

Bellambi Gully Flood Study

APPENDIX D
PROPOSED MITIGATION MEASURES



Legend

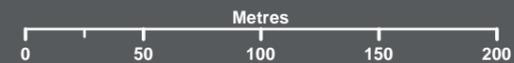
- Culvert
- Pipe
- Swale
- Cadastre (LPI, 2013)



Proposed Flood Mitigation

BELLAMBI GULLY FLOOD STUDY

1:3,000 Scale at A3



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
 Date: 2014-07-01
 Coordinate System: GDA 1994 MGA Zone 56
 Project: 82014089-01
 Map: G1004_ProposedFloodMitigation.mxd 02
 Aerial Imagery supplied by nearmap (July 2013)

Bellambi Gully Flood Study

APPENDIX E
PROPOSED SCENARIO HYDRAULIC
MODEL

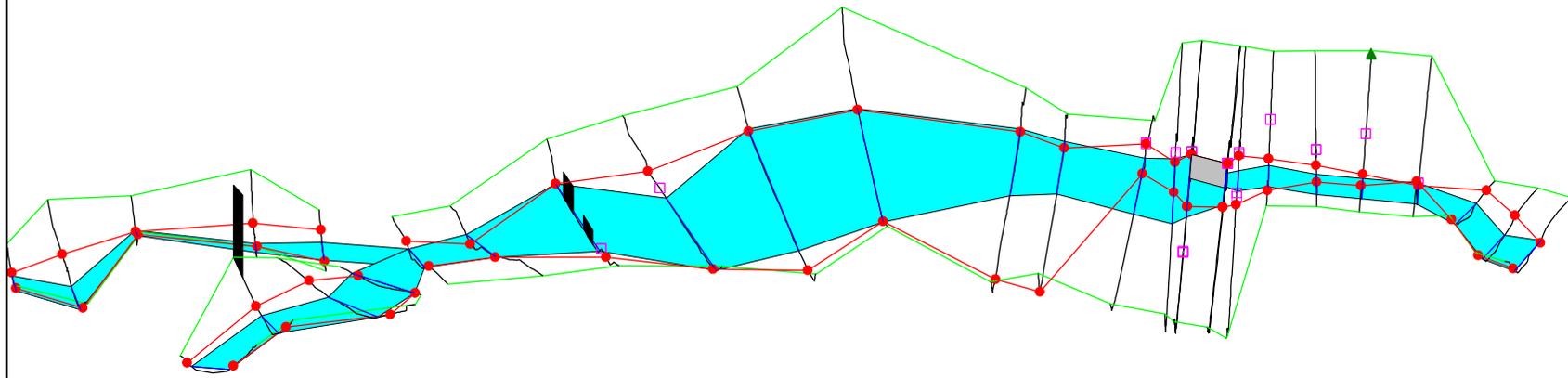
HECRAS Model View



Plan View

U:\FY14\089_Bellambi Gully Flood Study\D Plan: Prop_Sag2 7/01/2015

Legend	
	WS 100yr ARI
	Ground
	Bank Sta
	Levee
	Ineff

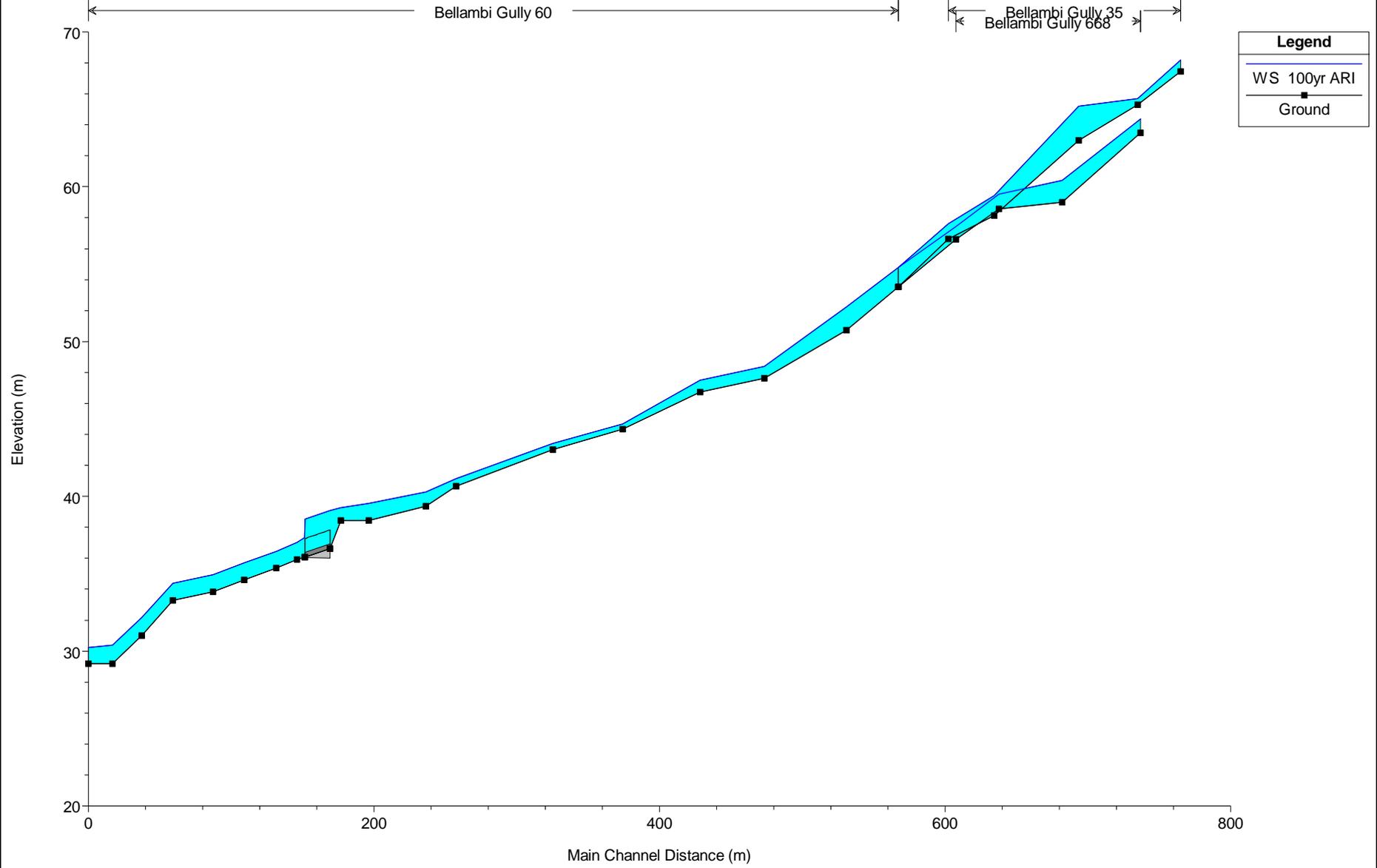


