From:	Danika Cowie
To:	[Refused]@wmawater.com.au"
Cc:	Garth Nolan
Subject:	Request for a fee proposal - Independant third party review of Flood Impact Assessment
Date:	Wednesday, 7 June 2017 2:35:00 PM

Good afternoon Mark,

Thank you for taking to the time to talk with me today. As I mentioned on the phone, the Department of Infrastructure, Local Government and Planning are currently finalising an assessment of a proposed major amendment to the *Sunshine Coast Planning Scheme 2014*, which related to a development site known as Twin Waters West. In order to complete the final state interest review for this proposed major amendment (now in adoption stage), we are seeking an engineering consultant to conduct an independent third party review of the Flood Impact Assessment (FIA) that has been provided by the Sunshine Coast Regional Council, justifying the proposed development master plan and concluding that there will be no worsening as a result of the site known as Twin Waters West being developed. *Please note that the FIA was prepared by Cardno on behalf of the Twin Waters West site land owner, Stocklands.*

Therefore, we would like to formally request you to provide a fee proposal to carry out the independent third party review. In the fee proposal could you please include the proposed scope of works that will form part of your review and the estimated timeframe to complete the review. Could you also please advise if your consultancy has any actual or perceived conflict of interest relating to this matter.

To assist you with responding to this request, I have provided a link below to the council's website outlining the proposed major amendment and support documentation the council has made publicly available regarding the flooding matters relevant to the scheme amendment.

https://www.sunshinecoast.qld.gov.au/Development/Planning-Documents/Sunshine-Coast-Planning-Scheme-2014/Amendments-to-the-Sunshine-Coast-Planning-Scheme-2014/Proposed-Amendments-Approved-by-Council-for-Adoption

Please feel free to contact me if you have any questions regarding the proposed major amendment and/or this request.

I look forward to hearing from you soon.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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Department of Infrastructure, Local Government and Planning
PO Box 1129
MAROOCHYDORE QLD 4558

EOI/P170609_TwinWatersWest

9 June 2017

Attention: Danika Cowie

Dear Danika,

Re: Independent Third Party Review of Flood Impact Assessment
Twin Waters West
Proposal for Consulting Services

Thank you for your email on the 7th June 2017 requesting this quotation for a review of the flood impact assessment that has been undertaken for the Twin Waters West development. Our proposed scope has been based on the information included with your email and our telephone discussion.

Overview

Sunshine Coast Council seeks to rezone Rural zone land under the Sunshine Coast Planning Scheme 2014 for the Twin Waters West development. The proposed rezoning area is subject to flooding and proposed changes to land form have been assessed as part of a Flood Impact Assessment. The Flood Impact Assessment assessed the viability of a flood solution concept for offsetting flood impacts. There were a number of submissions during the public consultation period with specific concerns related to worsening flood impacts as a result of the development.

WMAwater will review the work undertaken in the Flood Impact Assessment to ensure that best practice approaches have been used and the appropriateness of the proposed flood solution concept. WMAwater's work will give the Department of Infrastructure, Local Government and Planning the opportunity to critically examine work to date and to further understand this key site constraint.

WMAwater Pty Ltd

DIRECTORS
M K Babister, RPEQ
R W Dewar
E J Askew
F L N Ling, RPEQ

SENIOR ASSOCIATES
R Hardwick Jones
M E Retallick

ABN 14 600 315 053

Level 2, 160 Clarence St, SYDNEY NSW 2000
Phone: 02 9299 2855 Fax: 02 9262 6208
Email: enquiry@wmawater.com.au
Website: wmawater.com.au

Previous Experience and Staff

WMAwater are a consultancy specialising in flooding, with offices in Brisbane, Sydney and Hobart. WMAwater carry out a variety of flood related work including data collection and review, flood studies, hydrologic and hydraulic modelling and model review assessments. A key part of WMAwater's experience is in carrying out review work for government departments and local government.

The work would be undertaken by Mark Babister and Erin Askew. Mark is WMAwater's Managing Director and a national leader in floodplain management and analysis. Mark has held key roles in the development of a number of national best practice documents including Australian Rainfall and Runoff, ensuring these principles are applied to the review. Erin is a Director at WMAwater and has 15 years' experience in the fields of hydrologic and hydraulic modelling and floodplain management. Erin has carried out numerous flood and floodplain risk management studies and has experience in the review of work undertaken by other consultants.

Proposed Methodology

1. **Review of Available Information**

The aim of this phase will be to collate and review the available models and underlying data that informs the models. The reports, models (hydrologic and hydraulic) and input survey data associated with the assessment will form the main basis of review material. The project personnel will draw on their prior experience and knowledge to provide insight to the review.

2. **Review of Hydrological and Hydraulic model**

Our initial approach would be to review the overall modelling in terms of assumptions and results. The hydraulic model review will be undertaken considering the model setup in terms of general structure and model run parameters. The assumptions and parameters adopted in the hydrological model will be reviewed to determine suitability of the model. Further, review of the results of the modelling will be undertaken to determine suitability for use.

The approach to carry out the calibration and validation stages of the work will be reviewed to determine whether the model emulates catchment behaviour during flood events.

Key parameters to be include:

- Model boundary conditions;
- Bed roughness values;
- Schematisation of significant hydraulic features; and
- Results and design flood levels.

The associated documentation of the modelling methodology would also be reviewed for consistency with best practice and suitability of the modelling for the assessment of flood impacts and solution concepts at the site.

3. **Review of Flood Solution Concept**

This stage will include a review of the proposed flood solution concept in terms of its practicality and appropriateness for minimising flood impacts. In addition modelling of the concept would be reviewed. Comment will also be provided on limits of acceptable flood impacts.

Timetable

The review can be completed up to draft within 15 business days of this proposal being accepted and provision of all associated report and modelling files. Immediately on receipt of the modelling files we would undertake a review for completeness. Experience has shown that there can sometimes be some back and forth to obtain the correct files.

Budget

Costs are provided in the table below.

Rate (ex GST)	$ Refused unde	$ Refused unde	$ Refused under	
	MB	EA	Engineer	
Review of Available Information	Refused under section 47(3)(b) of the RTI Act. Disclosure w			$ Refused under sectio
Review Hydrologic and Hydraulic Model				$
Review Flood Solution Concept				$
Document Findings				$
Liaison				$
SUBTOTAL				$
GST				$
TOTAL (incl GST)				$ 17,248.00

Our budget has allowed for a desktop review and as such we have not allowed for any site inspections or meetings on site. Should attendance at any meetings be required these can be carried out on a time and expense basis. Charge out rates for staff are provided in the table above.

Potential Conflict of Interest

WMAwater has not undertaken any previous work associated with the Twin Waters West development or for Sunshine Coast Council. WMAwater are currently listed as a pre qualified supplier on Council's Regional Planning Services Arrangement No. R151. Category F - Hydrology / Hydraulic Services. We do not see this as a conflict of interest relating to this matter.

If you have any queries please do not hesitate to contact the undersigned on 9299 2855.

Yours Sincerely,

WMAwater

Refused under section 47(3)(b) of the

Mark Babister

Director

Queensland Government

Department of Infrastructure, Local Government and Planning

Our Ref: DILGP-0289-17 - File F17/6486

28 June 2017

WMAwater
Mark Babister
Level 2, 160 Clarence St
SYDNEY NSW 2000

Dear Mark,

Letter of Acceptance - DILGP-0289-17 Twin Waters West Flood Assessment Review

Your offer dated 09 June 2017 in response to the above mentioned procurement process has been formally accepted by the Department of Infrastructure, Local Government and Planning.

The following documents will constitute the entire Contract between the Customer and the Supplier, and in the event of any conflict between these documents the order of precedence to resolve conflict will be the order set out below:

a) the Order (this acceptance letter and/or any purchase order provided);

b) the Basic Purchasing Conditions of Contract;

c) the Supplier's offer (to the extent accepted under the Order); and

d) any other document, in whole or part, forming part of the Contract, as agreed in writing between the Customer and Supplier.

Term of Contract

The contract services will commence on the date of this letter and continue until 20 July 2017, unless otherwise advised in writing by the Customer.

Price

The price for the provision of goods and/or services under this contract is not to exceed $17,248.00, GST inclusive.

The Customer's nominated representative is:

Garth Nolan,
Planning Manager, SEQ North
Department of Infrastructure, Local Government and Planning
Email: garth.nolan@dilgp.qld.gov.au
Phone: (07) 5352 9710

The Department of Infrastructure, Local Government and Planning would like to thank you for the time and effort put into your offer response and look forward to developing a good working relationship with your organisation.

Please confirm your acceptance of this contract via return email to the Customer's nominated representative. If not already supplied, please provide a copy of your certificates of currency for required insurance.

Should you have any queries regarding this matter please contact us via email at the above address.

Yours sincerely

Garth Nolan
Planning Manager, SEQ North
Planning and Development Services
Planning Group

Chereena Morcan

From: Danika Cowie
Sent: Thursday, 7 December 2017 11:18 AM
To: DILGP Procurement
Subject: Twin Waters West RTI

Hi Chereena,

As discussed, the engagement of WMA Water did not warrant the need for a formal terms of reference given that the review required was very straight forward. The email seeking a fee proposal from WMA Water from myself is all that was provided to them to outline the fee proposal and associated scope of works to conduct the third party review of the flood impact assessment and modelling provided by council.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

Mary Bauer

From: Danika Cowie
Sent: Monday, 12 June 2017 10:11 AM
To: Amelia Radford
Subject: HPE CM: Request for a fee proposal - Independant third party review of Flood Impact Assessment
Attachments: P170609_TwinWatersWest.pdf

Hi Amelia,

Please find attached a new fee proposal from WMA Water to conduct the third party review of the Twin Waters West Flood Impact Assessment. Unfortunately, we had to cease using BMT WBM due to a perceived conflict of interest.

Can you please advise what needs to be completed to progress this fee proposal through procurement process?

Please feel free to contact me to discuss this further, if you have any questions.

Kind regards,
Danika

From: Erin Askew [mailto[Refused u]@wmawater.com.au]
Sent: Friday, 9 June 2017 5:00 PM
To: Danika Cowie
Cc: Mark Babister
Subject: RE: Request for a fee proposal - Independant third party review of Flood Impact Assessment

Hi Danika,
Please find attached our proposal for the independent third party review of the flood impact assessment for the Twin Waters West development.
Kind Regards,

Erin Askew
Director

E: Refused @wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Wednesday, 7 June 2017 2:36 PM
To: Refused under @wmawater.com.au
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Request for a fee proposal - Independant third party review of Flood Impact Assessment

Good afternoon Mark,

Thank you for taking to the time to talk with me today. As I mentioned on the phone, the Department of Infrastructure, Local Government and Planning are currently finalising an assessment of a proposed major amendment to the *Sunshine Coast Planning Scheme 2014*, which related to a development site known as Twin Waters West. In order to complete the final state interest review for this proposed major amendment (now in adoption stage), we are seeking an engineering consultant to conduct an independent third party review of the Flood Impact Assessment (FIA) that has been provided by the Sunshine Coast Regional Council, justifying the proposed development master plan and concluding that there will be no worsening as a result of the site known as Twin Waters West being developed. *Please note that the FIA was prepared by Cardno on behalf of the Twin Waters West site land owner, Stocklands.*

Therefore, we would like to formally request you to provide a fee proposal to carry out the independent third party review. In the fee proposal could you please include the proposed scope of works that will form part of your review and the estimated timeframe to complete the review. Could you also please advise if your consultancy has any actual or perceived conflict of interest relating to this matter.

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Please feel free to contact me if you have any questions regarding the proposed major amendment and/or this request.

I look forward to hearing from you soon.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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Department of Infrastructure, Local Government and Planning
PO Box 1129
MAROOCHYDORE QLD 4558

EOI/P170609_TwinWatersWest

9 June 2017

Attention: Danika Cowie

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Re: Independent Third Party Review of Flood Impact Assessment
Twin Waters West
Proposal for Consulting Services

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WMAwater Pty Ltd
DIRECTORS
M K Babister, RPEQ
R W Dewar
E J Askew
F L N Ling, RPEQ
SENIOR ASSOCIATES
R Hardwick Jones
M E Retallick
ABN 14 600 315 053
Level 2, 160 Clarence St, SYDNEY NSW 2000
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Proposed Methodology

1. **Review of Available Information**

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Budget

Costs are provided in the table below.

Rate (ex GST)	$	Refused und	$	Refused under	$	Refused under	
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Document Findings						$	
Liaison						$	
SUBTOTAL						**$**	
GST						$	
TOTAL (incl GST)						**$**	**17,248.00**

Our budget has allowed for a desktop review and as such we have not allowed for any site inspections or meetings on site. Should attendance at any meetings be required these can be carried out on a time and expense basis. Charge out rates for staff are provided in the table above.

Potential Conflict of Interest

WMAwater has not undertaken any previous work associated with the Twin Waters West development or for Sunshine Coast Council. WMAwater are currently listed as a pre qualified supplier on Council's Regional Planning Services Arrangement No. R151. Category F - Hydrology / Hydraulic Services. We do not see this as a conflict of interest relating to this matter.

If you have any queries please do not hesitate to contact the undersigned on 9299 2855.

Yours Sincerely,

WMAwater

Refused under section 47(3)(b) of the RTI Ac

Mark Babister

Director

Mary Bauer

From: DILGP Procurement
Sent: Thursday, 29 June 2017 12:38 PM
To: enquiry@wmawater.com.au
Subject: DILGP-0289-17 Twin Waters West Flood Assessment Review_Letter of Acceptance

Hi Mark,

Your offer for the above mentioned procurement process has been formally accepted by the Department of Infrastructure, Local Government and Planning.

The Basic Purchasing Conditions of Contract apply. Please refer to the attached letter for further information

Please confirm your acceptance of this contract via return email along with a copy of your certificates of currency for required insurance.

DILGP-0289-17
Signed Letter of...

Thank you,

Alisha Martin
Senior Procurement Officer
Procurement Services
Department of Infrastructure, Local Government and Planning
Level 13, 1 William St Brisbane QLD 4000
p. 07 345 27981 | **e.** DILGPProcurement@dilgp.qld.gov.au

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Queensland Government

Department of Infrastructure, Local Government and Planning

Our Ref: DILGP-0289-17 - File F17/6486

28 June 2017

WMAwater
Mark Babister
Level 2, 160 Clarence St
SYDNEY NSW 2000

Dear Mark,

Letter of Acceptance - DILGP-0289-17 Twin Waters West Flood Assessment Review

Your offer dated 09 June 2017 in response to the above mentioned procurement process has been formally accepted by the Department of Infrastructure, Local Government and Planning.

The following documents will constitute the entire Contract between the Customer and the Supplier, and in the event of any conflict between these documents the order of precedence to resolve conflict will be the order set out below:

a) the Order (this acceptance letter and/or any purchase order provided);

b) the Basic Purchasing Conditions of Contract;

c) the Supplier's offer (to the extent accepted under the Order); and

d) any other document, in whole or part, forming part of the Contract, as agreed in writing between the Customer and Supplier.

Term of Contract

The contract services will commence on the date of this letter and continue until 20 July 2017, unless otherwise advised in writing by the Customer.

Price

The price for the provision of goods and/or services under this contract is not to exceed $17,248.00, GST inclusive.

The Customer's nominated representative is:

Garth Nolan,
Planning Manager, SEQ North
Department of Infrastructure, Local Government and Planning
Email: garth.nolan@dilgp.qld.gov.au
Phone: (07) 5352 9710

The Department of Infrastructure, Local Government and Planning would like to thank you for the time and effort put into your offer response and look forward to developing a good working relationship with your organisation.

Please confirm your acceptance of this contract via return email to the Customer's nominated representative. If not already supplied, please provide a copy of your certificates of currency for required insurance.

Should you have any queries regarding this matter please contact us via email at the above address.

Yours sincerely

Garth Nolan
Planning Manager, SEQ North
Planning and Development Services
Planning Group

Basic Purchasing Conditions

1. The Contract

A Contract will be formed between the Customer and Supplier on the terms of these Basic Purchasing Conditions when the Supplier accepts a Basic Order, or provides the Goods or Services set out in a Basic Order. The Contract continues until the Goods are delivered or the Services are performed, or the expiry date specified in the Basic Order (if applicable) unless terminated earlier in accordance with this Contract.

2. Interpretation

The definitions and rules of interpretation apply to this Contract and are available under terms and conditions on www.hpw.qld.gov.au/Procurement

3. Supplier to provide Goods and/or Services

The Customer appoints the Supplier to supply the Goods and/or Services. The Supplier accepts the appointment. The Supplier must provide the Goods and/or Services in accordance with this Contract and the Customer's delivery instructions including within the timeframes specified in the Basic Order or as otherwise agreed.

The Supplier will promptly notify the Customer if it believes it will not be able to meet any delivery date or other timeframes specified in the Basic Order. If the Supplier cannot meet the timeframes specified in the Basic Order, then the Customer may terminate the Contract at no cost to the Customer.

4. Right to cancel Basic Order before delivery for convenience

The Customer has the right to cancel the Basic Order and terminate this Contract at any time prior to delivery of the Goods or completion of the Services, by written notice to the Supplier. The Supplier will promptly notify the Customer if it will incur expenses as a consequence of the cancellation, including the estimated amount. If the Customer proceeds to cancel the Basic Order, the Customer will reimburse the Supplier for its reasonable out of pocket expenses reasonably incurred as a direct consequence of the cancellation. The Supplier must take all reasonable steps to minimise the expenses associated with cancellation.

5. Requirements

(a) The Supplier must ensure that the Goods satisfy the description in the Contract or the Basic Order, are of a high quality, and fit for their usual purpose and any other purpose disclosed by the Customer before the Contract is formed.

(b) The Supplier must ensure the highest quality of work, and provide the Services in a proper, timely and efficient manner using the standard of care, skill, diligence, prudence and foresight that would reasonably be expected from a prudent, expert and experienced provider of services that are similar to the Services;

(c) If the Supplier enters the Site to deliver the Goods or provide the Services, the Supplier must comply with Customer policies, codes of conduct, rules, standards and procedures, and workplace health and safety policies, relevant to the Site. The Customer will make copies available on request.

(d) The Supplier must comply with all reasonable directions of the Customer in relation to the Supplier's performance of the Contract.

(e) The Supplier must comply with all Laws necessary for the Supplier to perform the Contract (and provide evidence of compliance if the Customer asks), and ensure that use of the Goods by the Customer as contemplated in the Contract will comply with all Laws.

(f) If the Supplier enters the Site to deliver the Goods or provide the Services, the Supplier must maintain public liability and products insurance for a minimum amount of $1 million per claim and workers' compensation insurance (if required by law), and any other insurance specified in writing by the Customer.

(g) The Supplier must not use or disclose or otherwise make available any Confidential Information to any person except to its Personnel on a need to know basis to perform the Contract.

(h) If the Supplier collects or has access to any Personal Information in order to perform the Contract, the Supplier must, when performing this Contract:

  (i) if the Customer is an 'agency' for the *Information Privacy Act*, other than for Chapter 3 of the *Information Privacy Act* – comply with those parts of Chapter 2 of the *Information Privacy Act* which are applicable to the Customer, as if the Supplier were the Customer; or

  (ii) otherwise – comply with the Australian Privacy Principles in the *Privacy Act.*

(i) The Supplier is fully responsible for its Personnel, including for ensuring Personnel comply with the

Requirements. The Supplier is not, and Supplier Personnel are not, employees of the Customer.

6. Conflict of Interest and criminal organisations

6.1. Conflict of Interest

The Supplier warrants that it and its Personnel do not hold any office or possess any property, are not engaged in any business or activity and do not have any obligations where a Conflict of Interest is created, or might appear to be created, in conflict with its obligations under this Contract, except as disclosed in writing to the Customer.

6.2. Criminal organisation

The Supplier warrants that neither it nor its Personnel:

(a) have been convicted of an offence under the Criminal Code where one of the elements of the offence is that the person is a participant in a criminal organisation within the meaning of section 60A(3) of the Criminal Code; or

(b) are subject to an order under, or have been convicted of an offence under the Criminal Organisation Act 2009 (Qld).

6.3. Warranties are ongoing

The warranties in this clause are provided as at the date of the Contract and on an ongoing basis. The Supplier warrants that it will immediately notify the Customer if it becomes aware that any warranty made in this clause was inaccurate, incomplete, out-of-date or misleading in any way when made, or becomes inaccurate, incomplete, out-of-date or misleading in any way.

In addition to any other remedies available to it under Law or contract, the Customer may, in its absolute discretion, immediately terminate the Contract if it believes the Supplier has breached any warranties in this clause.

7. Invoicing, Price and payment

(a) The Supplier may invoice the Customer after delivery of Goods or Services that comply with the Requirements.

(b) The Supplier must include adequate information for the Customer to verify that the invoice is accurate, and will provide supporting documentation reasonably requested by the Customer. The Customer is not required to pay any invoice that does not comply with this clause.

(c) The Customer will pay each correctly rendered tax invoice within 30 days of receipt.

(d) The Customer may withhold payment of any amount which it disputes in good faith, until the dispute is resolved and it is determined that the amount is payable.

(e) The Price is inclusive of all charges, expenses and overheads, and all taxes and duties, except for GST.

8. GST

(a) Unless expressly stated otherwise, all amounts payable under this Contract are GST exclusive.

(b) Where GST is imposed on a supply under the Contract, the recipient of the supply shall pay to the supplier an amount equal to the GST (if any) payable on the taxable supply, at the same time that it is required to make the payment for the taxable supply, provided that it receives a valid tax invoice at or before the time of payment. Terms in this clause have the same meanings as in the GST Law.

9. Liability

The maximum liability of a party to the other, whether in contract, tort (including negligence) or otherwise in connection with the Contract, is an amount equal to the total of all Prices (including additional expenses and charges) payable under the Contract, multiplied by 1.5. The cap on liability does not apply to liability in relation to:

(a) personal injury, including sickness, injury or death; or

(b) loss of, or damage to, tangible property; or

(c) Wilful Default, Wilful Misconduct, unlawful act or omission of, or failure to comply with applicable Law by the Supplier or its Personnel; or

(d) any Claim by a third party relating to this Contract, including breach of a third party's Intellectual Property Rights.

10. Intellectual Property Rights

The Supplier grants (and must procure that relevant third parties grant) the Customer an irrevocable, unconditional, perpetual, free of additional charge, non-exclusive, worldwide and transferable (including sub-licensable) licence to exercise all Intellectual Property Rights in the Goods and Services, for any purpose of the Customer, the State of Queensland or other Queensland Government Body. The Supplier warrants that it is authorised to grant the rights in this clause.

11. Customer Data

The ownership of Customer Data, including any Intellectual Property Rights in Customer Data, shall vest in the Customer on creation. The Supplier has no right, title or interest in Customer Data except as specified in this clause. The Supplier must not use, access, modify or disclose Customer Data to any person except to its Personnel on a need to know

basis to perform the Contract. The Supplier must comply with clause 5(h) and all applicable Laws in relation to Customer Data which is Personal Information, and must provide reasonable assistance to the Customer on request to enable the Customer to comply with Laws, policies and standards applicable to the Customer in relation to Customer Data including (without limitation) identifying, labelling, searching, reporting, copying, retrieving and modifying Customer Data in relation to Personal Information, public records, right to information and information standards.

12. Where Requirements not met

If any Requirements for the Goods and/or Services are not met, at the request of the Customer the Supplier will promptly:

(a) resupply the relevant Goods;

(b) re-perform the relevant Services; or

(c) refund the Customer any monies paid,

and the Customer may exercise any other right or remedy that it has under this Contract or otherwise.

If the Supplier fails to comply with its obligations under this clause, the Customer may have the Goods and/or Services re-supplied or re-performed by others, and the Supplier shall pay to the Customer on demand any costs incurred by the Customer in doing so.

Acceptance of the Goods and/or Services by the Customer does not relieve the Supplier of any of its obligations under the Contract.

13. General

The parties agree that:

(a) (**communication**) they will direct all enquiries relating to the Contract to the other party's nominated contact person, or to another person if the other party directs;

(b) (**variation**) the Contract may only be varied by written agreement of authorised representatives of the parties;

(c) (**entire agreement**) this Contract sets out all the parties' rights and obligations relating to the subject matter of the Contract, and it replaces all earlier representations, statements, agreements and understandings except as stated otherwise in this Contract. No other terms apply;

(d) (**relationship**) their relationship is of principal and contractor. This Contract does not create any partnership, joint venture or employment relationship. The Supplier must not represent itself or allow anyone else to represent that the Supplier is a partner, joint venturer, officer or employee of the Customer;

(e) (**manufacturer warranties**) the Supplier assigns any manufacturer's warranty to the Customer, where possible to do so, and must inform the Customer where it is not possible to do so;

(f) (**delivery**) the Supplier must deliver the Goods or other relevant Deliverables to the Site in accordance with the Customer's instructions. If the Supplier asks, the Customer will confirm in writing that the Deliverables have been received;

(g) (**packaging**) the Supplier must adequately pack and protect Goods to withstand transit and storage, and provide a packing note with the Goods;

(h) (**rejected Goods**) if the Customer rejects Goods, and the Supplier does not repossess the rejected Goods within 30 days of notice of rejection, the Customer may sell or dispose of the Goods, at the Customer's cost;

(i) (**risk**) risk will transfer to the Customer when the Goods are delivered to the delivery address specified in writing by the Customer, in accordance with the delivery instructions.

(j) (**title**) title in the Goods and Deliverables will transfer on the earlier of the delivery or payment of the applicable Price;

(k) (**no encumbrance**) the Supplier warrants that the Goods are not (and when title passes, will not be) subject to any encumbrance or interest, except for an encumbrance or interest which arises by operation of a Law that cannot be excluded by contract; and

(l) (**right to publish**) the Customer may publish information about the Contract on the Government's contract directory, where required or recommended by Government procurement policy, or as required under the Right to Information Act.

14. If Contract under SOA

(a) If this Contract is entered pursuant to a SOA the Customer may terminate the Contract for cause immediately on written notice to the Supplier if the Principal is entitled to terminate the SOA or if any customer (including the Customer) is entitled to terminate for cause any other contract entered under the SOA.

(b) Unless otherwise specified in the Basic Order, all the terms and conditions of this Contract (including this clause) will survive termination or expiry of the SOA, for any reason.

