR THOMSON WHITTING
PTY. LTD. Incorporated in N.S.W. A.C.N. 001 282 711
CONSULTING, STRUCTURAL & CIVIL ENGINEERS
48 CHANDOS STREET ST LEONARDS NSW 2065
PHONE 9439 7288 FAX 9439 3146 EMAIL postmaster@ttw.net.au

SCALE NTS	JOB No 051349
AUTHORISED	DRG No SKC800
	REV P1

APPENDIX C

- (i) -HEC–RAS Model Layout**
 - 100-year ARI Flood Extent and Flood Levels**
- (ii) HEC–RAS Flow Profile (Long Sections)**
- (iii) Typical Creek Sections**
- (iv) HEC-RAS Detailed Output for 100 year ARI.**



LEGEND

PRELIMINARY

Scale : A1
1:5000

Drawn
KH

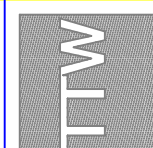
Job No
051349

Drawing No
SKC02A

Revision
P1

P1	PRELIMINARY	SB	DH	05.08.05										
Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date	Rev	Description	Eng	Draft	Date

Architect
CONYBEARE MORRISON
INTERNATIONAL
Level 1/ 52 -58 William St East Sydney NSW 2010



TaylorThomsonWhitting
Consulting Engineers
48 Chandos Street St.Leonards NSW 2065
T: +61 2 9439 7288 F: +61 2 9439 3146 tlwsyd@tlw.com.au
Taylor Thomson Whitting (NSW) Pty Ltd A.C.N. 113 578 377

Project

EMIRATES RESORT, LITHGOW

Sheet Subject

HEC-RAS LAYOUT

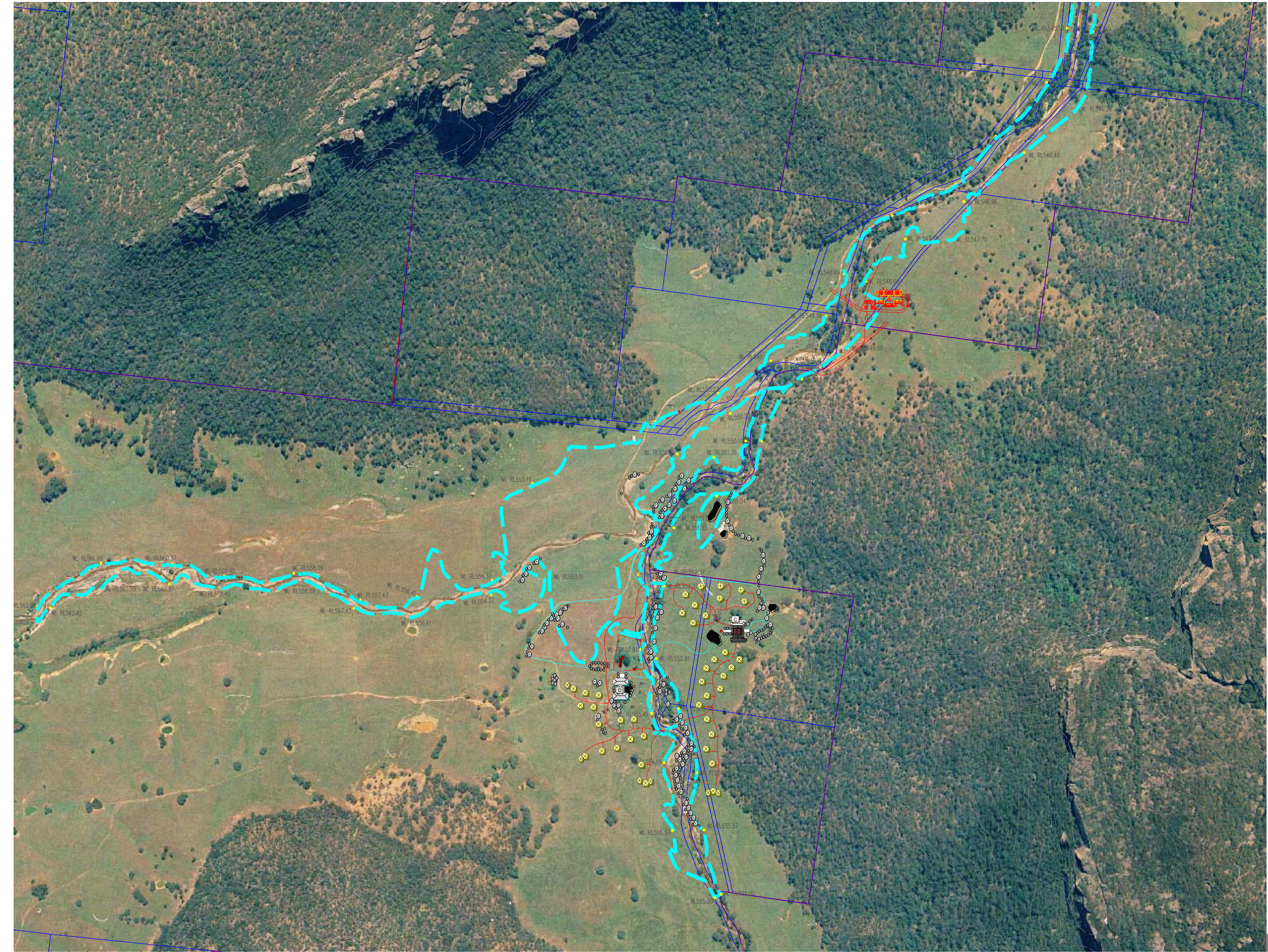
Scale : A1
1:5000

Drawn
KH

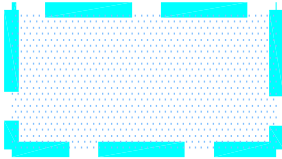
Job No
051349

Drawing No
SKC02A

Revision
P1



LEGEND



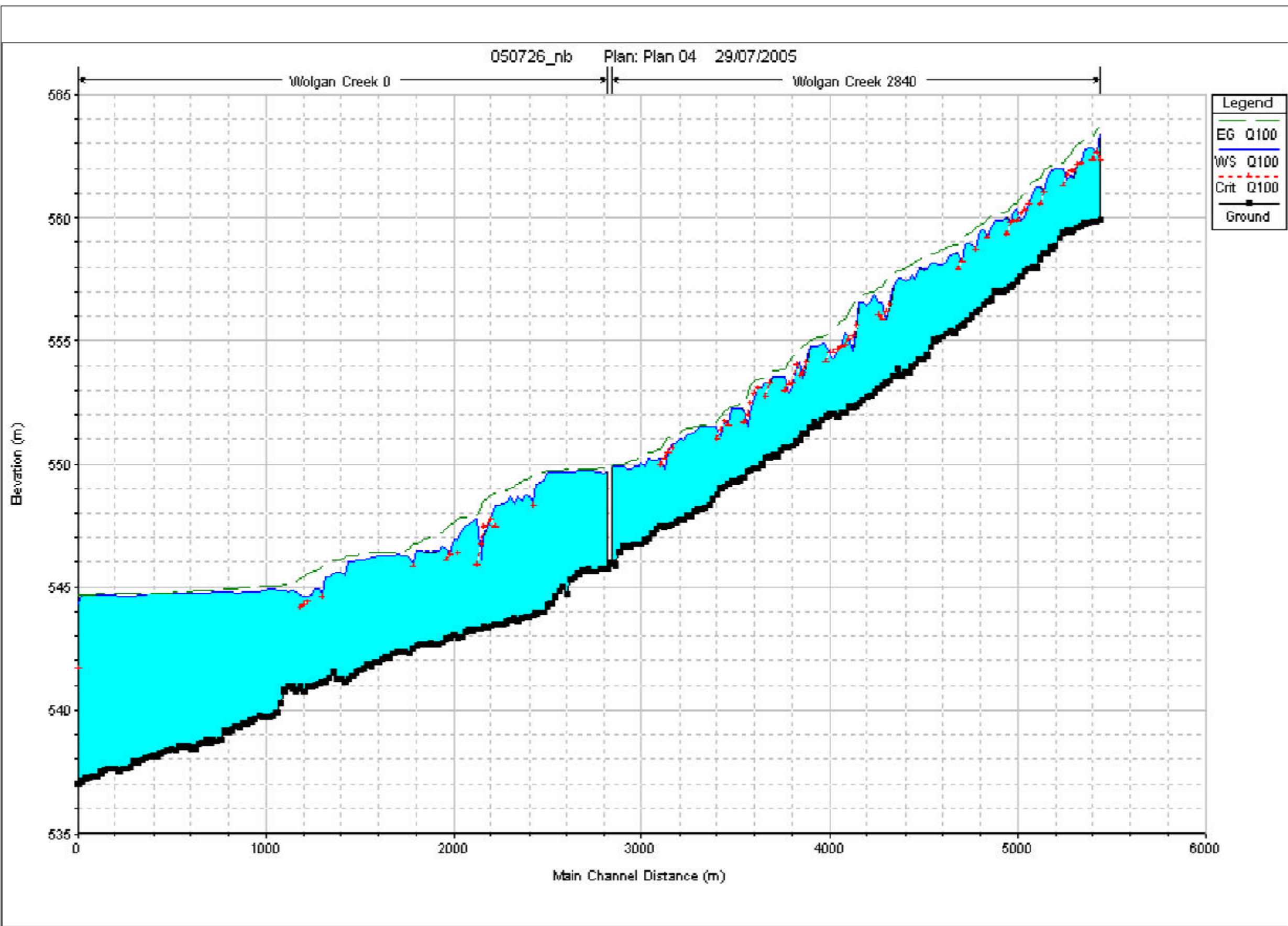
1 in 100 Year ARI Flood Extent

• WL RL551.03
(WATER LEVEL FOR 1 in 100 YEAR ARI FLOOD EVENT WITH BRIDGE)