Long Section View

U:\FY14\089_Bellambi Gully Flood Study\D Plan: Prop_Sag2 7/01/2015

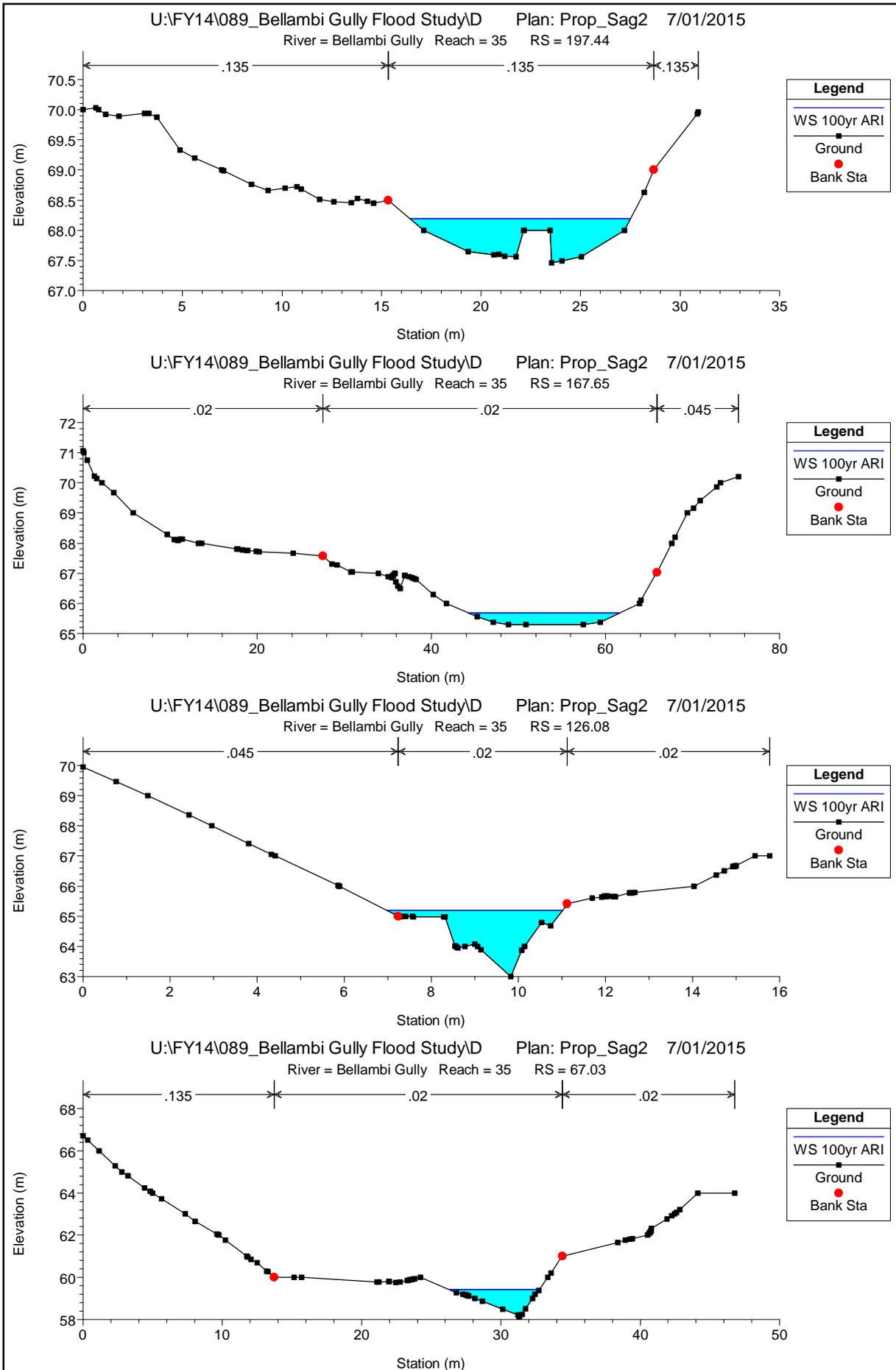
Bellambi Gully 60

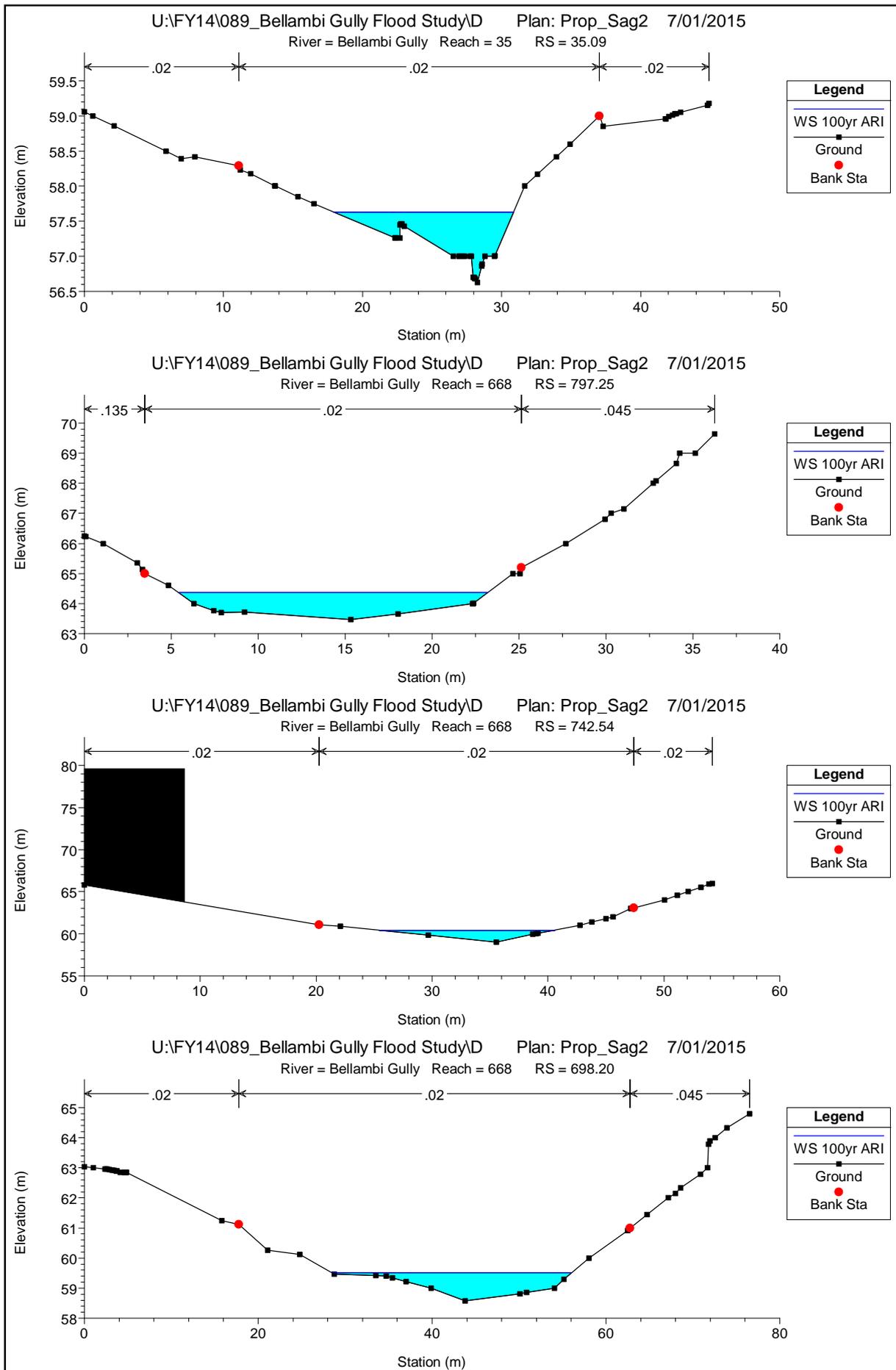
Bellambi Gully 35
Bellambi Gully 668

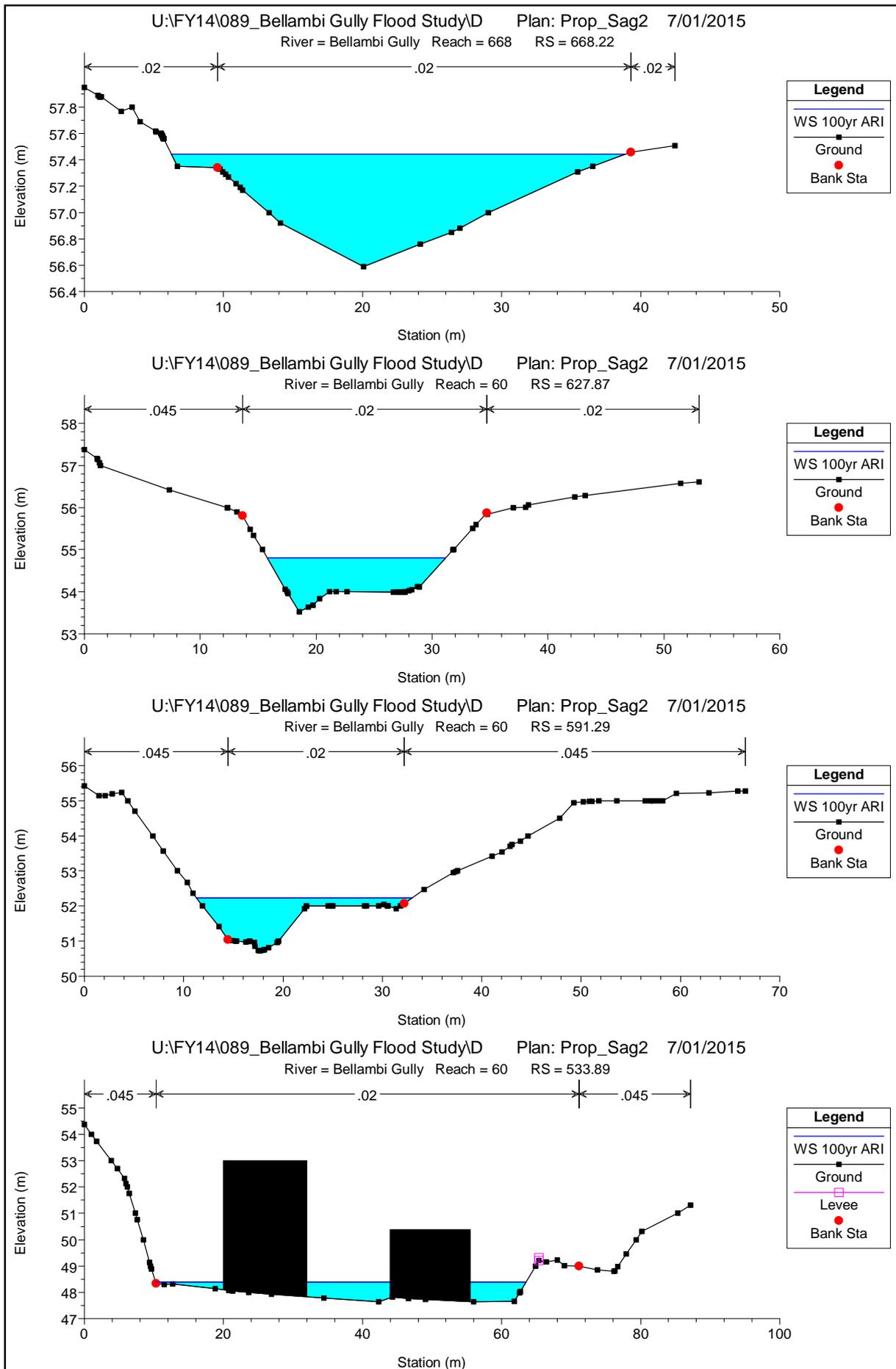


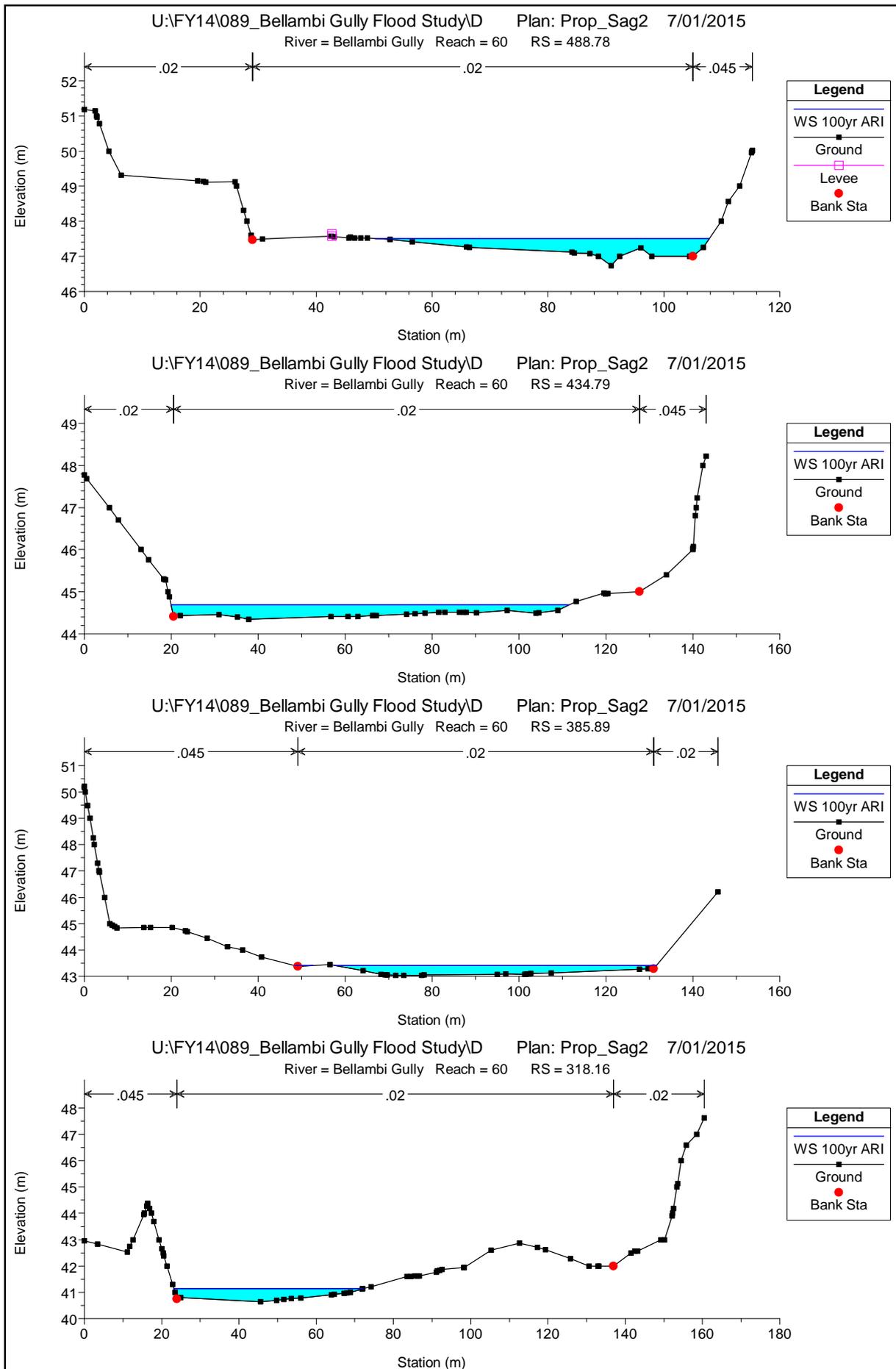
Legend	
WS 100yr ARI	(Cyan shaded area)
Ground	(Black line with square markers)