Garth Nolan

From: Erin Askew [Refused und] wmawater.com.au>
Sent: Friday, 11 August 2017 10:22 AM
To: Danika Cowie
Subject: FW: Correspondence from the Office of the Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning - Our Ref : MC17/1856

FYI

From: Mark Babister [mailto:[Refused under] wmawater.com.au]
Sent: Thursday, August 10, 2017 9:38 PM
To: Erin Askew [Refused und] wmawater.com.au>
Subject: Fwd: Correspondence from the Office of the Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning - Our Ref : MC17/1856

Mark Babister
--
DIRECTOR
WMA Water
ABN 14 600 315 053
Water & Environmental Engineers
Level 2, 160 Clarence Street, Sydney 2000
Phone: +61 2 9299 2855 Fax: +61 2 9262 6208
http://www.wmawater.com.au

Begin forwarded message:

> **From:** [Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to th]
> **Date:** 10 August 2017 at 17:21:22 GMT+8
> **To:** President <president@developmentwatch.org.au>
> **Cc:** [Refused under]@wmawater.com.au
> **Subject: Re: FW: Correspondence from the Office of the Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning - Our Ref : MC17/1856**
>
> Hi Lyn,
>
> The independent engineer is a company called WMA. They have offices in Brisbane and Sydney. I understand that the Sydney office is undertaking the review. The Managing Director for WMA is Mark Bapister, tel no 02 9299 2855.
>
> Trust this is useful to you.
>
> Kind regards,
>
> [Refused under section 47(3)(b) of]

On Thu, Aug 10, 2017 at 12:06 PM, President <president@developmentwatch.org.au> wrote:

I would like to know who the independent consulting engineer is (just so that we can ensure he is independent and doesn't have any connections and/or conflicts).

Lyn

On 9/8/17 3:33 pm, Narelle McCarthy wrote:

> Hi All
>
> Please find attached corro FYI's and any comment. It is concerning that the boxes are appearing to be ticked….
>
> I would ask that this letter not be published or reproduced (eg Facebook, websites, media) or circulated further please
>
> Many thanks
>
> Narelle
>
> Narelle McCarthy
>
> Liaison & Advocacy
>
> O: 07 5441 5747
>
> M: Refused under section 47(
>
> E: liaison@scec.org.au
>
> W: www.scec.org.au

SUNSHINE COAST Environment Council

The Sunshine Coast Environment Council (SCEC) is the peak regional environmental advocacy group on the Sunshine Coast, Queensland. Established in 1980, it currently represents 50 community groups working on conservation, natural resource management and sustainability with a combined membership of over 15,000 individuals.

From: Executive Correspondence DILGP [mailto:executivecorrespondence@dilgp.qld.gov.au]
Sent: Wednesday, 9 August 2017 3:12 PM
To: Narelle McCarthy
Subject: Correspondence from the Office of the Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning - Our Ref : MC17/1856

Please find attached correspondence from the Office of the Deputy Premier, Minister for Transport and Minister for Infrastructure and Planning.

Please do not reply to this email. All future communications should be addressed to the contact details shown below.

Office of the Hon. Jackie Trad MP

Deputy Premier, Minister for Transport and
Minister for Infrastructure and Planning

P 07 3719 7100 **E** deputy.premier@ministerial.qld.gov.au

1 William Street Brisbane Qld 4000

PO Box 15009 City East Qld 4002

Garth Nolan

From: Mark Babister [Refused under] wmawater.com.au>
Sent: Friday, 1 September 2017 9:18 AM
To: Danika Cowie
Subject: RE: Alternative date and time for Twin Waters West meeting

Danika,

Let me know as soon as possible whether you want me to book flights and claim at cost or Queensland government travel will arrange flights

Mark

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Thursday, 31 August 2017 12:13 PM
To: Mark Babister [Refused under] wmawater.com.au>
Subject: RE: Alternative date and time for Twin Waters West meeting

Hi Mark,

Thank you for that info. I will confirm with Nathan Rule my Director about having it in Brisbane at 1pm and ensure you can get out by no later than 3:30pm to catch your flight. I will be in touch very soon.

Once again sorry for the changes.

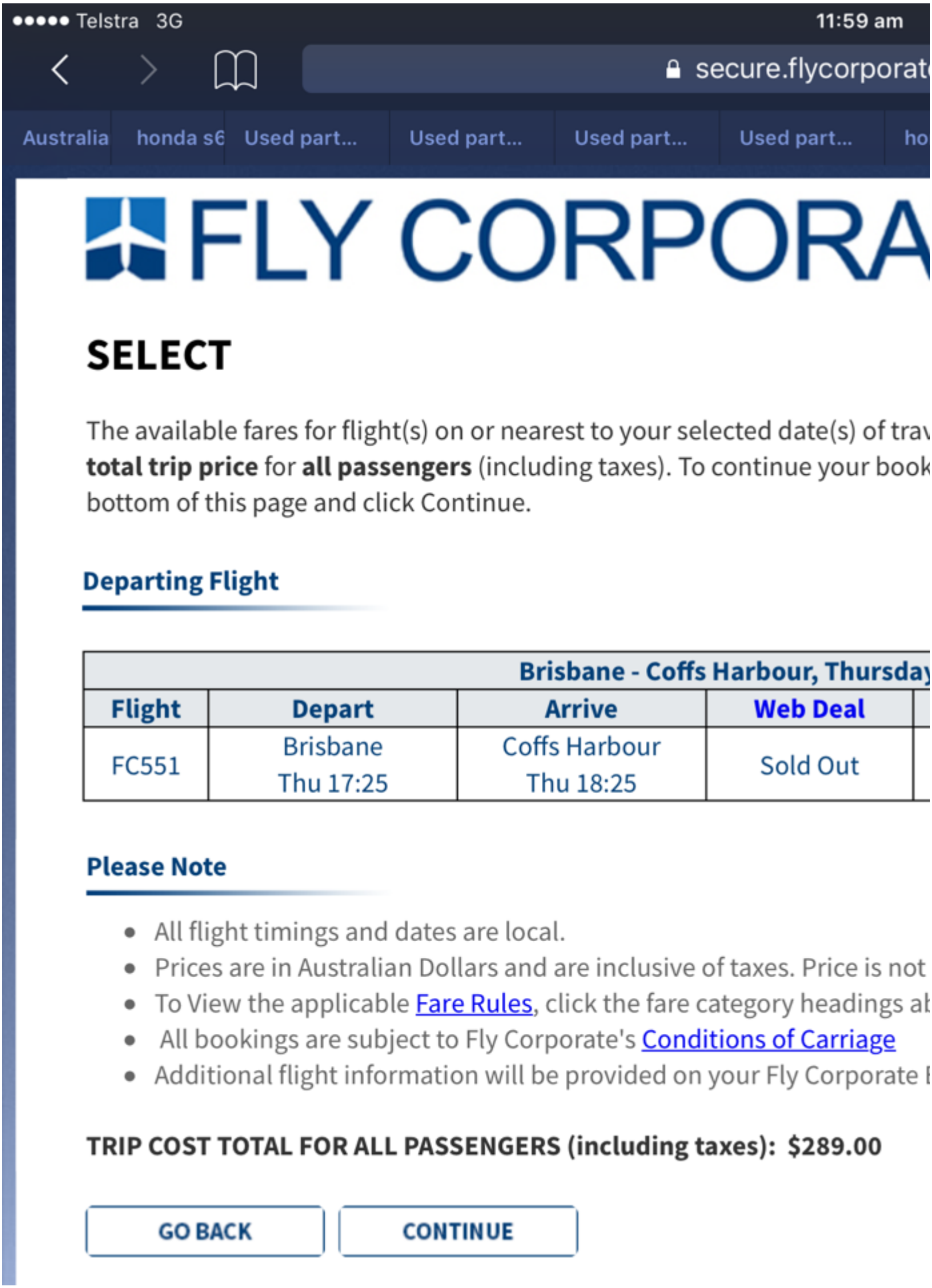
Kind regards,
Danika Cowie

From: Mark Babister [mailto[Refused under]@wmawater.com.au]
Sent: Thursday, 31 August 2017 12:05 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: Re: Alternative date and time for Twin Waters West meeting

Danika,

I need to catch a 17.25 flight from Brisbane airport on Thursday evening. So a meeting at 1pm in brisbane is workable. As long as I leave by 15.30 it will be Ok. Also fly corporate is just a regional airline, the Queensland government travel service thought it was a Charter flight the first time I used it.

Mark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FLY CORPORA
SELECT
The available fares for flight(s) on or nearest to your selected date(s) of trav
total trip price for all passengers (including taxes). To continue your book
bottom of this page and click Continue.
Departing Flight
Brisbane - Coffs Harbour, Thursday
Flight
Depart
Arrive
Web Deal
FC551
Brisbane
Thu 17:25
Coffs Harbour
Thu 18:25
Sold Out
Please Note
All flight timings and dates are local.
Prices are in Australian Dollars and are inclusive of taxes. Price is not
To View the applicable Fare Rules, click the fare category headings ab
All bookings are subject to Fly Corporate's Conditions of Carriage
Additional flight information will be provided on your Fly Corporate
TRIP COST TOTAL FOR ALL PASSENGERS (including taxes): $289.00
GO BACK
CONTINUE

On 31 Aug 2017, at 11:54 am, Danika Cowie <Danika.Cowie@dilgp.qld.gov.au> wrote:

Hi Mark,

How late are you able to attend the meeting on the Thursday? Would it be easier if it was held in Brisbane? Cardno has asked if 1pm is possible?

Let me know if you can do it at 1pm?

Sorry again.

Kind regards,
Danika

From: Mark Babister [mailto:Refused under wmawater.com.au]
Sent: Thursday, 31 August 2017 11:33 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: Re: Alternative date and time for Twin Waters West meeting

Danika,

On Tuesday I have to go to a NSW government flood portal launch in case there are hard questions

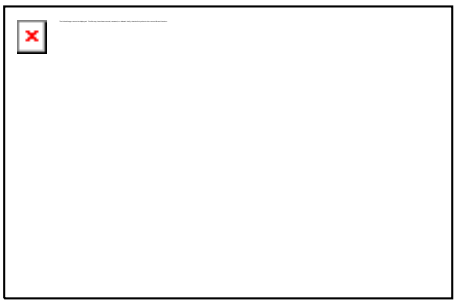
Mark

--

Mark Babister
Director

WMAwater
Level 2, 160 Clarence St
Sydney, NSW, 2000

p: (02) 9299 2855
f: (02) 9262 6208
e: Refused und ***wmawater.com.au***



On 31 Aug 2017, at 11:29 am, Danika Cowie <Danika.Cowie@dilgp.qld.gov.au> wrote:

Hi Mark,

Would you be available on the 5th (next Tuesday) by chance?

Cheers,
Danika

From: Mark Babister [mailto:Refused under wmawater.com.au]
Sent: Thursday, 31 August 2017 11:28 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: Re: Alternative date and time for Twin Waters West meeting

Danika,

I have not booked flights and most of the following week after is open other than Monday 11th

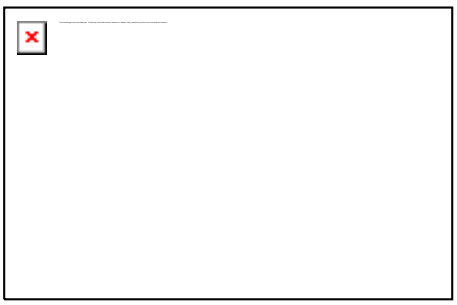
Mark

--

Mark Babister
Director

WMAwater
Level 2, 160 Clarence St
Sydney, NSW, 2000

p: (02) 9299 2855
f: (02) 9262 6208
e: Refused under ***@wmawater.com.au***



On 31 Aug 2017, at 11:14 am, Danika Cowie <Danika.Cowie@dilgp.qld.gov.au> wrote:

Hi Mark,

The flooding engineer from Cardno is unable to attend the meeting next Thursday, can you please advise whether you have booked a flight for that meeting and if not could you please advise what your availability is like for the following week to attend a meeting here at Maroochydore?

Sorry for the inconvenience.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

<image001.jpg>

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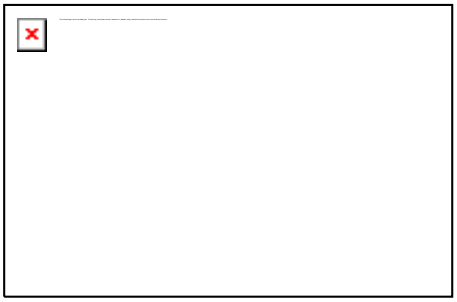
--

Mark Babister
Director

WMAwater
Level 2, 160 Clarence St
Sydney, NSW, 2000

p: (02) 9299 2855
f: (02) 9262 6208
e: Refused un***@wmawater.com.au***



Garth Nolan

From: Mark Babister [Refused under s] wmawater.com.au>
Sent: Friday, 1 September 2017 9:16 AM
To: Nathan Rule
Cc: Danika Cowie; Amelia Radford; Garth Nolan
Subject: RE: Extension of Contract

Nathan,

Thank you for that

mark

From: Nathan Rule [mailto:Nathan.Rule@dilgp.qld.gov.au]
Sent: Thursday, 31 August 2017 9:30 PM
To: [Refused under]@wmawater.com.au
Cc: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>; Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>; Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Extension of Contract

Hi Mark

I'd like to confirm that we will be extending our contract with WMA Water (contract number DILGP-0289-17) in relation to the Flood Assessment Review for Twin Waters.

We will provide a formal letter stating the new terms of the contract (extended timeframe, scope and cost, including reimbursing travel expenses) once we have held the client meeting with Council, so we can confirm the new details.

In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m.** [Refused under sectio] | **e.** nathan.rule@dilgp.qld.gov.au

Garth Nolan

From: Erin Askew [Refused ur]@wmawater.com.au>
Sent: Tuesday, 15 August 2017 4:38 PM
To: Danika Cowie
Subject: RE: Findings report

Hi Danika,
That sounds reasonable.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Tuesday, August 15, 2017 4:31 PM
To: Erin Askew [Refused und]@wmawater.com.au>
Subject: Findings report

Hi Erin,

We have just spoken with our Executive Director regarding our earlier discussion with you. He has asked if the findings report you issue tomorrow be in a draft form as the plan is to come back to WMA Water for a further independent review if council agrees to provide a revised flood model addressing the issues identified in your draft report.

Please let me know if you have any issues with this approach.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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Garth Nolan

From: Erin Askew [Refused under]@wmawater.com.au>
Sent: Friday, 9 June 2017 5:00 PM
To: Danika Cowie
Cc: Mark Babister
Subject: RE: Request for a fee proposal - Independant third party review of Flood Impact Assessment
Attachments: P170609_TwinWatersWest.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Danika,
Please find attached our proposal for the independent third party review of the flood impact assessment for the Twin Waters West development.
Kind Regards,

Erin Askew
Director

E: [Refused under]wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Wednesday, 7 June 2017 2:36 PM
To: [Refused under] wmawater.com.au
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Request for a fee proposal - Independant third party review of Flood Impact Assessment

Good afternoon Mark,

Thank you for taking to the time to talk with me today. As I mentioned on the phone, the Department of Infrastructure, Local Government and Planning are currently finalising an assessment of a proposed major amendment to the *Sunshine Coast Planning Scheme 2014*, which related to a development site known as Twin Waters West. In order to complete the final state interest review for this proposed major amendment (now in adoption stage), we are seeking an engineering consultant to conduct an independent third party review of the Flood Impact Assessment (FIA) that has been provided by the Sunshine Coast Regional Council, justifying the proposed development master plan and concluding that there will be no worsening as a result of the site known as Twin Waters West being developed. *Please note that the FIA was prepared by Cardno on behalf of the Twin Waters West site land owner, Stocklands.*

Therefore, we would like to formally request you to provide a fee proposal to carry out the independent third party review. In the fee proposal could you please include the proposed scope of works that will form part of your review and the estimated timeframe to complete the review. Could you also please advise if your consultancy has any actual or perceived conflict of interest relating to this matter.

To assist you with responding to this request, I have provided a link below to the council's website outlining the proposed major amendment and support documentation the council has made publicly available regarding the flooding matters relevant to the scheme amendment.

https://www.sunshinecoast.qld.gov.au/Development/Planning-Documents/Sunshine-Coast-Planning-Scheme-2014/Amendments-to-the-Sunshine-Coast-Planning-Scheme-2014/Proposed-Amendments-Approved-by-Council-for-Adoption

Please feel free to contact me if you have any questions regarding the proposed major amendment and/or this request.

I look forward to hearing from you soon.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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Department of Infrastructure, Local Government and Planning
PO Box 1129
MAROOCHYDORE QLD 4558

EOI/P170609_TwinWatersWest

9 June 2017

Attention: Danika Cowie

Dear Danika,

Re: Independent Third Party Review of Flood Impact Assessment
Twin Waters West
Proposal for Consulting Services

Thank you for your email on the 7th June 2017 requesting this quotation for a review of the flood impact assessment that has been undertaken for the Twin Waters West development. Our proposed scope has been based on the information included with your email and our telephone discussion.

Overview

Sunshine Coast Council seeks to rezone Rural zone land under the Sunshine Coast Planning Scheme 2014 for the Twin Waters West development. The proposed rezoning area is subject to flooding and proposed changes to land form have been assessed as part of a Flood Impact Assessment. The Flood Impact Assessment assessed the viability of a flood solution concept for offsetting flood impacts. There were a number of submissions during the public consultation period with specific concerns related to worsening flood impacts as a result of the development.

WMAwater will review the work undertaken in the Flood Impact Assessment to ensure that best practice approaches have been used and the appropriateness of the proposed flood solution concept. WMAwater's work will give the Department of Infrastructure, Local Government and Planning the opportunity to critically examine work to date and to further understand this key site constraint.

WMAwater Pty Ltd

DIRECTORS
M K Babister, RPEQ
R W Dewar
E J Askew
F L N Ling, RPEQ

SENIOR ASSOCIATES
R Hardwick Jones
M E Retallick

ABN 14 600 315 053

Level 2, 160 Clarence St, SYDNEY NSW 2000
Phone: 02 9299 2855 Fax: 02 9262 6208
Email: enquiry@wmawater.com.au
Website: wmawater.com.au

Previous Experience and Staff

WMAwater are a consultancy specialising in flooding, with offices in Brisbane, Sydney and Hobart. WMAwater carry out a variety of flood related work including data collection and review, flood studies, hydrologic and hydraulic modelling and model review assessments. A key part of WMAwater's experience is in carrying out review work for government departments and local government.

The work would be undertaken by Mark Babister and Erin Askew. Mark is WMAwater's Managing Director and a national leader in floodplain management and analysis. Mark has held key roles in the development of a number of national best practice documents including Australian Rainfall and Runoff, ensuring these principles are applied to the review. Erin is a Director at WMAwater and has 15 years' experience in the fields of hydrologic and hydraulic modelling and floodplain management. Erin has carried out numerous flood and floodplain risk management studies and has experience in the review of work undertaken by other consultants.

Proposed Methodology

1. **Review of Available Information**

The aim of this phase will be to collate and review the available models and underlying data that informs the models. The reports, models (hydrologic and hydraulic) and input survey data associated with the assessment will form the main basis of review material. The project personnel will draw on their prior experience and knowledge to provide insight to the review.

2. **Review of Hydrological and Hydraulic model**

Our initial approach would be to review the overall modelling in terms of assumptions and results. The hydraulic model review will be undertaken considering the model setup in terms of general structure and model run parameters. The assumptions and parameters adopted in the hydrological model will be reviewed to determine suitability of the model. Further, review of the results of the modelling will be undertaken to determine suitability for use.

The approach to carry out the calibration and validation stages of the work will be reviewed to determine whether the model emulates catchment behaviour during flood events.

Key parameters to be include:

- Model boundary conditions;
- Bed roughness values;
- Schematisation of significant hydraulic features; and
- Results and design flood levels.

The associated documentation of the modelling methodology would also be reviewed for consistency with best practice and suitability of the modelling for the assessment of flood impacts and solution concepts at the site.

3. **Review of Flood Solution Concept**

This stage will include a review of the proposed flood solution concept in terms of its practicality and appropriateness for minimising flood impacts. In addition modelling of the concept would be reviewed. Comment will also be provided on limits of acceptable flood impacts.

Timetable

The review can be completed up to draft within 15 business days of this proposal being accepted and provision of all associated report and modelling files. Immediately on receipt of the modelling files we would undertake a review for completeness. Experience has shown that there can sometimes be some back and forth to obtain the correct files.

Budget

Costs are provided in the table below.

Rate (ex GST)	$	Refused under s	$	Refused unde	$	Refused under
		MB		EA		Engineer
Review of Available Information	Refused under section 47(3)(b) of the RTI Act. Disclosure would				$	Refused under sectio
Review Hydrologic and Hydraulic Model					$	
Review Flood Solution Concept					$	
Document Findings					$	
Liaison					$	
SUBTOTAL					**$**	
GST					$	
TOTAL (incl GST)					**$**	**17,248.00**

Our budget has allowed for a desktop review and as such we have not allowed for any site inspections or meetings on site. Should attendance at any meetings be required these can be carried out on a time and expense basis. Charge out rates for staff are provided in the table above.

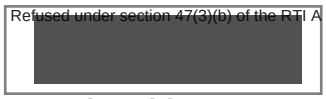
Potential Conflict of Interest

WMAwater has not undertaken any previous work associated with the Twin Waters West development or for Sunshine Coast Council. WMAwater are currently listed as a pre qualified supplier on Council's Regional Planning Services Arrangement No. R151. Category F - Hydrology / Hydraulic Services. We do not see this as a conflict of interest relating to this matter.

If you have any queries please do not hesitate to contact the undersigned on 9299 2855.

Yours Sincerely,

WMAwater



Mark Babister

Director

Garth Nolan

From: Erin Askew [Refused unde] wmawater.com.au>
Sent: Wednesday, 18 October 2017 9:20 AM
To: Danika Cowie
Cc: Garth Nolan
Subject: RE: Twin Waters West and Extension of Contract

Follow Up Flag: Follow up
Flag Status: Completed

Hi Danika,
My apologies, I have been caught up over the last week or so with a series of minor emergencies. I have a draft of the final report that I am sitting down right now to review. All going well I will be able to send a copy through for your review over the next day or so.
Ill keep you informed if there is more work needed after my review.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Tuesday, 17 October 2017 12:55 PM
To: Erin Askew [Refused unde] wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters West and Extension of Contract

Hi Erin,

I have tried to contact you a number of times over the past week as I am just wanting to touch base with you to see how the final report is going and if there are any issues?

We are also wondering what the anticipated timeframe is for the final report.

If you could let me know as soon as possible that would be greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Danika Cowie
Sent: Thursday, 12 October 2017 10:19 AM
To: Erin Askew [Refused under] wmawater.com.au>
Subject: RE: Extension of Contract

Hi Erin,

I just wanted to touch base with you to see how the final report is going for Twin Waters West, and if you could advise on an approximate timeframe on when we may receive it.
Also can you please advise if you have been able to work out the details for the contract extension as per my email on the 19 September 2017? Procurement are still chasing for the info. If you do have the information, please send it onto me and I can forward it onto procurement to finalise.

Please feel free to give me a call if you have any questions or wish to discuss the report of the procurement information further.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Danika Cowie
Sent: Tuesday, 26 September 2017 3:47 PM
To: 'Erin Askew' [Refused under] wmawater.com.au>
Subject: Extension of Contract

FYI

From: Danika Cowie
Sent: Tuesday, 19 September 2017 3:47 PM
To: [Refused under] wmawater.com.au
Cc: Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Mark,

Following on from Nathan's email regarding extending the contract for WMA Water to review the Twin Waters West flood modelling information. To assist in preparing the procurement paperwork, are you able to advise on an approximate timeframe for WMA Water to complete this next stage of work based on what was agreed at the meeting held on 7 September 2017 and provide approximate costs to complete the work.

Please feel free to contact me if you have any questions regarding the above request.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Nathan Rule
Sent: Thursday, 31 August 2017 9:30 PM
To: Refused under wmawater.com.au
Cc: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>; Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>; Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Extension of Contract

Hi Mark

I'd like to confirm that we will be extending our contract with WMA Water (contract number DILGP-0289-17) in relation to the Flood Assessment Review for Twin Waters.

We will provide a formal letter stating the new terms of the contract (extended timeframe, scope and cost, including reimbursing travel expenses) once we have held the client meeting with Council, so we can confirm the new details.

In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m.** Refused under section | **e.** nathan.rule@dilgp.qld.gov.au

Department does not accept any responsibility for any loss or damage that may result from reliance on, or use of, any information contained in this email and/or attachments.

Garth Nolan

From: Erin Askew [Refused und] wmawater.com.au>
Sent: Thursday, 4 January 2018 10:08 AM
To: Danika Cowie
Subject: Re: Twin Waters West

Hi Danika,
I'm back in the office on Monday and will send through the final then.

Kind Regards,

Erin Askew
WMAwater

On 4 Jan 2018, at 10:31 am, Danika Cowie <Danika.Cowie@dilgp.qld.gov.au> wrote:

> Good morning Erin,
>
> Firstly, happy new year, hope you've had a great break. To kick things off for 2018, I am happy to advise that we have been given the green light to request WMA Water to issue the final version of the findings report to the third party review. I can also advise that there are no further changes required. Can you please advise how quickly you can get the final version of the report to me as we are eager to progress the scheme amendment now that the third party review is completed.
>
> Please feel free to contact me if you have any questions or wish to discuss the finalising of the report further.
>
> Kind regards,

<image002.png>Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of State Development,
Manufacturing, Infrastructure and Planning

P 07 5352 9776
Level 3, Mike Ahern Centre 12 First Avenue, Maroochydore
QLD 4558
PO Box 1129 Maroochydore QLD 4558
www.dsdmip.qld.gov.au

From: Danika Cowie
Sent: Monday, 18 December 2017 2:49 PM
To: 'Erin Askew' [Refused und] wmawater.com.au>
Subject: RE: Twin Waters Wes

Hi Erin,

Thank you for your email. I am still waiting to hear from our Executive Director that he is happy with the revised report. Once we have his ok, we will be sending it to council for their review and then depending on their comments, advise you to finalise the report and issue the official review report which will go to the Minister. I was hoping to have this all wrapped up before Christmas but that is looking unlikely now.

So on that note, have a lovely Christmas break and I will no doubt be in touch in the new year.

Kind regards,
Danika

From: Erin Askew [mailto:Refused un@wmawater.com.au]
Sent: Monday, 18 December 2017 8:30 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Danika,
Im just following up on the Twin Water report and to let you know that our office will be closed from 20/12 and reopening on the 8th.
Let me know if you need any changes or you would like me to finalise the report.
I hope you have a great Christmas.
Kind Regards,
Erin

From: Erin Askew [mailto:Refused un wmawater.com.au]
Sent: Monday, 20 November 2017 12:11 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Ok no problem,
Thanks Danika

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Monday, 20 November 2017 12:09 PM
To: Erin Askew Refused und@wmawater.com.au>
Subject: RE: Twin Waters Wes

Hi Erin,

Thank you for sending that through. I shall forward it onto my management for their review. If there are any further changes requested, I will let you know. Otherwise, if they are happy with this version I will contact you to issue the "final" version of the report. Either way, I will be in touch soon.