PRELIMINARY

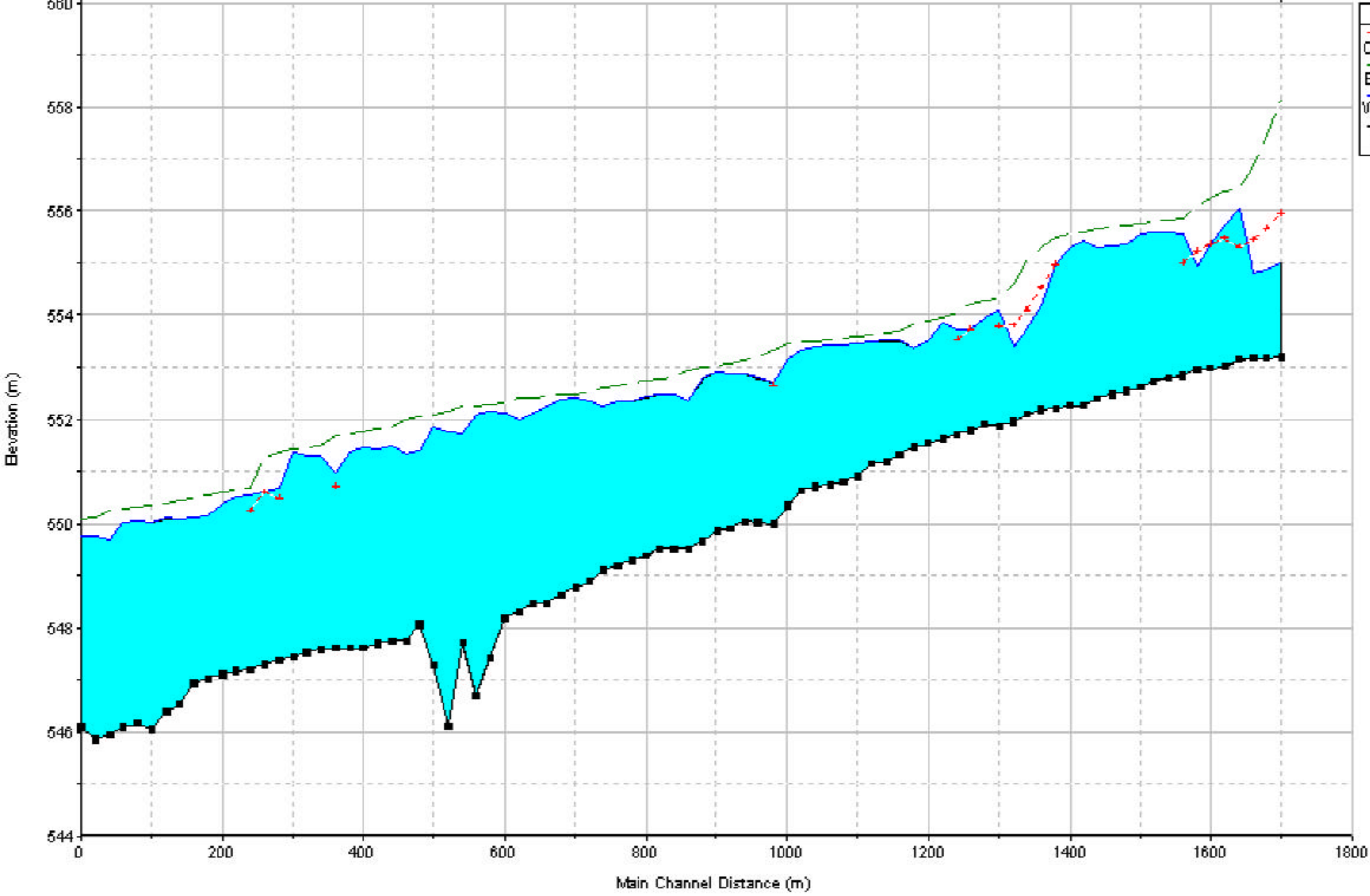
A1 0 1 2 3 4 5 6 7 8 9 10

P5 DA KH SB 29.09.05 P4 DA KH SB 28.09.05 P3 DA KH SB 08.09.05 P2 DA KH SB 26.08.05 P1 PRELIMINARY SB KH 12.08.05 Rev Description Eng Draft Date Rev Description Eng Draft Date Rev Description Eng Draft Date				Architect CONYBEARE MORRISON INTERNATIONAL Level 1/ 52 -58 William St East Sydney NSW 2010				TTW TaylorThomsonWhitting Consulting Engineers 48 Chandos Street St Leonards NSW 2065 T: +61 2 9439 7288 F: +61 2 9439 3146 ttwsyd@ttw.com.au Taylor Thomson Whitting (NSW) Pty Ltd A/C.N. 113 578 377				Project EMIRATES RESORT, LITHGOW				Sheet Subject FLOOD EXTENTS				Scale : A1 1:5000		Drawn KH	Authorised _____
												Job No 051349		Drawing No SKC02	Revision P5								



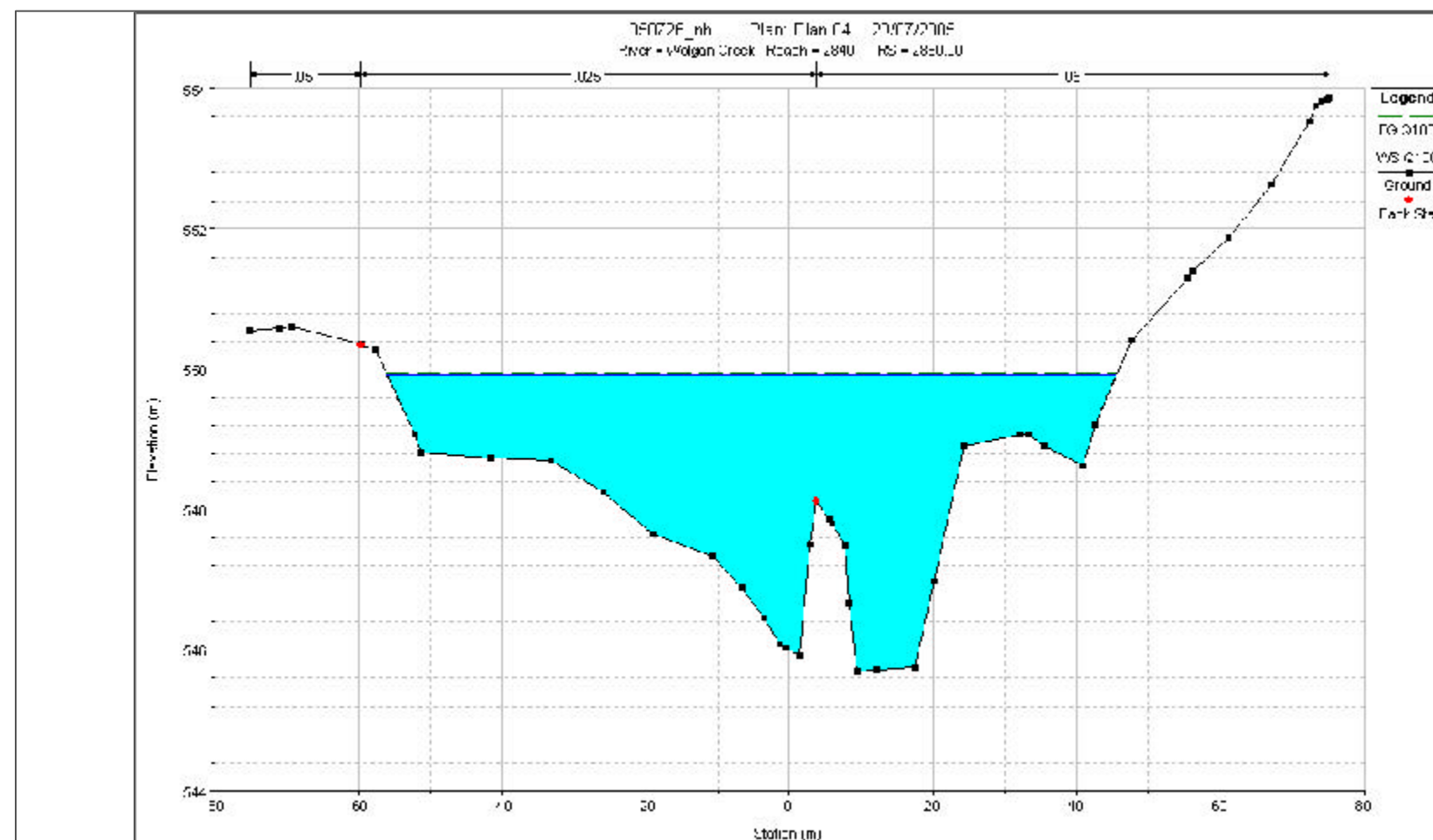
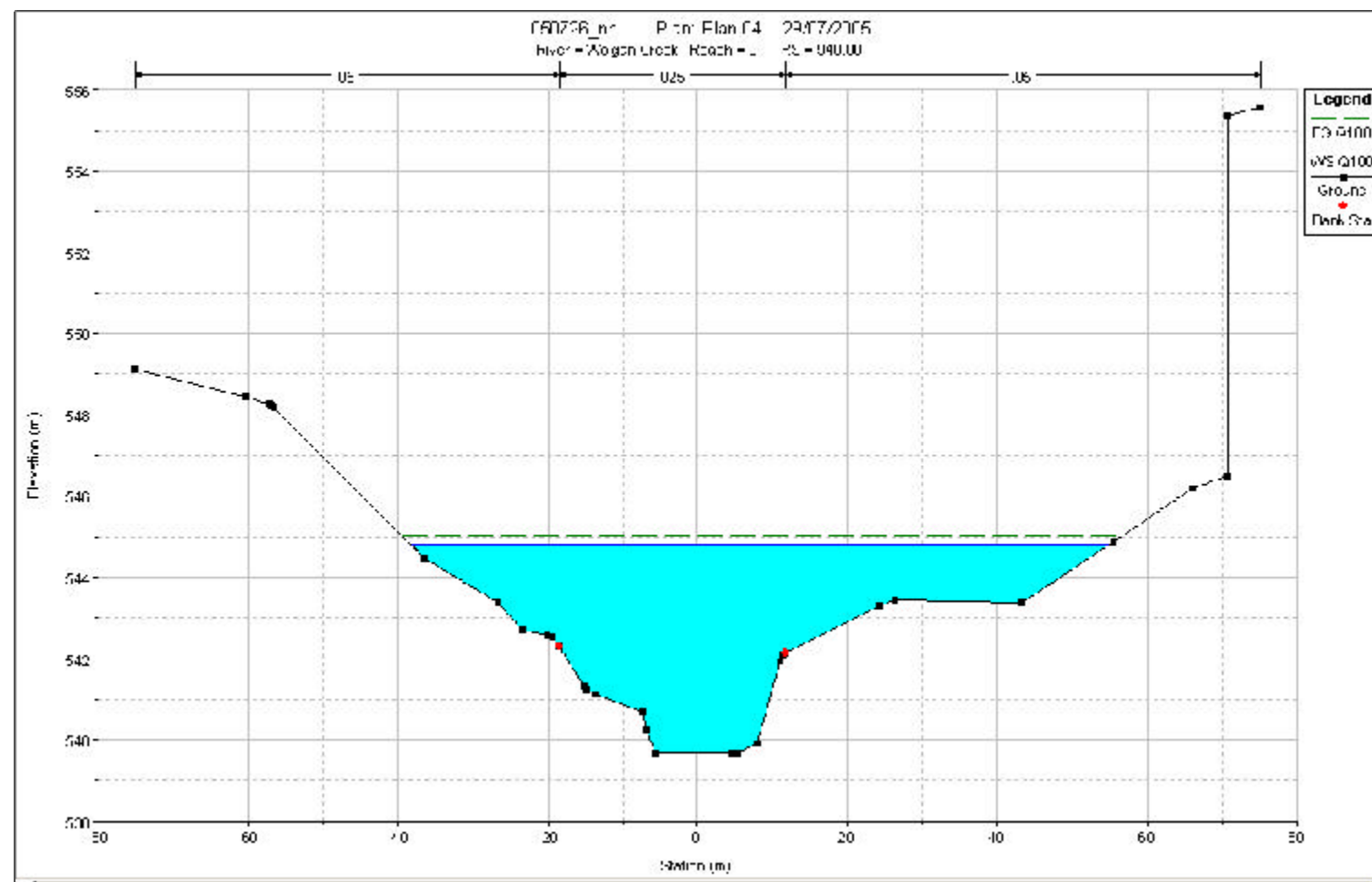
P1	ISSUE FOR INFORMATION	NB	NB	27.07.05
No	AMENDMENT	ENG	DRAFT	DATE
PROJECT				
EMIRATES LUXURY RESORT – FLOOD STUDY WOLGAN VALLEY				
SHEET SUBJECT				
WOLGAN RIVER PROFILE (LONG SECTION)				
CLIENT				
EMIRATES				
TAYLOR THOMSON WHITTING				
PTY. LTD. Incorporated in N.S.W. A.C.N. 001 282 711 CONSULTING, STRUCTURAL & CIVIL ENGINEERS 48 CHANDOS STREET ST. LEONARDS NSW 2060 PHONE 9438 7288 FAX 9438 3148 EMAIL postmaster@ttw.net.au				
SCALE	JOB No			
NTS	051349			
AUTHORISED	DRI No		REV	
	–		P1	

