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Rotokauri North Catchment Stormwater Modelling
Hamilton City Council
12-Oct-2018

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Rotokauri North Catchment Stormwater Modelling

Ohote Stream Capacity Assessment Model Build Report

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Rotokauri North Catchment Stormwater Modelling

Ohote Stream Capacity Assessment Model Build Report

Client: Hamilton City Council

Co No.: N/A

Prepared by

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12-Oct-2018

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Quality Information

Document Rotokauri North Catchment Stormwater Modelling

Ref 60582116

Date 12-Oct-2018

Prepared by Stepanka Vajlikova

Reviewed by Chris Hardy

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
A	12-Oct-2018	Draft for Client	Chris Hardy Project Manager	

D R A F T

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1.0 Introduction

AECOM New Zealand Limited (AECOM) has been engaged by Hamilton City Council (HCC) to undertake hydrologic modelling for the Rotokauri North Catchment Development Area (RNDA). The purpose of the modelling as described in the Consultant Agreement PSP17459 is to:

- Support HCC and the Developer to address some of the recognised future actions / information gaps in the Rotokauri Integrated Catchment Management Plan (ICMP) for the Rotokauri North Catchment.
- Undertake hydrological assessment of the impact of the proposed development will have on the downstream catchment in terms of flood level and extent.
- Help inform the requirement for the upstream storage and detention.

Assessments are being carried out using the Rotokauri North stormwater model which is a version of the Rotokauri Investigations & Design IFS model that has been reduced in its size (to cover only the area of interest).

The original PSP scope allowed for model setup specific to the requirements of the RNDA, the development of a set of baseline scenarios, and optioneering scenarios based on information provided by the Developer and HCC.

Additional stormwater modelling was agreed to be undertaken (Reference Variation 1 to PSP17459) based on the outcome of a workshop with the Developer and HCC. The objective of the additional work was to model a scenario based on unimpeded discharge to the Ohote Stream at Exelby Road.

The potential benefits of modelling an unrestricted discharge as the first option are as follows:

- It is likely to be the worst case scenario so if impacts are negligible, further downstream flood assessment may not be required.
- If it was deemed no further assessment is required, additional flood modelling in regard to flood storage and optimisation may not be required; or at least the number of options could be significantly reduced.

This report describes the additional modelling task only. An overall model build report is planned to be undertaken as per the original scope of PSP17459 that will include baseline scenarios and further discussion of options and proving scenarios.

2.0 Assumptions and limitations

The following assumptions and limitations apply to this assessment:

i. The modelling has been undertaken utilizing the existing model of decreased extent and in general accordance with the *HCC, Standard Stormwater Modelling Methodology, 1 May 2013*. It is noted that this guideline has now been superseded with a newer version; however for the consistency reasons, 2013 version guideline has been adopted and maintained for this model.

ii. Rainfall used in this modelling is as per existing model which uses the *Standard Stormwater Modelling Methodology*, *1 May 2013.*

iii. DHI software, 2016 version, was used.

iv. The terrain has been modified for the purpose of the modelling project. The modified terrain is not representative of the developed terrain. The terrain aspects upstream of the Exelby culvert in the Maximum Probable Development (MPD) scenario have changed. Direct comparison with the Existing Development (ED) scenario areas upstream of the Exelby culvert for baseline comparison purposes is not appropriate.

v. An average imperviousness value of 71% has been applied to all sub-catchments within the Hamilton City Boundary. This value was derived based on information provided by the Developer which is described in more detail in Section 3.2. This methodology will average the runoff across

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the development area; however, given the level of information available at this stage of the project, HCC and the Developer have agreed this methodology is reasonable.

vi. This model build report only documents the factual aspects of the modelling undertaken (e.g. provided input parameters and output results) but does not explain the basis of the parameters and consequential decisions made by the developer.

vii. This report is not intended to be a detail model build report, and serves as an addendum to the main model build report yet to be issued under the commission of the PSP17459.

3.0 Assessment Methodology

The intent of the modelling was to demonstrate the impact of an unimpeded discharge of the proposed development on the Ohote Stream downstream of Exelby Road. An outline of the methodology used for completing this modelling project is described in this section.

3.1 Catchment Overview

The total Rotokauri North catchment size is approximately 176 hectares (Ha). The main catchment outlet to the Ohote Stream is an existing culvert on Exelby Road at the city boundary. Approximately 39.3 Ha of the catchment currently discharges into the neighbouring Te Otomanui catchment via a culvert under Te Kowhai Road.

The catchment comprises undeveloped land that is used for pasture and grazing. The catchment drains via a system of farm drains and culverts into the Ohote Stream and the Te Otomanui Stream, then into the Waipa River.

3.2 Model Build

The following methodology was applied to the model build:

a. The model was developed using Mike Flood (by DHI software) consisting of Mike Urban module and the Mike 21 flexible mesh module to represent the various hydraulic and hydrological components of the catchment.

b. The flexible mesh applied to the model originates from the original 2 m by 2 m rectangular grid (refer to the *Rotokauri Stormwater Modelling, Model Build Report, 23 September 2016, AECOM*).

c. The flexible mesh in areas upstream of the Exelby Road culvert was updated to make sure conveyance into the Ohote Stream is maximised as far as practical without any significant restrictions. This was achieved by manually adjusting the elevation value of mesh vertices at the location of existing farm drains and streams. Channels were made conservatively wide and deep in order to achieve good channel conveyance. The modified mesh file was applied to all three modelled scenarios.

d. The proposed future development (MPD) scenario assumes that the area currently draining into the Te Otomanui catchment will be diverted into the Ohote Stream. This has been achieved by adjusting the terrain of the existing channels as described above, and by increasing the road elevation at the Te Kowhai Road culvert location, to make sure flow cannot enter the neighbouring catchment.

e. An impervious value of 71% was applied to all applied to all sub-catchments within City Boundary. Imperviousness values for sub-catchments outside the City Boundary were not changed from the original Rotokauri ICMP model. The RNDA imperviousness value was derived from information provided by the Developer (Table 1).