Kind regards,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Friday, 17 November 2017 9:16 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Danika,
Please find attached the updated report. Please let me know if you require any further refinements.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Wednesday, 15 November 2017 12:16 PM
To: Erin Askew <Refused un wmawater.com.au>
Subject: RE: Twin Waters Wes

Hi Erin,

How are you going with finalising the report? My management is anxious to get have the report finalised as soon as possible.

Can you please give me a call if there are likely to be any delays with finalising the report.

Kind regards,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Friday, 10 November 2017 8:24 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Danika,
I am currently out of the office undertaking a series of community consultation sessions and have not been able to make those final changes. I am back in the office early next week and this is at the top of my list. Ill touch base on Monday or Tuesday.
Kind Regards
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Friday, 10 November 2017 9:17 AM
To: Erin Askew Refused unde wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Good morning Erin,

I just want to touch base with you to see how you're going with finalising the report following on from our discussion last week. Can you please advise at your earliest convenience when you think we will receive the revised copy of the report?

Please feel free to contact me if you have any questions or wish to discuss the report further.

Kind regard,
Danika

From: Danika Cowie
Sent: Tuesday, 31 October 2017 3:18 PM
To: Erin Askew <Refused und wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Erin,

Thank you for yours and Mark's time this afternoon to discuss the draft report.

As mentioned in the meeting, could you please make the following changes to the rezoning references within the report to reflect the correct process that is being undertaken by council.

Please change any reference to "rezoning concept", "proposed concept" or "rezoning application" to state the following:

…rezoning process via an amendment to the Sunshine Coast Planning Scheme…

and then as a general reference throughout the report, refer to it as *…the rezoning process*…. Or *...planning scheme amendment process*….

If you could also reword any reference to “future assessment stages” to say, ….*future development applications for a proposed master plan*….

Please feel free to contact me if you have any questions regarding the above references.

Thank you again for all the work you have done as part of this review, it is greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Erin Askew [mailto: Refused ur wmawater.com.au]
Sent: Wednesday, 25 October 2017 1:51 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Twin Waters Wes

Hi Danika,
Please find attached our revised review. I have left it as a working draft to allow you to review.

Apologies again for the delay, we had a draft a few weeks ago but I became the constraint to getting it out to you.
Kind Regards,
Erin

Erin Askew
Director

E: Refused ur wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

Garth Nolan

From: Erin Askew [Refused und] wmawater.com.au>
Sent: Wednesday, 25 October 2017 1:51 PM
To: Danika Cowie
Cc: Garth Nolan
Subject: Twin Waters Wes
Attachments: DraftResponseMemo_TWWReview_171005_Rev1.pdf

Follow Up Flag: Follow up
Flag Status: Completed

Hi Danika,
Please find attached our revised review. I have left it as a working draft to allow you to review.

Apologies again for the delay, we had a draft a few weeks ago but I became the constraint to getting it out to you.
Kind Regards,
Erin

Erin Askew
Director

E: [Refused ur] wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

Memorandum

TO: Danika Cowie
FROM: Mark Babister
DATE: 25 October 2017
SUBJECT: Twin Waters West – Preliminary Draft Review Response
PROJECT NUMBER: 117056

1. EXECUTIVE SUMMARY

WMAwater has undertaken an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of a rezoning concept for the site. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for the proposed rezoning of the Twin Waters West site.

WMAwater undertook an initial review of the modelling and associated reporting submitted with the rezoning application. A number of recommendations and requests for clarifications were made as part of this review covering elements related to the specifics of the model structure and reasoning behind some implementations. The findings of independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council, the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken. SLR provided formal documentation of clarifications and undertook updates to the model.

WMAwater has assessed the model changes and justifications provided by SLR in response to the Twin Waters West – Preliminary Draft Review Memorandum. The majority of items have either been addressed by model updates or clarified with justification. WMAwater finds that the revised modelling and associated reporting meets the needs of the assessment for the purposes of a rezoning application.

In addition, WMAwater recommends that several key items not updated for this stage of the assessment be addressed prior to future or more detailed design modelling of the site for the purposes of a specific development application.

In order for the modelling and reporting to fulfil the requirement of informing the detailed design and be suitable for the assessment of impacts for future more development specific application stages, the following critical tasks must be undertaken:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Provide further documentation regarding the split of inflow 51 or provide supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network,
- Further supporting documentation on model development and validation.

2. TWIN WATERS WEST FLOOD MODEL REVIEW

2.1. Context

WMAwater has been engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review is to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development in the context of a rezoning application. The high level impact assessment will then be used to help inform the rezoning application for the Twin Waters West site. The preliminary findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council (SCC), the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken. SLR provided formal documentation of clarifications and undertook updates to the model. Several of the key issues and deficits have been revised. These revisions are captured in the appropriate sections of this memorandum.

The purpose of this memorandum is to assess the subsequent changes and responses from SLR made to address and respond to the preliminary review and to provide recommendations as to the suitability of the model for assessing the viability of the development in the context of a rezoning application.

2.2. Initial Review Summary

The initial report and model review (Reference 1) concluded that the Cardno TUFLOW model (Reference 2), used to assess the impact of the Twin Waters West development, was largely constructed from the SCC MIKEFLOOD model (Reference 3 and 4), utilising elements like inflow and roughness. The model diverged from the SCC model in some key areas including missing culverts or bridges, missing or diverted local runoff inflow locations and terrain elevation modifications which appeared questionable. Additionally, the provided reporting did not appropriately justify the exclusion or changes to these elements nor did the reporting adequately document the model development and validations against SCC's model. It was also found that a number of culverts or bridges within the TUFLOW model were producing unstable flow results which may be impacting on the wider model results.

Based on these facts it was found that the modelling and reporting (at the time of the review) were not adequate to determine the suitability of the modelling for assessing the impact on flood behaviour as a result of the proposed development. Furthermore, the following tasks were advised to be undertaken:

- Inclusion of missing localised inflows,
- Justification including sensitivity analysis for adopting a constant initial water level, as opposed to the spatially varying layer used in the MIKEFLOOD model,
- Sensitivity analysis of different bathymetry at the Maroochy River mouth,
- Sensitivity analysis of the changes of starting the model at timestep 0,
- Correction to the hydraulic structure instability issues,
- Justification of, or removal of questionable topographic modifications (where justification is not provided or deemed unacceptable),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification of, or inclusion of missing hydraulic structures,
- Provide further documentation regarding the split of inflow 51,
- Further supporting documentation on model development and validation.

Further details of the review are provided in Twin Waters West – Preliminary Draft Review Memorandum (Reference 1).

3. MODEL REVIEW RESPONSE

3.1. Summary of SLR Response

SLR have aimed to address or provide commentary/justification for several of the key issues outlined in Section 2.2. Details of the response/changes, including WMAwater comments, are provided in Appendix A.

The changes SLR have made to the model include the following:

- Update or justification for the use (of most) of questionable topographic modifications,
- Inclusion of missing inflow sources (please note this does not include sub-catchment 51).

Instability within the model representation of bridges and culverts (hydraulic structures) can artificially increase or decrease surrounding model results and tends to indicate that the structure representation is not appropriately functioning across a range of flood levels. While the structure may be stable at the peak of a particular event, instability at lower levels may limit the future use of the model for these smaller events. The unstable flow results at 1D hydraulic structures has not been resolved and is still present in the model. In this instance SLR has presented sound arguments regarding the impact of these flow instabilities on the water levels for the event assessed and the overall model health. Based on the purpose of the modelling in the context of a rezoning application, limited instability issues at the peak of the event assessed, WMAwater accepts that these issues do not require addressing at this stage of the modelling. However, it is still recommended that they be investigated and addressed in future assessment stages.

Additionally, in response to queries regarding missing and additional culverts when compared to the previous SCC modelling, SLR has confirmed that the culvert data included in the modelling process has been provided by SCC and is expected to be the most up to date. It was noted that existing culverts are represented equally in both the design and existing scenarios. Therefore, any missing culverts are unlikely to impact the results of this stage of the assessment.

Several key issues were not addressed by SLR. Further details of these issues are outlined in Section 3.2 and Appendix A.

3.2. WMA Response

Given the purpose of the modelling, WMAwater has found that the modelling is largely adequate for the purposes of informing the rezoning application. With that said, there are several key issues that should be resolved to improve the integrity of the model for future more detailed assessment stages. These items include:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Further supporting documentation on model development and validation.

Additional information regarding the splitting of sub-catchment 51 inflows (in comparison to the MIKEFLOOD model) was provided as part of SLR's response, whereby an argument was made that the Pacific Paradise stormwater infrastructure conveys runoff to the eastern canal system. It is unlikely that the stormwater network in this area has been designed to convey the 100 year ARI event or has the ability to capture the entirety of the runoff for this event. Further documentation regarding the split of inflow 51 or supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network should be provided in future assessment stages.

4. CONCLUSION AND RECOMMENDATIONS

WMAwater was engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impacts on flood behaviour as a result of the proposed development in the context of a rezoning application. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for the proposed rezoning of the Twin Waters West site. The findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

Due to the high-level nature of the assessment, WMAwater has found that the modelling is largely adequate for the purpose of informing the rezoning application. It is however recommended that the following critical tasks be undertaken or provided in order for the modelling and reporting to fulfil the requirement of informing the detailed design and assessment of impacts for future application stages:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Provide further documentation regarding the split of inflow 51 or provide supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network,
- Further supporting documentation on model development and validation.

5. REFERENCES

1. Twin Waters West – Preliminary Draft Review
WMAwater, August 2017

2. Flood Impact Assessment Twin Waters West Report
Cardno, April 2017

3. Maroochy River Flood Study
Sunshine Coast Regional Council, February 2010

4. Maroochy River Flood Study – Flood Hazard Mapping Project 2013/2014
Sunshine Coast Regional Council, July 2013

5. IFD 2013 Increases (%) Mapping
Sunshine Coast Regional Council, July 2013

6. B5 Airport and Surrounds – Flooding
Sunshine Coast Council & Sunshine Coast Airport

7.TUFLOW User Manual, TUFLOW.2016-03-AA
BMT WBM, April 2016

Appendix A

The queries raised by WMAwater, the responses from SLR and the subsequent response from WMAwater are provided in the tables below.

Table A1: Topographic Data

WMA Comment	SLR Response	WMA Response
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.	It is correctly noted that if the river mouth bathymetry was updated, it would likely impact both the existing and design scenarios equally. Therefore, it is unlikely to directly impact the assessment. WMAwater does recommend that an update to the river mouth bathymetry be taken in future assessment stages for the purposes of ensuring a more accurate representation of flood characteristics.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.	Noted and accepted. Refinement should be made as part of future assessment stages.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.	It is noted that 2d_zpt_Roads_Ex29 has been updated to 2d_zpt_Roads_Ex30 and has been correctly shifted to align with aerial imagery of the existing roadway.

4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are "thin" breaklines. The TUFLOW model reads the GIS layer using the "gully" parameter which ensures a continuous flowpath. It is also incorrect to say it is a "poor representation of a 20m wide channel" because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.	Section 6.8.3 of the TUFLOW manual (TUFLOW 2016-03-AA) notes the following: "The Read GIS Z Line default is to model a "thin" line which modify the ZH, ZU and ZV Zpt elevations only. If the THICK option occurs, interpolated Z values are applied to whole cells (ie. at the cell centres (ZC), all cell sides and cell corners). Other optional flags such as MAX, MIN, RIDGE or GULLY are also available." Please note that TUFLOW treats 2d_zln, 2d_zlr and 2d_zlg the same. Additionally, no "THICK" option has been applied to the 2d_zlg_Drain layer. Also note that the "GULLY" parameter does not ensure a continuous flowpath but instead only changes a Zpt elevation if the Z Shape elevation at the Zpt is lower. The above has only been included to justify the inclusion of original comments and explain how the 2d_zlg is applied by the model. It should be noted that it has minimal impact and therefore is not required in the model as the Lidar and 10m DEM appropriately represents the channels in these areas.

5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.	The primary concern of the inclusion of this layer is demonstrated in the image below. Please note that the depicted mapinfo file will create a channel from the sunshine coast motorway to the canal system (based on the placement of the nodes). This method has been included at other locations where the area is smoothed to then include a 2d layered flow constriction representation of the structure. In this case there is no 2d layered flow constriction.  As stated previously, no evidence could be found to support the inclusion of this channel. If culvert structures are located in this area, they should be included for completeness. It is noted that this inclusion is located south of the Twin Waters West site and unlikely to affect the model results at the development, however should be included for model completeness as part of future assessment stages. Additionally, this shapefile is included in both the existing and design scenario and therefore is unlikely to influence the impact assessment.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.	Noted and accepted.

7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).	Noted. This layer should be updated as part of future assessment stages as it is unlikely that a uniformly elevated bund would be constructed. The bund is currently containing water to the north of the site and may potential affect flood levels at the site.
8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.	Noted and accepted.

Table A2: Topographic Layers for Twin Waters Development

1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.	Noted and accepted. Any future assessment stages should include a representation of the lake design.

2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a “weir”. The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.	Noted and accepted. The 2d_zsh obstruction at the northern (eastern) weir location should be updated to the correct level during future assessment stages to ensure that the efficiency of the weir is correctly represented and not potentially overstated.
3. Conservative approach to modelling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.	Noted and accepted. Any future assessment stages should include a representation of the site design.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.	Noted and accepted. During future assessment stages the modelling of the bridge structure (as the current design removes the existing bridge) should be modelled.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.

Table A3: Local Inflow

<table>
<tr>
<td>The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behaviour at the site.</td>
<td>These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.
Peak Flood Levels Within Subject Site (mAHD)
<table>
<tr><th>Flood Event</th><th>Northern End</th><th>Southern End</th></tr>
<tr><td>Existing 1% AEP (without 4 local inflows)</td><td>2.402</td><td>2.124</td></tr>
<tr><td>Existing 1% AEP (with 4 local inflows)</td><td>2.402</td><td>2.125</td></tr>
<tr><td>Existing 1% AEP + CC (without 4 local inflows)</td><td>2.903</td><td>2.757</td></tr>
<tr><td>Existing 1% AEP + CC (with 4 local inflows)</td><td>2.903</td><td>2.758</td></tr>
</table>
</td>
<td>Noted and accepted.

Please note that providing the location of the extracted values on a figure (with the table) would provide further context.</td>
</tr>
<tr>
<td>Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.</td>
<td>Sub-catchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of sub-catchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake. A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.</td>
<td>It is noted that there is a stormwater network within the Pacific Paradise development that includes a 1200mm discharge pipe to the canal system but it is unlikely that the stormwater network would be designed to convey the 100 year ARI event.

Further justification for this choice is required as part of future assessment stages – (as a minimum) supporting calculations showing that the 100 year ARI event runoff is captured and conveyed by the existing stormwater network/overland flow system should be provided.

If this is undertaken and it is found that the system does not capture the significant portion of stormwater runoff and convey it to the canal system, an update to the hydrology should be undertaken. Consequently, the hydraulic model would need to be updated accordingly.</td>
</tr>
</table>

Table A4: Initial Water Level

The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.	The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.	Noted. As this methodology is applied in both the existing and design scenarios it is unlikely to impact the purpose of the assessment. It should be noted that running the model for the full duration and adopting the spatially varying initial water level would remove this issue. Similarly, justification (or comparison to the full length run scenario) regarding the choice to reduce the model run time should be provided with future assessment stages.

Table A5: Hydraulic Structures

<table>
<tr>
<td>There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.</td>
<td>Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1. The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly.

Hydraulic Structures – 1% AEP Flood Event
<table>
<tr><th>Structure</th><th>Peak Discharge (m³/s)</th><th>Structure Head Loss (m)</th></tr>
<tr><td>12A (Northern Culverts)</td><td>84.6</td><td>TUFLOW = 30 mm
HEC-RAS = 30 mm</td></tr>
<tr><td>11E (Southern Culverts)</td><td>53.0</td><td>TUFLOW = 50 mm
HEC-RAS = 50 mm</td></tr>
</table>
</td>
<td>Noted and accepted. Details of these calculations should be documented in the reporting accompanying any future assessment stages.</td>
</tr>
</table>

A number of structures within the TUFLOW model have instability issues.	The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs. The noted structures are remote from the subject site and do not affect the calculated results. The results at the structures are generally stable around the peak of the flood event. The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.	It is noted that the flow instabilities are not proportional to the water level instabilities. Additionally, as stated, the instabilities do not tend to occur during the peak of the assessed event. The cumulative model error is low and the peak error is also reasonably low indicating a healthy model. With these points noted, instabilities should not be ignored and WMAwater recommends that these issues be fixed for any future assessment stages. It is not reasonable to state that the culverts are not near to the site and therefore should have minimal impact on the assessment. The culverts have a direct impact on flow conveyance from west to east (under the sunshine coast motorway) and therefore are likely to directly impact areas around the motorway – particularly in events where the motorway is not overtopped.
Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts	In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.	Noted and accepted.
Structures not included from MIKE model (but within TUFLOW model extent).	• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event. • Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event. • Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.	Noted. Confirmation of culvert sizing to determine significance should be undertaken and detailed included in future assessment stages.
Structures only included in TUFLOW Model	Details of these structures were provided by SCC: • 12A is located under the Sunshine Motorway near Finland Road. • DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters. • SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.	Noted and accepted.

Garth Nolan

From: Erin Askew [Refused un]@wmawater.com.au>
Sent: Thursday, 17 August 2017 4:11 PM
To: Danika Cowie
Cc: Mark Babister
Subject: Updated Draft
Attachments: 11179.pdf

Hi Danika,
I have just sent you via our filesender an updated draft. Following some clarity from stepping away from the document for a few days – I have made quite a few edits to clarify and simplify the outcomes.

As discussed I am on leave from Monday so I have attached our invoice for the review.

Mark would be your best contact for questions while I am away.
Kind Regards,
Erin

Erin Askew
Director

E: [Refused un] wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

Sue-Ellen Goldfinch

From: Refused und wmawater.com.au
Sent: Thursday, 17 August 2017 4:11 PM
To: Danika Cowie
Cc: Refused unde wmawater.com.au
Subject: HPE CM: WMAwater FileSender: Draft Review - Twin Waters West

Record Number: E2018/000132906

Dear Sir, Madam,

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PreliminaryDraftMemo_TWWReview_170817_Rev2_withFig.pdf	51.98 MB	Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 4	15-11-2017
Personal message from Refused und wmawater.com.au:			
Hi Danika, *Please find attached for download our draft review.* *Kind Regards,* *Erin*			

Best regards,

WMAwater FileSender

Sue-Ellen Goldfinch

From: Refused und wmawater.com.au
Sent: Thursday, 10 August 2017 8:25 AM
To: Danika Cowie
Cc: Refused und wmawater.com.au
Subject: HPE CM: WMAwater FileSender: Preliminary Draft Review - Figures

Follow Up Flag: Follow up
Flag Status: Completed

Record Number: E2018/000132902

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Personal message from Refused und wmawater.com.au:

Hi Danika,
I have attached for download our preliminary draft review Figures. The text will be sent separately.
I will send a separate email setting out a way forward.
This link can be forwarded to others for download.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

Sue-Ellen Goldfinch

From: Refused und wmawater.com.au
Sent: Thursday, 10 August 2017 8:05 AM
To: Danika Cowie
Cc: Refused und wmawater.com.au
Subject: HPE CM: WMAwater FileSender: PreliminaryWorkingMemo_TWWReview_170809_TEXT_APP.pdf

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Record Number: E2018/000132899

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Personal message from Refused und wmawater.com.au:

Hi Danika,
I have attached for download our preliminary draft review Text. The figures will be sent separately.
I will send a separate email setting out a way forward.
This link can be forwarded to others for download.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

Garth Nolan

From: Danika Cowie
Sent: Tuesday, 31 October 2017 9:54 AM
To: Garth Nolan
Subject: FW: Extension of Contract
Attachments: 11244.pdf

FYI

From: Erin Askew [mailto:Refused ur wmawater.com.au]
Sent: Tuesday, 31 October 2017 9:52 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Danika,
I have attached our invoice for the work to date. This includes Mark's attendance at the meeting on the 7th September, review of the revised modelling and preparation of the draft response.
Please let me know if you have any questions.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Thursday, 12 October 2017 11:19 AM
To: Erin Askew Refused unde wmawater.com.au>
Subject: RE: Extension of Contract

Hi Erin,

I just wanted to touch base with you to see how the final report is going for Twin Waters West, and if you could advise on an approximate timeframe on when we may receive it.
Also can you please advise if you have been able to work out the details for the contract extension as per my email on the 19 September 2017? Procurement are still chasing for the info. If you do have the information, please send it onto me and I can forward it onto procurement to finalise.

Please feel free to give me a call if you have any questions or wish to discuss the report of the procurement information further.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Danika Cowie
Sent: Tuesday, 26 September 2017 3:47 PM
To: 'Erin Askew' [Refused unde] wmawater.com.au>
Subject: Extension of Contract

FYI

From: Danika Cowie
Sent: Tuesday, 19 September 2017 3:47 PM
To: [Refused under] wmawater.com.au
Cc: Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Mark,

Following on from Nathan's email regarding extending the contract for WMA Water to review the Twin Waters West flood modelling information. To assist in preparing the procurement paperwork, are you able to advise on an approximate timeframe for WMA Water to complete this next stage of work based on what was agreed at the meeting held on 7 September 2017 and provide approximate costs to complete the work.

Please feel free to contact me if you have any questions regarding the above request.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Nathan Rule
Sent: Thursday, 31 August 2017 9:30 PM
To: [Refused under] wmawater.com.au
Cc: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>; Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>; Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Extension of Contract

Hi Mark

I'd like to confirm that we will be extending our contract with WMA Water (contract number DILGP-0289-17) in relation to the Flood Assessment Review for Twin Waters.

We will provide a formal letter stating the new terms of the contract (extended timeframe, scope and cost, including reimbursing travel expenses) once we have held the client meeting with Council, so we can confirm the new details.

In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m.** Refused under sectio | **e.** nathan.rule@dilgp.qld.gov.au

Level 2, 160 Clarence Street, Sydney NSW 2000 ph (02) 92992855
ABN 14 600 315 053

TAX INVOICE

Department of Infrastructure, Local Government and Planning
PO Box 15009 City East
BRISBANE QLD 4000
ABN: 25166523889

Invoice No: 11244

Monday, October 30, 2017

Attention: Mr G NOLAN

In Reference to: Twin Waters West Review

Job No: 117056 00 **Order No:**

Claim No. 2 for the period 18-Aug-17 to 30-Oct-17

Lump Sum for work completed:	$8,024.20
GST:	$802.42
Total Amount of this Invoice (including GST):	**$8,826.62**

Total Fees Owing: $8,826.62

Includes flights 07 Sep 2017

For EFT payments : Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance Refused under section 47(3)(b) of the RTI Act. Disclosure would,

Please note that WMAwater is now trading as WMA Water P/L and has a new ABN and bank account.

Terms Strictly 14 Days Nett

Garth Nolan

From: Stephen Patey <Stephen.Patey@sunshinecoast.qld.gov.au>
Sent: Wednesday, 25 October 2017 8:46 AM
To: Garth Nolan
Subject: FW: Twin Waters

Hi Garth,

Please see below.

Are you able to provide me with any update on the status of the flood investigation peer review and in particular, whether this has now been finalised?

Kind regards,

Stephen Patey | Manager
Strategic Planning Branch
Planning and Environment Department | Sunshine Coast Council

Phone: 07 5420 8785
Mobile: Refused under section 4
Mailcode: CR17
Email: stephen.patey@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

From: Matthew Byrne [mailto Refused under section 47(3 stockland.com.au]
Sent: Tuesday, 24 October 2017 5:22 PM
To: Stephen Patey <Stephen.Patey@sunshinecoast.qld.gov.au>
Cc: Refused under section 47(3)(b) of the RTI Act. Disclosure wo stockland.com.au>
Subject: Twin Waters

Hi Steve,

Are you able to chase DILGIP for an update on Twin? I understood they were expecting signoff from their consultant on Monday.

Regards,

Matthew Byrne
Senior Economic Development Manager

Sunshine Coast - Residential Development QLD
Stockland, Level 1/8 Innovation Parkway, BIRTINYA Q 4575

T Refused under section 47 **M** Refused under section 47(3)(b) of the
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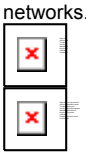

Sue-Ellen Goldfinch

From: Danika Cowie
Sent: Thursday, 17 August 2017 4:21 PM
To: Nathan Rule; Garth Nolan
Subject: FW: WMAwater FileSender: Draft Review - Twin Waters West

FYI

From: Refused und wmawater.com.au [mailto:Refused und wmawater.com.au]
Sent: Thursday, 17 August 2017 4:11 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Refused unde wmawater.com.au
Subject: WMAwater FileSender: Draft Review - Twin Waters West

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Personal message from Refused unde wmawater.com.au**:**

Hi Danika,
Please find attached for download our draft review.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

Sue-Ellen Goldfinch

From: Danika Cowie
Sent: Thursday, 10 August 2017 1:20 PM
To: Garth Nolan
Subject: FW: WMAwater FileSender: PreliminaryWorkingMemo_TWWReview_170809_TEXT_APP.pdf

Hi Garth,

I have received to download links from WMA Water. I think the files are too big for me to email to you, so I am forwarding the links to you to down load the files to look at. Let me know if you have any issues with trying to download the files and I will see what I can do.

I haven't read anything yet (it took a while to download) so I have no feedback back.

Kind regards,
Danika

From: Refused unde wmawater.com.au [mailto:Refused und wmawater.com.au]
Sent: Thursday, 10 August 2017 8:05 AM
To: Danika Cowie
Cc: Refused unde wmawater.com.au
Subject: WMAwater FileSender: PreliminaryWorkingMemo_TWWReview_170809_TEXT_APP.pdf

Dear Sir, Madam,

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I have attached for download our preliminary draft review Text. The figures will be sent separately.
I will send a separate email setting out a way forward.
This link can be forwarded to others for download.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

Garth Nolan

From: Stephen Patey <Stephen.Patey@sunshinecoast.qld.gov.au>
Sent: Tuesday, 5 September 2017 12:24 PM
To: Danika Cowie
Cc: Garth Nolan
Subject: Fwd: Twin Waters West - Preliminary Flood Modelling Report Response
Attachments: image0ff802.JPG; ATT00001.htm; 170904_Twin Waters_Stockland Response to WMA Report.pdf; ATT00002.htm

Danika,

Please see below and attached correspondence that I have been requested to forward on to the Department from Stockland in respect to Flood modelling for Twin Waters West.