050726_nb Plan: Plan 04 29/07/2005
Carne Creek 100

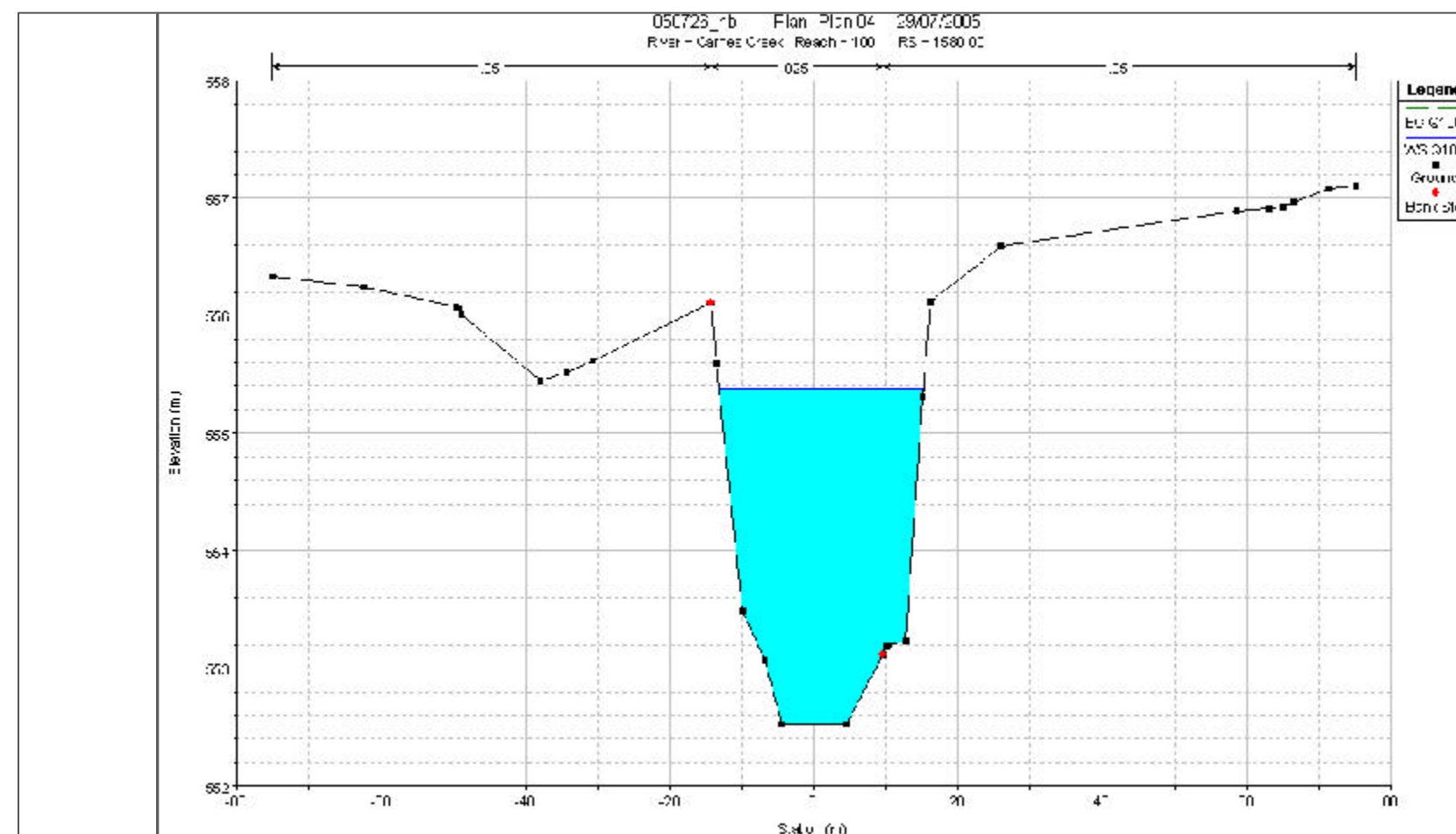
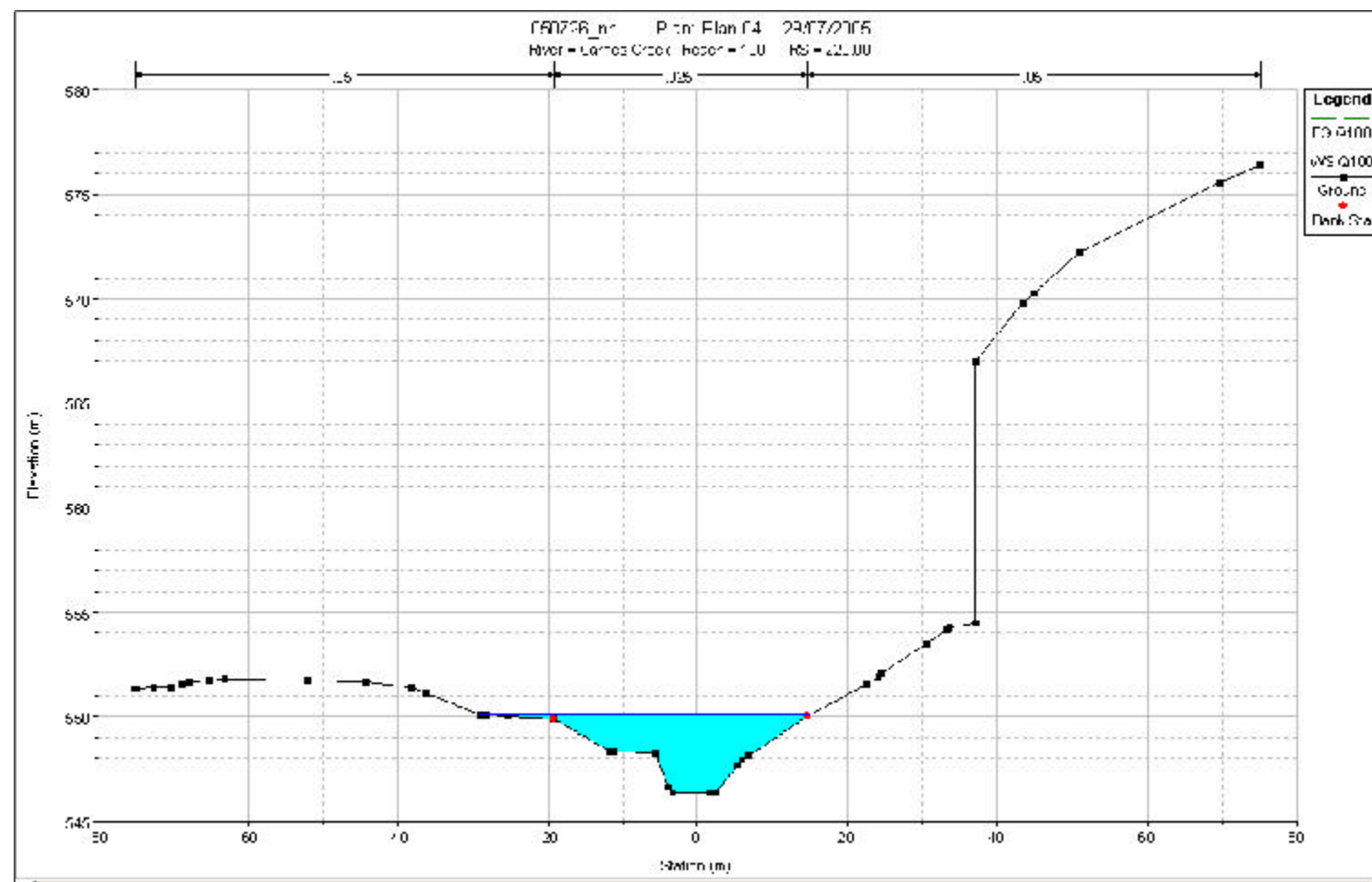


