Rous River Flood Study

ROUS RIVER WAY

Planning Proposal / Rezoning

NEWLAND DEVELOPERS PTY LTD

FEBRUARY 2012

REVISION 07

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Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
01	27/05/2011	CS	BT	27/05/2011	Draft
02	10/06/2011	CS	BT	10/06/2011	General Amendments
03	17/06/2011	CS	BT	17/06/2011	Final Draft
04	20/07/2011	CS	BT	20/06/2011	Final
05	24/11/2011	CS	BT	24/11/2011	Council RFI
06	16/12/2011	CS	BT	16/12/2011	General Amendments
07	16/12/2011	CS	BT	16/12/2011	Updated Flood Scenarios

Distribution of copies

Revision	Copy no	Quantity	Issued to
01	1	1.pdf	Newland Developers Pty Ltd
02	1	1.pdf	Newland Developers Pty Ltd
03	1	1.pdf	Newland Developers Pty Ltd
04	1	1.pdf	Newland Developers Pty Ltd
05	1	1.pdf	Newland Developers Pty Ltd
06	1	1.pdf	Newland Developers Pty Ltd
07	1	1.pdf	Newland Developers Pty Ltd

Printed:	5 March 2012
Last saved:	02/03/2012 15:43
File name:	G:\YC0291 Riva Vue Estate\07 Reports\03 Flood Study\YC0291 Flood Study R007.docx
Author:	Tom Watt
Project manager:	Garth Osmond
Name of organisation:	Yeats Consulting Pty Ltd
Name of project:	YC0291 Rous River Flood Study
Name of document:	YC0291 Flood Study R007.docx
Document version:	REV 07
Project number:	YC0291

Executive Summary

In Response to the terms of a Memorandum Of Understanding between Tweed Shire Council and Barnby Developments Pty Ltd a Flood Study of the Riva Vue development has been prepared by Yeats Consulting Pty Ltd. This study was carried out using the 2D hydraulic modelling program TUFLOW to simulate the flood behaviour of the Rous River adjacent to the subject site for a range of design storm events and filling scenarios.

In accordance with the NSW Floodplain Development Manual, the proposed filling of the subject land has been considered on both an individual and cumulative basis. This was achieved by modelling the following scenarios:

- Scenario 1: Existing conditions as modelled in the Tweed Valley Flood Study 2009 Update, provided by Tweed Shire Council;
- Scenario 2A: Earthworks associated with the development of Riva Vue Stages 1-3;
- Scenario 2B: Earthworks, including filling approximately 2.4ha, associated with the development of Riva Vue Stages 1-4;
- Scenario 3: Earthworks associated with the extension of Rous River Way to the intersection of Cane/Queensland Road utilising details supplied by Tweed Shire Council. This scenario also incorporates filling approximately 3.3ha of the currently Agricultural Protection zoned, Lot 22 on DP1080322, above the Q100 flood level. This was done to simulate future residential development over Lot 22 even though it is not included in the existing urban footprint or future urban release area under the Far North Coast Regional Strategy 2006-2031; and
- Scenario 4: A cumulative scenario incorporating scenario 2A, 2B and 3 detailed above.

An analysis of the impacts of these scenarios on the flood levels, velocities and duration on the areas surrounding the subject site, compared to the pre-developed scenario, was then undertaken. The results of this analysis are then utilised to produce maps depicting the Flood Depth and Water Level Increase for each of the Storm Events and Impact Scenarios.

The modelling demonstrates that stages 1-3 have minimal impacts on the flood levels surrounding the site, and negligible affects approximately 1km upstream and downstream of the site. It also demonstrates that while the proposed stage 4 will cause flood levels to increase in the areas surrounding the site, the increase will be less than 15mm and occurs over rural land to the north and the golf course and rural land to the west of the Riva Vue Estate. These increases are therefore less than the acceptable limit of 15mm over urban land and 50mm over rural land as set down by Tweed Shire Council officers at a meeting on the 26th of September 2005.

The main contributing scenario for impacts to the flood levels is the connection of Rous River Way to Queensland / Cane Road and filling of Lot 22 above the Q100 flood level. This is demonstrated in Impact Scenario B, with results showing an increase in flood depths of more than 50mm over the land adjacent to Lot 22. The alignment of the Rous River adjacent to Lot 22 exposes much of that lot to inundation, as in effect it forms part of a floodway. When viewing flood maps from the scenarios that do not include filling within Lot 22, it is clear that the entire lot is inundated by flood water for all storm events. Therefore filling within Lot 22 will result in significant increases in flood levels over the surrounding land.

In summary, this report concludes that, for all scenarios, excepting connection of Rous River Way and filling of Lot 22, rezoning and subsequent filling of Stage 4 of Riva Vue Estate as proposed will not have significant adverse impacts and would not be inconsistent with Council's adopted acceptable limits for flood level increases.

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1 Introduction

1.1 Background

Yeats Consulting Pty Ltd has been engaged by Newland Developers Pty Ltd to prepare a Flood Study for the proposed development of Lot 332 DP 1158142, Rous River Way, Murwillumbah.

The Flood Study has been prepared in response to the terms of reference of the Memorandum of Understanding between Tweed Shire Council and Barnby Developments Pty Ltd.

1.2 Site Description

1.2.1 Location

Street Address - Rous River Way, Murwillumbah (Refer Figure 1.1)

RP Description - Lot 332 DP 1158142

Site Area - 12.48 Ha

Proposed Use - Residential

Local Authority - Tweed Shire Council (TSC)

Refer to Figure 1.1 for the site Location.

1.2.2 Topography

The existing site is predominantly grassed open space; it comprises of an elevated ridge with scattered vegetation to the south but is predominantly low lying land. The site grades away from Rous River Drive, towards the Rous River to the north. One existing natural gully currently traverses the centre of the site. Additionally, an existing open drain crosses the subject site adjacent to the north-western boundary and directs the up-stream stormwater run-off towards the Rous River. The site reaches a maximum RL of approximately 15.5m to the south adjacent to the northern side of the Rous River Way and a minimum RL of approximately 1.0m within the open drain at the north-eastern corner.

Existing stormwater run-off is currently conveyed overland towards the northern boundary and into the open drain before discharging into the Rous River.

Refer to Figure 1.2 for the existing aerial view.

Figure 1.1 Site Location (Source: Google Maps)

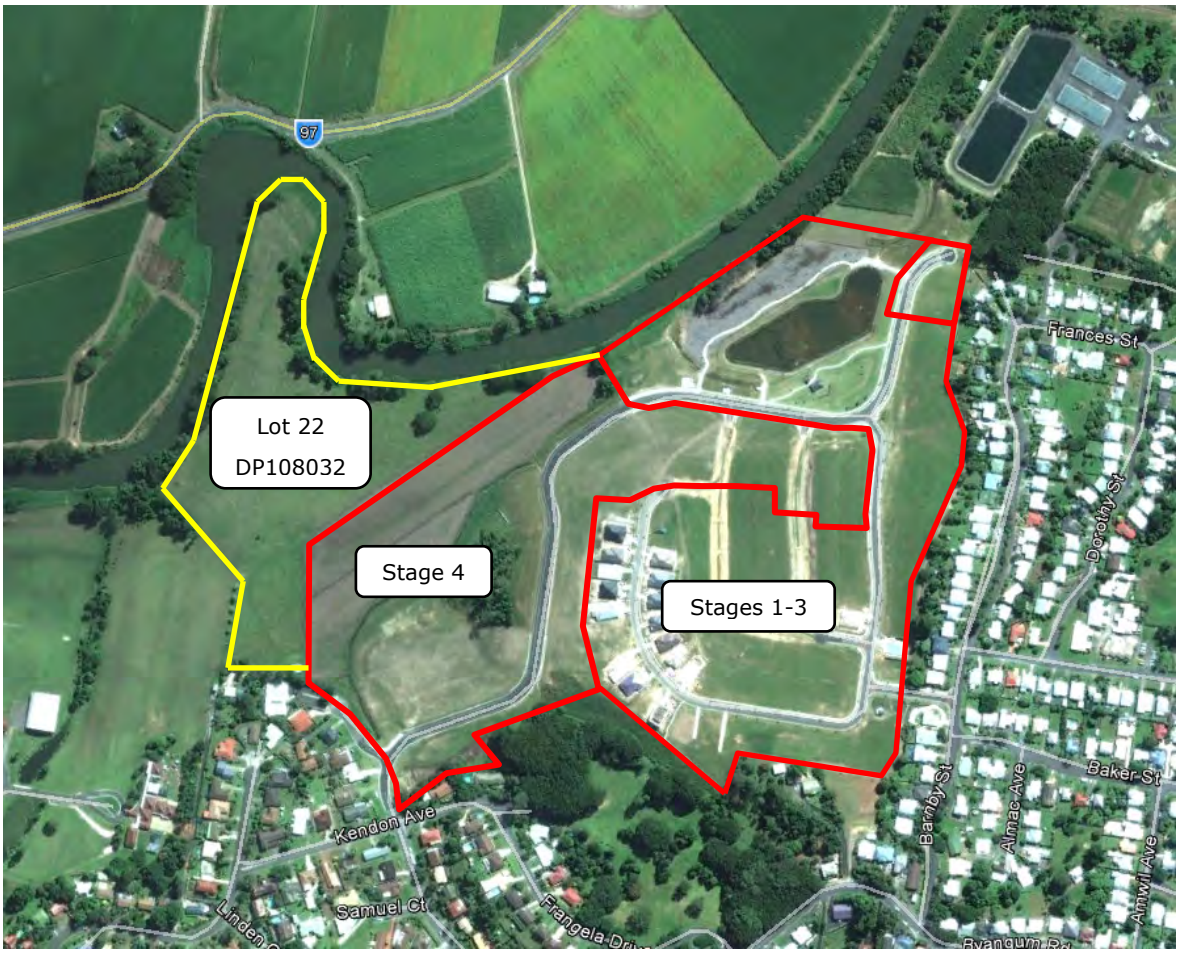


Figure 1.2 Site Aerial Photo (Source: Google Earth)

1.3 Objectives

The objectives, as defined by the terms of reference of the MOU, are:

- Assessment of the potential impacts of the proposed filling of the subject land on local flood behaviour for a range of flood intensities; and
- Assessment of flood mitigation works necessary to address impacts of the development on local flood behaviour.

1.4 Scope

The general approach and methodology to achieve the above objectives are again defined in the MOU, and are summarised below:

- Investigate the 5 year, 20 year, and 100 year ARI regional flood events;
- Investigate the 5 year ARI event coupled with a 100 year storm surge event including climate change parameter of 0.9m sea level increase;
- Investigate the 100 year ARI event with additional climate change parameter of 10% increased rainfall intensity;
- Report on changes to peak flood level, flood velocity and duration of inundation due to the development;
- Report on impacts on major trunk drainage in the local catchment;
- Include not only the proposed filling due to stage 4, but also the filling carried out as part of stages 1-3 of Riva Vue;
- The potential future filling of the adjoining rural allotment, Lot 22 on DP108032, in accordance with the NSW Floodplain Development Manual; and
- Filling due to the future road connection between Rous River Way and Cane/Queensland Roads.

2 Methodology

Council's Tweed Valley TUFLOW Flood model has been obtained and used as the basis for the flood study. The hydrology associated with the model will not be updated, with only the hydraulic components amended to reflect the associated development. As the development has been staged, with stages 1-3 already developed, four separate scenarios have been modelled to show the effects of stages 1-3, stages 1-4, the extension of Rous River Way combined with the filling of Lot 22 on DP1080322 and a cumulative scenario. The steps taken to produce the final model are detailed below:

- Review the development location and nominate the areas where earthworks are to take place;
- Using the 40m grid, create two z point GIS layers, one for stages 1-3 and one for stages 1-4, using the associated post-development DEM's;
- Obtain the Rous River Way extension design from Council and create a GIS layer representing the proposed road construction and future filling to Lot 22 on DP1080322 above the Q100 flood level;
- Update the TUFLOW geometry (.tgc) and control (.tcf) files using the new GIS layers created above;
- Create runs for the various ARI's for each of the two development scenarios nominated above (stages 1-3, and stages 1-4);
- Create runs for the various ARI's for the proposed road construction of Rous River Road and Cane / Queensland Road connection scenario and future filling of Lot 22 as nominated above; and
- Review and present the results.

3 Results

3.1 Changes to Flood Behaviour

Changes to the existing flood behaviour of the Rous River, in the vicinity of the Riva Vue Development, has occurred due to filling within existing flood prone areas. As mentioned in section 2, the various scenarios modelled as part of this report include:

- Existing conditions in the 'Tweed Valley Flood Model' provided by T.S.C, to be known as 'Scenario 1';
- Earthworks associated with the development of (existing) Riva Vue Stages 1-3, to be known as 'Scenario 2A';
- Earthworks, including filling approximately 2.4ha, associated with the proposed development of Riva Vue Stage 1-4, to be known as 'Scenario 2B';
- Earthworks associated with the future extension of Rous River Way and urban development of Lot 22 on DP1080322, to be known as 'Scenario 3'; and
- Earthworks associated with the development of Riva Vue Stage 1-4, Rous River Way extension and urban development of Lot 22, to be known as 'Scenario 4'.

Results and discussions on the changes to the flood behaviour for the various scenarios outlined above are presented in the following sections. These results have been presented as the following 'Impact Scenarios':

- Impact of Scenario 2A compared to Scenario 1, to be known as 'Impact Scenario A1';
- Impact of Scenario 2B compared to Scenario 1, to be known as 'Impact Scenario A2';
- Impact of Scenario 3 compared to Scenario 1, to be known as 'Impact Scenario B';
- Impact of Scenario 4 compared to Scenario 1, to be known as 'Impact Scenario C'; and
- Impact of Scenario 4 compared to Scenario 3, to be known as 'Impact Scenario D'.

Note: Scenario 4 and Impact Scenario's C and D have been modelled and provided on the basis that they are a requirement of the MOU and the NSW Floodplain Development Manual. However, Lot 22 which is immediately adjoining and upstream of the subject site, is zoned 1(b2) Agricultural Protection under Tweed Local Environment Plan 2000. Further to this, Lot 22 is not included in the existing urban footprint or as a future urban release area under the Far North Coast Regional Strategy 2006-2031. Therefore its potential to be rezoned and ultimately filled to facilitate urban development is negligible.

The tabulated results contained within the following sections have been compiled to the standard form of presentation of results as depicted with the BMT WBM "Digital outputs of Tweed Valley Flood Study 2009 Update" memo provided with the TUFLOW model from Tweed Shire Council.

3.2 Design Events

As per the MOU, following design events modelled to determine the changes to flood behaviour associated with the various Impact Scenarios are in accordance with the Tweed Valley Flood Study 2009 Update prepared by BMT WBM. Details of these events are presented in Table 3.1 below.

Table 3.1 Design Events

Notation	Rainfall Event	Storm Surge Event
Q005_H005	5 year ARI	5 year ARI
Q005_H100	5 year ARI	100 year ARI
Q005_H100_91cm (Sea level increase)	5 year ARI	100 year ARI + 91cm
Q020_H020	20 year ARI	20 year ARI
Q100_H020	100 year ARI	20 year ARI
Q100_10% (Climate change scenario)	100 year ARI + 10%	20 year ARI

The flood depths, velocities and durations have been recorded in three separate points around the site (Flood_Pt1, Flood_Pt3, Flood_Pt5) as shown on drawing YC0291-SK16 which is presented in appendix B. The changes recorded at each of these flood points are presented in the following sections for each of the impact scenarios described in Section 3.1.

Further to this, maps depicting the peak Flood Depth and peak Water Level Increase for each Design Event are presented in Appendix C.

3.3 Impact Scenario A1

The following section of the report has identified the changes in the flood characteristics associated to the existing stages 1-3 only of Riva Vue Estate.