Table 1 Information used to derive the average imperviousness value

Land use	Residential	Roads	Commercial	Education	Open space & reserves
Land use area proportion	52%	26%	1%	3%	18%
Land use imperviousness	80 %	95 %	95 %	40 %	15 %

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f. An average roughness coefficient of 24.18 (Manning's M) was applied to grid cells located within the RNDA in the bed resistance file. The bed resistance file is used by the Mike 21 module. This value was derived from information summarised in Table 2.

Table 2 Information used to derive the average roughness coefficient value

Land use	Residential	Roads	Commercial	Education	Open space & reserves
Land use area proportion	52 %	26 %	1 %	3 %	18 %
Manning's M	12	50	11	11	25

g. The Exelby Road culvert was removed from the 1D model (Mike Urban). The model terrain was cut to stream invert level over a width of about 3 m (approximating the existing downstream channel and / or a small single span bridge) at the culvert location to allow virtually unrestricted discharge.

3.3 Run the scenarios

Three MPD model scenarios were run using nested hyetographs with a 24 hour rainfall duration. The simulations were run for 36 hours for the following rainfall events:

- 2 year ARI rainfall event with climate change
- 10 year ARI rainfall event with climate change
- 100 year ARI rainfall event with climate change

4.0 Model Outputs

The following system performance outputs were provided to HCC and the Developer:

1. RNDA-Variation 1-Discharge Hydrographs.xlsx: This spreadsheet contains the discharge time series for the Exelby Road culvert location and Duck Road Bridge for all three event scenarios. The discharge time series is provided in the 5 minute time step interval.
2. Maximum water depth maps: These maps show the maximum water depth achieved during the simulation for each grid cell. A threshold of 100mm has been applied; therefore only depth above 100mm is plotted. The following maps have been provided:
   - RNDA_Variation1_MPD2CC_MaxWaterDepth.pdf
   - RNDA_Variation1_MPD10CC_MaxWaterDepth.pdf
   - RNDA_Variation1_MPD100CC_MaxWaterDepth.pdf
3. Maximum water level maps: These maps show the maximum water level as R.L. achieved during the simulation for each grid cell considered by the model a 'wet cell'. The following maps have been provided:
   - RNDA_Variation1_MPD2CC_MaxWaterLevel.pdf
   - RNDA_Variation1_MPD10CC_MaxWaterLevel.pdf
   - RNDA_Variation1_MPD100CC_MaxWaterLevel.pdf
4. Maximum velocity maps: These maps show the maximum flow velocity achieved during the simulation for each grid cell. A threshold of 0.05m/s has been applied; therefore only the velocity above this threshold value is plotted. The following maps have been provided:
   - RNDA_Variation1_MPD2CC_MaxVelocity.pdf
   - RNDA_Variation1_MPD10CC_MaxVelocity.pdf
   - RNDA_Variation1_MPD100CC_MaxVelocity.pdf
5. Flood extent comparison maps: These maps show the MPD maximum water depth result (as noted in the bullet point 2) for an event with climate change, overlaid with the ED flood extent

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result (for which the maximum water depth exceeds 100mm) for the same rainfall event without climate change. It is noted that comparison of flood extents upstream of the Exelby Road culvert location is not appropriate due to terrain changes applied to the MPD models. The following maps have been provided:

- RNDA_Variation1_MPD2CC vs ED2 Flood Extent.pdf
- RNDA_Variation1_MPD10CC vs ED10 Flood Extent.pdf
- RNDA_Variation1_MPD100CC vs ED100 Flood Extent.pdf

6. RNDA_Var1_Raster_Results.gdb: This is ArcGIS geodatabase file compiling raw model result files for the three MPD scenarios in a raster format. The following raster files are included in the *.gdb file:
   - RNDA_Var1_MPD100CC_MaxDepth
   - RNDA_Var1_MPD100CC_MaxV
   - RNDA_Var1_MPD100CC_MaxWL
   - RNDA_Var1_MPD10CC_MaxDepth
   - RNDA_Var1_MPD10CC_MaxV
   - RNDA_Var1_MPD10CC_MaxWL
   - RNDA_Var1_MPD2CC_MaxDepth
   - RNDA_Var1_MPD2CC_MaxV
   - RNDA_Var1_MPD2CC_MaxWL

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5.0 Discussion

The following is noted based on the model outputs taking into account the assumptions and limitations:

a. The channels cut into the model do not represent designed flood storage but they do represent a significant storage volume due to their size and combined length in the flat catchment.

b. A manual peak discharge assessment undertaken by the Developers Engineers yielded a peak flow in the order of 7 m^3/s. This rate was not achieved in the model likely due to the storage volume in the cut conveyance channels and the flat nature of the site (and therefore the channels). The model yielded a peak discharge rate of 2.3 m^3/s.

c. It is anticipated that it will not be practical to increase the discharge rate any further in the model, therefore the final solution will need to provide some degree of conveyance storage volume to suit the final adopted Exelby Road flow control (culvert or bridge).

d. The terrain cut at Exelby Road currently approximates a bridge with a span of 3m. Further consideration and optioneering of the final waterway form will be required for the Exelby Road discharge point in association with the point made above regarding conveyance storage.

e. It should be noted that the velocity maps show velocities for all flooding including under 100mm depth (which is typically removed). Reference should be made to the flood extent maps which do not show flooding less than 100 mm which can be treated as negligible.