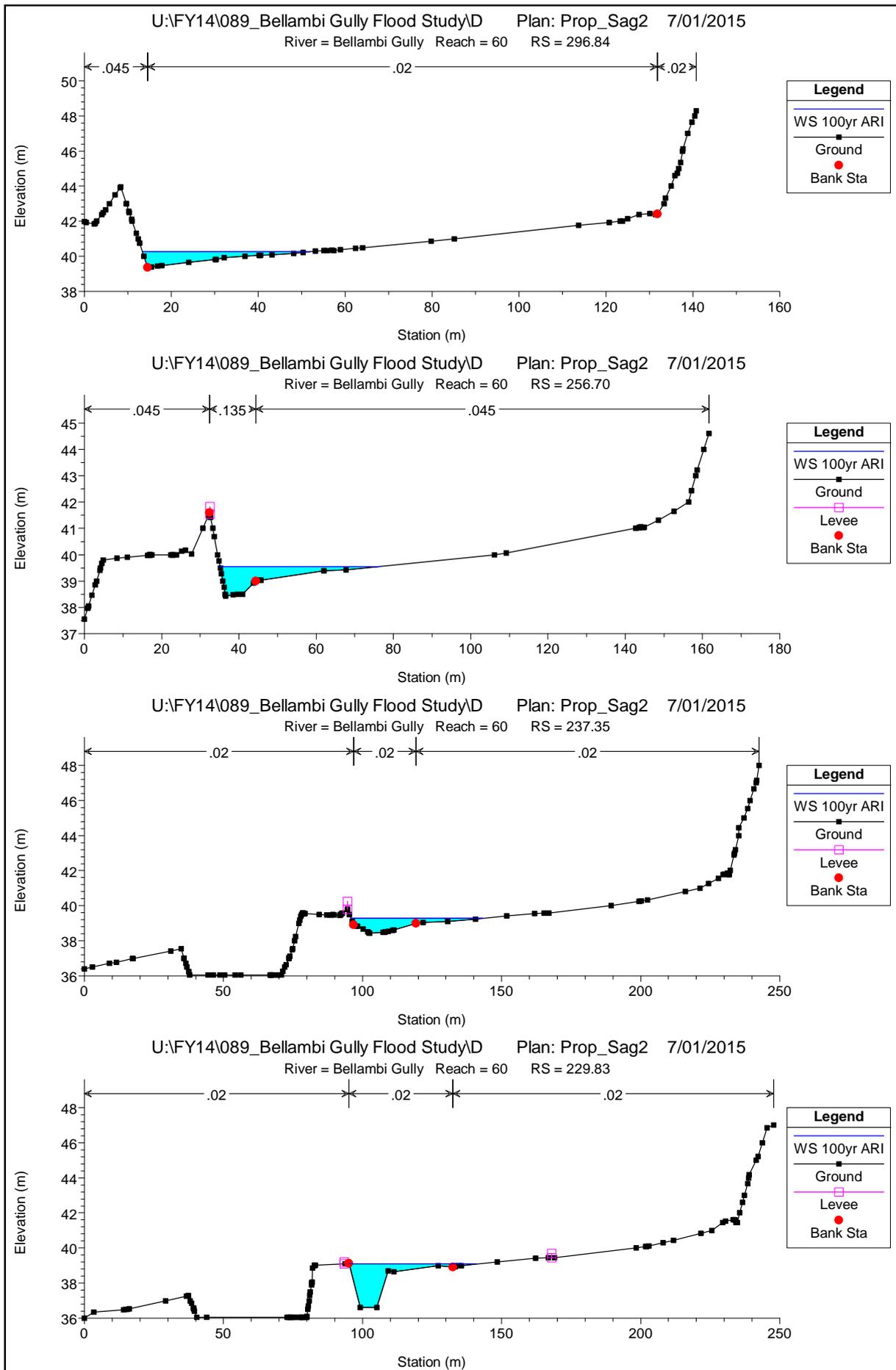
Cross Sections

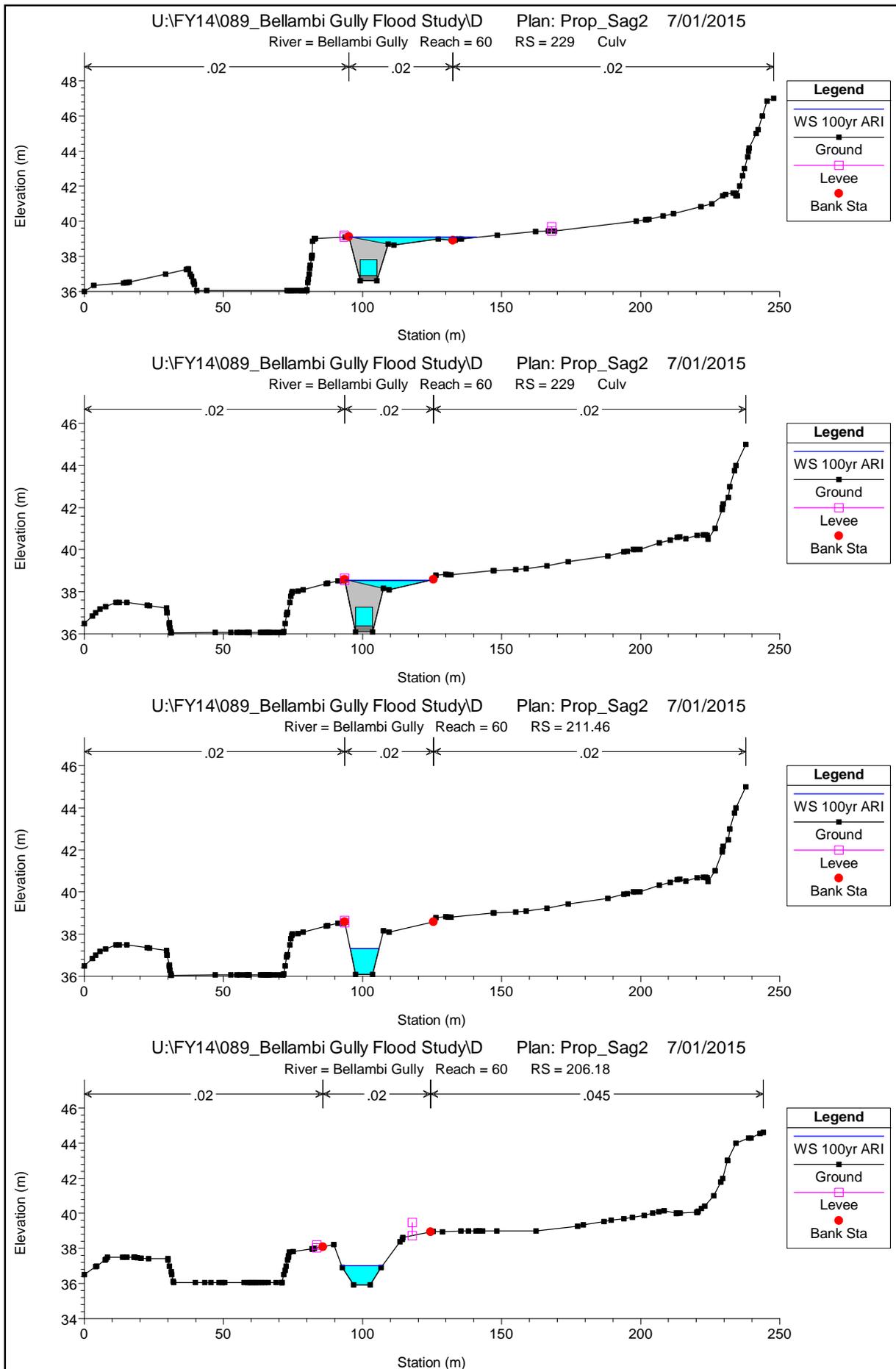


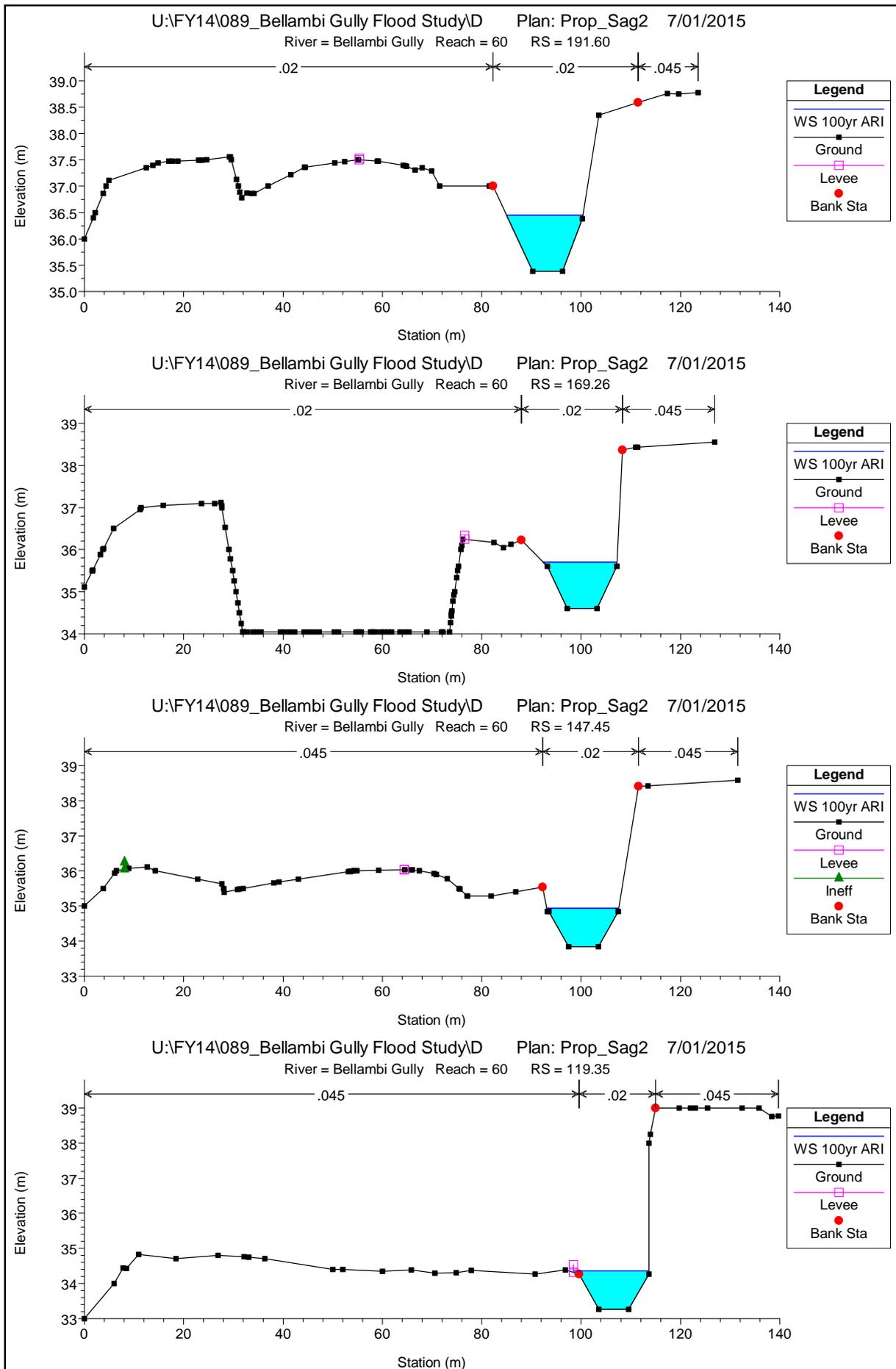


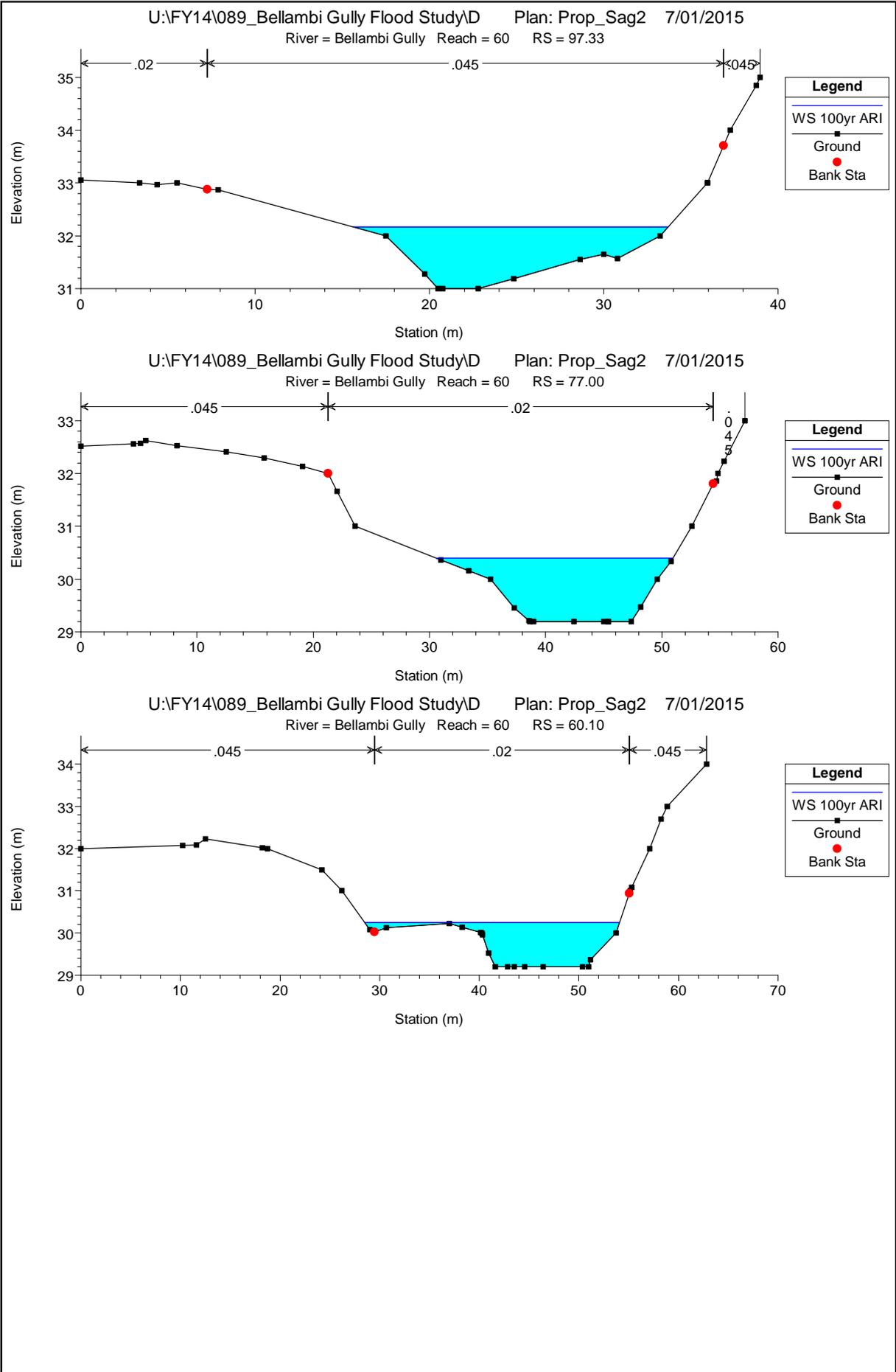












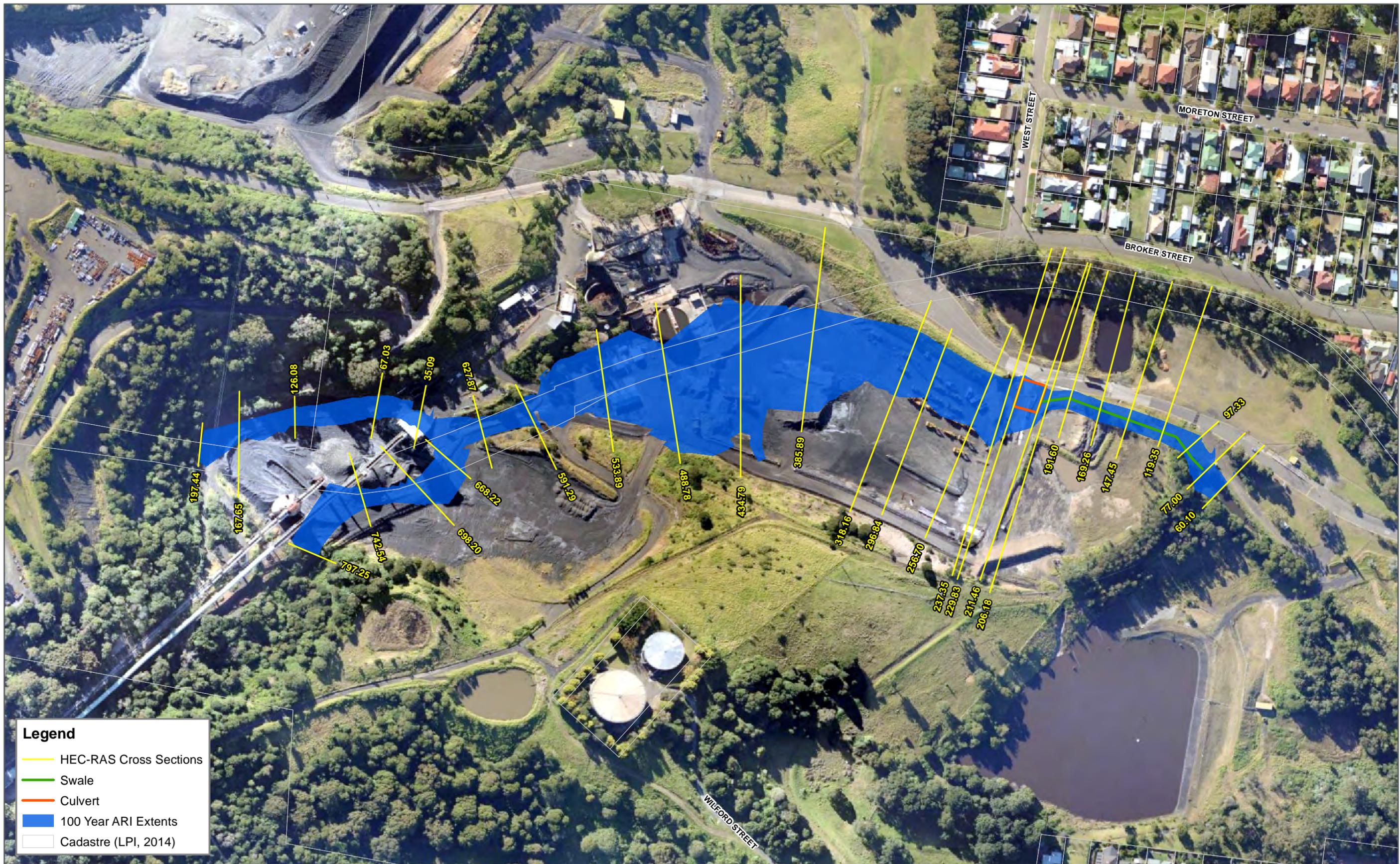
Results Table

HEC-RAS Plan: Prop_sag2 Profile: 100yr ARI

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)	Hydr Depth (m)
35	197.44	100yr ARI	9.74	67.46	68.19	68.19	68.41	0.270153	2.07	4.70	0.42
35	167.65	100yr ARI	9.74	65.29	65.69	65.69	65.85	0.005791	1.76	5.52	0.32
35	126.08	100yr ARI	9.74	63.00	65.20	65.20	65.64	0.008790	2.93	3.35	0.83
35	67.03	100yr ARI	9.74	58.14	59.42	59.42	59.73	0.005463	2.48	3.92	0.61
35	35.09	100yr ARI	9.74	56.63	57.63	57.63	57.83	0.005917	1.96	4.96	0.38
668	797.25	100yr ARI	28.60	63.47	64.37	64.37	64.69	0.004705	2.52	11.35	0.64
668	742.54	100yr ARI	28.60	59.00	60.43	60.43	60.79	0.004660	2.67	10.70	0.71
668	698.20	100yr ARI	28.60	58.57	59.51	59.51	59.76	0.005331	2.20	12.98	0.47