3.3.1 Changes to Flood Depths - Impact Scenario A1

The most noticeable change on average to the flood level attributed to this vicinity of the development is at Flood_Pt5 which is located adjacent to Riva Vue Stages 1-3. The changes in flood depths in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.2 below:

Table 3.2 Change in Flood Depth - Impact Scenario A1

ARI	Change in Flood Depth at Flood_Pt1	Change in Flood Depth at Flood_Pt3	Change in Flood Depth at Flood_Pt5
Q005_H005	+2.5mm	-0.3mm	+2.0mm
Q005_H100	+2.5mm	+1.2mm	+2.3mm
Q005_H100_91cm	+2.2mm	+0.9mm	+2.2mm
Q020_H020	+3.6mm	+2.3mm	+4.8mm
Q100_H020	+6.9mm	+4.6mm	+7.0mm
Q100_10%	+8.8mm	+5.0mm	+8.7mm

3.3.2 Changes to Flood Velocity - Impact Scenario A1

The most noticeable change on average to the flood velocity attributed to this vicinity of the development is at Flood_Pt5 which is located adjacent to Riva Vue Stages 1-3. The changes in flood velocity in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.3 below:

Table 3.3 Change in Flood Velocity - Impact Scenario A1

ARI	Change in Flood Velocity at Flood_Pt1	Change in Flood Velocity at Flood_Pt3	Change in Flood Velocity at Flood_Pt5
Q005_H005	+0.0026m/s	-0.0025m/s	+0.0041m/s
Q005_H100	-0.0242m/s	+0.0025m/s	+0.0044m/s
Q005_H100 _91cm	-0.0010m/s	+0.0026m/s	+0.0047m/s
Q020_H020	-0.0045m/s	+0.0112m/s	+0.0083m/s
Q100_H020	+0.0339m/s	-0.0276m/s	+0.0531m/s
Q100_10%	+0.0007m/s	+0.0440m/s	+0.0099m/s

3.4 Impact Scenario A2

The following section of the report has identified the changes in the flood characteristics of the combined effect of stages 1 – 4 of Riva Vue Estate.

3.4.1 Changes to Flood Depths - Impact Scenario A2

The most noticeable change on average in the flood level attributed to this vicinity of the development is at Flood_Pt1 which is located upstream of Riva Vue Stages 1-4. The changes in flood depths in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.4 below:

Table 3.4 Change in Flood Depth - Impact Scenario A2

ARI	Change in Flood Depth at Flood_Pt1	Change in Flood Depth at Flood_Pt3	Change in Flood Depth at Flood_Pt5
Q005_H005	+5.0mm	+0.3mm	+3.7mm
Q005_H100	+4.8mm	+0.2mm	+3.6mm
Q005_H100 _91cm	+4.4mm	+0.4mm	+3.0mm
Q020_H020	+3.2mm	+4.5mm	+1.9mm
Q100_H020	+8.1mm	+5.6mm	+5.4mm
Q100_10%	+9.9mm	+5.8mm	+6.7mm

The changes in flood depths occurring in Impact Scenario A2 in the areas surrounding Riva Vue Estate are shown graphically on Drawings YC0291-SKF108 - 112, 126 - 127 in Appendix C. These drawings demonstrate that although the earthworks associated with Stages 1-4 of the Riva Vue Estate cause an increase in flood depths in the vicinity of the development, the increase is generally less than 15mm and occurs over the rural land to the north and west of the development. This increase is below the acceptable limit of 15mm in urban areas and 50mm in rural areas as defined by Tweed Shire Council officers at a meeting on the 26th of September 2005, in relation to a rezoning at Fernvale Road/Wardrop Valley Road.

3.4.2 Changes to Flood Velocity - Impact Scenario A2

The most noticeable change on average to the flood velocity attributed to this vicinity of the development is at Flood_Pt1 which is located upstream of Riva Vue Stages 1- 4. The changes in flood velocity in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.5 below:

Table 3.5 Change in Flood Velocity - Impact Scenario A2

ARI	Change in Flood Velocity at Flood_Pt1	Change in Flood Velocity at Flood_Pt3	Change in Flood Velocity at Flood_Pt5
Q005_H005	-0.0225m/s	-0.0046m/s	-0.0270m/s
Q005_H100	+0.0025m/s	+0.0044m/s	-0.0268m/s
Q005_H100_91cm	+0.0006m/s	+0.0048m/s	-0.0270m/s
Q020_H020	-0.0038m/s	-0.0062m/s	-0.0391m/s
Q100_H020	+0.0341m/s	+0.0010m/s	+0.0194m/s
Q100_10%	+0.0009m/s	-0.0139m/s	-0.0239m/s

3.5 Impact Scenario B

The following section of the report has identified the changes in the flood characteristics associated with the construction of Rous River Way extension and Cane/Queensland Road connection combined with filling of Lot 22 on DP1080322 above the Q100 flood level.

3.5.1 Changes to Flood Depths - Impact Scenario B

This most noticeable change on average to the flood level for this scenario was recorded at Flood_Pt5, adjacent to Riva Vue Stages 1-4. The changes in flood depths in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.6 below:

Table 3.6 Change in Flood Depth - Impact Scenario B

ARI	Change in Flood Depth at Flood_Pt1	Change in Flood Depth at Flood_Pt3	Change in Flood Depth at Flood_Pt5
Q005_H005	+19.4mm	+5.4mm	+19.9mm
Q005_H100	+19.0mm	+8.0mm	+18.3mm
Q005_H100_91cm	+19.0mm	+12.3mm	+21.3mm
Q020_H020	+20.0mm	+35.0mm	+29.3mm
Q100_H020	+31.9mm	+32.1mm	+33.7mm
Q100_10%	+33.7mm	+25.6mm	+30.6mm

The changes in flood depths occurring in Impact Scenario B in the areas surrounding Riva Vue Estate are shown graphically on Drawings YC0291-SKF128-133 in Appendix C. These drawings demonstrate Impact scenario B will cause flood depths to increase by more than 50mm on the land adjacent to Lot 22.

3.5.2 Changes to Flood Velocity - Impact Scenario B

The most noticeable change on average to the flood velocity recorded for this scenario is at Flood_Pt3, downstream of Riva Vue Stages 1- 4. The changes in flood velocity in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.7 below:

Table 3.7 Change in Flood Velocity - Impact Scenario B

ARI	Change in Flood Velocity at Flood_Pt1	Change in Flood Velocity at Flood_Pt3	Change in Flood Velocity at Flood_Pt5
Q005_H005	-0.0006m/s	+0.0157m/s	-0.1071m/s

Q005_H100	+0.0078m/s	+0.0267m/s	-0.1065m/s
Q005_H100 _91cm	+0.0056m/s	+0.0329m/s	-0.1103m/s
Q020_H020	+0.0058m/s	+0.0572m/s	-0.1975m/s
Q100_H020	+0.0030m/s	+0.0042m/s	-0.2985m/s
Q100_10%	+0.0033m/s	+0.0084m/s	-0.3203m/s

3.6 Impact Scenario C

The following section of the report has identified the changes in the flood characteristics associated with the construction of Riva Vue Estate (Stages 1-4), Rous River Way extension and filling of Lot 22 above the Q100 flood level.

3.6.1 Changes to Flood Depths - Impact Scenario C

The most noticeable change on average to the flood level for this scenario was recorded at Flood_ Pt5, adjacent to Riva Vue Stages 1-4. The changes in flood depths in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.8 below:

Table 3.8 Change in Flood Depth - Impact Scenario C

ARI	Change in Flood Depth at Flood_Pt1	Change in Flood Depth at Flood_Pt3	Change in Flood Depth at Flood_Pt5
Q005_H005	+26.4mm	+7.8mm	+25.5mm
Q005_H100	+26.9mm	+10.3mm	+26.4mm
Q005_H100 _91cm	+25.4mm	+16.7mm	+28.5mm
Q020_H020	+24.2mm	+44.8mm	+33.9mm
Q100_H020	+40.7mm	+38.1mm	+42.3mm
Q100_10%	+44.0mm	+31.9mm	+40.5mm

The changes in flood depths occurring in Impact Scenario C in the areas surrounding Riva Vue Estate are shown graphically on Drawing YC0291-SKF134-139 in Appendix C. These drawings demonstrate that Impact Scenario C will cause flood depths to increase by more than 50mm on the land adjacent to Lot 22 and the rural land to the north and west of the development. Options available to reduce the impact of the extension of Rous River Way on flood levels in the surrounding area include reducing the flood immunity of the road, providing additional flow mechanisms under the road and preventing urban development over Lot 22.

3.6.2 Changes to Flood Velocity - Impact Scenario C

The most noticeable change on average to the flood velocity for this scenario was recorded at Flood_Pt3, downstream of Riva Vue Stages 1-4. The changes in flood velocity in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.9 below:

Table 3.9 Change in Flood Velocity - Impact Scenario C

ARI	Change in Flood Velocity at Flood_Pt1	Change in Flood Velocity at Flood_Pt3	Change in Flood Velocity at Flood_Pt5
Q005_H005	+0.0052m/s	+0.0217m/s	-0.1045m/s
Q005_H100	+0.0032m/s	+0.0347m/s	-0.1044m/s

Q005_H100_91cm	-0.0281m/s	+0.0407m/s	-0.1076m/s
Q020_H020	-0.0077m/s	-0.0478m/s	-0.1949m/s
Q100_H020	+0.0039m/s	+0.0823m/s	-0.2949m/s
Q100_10%	+0.0042m/s	+0.0011m/s	-0.3153m/s

3.7 Impact Scenario D

The following section of the report has identified the changes in the flood characteristics associated with the construction of Riva Vue Estate (Stages 1-4), Rous River Way extension and filling of Lot 22 above the Q100 flood level compared to Impact scenario B.

3.7.1 Changes to Flood Depths - Impact Scenario D

The most noticeable change on average to the flood level for this scenario was recorded at Flood_ Pt1 which is located upstream of Riva Vue Stages 1- 4. The changes in flood depths in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.10 below:

Table 3.10 Change in Flood Depth - Impact Scenario D

ARI	Change in Flood Depth at Flood_Pt1	Change in Flood Depth at Flood_Pt3	Change in Flood Depth at Flood_Pt5
Q005_H005	+7.0mm	+2.4mm	+5.6mm
Q005_H100	+7.9mm	+2.3mm	+8.1mm
Q005_H100_91cm	+6.4mm	+4.4mm	+7.2mm
Q020_H020	+4.2mm	+9.8mm	+4.6mm
Q100_H020	+8.8mm	+6.0mm	+8.6mm
Q100_10%	+10.3mm	+6.3mm	+9.9mm

The changes in flood depths occurring in Impact Scenario D in the areas surrounding Riva Vue Estate are shown graphically on Drawing YC0291-SKF140-145 in Appendix C. These drawings demonstrate that although the earthworks associated with Stages 1-4 of the Riva Vue Estate cause an increase in flood depths from Impact Scenario B in the vicinity of the development, the increase is generally less than 15mm and occurs over the rural land to the north and west of the development.

3.7.2 Changes to Flood Velocity - Impact Scenario D

The most noticeable change on average to the flood velocity for this scenario was recorded at Flood_Pt3, downstream of Riva Vue Stages 1-4. The changes in flood velocity in the vicinity of the development, due to the effect of the above filling activities, are presented in Table 3.11 below:

Table 3.11 Change in Flood Velocity - Impact Scenario D

ARI	Change in Flood Velocity at Flood_Pt1	Change in Flood Velocity at Flood_Pt3	Change in Flood Velocity at Flood_Pt5
Q005_H005	+0.0058m/s	+0.0060m/s	+0.0026m/s
Q005_H100	-0.0046m/s	+0.0080m/s	+0.0021m/s
Q005_H100_91cm	-0.0337m/s	+0.0078m/s	+0.0027m/s

Q020_H020	-0.0135m/s	-0.0094m/s	+0.0026m/s
Q100_H020	+0.0009m/s	+0.0781m/s	+0.0036m/s
Q100_10%	+0.0009m/s	-0.0073m/s	+0.0050m/s

3.8 Changes to Flood Duration - All Development Scenarios

The modelling showed no significant increase in the duration of flood inundation at any of the reporting points for all of the storm events and development scenarios. Please refer to the graphs in Appendix D for details.

4 Trunk Drainage Infrastructure Analysis

In the Memorandum Of Understanding between TSC and the developer, it is noted that the existing open drain in the south-western corner of the site is not functioning as intended. This has led to water ponding within the channel leading to issues such as odours, boggy grounds etc. that have been the focus of complaints from current residents. A detailed analysis of the existing culvert as well as the proposed channel where undertaken and detailed within 'Section 4' of the 'Conceptual Site Based Stormwater Management Plan' by Yeats Consulting. Please refer to this report for further details.

5 Summary and Conclusions

This report has addressed the requirements outlined in the Tweed Shire Council Memorandum of Understanding letter dated December 2010, and has identified the potential impacts from the proposed Stage 4 of the Riva Vue Estate residential development located at Barnby Street, Murwillumbah.

This report has the following components:

- Identified the various scenarios of filling related to the above development;
- Analysis of the various scenarios and their impacts external to the development in three different locations utilising the information provided by Tweed Shire Council and the TUFLOW hydraulic software; and
- Tabulating the results of the various scenarios for the listed design events;

The modelling demonstrates that stages 1-3 have minimal impacts on the flood levels surrounding the site, and negligible affects approximately 1km upstream and downstream of the site. It also demonstrates that while the proposed stage 4 will cause flood levels to increase in the areas surrounding the site, the increase will be less than 15mm and occurs over rural land to the north and the golf course and rural land to the west of the Riva Vue Estate. These increases are therefore less than the acceptable limit of 15mm over urban land and 50mm over rural land as set down by Tweed Shire Council officers at a meeting on the 26th of September 2005.

The main contributing scenario for impacts to the flood levels is the connection of Rous River Way to Queensland / Cane Road and filling of Lot 22 above the Q100 flood level. This is demonstrated in Impact Scenario B, with results showing an increase in flood depths of more than 50mm over the land adjacent to Lot 22. The alignment of the Rous River adjacent to Lot 22 exposes much of that lot to inundation, as in effect it forms part of a floodway. When viewing flood maps from the scenarios that do not include filling within Lot 22, it is clear that the entire lot is inundated by flood water for all storm events. Therefore filling within Lot 22 will result in significant increases in flood levels over the surrounding land.

In summary, this report concludes that, for all scenarios, excepting connection of Rous River Way and filling of Lot 22, rezoning and subsequent filling of Stage 4 of Riva Vue Estate as proposed will not have significant adverse impacts and would not be inconsistent with Council's adopted acceptable limits for flood level increases.

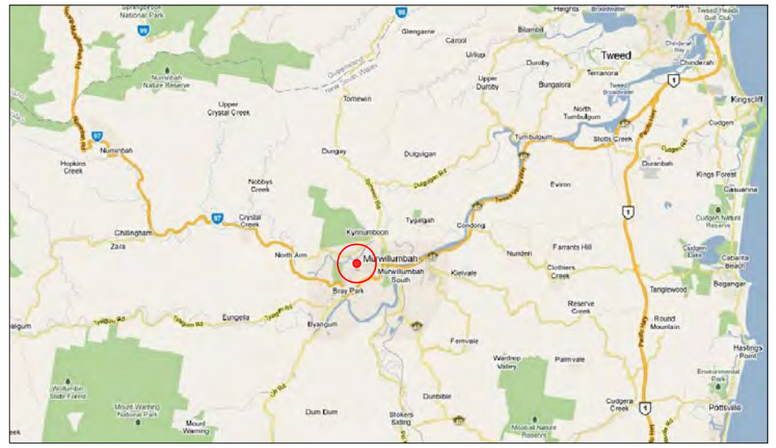
6 References

Institution of Engineers, Australia (2001) "Australian Rainfall and Runoff – A guide to flood estimation".

Neville Jones & Associates (1992) "Queensland Urban Drainage Design Manual (QUDM)", Edition 2.