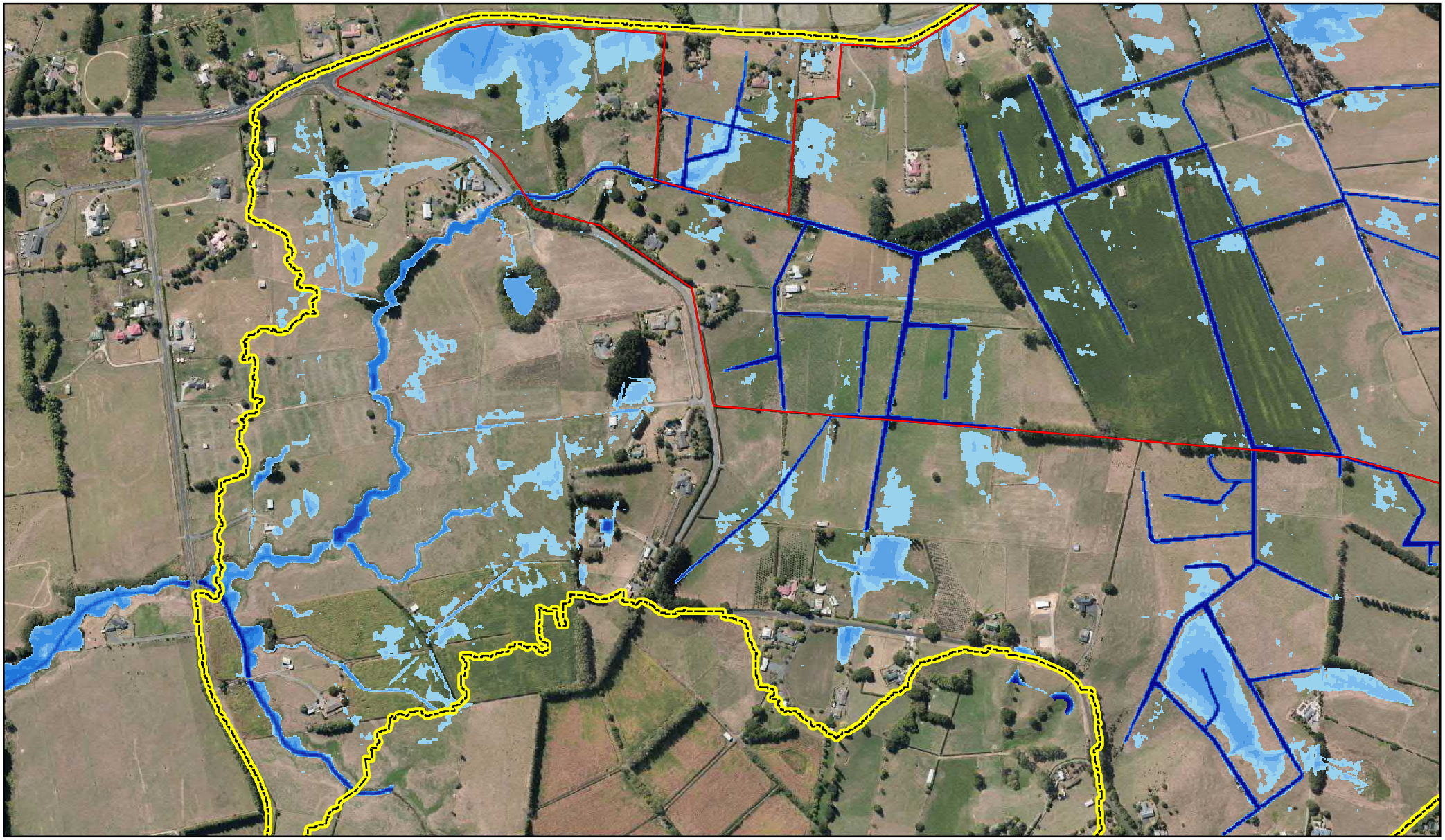
f. The flood extent maps show that the cut channels have reduced surface flooding and adequately discharged runoff from most of the catchment. Minor areas of surface flooding remain in small depressions and very flat areas of the catchment; these are typically impractical to remove and should not occur in reality once earthworks and the final development infrastructure is in place (e.g. roads).

g. The 100 year ARI ED versus MPD comparison map shows that there is a small increase in the extent of flooding downstream of Exelby Road. The flood extent appears to be maintained within the gully channel (i.e. the flooding does not appear to breach the top of the gully bank).

Consent has not been provided by HCC to provide recommendations in regards to the results in terms of impact assessment. Therefore recommendations have not been assessed or provided in this report.

Appendix A

Plans



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Approved		Date	2/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Maximum Water Depth

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 100 year ARI with climate change
Flooding Results - Maximum Water Depth (above 100mm)

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 01

Rev.	By	App.	Description	Date
0	SV	JM	Draft	2/10/2018

Maximum Water Depth above 100mm

- 0.1001 - 0.2000
- 0.2001 - 0.3000
- 0.3001 - 0.5000
- 0.5001 - 0.7500
- 0.7501 - 1.0000
- 1.0001 - 1.2500
- 1.2501 - 1.5000
- 1.5001 - 2.0000
- > 2.0001

Model Boundary

Rotokauri North Development Area

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MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
HCC Supplied GIS Datasets, Network, Aerial Imagery, Topographical.
LINZ Topo Data, CRS 2011, ESRI Global Map 2010,
BING Satellite Imagery