Legend	
---	Crit Q100
---	EG Q100
---	W/S Q100
●	Ground

P1	ISSUE FOR INFORMATION	NB	NB 27.07.05
No	AMENDMENT	ENG	DRAFT DATE
PROJECT EMIRATES LUXURY RESORT – FLOOD STUDY WOLGAN VALLEY			
SHEET SUBJECT CARNE CREEK PROFILE (LONG SECTION)			
CLIENT EMIRATES			
TAYLOR THOMSON WHITTING PTY. LTD. Incorporated in N.S.W. A.C.N. 001 282 711 CONSULTING, STRUCTURAL & CIVIL ENGINEERS 48 CHANDOS STREET ST. LEONARDS NSW 2060 PHONE 9438 7288 FAX 9438 3148 EMAIL postmaster@ttwnet.au			
SCALE NTS	JOB No 051349		
AUTHORISED	DRG No –	REV P1	



P1	ISSUE FOR INFORMATION	NE	NB	27.07.05
No	AMENDMENT	ENG	DRAFT	DATE
PROJECT				
EMIRATES LUXURY RESORT – FLOOD STUDY WOLGAN VALLEY				
SHEET SUBJECT				
WOLGAN RIVER TYPICAL X-SECTIONS (CH 940 & CH2860)				
CLIENT				
EMIRATES				
TAYLOR THOMSON WHITTING PTY. LTD. Incorporated in N.S.W. A.C.N. 001 282 711 CONSULTING, STRUCTURAL & CIVIL ENGINEERS 48 CHANDOS STREET ST. LEONARDS NSW 2060 PHONE 9438 7288 FAX 9438 3146 EMAIL postmaster@ttw.net.au				
SCALE	JOB No			
NTS	051349			
AUTHORISED	DRG No	REV		
	–	P1		



P1	ISSUE FOR INFORMATION	NE	NB	27.07.05
No	AMENDMENT	ENG	DRAFT	DATE
PROJECT				
EMIRATES LUXURY RESORT – FLOOD STUDY WOLGAN VALLEY				
SHEET SUBJECT				
CARNE CREEK X-SECTIONS (CH220 & CH1580)				
CLIENT				
EMIRATES				
TAYLOR THOMSON WHITTING PTY. LTD. Incorporated in N.S.W. A.C.N. 001 282 711 CONSULTING, STRUCTURAL & CIVIL ENGINEERS 48 CHANDOS STREET ST. LEONARDS NSW 2066 PHONE 9438 7288 FAX 9438 3146 EMAIL postmaster@ttw.net.au				
SCALE		JOB No		
NTS		051349		
AUTHORISED		DRG No	REV	
		–	P1	

HEC-RAS Plan: Plan 06 Profile: Q100													
River	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
Carnes Creek	100	100	Q100	160	546.09	550.06		550.27	0.001299	2.05	78.45	45.04	0.49
Carnes Creek	100	120	Q100	160	545.87	550.03		550.31	0.001047	2.37	73.81	44.93	0.47
Carnes Creek	100	140	Q100	160	545.93	549.98		550.38	0.001909	2.82	59.52	41.68	0.61
Carnes Creek	100	160	Q100	160	546.07	550.19		550.42	0.000924	2.15	79.29	42.38	0.43
Carnes Creek	100	179.86	Q100	160	546.15	550.2		550.44	0.000855	2.17	77.81	38.99	0.42
Carnes Creek	100	200	Q100	160	546.04	550.19		550.47	0.001186	2.35	70.31	38.58	0.49
Carnes Creek	100	220	Q100	160	546.38	550.25		550.5	0.001211	2.23	73.87	45.83	0.49
Carnes Creek	100	240	Q100	160	546.52	550.23		550.55	0.001729	2.53	64.61	47.85	0.58
Carnes Creek	100	260	Q100	160	546.94	550.27		550.59	0.001612	2.51	63.96	36.8	0.56
Carnes Creek	100	280	Q100	160	547.03	550.29		550.63	0.002108	2.56	62.62	36.97	0.63
Carnes Creek	100	300	Q100	160	547.11	550.46		550.67	0.001354	2.03	78.62	47.33	0.5
Carnes Creek	100	320	Q100	160	547.15	550.59		550.71	0.001068	1.69	134.27	118.19	0.44
Carnes Creek	100	340	Q100	160	547.2	550.63	550.26	550.74	0.002195	1.78	124.13	148.69	0.59
Carnes Creek	100	360	Q100	160	547.3	550.61	550.61	551.28	0.003463	4.03	65.85	78	0.8
Carnes Creek	100	380	Q100	160	547.39	550.67	550.5	551.34	0.003327	3.85	60.71	72.12	0.8
Carnes Creek	100	400	Q100	160	547.44	551.34		551.41	0.00025	1.33	210.64	177.58	0.24
Carnes Creek	100	420	Q100	160	547.52	551.26		551.45	0.00062	1.95	100.76	100.9	0.37
Carnes Creek	100	440	Q100	160	547.59	551.28		551.46	0.000716	2.07	127.57	126.43	0.39
Carnes Creek	100	460	Q100	160	547.6	550.91	550.72	551.66	0.003794	3.87	45.03	34.79	0.84
Carnes Creek	100	480	Q100	160	547.61	551.34		551.74	0.001324	2.86	72.01	85.23	0.51
Carnes Creek	100	500	Q100	160	547.61	551.44		551.77	0.001061	2.56	72.03	76.34	0.45
Carnes Creek	100	520	Q100	160	547.7	551.42		551.81	0.001489	2.78	59.03	35.99	0.54
Carnes Creek	100	540	Q100	160	547.74	551.49		551.84	0.001198	2.63	64.55	36.54	0.49
Carnes Creek	100	560	Q100	160	547.75	551.32		551.97	0.002791	3.59	44.76	20.58	0.73
Carnes Creek	100	580	Q100	160	548.05	551.4		552.04	0.002967	3.53	46.31	26.36	0.75
Carnes Creek	100	600	Q100	160	547.26	551.85		552.1	0.000707	2.22	77.47	43.17	0.38
Carnes Creek	100	620	Q100	156	546.11	551.77		552.16	0.001184	2.77	61.25	37.28	0.48
Carnes Creek	100	640	Q100	156	547.72	551.72		552.22	0.001824	3.14	52.96	30.68	0.6
Carnes Creek	100	660	Q100	156	546.7	552.06		552.27	0.000575	2.01	82.76	38.9	0.35
Carnes Creek	100	680	Q100	156	547.41	552.13		552.28	0.000465	1.75	93.73	45.16	0.32
Carnes Creek	100	700	Q100	156	548.19	552.11		552.31	0.000723	2	79.52	45.24	0.39
Carnes Creek	100	720	Q100	156	548.31	551.99		552.39	0.001659	2.81	58.13	34.99	0.56
Carnes Creek	100	740	Q100	156	548.35	552.18		552.43	0.000889	2.22	76.09	58.76	0.43
Carnes Creek	100	760	Q100	156	548.39	552.21		552.45	0.000906	2.2	78.11	73.78	0.43
Carnes Creek	100	780	Q100	156	548.64	552.36		552.47	0.000403	1.49	111.66	61.9	0.29
Carnes Creek	100	800	Q100	156	548.77	552.37		552.48	0.000418	1.54	110.94	69.45	0.3
Carnes Creek	100	810	Bridge										
Carnes Creek	100	820	Q100	156	548.89	552.35	551.12	552.55	0.00092	1.98	81.57	51.51	0.43
Carnes Creek	100	840	Q100	156	549.12	552.28		552.61	0.002146	2.54	61.49	38.33	0.63
Carnes Creek	100	860	Q100	156	549.18	552.34		552.66	0.002146	2.48	62.79	38.17	0.62
Carnes Creek	100	880	Q100	156	549.29	552.36		552.71	0.002041	2.63	59.37	32.59	0.62
Carnes Creek	100	900	Q100	156	549.39	552.44		552.75	0.001415	2.48	63.01	28.62	0.53
Carnes Creek	100	920	Q100	156	549.52	552.49		552.78	0.001357	2.4	65.13	30.29	0.52
Carnes Creek	100	940	Q100	156	549.52	552.48		552.83	0.001712	2.6	61.58	39.7	0.58
Carnes Creek	100	960	Q100	156	549.53	552.37		552.94	0.003052	3.36	46.41	23.49	0.76
Carnes Creek	100	980	Q100	156	549.65	552.8		553.02	0.001302	2.16	87.82	55.87	0.5
Carnes Creek	100	1000	Q100	156	549.85	552.91		553.04	0.000581	1.59	98.15	45.54	0.35
Carnes Creek	100	1010	Bridge										
Carnes Creek	100	1020	Q100	156	549.92	552.92	551.85	553.11	0.000882	1.94	80.62	37.75	0.42
Carnes Creek	100	1040	Q100	156	550.05	552.91		553.15	0.001403	2.17	71.77	40.32	0.52
Carnes Creek	100	1059.15	Q100	156	550.03	552.86		553.22	0.002628	2.67	58.32	37.48	0.68
Carnes Creek	100	1080	Q100	156	549.99	552.77	552.66	553.37	0.00484	3.42	45.6	31.68	0.91
Carnes Creek	100	1101.86	Q100	156	550.36	553.18		553.46	0.001971	2.34	66.54	42.67	0.6
Carnes Creek	100	1120	Q100	156	550.64	553.34		553.5	0.001075	1.75	89.08	56.71	0.45
Carnes Creek	100	1140	Q100	156	550.71	553.42		553.52	0.00083	1.46	107.13	74.18	0.39
Carnes Creek	100	1160	Q100	156	550.74	553.43		553.54	0.0009	1.46	106.68	78.29	0.4
Carnes Creek	100	1180	Q100	156	550.8	553.44		553.56	0.001095	1.55	100.94	79.02	0.44
Carnes Creek	100	1200	Q100	156	550.9	553.45		553.59	0.001136	1.66	94.03	68.4	0.45
Carnes Creek	100	1220	Q100	156	551.15	553.49		553.62	0.001005	1.55	100.61	74	0.42
Carnes Creek	100	1240	Q100	156	551.18	553.51		553.64	0.001237	1.57	99.52	94.64	0.46
Carnes Creek	100	1260.02	Q100	156	551.32	553.5		553.69	0.001681	1.91	82.02	69.46	0.54
Carnes Creek	100	1280	Q100	156	551.46	553.37		553.82	0.003636	2.95	52.86	39.62	0.8
Carnes Creek	100	1300	Q100	156	551.55	553.55		553.89	0.002571	2.58	60.51	41.43	0.68
Carnes Creek	100	1320	Q100	156	551.62	553.85		553.96	0.001881	1.56	108.53	119.48	0.54
Carnes Creek	100	1340	Q100	156	551.72	553.74	553.53	554.07	0.00294	2.83	75.87	64.9	0.74
Carnes Creek	100	1360	Q100	156	551.8	553.75	553.75	554.19	0.00379	3.05	66.19	105.3	0.83
Carnes Creek	100	1380	Q100	156	551.89	553.93		554.26	0.002703	2.66	76.06	88.72	0.7
Carnes Creek	100	1390	Bridge										
Carnes Creek	100	1400	Q100	156	551.87	554.15	553.8	554.35	0.001596	2.14	98.72	99.55	0.54
Carnes Creek	100	1420	Q100	156	551.97	554.17	553.82	554.39	0.001703	2.22	92.64	85.83	0.56
Carnes Creek	100	1440	Q100	156	552.11	553.72	554.11	555.05	0.018396	5.26	38.59	86.8	1.71
Carnes Creek	100	1460	Q100	156	552.18	554.17	554.55	555.33	0.009733	4.94	43.64	77	1.31
Carnes Creek	100	1480	Q100	156	552.2	554.97	554.97	555.5	0.003412	3.69	72.17	68.61	0.81
Carnes Creek	100	1500	Q100	156	552.25	555.28		555.56	0.00123	2.49	82.3	54.65	0.51
Carnes Creek	100	1520	Q100	156	552.27	555.43		555.59	0.000628	1.88	112.64	82.4	0.37
Carnes Creek	100	1530	Bridge										
Carnes Creek	100	1540	Q100	156	552.4	555.59	554.56	555.86	0.000953	2.44	85.44	63.67	0.46
Carnes Creek	100	1560	Q100	156	552.48	555.6		555.88	0.001057	2.41	74.52	50.33	0.48
Carnes Creek	100	1580	Q100	156	552.53	555.62		555.91	0.001104	2.45	71.48	39.64	0.49
Carnes Creek	100	1600	Q100	156	552.62	555.77		555.94	0.0007	1.91	100.24	59.85	0.39
Carnes Creek	100	1620	Q100	156	552.73	555.78		555.95	0.000707	1.89	96.63	53.89	0.39
Carnes Creek	100	1640	Q100	156	552.78	555.79		555.97	0.000793	1.97	112.33	97.31	0.41