Appendix A

Study Area Locality Plan



STATUS	PRELIMINARY	NOT TO BE USED FOR CONSTRUCTION		
B	GENERAL AMENDMENTS		K.E.	28.11.11
A	ORIGINAL ISSUE		S.S.	09.06.11
REV	DESCRIPTION		DRAWN	DATE

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SHEET SIZE)

SCALE 50 0 50 100 1:2500

ORIGINAL SHEET SIZE: A1

CLIENT: NEWLAND DEVELOPERS PTY LTD

PROJECT: RIVA VUE ESTATE
MURWILLUMBAH, NSW 2484

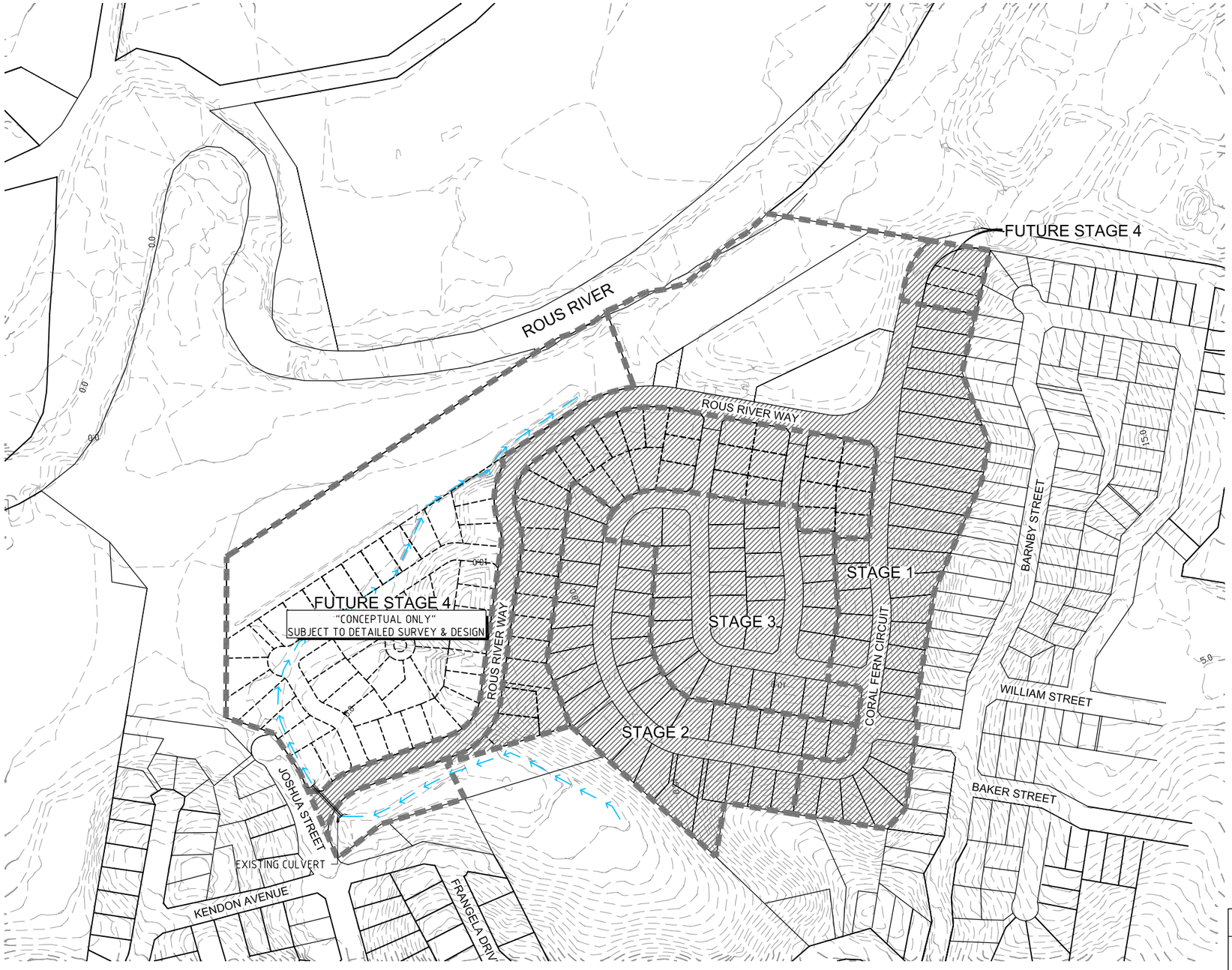
YEATS CONSULTING ENGINEERS
LEVEL 1, 193 FERRY ROAD SOUTHPORT QLD 4215 AUSTRALIA
T 07 5571 2232 F 07 5503 1672 info@yeats.com.au www.yeats.com.au

TITLE: SITE LOCALITY PLAN

TASK	BY	INITIAL	DATE
REVIEW	S.W.		12.05.11
DESIGN	S.S.		12.05.11
DRAWN	S.S		12.05.11

APPROVED RPEQ No N/A

DRAWING NUMBER YC0291-SK12 REVISION B



LEGEND

- EXISTING CONTOURS (1.0m INTERVALS)
- STAGE BOUNDARY
- EARTHWORKS AREA
- EXISTING DRAINAGE CHANNEL
- LOT BOUNDARY - SUBJECT TO DETAILED SURVEY & DESIGN

STATUS	PRELIMINARY	NOT TO BE USED FOR CONSTRUCTION		
B	GENERAL AMENDMENTS		K.E.	28.11.11
A	ORIGINAL ISSUE		T.W.	15.06.11
REV	DESCRIPTION		DRAWN	DATE

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SHEET SIZE)

SCALE 20 10 0 20 40 60 80 100 1:2000

ORIGINAL SHEET SIZE: A1

CLIENT: NEWLAND DEVELOPERS PTY LTD

PROJECT: RIVA VUE ESTATE
MURWILLUMBAH, NSW 2484

YEATS CONSULTING ENGINEERS
LEVEL 1, 193 FERRY ROAD SOUTHPORT QLD 4215 AUSTRALIA
T 07 5571 2232 F 07 5503 1672 info@yeats.com.au www.yeats.com.au

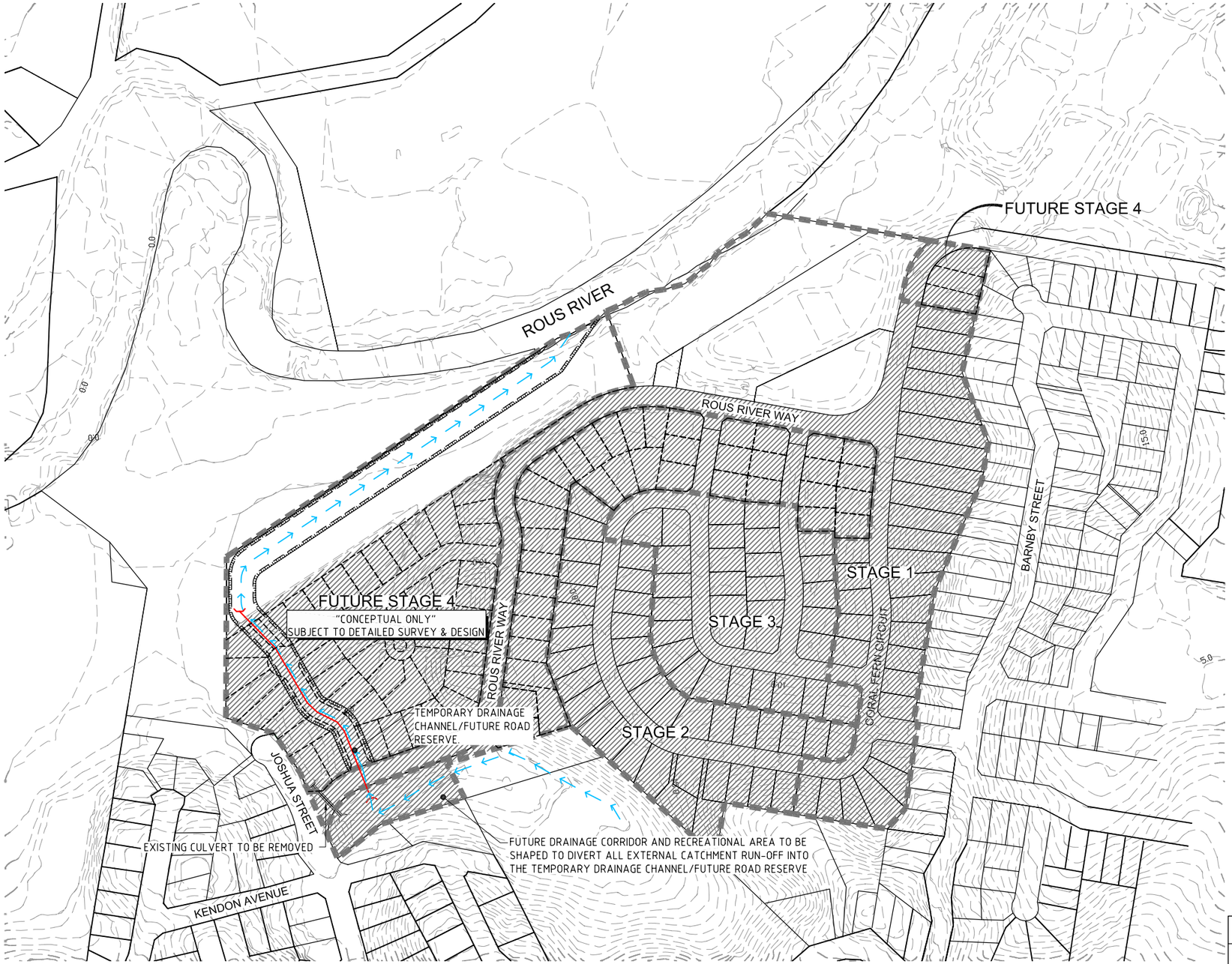
TITLE: STAGES 1-3 EARTHWORKS EXTENTS

TASK	BY	INITIAL	DATE
REVIEW	S.W.		15.06.11
DESIGN	T.W.		15.06.11
DRAWN	T.W.		15.06.11

APPROVED RPEQ No N/A

DRAWING NUMBER: YC0291-SK13

REVISION: B



STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION

REV	DESCRIPTION	DRAWN	DATE
B	GENERAL AMENDMENTS	K.E.	28.11.11
A	ORIGINAL ISSUE	T.W.	15.06.11

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SHEET SIZE) 20 10 0 20 40 60 80 100 SCALE 1:2000

ORIGINAL SHEET SIZE A1

CLIENT NEWLAND DEVELOPERS PTY LTD

PROJECT RIVA VUE ESTATE
MURWILLUMBAH, NSW 2484

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TITLE STAGES 1-4 EARTHWORKS EXTENTS

TASK	BY	INITIAL	DATE
REVIEW	S.W.		15.06.11
DESIGN	T.W.		15.06.11
DRAWN	T.W.		15.06.11

APPROVED RPEQ No N/A

DRAWING NUMBER YC0291-SK14 REVISION B

EARTHWORKS EXTENTS FOR ROUS RIVER WAY ARE APPROXIMATE ONLY

LEGEND

EARTHWORKS AREA

STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION

REV	DESCRIPTION	DRAWN	DATE
A	ORIGINAL ISSUE	T.W.	15.06.11

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SHEET SIZE)

SCALE 100 50 0 100 200 1:5000

ORIGINAL SHEET SIZE A1

CLIENT NEWLAND DEVELOPERS PTY LTD

PROJECT RIVA VUE ESTATE
MURWILLUMBAH, NSW 2484

YEATS CONSULTING ENGINEERS
LEVEL 1, 193 FERRY ROAD SOUTHPORT QLD 4215 AUSTRALIA
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TITLE ROUS RIVER WAY EARTHWORKS EXTENTS

TASK	BY	INITIAL	DATE
REVIEW	S.W.		15.06.11
DESIGN	T.W.		15.06.11
DRAWN	T.W.		15.06.11

APPROVED RPEQ No N/A

DRAWING NUMBER YC0291-SK15 REVISION A

Appendix B

Flood Point Locations

STATUS	PRELIMINARY	NOT TO BE USED FOR CONSTRUCTION		
A	ORIGINAL ISSUE		T.W.	15.06.11
REV	DESCRIPTION		DRAWN	DATE

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SHEET SIZE)

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ORIGINAL SHEET SIZE: A1

CLIENT: NEWLAND DEVELOPERS PTY LTD

PROJECT: RIVA VUE ESTATE
MURWILLUMBAH, NSW 2484

YEATS CONSULTING ENGINEERS
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TITLE: FLOOD POINT LOCATIONS

TASK	BY	INITIAL	DATE
REVIEW	S.W.		15.06.11
DESIGN	T.W.		15.06.11
DRAWN	T.W.		15.06.11

APPROVED RPEQ No N/A

DRAWING NUMBER YC0291-SK16 REVISION A

Appendix C

Flood Extents Mapping

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H005
SCENARIO 2B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NO. YC0286-SKF101

REVISION B

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H100
SCENARIO 2B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NO. YC0286-SKF102

REVISION B

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H100_91cm
SCENARIO 2B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NO. YC0286-SKF103

REVISION B

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q020_H020
SCENARIO 2B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF104

REVISION: B

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q100_H020
SCENARIO 2B

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER
YC0286-SKF105

REVISION
B

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q100_10%_H020
SCENARIO 2B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF106

REVISION: B

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H005
IMPACT SCENARIO A2

SCALE (AT ORIGINAL SIZE)

A3

DRAWING No. YC0286-SKF108

REVISION C

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100
IMPACT SCENARIO A2

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NO. YC0286-SKF109

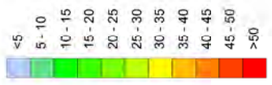
REVISION C

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100_91cm
IMPACT SCENARIO A2

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF126

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q020_H020
IMPACT SCENARIO A2

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF111

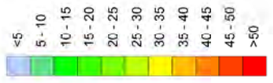
REVISION: C

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_H020
IMPACT SCENARIO A2

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER / REVISION
YC0286-SKF112 C

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_10%_H020
IMPACT SCENARIO A2

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF127

REVISION: A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H005
SCENARIO 3

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER
YC0286-SKF114

REVISION
A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H100
SCENARIO 3

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER
YC0286-SKF115

REVISION
A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H100_91cm
SCENARIO 3

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER
YC0286-SKF116

REVISION
A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q020_H020
SCENARIO 3

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF117

REVISION: A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q100_H020
SCENARIO 3

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER
YC0286-SKF118

REVISION
A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q100_10%_H020
SCENARIO 3

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF119

REVISION: A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H005
SCENARIO 4

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF120

REVISION: A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H100
SCENARIO 4

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER
YC0286-SKF121

REVISION
A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q005_H100_91cm
SCENARIO 4

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF122 REVISION: A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT:
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q020_H020
SCENARIO 4

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER | REVISION
YC0286-SKF123 A

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q100_H020
SCENARIO 4

SCALE (AT ORIGINAL SIZE)

ORIGINAL SHEET SIZE
A3

DRAWING NUMBER: **YC0286-SKF124**
REVISION: **A**

YEATS

LOCALITY

LEGEND

WATER DEPTH (m)

- <0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- >4.0

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
FLOOD DEPTH Q100_10%_H020
SCENARIO 4

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF125

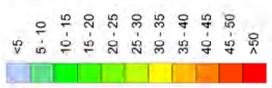
REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H005
IMPACT SCENARIO B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF128

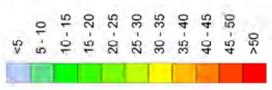
REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100
IMPACT SCENARIO B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF129

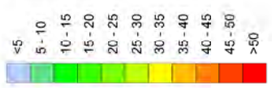
REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100_91cm
IMPACT SCENARIO B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF130

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q020_H020
IMPACT SCENARIO B

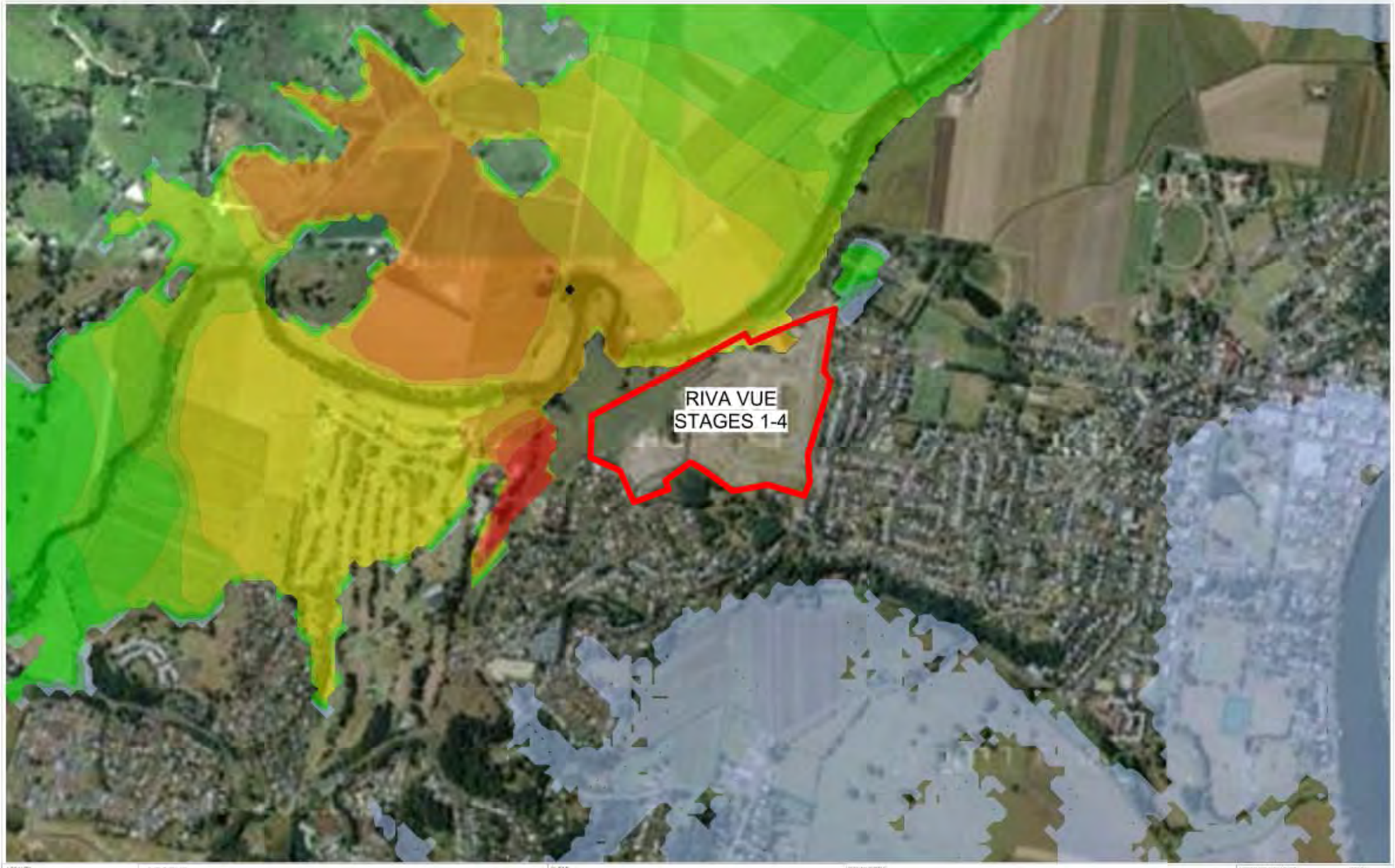
SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF131