668	668.22	100yr ARI	28.60	56.59	57.44	57.44	57.67	0.004954	2.10	13.82	0.42
60	627.87	100yr ARI	31.63	53.52	54.80	54.80	55.19	0.004619	2.75	11.52	0.75
60	591.29	100yr ARI	31.63	50.72	52.24	52.24	52.57	0.005330	2.65	13.09	0.60
60	533.89	100yr ARI	31.63	47.64	48.38	48.38	48.63	0.005597	2.20	14.40	0.48
60	488.78	100yr ARI	31.63	46.73	47.51	47.51	47.66	0.005638	1.76	18.44	0.32
60	434.79	100yr ARI	31.63	44.35	44.69	44.69	44.80	0.006344	1.50	21.11	0.23
60	385.89	100yr ARI	31.63	43.03	43.41	43.41	43.54	0.006205	1.59	19.88	0.25
60	318.16	100yr ARI	31.63	40.64	41.14	41.14	41.32	0.005680	1.87	17.01	0.35
60	296.84	100yr ARI	31.63	39.35	40.28	40.28	40.49	0.005609	2.05	15.75	0.41
60	256.70	100yr ARI	31.63	38.43	39.55	39.55	39.76	0.067705	1.73	16.02	0.39
60	237.35	100yr ARI	31.63	38.43	39.28	39.28	39.48	0.003253	2.07	17.61	0.37
60	229.83	100yr ARI	31.63	36.62	39.09	37.87	39.14	0.000532	1.01	31.93	0.70