HEC-RAS Plan: Plan 06 Profile: Q100													
River	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
Carnes Creek	100	1660	Q100	156	552.85	555.77		556	0.001065	2.24	94.41	71.23	0.47
Carnes Creek	100	1680	Q100	156	552.96	555.64		556.11	0.002396	3.09	58.71	48.55	0.69
Carnes Creek	100	1700	Q100	156	552.98	555.48	555.37	556.28	0.004626	3.96	39.35	21.25	0.93
Carnes Creek	100	1720	Q100	156	553.01	555.7	555.49	556.37	0.003939	3.62	43.06	23.89	0.86
Carnes Creek	100	1740	Q100	156	553.16	556.06	555.31	556.45	0.001809	2.77	56.24	25.6	0.6
Carnes Creek	100	1760	Q100	156	553.17	554.82	555.46	556.87	0.018726	6.34	24.6	19.08	1.78
Carnes Creek	100	1780	Q100	156	553.17	554.86	555.66	557.45	0.023404	7.13	21.88	16.61	1.98
Carnes Creek	100	1800	Q100	156	553.22	555	555.94	558.15	0.030019	7.86	19.85	15.7	2.23
Wolgan Creek	0	0	Q100	349	537.02	544.3	541.71	544.66	0.001	3.16	153.19	27.33	0.38
Wolgan Creek	0	20	Q100	325	537.15	544.67		544.69	0.000037	0.85	607.65	105.56	0.1
Wolgan Creek	0	40	Q100	325	537.21	544.68		544.7	0.000018	0.6	1045.91	217.64	0.07
Wolgan Creek	0	60	Q100	325	537.29	544.69		544.7	0.000014	0.53	1131.35	232.76	0.06
Wolgan Creek	0	80	Q100	325	537.32	544.69		544.7	0.000018	0.58	1055.8	246.57	0.07
Wolgan Creek	0	100	Q100	325	537.36	544.68		544.7	0.000022	0.64	870.54	215.5	0.08
Wolgan Creek	0	120	Q100	325	537.47	544.68		544.7	0.000027	0.71	724.58	142.17	0.09
Wolgan Creek	0	140	Q100	325	537.59	544.68		544.7	0.000035	0.81	596.29	114.48	0.1
Wolgan Creek	0	160	Q100	325	537.63	544.67		544.71	0.000047	0.91	504.5	100.76	0.12
Wolgan Creek	0	180	Q100	325	537.64	544.66		544.71	0.000069	1.11	424.46	86.96	0.14
Wolgan Creek	0	200	Q100	325	537.65	544.65		544.72	0.000105	1.34	363.07	80.87	0.17
Wolgan Creek	0	220	Q100	325	537.55	544.64		544.73	0.000129	1.48	332.69	78.08	0.19
Wolgan Creek	0	240	Q100	325	537.67	544.63		544.73	0.000145	1.56	315.8	77.73	0.2
Wolgan Creek	0	260	Q100	325	537.67	544.62		544.75	0.000204	1.77	270.95	69.37	0.23
Wolgan Creek	0	280	Q100	325	537.69	544.63		544.75	0.000235	1.83	280.31	72.56	0.24
Wolgan Creek	0	300	Q100	325	537.91	544.64		544.76	0.000231	1.77	284.37	69.13	0.24
Wolgan Creek	0	320	Q100	325	537.9	544.65		544.76	0.000161	1.65	311.56	80.23	0.21
Wolgan Creek	0	340	Q100	325	538.02	544.66		544.76	0.000147	1.61	324.29	84.09	0.2
Wolgan Creek	0	360	Q100	325	538.06	544.68		544.77	0.000123	1.45	336.5	86.7	0.19
Wolgan Creek	0	380	Q100	325	538.11	544.72		544.77	0.000075	1.13	384.24	85.04	0.15
Wolgan Creek	0	400	Q100	325	538.16	544.71		544.78	0.000097	1.28	370.51	78.94	0.16
Wolgan Creek	0	420	Q100	325	538.16	544.71		544.78	0.000126	1.44	383.4	94.79	0.19
Wolgan Creek	0	440	Q100	325	538.29	544.71		544.78	0.000123	1.43	382.16	102.89	0.19
Wolgan Creek	0	460	Q100	325	538.34	544.71		544.79	0.00013	1.45	360.51	107.54	0.19
Wolgan Creek	0	480	Q100	325	538.4	544.72		544.79	0.000121	1.38	357.21	102.67	0.18
Wolgan Creek	0	500	Q100	325	538.43	544.73		544.8	0.000118	1.28	347.94	101.19	0.18
Wolgan Creek	0	520	Q100	325	538.38	544.71		544.81	0.000155	1.52	307.76	96.35	0.21
Wolgan Creek	0	540	Q100	325	538.54	544.73		544.81	0.000154	1.36	297.58	90.56	0.2
Wolgan Creek	0	560	Q100	325	538.52	544.71		544.82	0.000228	1.57	272.89	88.96	0.23
Wolgan Creek	0	580	Q100	325	538.54	544.7		544.84	0.00029	1.87	268.6	88.91	0.26
Wolgan Creek	0	600	Q100	325	538.5	544.7		544.85	0.000309	1.93	263.36	98.69	0.28
Wolgan Creek	0	620	Q100	325	538.5	544.72		544.85	0.000255	1.81	282.18	100.13	0.25
Wolgan Creek	0	640	Q100	325	538.64	544.73		544.86	0.000241	1.76	289.08	106.71	0.25
Wolgan Creek	0	660	Q100	325	538.67	544.71		544.88	0.000341	1.99	252.73	100.98	0.29
Wolgan Creek	0	680	Q100	325	538.77	544.74		544.88	0.000328	1.9	254.35	87.29	0.28
Wolgan Creek	0	700	Q100	325	538.7	544.79		544.89	0.000191	1.5	294.16	95.59	0.21
Wolgan Creek	0	720	Q100	325	538.78	544.84		544.9	0.000108	1.15	361.58	111.64	0.17
Wolgan Creek	0	740	Q100	325	538.73	544.85		544.9	0.000089	1.08	390.69	112.63	0.15
Wolgan Creek	0	760	Q100	325	538.8	544.84		544.91	0.000114	1.2	363.8	112.61	0.17
Wolgan Creek	0	780	Q100	325	539.17	544.83		544.92	0.000152	1.4	340.56	114.94	0.2
Wolgan Creek	0	800	Q100	325	539.18	544.83		544.92	0.000175	1.51	325.03	109.42	0.21
Wolgan Creek	0	820	Q100	325	539.19	544.81		544.94	0.000275	1.77	291.28	107.51	0.27
Wolgan Creek	0	840	Q100	325	539.38	544.79		544.95	0.000343	1.99	263.46	109.25	0.3
Wolgan Creek	0	860	Q100	325	539.31	544.8		544.96	0.000331	1.96	261.28	114.28	0.29
Wolgan Creek	0	880	Q100	325	539.48	544.81		544.97	0.000343	1.93	245.31	107.53	0.29
Wolgan Creek	0	900	Q100	325	539.48	544.83		544.98	0.000296	1.8	254.39	102.6	0.27
Wolgan Creek	0	920	Q100	325	539.6	544.83		544.98	0.000313	1.85	247.92	103.58	0.28
Wolgan Creek	0	940	Q100	325	539.67	544.8		545.01	0.000423	2.14	217.7	92.95	0.33
Wolgan Creek	0	960	Q100	325	539.78	544.84		545.02	0.000369	2.02	232.45	100.46	0.31
Wolgan Creek	0	980	Q100	325	539.71	544.89		545.03	0.000291	1.83	288.59	121.43	0.27
Wolgan Creek	0	1000	Q100	325	539.71	544.89		545.04	0.000306	1.91	289.17	120.83	0.28
Wolgan Creek	0	1020	Q100	325	539.74	544.92		545.05	0.000298	1.74	288.16	137.24	0.27
Wolgan Creek	0	1040	Q100	325	539.77	544.92		545.05	0.000309	1.76	271.1	135.75	0.28
Wolgan Creek	0	1060	Q100	325	539.94	544.88		545.08	0.000512	2.1	219.74	122.08	0.35
Wolgan Creek	0	1080	Q100	325	540.3	544.86		545.11	0.000688	2.36	197.83	120.48	0.4
Wolgan Creek	0	1100	Q100	325	540.84	544.86		545.13	0.000774	2.41	187.81	117.98	0.43
Wolgan Creek	0	1120	Q100	325	540.96	544.84		545.16	0.001053	2.6	156.61	105.41	0.48
Wolgan Creek	0	1140	Q100	325	540.94	544.86		545.18	0.001149	2.6	155.21	97.26	0.5
Wolgan Creek	0	1160	Q100	325	540.83	544.81		545.24	0.001309	3	139.36	103.76	0.54
Wolgan Creek	0	1180	Q100	325	540.91	544.67	544.18	545.35	0.002291	3.71	104.33	93.71	0.71
Wolgan Creek	0	1200	Q100	325	540.78	544.61	544.3	545.45	0.002829	4.12	88.53	56.89	0.79
Wolgan Creek	0	1220	Q100	325	540.99	544.6	544.39	545.54	0.003068	4.37	85.15	47.04	0.83
Wolgan Creek	0	1240	Q100	325	541	544.66		545.6	0.003078	4.35	83.03	41.01	0.83
Wolgan Creek	0	1260	Q100	325	541.01	544.95		545.67	0.002096	3.81	98.26	51	0.69
Wolgan Creek	0	1280	Q100	325	541.08	544.94		545.74	0.002531	4.02	89.4	47.85	0.75
Wolgan Creek	0	1300	Q100	325	541.12	544.79	544.63	545.89	0.003202	4.7	78.93	44.75	0.85
Wolgan Creek	0	1320	Q100	325	541.21	545.44		545.99	0.001423	3.36	119	63.04	0.58
Wolgan Creek	0	1340	Q100	325	541.36	545.45		546.03	0.001677	3.46	113.05	61.58	0.62
Wolgan Creek	0	1360	Q100	325	541.57	545.55		546.07	0.001453	3.26	119.13	62.1	0.58
Wolgan Creek	0	1380	Q100	325	541.31	545.58		546.09	0.001394	3.28	123.12	63.65	0.57
Wolgan Creek	0	1400	Q100	325	541.3	545.59		546.13	0.001413	3.37	118.56	60.46	0.58
Wolgan Creek	0	1420	Q100	325	541.15	545.53		546.21	0.00197	3.74	105.1	60.79	0.67
Wolgan Creek	0	1440	Q100	325	541.31	546.01		546.27	0.000735	2.32	160.29	82.12	0.41