REVISION: A

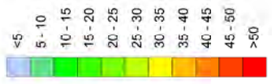
YEATS



LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_H020
IMPACT SCENARIO B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF132

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_10%_H020
IMPACT SCENARIO B

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF133

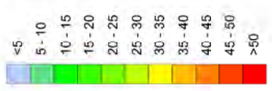
REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H005
IMPACT SCENARIO C

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF134

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100
IMPACT SCENARIO C

DRAWING NUMBER: YC0286-SKF135
REVISION: A

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SIZE)

A3

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100_91cm
IMPACT SCENARIO C

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF136

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q020_H020
IMPACT SCENARIO C

DRAWING IS NOT TO BE SCALED

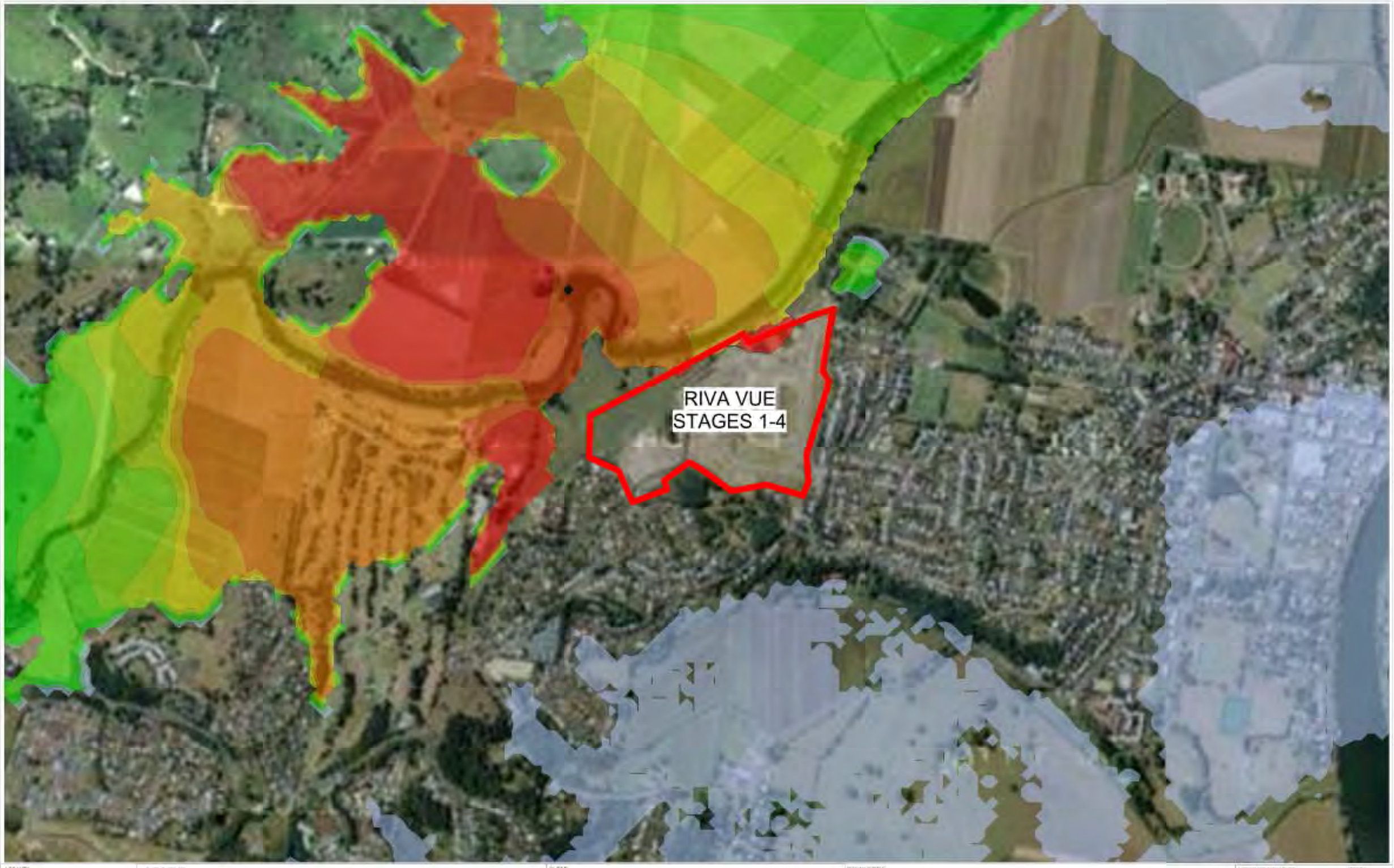
SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF137

REVISION: A

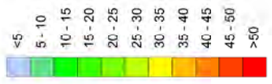
YEATS



LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)



CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_H020
IMPACT SCENARIO C

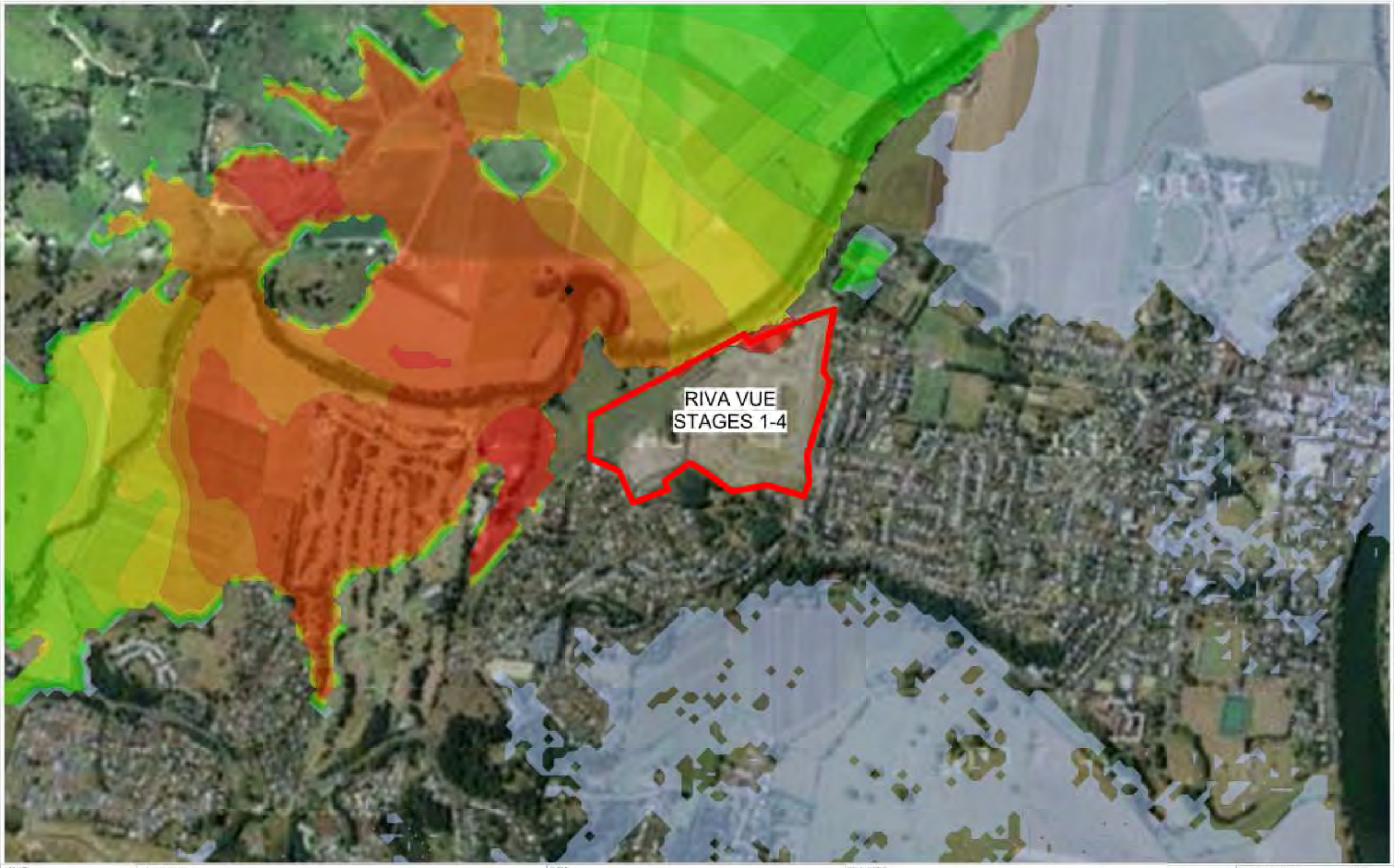
SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF138

REVISION: A

YEATS



LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_10%_H020
IMPACT SCENARIO C

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF139

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H005
IMPACT SCENARIO D

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF140

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100
IMPACT SCENARIO D

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF141

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q005_H100_91cm
IMPACT SCENARIO D

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF142

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q020_H020
IMPACT SCENARIO D

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: **YC0286-SKF143** REVISION: **A**

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_H020
IMPACT SCENARIO D

SCALE (AT ORIGINAL SIZE)

A3

DRAWING NUMBER: YC0286-SKF144

REVISION: A

YEATS

LOCALITY

LEGEND

WATER LEVEL INCREASE (mm)

<5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50 | >50

CLIENT
NEWLAND DEVELOPMENTS

PROJECT
RIVA VUE ESTATE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
WATER LEVEL INCREASE Q100_10%_H020
IMPACT SCENARIO D

DRAWING NUMBER: YC0286-SKF145
REVISION: A

DRAWING IS NOT TO BE SCALED

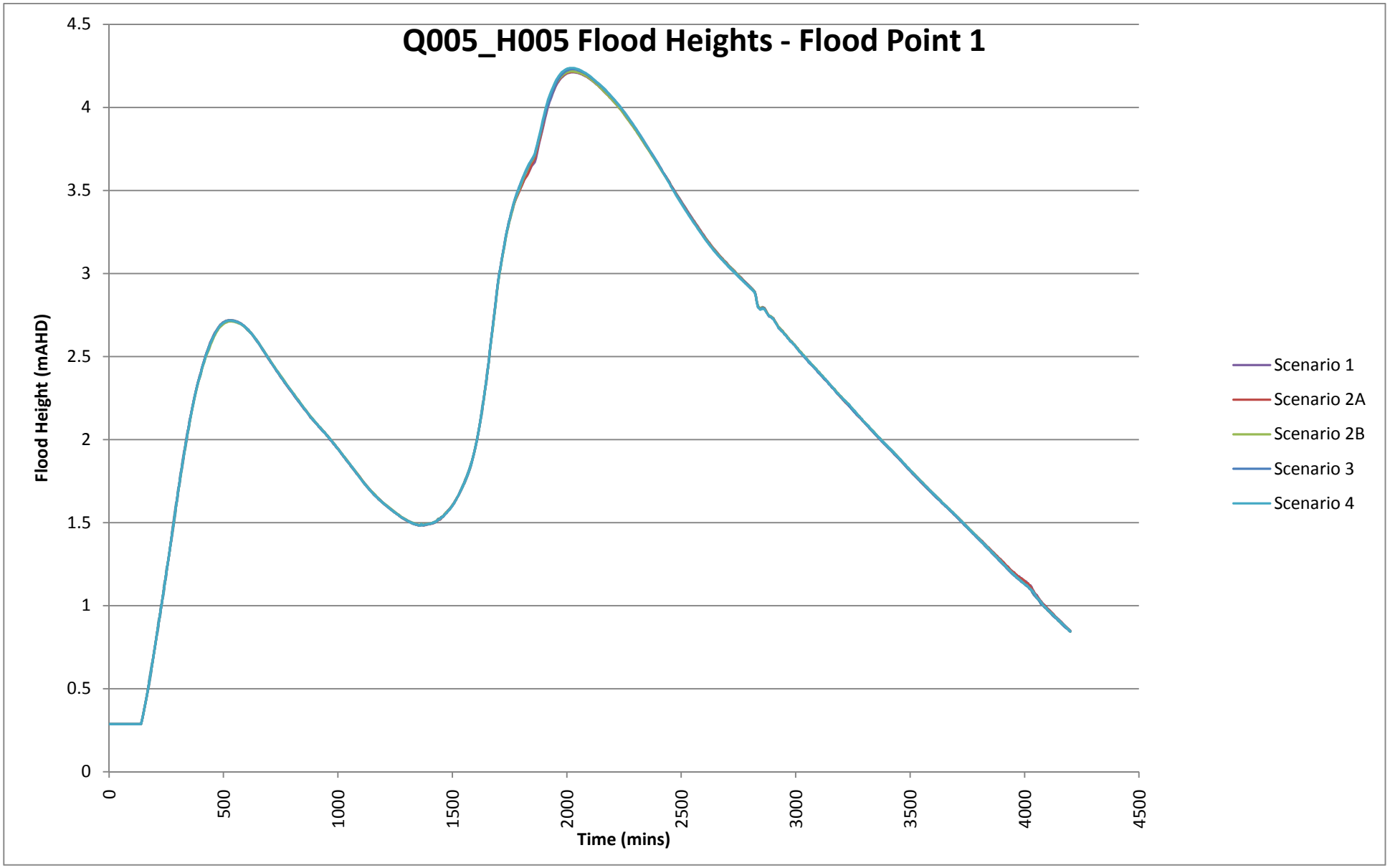
SCALE (AT ORIGINAL SIZE)