Kind regards,

Stephen Patey | Manager
Strategic Planning Branch
Planning and Environment | Sunshine Coast Council

Phone: 07 5420 8785
Mobile: Refused under section 47
Mailcode: CR17
Email: stephen.patey@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Begin forwarded message:

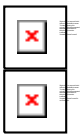
> **From:** Refused under section 47(3)(b) of the RTI Act. Disclosure woul stockland.com.au>
> **To:** "Stephen Patey" <Stephen.Patey@sunshinecoast.qld.gov.au>
> **Cc:** "Trevor Johnson" <Trevor.Johnson@cardno.com.au>, Refused under slrconsulting.com" <Refused und slrconsulting.com>, "Kevin Covey" <kevinc@covey.com.au>, "Matthew Byrne" Refused under section 47(3)(stockland.com.au>
> **Subject: Twin Waters West - Preliminary Flood Modelling Report Response**
>
> Hi Stephen
>
> I hope you are well.
>
> Please find attached response to the Twin Waters West – Preliminary Draft Review Memorandum previously supplied by WMAwater.
>
> Could you please forward to the State in preparation for the meeting coming this Thursday.
>
> If there are any issues please don't hesitate to contact me, or if you, or your team, have any technical queries regarding the content of the report please don't hesitate to contact Dr Trevor Johnson directly.
>
> Thank you.

Refused under section 47(3)(b) of the

Development Manager

Sunshine Coast - Residential Development QLD
Stockland, Level 1/8 Innovation Parkway, BIRTINYA Q 4575

T Refused under section 47(3)(b) M Refused under section 47(3)(b)
F +61 7 5491 0144 E stockland.com.au



Level 1, 8 Innovation Parkway
Birtinya Qld 4575
PO Box 6020
Meridan Plains 4551

T 07 54910100
F 07 54910144

www.stockland.com.au

4 September

Attention: Mr Stephen Patey

Dear Stephen,

RE: TWIN WATERS WEST PROJECT – REVIEW OF COMMENTS ON HYDRAULIC MODELLING

Please find attached letter and detailed comments from Dr Trevor Johnson in response to the recently received "Twin Waters West – Preliminary Draft Review Memorandum" from WMAwater.

It would be appreciated if you could please forward this correspondence to Nathan Rule at DILGP who can share it with WMAwater in preparation for the scheduled meeting on 7 September 2017 to discuss the preliminary draft findings.

Please do not hesitate to contact me on the details below if you have any further queries.

Yours sincerely

Refused under section 47(3)(b) of the RTI Act. Disclosure would, o

Refused under section 47(3)(b) of the RT

Development Manager

Refused under section 47(3)(b) of @stockland.com.au

4 September 2017

Trevor Johnson
Engineering Consultant
252 Pacific Parade
BILINGA QLD 4225

Stockland Kawana

By Email

Attention: Mr Matt Byrne

Dear Matt

TWIN WATERS WEST PROJECT
REVIEW OF COMMENTS ON HYDRAULIC MODELLING

WMA Water was commissioned by the Department of Infrastructure, Local Government and Planning (DILGP) to complete a technical review of hydraulic modelling undertaken by Cardno for the proposed Twin Waters West urban development north of Maroochydore. WMA has raised a number of issues in respect of the modelling, and the reporting which accompanied it, and this current report provides a response to these issues.

Before commencing on addressing specific matters raised by WMA, I believe that it will be beneficial to the process to understand the context under which the Cardno hydraulic modelling and reporting was undertaken. Stockland has proposed to develop Twin Waters West for residential purposes for a number of years, and an initial development application for the site was refused by Sunshine Coast Regional Council in 2012. While this application was for a different development concept, detailed hydraulic modelling had been undertaken by Cardno to support the application. This modelling was subject to extensive review by BMT WBM when Stockland appealed this refusal to the Planning and Environment Court. While the court confirmed the refusal, there was no adverse finding in respect of the hydraulic modelling, where general agreement had been reached between me and Neil Collins of BMT WBM as the experts for each side.

Following the refusal, Stockland embarked on extensive consultation with Council and the local community to determine what form of development, if any, was likely to be acceptable on the Twin Waters West site. Cardno was subsequently commissioned to revise the hydraulic modelling to consider the concept of a lake-based development, similar to the original Twin Waters Residential Community which the site adjoins. A more rigorous TUFLOW model was adopted for this purpose, also based on the Council MIKE FLOOD model. This model had originally been developed by Cardno for another Council project, and was considered the most appropriate for the task.

The principal aim of the modelling was not to support a development application over the site. Rather, the work was designed primarily to determine approximately how much lake area was required in order to ensure that development would not have an adverse impact on flood levels and flooding behaviour. In that respect, the analysis required a comparison between pre- and post-development flood levels so as to achieve compliance with the relevant non-worsening criterion which applies to development in Queensland. The intent of the modelling at that stage was simply to adequately demonstrate that urban development was achievable on the site, such that no actionable flooding nuisance would result.

Following substantial modelling effort, it was determined that a lake area of about 23 ha was sufficient to ensure that no worsening occurred. There was no intent that this internal model would be used for any purpose other than to confirm that a residential zoning was generally appropriate for the Twin Waters West site. The modelling was supplied to Council for its own review process. No detailed report was proposed to be prepared since there was no purpose for such a report. Cardno was not involved in the Council process to achieve the land use change.

However, Council requested some supporting information to facilitate its own review of the modelling, and a preliminary report was then prepared and submitted. This report was intended only for Council internal assessment, and I had a subsequent meeting with Council engineering officers where the information was discussed. The report was not at development assessment standard, and was never required to be.

WMA have rightly pointed out that the report is incomplete, and I accept that this is a valid criticism if the report were intended to support a development application. However, it was not intended for that purpose, and indeed, was not expected to be issued beyond Council technical officers at the time that it was supplied. It must be noted that the report has no formal status, and that Cardno similarly has no formal status in the planning process which is currently underway.

Notwithstanding this position, I am happy to respond positively to the various issues which have been raised, so long as all parties appreciate the context under which the work was originally undertaken.

A comprehensive assessment of specific items raised by WMA is included herein as Appendix A. However, it seems to me from a review of the WMA report that there are two principal issues which need to be addressed.

Firstly, WMA has stated that there are inflows missing from the model, and we accept that this is correct. While the inflows are located well away from the subject land, we agree that they should be included, and their absence was simply an oversight in the communications between Council and Cardno. Modelling is therefore underway to include these inflows in both the pre- and post-development models, and the results will be presented at the meeting on 7 March. It is important to note that while this analysis may result in an increased flood level, it is very unlikely to affect the comparison. That is, the non-worsening criterion will still be achieved.

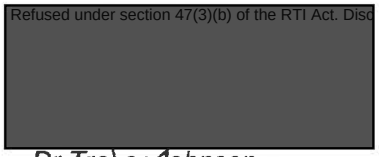
Secondly, WMA has stated that the TUFLOW model does not include two culvert structures which convey flow under the Sunshine Motorway onto the subject site. It is noted that this is not actually a correct characterisation. In Table C1 of the WMA report, it is acknowledged that the structures are included in the model as 2-dimensional layered constrictions, rather than the 1-d representations normally adopted. In fact, the typification of the structures as 2-d flow components is more technically rigorous than the alternative. We are currently undertaking further hydraulic assessment of the 2-d structures included in the model to demonstrate that they are behaving in accord with predicted hydraulic performance. The 2-d culverts were adopted to prevent instability in model performance of these critical elements. Again, even if the analysis shows that an alternative discharge treatment is required, there will be no effect on the pre- and post-development comparison, ie no actionable nuisance will occur, even if the absolute water level increases.

The other matters raised by WMA are potentially important in determining the peak flood levels, and corresponding minimum reclamation level for the project. However, given that identical treatment has been applied to both the existing and developed case models, there is no reason to consider that there will be any impact on the result of the non-worsening assessment.

We will implement all model changes which are considered necessary as part of our assessment for development application purposes. This will produce an accurate flood level assessment which will form the basis of the development which is constructed on site. However, in my opinion, none of this detracts from the Council finding that urban development is achievable on the Twin Waters West, and the designation of the site for residential purposes is supportable.

I trust that this addresses the issues raised in sufficient depth. If there are any queries, or I can assist further, please do not hesitate to contact the undersigned.

Yours sincerely



Dr Trevor Johnson
Engineering Consultant

Encl: Appendix A – Detailed Comments

APPENDIX A

DETAILED COMMENTS

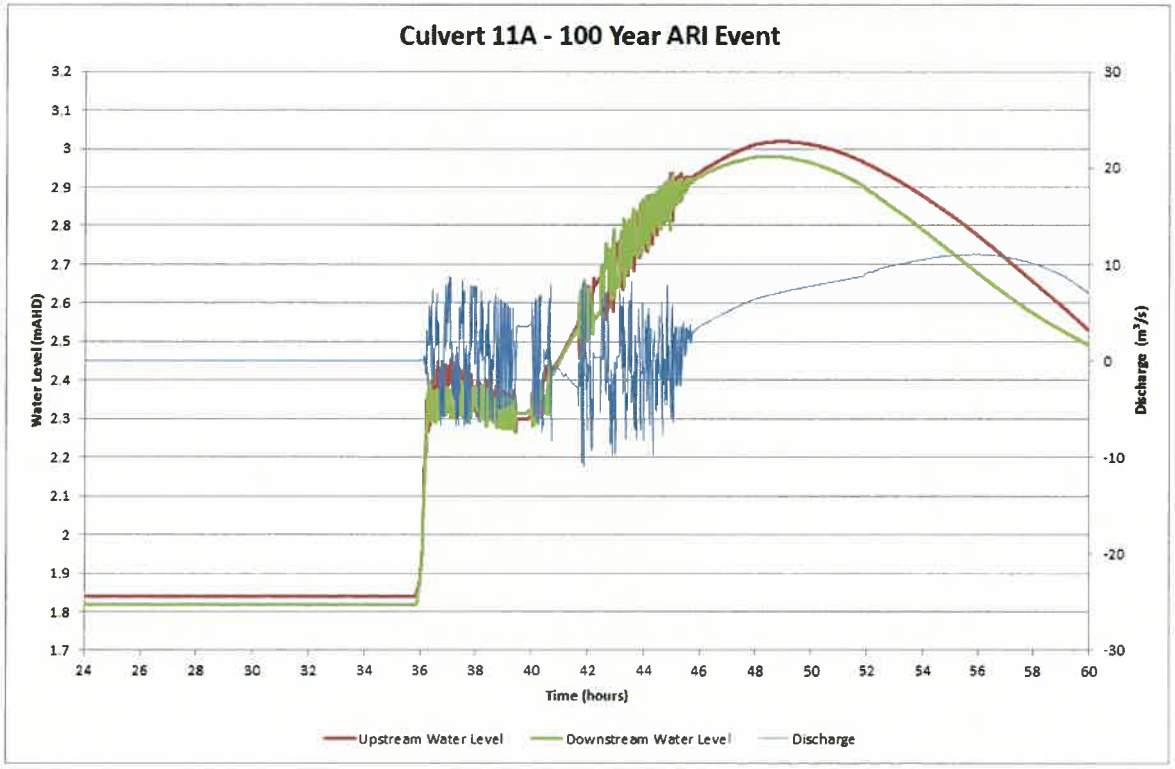
WMA Comment	SLR Response
Section 4.3. Topographic Data and Table A1. Topographic Data	
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.
4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are "thin" breaklines. The TUFLOW model reads the GIS layer using the "gully" parameter which ensures a continuous flowpath. It is also incorrect to say it is a "poor representation of a 20m wide channel" because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.
5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.
7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).
8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.

Table A2. Topographic Layers for Twin Waters Development	
1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model.. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.
2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a "weir". The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.
3. Conservative approach to modeling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.
Section 4.4.2. Local Inflow	
The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model... The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behavior at the site.	These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site. ***Peak Flood Levels Within Subject Site (mAHD)***

Flood Event	Northern End	Southern End
Existing 1% AEP (without 4 local inflows)	2.402	2.124
Existing 1% AEP (with 4 local inflows)	2.402	2.125
Existing 1% AEP + CC (without 4 local inflows)	2.903	2.757
Existing 1% AEP + CC (with 4 local inflows)	2.903	2.758

Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split... Further justification for this change should be made.	Subcatchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of subcatchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake.
Section 4.4.4. Initial Water Level	
The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.	The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.
Section 4.6. Hydraulic Structures & Table C1: Hydraulic Structures	
There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.	Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1. The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly. ***Hydraulic Structures – 1% AEP Flood Event*** **Structure** / **Peak Discharge (m^3/s)** / **Structure Head Loss (m)** 12A (Northern Culverts) / 84.6 / TUFLOW = 30 mm, HEC-RAS = 30 mm 11E (Southern Culverts) / 53.0 / TUFLOW = 50 mm, HEC-RAS = 50 mm
A number of structures within the TUFLOW model have instability issues.	The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs. The noted structures are remote from the subject site and do not affect the calculated results. The results at the structures are generally stable around the peak of the flood event. For example, Figure D2 in the WMAwater report shows the discharge hydrograph at Culvert 11A in the 100 year ARI event. This graph is reproduced below, including the water level hydrographs on the upstream and downstream sides of the culvert. The graph demonstrates that the minor instabilities do not affect the calculation of the peak flood level at the structure.
Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts	In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.

Structures not included from MIKE model (but within TUFLOW model extent).	• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event. • Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event. • Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.
Structures only included in TUFLOW Model	Details of these structures were provided by SCC: • 12A is located under the Sunshine Motorway near Finland Road. • DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters. • SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.



Garth Nolan

From: Erin Askew [Refused under] wmawater.com.au>
Sent: Thursday, 29 June 2017 12:44 PM
To: Garth Nolan
Subject: RE: DILGP-0289-17 Twin Waters West Flood Assessment Review_Letter of Acceptance

Hi Garth,
I confirm WMAwater's acceptance of this contract.
Kind Regards,
Erin

Erin Askew
Director

E: [Refused under] wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

From: DILGP Procurement [mailto:DILGPProcurement@dilgp.qld.gov.au]
Sent: Thursday, June 29, 2017 12:38 PM
To: enquiry@wmawater.com.au
Subject: DILGP-0289-17 Twin Waters West Flood Assessment Review_Letter of Acceptance

Hi Mark,

Your offer for the above mentioned procurement process has been formally accepted by the Department of Infrastructure, Local Government and Planning.

The Basic Purchasing Conditions of Contract apply. Please refer to the attached letter for further information

Please confirm your acceptance of this contract via return email along with a copy of your certificates of currency for required insurance.

Thank you,

Alisha Martin
Senior Procurement Officer
Procurement Services
Department of Infrastructure, Local Government and Planning
Level 13, 1 William St Brisbane QLD 4000
p. 07 345 27981 | **e.** DILGPProcurement@dilgp.qld.gov.au

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Garth Nolan

From: Danika Cowie
Sent: Tuesday, 31 October 2017 9:57 AM
To: Erin Askew
Cc: Garth Nolan
Subject: RE: Extension of Contract

Hi Erin,

Thanks so much for sending that through. I was wondering if Garth and I could have a teleconference with you to just talk through the draft report as we would like to have a few minor changes made before finalising it. Can you please let me know what time suits you.

Thanks in advance.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Erin Askew [mailto:Refused und wmawater.com.au]
Sent: Tuesday, 31 October 2017 9:52 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Danika,
I have attached our invoice for the work to date. This includes Mark's attendance at the meeting on the 7th September, review of the revised modelling and preparation of the draft response.
Please let me know if you have any questions.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Thursday, 12 October 2017 11:19 AM
To: Erin Askew Refused und wmawater.com.au>
Subject: RE: Extension of Contract

Hi Erin,

I just wanted to touch base with you to see how the final report is going for Twin Waters West, and if you could advise on an approximate timeframe on when we may receive it.
Also can you please advise if you have been able to work out the details for the contract extension as per my email on the 19 September 2017? Procurement are still chasing for the info. If you do have the information, please send it onto me and I can forward it onto procurement to finalise.

Please feel free to give me a call if you have any questions or wish to discuss the report of the procurement information further.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Danika Cowie
Sent: Tuesday, 26 September 2017 3:47 PM
To: 'Erin Askew' [Refused under] wmawater.com.au>
Subject: Extension of Contract

FYI

From: Danika Cowie
Sent: Tuesday, 19 September 2017 3:47 PM
To: [Refused under] wmawater.com.au
Cc: Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Mark,

Following on from Nathan's email regarding extending the contract for WMA Water to review the Twin Waters West flood modelling information. To assist in preparing the procurement paperwork, are you able to advise on an approximate timeframe for WMA Water to complete this next stage of work based on what was agreed at the meeting held on 7 September 2017 and provide approximate costs to complete the work.

Please feel free to contact me if you have any questions regarding the above request.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Nathan Rule
Sent: Thursday, 31 August 2017 9:30 PM
To: Refused under s wmawater.com.au
Cc: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>; Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>; Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Extension of Contract

Hi Mark

I'd like to confirm that we will be extending our contract with WMA Water (contract number DILGP-0289-17) in relation to the Flood Assessment Review for Twin Waters.

We will provide a formal letter stating the new terms of the contract (extended timeframe, scope and cost, including reimbursing travel expenses) once we have held the client meeting with Council, so we can confirm the new details.

In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m.** Refused under sectio | **e.** nathan.rule@dilgp.qld.gov.au

Garth Nolan

From: Danika Cowie
Sent: Wednesday, 28 June 2017 3:36 PM
To: 'Erin Askew'
Cc: 'Mark Babister'; Garth Nolan
Subject: RE: Third party review of the Flood impact assessment and associated modelling for Twin Waters West planning scheme amendment (email 2 of 2)
Attachments: Refused under letter to Trad - Sunshine coast planning scheme amendment - TWW.pdf; Refused under section 47 - Letter to DP - Flood Modelling Concerns.pdf

Hi Erin,

This is email 2 of 2.

Kind regards,
Danika Cowie

From: Danika Cowie
Sent: Wednesday, 28 June 2017 3:34 PM
To: 'Erin Askew'
Cc: Mark Babister; Garth Nolan
Subject: Third party review of the Flood impact assessment and associated modelling for Twin Waters West planning scheme amendment (email 1 of 2)

Hi Erin,

As discussed, please find below the email from Sunshine Coast Regional Council outlining how to request a copy of the flood modelling from them.

I have attached a copy of the Flood Impact Assessment that was prepared by Cardno on behalf of Stockland (the developer and land owner of the Twin Waters West site) which was prepared in response to the flood modelling for the Twin Waters West site for your review and comment. As I mentioned on the phone earlier this afternoon, we have received two pieces of correspondence from members of the public, which we would like you to review and provide guidance and comment on an appropriate response as they are quite technical in nature.

Due to the size of the Flood Impact Assessment file, I have to send the documents over to emails, this being email 1 of 2.

If you have any questions or issues with accessing the modelling, please do not hesitate to contact me. We look forward to receiving your review.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

19 June 2017

Attention: The Honourable Jackie Trad, Deputy Premier and Minister for Infrastructure and Planning

cc. Premier Annastacia Palaszczuk

Sunshine Coast Planning Scheme Amendment - Twin Waters West

Dear Minister Trad

I am writing in regard to Sunshine Coast Council's proposal to amend its Planning Scheme 2014 as per the Major Amendment – Twin Waters West to rezone the land from rural to emerging community, and related amendments that aim to overcome planning hurdles to facilitate development approval of a canal estate on flood prone land.

For many in the community we find it quite astounding that Council could propose these changes which are inconsistent with SPP 2016 and its own planning scheme, recommendations from the *Queensland Floods Commission of Inquiry* (QFCI 2012), a complete reversal of Council's position since a QPEC 2013 decision, as well as substantial community opposition.

One might ask what has changed since Council's endorsement of the 2014 planning scheme, and what might have influenced adoption of such an amendment? Certainly the risk to adjacent communities due to additional floodplain development is even higher than in 2013.

I'll preface my remarks by saying that I have a long standing professional interest and expertise in coastal and catchment planning and community consultation. Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act.

Refused under section 47(3)(b) of the RTI Act. Disclosure would though if I did live in an adjacent community, I would be very worried about the effect of this proposal on my property.

My key points are related to:

1. Inadequate public consultation;
2. Lack of information to alleviate concern regarding flood risk; and
3. Inadequate planning grounds.

1. Inadequate public consultation

Council undertook the minimum required consultation (26 September to 7 November 2016) on a major planning scheme amendment that was well known to be controversial. Two community organisations (Development Watch and Twin Waters Residents Association) and two private individuals had joined Council in defending and defeating an appeal by Stockland in the QPEC2013. Development Watch (DW) only became aware of this proposed amendment when it came out for publication notification, with little time to examine the proposal and seek member views. Development Watch subsequently met with the Planning Officers together with the Sunshine Coast Environment Council (SCEC) during the notification period (such meeting held at the request of SCEC).

The only meeting open to the general public was organised by a long-term resident of the adjacent area. With 4 days' notice, on Oct 31 2016, this meeting was attended by invited Council planners and 2 Councillors, and more than 130 people. It was clear from the tenor of the meeting that there was widespread opposition to the proposed amendment from adjacent neighbouring communities.

A major concern was the lack of information provided to allay concerns about potential flood impacts.

A written request for an extension of the timeframe for consultation by DW was refused by Council (letter from DW to CEO Council, 27 October 2016). In an ABC radio interview on 1 Nov 2016, Councillor Dickson said that an extension would only allow time for organisation of greater opposition. No doubt this is true, and confirms the impression that Council was not seeking genuine informed input to the amendment.

In the Amendment Explanatory Memo it states -

> 'Given previous reservations from the local community in relation to development of the subject land, Council required demonstration [by the developer] of community consultation and community support for development of the Twin Waters West land, before contemplating a planning scheme amendment process. Following consultation with the proponent, one local community association has subsequently indicated its conditional support for development of the subject land'.

Stockland only consulted with one of the co-respondents to the appeal, Twin Waters Residents Association (TWRA), an organisation which actually dropped out of the appeal action before it was completed. TWRA gave support to the proposed amendment process, based on about 38 members out of a population of about 2000 who showed up for a meeting on 10 Oct 2016. Further, at the community meeting on Oct 31 2016, and in properly made submissions, many Twin Waters residents indicated that they did not support TWRA's endorsement of the proposal.

Development Watch (DW) continued as a major co-respondent to the appeal, along with Council, through to the end in 2013. DW had not seen this amendment prior to the consultation period, yet Council claimed in the Explanatory Memo there was community support based on targeted consultation with TWRA.

Council's assessment of community support for the development prior to notifying the amendment was flawed and inaccurate.

The purpose of consultation

The purpose of consultation is to provide the range of stakeholders with an opportunity to have informed input to decisions. This is endorsed in the proposed Queensland government 'Draft community engagement toolkit for planning' and Sunshine Coast Council community engagement policies.

Besides the owner of the land, those who have a legitimate interest in the amendment re Twin Waters West include:

- residents of the adjacent subdivisions of Pacific Paradise, Mudjimba and Twin Waters who are concerned about potential increased flooding in the future and loss of amenity;
- Sunshine Coast Council ratepayers who will need to contribute to fund adaptation to climate change of low lying existing development along the coast in the future as well as effects of new poor decisions and lack of foresight regarding climate change effects; and
- Queensland and other Australian taxpayers who continue to contribute funds for disaster impacted humans and infrastructure.

At the Oct 31 public meeting, community members complained that the amendment was not on display or easily available in Council offices, nor was a notice posted on Council's web tab 'Community engagement'. Rather the amendment was buried under the 'planning-development' tab, and many complained they needed to be sent a link in order to find it. After the public meeting on 31 Oct 2016, an alert tab was placed on Council's website front page 'View proposed amendments to the planning scheme'; this was less than one week before submissions were due on 7 November, and only after Council had been publicly accused of poor notification and consultation.

This again might give one the impression that Council was not seeking genuine informed input.

Proactive consultation is designed to take community views into account. The tragedy of poor consultation is the cost in time and effort required by community members to react to poor planning, rather than spending time going about their normal business, nurturing family, friends and the community, building social capital and resilience. Another tragedy is the cost to taxpayers of public servants' and elected officials' time and effort to react to public concerns when they could have proactively provided information and engaged the community properly, - OR, in this case, made an appropriate decision not to amend the planning scheme in the first place.

Attached is documentation of Council's face to face consultation on the scheme, compiled from a Council letter to me and checked and corrected by community organisations (see Attachment 1).

It is indeed, minimal, considering that this was a major controversial amendment about a development that had already had community organisations as co-respondents to an appeal and which was rejected in the QPEC in 2013, with continuation of rural zoning through adoption of the planning scheme in 2014.

State government and Sunshine Coast Council's commitment to genuine community consultation

Council endorsed the amendment in spite of the substantial opposition (80% opposed out of 629 submissions) to this amendment. In addition 3 petitions with a total of 614 signatories were in opposition. Submitters have not been informed how many of those opposed were from nearby neighbourhoods genuinely concerned about impacts; though as mentioned above, many other submitters have a legitimate concern.

In Council's minutes of the confidential meeting of 13 April 2017, not made public but obtained under an RTI request, I draw attention to a dismissive attitude to community's genuine concerns.

> It is considered that the concerns raised by submitters, particularly in relation to flooding, coastal processes, visual amenity, habitat values and traffic are appropriately addressed either by existing planning scheme provisions (i.e. via the strategic framework and overlays) or by the content of the proposed planning scheme amendment …. (p133).

Obviously the community didn't think so, or they wouldn't have put in long hours making submissions. Alternatively one could take the view that the community misunderstood the amendment and needed to be better informed by Council, in which case the minimum consultation period and lack of accompanying information was inadequate for that purpose.

In conversations with Council planners, they claim that State government insists on reduced consultation periods, as reflected in revisions to the Planning Act. I made a submission to State government's Draft Community Engagement Toolkit, about the inconsistent messages community is receiving about sincerity of both levels of government in terms of consultation. In the last year, for example, community groups in the Sunshine Coast Council region have made many submissions on a number of planning and policy reforms to both State government and Sunshine Coast Council. This does not even include the fact that some community groups span the entire Sunshine coastal region and make submissions also to Noosa Council which is quite proactive about community consultation

and in the process of reviewing and revising its planning scheme and developing its Coastal Hazard Adaptation Strategy. A brief consultation period does not recognise that some community groups have additional roles in terms of community education/awareness and action projects, and are not solely waiting around for the opportunity to give input on a variety of relevant government initiatives that affect the community.

In most cases, submissions are expected within 3 weeks, quite difficult for community groups which aim to represent their constituents (indeed, governments expect that they do) and operate mainly with volunteer help. In some cases, less weight appears to be placed on pro-forma submissions and petitions versus individually constructed submissions. One concern with this approach is that with minimum consultation periods, by the time people learn about a proposal and seek answers to questions, they do not have time to construct their own submission, and hence a pro-forma submission works well for them. They would not sign a proforma if they didn't agree with it. In the case of the Twin Waters West proposal, *many* of those who submitted a proforma letter also added their own comments, showing that they did give thought to the matter – this was confirmed through the RTI process. Secondly, if a mark on a ballot paper is enough to elect a politician, surely petitions and proforma letters should count in an equal way.

A three month minimum period for major policies and plans has been an accepted best practice timeframe in the past by both levels of government. This is based on needing to schedule information meetings with groups, groups gathering or reviewing relevant information to support their submissions, and getting endorsement from membership of a submission.