HEC-RAS Plan: Plan 06 Profile: Q100													
River	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
Wolgan Creek	0	1480	Q100	325	541.55	546.09		546.31	0.000541	2.07	180.13	83.08	0.36
Wolgan Creek	0	1500	Q100	325	541.68	546.06		546.34	0.000812	2.38	158.39	84.44	0.43
Wolgan Creek	0	1520	Q100	325	541.71	546.13		546.36	0.000624	2.16	179.6	95.84	0.38
Wolgan Creek	0	1540	Q100	325	541.85	546.18		546.37	0.000571	2.01	190.42	99.75	0.36
Wolgan Creek	0	1560	Q100	325	541.78	546.21		546.38	0.000464	1.87	198.95	99.6	0.33
Wolgan Creek	0	1580	Q100	325	541.95	546.25		546.4	0.000403	1.73	215.28	103.22	0.31
Wolgan Creek	0	1600	Q100	325	541.98	546.26		546.4	0.000421	1.72	208.78	102.98	0.31
Wolgan Creek	0	1620	Q100	325	542.08	546.28		546.41	0.000391	1.6	206.02	90.67	0.3
Wolgan Creek	0	1640	Q100	325	542.18	546.29		546.42	0.000423	1.63	199.5	69.86	0.31
Wolgan Creek	0	1660	Q100	325	542.2	546.3		546.43	0.000457	1.65	197.11	72.6	0.32
Wolgan Creek	0	1680	Q100	325	542.32	546.31		546.44	0.000455	1.63	199.67	74.17	0.32
Wolgan Creek	0	1700	Q100	325	542.41	546.31		546.46	0.000518	1.7	191.62	73.79	0.34
Wolgan Creek	0	1720	Q100	325	542.37	546.28		546.49	0.000889	2.04	159.29	69.52	0.43
Wolgan Creek	0	1740	Q100	325	542.37	546.29		546.51	0.0008	2.07	157.32	62.16	0.41
Wolgan Creek	0	1760	Q100	325	542.32	546.24		546.56	0.001531	2.53	128.31	61.25	0.56
Wolgan Creek	0	1780	Q100	325	542.51	545.97	545.86	546.75	0.003786	3.95	89.45	57.06	0.88
Wolgan Creek	0	1800	Q100	325	542.65	546.48		546.83	0.001126	2.67	141.67	84.34	0.5
Wolgan Creek	0	1820	Q100	325	542.69	546.47		546.86	0.001297	2.83	133.75	74.53	0.54
Wolgan Creek	0	1840	Q100	325	542.7	546.4		546.94	0.002087	3.32	113.91	67.41	0.67
Wolgan Creek	0	1860	Q100	325	542.71	546.44		546.98	0.002	3.33	114.28	67.47	0.65
Wolgan Creek	0	1880	Q100	325	542.74	546.41		547.06	0.00262	3.64	104.38	67.26	0.74
Wolgan Creek	0	1900	Q100	325	542.71	546.46		547.1	0.002359	3.62	105.03	67.91	0.71
Wolgan Creek	0	1920	Q100	325	542.7	546.48		547.17	0.00265	3.75	100.83	65.74	0.75
Wolgan Creek	0	1940	Q100	325	542.77	546.64		547.23	0.001992	3.44	109.33	66.03	0.66
Wolgan Creek	0	1960	Q100	325	542.9	546.52	546.14	547.35	0.00279	4.07	90.48	67.38	0.78
Wolgan Creek	0	1980	Q100	325	542.94	546.33	546.32	547.55	0.004732	4.88	67.43	31.16	0.99
Wolgan Creek	0	2000	Q100	325	543.04	546.96	546.25	547.66	0.002283	3.72	91.18	57.89	0.7
Wolgan Creek	0	2020	Q100	325	542.97	546.92	546.39	547.75	0.00281	4.06	85.68	56.39	0.77
Wolgan Creek	0	2040	Q100	325	543.02	547.27		547.82	0.001544	3.31	109.43	66.49	0.58
Wolgan Creek	0	2060	Q100	325	543.16	547.49		547.87	0.001214	2.73	130.63	75.13	0.52
Wolgan Creek	0	2080	Q100	325	543.1	547.59		547.9	0.001058	2.47	144.99	88.96	0.48
Wolgan Creek	0	2100	Q100	325	543.18	547.7		547.92	0.000593	2.08	177.37	111.31	0.37
Wolgan Creek	0	2120	Q100	325	543.15	547.77		547.94	0.000479	1.84	193	111.92	0.33
Wolgan Creek	0	2140	Q100	325	543.16	547.5	546.63	548.07	0.001671	3.43	111.33	56.15	0.61
Wolgan Creek	0	2160	Q100	325	543.4	547.09	547.45	548.49	0.005975	5.27	67.85	51.21	1.09
Wolgan Creek	0	2180	Q100	325	543.38	547.34	547.58	548.61	0.00459	5.06	73.92	54.58	0.97
Wolgan Creek	0	2200	Q100	325	543.43	547.75	547.75	548.71	0.00344	4.43	90.87	74.41	0.84
Wolgan Creek	0	2220	Q100	325	543.45	548.14	547.46	548.79	0.002069	3.66	114.65	97.27	0.67
Wolgan Creek	0	2240	Q100	325	543.47	548.2		548.83	0.001758	3.58	114.07	99.03	0.62
Wolgan Creek	0	2260	Q100	325	543.43	548.33		548.88	0.001412	3.37	128.73	109.6	0.57
Wolgan Creek	0	2280	Q100	325	543.42	548.37		548.91	0.001601	3.32	122.08	103.07	0.59
Wolgan Creek	0	2300	Q100	325	543.41	548.66		548.96	0.000777	2.49	172.6	138.17	0.42
Wolgan Creek	0	2320	Q100	325	543.72	548.38		549.11	0.001827	4	112.39	67.4	0.65
Wolgan Creek	0	2340	Q100	325	543.64	548.63		549.16	0.001137	3.32	126.22	71.1	0.52
Wolgan Creek	0	2360	Q100	325	543.76	548.48		549.27	0.002121	4.05	101.29	66.06	0.69
Wolgan Creek	0	2380	Q100	325	543.8	548.72		549.33	0.001497	3.57	115.95	66.62	0.59
Wolgan Creek	0	2400	Q100	325	543.79	548.67	547.88	549.4	0.001866	3.87	100.47	49.25	0.65
Wolgan Creek	0	2420	Q100	315	543.86	547.66	548.21	549.63	0.00793	6.31	54.89	27.89	1.26
Wolgan Creek	0	2430		Bridge									
Wolgan Creek	0	2440	Q100	315	543.94	549.68	547.77	549.97	0.000622	2.55	182.91	108.01	0.39
Wolgan Creek	0	2460	Q100	315	544	549.71		549.99	0.000594	2.5	186.64	108.36	0.38
Wolgan Creek	0	2480	Q100	315	544.01	549.75		550	0.000558	2.31	183.29	105.41	0.37
Wolgan Creek	0	2500	Q100	315	544.29	549.96		550.03	0.000107	1.14	306.71	121.02	0.17
Wolgan Creek	0	2520	Q100	315	544.37	549.98		550.03	0.000108	1.02	328.74	124.89	0.16
Wolgan Creek	0	2540.09	Q100	315	544.6	550		550.03	0.000074	0.85	388.39	145.79	0.14
Wolgan Creek	0	2559.96	Q100	315	544.81	549.99		550.04	0.000099	0.93	347.3	117.49	0.16
Wolgan Creek	0	2580.02	Q100	315	545.01	549.99		550.04	0.000123	0.99	319.91	94.41	0.17
Wolgan Creek	0	2600	Q100	315	544.7	549.99		550.05	0.000157	1.08	296.42	109.91	0.19
Wolgan Creek	0	2620	Q100	315	545.34	549.99		550.05	0.000193	1.15	276.12	97.76	0.21
Wolgan Creek	0	2640	Q100	315	545.41	549.99		550.06	0.000189	1.13	281.15	96.8	0.21
Wolgan Creek	0	2660.01	Q100	315	545.58	550.03		550.06	0.000082	0.79	411.38	153.59	0.14
Wolgan Creek	0	2680	Q100	315	545.72	550.03		550.07	0.000088	0.82	390.51	140.96	0.14
Wolgan Creek	0	2700	Q100	315	545.66	550.03		550.07	0.00012	0.91	348.48	119.37	0.17
Wolgan Creek	0	2720	Q100	315	545.77	550.02		550.08	0.000193	1.1	291.52	109.92	0.21
Wolgan Creek	0	2740	Q100	315	545.64	550.01		550.09	0.000271	1.29	264.08	107.93	0.25
Wolgan Creek	0	2760	Q100	315	545.68	550		550.1	0.000405	1.49	230.1	102.89	0.3
Wolgan Creek	0	2780	Q100	315	545.77	549.98		550.13	0.000496	1.83	217.69	114.02	0.34
Wolgan Creek	0	2800	Q100	315	545.76	549.96		550.15	0.000713	2.07	192.78	85.25	0.4
Wolgan Creek	0	2820.01	Q100	315	545.76	549.99		550.17	0.00078	1.94	192.28	97.52	0.4
Wolgan Creek	2840	2840	Q100	156	545.99	550.16		550.19	0.000134	0.89	232.9	111.47	0.17
Wolgan Creek	2840	2860	Q100	156	545.93	550.16		550.19	0.000183	0.88	223.88	103.59	0.19
Wolgan Creek	2840	2880	Q100	156	546.44	550.16		550.2	0.00019	0.89	238.59	125.25	0.2
Wolgan Creek	2840	2900	Q100	156	546.65	550.17		550.2	0.000233	0.95	215.58	107.34	0.22
Wolgan Creek	2840	2920	Q100	156	546.67	550.08		550.25	0.001029	1.81	86.87	52.64	0.44
Wolgan Creek	2840	2940	Q100	156	546.68	550.07		550.29	0.001661	2.1	74.23	49.78	0.55
Wolgan Creek	2840	2960	Q100	156	546.74	550.13		550.33	0.001541	1.96	80.38	61.77	0.52
Wolgan Creek	2840	2980	Q100	156	546.77	550.15		550.37	0.001662	2.07	80.57	61.65	0.55
Wolgan Creek	2840	2990		Bridge									
Wolgan Creek	2840	3000	Q100	156	546.75	550.23	549.53	550.42	0.001183	1.97	84.63	60.11	0.48
Wolgan Creek	2840	3020	Q100	156	546.91	550.15		550.5	0.001869	2.65	66.39	49.94	0.61
Wolgan Creek	2840	3040	Q100	156	547.02	550.36		550.54	0.000883	1.88	88.03	62.05	0.42
Wolgan Creek	2840	3060	Q100	156	547.19	550.31		550.59	0.001221	2.46	88.58	80.98	0.51