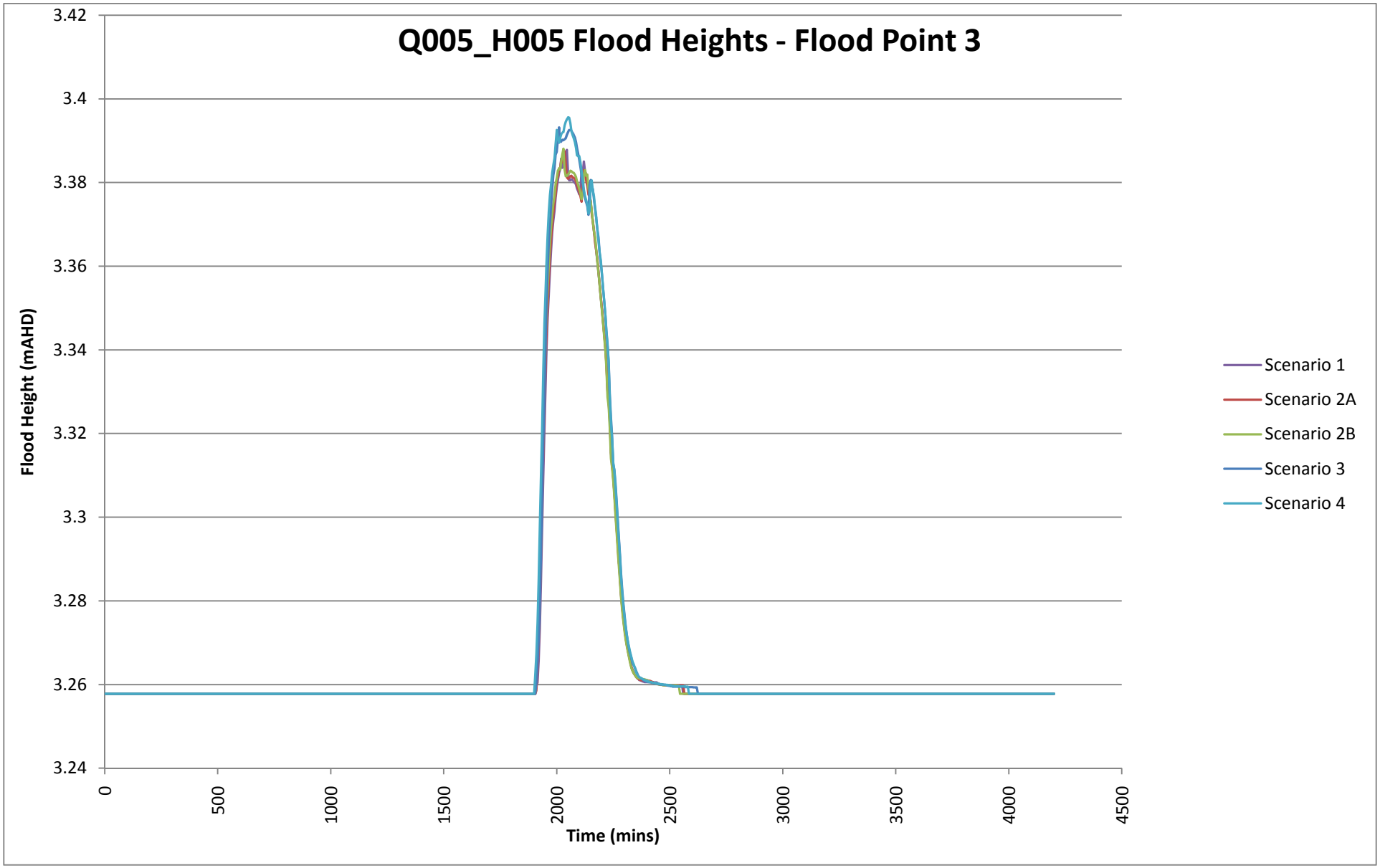
A3

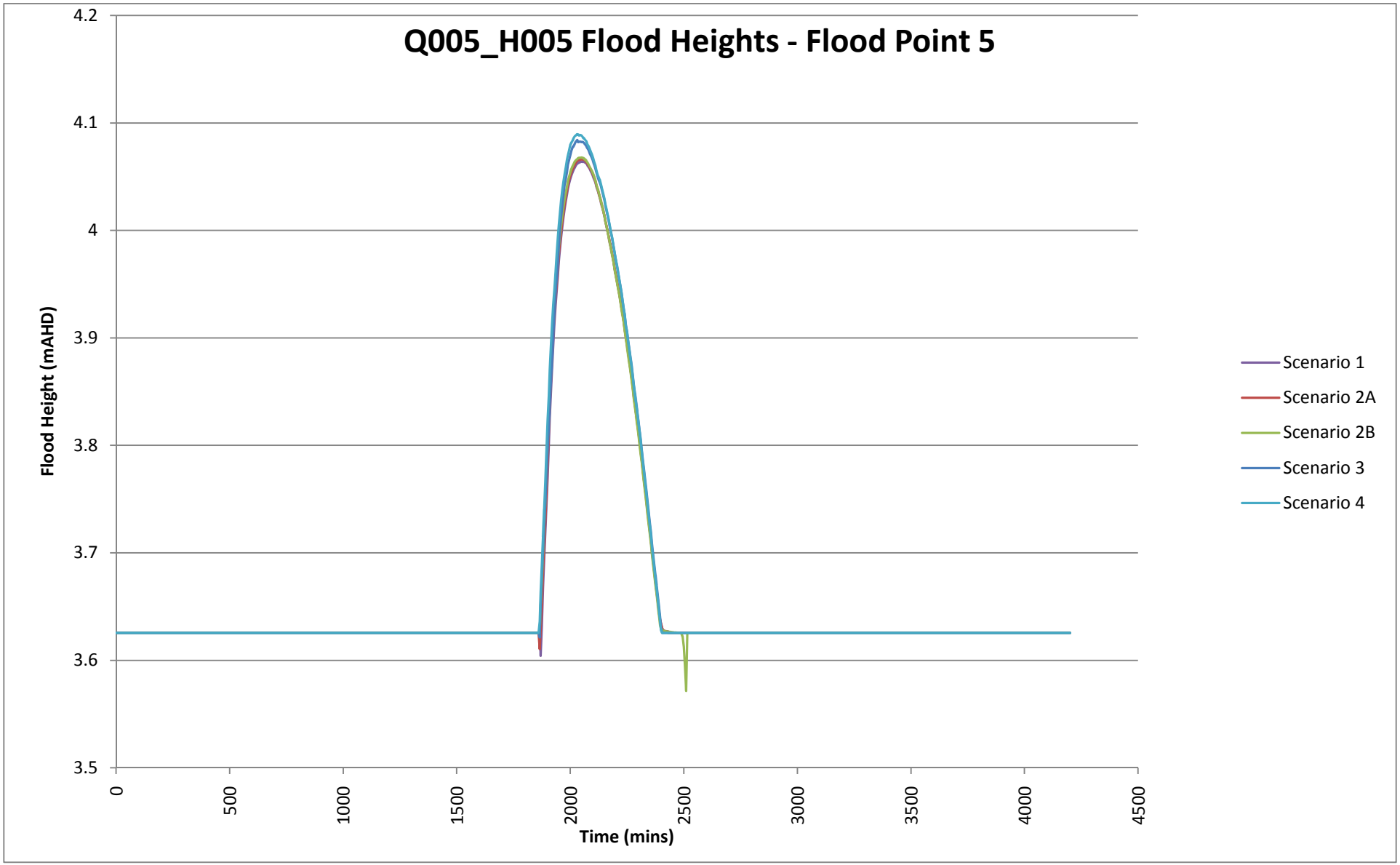
YEATS

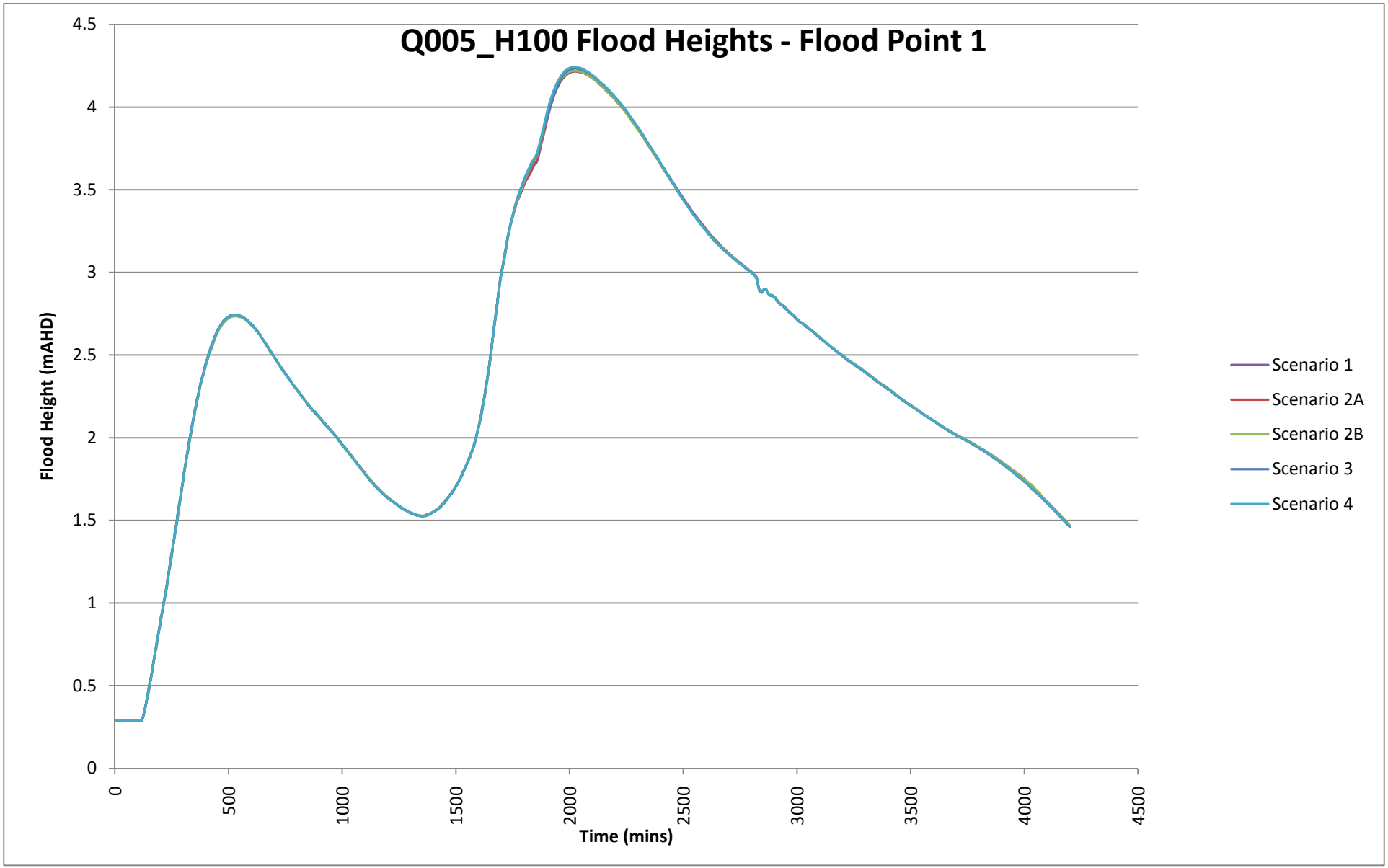
Appendix D

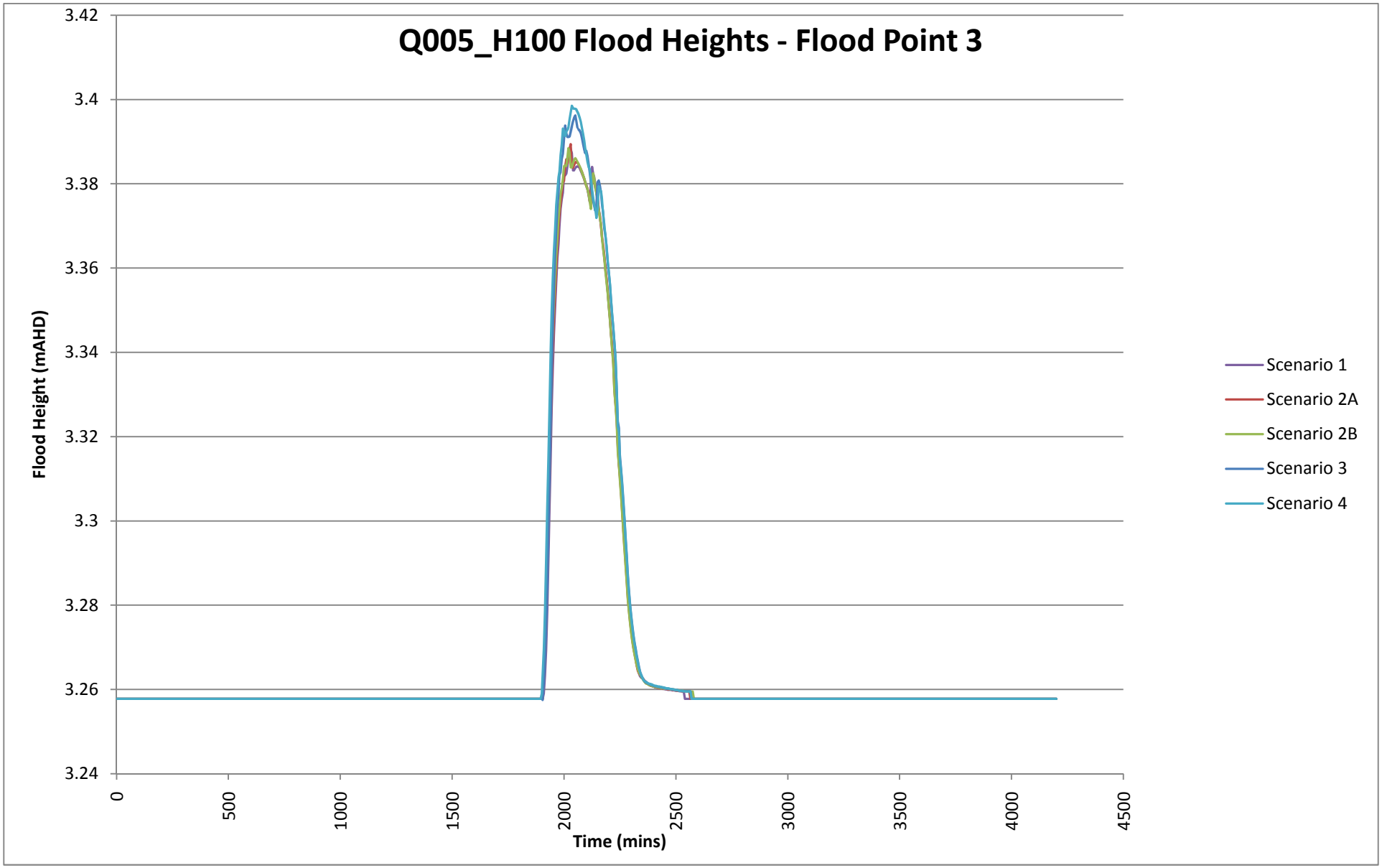
Flood Event Graphs

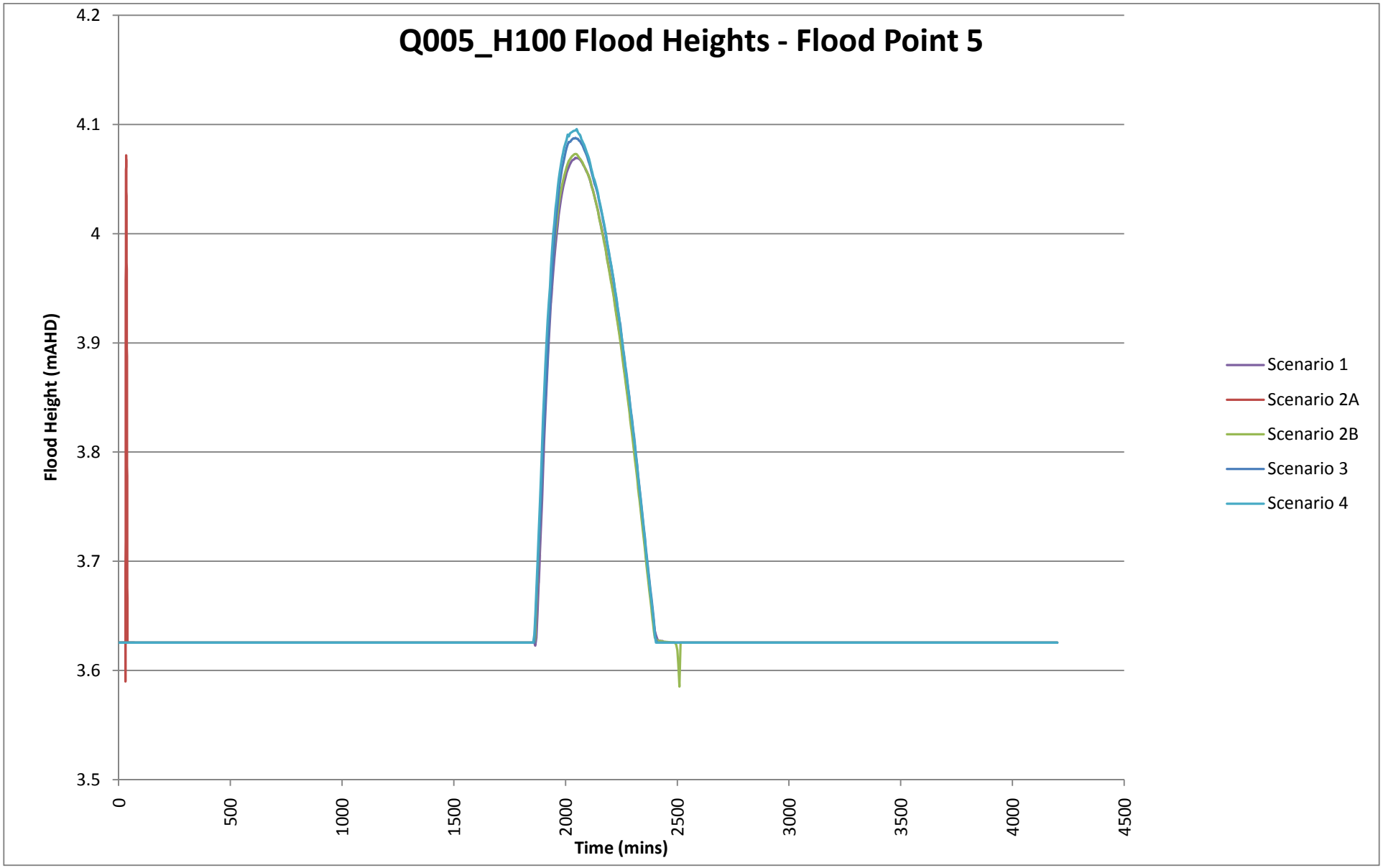

Q005_H005 Flood Heights - Flood Point 1
Flood Height (mAHD)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