However my major concern about consultation in relation to this proposed amendment relates to the lack of information provided to the community to alleviate concerns about flood risk, which I will now address.

2. Lack of Information to alleviate concern about flood risk

Council's flood overlay clearly shows that the subject site is flood prone and that the site (circled in red) and adjacent areas will be even more susceptible in future climate scenarios. According to SPP 2016, similar provisions apply to both planning schemes and their amendments. This basic information should have been provided in its publicly available amendment information but Council did not incorporate it.

The QFCI recommendation (5.3) stated

> Councils should include a flood overlay map in their planning schemes. The map should identify the areas of a council region:
> - that are known not to be affected by flood
> - that are affected by flood and on which councils impose planning controls (there may be subsets in each area to which different planning controls attach).

Council did not provide basic information about flood risk to this proposed development or adjacent properties in its amendment. The level of risk changed with its proposal to re-zone the area from rural to emerging community use.

Figure 1 SCC flood hazard mapping of the site and adjacent vulnerable area: dark blue shows flood modelling under current climate; Light blue extends the area under future climate http://maps.sunshinecoast.qld.gov.au/maplet/index.html?config=config/mymaps/myplace/FloodHazardArea.xml

The amendment does not meet the State Interest test and SPP 2016

State Planning Policy 2016 indicates that planning schemes and their amendments need to 'appropriately integrate State interests'. Council's Amendment Explanatory Memo suggests that Council met SPP 2016 requirements because sufficient information (such as the flood hazard overlay) was provided when Sunshine Coast Council's Planning Scheme was adopted in 2014. However at the time, this site was proposed as rural land, and Council's urban growth boundary and MNS did not include this land. The information provided at that time *was adequate for the proposed rural use*. SPP 2016 indicates that a LG planning instrument (and its amendment) must 'identify all natural hazards based on a fit for purpose natural hazard study' and 'avoid direct, indirect and cumulative increase in severity of natural hazard', among other very relevant matters. However such hazards have not been identified or addressed in the amendment, neither has a natural hazard study been provided that is fit for this new purpose, or any indication that an acceptable level of risk can be addressed, as required by the SPP (p35).

As you would be aware, development of SPP 2016 was informed by Recommendations regarding planning and development from the Qld Flood Commission of Inquiry.

The QFCI indicated that

> 'Flood maps, and property specific flooding information intended for use by the general public, should be readily interpretable and should, where necessary, be accompanied by a comprehensible explanatory note (2.17)'.

While the flood overlay clearly indicates this area is flood prone, this did not accompany the planning amendment, nor did any explanation why, given its flood-proneness, the area would now be safe to develop and with little impact on neighbouring communities. The new TWW development will be built at a higher ground level than existing adjacent communities. Current knowledge suggests that these adjacent communities will experience increasing risk of flooding with climate change. There is no indication that this development will not bring forward the risk in time or increased severity to these communities.

Another recommendation of the QFCI is that in model flood planning controls and/or Council assessment criteria in their planning schemes, it should be required that

> works in a floodplain do not reduce flood storage capacity on site or affect flooding storage, flow paths, flood warning times outside the site (7.16/17).

The information provided at the time of the amendment was inadequate and not 'fit for purpose' for the increased risk associated with the proposed intensive urban development. No evidence was provided that the works would not reduce flood storage capacity, flow paths, and flood warning times outside the site.

This amendment has clearly not met the state interest test.

QPEC 2013-79 - No need to put additional people at risk of flooding

One of the reasons for Council's rejection of Stockland's previous development application was flood vulnerability. The resulting QPEC decision in 2013 stated that there was no over-riding need to overrule Council's planning scheme to put additional people at risk in flood-prone land.

The conclave of experts agreed that there would be flooding but that it could be attenuated by providing an evacuation area at a higher level. There are three points to note in this regard:

- One cannot assume that Judge Rackemann intended that if Council's planning scheme was changed to favour the development, then it would be ok to put additional people at risk in flood-prone land.
- While the proposed evacuation area would enable residents to retreat to higher ground *if* there was enough time (given rapid rise of coastal rivers), it would not protect their property.
- A good test of an independent view of flooding would be to pose the question of risk to insurers.

The QFCI stated:

> Councils should not rely on a condition requiring an evacuation plan as the sole basis for approving a development susceptible to flooding (8.7).

Need for up to date flood modelling to be made publicly available.

Since the amendment was endorsed by Council in April 2017 and in response to considerable concerns continuing to be raised by the community, Council added more information on its website about flooding at the end of May 2017. Accompanying documentation claims that the recent modelling takes into account the new airport runway and associated buildings (230 ha) approved on the floodplain. Yet the large associated sealed surfaces will increase directional runoff and the airport area requires even more fill than originally estimated in the airport EIS. That is, further investigations as part of the airport development have found that the land levels are even lower than previously indicated and therefore require more fill than estimated (according to a presentation to Sunshine Coast branch of Engineers Australia). Presumably this also means that the area provided more flood storage capacity than originally thought. Additional proposed developments in the floodplain include an industrial area near the airport west of Sunshine Motorway, Marcoola Sands development, and Maroochy PAC, all being developed on flood prone land which is bound to affect flow and storage capacity. See Attachment 2, for a crudely annotated map of major known proposed developments.

In response to the community's more recent inquiries to Council about lack of information provided about flood risk, a Council letter has recently advised of 'the level of sophistication of Council's adopted MIKEFLOOD 2D model for the Maroochy River and derived 2D TUFLOW model for Twin Waters West', and that 'the proponent has been able to, more than adequately (as part of the proposed planning scheme amendment process), demonstrate that an acceptable flood solution is available for the Twin Waters West land' (Patey letter to Simmons 31.5.17). However this modelling information was not made publicly available, nor has it been independently verified. Furthermore, Council's letter advised that 'a new regional Maroochy river flood Model is currently under development by a specialist flood modelling consultant' and 'a Lower Mooloolah River and Maroochy River Flood Management Study is currently in progress' (Patey letter to Simmons 31.5.17). This was not announced publicly. If this is the case, it would make good sense to wait for the results, have it independently reviewed by other experts who would be available, along with Council representatives, to explain it and have a dialogue with the community.

A recommendation of the QFCI (2012) was that:

> A recent flood study should be available for use in floodplain management for every urban area in Queensland (rec 2.4). Where no recent study exists, one should be initiated.

Council claims that flooding will not affect adjacent communities based on a private in-house assessment of risk, not made publicly available. The lack of transparency and dialogue is patronising and has affected trust; Council's 'believe us' attitude is unacceptable. Many residents believe their properties will be at a higher risk of flooding as a result of this development. Presumably State government is funding QCoast 2100 to encourage Councils to address coastal hazard adaptation issues; the QCoast 2100 promotes best practice community engagement. It is not clear though, that

the Maroochy River floodplain would be considered under Council's QCoast2100 process which is in very early stages. Further, Council and State government liability for approving an at-risk development should be investigated, as well as advice sought from insurers regarding the effect on existing properties. It would be appropriate to form a stakeholder advisory committee to advise and review a Maroochydore flood study and management plan, as well as Council's QCoast2100 process. Because it is difficult to predict the rate at which climate change will affect coastal areas, a cautious approach should be taken.

There is no urgency for this planning amendment. It should be put on permanent hold, or dismissed completely, until the Flood studies are complete, independently verified, with adequate dialogue with the community through an effective community consultation process, and shown to not increase risk to existing stakeholders.

3. Inadequate Planning Grounds

No over-riding need in public interest

Judge Rackemann stated in the QPEC 2013 decision that 'overriding community need *in the public interest* would have to be established if urban development of the subject site is to meet that specific intent, even assuming adequate mitigation measures by filling and by adoption of an emergency management plan' (s 100). Council has not established that there is 'overriding community need in the public interest'. The impression is that Council has done a complete reversal of its approach to development of the site*, not based on public interests, but on private interests of an influential developer*.

Accommodating future growth - *Shaping SEQ: Draft SEQ Regional Plan, Oct 2016*

During the QPEC's consideration of the appeal, the land was classified in the urban footprint under the SEQ Regional Plan 2009-2031, which was inconsistent with Council's zoning as rural land. The new draft SEQ Regional Plan, recently closed for public comment in March 2017, still proposes the site as within the urban footprint. It should be noted that QPEC 13-79 stated: 'the SEQRP's inclusion of the site within the urban footprint does not determine that the land ought be used for urban development' (s205). Thus there is no reason why the Regional Plan and Planning Scheme cannot remain inconsistent. In spite of this, it would be preferable if the Regional Plan could specify that undeveloped flood prone land should be reclassified as 'no future development' whenever possible. This would acknowledge the considerable impacts on community and the costs to public infrastructure from previous flooding in SEQ and respect Queensland's flood victims. The new SEQ Regional Plan is for 25 years. If further information is available at the end of this time that suggests the land can be developed with minimum risk in the public interest, then it could be reconsidered.

Council justifies the need for this development based on the benefits of providing additional population near the Maroochy PAC and to meet SEQ RP growth targets. It suggests that the new development would be 'less than 5 km from the Maroochydore City Centre' (Letter from Patey to

10 May 2017). In actuality it is about 15 minutes from the edge of the new TWW to MPAC entrance. Areas designated for growth such as Bli Bli, Sippy Downs education hub, and Kawana medical hub are as close, and Nambour, on the train line is only 20 minutes to Maroochy PAC.

Council's submission to the Draft SEQ regional plan indicates that growth in population can be accommodated in a number of different areas, several of which are close to Maroochydore PAC. In fact, Twin Waters West is not mentioned at all as an accommodation solution in Council's submission to the Regional Plan.

Stockland's development proposes up to 700 residential lots (mostly low density) accommodating an estimated 2000 people in a canal estate. With no evidence to suggest otherwise, an additional 3000+

people in the existing adjacent settlements could be at risk resulting in a net loss of population. Further the regional plan prioritises infill, whereas this site is rural greenfield land on the urban fringe, in spite of Council's claim that it is not, because it has development on two sides, - a risky definition of infill.

Setting a precedent for planning scheme amendments

The Sunshine Coast planning scheme was endorsed in 2014 after comprehensive public consultation, and endorsed the rural zoning of the TWW site. In the two years since the planning scheme was adopted, it is unlikely that public opinion will change, and there is no reason.

Amending the planning scheme with such inadequate information, justification, and consultation sets a precedent for the quality of information required for planning scheme amendments and developments within the sizeable Maroochy River floodplain, and in fact, across Queensland. This is of even greater importance since changes to the Planning Act have reduced times for development assessment. A poorly considered decision by Council may lead to future compensation claims by developers and residents, and lead to a heavy burden on ratepayers. The community *does* expect that Council is acting in the *public's* interests, as required by the *Local Government Act s4 (2) and 12 (6).*

Further, while Council officers claim that this does not set a precedent for further development in the floodplain, Council's submission to the Regional Plan indicated that an area immediately west of Sunshine Motorway and Sunshine Coast airport extension, *in the floodplain* on floodprone land is being investigated by Council for potential use for 'aviation industry and services, tourism or transport facilities'. [see Attachment 2 illustrating floodplain developments either approved or under consideration]. Council has appropriately indicated that no commitment to this area can be made at this time, due to need for further studies. This would be an appropriate approach to TWW as well. However the point is that there is an anomaly between what Council is telling the community about this amendment not setting a precedent regarding future floodplain development, and its submission on the Regional Plan which clearly is considering future development in the floodplain. *Could this affect community's trust in Council and any other promises made?*

Policy approach to canal estate development

Canal estate developments are banned in New South Wales and up until 2014 in Victoria. They unlikely will occur in the future in Tasmania given the successful campaign against the Ralphs Bay canal and marina development (Stocker et al 2016). In Western Australia, rather than banning canal estates, the State requires a high level of scientific evidence to be gathered during the initial planning process (Harvey and Stocker 2015). In Queensland we rely on the SPP 2016 to provide safeguards but these must be rigorously applied to be meaningful. We are still learning about how to adapt to climate change, so a suitable approach would be to put a moratorium on canal estate development until better information is available that the risks of climate change impacts can be mitigated, and of the amount of scarce government resources that might needed for adaptation to climate change in existing low lying coastal land. That is, can the State, local governments and ratepayers afford climate change adaptation?

In Queensland, once a canal development is completed, the canal management and maintenance is handed to Councils, with private property owners being responsible for their own land and revetment walls. If canal estates were to be allowed in future, an alternative might be to have the developer retain ownership and maintenance of the canal so they have a financial incentive to achieve effective long-term outcomes (Stocker et al 2016).

However the following legitimate policy issues around canal estate developments remain:

- Who should bear responsibility for the ongoing maintenance costs of new developments including of canal estates, in low-lying flood-prone areas?
- Who should bear the costs of *past* development decisions given projected climate change impacts, and what adaptive actions should be implemented to assist transition in existing vulnerable areas? Councils must systematically integrate climate change impacts into their planning schemes and develop comprehensive adaptation strategies covering a range of potential climatic impacts, including flooding. The insurance industry already applies climate change risk assessments in their current analyses, and there are reports that some landowners in the existing Twin Waters estate cannot get insurance.

Both developers and Councils have a responsibility to consider financial risk. Recent advice indicates that Directors of companies 'who fail to consider the impact of foreseeable climate change risks on their business property could be held personally liable for breaching the duty of due car and diligence they owe to their companies' (CPD, October 2016). Directors' liability 'hinges on the foreseeability of risks or opportunities material to the best interests of the company' (McLeod and Wiseman 2016). Companies conduct due diligence on land purchases regarding current and future physical constraints, financial risks, and the applicable planning controls. Thus the public purse should not be put into a position where it subsidises developers' poor investment decisions. A future implication of this advice is that any CEO of a local government that does not consider such risks may be also personally liable. Unfortunately many directors, government officers and Councillors may be long gone by the time the effects of climate change are felt, but governments *will* be held accountable.

Planning schemes are an appropriate place to address cumulative impacts on floodplains

Council insists that any issues about flooding can be addressed at the development application stage. There are two problems with that.

One, a challenging issue from both policy and technical aspects is cumulative impacts of development on a floodplain. A good example is the inundation of the Brisbane suburb of Rocklea on the Oxley Creek floodplain during the 2011/12 floods. The policy up until then in this area, was that individual new development proposals had to prove that they would not increase flood impacts off-site. While individual applications were able to provide convincing enough information about minimal impact, the cumulative effects of many developments were not taken into account. The ad-hoc development increased the impervious surfaces and associated runoff, there was inadequate consideration of drainage requirements as developments took place in an ad-hoc manner, and this decreased flood storage capacity, thus exacerbating flooding.

In the case of the Maroochy floodplain, a considerable amount of fill will be required to achieve flood immunity for the second runway of the Sunshine Coast airport, thus affecting the floodplain storage capacity. Already adjacent communities have flood impacts (see Attachment 3), and climate modelling indicates that this will increase in the future. The planning scheme is the appropriate place to consider cumulative impacts, not the development application stage.

Second, with decreased minimum times for consultation at the development stage introduced by state government, and with a history of lack of genuine consultation and serious consideration by Sunshine Council of community's sincere concerns, there is no guarantee that timeframe and information provided for the review of a development application on TWW would be adequate.

Confirming the importance of planning, over 50 of the QFCI (2012) recommendations were about planning and development assessment. Among the recommendations were that model flood planning controls should require that works in a floodplain:

> do not reduce on-site flood storage capacity; and
>
> do not change the flood characteristics outside the subject site in ways that result in:
> – loss of flood storage
> – loss of/changes to flow paths
> – acceleration or retardation of flows, or
> – any reduction in flood warning times elsewhere on the floodplain. (7.16)

Queenslanders are sensitive to potential flood risks based on the experience of many individual business and home owners after the Queensland floods of 2011-12 who were unable to gain compensation from insurance companies, and whose lives were severely disrupted. The sizeable cost to local councils and other levels of government for repair of damaged roads and other infrastructure needs to be avoided.

No amendment should proceed until a Maroochy river floodplain study and management plan are completed.

In closing, I refer to advice from the Environmental Defenders Office Qld (2016):

> The importance of getting planning schemes right cannot be understated. Planning schemes are a blueprint for later development. Anything that is not recognised and protected in the planning scheme is unlikely to be protected by the local government or the Planning and Environment Court. It is therefore vital that when a planning scheme is being amended, the community be given the opportunity to make submissions and recommendations about areas that should be protected from development.

Recommendation 1: that State government reject the amendment to Sunshine Coast Council's Planning scheme – Twin Waters West.

Recommendation 2: that Sunshine Coast Council undertake and consult on a comprehensive Maroochy River floodplain study, based on best practice, and that this study and an ensuing management plan involve community consultation that includes a local advisory group of interested stakeholders as well as independent verification of the modelling. This plan should address cumulative impacts of potential development on the floodplain.

Recommendation 3: that any development approval on floodplains should include a long term bond from the developer for remedial rectification, and a caveat on every title and parcel for sale warning potential buyers of flood risk, in accordance with QFCI. It is inappropriate that public monies be spent addressing new flooding when we know that existing residential areas are at risk.

Recommendation 4: that any development approval on floodplains require that relevant Councils provide evidence that it has a solution to deal with a precedent being set allowing development in a floodplain, and that it has a strategy and adequate resources to deal with the consequences.

Recommendation 5: that State government give clear guidance whether it will consider future canal estate development, given knowledge of existing vulnerabilities of existing canal developments in SEQ.

Sincerely,

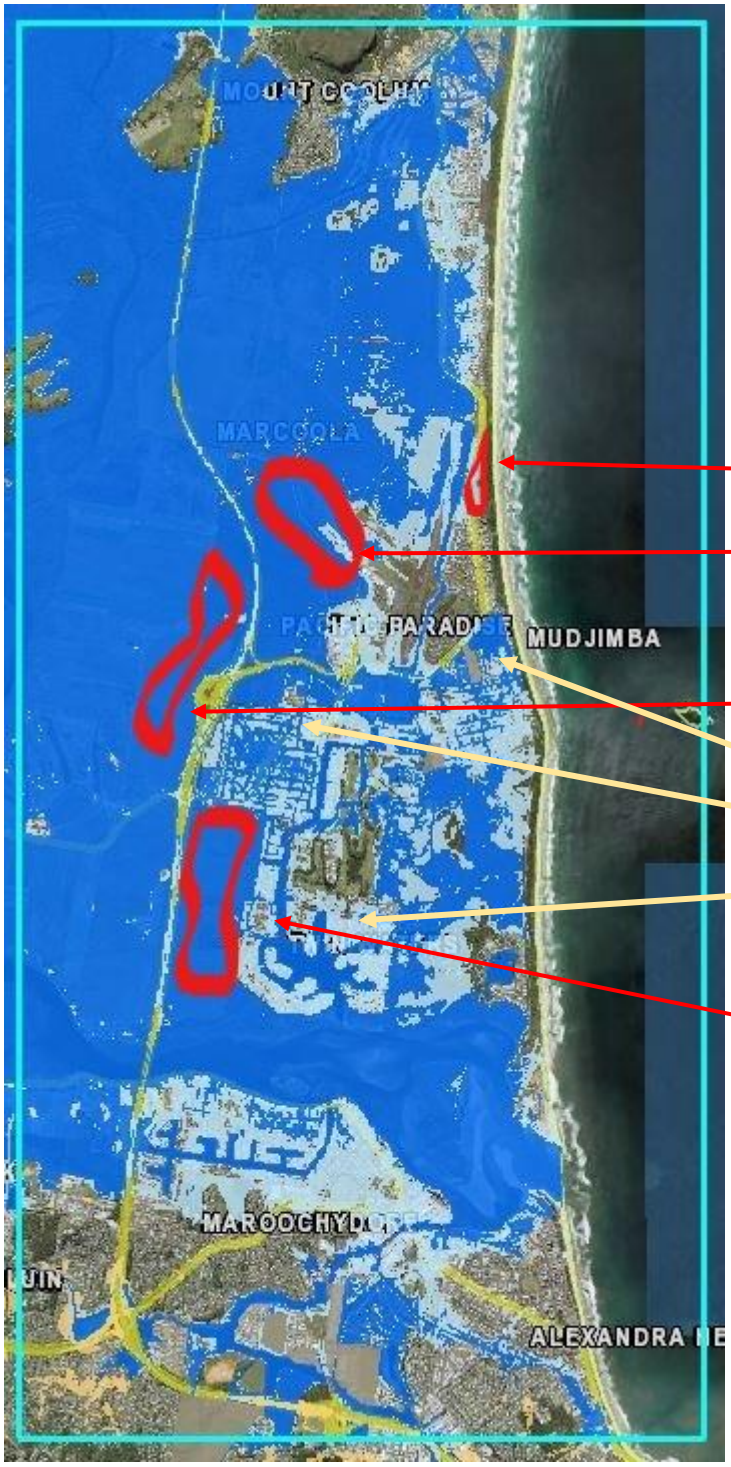
Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary

Attachment 1: Consultation process by Council for a major amendment to Sunshine Coast Planning Scheme - Twin Waters West

Public notification period was from 26 Sept to 13 Oct 2016.

Stakeholder group	Who attended	When	Outcome/response
Development Watch (DW)	Brian Raison Council staff	during public notification period 27 Sept 2016 (meeting held at the request of SCEC)	Submission opposed
SC Environment Council	Narelle McCarthy – same meeting as DW	During public notification period 27 Sept 2016	Submission opposed
Twin Waters Residents' Assn	Executive only, Council staff	1 meeting prior to public notification period	
Twin Waters Residents' Assn	Executive only	2 meetings during public notification period– 4 Oct 2016	
Twin Waters Residents' Assn (TWRA)	General meeting – 38 members supported? (SCC reports 60 attendees); Council staff, Cr Jason O'Pray	10 Oct 2016	Submission supported Many members of TWRA sent submissions opposed
Pacific Paradise Progress Assn (Only has 8 members, no pres or sec.)	10 including council staff and O'Pray, at Novotel	17 Oct 2016	Submission Supported Vice Pres formed group that opposed
Meeting called by Phil Burke, member of Mudjimba Res Assn, long term Mudjimba resident, member of public opposed to TWW	Public meeting at North Shore community centre– 120 people; Council staff; Cr O'Pray	31 Oct 2016 - 5 days before close of public notification	Vocal opposition registered at meeting
Mudjimba Residents Assn			Submission opposed
Marcoola Residents Assn			Submission opposed

Attachment 2: Potential developments on Maroochy floodplain



Marcoola Sands
(DA 5.5 ha)

SC airport runway and facilities (126 ha)

Potential industrial area under investigation

Adjacent communities potentially at increased risk: Twin Waters, Pacific Paradise, Mudjimba

Twin Waters West

(700 lots)

Attachment 3: Flooding and impacts in existing Twin Waters Community

(Aerial view, courtesy of Google Earth 2014; photos provided by TW residents for research project - Grant et al 2014)

Photo key- Clockwise from top centre.

Photo 1- Flood levels overtopping lake system impacting paths and infrastructure.

Photo 2- As above

Photo 3- Flood event impacting properties- indicates backfilling of sites for mitigation.

Photo 4- Flood levels

Photo 5- Indicates boat pontoon approximately 1 metre above normal height, due to water volumes in system after flood.

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act.

23 May 2017

Queensland Parliament
1 William Street
Brisbane QLD 40000

Attention: Premier the Honourable Annastacia Palaszczuk
Deputy Premier the Honourable Jackie Trad, Minister for Infrastructure and Planning

TWIN WATERS WEST FLOOD SUSCEPTIBILITY, SUNSHINE COAST

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act.

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act. I wish to register my major concern with Sunshine Coast Regional Council's decision to amend the Sunshine Coast Planning Scheme 2014: Major Amendment – Twin Waters West, Sept 2016. I am a consulting geotechnical and civil engineer with personal experience in design and certification of levees and dams which have involved my close professional familiarity with flood modelling studies.

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act.

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act. My personal experience of the relationships between high quality modelling and actual on-ground flood outcomes is that such models are at best a good guide to what might happen in the future, subject to limitations of knowledge and assumptions made at the time when the modelling was undertaken.

I maintain a working awareness of the findings and recommendations of the Queensland Floods Commission of Inquiry final report (QFCI, March 2012). Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance,

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act.

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act. This reinforced for me the fact that public debate and publicly available information falls well short of the standards expected following the release of the QFCI report, and the subsequent major update to Australian Rainfall and Runoff Guidelines in 2016.

I have been following public discussion regarding the approval of the planning scheme amendment which will facilitate residential development of the lower Maroochy River floodplain at Twin Waters West. Based on my understanding of information currently provided to the public, I believe that the flood modelling for this development falls far short of the standards required for informed decision making when lives and property are potentially at stake.

I urgently recommend that a floodplain modelling study be commissioned that includes within its boundaries the future filling for upgrading the Sunshine Coast Airport and potential expansion of the adjacent light industrial area, proposed finished landform and drainages for Twin Waters West, as well as existing residential areas east of the Sunshine Motorway. Based on my review of flooding information on the SCRC website, minimum requirements for reliable modelling would be:

1. a coarse-scale model of the entire Maroochy River catchment and sub-catchments, *supplemented by*:
2. an appropriately detailed model with boundaries including the entire catchment and sub-catchments downstream of the Dunethin Rock locality and specifically incorporating the areas west of the Sunshine Motorway and dynamic tidal constraints at the river mouth.

Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49 of the RTI Act.

Based on my expertise, I have prepared the attached list of reasonable minimum requirements for flood modelling that would ensure public awareness of potential future flooding scenarios particularly where there are identifiable and quantifiable risks to public safety. For reference, I also attach a summary of relevant findings and recommendations from the QFCI report.

I therefore urge that the decision to amend the Planning Scheme regarding Twin Waters West Residential Development be reversed until such time as:

- adequate flood modelling is undertaken,
- flood modelling is independently reviewed to an adequate standard,
- model outcomes and predictions are made available to the public with acceptable transparency and explanation,
- model outcomes and predictions have been given thoughtful and responsible consideration by decision-makers, particularly those elected to represent the public interest.

I have also provided a re-addressed copy of this letter to Sunshine Coast Regional Council Mayor Mark Jamieson, CEO Michael Whittaker, Cr Christian Dickson, and Mr Warren Bunker (Manager Planning and Development).

Yours faithfully

Attached: 1. List of reasonable minimum requirements for flood modelling

2 Summary of relevant findings from Queensland Flood Commission of Inquiry Final Report, March 2012

Minimum Requirements for Flood Modelling and Reporting

Clear definition of data sources

- Topo (date/year) – source/accuracy
- Infrastructure design (fill level/plan shape/slope/drains)
- Intensity/frequency/duration for rainfall (IFD)
    - Australian Rainfall and Runoff 2016 guidelines
    - Site/region specific IFD studies
- Antecedent infiltration/runoff functionality to represent prior catchment states:
    - Drought
    - Normal
    - Wetted
- Flow roughness (Manning's n or equivalent)
- Boundary conditions
    - Catchment
    - Subcatchment
    - Discharge (river/mouth is tidal)
    - Static or dynamic during rainfall event

Clear statement of how modelling was run

- Software (e.g. MIKE21)
- Outputs interrogated where?
    - Model plan
    - Related to cartography, landmarks?
- Outputs presented as?
    - Time histories
    - Contour maps
    - Animations / video simulation of time-history

Clear statement about calibration, calibrated to or 'verified' against?