60	229		Culvert								
60	211.46	100yr ARI	31.63	36.08	37.32	37.32	37.81	0.004282	3.10	10.20	0.98
60	206.18	100yr ARI	31.63	35.92	37.02	37.02	37.41	0.004339	2.76	11.48	0.78
60	191.60	100yr ARI	31.63	35.38	36.46	36.46	36.83	0.004417	2.72	11.62	0.75
60	169.26	100yr ARI	31.63	34.60	35.71	35.71	36.09	0.004319	2.73	11.58	0.77
60	147.45	100yr ARI	31.63	33.84	34.94	34.94	35.33	0.004426	2.78	11.37	0.78
60	119.35	100yr ARI	31.63	33.27	34.37	34.37	34.76	0.004218	2.78	11.45	0.75
60	97.33	100yr ARI	31.63	31.00	32.17	32.17	32.51	0.023347	2.59	12.21	0.68
60	77.00	100yr ARI	31.63	29.20	30.40		30.59	0.002085	1.94	16.27	0.80
60	60.10	100yr ARI	31.63	29.20	30.24	30.24	30.53	0.005061	2.35	13.58	0.53

Bellambi Gully Flood Study

APPENDIX F
PROPOSED SCENARIO FLOOD MAP



Legend

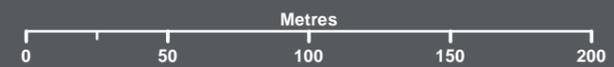
- HEC-RAS Cross Sections
- Swale
- Culvert
- 100 Year ARI Extents
- Cadastre (LPI, 2014)