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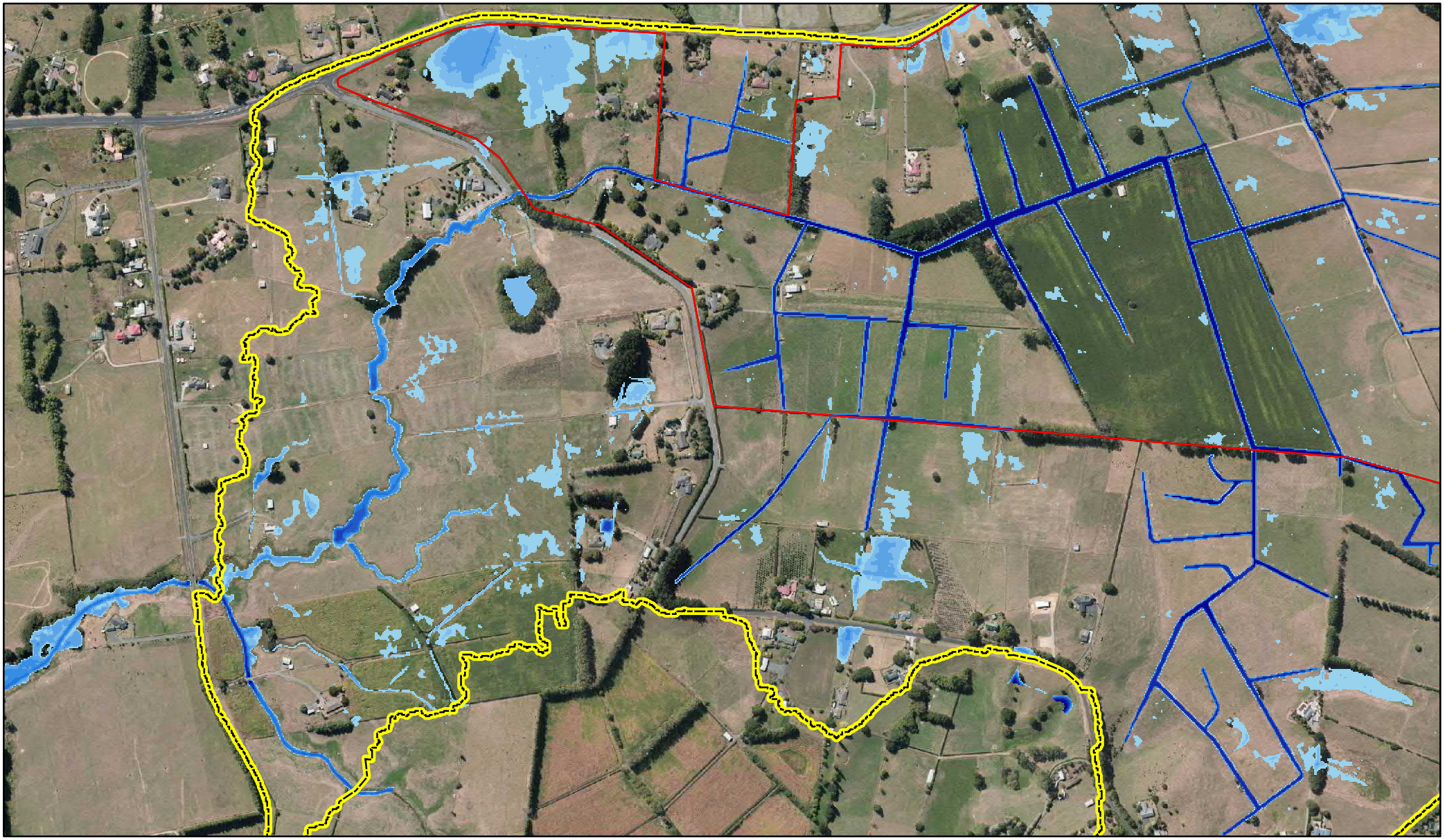

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Approved		Date	2/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Maximum Water Depth

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 10 year ARI with climate change
Flooding Results - Maximum Water Depth (above 100mm)

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 02

Rev.	By	App.	Description	Date
0	SV	JM	Draft	2/10/2018

Maximum Water Depth above 100mm

- 0.1001 - 0.2000
- 0.2001 - 0.3000
- 0.3001 - 0.5000
- 0.5001 - 0.7500
- 0.7501 - 1.0000
- 1.0001 - 1.2500
- 1.2501 - 1.5000
- 1.5001 - 2.0000
- > 2.0001