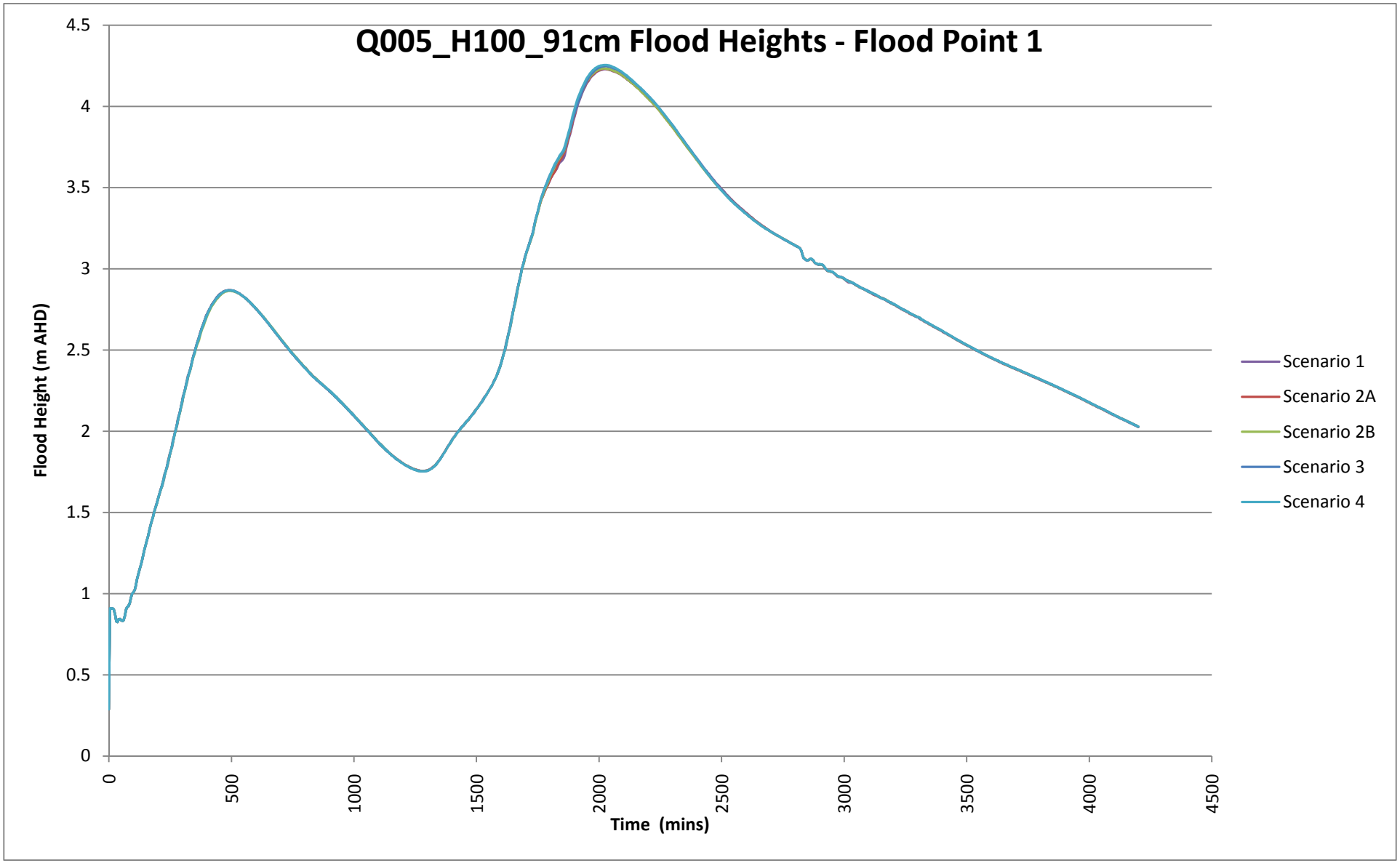

Q005_H005 Flood Heights - Flood Point 3
Flood Height (mAHD)
3.42
3.4
3.38
3.36
3.34
3.32
3.3
3.28
3.26
3.24
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

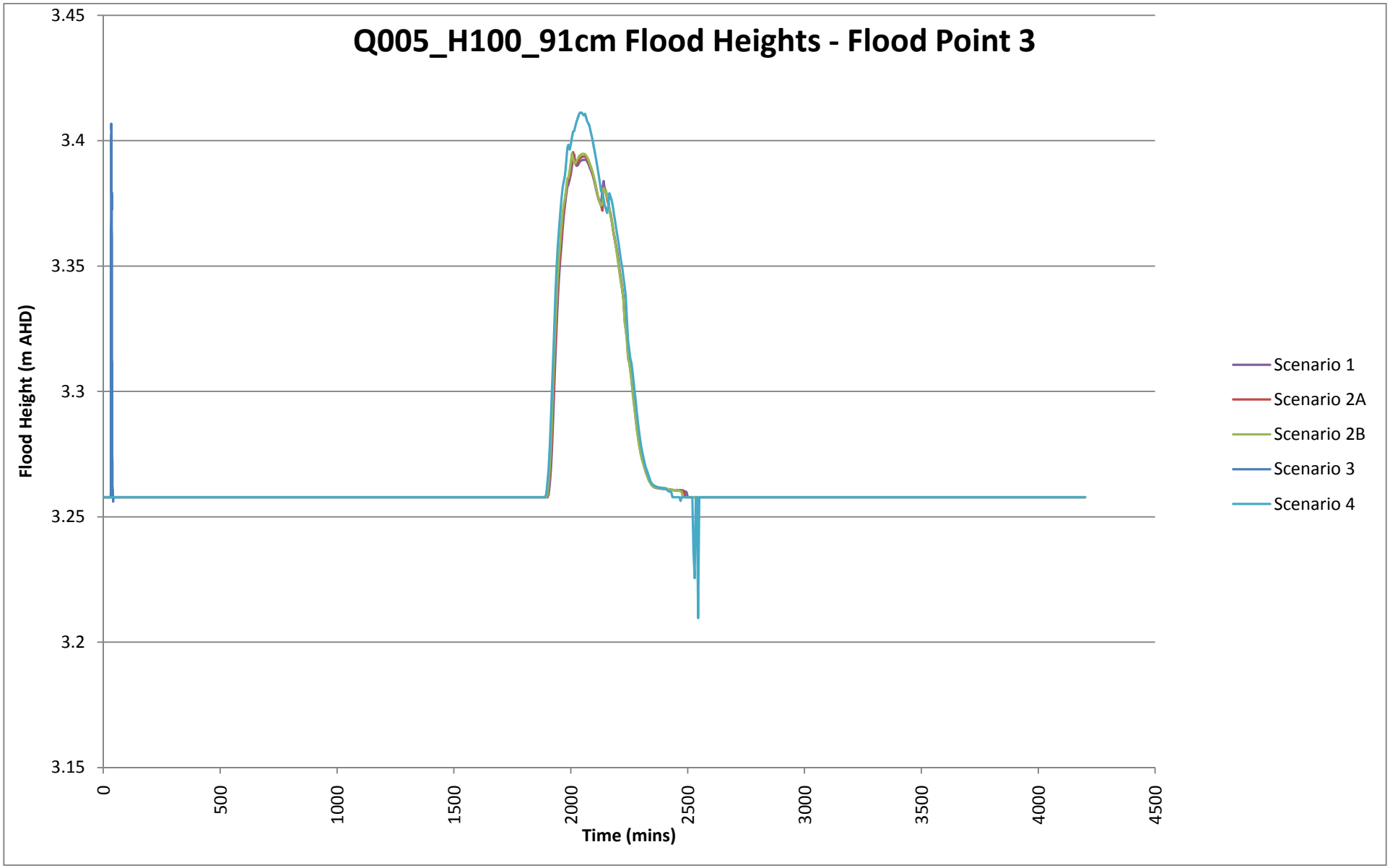

Q005_H005 Flood Heights - Flood Point 5
Flood Height (mAHD)
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

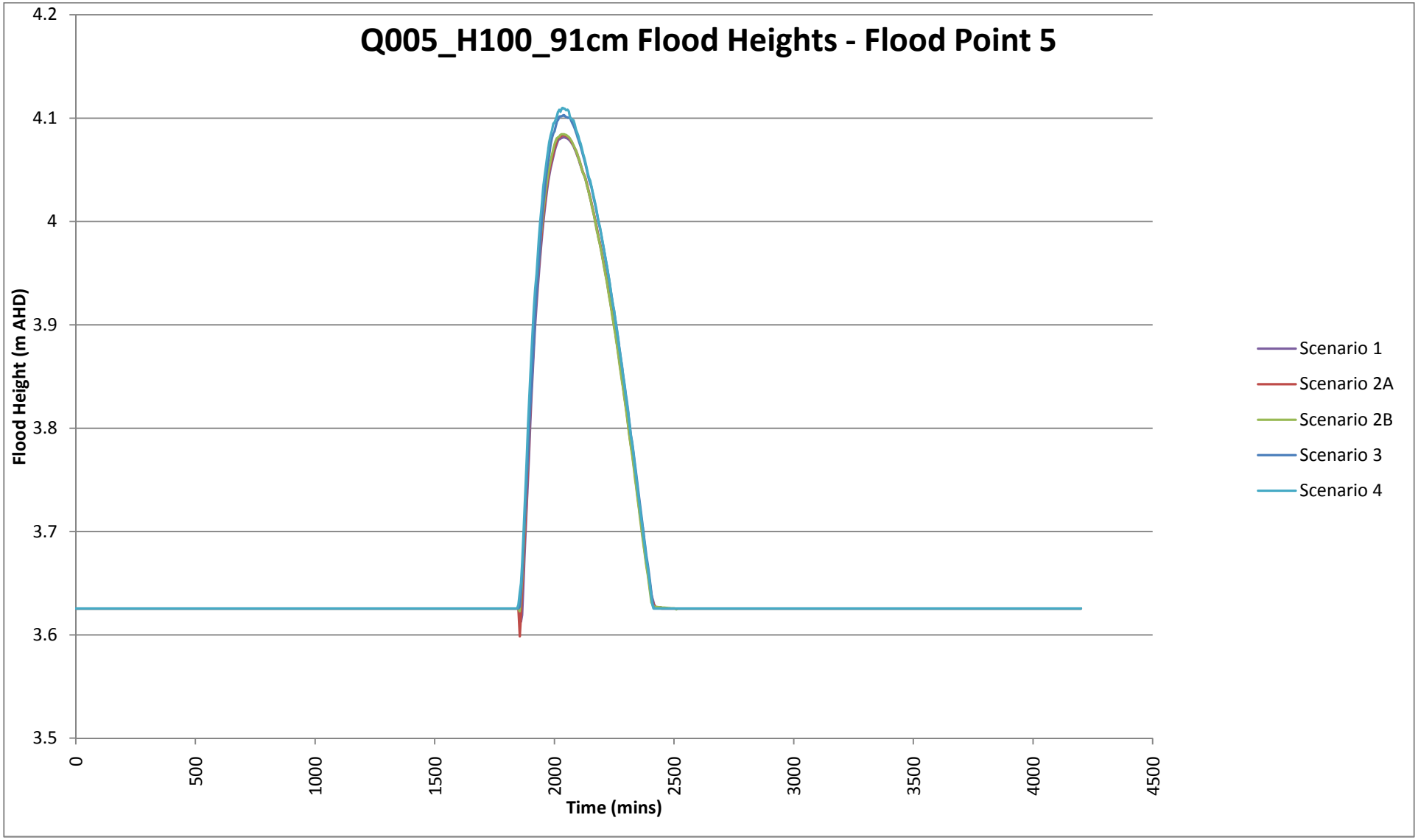

Q005_H100 Flood Heights - Flood Point 1
Flood Height (mAHD)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

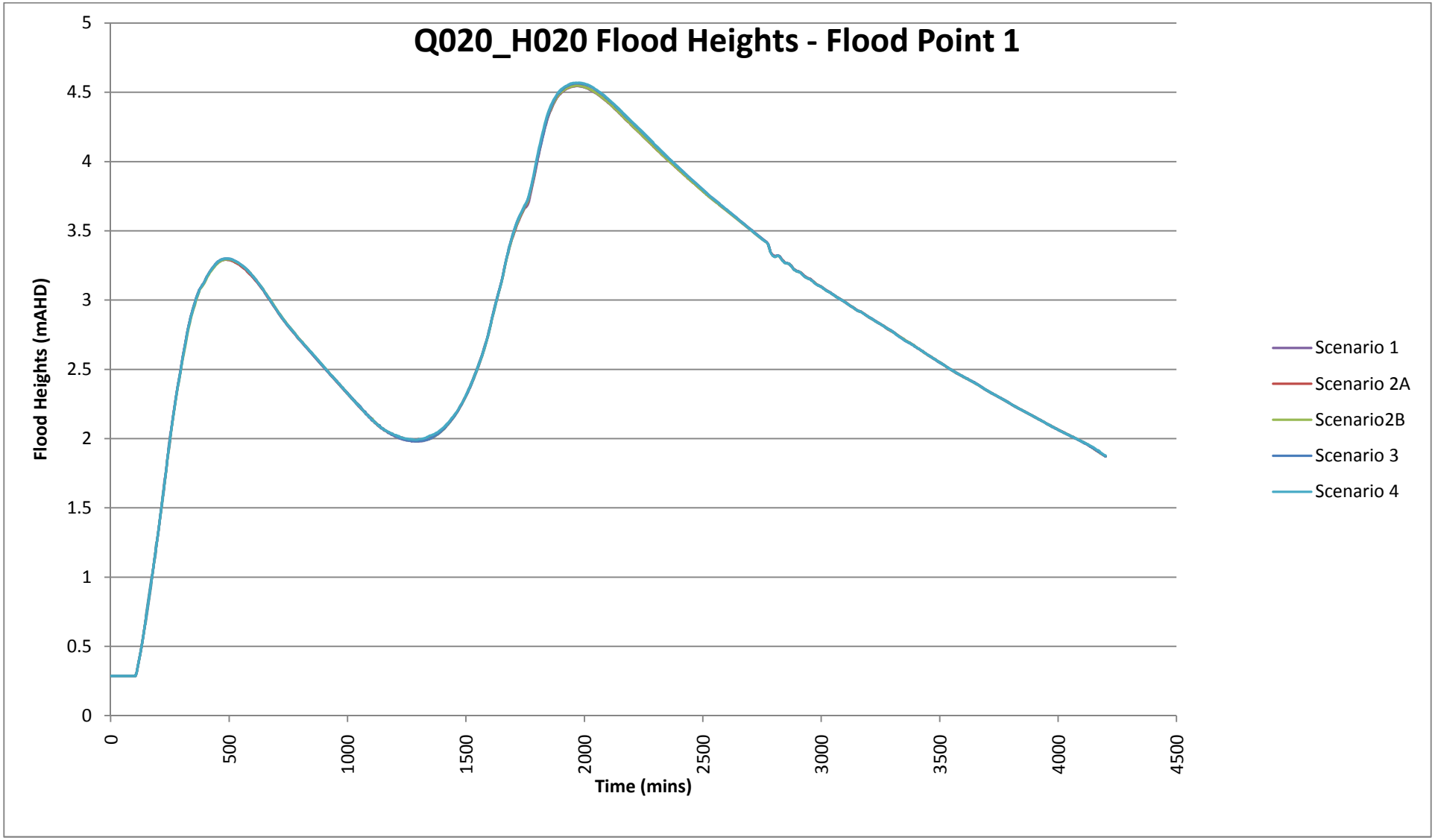

Q005_H100 Flood Heights - Flood Point 3
Flood Height (mAHD)
3.42
3.4
3.38
3.36
3.34
3.32
3.3
3.28
3.26
3.24
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