Proposed Scenario

BELLAMBI GULLY FLOOD STUDY

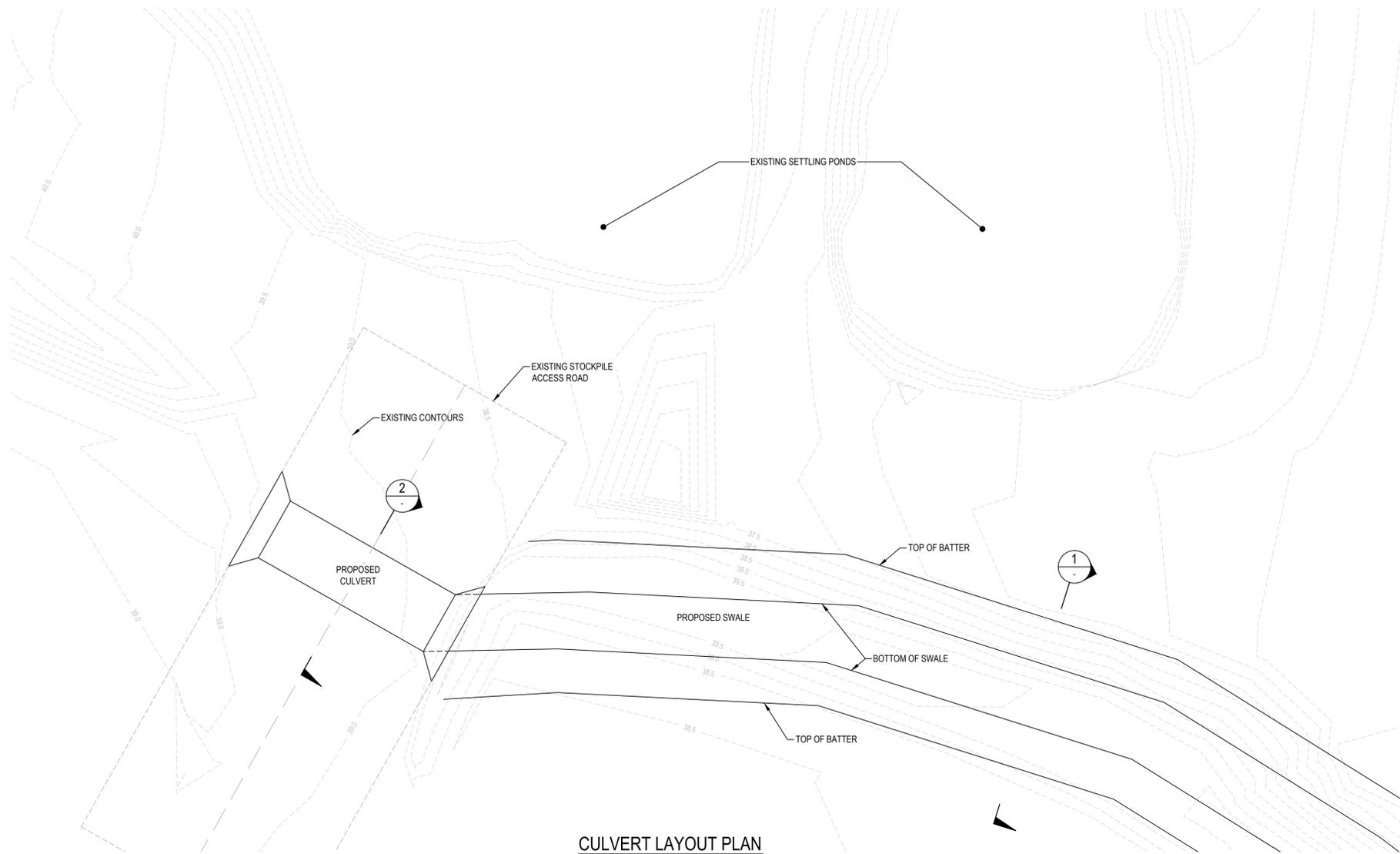
1:2,500 Scale at A3



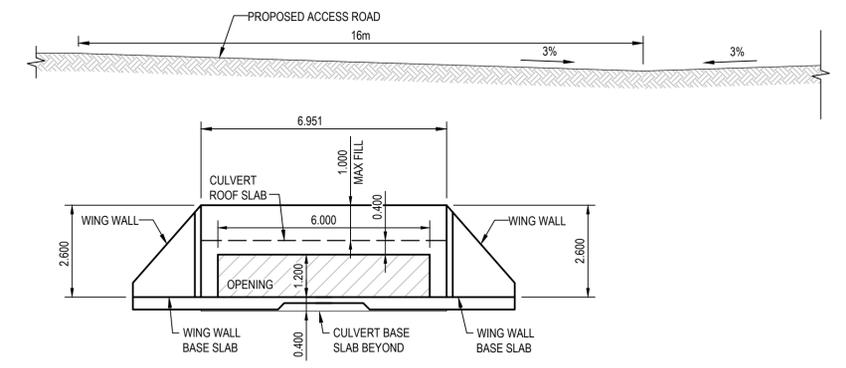
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
 Date: 2015-01-07
 Coordinate System: GDA 1994 MGA Zone 56
 Project: B2014089-01
 Map: G1005_ProposedScenario.mxd 04
 Aerial imagery supplied by Nearmap (July, 2013).

Bellambi Gully Flood Study

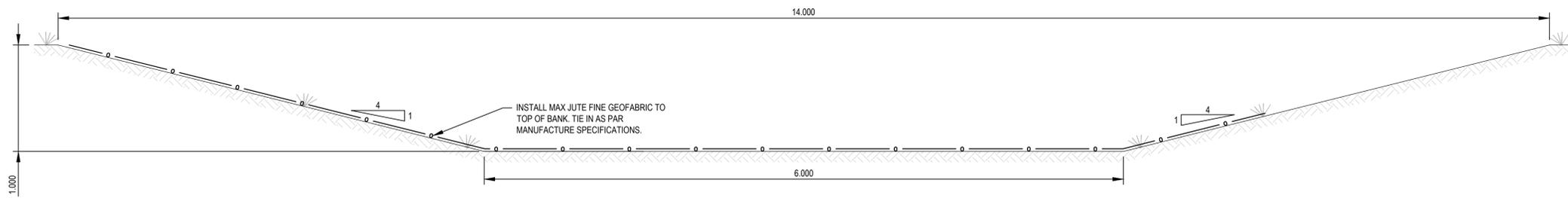
APPENDIX G
PROPOSED MITIGATION STRUCTURES



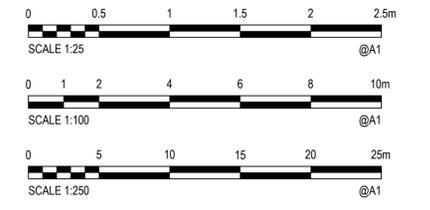
CULVERT LAYOUT PLAN
SCALE 1:250



SECTION 2
SCALE 1:100



SECTION 1
SCALE 1:25



Rev.	Date	Description	Des.	Verif.	Appd.
2	7/01/2015	MINOR AMENDMENTS AS PER COUNCIL COMMENTS	BAH	SBR	ODJ
1	24/11/2014	ISSUED FOR APPROVAL	AMW	SBR	ODJ

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Drawn	AMW	Date	24/11/2014
Checked	FK	Date	24/11/2014
Designed	AMW	Date	24/11/2014
Verified	SBR	Date	24/11/2014
Approved	ODJ	Date	24/11/2014

Client	WOLLONGONG COAL LIMITED
Project	BELLAMBI GULLY FLOOD STUDY
Title	PROPOSED CULVERT AND SWALE SECTIONS AND DETAILS

Status	FOR APPROVAL		
NOT TO BE USED FOR CONSTRUCTION PURPOSES			
DATUM	AHD	Scale	AS SHOWN
Size			A1
Drawing Number	82014089-01-C1000		Revision
			2

David Clarkson

From: Ron Zwicker <RZwicker@wollongong.nsw.gov.au>
Sent: Monday, 16 February 2015 8:45 AM
To: David Clarkson
Cc: Sara Wilson (Sara.Wilson@planning.nsw.gov.au); Howard.Reed@planning.nsw.gov.au
Subject: FW: TRIM: FW: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Hi Dave

Please see comments from Sasho – The revised January 2015 Flood Study has addressed Council’s previous comments.

Therefore, Council requests that the revised January 2015 Flood Study form part of the conditions of any consent granted for the Russell Vale Colliery Underground Expansion Project. This advice was also communicated to the PAC Commissioners when Council met the PAC recently.

Regards

Ron Zwicker
Special Projects Manager
Wollongong City Council
Locked Bag 8821
WOLLONGONG DC NSW 2500
Ph. (02) 4227 7639
Email: rzwicker@wollongong.nsw.gov.au

From: Sasho Srbinovski [mailto:SSrbinovski@wollongong.nsw.gov.au]
Sent: Thursday, 29 January 2015 3:50 PM
Subject: RE: TRIM: FW: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Hi Ron

The revised Bellambi Gully Flood Study by Cardno dated January 2015 submitted in support of alternative flood mitigation measures on the Russellvale Colliery site has been assessed against Chapters E13/E14 of the Wollongong DCP 2009 and previous stormwater comments dated 17 December 2014.