Model Boundary

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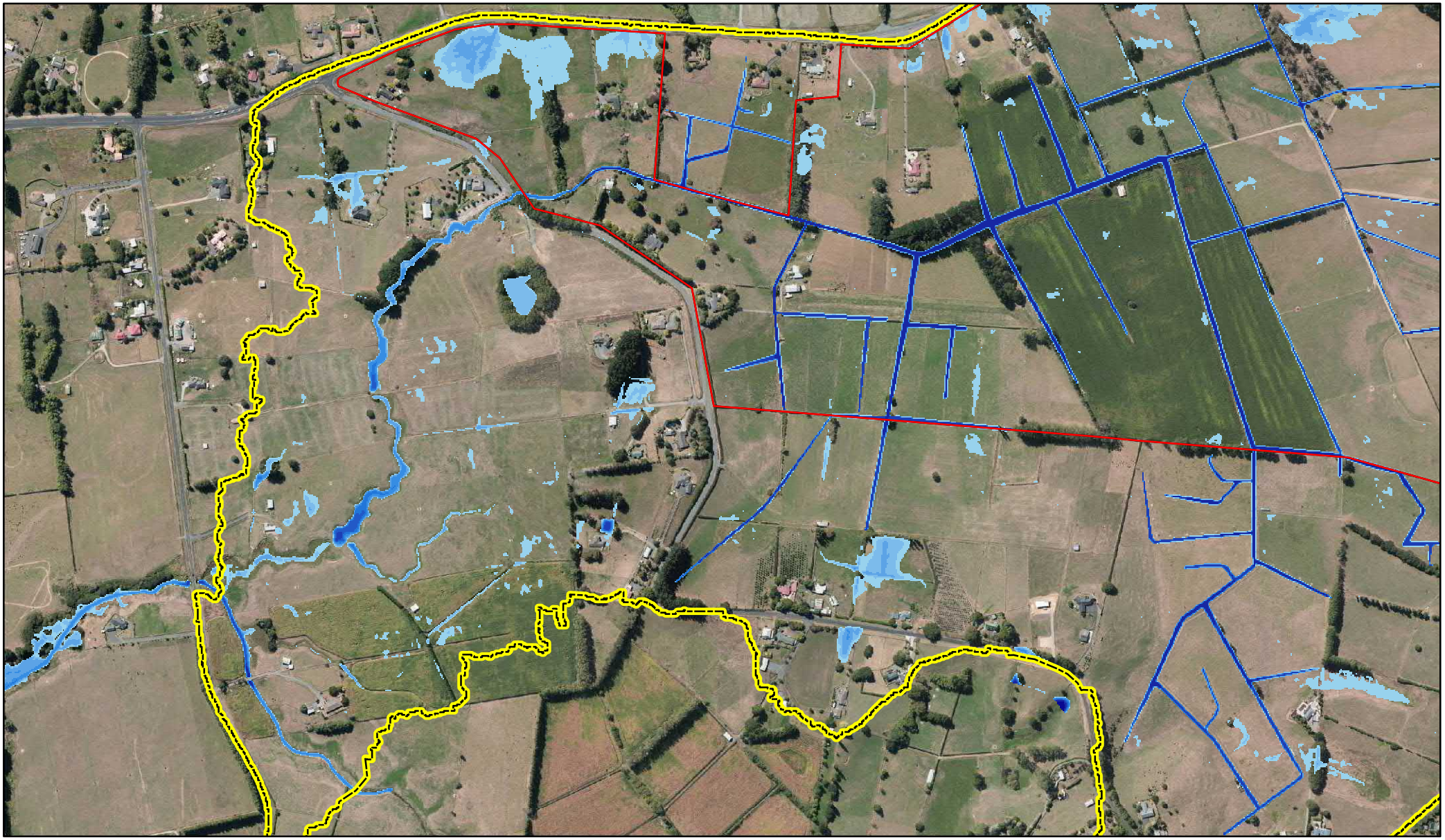

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Approved		Date	4/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Maximum Water Depth

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 2 year ARI with climate change
Flooding Results - Maximum Water Depth (above 100mm)

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 03

Rev.	By	App.	Description	Date
0	SV	JM	Draft	4/10/2018

Maximum Water Depth above 100mm

- 0.1001 - 0.2000
- 0.2001 - 0.3000
- 0.3001 - 0.5000
- 0.5001 - 0.7500
- 0.7501 - 1.0000
- 1.0001 - 1.2500
- 1.2501 - 1.5000
- 1.5001 - 2.0000
- > 2.0001

Model Boundary

Rotokauri North Development Area

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Approved		Date	2/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Maximum Water Level

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 100 year ARI with climate change
Flooding Results - Maximum Water Level

Scale: Scale: 1:10,000 (A4 size) 100 50 0 100 200 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 04

Rev.	By	App.	Description	Date
0	SV	JM	Draft	2/10/2018

Maximum Water Level R.L. above 18.0m

- 18.0001 - 20.0000
- 20.0001 - 22.0000
- 22.0001 - 24.0000
- 24.0001 - 26.0000
- 26.0001 - 28.0000
- 28.0001 - 30.0000
- 30.0001 - 35.0000
- 35.0001 - 40.0000
- > 40.0001

Model Boundary

Rotokauri North Development Area

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MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
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LINZ Topo Data, CRS 2011, ESRI Global Map 2010,
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Approved		Date	2/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Maximum Water Level

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 10 year ARI with climate change
Flooding Results - Maximum Water Level

Scale: Scale: 1:10,000 (A4 size) 100 50 0 100 200 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 05

Rev.	By	App.	Description	Date
0	SV	JM	Draft	2/10/2018

Maximum Water Level R.L. above 18.0m
- 18.0001 - 20.0000
- 20.0001 - 22.0000
- 22.0001 - 24.0000
- 24.0001 - 26.0000
- 26.0001 - 28.0000
- 28.0001 - 30.0000
- 30.0001 - 35.0000
- 35.0001 - 40.0000
- > 40.0001

Model Boundary
Rotokauri North Development Area

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Printed	4/10/2018 7:38:15 a.m.		
Approved		Date	4/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Maximum Water Level

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 2 year ARI with climate change
Flooding Results - Maximum Water Level

Scale: Scale: 1:10,000 (A4 size) 100 50 0 100 200 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 06

Rev.	By	App.	Description	Date
0	SV	JM	Draft	4/10/2018

Maximum Water Level R.L. above 18.0m

- 18.0001 - 20.0000
- 20.0001 - 22.0000
- 22.0001 - 24.0000
- 24.0001 - 26.0000
- 26.0001 - 28.0000
- 28.0001 - 30.0000
- 30.0001 - 35.0000
- 35.0001 - 40.0000
- > 40.0001