- Actual flood data measured (where)
- Max levels or level/time history

Model outputs

- Comprehensible explanation of terms used
    - e.g. 100 year average recurrence interval (ARI) is 1 in 100 years event, is 1% annual exceedance probability (AEP), is Q100, and does not mean that, once it occurs, it will not occur for another 99 years! Probability concepts must be explained
- Time histories of outputs at nominated locations
    - Level/time
    - Rate of rise
    - Duration (as a function of level and location)
    - Flow rate (eg cumecs for drains to enable detailed functional design)
    - Afflux – upstream effect of flow obstruction (also known as backwater effect) e.g.
        - A filled zone
        - A bridge
        - A saltwater barrier
        - Tidal effect at river mouth
- Modelling team contact process and details for explanation in greater detail

Relevant recommendations from the Qld Flood Commission of Inquiry (chapter2 Recommendations) include (*with my comments*)**:**

A recent flood study should be available for use in floodplain management for every urban area in Queensland (rec 2.4). Where no recent study exists, one should be initiated. *Has a recent flood study been done for the Maroochy River floodplain?*

For example flood studies for Brisbane River are expected to include (rec 2.2):

- rainfall data including historical and design data and radar
  – stream flow data
  – tide levels
  – inundation levels and extents
- involve determining the correlation between any of the data sets above
- produce suitable hydrologic models run in a Monte Carlo framework, taking account of variability over the following factors:
  – spatial and temporal rainfall patterns
  – saturation of the catchment
  – initial water level in dams
  – effect of operating procedures
  – physical limitations on the operation of the dams
  – tidal conditions
  – closely occurring rainfall events
- validate hydrologic models to ensure they reproduce:
  – observed hydrograph attenuation
  – probability distributions of observed values for total flood volume and peak flow
  – timing of major tributary flows
  – observed flood behaviour under no dams conditions and current conditions
- produce a suitable hydraulic model or models that:
  – are able to determine flood heights, extents of inundation, velocities, rate of rise and duration of inundation for floods of different probabilities
  – are able to deal with movement of sediment and changes in river beds during floods
  – are able to assess historical changes to river bathymetry
  – are able to be run in a short time to allow detailed calibration and assessment work
  – characterise the backwater effect at the confluence of the Brisbane and Bremer rivers and other confluences as appropriate
- involve analysis of the joint probability of floods occurring in the Brisbane and Bremer rivers (and any other pair of rivers if considered appropriate)
- be iterative, and obtain a short-term estimate of the characteristics of floods of different probabilities in all significant locations in the catchment.

To what extent have any flood studies for the Maroochy River considered any of the above?

Councils in floodplain areas should, resources allowing, develop comprehensive floodplain management plans that accord as closely as practicable with best practice principles (2.12)
To my knowledge there is no floodplain management plan for the Maroochy River floodplain.

Councils and the Queensland Government should display on their websites all flood mapping they have commissioned or adopted. (2.16). *The flood overlays on SCRC websites indicates that there is very high risk to the existing Twin Waters community and future Twin Waters West footprint. No other commissioned flood studies are displayed on the website.*

Flood maps, and property specific flooding information intended for use by the general public, should be readily interpretable and should, where necessary, be accompanied by a comprehensible explanatory note (2.17). *While the SCRC flood overlay clearly indicates this area is flood prone, this flood overlay did not accompany the planning amendment, nor did any explanation of why the area was considered to be safe.*

The Queensland Government should consider implementing a mechanism by which prospective purchasers of property are alerted to the issue of flood risk.(2.19) *I assume that this means any Twin Waters West development would include a caveat on titles advising of flood risk. It is unclear how the existing Twin Waters community has been or would be advised of current risk, and future increased risk based on projections of sea level rise.*

A recent flood study should be available for use in floodplain management for every urban area in Queensland (2.4). *No evidence has been provided of any recent flood study for use in Maroochy River floodplain management, taking into account decisions made since 2013 such as the filling that will take place for the Sunshine Coast Airport Upgrade.*

Councils should consider using the limited development (constrained land) zone in their planning schemes for areas that have a very high flood risk (4.6). *This does not appear to have been considered in this area of very high risk.*

Councils should include a flood overlay map in their planning schemes. The map should identify the areas of a council region:

- that are known not to be affected by flood
- that are affected by flood and on which councils impose planning controls (there may be subsets in each area to which different planning controls attach)
- for which there is no flood information available to council.(5.3)

Council's amendment to enable the Twin Waters West development in a floodplain did not include a flood overlay map, which should have been the minimum flood information provided.

From:	Danika Cowie
To:	Jason Krueger
Cc:	Garth Nolan; Stephen Patey; Roma Stevenson; Crispin Smythe
Subject:	RE: Access to flood model for Twin Waters West
Date:	Tuesday, 13 June 2017 8:35:00 AM

Good morning Jason,

Thank you very much for your email.

We greatly appreciate your agreement to provide the flood modelling.

Once we have formally engaged WMA Water, I shall liaise with them about the process to make the request for the flood modelling as per your recommendation.

I will be in touch very soon.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

Customers first | Ideas into action | Unleash potential | Be courageous | Empower people

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From: Jason Krueger [mailto:Jason.Krueger@sunshinecoast.qld.gov.au]
Sent: Tuesday, 13 June 2017 8:12 AM
To: Danika Cowie
Cc: Garth Nolan; Stephen Patey; Roma Stevenson; Crispin Smythe
Subject: Access to flood model for Twin Waters West

Hi Danika,

Further to our discussion yesterday regarding the above subject, I can confirm that council is able to supply the modelling information for Twin Waters West.

Upon engagement, it would be quicker and easier for WMA Water to request the model directly from Crispin Smythe, Coordinator, Flooding and Stormwater Management Team:

Crispin.Smythe@sunshinecoast.qld.gov.au
Phone: (07) 5441 8108

Upon making this request, WMA Water will be required to sign an agreement that goes with the supply of the model, which limits its use to that described in the agreement.

Upon receipt and review of the model, Crispin has also offered to provide a briefing to representatives from WMA Water on the assumptions used in the model.

Kind regards,

Jason Krueger | Coordinator Planning Scheme and Projects

Strategic Planning Branch
Regional Strategy and Planning | Sunshine Coast Council

Phone: 07 5420 8710
Mobile: Refused under section 4
Email: jason.krueger@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Garth Nolan

From: Danika Cowie
Sent: Friday, 10 November 2017 8:17 AM
To: Erin Askew
Cc: Garth Nolan
Subject: RE: Twin Waters Wes

Good morning Erin,

I just want to touch base with you to see how you're going with finalising the report following on from our discussion last week. Can you please advise at your earliest convenience when you think we will receive the revised copy of the report?

Please feel free to contact me if you have any questions or wish to discuss the report further.

Kind regard,
Danika

From: Danika Cowie
Sent: Tuesday, 31 October 2017 3:18 PM
To: Erin Askew [Refused unde] wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Erin,

Thank you for yours and Mark's time this afternoon to discuss the draft report.

As mentioned in the meeting, could you please make the following changes to the rezoning references within the report to reflect the correct process that is being undertaken by council.

Please change any reference to "rezoning concept", "proposed concept" or "rezoning application" to state the following:

…rezoning process via an amendment to the Sunshine Coast Planning Scheme…

and then as a general reference throughout the report, refer to it as *…the rezoning process*…. Or *...planning scheme amendment process*….

If you could also reword any reference to "future assessment stages" to say, ….*future development applications for a proposed master plan*….

Please feel free to contact me if you have any questions regarding the above references.

Thank you again for all the work you have done as part of this review, it is greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Erin Askew [mailto Refused un wmawater.com.au]
Sent: Wednesday, 25 October 2017 1:51 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Twin Waters Wes

Hi Danika,
Please find attached our revised review. I have left it as a working draft to allow you to review.

Apologies again for the delay, we had a draft a few weeks ago but I became the constraint to getting it out to you.
Kind Regards,
Erin

Erin Askew
Director

E: Refused un wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

Memorandum

TO: Danika Cowie
FROM: Mark Babister
DATE: 25 October 2017
SUBJECT: Twin Waters West – Preliminary Draft Review Response
PROJECT NUMBER: 117056

1. EXECUTIVE SUMMARY

WMAwater has undertaken an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of a rezoning concept for the site. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for the proposed rezoning of the Twin Waters West site.

WMAwater undertook an initial review of the modelling and associated reporting submitted with the rezoning application. A number of recommendations and requests for clarifications were made as part of this review covering elements related to the specifics of the model structure and reasoning behind some implementations. The findings of independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council, the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken. SLR provided formal documentation of clarifications and undertook updates to the model.

WMAwater has assessed the model changes and justifications provided by SLR in response to the Twin Waters West – Preliminary Draft Review Memorandum. The majority of items have either been addressed by model updates or clarified with justification. WMAwater finds that the revised modelling and associated reporting meets the needs of the assessment for the purposes of a rezoning application.

In addition, WMAwater recommends that several key items not updated for this stage of the assessment be addressed prior to future or more detailed design modelling of the site for the purposes of a specific development application.

In order for the modelling and reporting to fulfil the requirement of informing the detailed design and be suitable for the assessment of impacts for future more development specific application stages, the following critical tasks must be undertaken:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Provide further documentation regarding the split of inflow 51 or provide supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network,
- Further supporting documentation on model development and validation.

2. TWIN WATERS WEST FLOOD MODEL REVIEW

2.1. Context

WMAwater has been engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review is to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development in the context of a rezoning application. The high level impact assessment will then be used to help inform the rezoning application for the Twin Waters West site. The preliminary findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council (SCC), the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken. SLR provided formal documentation of clarifications and undertook updates to the model. Several of the key issues and deficits have been revised. These revisions are captured in the appropriate sections of this memorandum.

The purpose of this memorandum is to assess the subsequent changes and responses from SLR made to address and respond to the preliminary review and to provide recommendations as to the suitability of the model for assessing the viability of the development in the context of a rezoning application.

2.2. Initial Review Summary

The initial report and model review (Reference 1) concluded that the Cardno TUFLOW model (Reference 2), used to assess the impact of the Twin Waters West development, was largely constructed from the SCC MIKEFLOOD model (Reference 3 and 4), utilising elements like inflow and roughness. The model diverged from the SCC model in some key areas including missing culverts or bridges, missing or diverted local runoff inflow locations and terrain elevation modifications which appeared questionable. Additionally, the provided reporting did not appropriately justify the exclusion or changes to these elements nor did the reporting adequately document the model development and validations against SCC's model. It was also found that a number of culverts or bridges within the TUFLOW model were producing unstable flow results which may be impacting on the wider model results.

Based on these facts it was found that the modelling and reporting (at the time of the review) were not adequate to determine the suitability of the modelling for assessing the impact on flood behaviour as a result of the proposed development. Furthermore, the following tasks were advised to be undertaken:

- Inclusion of missing localised inflows,
- Justification including sensitivity analysis for adopting a constant initial water level, as opposed to the spatially varying layer used in the MIKEFLOOD model,
- Sensitivity analysis of different bathymetry at the Maroochy River mouth,
- Sensitivity analysis of the changes of starting the model at timestep 0,
- Correction to the hydraulic structure instability issues,
- Justification of, or removal of questionable topographic modifications (where justification is not provided or deemed unacceptable),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification of, or inclusion of missing hydraulic structures,
- Provide further documentation regarding the split of inflow 51,
- Further supporting documentation on model development and validation.

Further details of the review are provided in Twin Waters West – Preliminary Draft Review Memorandum (Reference 1).

3. MODEL REVIEW RESPONSE

3.1. Summary of SLR Response

SLR have aimed to address or provide commentary/justification for several of the key issues outlined in Section 2.2. Details of the response/changes, including WMAwater comments, are provided in Appendix A.

The changes SLR have made to the model include the following:

- Update or justification for the use (of most) of questionable topographic modifications,
- Inclusion of missing inflow sources (please note this does not include sub-catchment 51).

Instability within the model representation of bridges and culverts (hydraulic structures) can artificially increase or decrease surrounding model results and tends to indicate that the structure representation is not appropriately functioning across a range of flood levels. While the structure may be stable at the peak of a particular event, instability at lower levels may limit the future use of the model for these smaller events. The unstable flow results at 1D hydraulic structures has not been resolved and is still present in the model. In this instance SLR has presented sound arguments regarding the impact of these flow instabilities on the water levels for the event assessed and the overall model health. Based on the purpose of the modelling in the context of a rezoning application, limited instability issues at the peak of the event assessed, WMAwater accepts that these issues do not require addressing at this stage of the modelling. However, it is still recommended that they be investigated and addressed in future assessment stages.

Additionally, in response to queries regarding missing and additional culverts when compared to the previous SCC modelling, SLR has confirmed that the culvert data included in the modelling process has been provided by SCC and is expected to be the most up to date. It was noted that existing culverts are represented equally in both the design and existing scenarios. Therefore, any missing culverts are unlikely to impact the results of this stage of the assessment.

Several key issues were not addressed by SLR. Further details of these issues are outlined in Section 3.2 and Appendix A.

3.2. WMA Response

Given the purpose of the modelling, WMAwater has found that the modelling is largely adequate for the purposes of informing the rezoning application. With that said, there are several key issues that should be resolved to improve the integrity of the model for future more detailed assessment stages. These items include:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Further supporting documentation on model development and validation.

Additional information regarding the splitting of sub-catchment 51 inflows (in comparison to the MIKEFLOOD model) was provided as part of SLR's response, whereby an argument was made that the Pacific Paradise stormwater infrastructure conveys runoff to the eastern canal system. It is unlikely that the stormwater network in this area has been designed to convey the 100 year ARI event or has the ability to capture the entirety of the runoff for this event. Further documentation regarding the split of inflow 51 or supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network should be provided in future assessment stages.

4. CONCLUSION AND RECOMMENDATIONS

WMAwater was engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impacts on flood behaviour as a result of the proposed development in the context of a rezoning application. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for the proposed rezoning of the Twin Waters West site. The findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

Due to the high-level nature of the assessment, WMAwater has found that the modelling is largely adequate for the purpose of informing the rezoning application. It is however recommended that the following critical tasks be undertaken or provided in order for the modelling and reporting to fulfil the requirement of informing the detailed design and assessment of impacts for future application stages:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Provide further documentation regarding the split of inflow 51 or provide supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network,
- Further supporting documentation on model development and validation.

5. REFERENCES

1. Twin Waters West – Preliminary Draft Review
WMAwater, August 2017

2. Flood Impact Assessment Twin Waters West Report
Cardno, April 2017

3. Maroochy River Flood Study
Sunshine Coast Regional Council, February 2010

4. Maroochy River Flood Study – Flood Hazard Mapping Project 2013/2014
Sunshine Coast Regional Council, July 2013

5. IFD 2013 Increases (%) Mapping
Sunshine Coast Regional Council, July 2013

6. B5 Airport and Surrounds – Flooding
Sunshine Coast Council & Sunshine Coast Airport

7.TUFLOW User Manual, TUFLOW.2016-03-AA
BMT WBM, April 2016

Appendix A

The queries raised by WMAwater, the responses from SLR and the subsequent response from WMAwater are provided in the tables below.

Table A1: Topographic Data

WMA Comment	SLR Response	WMA Response
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.	It is correctly noted that if the river mouth bathymetry was updated, it would likely impact both the existing and design scenarios equally. Therefore, it is unlikely to directly impact the assessment. WMAwater does recommend that an update to the river mouth bathymetry be taken in future assessment stages for the purposes of ensuring a more accurate representation of flood characteristics.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.	Noted and accepted. Refinement should be made as part of future assessment stages.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.	It is noted that 2d_zpt_Roads_Ex29 has been updated to 2d_zpt_Roads_Ex30 and has been correctly shifted to align with aerial imagery of the existing roadway.

4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are "thin" breaklines. The TUFLOW model reads the GIS layer using the "gully" parameter which ensures a continuous flowpath. It is also incorrect to say it is a "poor representation of a 20m wide channel" because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.	Section 6.8.3 of the TUFLOW manual (TUFLOW 2016-03-AA) notes the following: "The Read GIS Z Line default is to model a "thin" line which modify the ZH, ZU and ZV Zpt elevations only. If the THICK option occurs, interpolated Z values are applied to whole cells (ie. at the cell centres (ZC), all cell sides and cell corners). Other optional flags such as MAX, MIN, RIDGE or GULLY are also available." Please note that TUFLOW treats 2d_zln, 2d_zlr and 2d_zlg the same. Additionally, no "THICK" option has been applied to the 2d_zlg_Drain layer. Also note that the "GULLY" parameter does not ensure a continuous flowpath but instead only changes a Zpt elevation if the Z Shape elevation at the Zpt is lower. The above has only been included to justify the inclusion of original comments and explain how the 2d_zlg is applied by the model. It should be noted that it has minimal impact and therefore is not required in the model as the Lidar and 10m DEM appropriately represents the channels in these areas.

5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.	The primary concern of the inclusion of this layer is demonstrated in the image below. Please note that the depicted mapinfo file will create a channel from the sunshine coast motorway to the canal system (based on the placement of the nodes). This method has been included at other locations where the area is smoothed to then include a 2d layered flow constriction representation of the structure. In this case there is no 2d layered flow constriction.  As stated previously, no evidence could be found to support the inclusion of this channel. If culvert structures are located in this area, they should be included for completeness. It is noted that this inclusion is located south of the Twin Waters West site and unlikely to affect the model results at the development, however should be included for model completeness as part of future assessment stages. Additionally, this shapefile is included in both the existing and design scenario and therefore is unlikely to influence the impact assessment.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.	Noted and accepted.

7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).	Noted. This layer should be updated as part of future assessment stages as it is unlikely that a uniformly elevated bund would be constructed. The bund is currently containing water to the north of the site and may potential affect flood levels at the site.
8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.	Noted and accepted.

Table A2: Topographic Layers for Twin Waters Development

1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.	Noted and accepted. Any future assessment stages should include a representation of the lake design.

2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a “weir”. The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.	Noted and accepted. The 2d_zsh obstruction at the northern (eastern) weir location should be updated to the correct level during future assessment stages to ensure that the efficiency of the weir is correctly represented and not potentially overstated.
3. Conservative approach to modelling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.	Noted and accepted. Any future assessment stages should include a representation of the site design.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.	Noted and accepted. During future assessment stages the modelling of the bridge structure (as the current design removes the existing bridge) should be modelled.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.

Table A3: Local Inflow

<table>
<tr>
<td>The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behaviour at the site.</td>
<td>These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.
Peak Flood Levels Within Subject Site (mAHD)
<table>
<tr><th>Flood Event</th><th>Northern End</th><th>Southern End</th></tr>
<tr><td>Existing 1% AEP (without 4 local inflows)</td><td>2.402</td><td>2.124</td></tr>
<tr><td>Existing 1% AEP (with 4 local inflows)</td><td>2.402</td><td>2.125</td></tr>
<tr><td>Existing 1% AEP + CC (without 4 local inflows)</td><td>2.903</td><td>2.757</td></tr>
<tr><td>Existing 1% AEP + CC (with 4 local inflows)</td><td>2.903</td><td>2.758</td></tr>
</table>
</td>
<td>Noted and accepted.

Please note that providing the location of the extracted values on a figure (with the table) would provide further context.</td>
</tr>
<tr>
<td>Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.</td>
<td>Sub-catchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of sub-catchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake. A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.</td>
<td>It is noted that there is a stormwater network within the Pacific Paradise development that includes a 1200mm discharge pipe to the canal system but it is unlikely that the stormwater network would be designed to convey the 100 year ARI event.

Further justification for this choice is required as part of future assessment stages – (as a minimum) supporting calculations showing that the 100 year ARI event runoff is captured and conveyed by the existing stormwater network/overland flow system should be provided.

If this is undertaken and it is found that the system does not capture the significant portion of stormwater runoff and convey it to the canal system, an update to the hydrology should be undertaken. Consequently, the hydraulic model would need to be updated accordingly.</td>
</tr>
</table>

Table A4: Initial Water Level

The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.	The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.	Noted. As this methodology is applied in both the existing and design scenarios it is unlikely to impact the purpose of the assessment. It should be noted that running the model for the full duration and adopting the spatially varying initial water level would remove this issue. Similarly, justification (or comparison to the full length run scenario) regarding the choice to reduce the model run time should be provided with future assessment stages.

Table A5: Hydraulic Structures

<table>
<tr>
<td>There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.</td>
<td>Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1. The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly.

Hydraulic Structures – 1% AEP Flood Event
<table>
<tr><th>Structure</th><th>Peak Discharge (m³/s)</th><th>Structure Head Loss (m)</th></tr>
<tr><td>12A (Northern Culverts)</td><td>84.6</td><td>TUFLOW = 30 mm
HEC-RAS = 30 mm</td></tr>
<tr><td>11E (Southern Culverts)</td><td>53.0</td><td>TUFLOW = 50 mm
HEC-RAS = 50 mm</td></tr>
</table>
</td>
<td>Noted and accepted. Details of these calculations should be documented in the reporting accompanying any future assessment stages.</td>
</tr>
</table>

A number of structures within the TUFLOW model have instability issues.	The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs. The noted structures are remote from the subject site and do not affect the calculated results. The results at the structures are generally stable around the peak of the flood event. The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.	It is noted that the flow instabilities are not proportional to the water level instabilities. Additionally, as stated, the instabilities do not tend to occur during the peak of the assessed event. The cumulative model error is low and the peak error is also reasonably low indicating a healthy model. With these points noted, instabilities should not be ignored and WMAwater recommends that these issues be fixed for any future assessment stages. It is not reasonable to state that the culverts are not near to the site and therefore should have minimal impact on the assessment. The culverts have a direct impact on flow conveyance from west to east (under the sunshine coast motorway) and therefore are likely to directly impact areas around the motorway – particularly in events where the motorway is not overtopped.
Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts	In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.	Noted and accepted.
Structures not included from MIKE model (but within TUFLOW model extent).	• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event. • Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event. • Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.	Noted. Confirmation of culvert sizing to determine significance should be undertaken and detailed included in future assessment stages.
Structures only included in TUFLOW Model	Details of these structures were provided by SCC: • 12A is located under the Sunshine Motorway near Finland Road. • DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters. • SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.	Noted and accepted.

Garth Nolan

From: Erin Askew [Refused und] wmawater.com.au>
Sent: Wednesday, 18 October 2017 9:20 AM
To: Danika Cowie
Cc: Garth Nolan
Subject: RE: Twin Waters West and Extension of Contract

Hi Danika,
My apologies, I have been caught up over the last week or so with a series of minor emergencies. I have a draft of the final report that I am sitting down right now to review. All going well I will be able to send a copy through for your review over the next day or so.
Ill keep you informed if there is more work needed after my review.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Tuesday, 17 October 2017 12:55 PM
To: Erin Askew [Refused und] wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters West and Extension of Contract

Hi Erin,

I have tried to contact you a number of times over the past week as I am just wanting to touch base with you to see how the final report is going and if there are any issues?

We are also wondering what the anticipated timeframe is for the final report.

If you could let me know as soon as possible that would be greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

Customers first | **Ideas into action** | **Unleash potential** | **Be courageous** | **Empower people**

From: Danika Cowie
Sent: Thursday, 12 October 2017 10:19 AM
To: Erin Askew [Refused und] wmawater.com.au>
Subject: RE: Extension of Contract

Hi Erin,

I just wanted to touch base with you to see how the final report is going for Twin Waters West, and if you could advise on an approximate timeframe on when we may receive it.
Also can you please advise if you have been able to work out the details for the contract extension as per my email on the 19 September 2017? Procurement are still chasing for the info. If you do have the information, please send it onto me and I can forward it onto procurement to finalise.

Please feel free to give me a call if you have any questions or wish to discuss the report of the procurement information further.

Kind regards,

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From: Danika Cowie
Sent: Tuesday, 26 September 2017 3:47 PM
To: 'Erin Askew' Refused under s wmawater.com.au>
Subject: Extension of Contract

FYI

From: Danika Cowie
Sent: Tuesday, 19 September 2017 3:47 PM
To: Refused under s wmawater.com.au
Cc: Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Mark,

Following on from Nathan's email regarding extending the contract for WMA Water to review the Twin Waters West flood modelling information. To assist in preparing the procurement paperwork, are you able to advise on an approximate timeframe for WMA Water to complete this next stage of work based on what was agreed at the meeting held on 7 September 2017 and provide approximate costs to complete the work.

Please feel free to contact me if you have any questions regarding the above request.

Kind regards,

Danika Cowie
Principal Planning Officer
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post PO Box 1129 Maroochydore QLD 4558
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p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Nathan Rule
Sent: Thursday, 31 August 2017 9:30 PM
To: Refused under s wmawater.com.au
Cc: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>; Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>; Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Extension of Contract

Hi Mark

I'd like to confirm that we will be extending our contract with WMA Water (contract number DILGP-0289-17) in relation to the Flood Assessment Review for Twin Waters.

We will provide a formal letter stating the new terms of the contract (extended timeframe, scope and cost, including reimbursing travel expenses) once we have held the client meeting with Council, so we can confirm the new details.

In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m.** Refused under sectio | **e.** nathan.rule@dilgp.qld.gov.au

Garth Nolan

From: Danika Cowie
Sent: Tuesday, 24 October 2017 2:49 PM
To: Erin Askew
Cc: Garth Nolan
Subject: RE: Twin Waters West and Extension of Contract

Hi Erin,

That's great news. When you send the report through can you please send it to both myself and Garth Nolan as I am on leave from tomorrow and will be back in the office next Monday.

Kind regards,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Tuesday, 24 October 2017 2:44 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters West and Extension of Contract

Hi Danika,
I was just about to return your call. I am going to finalise the report tonight and get you a draft for review tomorrow.
My greatest apologies for the delay.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Tuesday, 24 October 2017 3:28 PM
To: Erin Askew Refused unde wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Twin Waters West and Extension of Contract

Hi Erin,

How are you going with the review of the report?
My management is madly chasing the report and would like to get an idea on when we can expect to receive it.
If you could please let me know that would be greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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Sent: Wednesday, 18 October 2017 9:20 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters West and Extension of Contract

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Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
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Principal Planning Officer
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Department of Infrastructure, Local Government and Planning
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Kind regards,

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Principal Planning Officer
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Subject: Extension of Contract

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In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m.** Refused under sectio | **e.** nathan.rule@dilgp.qld.gov.au

Department does not accept any responsibility for any loss or damage that may result from reliance on, or use of, any information contained in this email and/or attachments.