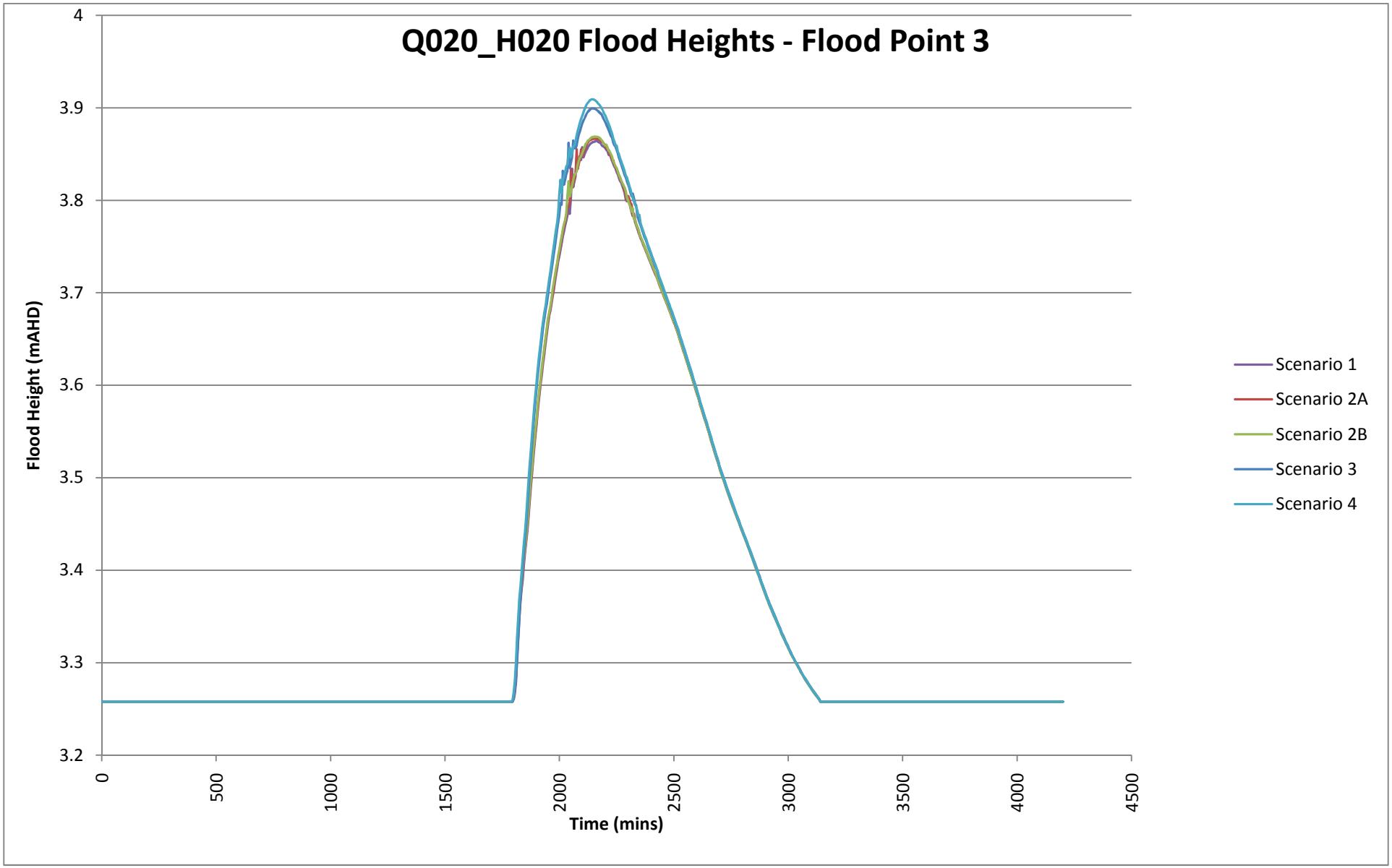

Q005_H100 Flood Heights - Flood Point 5
Flood Height (mAHD)
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

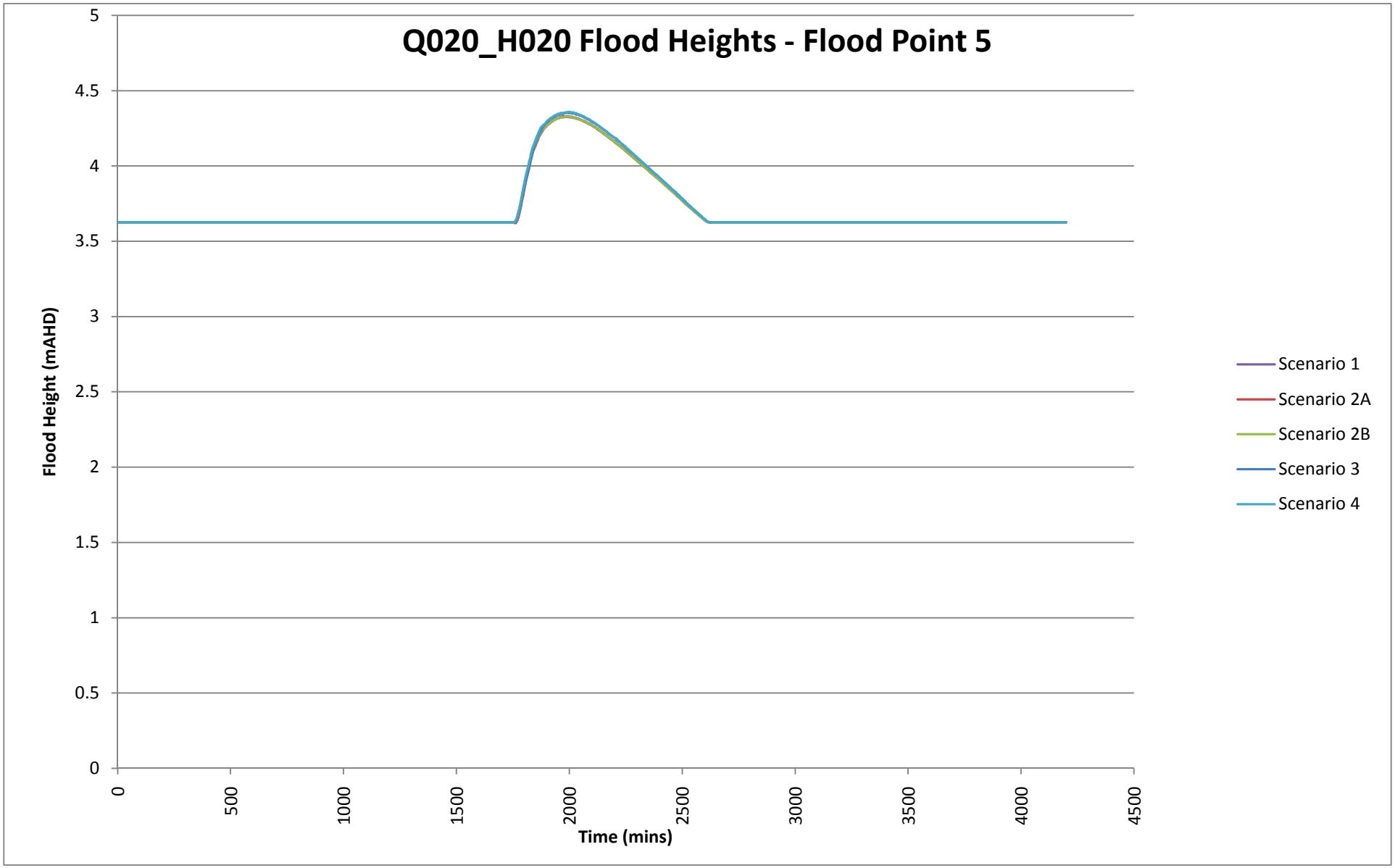

Q005_H100_91cm Flood Heights - Flood Point 1
Flood Height (m AHD)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

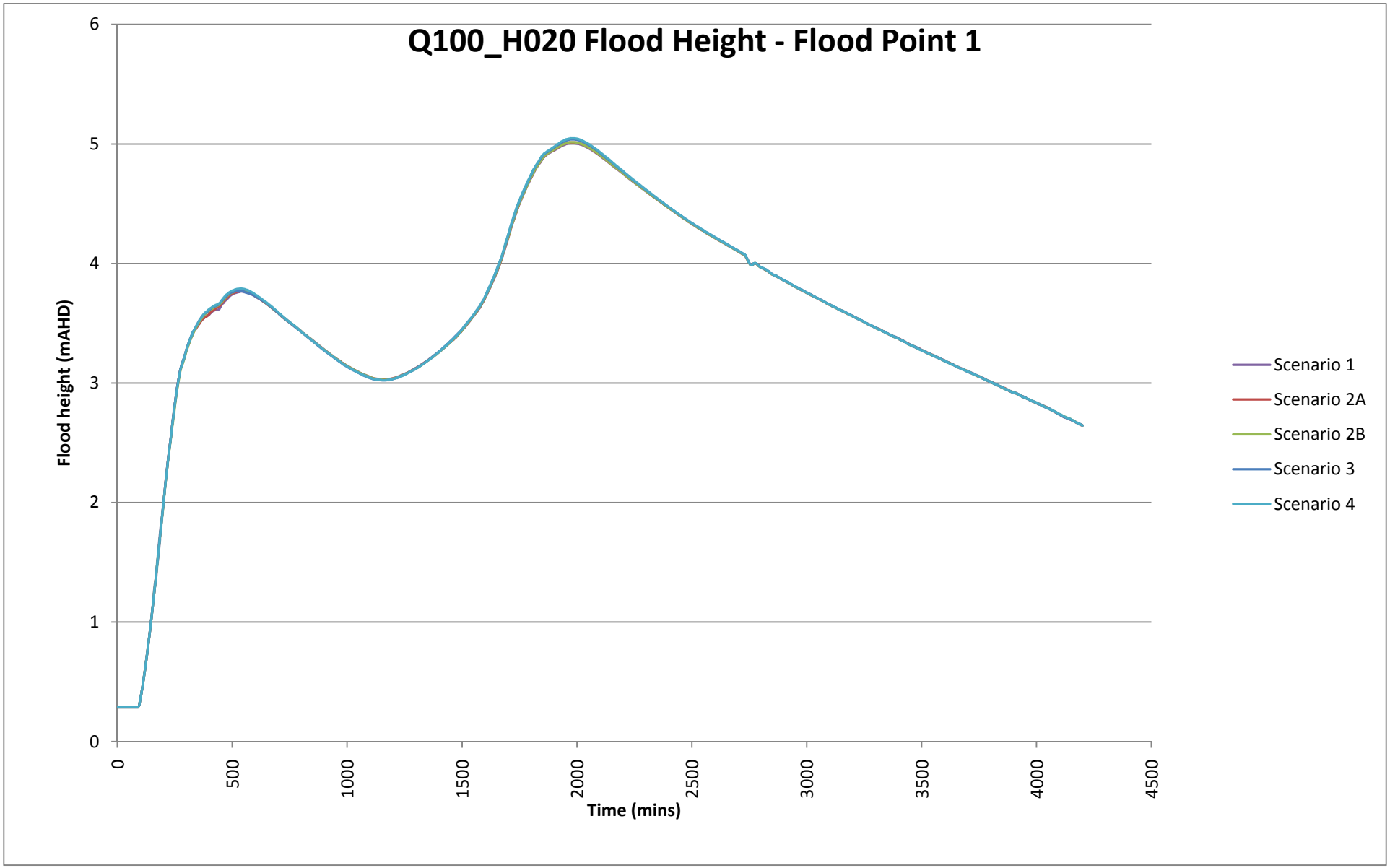

Q005_H100_91cm Flood Heights - Flood Point 3
Flood Height (m AHD)
3.45
3.4
3.35
3.3
3.25
3.2
3.15
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

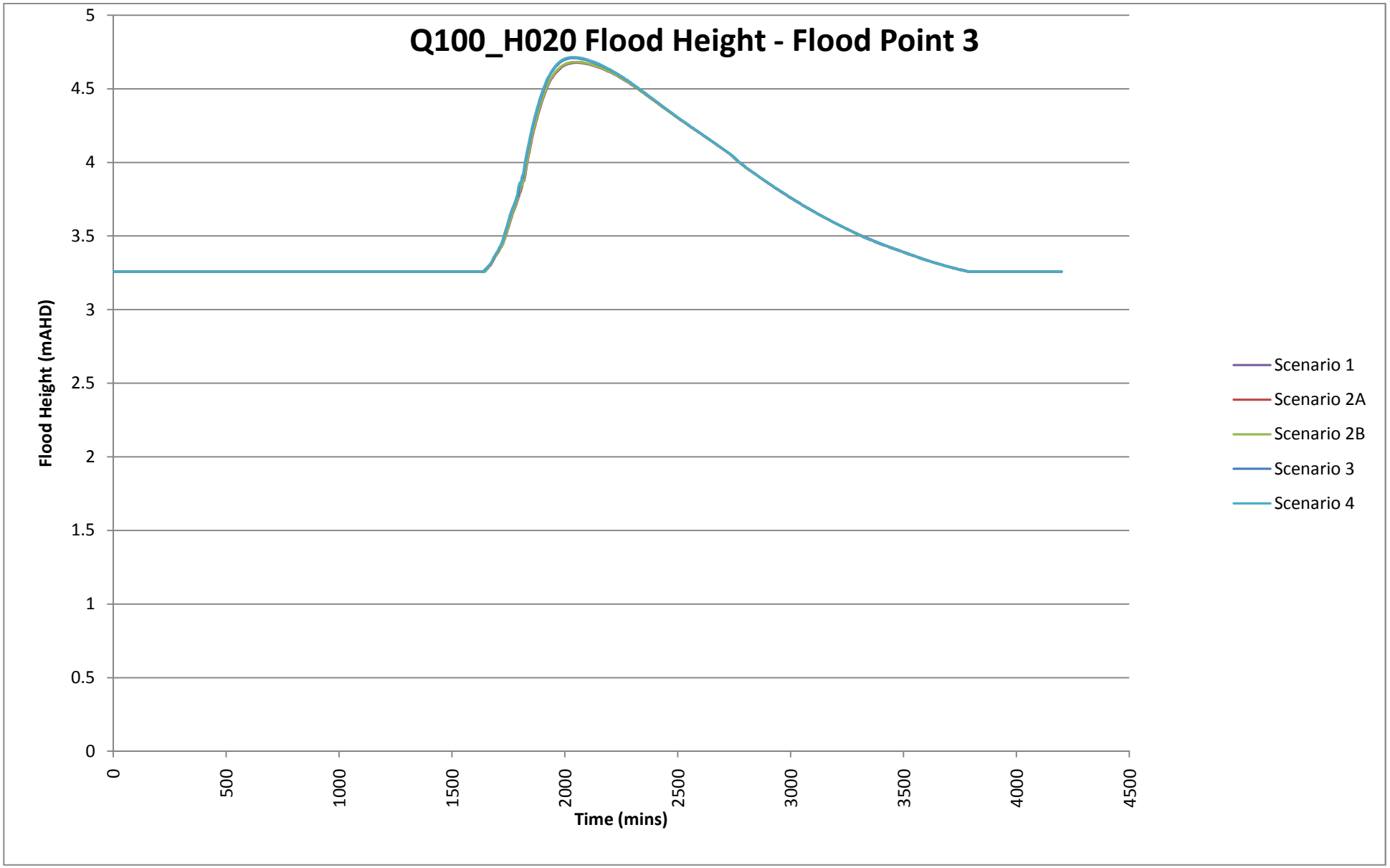

Q005_H100_91cm Flood Heights - Flood Point 5
Flood Height (m AHD)
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

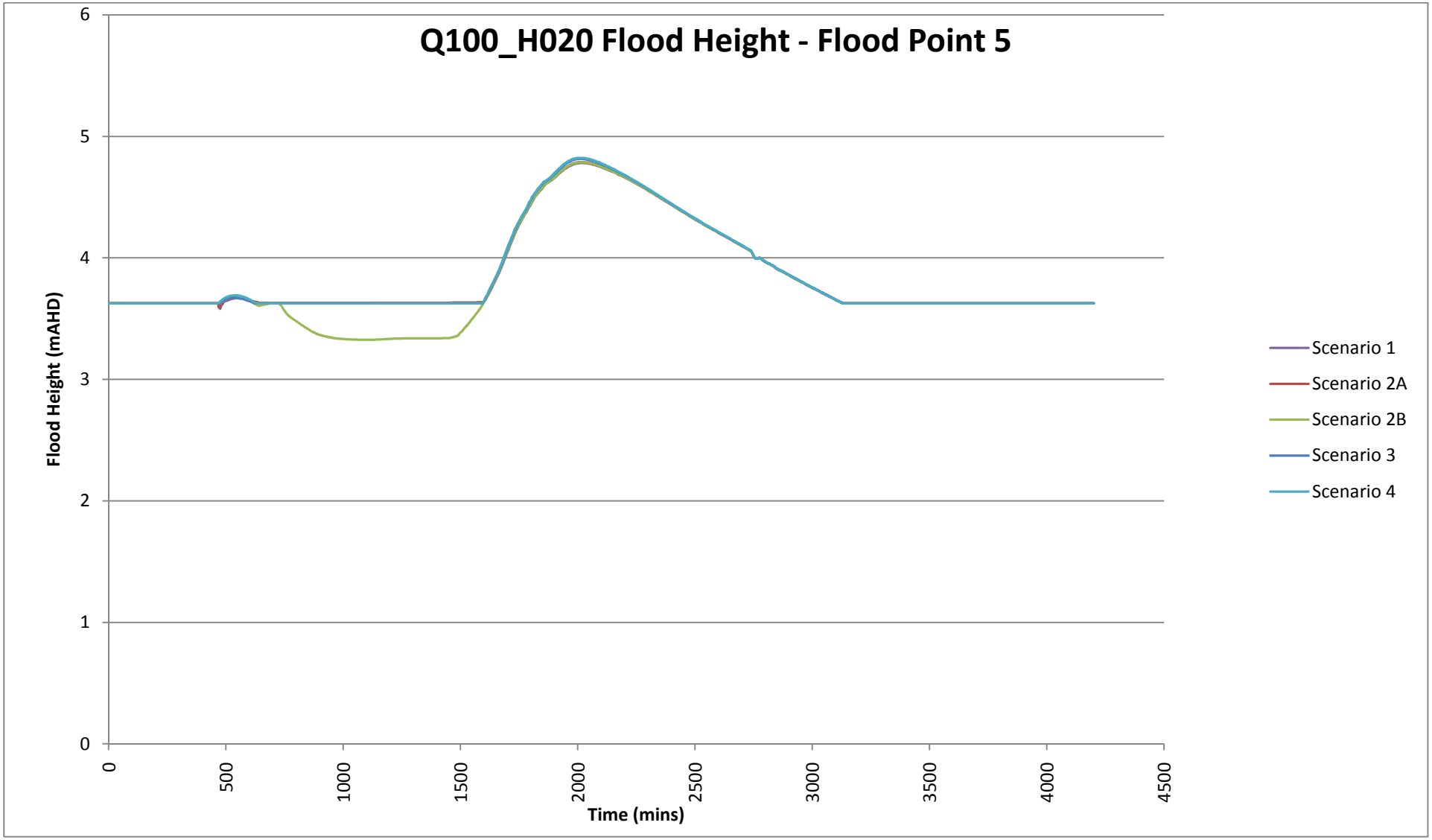

Q020_H020 Flood Heights - Flood Point 1
Flood Heights (mAHD)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario2B
Scenario 3
Scenario 4