HEC-RAS Plan: Plan 06 Profile: Q100													
River	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
Wolgan Creek	2840	3080	Q100	156	547.35	550.3		550.64	0.001626	2.78	85.28	82.56	0.58
Wolgan Creek	2840	3100	Q100	156	547.46	550.34	550	550.67	0.001686	2.74	84.82	87.35	0.58
Wolgan Creek	2840	3120	Q100	156	547.43	549.82	550.24	550.92	0.007594	4.67	37.18	44.92	1.17
Wolgan Creek	2840	3140	Q100	156	547.49	550.51	550.51	551.07	0.003606	3.59	65.57	75.74	0.83
Wolgan Creek	2840	3160	Q100	156	547.54	550.88	550.64	551.16	0.002373	2.61	93.77	109.83	0.66
Wolgan Creek	2840	3180	Q100	156	547.62	550.87		551.24	0.00242	2.88	79.11	88.59	0.68
Wolgan Creek	2840	3200	Q100	156	547.75	551		551.29	0.002081	2.54	91.47	112.49	0.62
Wolgan Creek	2840	3220	Q100	156	547.74	550.95		551.38	0.002963	3.05	70.67	76.91	0.74
Wolgan Creek	2840	3240	Q100	156	547.87	551.2		551.44	0.001478	2.37	105.55	135.55	0.54
Wolgan Creek	2840	3260	Q100	156	547.9	551.21		551.48	0.001747	2.58	103.32	127.38	0.59
Wolgan Creek	2840	3280	Q100	156	548.09	551.34		551.52	0.001107	2.13	135.12	162.88	0.47
Wolgan Creek	2840	3300	Q100	156	548.15	551.44		551.55	0.001224	1.7	147.68	166.33	0.47
Wolgan Creek	2840	3320	Q100	156	548.16	551.51		551.57	0.000511	1.14	202.06	211.47	0.3
Wolgan Creek	2840	3340	Q100	152	548.21	551.51		551.59	0.000688	1.28	158.52	155.82	0.35
Wolgan Creek	2840	3360	Q100	152	548.36	551.51		551.61	0.000813	1.44	136.77	138.03	0.38
Wolgan Creek	2840	3380	Q100	152	548.55	551.51		551.63	0.001147	1.58	120.63	166.9	0.45
Wolgan Creek	2840	3399.93	Q100	152	548.78	551.52	551.04	551.67	0.001796	1.75	98.67	162.1	0.54
Wolgan Creek	2840	3419.96	Q100	152	549.04	551.11	551.39	551.92	0.012209	4.01	37.93	43.46	1.37
Wolgan Creek	2840	3440	Q100	152	549.08	551.73	551.73	552.1	0.003864	2.84	73.72	128.46	0.81
Wolgan Creek	2840	3460	Q100	152	549.21	551.64	551.6	552.25	0.003951	3.51	49.86	55.32	0.86
Wolgan Creek	2840	3480	Q100	152	549.3	552.27		552.32	0.000294	1.11	175.6	187.6	0.24
Wolgan Creek	2840	3500	Q100	152	549.29	552.24		552.35	0.001342	1.54	107.93	110.99	0.47
Wolgan Creek	2840	3520.16	Q100	152	549.34	552.24		552.39	0.001257	1.73	93.6	76.8	0.47
Wolgan Creek	2840	3540.02	Q100	152	549.45	552.23	551.68	552.44	0.001629	2.09	89.48	108.87	0.54
Wolgan Creek	2840	3560.06	Q100	152	549.7	551.56	552.02	552.88	0.019019	5.22	33.83	49.16	1.72
Wolgan Creek	2840	3580	Q100	152	549.78	552.04	552.46	553.17	0.009949	5.05	44.65	60.39	1.31
Wolgan Creek	2840	3600	Q100	152	549.81	552.66	552.89	553.33	0.003908	3.94	68.01	117.35	0.86
Wolgan Creek	2840	3620	Q100	152	549.84	553.07	553.07	553.42	0.002291	3.12	102.49	150	0.66
Wolgan Creek	2840	3640	Q100	152	549.99	553.08		553.49	0.002276	3.2	95.64	150	0.65
Wolgan Creek	2840	3660	Q100	152	550.21	553.34	552.78	553.54	0.001063	2.27	128.58	150	0.46
Wolgan Creek	2840	3680	Q100	152	550.29	553.31	553.31	553.7	0.002013	3.04	95.46	150	0.63
Wolgan Creek	2840	3700	Q100	152	550.35	553.57		553.75	0.00106	2.05	120.13	150	0.45
Wolgan Creek	2840	3720	Q100	152	550.34	553.56		553.79	0.001287	2.25	103.99	150	0.5
Wolgan Creek	2840	3740	Q100	152	550.56	553.57		553.82	0.001354	2.35	97.29	150	0.51
Wolgan Creek	2840	3760	Q100	152	550.68	553.57	552.96	553.87	0.001723	2.49	80.22	150	0.57
Wolgan Creek	2840	3780	Q100	152	550.69	552.88	553.25	554.13	0.010617	4.94	30.76	22.34	1.34
Wolgan Creek	2840	3800	Q100	152	550.77	553.12	553.33	554.32	0.007816	4.85	31.34	18.44	1.19
Wolgan Creek	2840	3820	Q100	152	550.93	554.02	554.02	554.47	0.002419	3.11	76.94	148.01	0.68
Wolgan Creek	2840	3840	Q100	152	551.03	554.11	553.61	554.52	0.00222	2.93	72.35	135.44	0.65
Wolgan Creek	2840	3860	Q100	152	551.2	553.44	553.71	554.75	0.008614	5.08	29.9	17.34	1.24
Wolgan Creek	2840	3880	Q100	152	551.21	554.15	554.15	554.93	0.004518	3.92	43.12	51.49	0.89
Wolgan Creek	2840	3900	Q100	152	551.47	554.76		555.02	0.001221	2.41	105.9	150	0.5
Wolgan Creek	2840	3920	Q100	152	551.67	554.77		555.05	0.001381	2.43	81.41	85.69	0.51
Wolgan Creek	2840	3940	Q100	152	551.61	554.77		555.1	0.002038	2.58	64.74	61.51	0.6
Wolgan Creek	2840	3960	Q100	152	551.77	554.92		555.15	0.001108	2.14	89.78	96.79	0.46
Wolgan Creek	2840	3980	Q100	152	551.95	554.87		555.21	0.001784	2.55	60.25	50.59	0.57
Wolgan Creek	2840	4000	Q100	152	551.99	554.71	554.56	555.36	0.004302	3.58	43.51	28.16	0.88
Wolgan Creek	2840	4020	Q100	152	552.05	554.27	554.54	555.5	0.008715	4.93	30.86	19.26	1.24
Wolgan Creek	2840	4040	Q100	152	551.93	554.56	554.68	555.67	0.006743	4.67	32.58	17.72	1.1
Wolgan Creek	2840	4060	Q100	152	552.12	554.77	554.77	555.8	0.005545	4.48	34	17.17	1.01
Wolgan Creek	2840	4080	Q100	152	552.12	555.33	554.81	555.91	0.002695	3.39	45.5	28.08	0.72
Wolgan Creek	2840	4100	Q100	152	552.33	555.23	555.08	556.05	0.004774	4.02	37.86	19.02	0.91
Wolgan Creek	2840	4120	Q100	152	552.33	554.61	555.16	556.45	0.012266	6.02	25.26	14.55	1.46
Wolgan Creek	2840	4140	Q100	152	552.39	555.65	555.65	556.69	0.004999	4.51	35.34	26.57	0.94
Wolgan Creek	2840	4160	Q100	152	552.45	556.58		556.8	0.000673	2.07	82.26	82.44	0.38
Wolgan Creek	2840	4180	Q100	152	552.58	556.56		556.83	0.000813	2.31	77.46	56.55	0.42
Wolgan Creek	2840	4200	Q100	152	552.72	556.41		556.93	0.002249	3.23	52.2	38.88	0.65
Wolgan Creek	2840	4220	Q100	152	552.76	556.64		556.98	0.001286	2.6	66.4	48.77	0.51
Wolgan Creek	2840	4240	Q100	152	552.92	556.81		557.01	0.000635	2.01	82.9	52.79	0.37
Wolgan Creek	2840	4260	Q100	152	553.12	556.58	556.04	557.15	0.002655	3.34	46.45	34.6	0.71
Wolgan Creek	2840	4280	Q100	152	553.22	556.59	555.91	557.21	0.002377	3.5	43.62	16.97	0.67
Wolgan Creek	2840	4300	Q100	152	553.3	555.89	556.22	557.46	0.0089	5.56	27.33	13.31	1.24
Wolgan Creek	2840	4320	Q100	152	553.42	556.49	556.49	557.63	0.004988	4.88	35.33	16.05	1
Wolgan Creek	2840	4340	Q100	152	553.54	557.2		557.77	0.003166	3.81	51.49	20.61	0.79
Wolgan Creek	2840	4360	Q100	152	553.89	557.49		557.84	0.001869	3.02	65.25	23.49	0.62
Wolgan Creek	2840	4380	Q100	152	553.62	557.54		557.87	0.001422	2.74	66.39	25.9	0.55
Wolgan Creek	2840	4400	Q100	152	553.7	557.44		557.97	0.002146	3.23	47.13	18.09	0.64
Wolgan Creek	2840	4420	Q100	152	553.74	557.47		558.02	0.002481	3.31	45.99	18.85	0.67
Wolgan Creek	2840	4440	Q100	152	553.95	557.69		558.08	0.001465	2.76	55.01	20.81	0.54
Wolgan Creek	2840	4460	Q100	152	554.1	557.48		558.23	0.00356	3.84	39.56	16.84	0.8
Wolgan Creek	2840	4480	Q100	152	554.23	557.97		558.31	0.001247	2.57	59.09	21.53	0.5
Wolgan Creek	2840	4500	Q100	152	554.24	557.87		558.4	0.002261	3.21	47.4	19.8	0.66
Wolgan Creek	2840	4520	Q100	152	554.41	557.93		558.44	0.002179	3.17	47.97	19.32	0.64
Wolgan Creek	2840	4540	Q100	152	554.76	558.15		558.5	0.001393	2.62	58.08	23.16	0.53
Wolgan Creek	2840	4560	Q100	152	555	558.12		558.56	0.00196	2.93	51.85	22.82	0.62
Wolgan Creek	2840	4580	Q100	152	555.08	558.06		558.65	0.00258	3.39	44.87	18.45	0.69
Wolgan Creek	2840	4600	Q100	152	555.16	558.09		558.71	0.003033	3.49	43.56	20.29	0.76
Wolgan Creek	2840	4620	Q100	152	555.28	558.25		558.78	0.002438	3.2	47.45	21.39	0.69
Wolgan Creek	2840	4640	Q100	152	555.36	558.44		558.83	0.001761	2.77	54.95	24.54	0.59
Wolgan Creek	2840	4660	Q100	152	555.35	558.53		558.87	0.001692	2.59	58.7	28.71	0.58
Wolgan Creek	2840	4680	Q100	152	555.54	558.54	557.94	558.92	0.001992	2.74	55.46	27.88	0.62
Wolgan Creek	2840	4700	Q100	152	555.57	558.26	558.26	559.19	0.005576	4.28	35.49	19.39	1.01