Sue-Ellen Goldfinch

From: Danika Cowie
Sent: Thursday, 10 August 2017 1:20 PM
To: Garth Nolan
Subject: RE: WMAwater FileSender: Preliminary Draft Review - Figures

Here is the second link

From: Refused und wmawater.com.au [mailto Refused und wmawater.com.au]
Sent: Thursday, 10 August 2017 8:25 AM
To: Danika Cowie
Cc: Refused und wmawater.com.au
Subject: WMAwater FileSender: Preliminary Draft Review - Figures

Dear Sir, Madam,

The file below has been uploaded to WMAwater FileSender by Refused unde wmawater.com.au and you have been granted permission to download this file.

Filename	Filesize	Download link	Valid until
PreliminaryWorkingMemo_TWWReview_170809_FIG.pdf	50.74 MB	Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49	08-11-2017

Personal message from Refused under wmawater.com.au:

Hi Danika,
I have attached for download our preliminary draft review Figures. The text will be sent separately.
I will send a separate email setting out a way forward.
This link can be forwarded to others for download.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

Garth Nolan

From: Danika Cowie
Sent: Monday, 12 June 2017 8:23 AM
To: Garth Nolan
Subject: Request for a fee proposal - Independant third party review of Flood Impact Assessment
Attachments: P170609_TwinWatersWest.pdf

Hi Garth,

Please find attached the fee proposal from WMA Water. Let me know what needs to be done with this one given that the fee proposal is above $10,000.

Kind regards,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Friday, 9 June 2017 5:00 PM
To: Danika Cowie
Cc: Mark Babister
Subject: RE: Request for a fee proposal - Independant third party review of Flood Impact Assessment

Hi Danika,
Please find attached our proposal for the independent third party review of the flood impact assessment for the Twin Waters West development.
Kind Regards,

Erin Askew
Director

E: Refused ur wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Wednesday, 7 June 2017 2:36 PM
To: Refused under s wmawater.com.au
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Request for a fee proposal - Independant third party review of Flood Impact Assessment

Good afternoon Mark,

Thank you for taking to the time to talk with me today. As I mentioned on the phone, the Department of Infrastructure, Local Government and Planning are currently finalising an assessment of a proposed major amendment to the *Sunshine Coast Planning Scheme 2014*, which related to a development site known as Twin Waters West. In order to complete the final state interest review for this proposed major amendment (now in adoption stage), we are seeking an engineering consultant to conduct an independent third party review of the Flood Impact Assessment (FIA) that has been provided by the Sunshine Coast Regional Council, justifying the proposed development master plan and

concluding that there will be no worsening as a result of the site known as Twin Waters West being developed. *Please note that the FIA was prepared by Cardno on behalf of the Twin Waters West site land owner, Stocklands.*

Therefore, we would like to formally request you to provide a fee proposal to carry out the independent third party review. In the fee proposal could you please include the proposed scope of works that will form part of your review and the estimated timeframe to complete the review. Could you also please advise if your consultancy has any actual or perceived conflict of interest relating to this matter.

To assist you with responding to this request, I have provided a link below to the council's website outlining the proposed major amendment and support documentation the council has made publicly available regarding the flooding matters relevant to the scheme amendment.

https://www.sunshinecoast.qld.gov.au/Development/Planning-Documents/Sunshine-Coast-Planning-Scheme-2014/Amendments-to-the-Sunshine-Coast-Planning-Scheme-2014/Proposed-Amendments-Approved-by-Council-for-Adoption

Please feel free to contact me if you have any questions regarding the proposed major amendment and/or this request.

I look forward to hearing from you soon.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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Department of Infrastructure, Local Government and Planning
PO Box 1129
MAROOCHYDORE QLD 4558

EOI/P170609_TwinWatersWest

9 June 2017

Attention: Danika Cowie

Dear Danika,

Re: Independent Third Party Review of Flood Impact Assessment
Twin Waters West
Proposal for Consulting Services

Thank you for your email on the 7th June 2017 requesting this quotation for a review of the flood impact assessment that has been undertaken for the Twin Waters West development. Our proposed scope has been based on the information included with your email and our telephone discussion.

Overview

Sunshine Coast Council seeks to rezone Rural zone land under the Sunshine Coast Planning Scheme 2014 for the Twin Waters West development. The proposed rezoning area is subject to flooding and proposed changes to land form have been assessed as part of a Flood Impact Assessment. The Flood Impact Assessment assessed the viability of a flood solution concept for offsetting flood impacts. There were a number of submissions during the public consultation period with specific concerns related to worsening flood impacts as a result of the development.

WMAwater will review the work undertaken in the Flood Impact Assessment to ensure that best practice approaches have been used and the appropriateness of the proposed flood solution concept. WMAwater's work will give the Department of Infrastructure, Local Government and Planning the opportunity to critically examine work to date and to further understand this key site constraint.

WMAwater Pty Ltd

DIRECTORS
M K Babister, RPEQ
R W Dewar
E J Askew
F L N Ling, RPEQ

SENIOR ASSOCIATES
R Hardwick Jones
M E Retallick

ABN 14 600 315 053

Level 2, 160 Clarence St, SYDNEY NSW 2000
Phone: 02 9299 2855 Fax: 02 9262 6208
Email: enquiry@wmawater.com.au
Website: wmawater.com.au

Previous Experience and Staff

WMAwater are a consultancy specialising in flooding, with offices in Brisbane, Sydney and Hobart. WMAwater carry out a variety of flood related work including data collection and review, flood studies, hydrologic and hydraulic modelling and model review assessments. A key part of WMAwater's experience is in carrying out review work for government departments and local government.

The work would be undertaken by Mark Babister and Erin Askew. Mark is WMAwater's Managing Director and a national leader in floodplain management and analysis. Mark has held key roles in the development of a number of national best practice documents including Australian Rainfall and Runoff, ensuring these principles are applied to the review. Erin is a Director at WMAwater and has 15 years' experience in the fields of hydrologic and hydraulic modelling and floodplain management. Erin has carried out numerous flood and floodplain risk management studies and has experience in the review of work undertaken by other consultants.

Proposed Methodology

1. **Review of Available Information**

The aim of this phase will be to collate and review the available models and underlying data that informs the models. The reports, models (hydrologic and hydraulic) and input survey data associated with the assessment will form the main basis of review material. The project personnel will draw on their prior experience and knowledge to provide insight to the review.

2. **Review of Hydrological and Hydraulic model**

Our initial approach would be to review the overall modelling in terms of assumptions and results. The hydraulic model review will be undertaken considering the model setup in terms of general structure and model run parameters. The assumptions and parameters adopted in the hydrological model will be reviewed to determine suitability of the model. Further, review of the results of the modelling will be undertaken to determine suitability for use.

The approach to carry out the calibration and validation stages of the work will be reviewed to determine whether the model emulates catchment behaviour during flood events.

Key parameters to be include:

- Model boundary conditions;
- Bed roughness values;
- Schematisation of significant hydraulic features; and
- Results and design flood levels.

The associated documentation of the modelling methodology would also be reviewed for consistency with best practice and suitability of the modelling for the assessment of flood impacts and solution concepts at the site.

3. **Review of Flood Solution Concept**

This stage will include a review of the proposed flood solution concept in terms of its practicality and appropriateness for minimising flood impacts. In addition modelling of the concept would be reviewed. Comment will also be provided on limits of acceptable flood impacts.

Timetable

The review can be completed up to draft within 15 business days of this proposal being accepted and provision of all associated report and modelling files. Immediately on receipt of the modelling files we would undertake a review for completeness. Experience has shown that there can sometimes be some back and forth to obtain the correct files.

Budget

Costs are provided in the table below.

Rate (ex GST)	$	Refused under s	$	Refused under s	$	Refused under
		MB		EA		Engineer
Review of Available Information	Refused under section 47(3)(b) of the RTI Act. Disclosure would, on				$	Refused under section
Review Hydrologic and Hydraulic Model					$	
Review Flood Solution Concept					$	
Document Findings					$	
Liaison					$	
SUBTOTAL					**$**	
GST					$	
TOTAL (incl GST)					**$**	**17,248.00**

Our budget has allowed for a desktop review and as such we have not allowed for any site inspections or meetings on site. Should attendance at any meetings be required these can be carried out on a time and expense basis. Charge out rates for staff are provided in the table above.

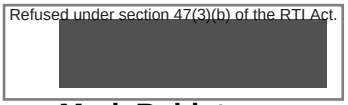
Potential Conflict of Interest

WMAwater has not undertaken any previous work associated with the Twin Waters West development or for Sunshine Coast Council. WMAwater are currently listed as a pre qualified supplier on Council's Regional Planning Services Arrangement No. R151. Category F - Hydrology / Hydraulic Services. We do not see this as a conflict of interest relating to this matter.

If you have any queries please do not hesitate to contact the undersigned on 9299 2855.

Yours Sincerely,

WMAwater



Mark Babister

Director

Garth Nolan

From: Stephen Patey <Stephen.Patey@sunshinecoast.qld.gov.au>
Sent: Tuesday, 29 August 2017 11:01 AM
To: Garth Nolan
Cc: Jason Krueger; Roma Stevenson; Crispin Smythe; Geoffrey Newell; Danika Cowie
Subject: Request for meeting with WMA Water regarding flood issues associated with proposed planning scheme amendment

Hi Garth,

Thanks for the opportunity to meet with yourself and Danika last week

As discussed at that meeting I would like the opportunity for Council's and Stockland's flooding technical experts to meet with the Department's Peer Review Consultant (WMA Water) to further discuss the issues raised in the preliminary report.

I see this as the shortest and most effective way to achieve a better understanding on behalf of all parties and to ensure that Council's response fully addresses the issues that have been raised.

I would anticipate that this meeting should probably involve the following participants:-

- Departmental representatives as you see fit;
- WMA Water representatives;
- Crispin Smythe and Geoff Newell from SCRC;
- Trevor Johnson and Kevin Covey representing Stockland;
- Either myself or Jason Krueger as planning representatives from SCRC.

As you would appreciate, Council is keen to move this matter forward and in this regard, I would be appreciative if a suitable meeting time could be arranged as soon as practicable.

Please don't hesitate to contact me if you have any queries or wish to discuss further.

Kind regards,

Stephen Patey | Manager
Strategic Planning Branch
Planning and Environment Department | Sunshine Coast Council

Phone: 07 5420 8785
Mobile: Refused under section 47
Mailcode: CR17
Email: stephen.patey@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Garth Nolan

From: Matthew Byrne [Refused under section 47(3] stockland.com.au>
Sent: Wednesday, 30 August 2017 2:24 PM
To: Stephen Patey; Garth Nolan; Nathan Rule; Trevor Johnson; Kevin Covey (kevinc@covey.com.au); Matt Paterson; Graeme Bolton
Cc: Jason Krueger; Roma Stevenson; Crispin Smythe; Geoffrey Newell; Danika Cowie
Subject: Twin Waters - Request for meeting with WMA Water regarding flood issues associated with proposed planning scheme amendment

Hi Nathan,

Thankyou for meeting with us yesterday.

Any update on the timing of this meeting?

Regards,

Matthew Byrne
Senior Economic Development Manager

Sunshine Coast - Residential Development QLD
Stockland, Level 1/8 Innovation Parkway, BIRTINYA Q 4575

T [Refused under section 4] **M** [Refused under section 47(3)(b) of th]
F 07) 5491 0144 **E** stockland.com.au

Experience Stockland today at http://www.stockland.com.au/

Please consider the environment before you print this email.

From: Stephen Patey [mailto:Stephen.Patey@sunshinecoast.qld.gov.au]
Sent: Tuesday, 29 August 2017 11:01 AM
To: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Cc: Jason Krueger <Jason.Krueger@sunshinecoast.qld.gov.au>; Roma Stevenson <Roma.Stevenson@sunshinecoast.qld.gov.au>; Crispin Smythe <Crispin.Smythe@sunshinecoast.qld.gov.au>; Geoffrey Newell <Geoffrey.Newell@sunshinecoast.qld.gov.au>; Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
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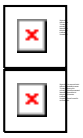
Strategic Planning Branch
Planning and Environment Department | Sunshine Coast Council

Phone: 07 5420 8785
Mobile: Refused under section 41
Mailcode: CR17
Email: stephen.patey@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560



Garth Nolan

From: Michael Della <Refused under slrconsulting.com>
Sent: Thursday, 14 September 2017 5:30 PM
To: Refused under section wmawater.com.au
Cc: Trevor Johnson; Refused under section 47(3)(b) of the RTI Act. Disclosur stockland.com.au); Matthew Byrne Refused under section 47(3) stockland.com.au); Garth Nolan; Nathan Rule; geoffrey.newell@sunshinecoast.qld.gov.au; crispin.smythe@sunshinecoast.qld.gov.au; stephen.patey@sunshinecoast.qld.gov.au
Subject: Twin Waters West - Updated Flood Modelling
Attachments: WMA Response 20170914.pdf

Hi Mark

We have updated the flood modelling as per our meeting last week. You will shortly receive an email inviting you to download the model files and associated results.

The attached PDF contains our previous responses, and explains the revised modelling. A README.TXT file is also included in the downloads.

Please don't hesitate to contact me if you require any further information.

Regards

SLR

Michael Della
Technical Director - Water Advisory
d Refused under section 47
m
o +61 7 3858 4800
e Refused under section 47(3)(b) of the

SLR Consulting Australia Pty Ltd
Level 2, 15 Astor Terrace, Spring Hill, QLD, 4000

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TWIN WATERS WEST

FLOOD MODELLING

Responses to the queries raised by WMA Water are provided in the Table below.

Updated flood model have also been provided. These flood models include:

- revisions to the Existing Case model to improve the definition of flow through 1D culverts;
- a revised development layout; and
- sensitivity analysis of the inflow hydrograph from subcatchment 51.

WMA Comment	SLR Response
Section 4.3. Topographic Data and Table A1. Topographic Data	
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.
4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are “thin” breaklines. The TUFLOW model reads the GIS layer using the “gully” parameter which ensures a continuous flowpath. It is also incorrect to say it is a “poor representation of a 20m wide channel” because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.
5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.
7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).

8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.
Table A2. Topographic Layers for Twin Waters Development	
1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model.. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.
2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a "weir". The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.
3. Conservative approach to modeling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.

Section 4.4.2. Local Inflow

The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behavior at the site.

These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.

Peak Flood Levels Within Subject Site (mAHD)

Flood Event	Northern End	Southern End
Existing 1% AEP (without 4 local inflows)	2.402	2.124
Existing 1% AEP (with 4 local inflows)	2.402	2.125
Existing 1% AEP + CC (without 4 local inflows)	2.903	2.757
Existing 1% AEP + CC (with 4 local inflows)	2.903	2.758

Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.

Subcatchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of subcatchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake.

A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.

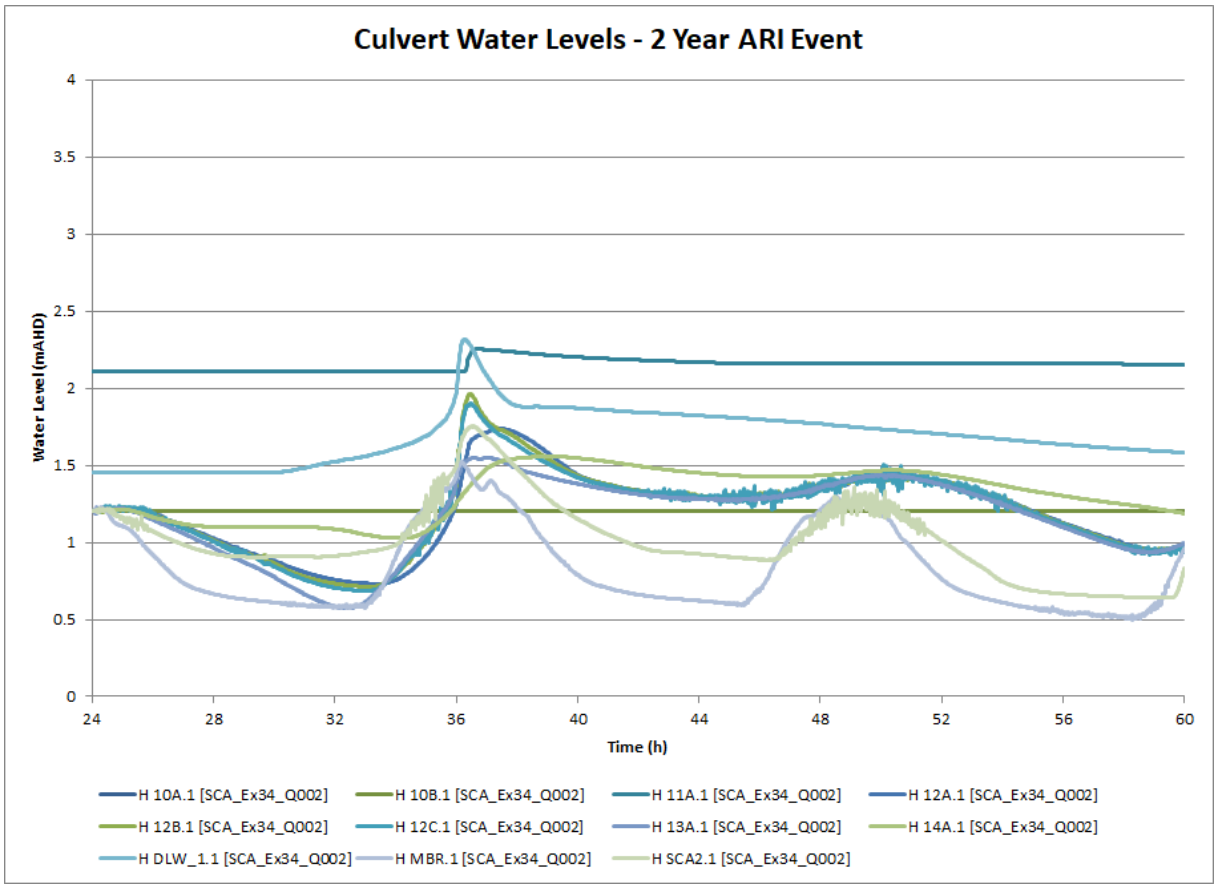
Section 4.4.4. Initial Water Level

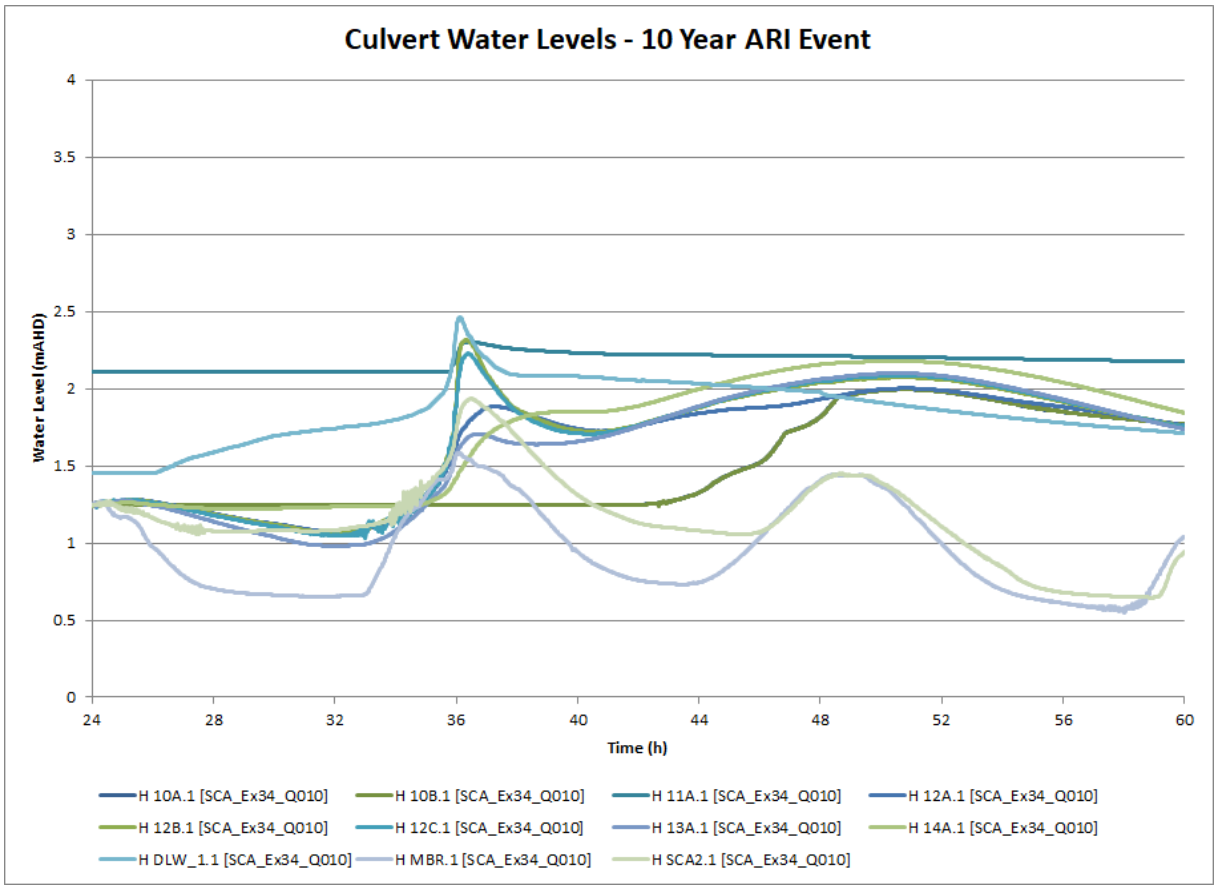
The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.

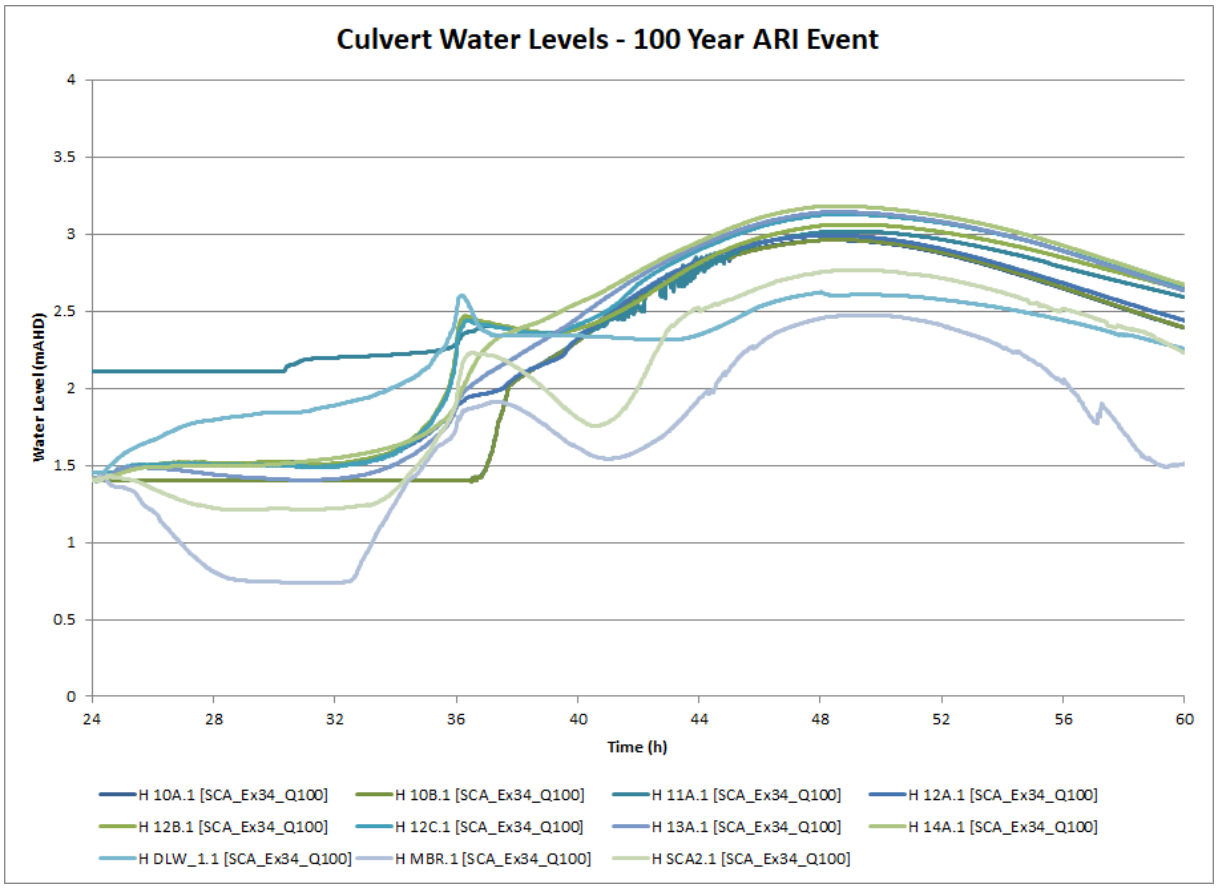
The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.