Model Boundary

Rotokauri North Development Area

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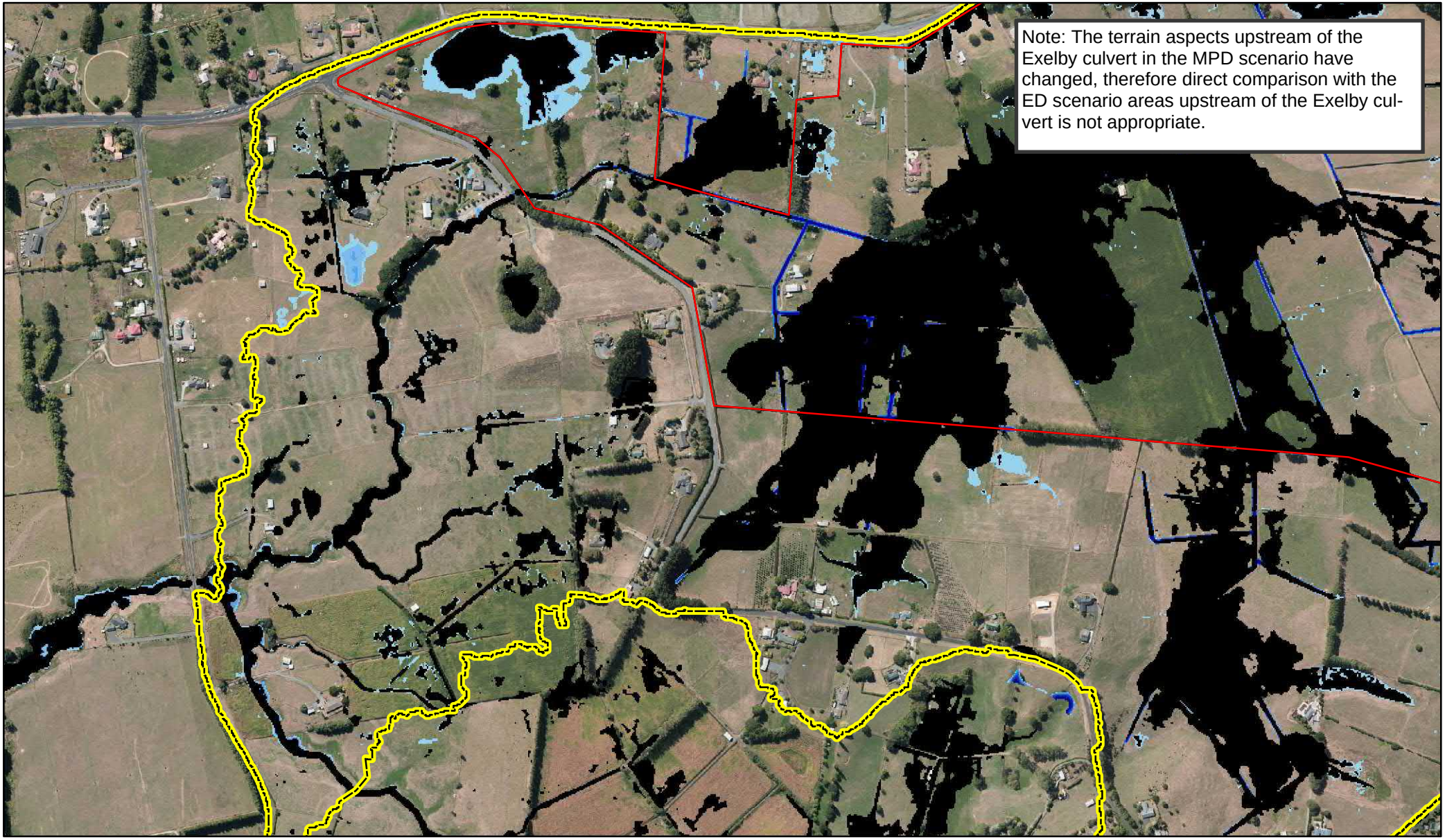

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Checked	JM	Checked	JM
Primary Map No.	60582116 - Flood Extent Comparison		

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development (MPD) - 100 year ARI with climate change Flooding Extent Comparison with Existing Development (ED)

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 07

Rev.	By	App.	Description	Date
0	SV	JM	Draft	2/10/2018

MPD Maximum Water Depth above 100mm
- 0.1001 - 0.2000
- 0.2001 - 0.3000
- 0.3001 - 0.5000
- 0.5001 - 0.7500
- 0.7501 - 1.0000
- 1.0001 - 1.2500
- 1.2501 - 1.5000
- 1.5001 - 2.0000
- > 2.0001

- Model Boundary
- Rotokauri North Development Area
- ED Flooding Extent (maximum water depth above 100mm) for 100 year ARI

MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
HCC Supplied GIS Datasets, Network, Aerial Imagery, Topographical.
LINZ Topo Data, CRS 2011, ESRI Global Map 2010,
BING Satellite Imagery