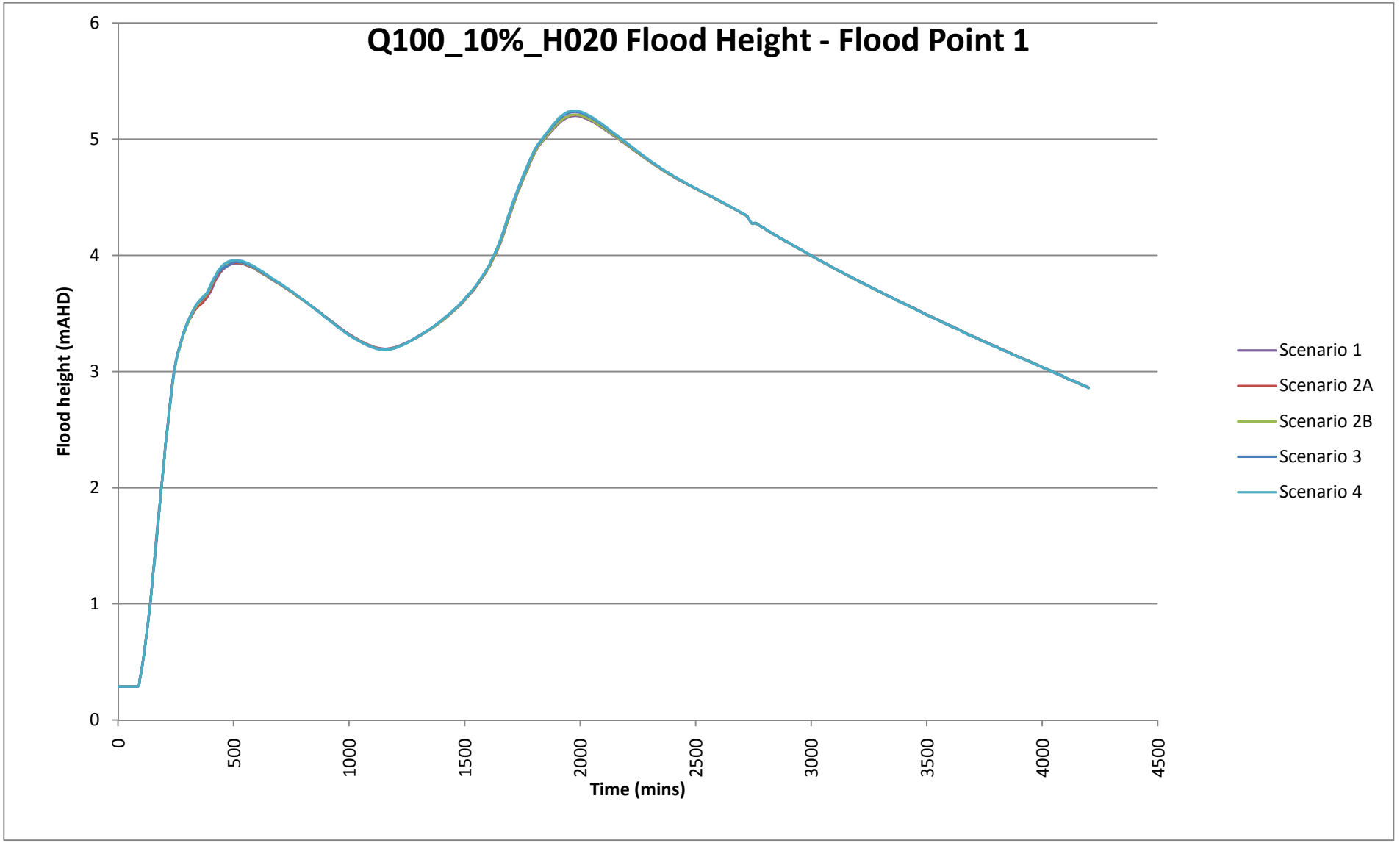

Q020_H020 Flood Heights - Flood Point 3
Flood Height (mAHD)
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

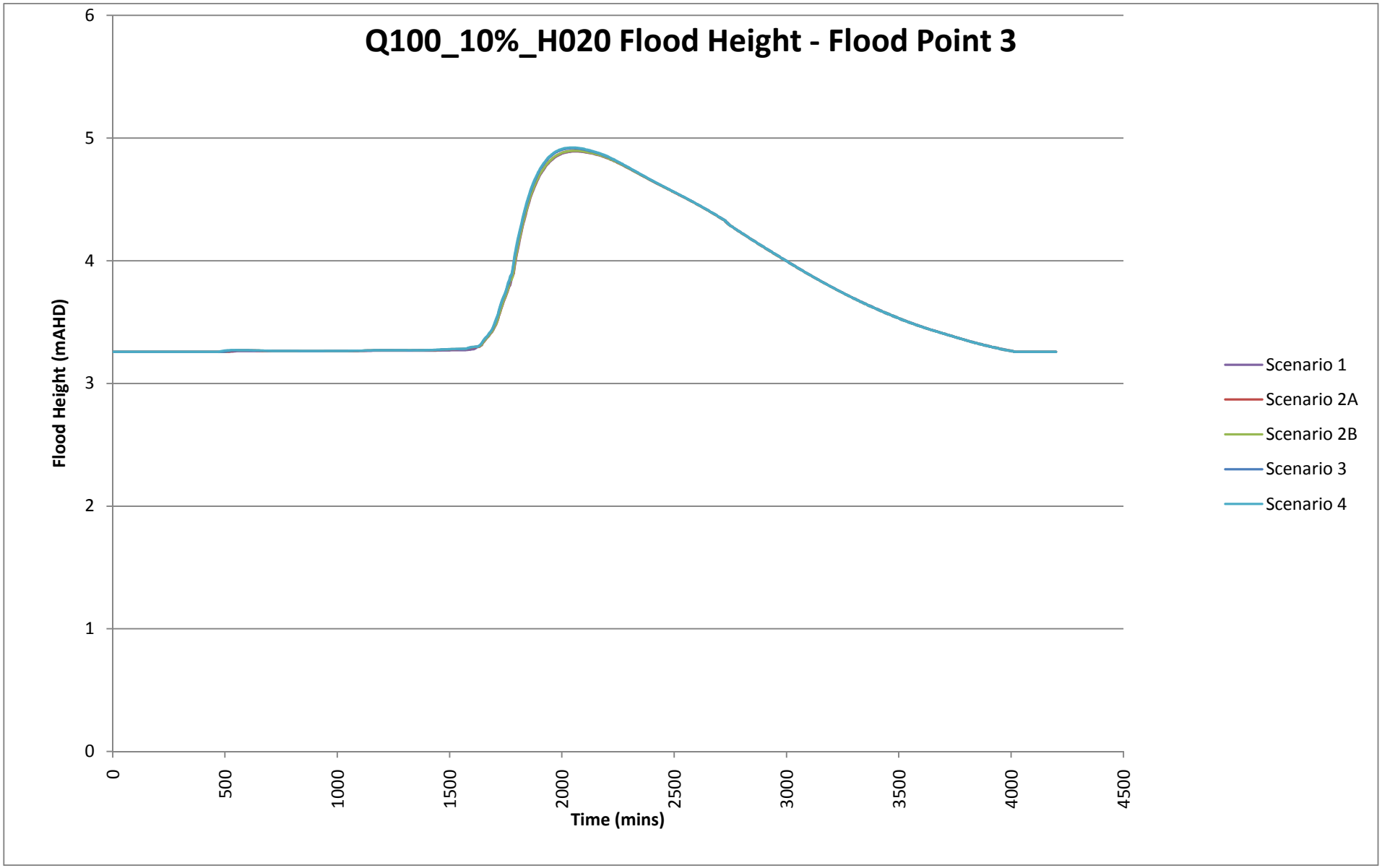

Q020_H020 Flood Heights - Flood Point 5
Flood Height (mAHD)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

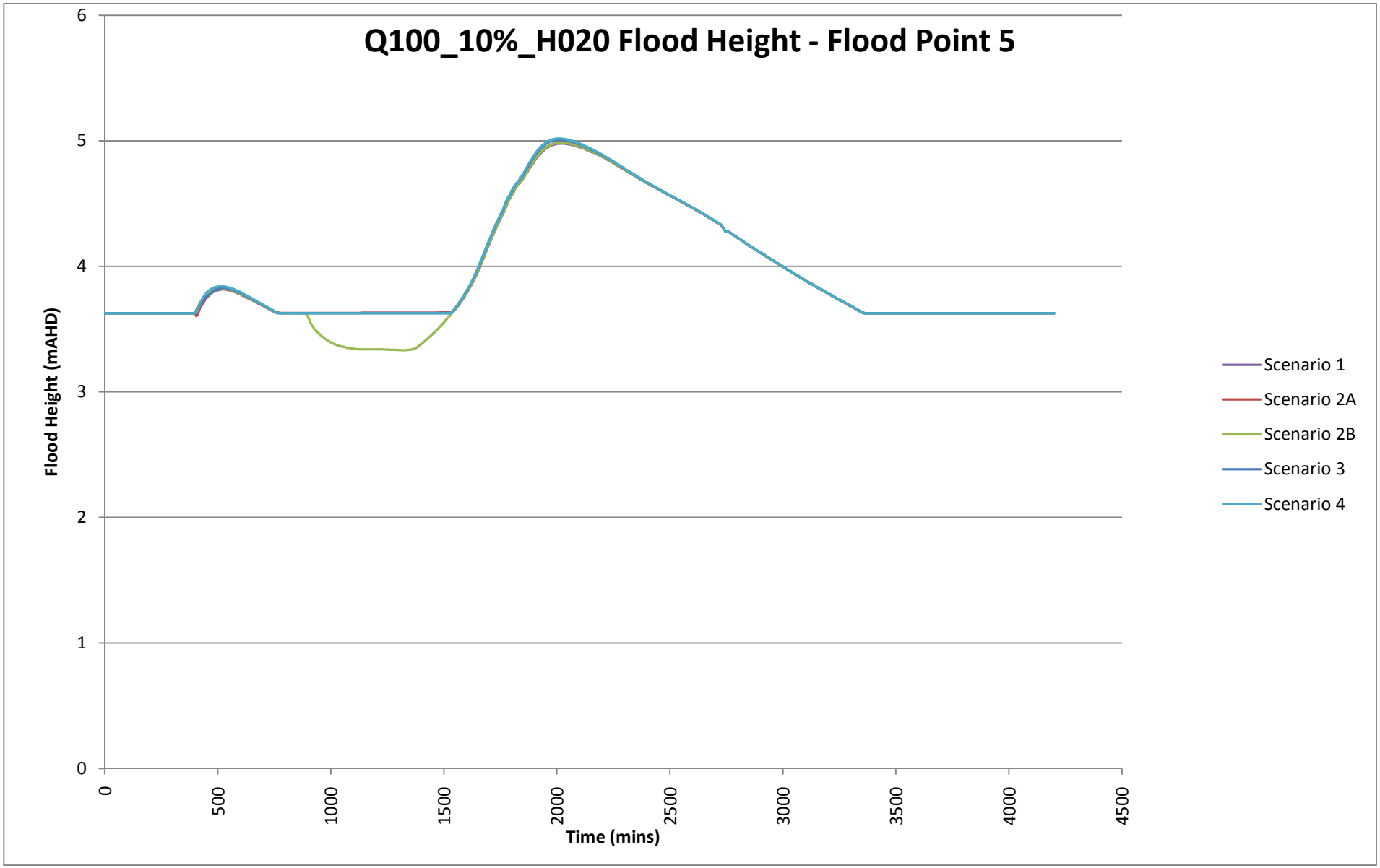

Q100_H020 Flood Height - Flood Point 1
Flood height (mAHD)
0
1
2
3
4
5
6
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4


Q100_H020 Flood Height - Flood Point 3
Flood Height (mAHD)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4


Q100_H020 Flood Height - Flood Point 5
Flood Height (mAHD)
6
5
4
3
2
1
0
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4


Q100_10%_H020 Flood Height - Flood Point 1
Flood height (mAHD)
0
1
2
3
4
5
6
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4


Q100_10%_H020 Flood Height - Flood Point 3
Flood Height (mAHD)
0
1
2
3
4
5
6
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4


Q100_10%_H020 Flood Height - Flood Point 5
Flood Height (mAHD)
0
1
2
3
4
5
6
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Time (mins)
Scenario 1
Scenario 2A
Scenario 2B
Scenario 3
Scenario 4

Yeats Consulting Pty Ltd

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Southport Qld 4215

Email: info@yeats.com.au

REFER TO INSET A FOR CONTINUATION

INSET A

ROUS RIVER

SCOUR PROTECTION

PROPOSED OFFLINE BIO-RETENTION BASINS

STAGE 4

"CONCEPTUAL ONLY"
SUBJECT TO DETAILED SURVEY & DESIGN

PT 332
DP 1158142

PT 332
DP 1158142

PT 332
DP 1158142

CORAL FERN CIRCUIT

FIG COURT

SILKPOD AVENUE

ROUS RIVER WAY

EXISTING
STAGES 1,2 & 3

22
DP1080322

PT 332
DP 1158142

TEMPORARY DRAINAGE CHANNEL/FUTURE ROAD RESERVE.

3
DP540943

5
DP239140

JOSHUA STREET

EXISTING CULVERT TO BE REMOVED

FUTURE DRAINAGE CORRIDOR AND RECREATIONAL AREA TO BE SHAPED TO DIVERT ALL EXTERNAL CATCHMENT RUN-OFF INTO THE TEMPORARY DRAINAGE CHANNEL/FUTURE ROAD RESERVE

FOR INFORMATION ONLY

LEGEND

- STAGE 4 BOUNDARY
- PROPOSED DRAINAGE CHANNEL
- LOT BOUNDARY - SUBJECT TO DETAILED SURVEY & DESIGN
- TOP/TOE OF BATTER
- TEMPORARY DRAINAGE CHANNEL / FUTURE ROAD RESERVE
- PROPOSED OFFLINE BIO-RETENTION BASIN
- RIPARIAN BUFFER ZONE
- FUTURE DRAINAGE CORRIDOR AND PARK
- FUTURE PATH (INDICATIVE LOCATION ONLY)

STATUS PRELIMINARY — NOT FOR CONSTRUCTION

REV	DESCRIPTION	DRAWN	DATE
B	GENERAL AMENDMENTS	K.E.	22.11.11
A	ORIGINAL ISSUE	T.W.	02.11.11

DRAWING IS NOT TO BE SCALED

SCALE (AT ORIGINAL SHEET SIZE) 10 0 10 20 30 40 50 SCALE 1:1000

ORIGINAL SHEET SIZE A1

CLIENT NEWLAND DEVELOPERS PTY LTD

PROJECT RIVA VUE ESTATE - STAGE 4
MURWILLUMBAH, NSW 2484

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TITLE STAGE 4 CONCEPT PLAN

TASK	BY	INITIAL	DATE
REVIEW	A.C.		02.11.11
DESIGN	T.W.		02.11.11
DRAWN	T.W.		02.11.11

APPROVED RPEQ No N/A

DRAWING NUMBER YC0291-SK18 REVISION B