It is considered that the previous flooding comments raised have now been addressed. In particular, the flood modelling has now considered all culverts <6m in diagonal as 100% blocked and (proposed) culverts >6m in diagonal as 25% blocked btm up. This has resulted in a proposed culvert 6m wide x 1.2m high under access road with low point in access road to direct overflows into proposed swale designed to carry the 100 year flows from the site.

The following condition is recommended with respect to the proposed flood mitigation works on the site:

The proposed flood mitigation works for the site should be undertaken in accordance with the measures put forward within the Bellambi Gully Flood Study report 001 version 06 by Cardno dated January 2015.

regards

Sasho Srbinovski | Senior Stormwater Development Engineer | Wollongong City Council

T: 02 4227 7111 | F: 02 4227 7048 | E: ssrbinovski@wollongong.nsw.gov.au

41 Burelli Street, Wollongong NSW 2500

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From: Ron Zwicker
Sent: Tuesday, 27 January 2015 10:23 AM
To: Sasho Srbinovski
Subject: TRIM: FW: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Sasho

Please see revised flood study.

Cheers

Ron

From: Dianne Munro [<mailto:DMunro@hansenbailey.com.au>]
Sent: Tuesday, 27 January 2015 9:46 AM
To: Ron Zwicker

Cc: Howard Reed; Sara Wilson; David Clarkson; Andrew Wu

Subject: RE: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

A file has been sent to you via the [YouSendIt](#) File Delivery Service.

Download the file - [Report 001 V06 Bellambi Gully Flood Study_\(Amendments_Highlighted\).pdf](#)

Your file will expire after 14 days or 500 downloads.

Hi Ron, find attached updated flood study as forwarded by Dave Clarkson on 14 January.

Please let us know if you require anything further.

Regards,

Dianne.

Dianne Munro

Principal

MEnvLaw BSc

HANSEN BAILEY

Tel: (02) 6575 2003

Fax: (02) 6575 2001

Mobile: 0428 772 566

Email: dmunro@hansenbailey.com.au

From: David Clarkson [<mailto:dclarkson@wcl.net.au>]

Sent: Wednesday, January 14, 2015 10:38 AM

To: rzwicker@wollongong.nsw.gov.au

Cc: Dianne Munro; Howard Reed; Sara Wilson

Subject: Updated Bellambi Gully Flood Study for Russell Vale Colliery Site (82014089-01)

Hi Ron,

Please find attached a revised Bellambi Gully flood study to incorporate Council's requests in your email below.

The revised report adopts Council blockage policy upstream of the 6m culvert, and increases the sag over the culvert to convey 100 year ARI flows overtopping the road in this scenario. Amended sections have been highlighted for reference.

The revised modelling does not affect the conclusion or recommendations.

We look forward to your early approval of the attached report.

Cheers

Dave Clarkson

Group Environment Manager



☎ Mob: 0458 059 564

✉ Email: dclarkson@wcl.net.au

From: Ron Zwicker <RZwicker@wollongong.nsw.gov.au>

Date: 18 December 2014 9:27:41 am AEST

To: "David Clarkson (dclarkson@wcl.net.au)" <dclarkson@wcl.net.au>, "Owen de Jong (owen.dejong@cardno.com.au) (owen.dejong@cardno.com.au)" <owen.dejong@cardno.com.au>

Cc: Sasho Srbinovski <SSrbinovski@wollongong.nsw.gov.au>, "Sara Wilson (Sara.Wilson@planning.nsw.gov.au)" <Sara.Wilson@planning.nsw.gov.au>, "Howard.Reed@planning.nsw.gov.au" <Howard.Reed@planning.nsw.gov.au>

Subject: FW: review of Bellambi Gully Flood Study for Russell Vale Colliery Site

Hi Dave / Owen

Please see Sasho's comments regarding the revised Bellambi Gully Flood Study.

Regards

Ron Zwicker

Special Projects Manager

Wollongong City Council

Locked Bag 8821

WOLLONGONG DC NSW 2500

Ph. (02) 4227 7639

Email: rzwicker@wollongong.nsw.gov.au

From: Sasho Srbinovski
Sent: Thursday, 18 December 2014 9:50 AM
To: Ron Zwicker
Subject: review of Bellambi Gully Flood Study for Russell Vale Colliery Site

Hi Ron

Please find my comments below.

The Bellambi Gully Flood Study by Cardno dated November 2014 submitted in support of alternative flood mitigation measures on the Russellvale Colliery site has been assessed against Chapters E13/E14 of the Wollongong DCP 2009 and previous stormwater comments dated 22 September 2014. The following comments are made:

The proposed mitigation option within the current (November 2014) flood study by Cardno for the subject site has assumed a portion of the contributing stormwater flows at the site will be catered for within the existing stormwater pipes, which is considered unrealistic in light of the flood impacts experienced both on site and downstream in 1998.

Whilst the proposal to implement debris control structures across existing inlets together with management procedures has merit, these measures are not considered as 'failsafe' and therefore unlikely to prevent a recurrence of the flood impacts experienced in this area in 1998.

In order to address the concerns raised above, the proposed mitigation option for the site should be based on the Wollongong Council 'policy based' conduit blockage criteria. This approach adopts 100% blockage of all stormwater pipes having less than 6m diagonal opening and 25% bottom up blockage for stormwater pipes having greater than 6m diagonal opening. This would result in a culvert design of greater than 6m in diagonal located at the stockpile access road to cater for the contributing stormwater flows arriving on the site for a 100 year ARI event or greater. The proposed swale alongside the stockpile access road should also be designed to cater for the contributing 100 year ARI flows or greater to ensure these flows are conveyed to the licensed discharge point at Bellambi Creek.

The proposed flood mitigation measures for the site should be accurately reflected within Appendix E of the updated study.

Final dimensions of the proposed culvert and swale including calculations demonstrating the capacity of each in line with the abovementioned conduit blockage policy should be included within the study for further assessment.

regards

Sasho Srbinovski | Senior Stormwater Development Engineer | Wollongong City Council
T: 02 4227 7111 | F: 02 4227 7048 | E: ssrbinovski@wollongong.nsw.gov.au
41 Burelli Street, Wollongong NSW 2500

From: Ron Zwicker
Sent: Tuesday, 25 November 2014 3:29 PM
To: Owen de Jong; Sasho Srbinovski
Cc: David Clarkson (dclarkson@wcl.net.au); Shaza Raini; Wollongong Document Control
Subject: RE: Bellambi Gully Flood Study (82014089-01)

Hi Owen

Thanks for the revised flood study.

The revised flood study will be reviewed and we will provide appropriate feedback within the next 2 weeks.

In light of this, I agree that the meeting this week is no longer necessary.

Can you also ask Wollongong Coal to formally lodge the revised flood study with the NSW Department of Planning & Environment since the Department will also need to be involved in any decision making concerning this revised flood study.

Regards

Ron Zwicker
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Ph. (02) 4227 7639
Email: rzwicker@wollongong.nsw.gov.au

From: Owen de Jong [<mailto:owen.dejong@cardno.com.au>]
Sent: Tuesday, 25 November 2014 2:59 PM
To: Ron Zwicker; Sasho Srbinovski
Cc: David Clarkson (dclarkson@wcl.net.au); Shaza Raini; Wollongong Document Control
Subject: Bellambi Gully Flood Study (82014089-01)

Ron / Sasho,

Please find attached the updated Bellambi Gully flood study for your consideration, which has been revised following the outcomes of our recent meeting.

With regards to the culvert sizing, we reviewed sizing of the 6m RCBC designed for the Ridge (as discussed), and found that 1.2m H was adopted following liaison / agreement with Council. On this basis we've adopted 1.2m H for this site also.

Happy to meet on Thursday to discuss (if necessary), otherwise if any further clarity is required please don't hesitate to contact me.

Regards,

Owen de Jong

SENIOR WATER ENGINEER - MIEAUST CPENG
CARDNO



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