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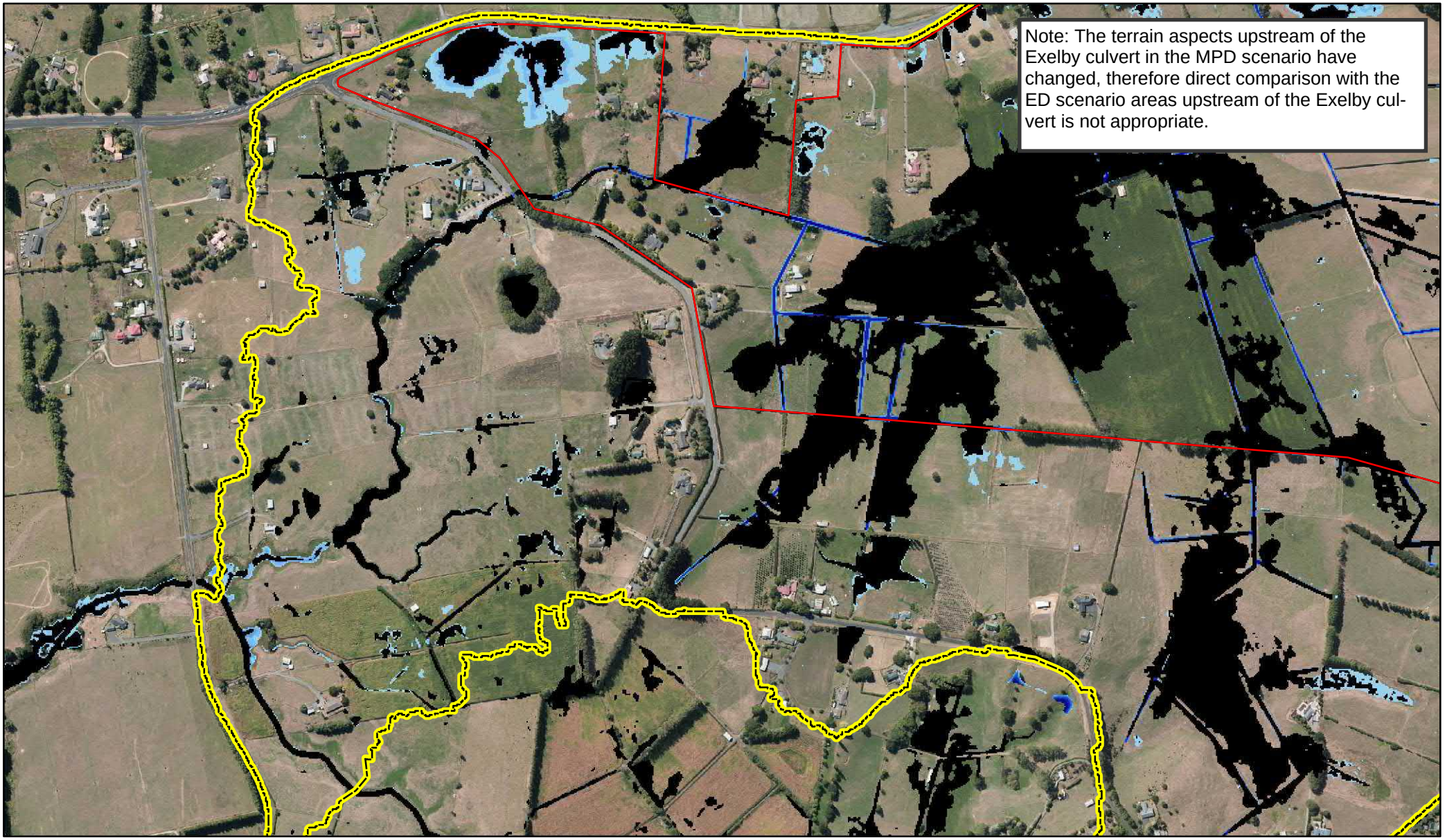

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Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Flood Extent Comparison

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development (MPD) - 10 year ARI with climate change Flooding Extent Comparison with Existing Development (ED)

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 08

Rev.	By	App.	Description	Date
0	SV	JM	Draft	2/10/2018

MPD Maximum Water Depth above 100mm
- 0.1001 - 0.2000
- 0.2001 - 0.3000
- 0.3001 - 0.5000
- 0.5001 - 0.7500
- 0.7501 - 1.0000
- 1.0001 - 1.2500
- 1.2501 - 1.5000
- 1.5001 - 2.0000
- > 2.0001

- Model Boundary
- Rotokauri North Development Area
- ED Flooding Extent (maximum water depth above 100mm) for 10 year ARI

MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
HCC Supplied GIS Datasets, Network, Aerial Imagery, Topographical.
LINZ Topo Data, CRS 2011, ESRI Global Map 2010,
BING Satellite Imagery