HEC-RAS Plan: Plan 06 Profile: Q100													
River	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
Wolgan Creek	2840	4720	Q100	152	555.7	558.92		559.3	0.001706	2.74	55.42	23.67	0.57
Wolgan Creek	2840	4740	Q100	152	555.86	558.97		559.34	0.001763	2.7	56.27	26.01	0.59
Wolgan Creek	2840	4760	Q100	152	556.01	558.87		559.45	0.002997	3.36	45.18	21.96	0.75
Wolgan Creek	2840	4780	Q100	152	556.14	558.75	558.71	559.61	0.005472	4.12	36.89	20.35	0.98
Wolgan Creek	2840	4800	Q100	152	556.27	559.45		559.72	0.001231	2.31	65.79	30.02	0.5
Wolgan Creek	2840	4820	Q100	152	556.45	559.51		559.75	0.001267	2.16	70.32	36.63	0.5
Wolgan Creek	2840	4840	Q100	152	556.56	559.23	559.22	559.94	0.005609	3.75	40.53	27.82	0.99
Wolgan Creek	2840	4860	Q100	152	556.68	559.57		560.04	0.00255	3.02	50.33	26.09	0.69
Wolgan Creek	2840	4880	Q100	152	557	559.86		560.09	0.001042	2.15	70.66	31.59	0.46
Wolgan Creek	2840	4900.02	Q100	152	556.96	559.89		560.12	0.001272	2.11	72.17	38.87	0.49
Wolgan Creek	2840	4920	Q100	152	557.02	559.86		560.17	0.001793	2.48	61.36	33.15	0.58
Wolgan Creek	2840	4940	Q100	152	557.1	559.99	559.33	560.21	0.001514	2.11	72.15	44.79	0.53
Wolgan Creek	2840	4960	Q100	152	557.21	559.78	559.78	560.44	0.006143	3.58	42.47	33.6	1.02
Wolgan Creek	2840	4979.55	Q100	152	557.27	560.29	559.86	560.55	0.002465	2.26	67.3	54.12	0.65
Wolgan Creek	2840	5000	Q100	152	557.42	560.37	559.86	560.6	0.001805	2.12	71.62	50.02	0.57
Wolgan Creek	2840	5020	Q100	152	557.63	559.9	560.16	560.8	0.013002	4.2	36.18	39.91	1.41
Wolgan Creek	2840	5040	Q100	152	557.8	560.01	560.34	561.12	0.013714	4.67	32.52	31.32	1.46
Wolgan Creek	2840	5060	Q100	152	557.92	560.57	560.57	561.33	0.005705	3.85	39.46	26.12	1
Wolgan Creek	2840	5080	Q100	152	558	560.85		561.43	0.00346	3.38	45.01	24.84	0.8
Wolgan Creek	2840	5100	Q100	152	557.99	561.22		561.5	0.001529	2.38	64.69	36.51	0.55
Wolgan Creek	2840	5120	Q100	152	558.34	561.19	560.53	561.56	0.001886	2.7	56.2	27.93	0.61
Wolgan Creek	2840	5140	Q100	152	558.57	561.03	561.03	561.94	0.005657	4.22	36.01	20.28	1.01
Wolgan Creek	2840	5160	Q100	152	558.55	561.72		562.05	0.001741	2.54	59.92	30.72	0.58
Wolgan Creek	2840	5180	Q100	152	558.74	561.91		562.09	0.000979	1.9	79.83	41.63	0.44
Wolgan Creek	2840	5200	Q100	152	558.86	561.99		562.11	0.000644	1.55	98.16	51.31	0.36
Wolgan Creek	2840	5220	Q100	152	559.19	561.98		562.14	0.001373	1.77	85.94	65.41	0.49
Wolgan Creek	2840	5240	Q100	152	559.41	562	561.29	562.18	0.001615	1.88	80.93	63.53	0.53
Wolgan Creek	2840	5260	Q100	152	559.43	561.53	561.71	562.41	0.008373	4.16	36.51	29.31	1.19
Wolgan Creek	2840	5280	Q100	152	559.43	561.75	561.9	562.57	0.007754	4.02	37.77	29.88	1.14
Wolgan Creek	2840	5300	Q100	152	559.49	561.6	561.91	562.8	0.010001	4.84	31.41	22.96	1.32
Wolgan Creek	2840	5320	Q100	152	559.59	562.16	562.16	562.98	0.005696	4.03	37.72	23.24	1.01
Wolgan Creek	2840	5340	Q100	152	559.65	562.38	562.21	563.09	0.004263	3.72	40.86	22.95	0.89
Wolgan Creek	2840	5360	Q100	152	559.74	562.75		563.17	0.002097	2.88	52.82	25.77	0.64
Wolgan Creek	2840	5380	Q100	152	559.78	562.79	562.2	563.22	0.002179	2.91	52.28	25.94	0.65
Wolgan Creek	2840	5400	Q100	152	559.84	561.95	562.35	563.34	0.012017	5.23	29.08	21.69	1.44
Wolgan Creek	2840	5420	Q100	152	559.85	562.66	562.66	563.56	0.005676	4.19	36.27	20.6	1.01
Wolgan Creek	2840	5440	Q100	152	559.89	563.38	562.37	563.66	0.001221	2.35	64.72	28.46	0.5