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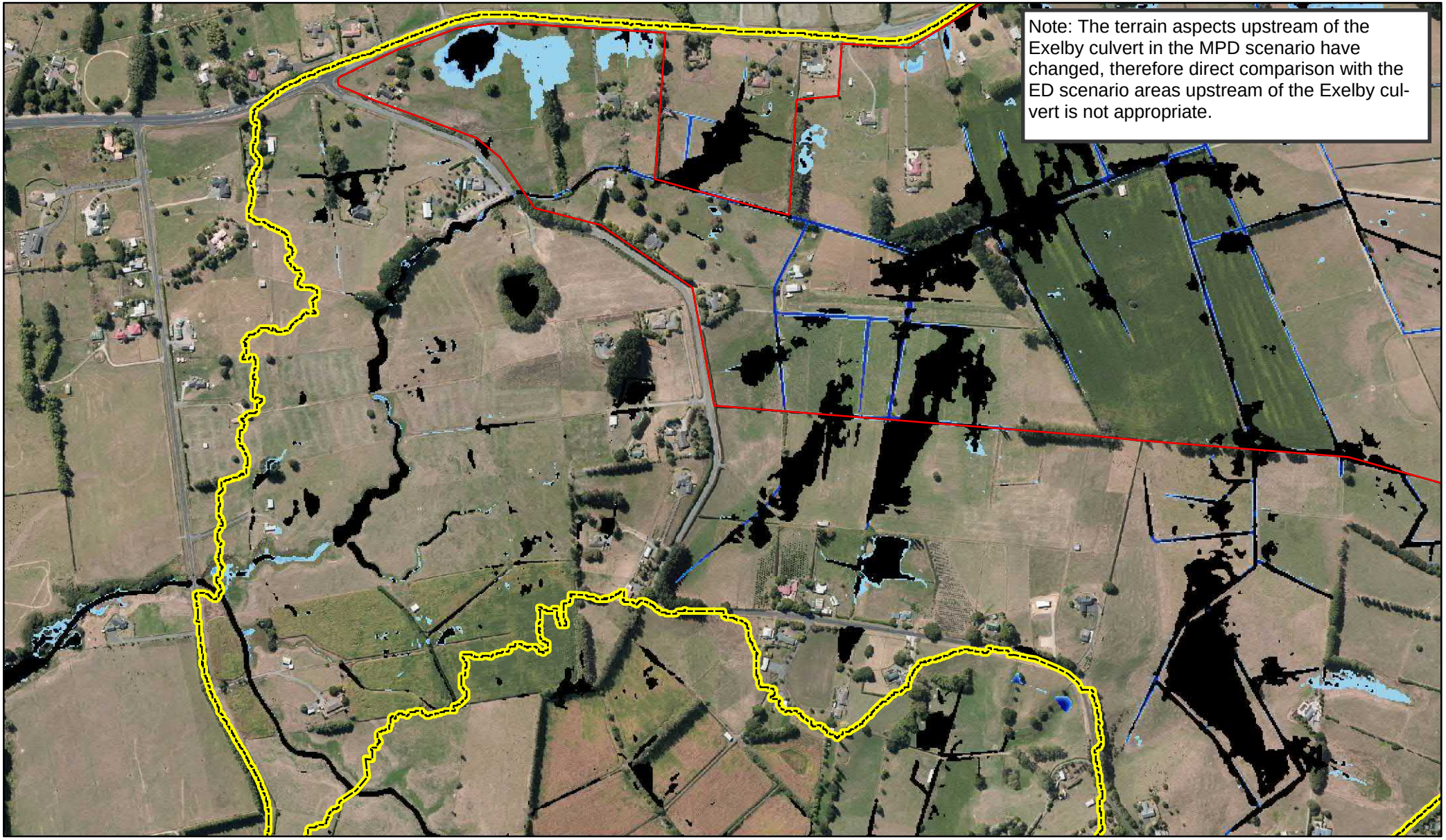

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Printed	4/10/2018 7:06:27 a.m.		
Approved		Date	4/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Flood Extent Comparison

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development (MPD) - 2 year ARI with climate change Flooding Extent Comparison with Existing Development (ED)

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 09

Rev.	By	App.	Description	Date
0	SV	JM	Draft	4/10/2018

MPD Maximum Water Depth above 100mm

- 0.1001 - 0.2000
- 0.2001 - 0.3000
- 0.3001 - 0.5000
- 0.5001 - 0.7500
- 0.7501 - 1.0000
- 1.0001 - 1.2500
- 1.2501 - 1.5000
- 1.5001 - 2.0000
- > 2.0001

- Model Boundary
- Rotokauri North Development Area
- ED Flooding Extent (maximum water depth above 100mm) for 2 year ARI

MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
HCC Supplied GIS Datasets, Network, Aerial Imagery, Topographical.
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Printed	4/10/2018 11:04:42 a.m.		
Approved		Date	4/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Peak Velocity

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 100 year ARI with climate change
Peak Velocity Result

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 10

Rev.	By	App.	Description	Date
0	SV	JM	Draft	4/10/2018

Peak Velocity
- 0.0501 - 0.1000 m/s
- 0.1001 - 0.5000 m/s
- 0.5001 - 1.0000 m/s
- 1.0001 - 3.0000 m/s
- > 3.0001 m/s

Model Boundary

Rotokauri North Development Area

MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
HCC Supplied GIS Datasets, Network, Aerial Imagery, Topographical.
LINZ Topo Data, CRS 2011, ESRI Global Map 2010,
BING Satellite Imagery

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Printed	4/10/2018 10:57:18 a.m.		
Approved		Date	4/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Peak Velocity

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 10 year ARI with climate change
Peak Velocity Result

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 11

Rev.	By	App.	Description	Date
0	SV	JM	Draft	4/10/2018

Peak Velocity
- 0.0501 - 0.1000 m/s
- 0.1001 - 0.5000 m/s
- 0.5001 - 1.0000 m/s
- 1.0001 - 3.0000 m/s
- > 3.0001 m/s

Model Boundary

Rotokauri North Development Area

MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
HCC Supplied GIS Datasets, Network, Aerial Imagery, Topographical.
LINZ Topo Data, CRS 2011, ESRI Global Map 2010,
BING Satellite Imagery

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Approved		Date	4/10/2018
Designed	SV	Drawn	SV
Checked	JM	Checked	JM

Primary Map No. 60582116 - Peak Velocity

Project: **Rotokauri North Catchment Stormwater Modelling**

Title: Maximum Probable Development - 2 year ARI with climate change
Peak Velocity Result

Scale: Scale: 1:8,000 (A4 size) 100 50 0 100 Meters

Status: DRAFT | Rev. 0 | Map No. 60582116 - 12

Rev.	By	App.	Description	Date
0	SV	JM	Draft	4/10/2018

Peak Velocity
- 0.0501 - 0.1000 m/s
- 0.1001 - 0.5000 m/s
- 0.5001 - 1.0000 m/s
- 1.0001 - 3.0000 m/s
- > 3.0001 m/s

Model Boundary

Rotokauri North Development Area

MAP FEATURES: depicted in terms of NZGD2000 - NZTM
MAP GRIDS: NZGD2000 - NZTM2000
DATA SOURCES:
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