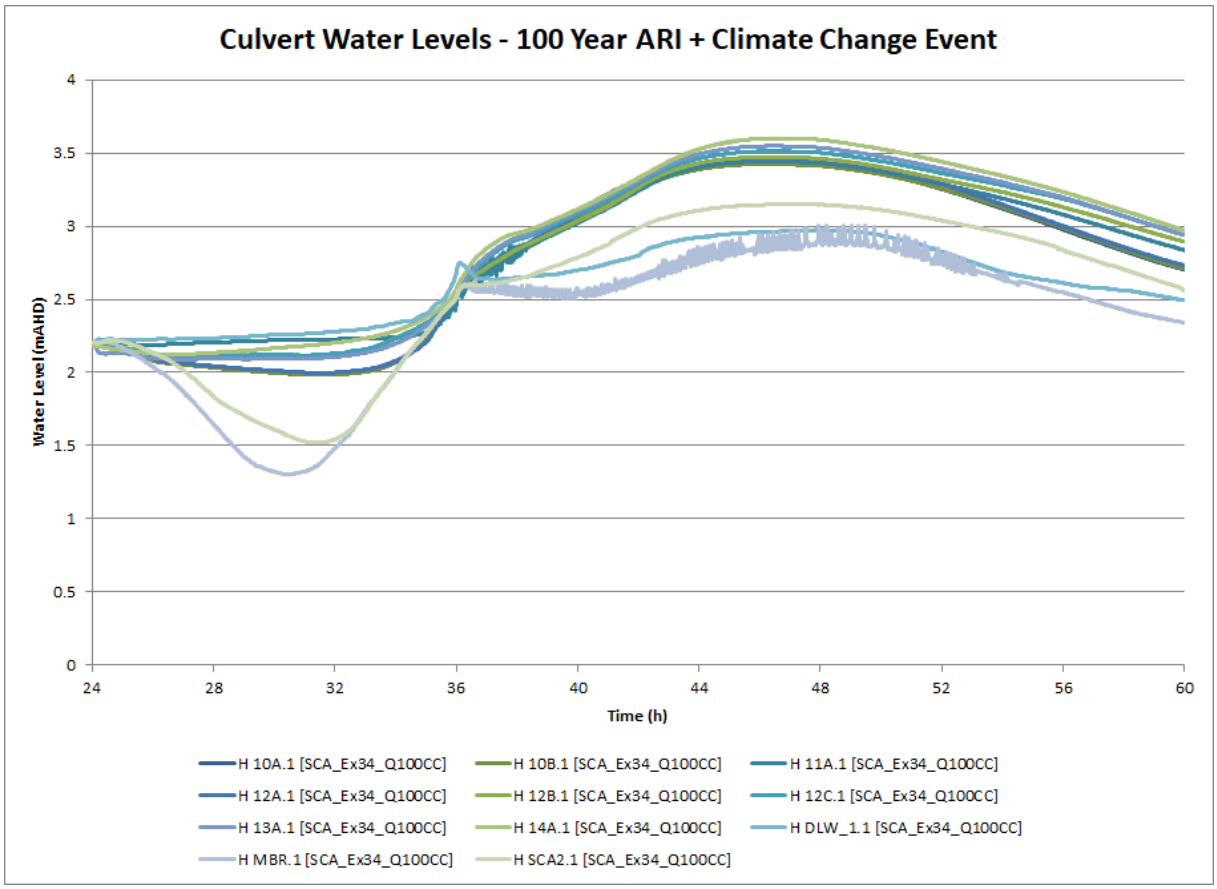
<table>
<tr><th colspan="2">Section 4.6. Hydraulic Structures & Table C1: Hydraulic Structures</th></tr>
<tr><td>There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.</td><td>Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1.
The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly.

Hydraulic Structures – 1% AEP Flood Event
<table><tr><th>Structure</th><th>Peak Discharge (m^3/s)</th><th>Structure Head Loss (m)</th></tr><tr><td>12A (Northern Culverts)</td><td>84.6</td><td>TUFLOW = 30 mm
HEC-RAS = 30 mm</td></tr><tr><td>11E (Southern Culverts)</td><td>53.0</td><td>TUFLOW = 50 mm
HEC-RAS = 50 mm</td></tr></table></td></tr>
<tr><td>A number of structures within the TUFLOW model have instability issues.</td><td>The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs.
The noted structures are remote from the subject site and do not affect the calculated results.
The results at the structures are generally stable around the peak of the flood event.
The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.</td></tr>
<tr><td>Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts</td><td>In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.</td></tr>
<tr><td>Structures not included from MIKE model (but within TUFLOW model extent).</td><td>• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event.
• Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event.
• Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.</td></tr>
<tr><td>Structures only included in TUFLOW Model</td><td>Details of these structures were provided by SCC:
• 12A is located under the Sunshine Motorway near Finland Road.
• DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters.
• SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.</td></tr>
</table>


Culvert Water Levels - 2 Year ARI Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q002]
H 10B.1 [SCA_Ex34_Q002]
H 11A.1 [SCA_Ex34_Q002]
H 12A.1 [SCA_Ex34_Q002]
H 12B.1 [SCA_Ex34_Q002]
H 12C.1 [SCA_Ex34_Q002]
H 13A.1 [SCA_Ex34_Q002]
H 14A.1 [SCA_Ex34_Q002]
H DLW_1.1 [SCA_Ex34_Q002]
H MBR.1 [SCA_Ex34_Q002]
H SCA2.1 [SCA_Ex34_Q002]


Culvert Water Levels - 10 Year ARI Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q010]
H 10B.1 [SCA_Ex34_Q010]
H 11A.1 [SCA_Ex34_Q010]
H 12A.1 [SCA_Ex34_Q010]
H 12B.1 [SCA_Ex34_Q010]
H 12C.1 [SCA_Ex34_Q010]
H 13A.1 [SCA_Ex34_Q010]
H 14A.1 [SCA_Ex34_Q010]
H DLW_1.1 [SCA_Ex34_Q010]
H MBR.1 [SCA_Ex34_Q010]
H SCA2.1 [SCA_Ex34_Q010]


Culvert Water Levels - 100 Year ARI Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q100]
H 10B.1 [SCA_Ex34_Q100]
H 11A.1 [SCA_Ex34_Q100]
H 12A.1 [SCA_Ex34_Q100]
H 12B.1 [SCA_Ex34_Q100]
H 12C.1 [SCA_Ex34_Q100]
H 13A.1 [SCA_Ex34_Q100]
H 14A.1 [SCA_Ex34_Q100]
H DLW_1.1 [SCA_Ex34_Q100]
H MBR.1 [SCA_Ex34_Q100]
H SCA2.1 [SCA_Ex34_Q100]


Culvert Water Levels - 100 Year ARI + Climate Change Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q100CC]
H 10B.1 [SCA_Ex34_Q100CC]
H 11A.1 [SCA_Ex34_Q100CC]
H 12A.1 [SCA_Ex34_Q100CC]
H 12B.1 [SCA_Ex34_Q100CC]
H 12C.1 [SCA_Ex34_Q100CC]
H 13A.1 [SCA_Ex34_Q100CC]
H 14A.1 [SCA_Ex34_Q100CC]
H DLW_1.1 [SCA_Ex34_Q100CC]
H MBR.1 [SCA_Ex34_Q100CC]
H SCA2.1 [SCA_Ex34_Q100CC]

Garth Nolan

From: Danika Cowie
Sent: Monday, 20 November 2017 11:07 AM
To: Garth Nolan; Nathan Rule; Graeme Bolton
Subject: Twin Waters West - WMA Water draft report
Attachments: DraftResponseMemo_TWWReview_171117_Rev2.pdf

Good morning,

Please find attached the updated draft report from WMA Water for TWW flood modelling review.

I have read through it and consider this revised draft report to reflect the changes requested.

Please let me know if you have any questions regarding the attached draft report. Otherwise, if you are all happy with this draft please let me know and I will ask WMA Water to issue the final version.

Kind regards,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Friday, 17 November 2017 9:16 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Danika,
Please find attached the updated report. Please let me know if you require any further refinements.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Wednesday, 15 November 2017 12:16 PM
To: Erin Askew <Refused und wmawater.com.au>
Subject: RE: Twin Waters Wes

Hi Erin,

How are you going with finalising the report? My management is anxious to get have the report finalised as soon as possible.

Can you please give me a call if there are likely to be any delays with finalising the report.

Kind regards,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Friday, 10 November 2017 8:24 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Danika,
I am currently out of the office undertaking a series of community consultation sessions and have not been able to make those final changes. I am back in the office early next week and this is at the top of my list. Ill touch base on Monday or Tuesday.
Kind Regards
Erin

Memorandum

TO: Danika Cowie
FROM: Mark Babister
DATE: 17 November 2017
SUBJECT: Twin Waters West – Preliminary Draft Review Response
PROJECT NUMBER: 117056

1. EXECUTIVE SUMMARY

WMAwater has undertaken an independent third party review of the Flood Impact Assessment for the Twin Waters West site submitted in support of a proposed Sunshine Coast Planning Scheme amendment. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of the rezoning process. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for a planning scheme amendment of the Twin Waters West site.

WMAwater undertook an initial review of the modelling and associated reporting submitted as part of the rezoning process. A number of recommendations and requests for clarifications were made as part of this initial review covering elements related to the specifics of the model structure and reasoning behind some implementations. The findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council, the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken for the rezoning process. SLR provided formal documentation of clarifications and undertook updates to the model.

WMAwater has assessed the model updates and documentation provided by SLR in response to the Twin Waters West – Preliminary Draft Review Memorandum. The majority of items have either been addressed by model updates or clarified with justification. WMAwater finds that the revised modelling and associated reporting is suitable for use in the context of the rezoning process.

In addition, WMAwater has made recommendations for model improvements that should be addressed prior to use of the model for assessment to support future development applications for a proposed master plan.

2. TWIN WATERS WEST FLOOD MODEL REVIEW

2.1. Context

WMAwater has been engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for the Twin Waters West site. The primary aim of the review is to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of a rezoning process via an amendment to the Sunshine Coast Planning Scheme. The high level impact assessment will then be used to help inform the planning scheme amendment process for the Twin Waters West site. The preliminary findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council (SCC), the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential model updates to be undertaken for the rezoning process. SLR provided formal documentation of clarifications and undertook updates to the model. Several of the key issues and deficits have been revised or updated. These revisions are captured in the appropriate sections of this memorandum.

The purpose of this memorandum is to assess the subsequent changes and responses from SLR made to address and respond to the preliminary review and to provide recommendations as to the suitability of the model for assessing the viability of the development in the context of the planning scheme amendment process.

2.2. Initial Review Summary

The initial report and model review (Reference 1) concluded that the Cardno TUFLOW model (Reference 2), used to assess the flood behaviour impact of the Twin Waters West development, was largely constructed from the SCC MIKEFLOOD model (Reference 3 and 4), utilising elements like inflow and roughness. The model diverged from the SCC model in some key areas including missing culverts or bridges, missing or diverted local runoff inflow locations and terrain elevation modifications which appeared questionable. Additionally, the provided reporting did not appropriately justify the exclusion or changes to these elements nor did the reporting adequately document the model development and validations against SCC's model. It was also found that a number of culverts or bridges within the TUFLOW model were producing unstable flow results which may impact on the wider model results.

Based on these facts it was found that the modelling and reporting (at the time of the review) were not adequate to determine the suitability of the modelling for assessing the impact on flood behaviour as a result of the proposed development in the context of a planning scheme amendment. Furthermore, the following tasks were advised to be undertaken:

- Inclusion of missing localised inflows,
- Justification including sensitivity analysis for adopting a constant initial water level, as opposed to the spatially varying layer used in the MIKEFLOOD model,
- Sensitivity analysis of different bathymetry at the Maroochy River mouth,
- Sensitivity analysis of the changes of starting the model at timestep 0,
- Correction to the hydraulic structure instability issues,
- Justification of, or removal of questionable topographic modifications (where justification is not provided or deemed unacceptable),

- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification of, or inclusion of missing hydraulic structures,
- Provide further documentation regarding the split of inflow 51,
- Further supporting documentation on model development and validation.

Further details of the review are provided in Twin Waters West – Preliminary Draft Review Memorandum (Reference 1).

3. MODEL REVIEW RESPONSE

3.1. Summary of SLR Response

SLR have aimed to address or provide commentary/justification for several of the issues outlined in Section 2.2. Details of the response/changes, including WMAwater comments, are provided in Appendix A.

The changes SLR have made to the model include the following:

- Update or justification for the use (of most) of questionable topographic modifications,
- Inclusion of missing inflow sources (please note this does not include sub-catchment 51).

Instability within the model representation of bridges and culverts (hydraulic structures) can artificially increase or decrease surrounding model results and tends to indicate that the structure representation is not appropriately functioning across a range of flood levels. While the structure may be stable at the peak of a particular event, instability at lower levels may limit the future use of the model for assessment during these smaller events. The unstable flow results at 1D hydraulic structures has not been resolved and is still present in the model. In this instance SLR has presented sound arguments regarding the impact of these flow instabilities on the water levels for the event assessed as part of the current work and the overall model health. Based on the purpose of the modelling in the context of the rezoning process, limited instability issues at the peak of the event assessed, WMAwater accepts that these issues do not require addressing at this stage of the modelling. However, it is still recommended that they be investigated and addressed prior to use of the model in assessment to support future development applications for a proposed master plan.

Additionally, in response to queries regarding missing and additional culverts when compared to the previous SCC modelling, SLR has confirmed that the culvert data included in the modelling process has been provided by SCC and is expected to be the most up to date. It was noted that existing culverts are represented equally in both the design and existing scenarios. Therefore, any missing culverts are unlikely to impact the results of the assessment for the purposes of the rezoning process.

Several items were not addressed by SLR. Further details of these are outlined in Section 3.2 and Appendix A.

3.2. WMA Response

Given the purpose of the modelling, WMAwater has found that the modelling is largely adequate for the purposes of informing the planning scheme amendment process. With that said, there are several items that should be addressed to improve the integrity of the model for use in a site specific assessment to support future development applications for the proposed master plan. These items include:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),

- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Further supporting documentation on model development and validation.

Additional information regarding the splitting of sub-catchment 51 inflows (in comparison to the MIKEFLOOD model) was provided as part of SLR's response, whereby an argument was made that the Pacific Paradise stormwater infrastructure conveys runoff to the eastern canal system. It is unlikely that the stormwater network in this area has been designed to convey the 100 year ARI event or has the ability to capture the entirety of the runoff for this event. Further documentation regarding the split of inflow 51 or supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network should be provided if the model is used for a site specific assessment to support future development applications for the proposed master plan.

4. CONCLUSION AND RECOMMENDATIONS

WMAwater was engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for the Twin Waters West site. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impacts on flood behaviour as a result of the proposed development within the context of a rezoning process via an amendment to the Sunshine Coast Planning Scheme. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for a planning scheme amendment of the Twin Waters West site. The findings of the initial independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

Further documentation and model updates were undertaken, and subsequently reviewed. It was determined for the purposes of a planning scheme amendment process, WMAwater are satisfied that the modelling and assessment are suitable.

To improve the integrity of the model for use in a site specific assessment to support future development applications for the proposed master plan, a number of updates and assessments are recommended. These are detailed in Section 3.2 above.

5. REFERENCES

1. Twin Waters West – Preliminary Draft Review
WMAwater, August 2017

2. Flood Impact Assessment Twin Waters West Report
Cardno, April 2017

3. Maroochy River Flood Study
Sunshine Coast Regional Council, February 2010

4. Maroochy River Flood Study – Flood Hazard Mapping Project 2013/2014
Sunshine Coast Regional Council, July 2013

5. IFD 2013 Increases (%) Mapping
Sunshine Coast Regional Council, July 2013

6. B5 Airport and Surrounds – Flooding
Sunshine Coast Council & Sunshine Coast Airport

7.TUFLOW User Manual, TUFLOW.2016-03-AA
BMT WBM, April 2016

Appendix A

The queries raised by WMAwater, the responses from SLR and the subsequent response from WMAwater are provided in the tables below.

Table A1: Topographic Data

WMA Comment	SLR Response	WMA Response
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.	It is correctly noted that if the river mouth bathymetry was updated, it would likely impact both the existing and design scenarios equally. Therefore, it is unlikely to directly impact the assessment. WMAwater does recommend that an update to the river mouth bathymetry be taken in future assessment stages for the purposes of ensuring a more accurate representation of flood characteristics.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.	Noted and accepted. Refinement should be made as part of future assessment stages.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.	It is noted that 2d_zpt_Roads_Ex29 has been updated to 2d_zpt_Roads_Ex30 and has been correctly shifted to align with aerial imagery of the existing roadway.

4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are "thin" breaklines. The TUFLOW model reads the GIS layer using the "gully" parameter which ensures a continuous flowpath. It is also incorrect to say it is a "poor representation of a 20m wide channel" because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.	Section 6.8.3 of the TUFLOW manual (TUFLOW 2016-03-AA) notes the following: "The Read GIS Z Line default is to model a "thin" line which modify the ZH, ZU and ZV Zpt elevations only. If the THICK option occurs, interpolated Z values are applied to whole cells (ie. at the cell centres (ZC), all cell sides and cell corners). Other optional flags such as MAX, MIN, RIDGE or GULLY are also available." Please note that TUFLOW treats 2d_zln, 2d_zlr and 2d_zlg the same. Additionally, no "THICK" option has been applied to the 2d_zlg_Drain layer. Also note that the "GULLY" parameter does not ensure a continuous flowpath but instead only changes a Zpt elevation if the Z Shape elevation at the Zpt is lower. The above has only been included to justify the inclusion of original comments and explain how the 2d_zlg is applied by the model. It should be noted that it has minimal impact and therefore is not required in the model as the Lidar and 10m DEM appropriately represents the channels in these areas.

5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.	The primary concern of the inclusion of this layer is demonstrated in the image below. Please note that the depicted mapinfo file will create a channel from the sunshine coast motorway to the canal system (based on the placement of the nodes). This method has been included at other locations where the area is smoothed to then include a 2d layered flow constriction representation of the structure. In this case there is no 2d layered flow constriction.  As stated previously, no evidence could be found to support the inclusion of this channel. If culvert structures are located in this area, they should be included for completeness. It is noted that this inclusion is located south of the Twin Waters West site and unlikely to affect the model results at the development, however should be included for model completeness as part of future assessment stages. Additionally, this shapefile is included in both the existing and design scenario and therefore is unlikely to influence the impact assessment.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.	Noted and accepted.

7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).	Noted. This layer should be updated as part of future assessment stages as it is unlikely that a uniformly elevated bund would be constructed. The bund is currently containing water to the north of the site and may potential affect flood levels at the site.
8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.	Noted and accepted.

Table A2: Topographic Layers for Twin Waters Development

1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.	Noted and accepted. Any future assessment stages should include a representation of the lake design.

2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a “weir”. The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.	Noted and accepted. The 2d_zsh obstruction at the northern (eastern) weir location should be updated to the correct level during future assessment stages to ensure that the efficiency of the weir is correctly represented and not potentially overstated.
3. Conservative approach to modelling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.	Noted and accepted. Any future assessment stages should include a representation of the site design.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.	Noted and accepted. During future assessment stages the modelling of the bridge structure (as the current design removes the existing bridge) should be modelled.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.

Table A3: Local Inflow

<table>
<tr>
<td>The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behaviour at the site.</td>
<td>These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.
Peak Flood Levels Within Subject Site (mAHD)
<table>
<tr><th>Flood Event</th><th>Northern End</th><th>Southern End</th></tr>
<tr><td>Existing 1% AEP (without 4 local inflows)</td><td>2.402</td><td>2.124</td></tr>
<tr><td>Existing 1% AEP (with 4 local inflows)</td><td>2.402</td><td>2.125</td></tr>
<tr><td>Existing 1% AEP + CC (without 4 local inflows)</td><td>2.903</td><td>2.757</td></tr>
<tr><td>Existing 1% AEP + CC (with 4 local inflows)</td><td>2.903</td><td>2.758</td></tr>
</table>
</td>
<td>Noted and accepted.

Please note that providing the location of the extracted values on a figure (with the table) would provide further context.</td>
</tr>
<tr>
<td>Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.</td>
<td>Sub-catchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of sub-catchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake. A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.</td>
<td>It is noted that there is a stormwater network within the Pacific Paradise development that includes a 1200mm discharge pipe to the canal system but it is unlikely that the stormwater network would be designed to convey the 100 year ARI event.

Further justification for this choice is required as part of future assessment stages – (as a minimum) supporting calculations showing that the 100 year ARI event runoff is captured and conveyed by the existing stormwater network/overland flow system should be provided.

If this is undertaken and it is found that the system does not capture the significant portion of stormwater runoff and convey it to the canal system, an update to the hydrology should be undertaken. Consequently, the hydraulic model would need to be updated accordingly.</td>
</tr>
</table>

Table A4: Initial Water Level

The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.	The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.	Noted. As this methodology is applied in both the existing and design scenarios it is unlikely to impact the purpose of the assessment. It should be noted that running the model for the full duration and adopting the spatially varying initial water level would remove this issue. Similarly, justification (or comparison to the full length run scenario) regarding the choice to reduce the model run time should be provided with future assessment stages.

Table A5: Hydraulic Structures

<table>
<tr>
<td>There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.</td>
<td>Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1. The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly.

Hydraulic Structures – 1% AEP Flood Event
<table>
<tr><th>Structure</th><th>Peak Discharge (m³/s)</th><th>Structure Head Loss (m)</th></tr>
<tr><td>12A (Northern Culverts)</td><td>84.6</td><td>TUFLOW = 30 mm
HEC-RAS = 30 mm</td></tr>
<tr><td>11E (Southern Culverts)</td><td>53.0</td><td>TUFLOW = 50 mm
HEC-RAS = 50 mm</td></tr>
</table>
</td>
<td>Noted and accepted. Details of these calculations should be documented in the reporting accompanying any future assessment stages.</td>
</tr>
</table>

A number of structures within the TUFLOW model have instability issues.	The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs. The noted structures are remote from the subject site and do not affect the calculated results. The results at the structures are generally stable around the peak of the flood event. The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.	It is noted that the flow instabilities are not proportional to the water level instabilities. Additionally, as stated, the instabilities do not tend to occur during the peak of the assessed event. The cumulative model error is low and the peak error is also reasonably low indicating a healthy model. With these points noted, instabilities should not be ignored and WMAwater recommends that these issues be fixed for any future assessment stages. It is not reasonable to state that the culverts are not near to the site and therefore should have minimal impact on the assessment. The culverts have a direct impact on flow conveyance from west to east (under the sunshine coast motorway) and therefore are likely to directly impact areas around the motorway – particularly in events where the motorway is not overtopped.
Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts	In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.	Noted and accepted.
Structures not included from MIKE model (but within TUFLOW model extent).	• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event. • Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event. • Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.	Noted. Confirmation of culvert sizing to determine significance should be undertaken and detailed included in future assessment stages.
Structures only included in TUFLOW Model	Details of these structures were provided by SCC: • 12A is located under the Sunshine Motorway near Finland Road. • DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters. • SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.	Noted and accepted.

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Friday, 10 November 2017 9:17 AM
To: Erin Askew [Refused und] wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Good morning Erin,

I just want to touch base with you to see how you're going with finalising the report following on from our discussion last week. Can you please advise at your earliest convenience when you think we will receive the revised copy of the report?

Please feel free to contact me if you have any questions or wish to discuss the report further.

Kind regard,
Danika

From: Danika Cowie
Sent: Tuesday, 31 October 2017 3:18 PM
To: Erin Askew [Refused und] wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters Wes

Hi Erin,

Thank you for yours and Mark's time this afternoon to discuss the draft report.

As mentioned in the meeting, could you please make the following changes to the rezoning references within the report to reflect the correct process that is being undertaken by council.

Please change any reference to "rezoning concept", "proposed concept" or "rezoning application" to state the following:

…rezoning process via an amendment to the Sunshine Coast Planning Scheme…

and then as a general reference throughout the report, refer to it as *…the rezoning process*…. Or *...planning scheme amendment process*….

If you could also reword any reference to "future assessment stages" to say, ….*future development applications for a proposed master plan*….

Please feel free to contact me if you have any questions regarding the above references.

Thank you again for all the work you have done as part of this review, it is greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Erin Askew [mailto Refused under wmawater.com.au]
Sent: Wednesday, 25 October 2017 1:51 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Twin Waters Wes

Hi Danika,
Please find attached our revised review. I have left it as a working draft to allow you to review.

Apologies again for the delay, we had a draft a few weeks ago but I became the constraint to getting it out to you.
Kind Regards,
Erin

Erin Askew
Director

E: Refused under wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

Garth Nolan

From: Danika Cowie
Sent: Tuesday, 24 October 2017 2:28 PM
To: Erin Askew
Cc: Garth Nolan
Subject: Twin Waters West and Extension of Contract

Hi Erin,

How are you going with the review of the report?
My management is madly chasing the report and would like to get an idea on when we can expect to receive it.
If you could please let me know that would be greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Wednesday, 18 October 2017 9:20 AM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters West and Extension of Contract

Hi Danika,
My apologies, I have been caught up over the last week or so with a series of minor emergencies. I have a draft of the final report that I am sitting down right now to review. All going well I will be able to send a copy through for your review over the next day or so.
Ill keep you informed if there is more work needed after my review.
Kind Regards,
Erin

From: Danika Cowie [mailto:Danika.Cowie@dilgp.qld.gov.au]
Sent: Tuesday, 17 October 2017 12:55 PM
To: Erin Askew Refused unde wmawater.com.au>
Cc: Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: RE: Twin Waters West and Extension of Contract

Hi Erin,

I have tried to contact you a number of times over the past week as I am just wanting to touch base with you to see how the final report is going and if there are any issues?

We are also wondering what the anticipated timeframe is for the final report.

If you could let me know as soon as possible that would be greatly appreciated.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Danika Cowie
Sent: Thursday, 12 October 2017 10:19 AM
To: Erin Askew [Refused under] wmawater.com.au>
Subject: RE: Extension of Contract

Hi Erin,

I just wanted to touch base with you to see how the final report is going for Twin Waters West, and if you could advise on an approximate timeframe on when we may receive it.
Also can you please advise if you have been able to work out the details for the contract extension as per my email on the 19 September 2017? Procurement are still chasing for the info. If you do have the information, please send it onto me and I can forward it onto procurement to finalise.

Please feel free to give me a call if you have any questions or wish to discuss the report of the procurement information further.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Danika Cowie
Sent: Tuesday, 26 September 2017 3:47 PM
To: 'Erin Askew' Refused unde wmawater.com.au>
Subject: Extension of Contract

FYI

From: Danika Cowie
Sent: Tuesday, 19 September 2017 3:47 PM
To: Refused under wmawater.com.au
Cc: Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>
Subject: RE: Extension of Contract

Hi Mark,

Following on from Nathan's email regarding extending the contract for WMA Water to review the Twin Waters West flood modelling information. To assist in preparing the procurement paperwork, are you able to advise on an approximate timeframe for WMA Water to complete this next stage of work based on what was agreed at the meeting held on 7 September 2017 and provide approximate costs to complete the work.

Please feel free to contact me if you have any questions regarding the above request.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Nathan Rule
Sent: Thursday, 31 August 2017 9:30 PM
To: Refused under se wmawater.com.au
Cc: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>; Amelia Radford <Amelia.Radford@dilgp.qld.gov.au>; Garth Nolan <Garth.Nolan@dilgp.qld.gov.au>
Subject: Extension of Contract

Hi Mark

I'd like to confirm that we will be extending our contract with WMA Water (contract number DILGP-0289-17) in relation to the Flood Assessment Review for Twin Waters.

We will provide a formal letter stating the new terms of the contract (extended timeframe, scope and cost, including reimbursing travel expenses) once we have held the client meeting with Council, so we can confirm the new details.

In the meantime, please accept this email as confirmation that we wish to contract WMA Water through to the completion of this review.

With regards

Nathan Rule
Director, Planning
Planning and Development Services | Southern Region
Department of Infrastructure, Local Government and Planning
Level 4, 117 Brisbane Street, Ipswich QLD 4305
p. 07 3432 2409 | **m** Refused under sectio | **e.** nathan.rule@dilgp.qld.gov.au

Garth Nolan

From: Danika Cowie
Sent: Wednesday, 21 June 2017 12:31 PM
To: Jason Krueger
Cc: Garth Nolan; Stephen Patey; Roma Stevenson
Subject: Twin Waters West

Hi Jason,

After liaising with our Director, it has been determined that we will need to "stop the clock" on the MAPLI process until the third party review has been completed. So on that note, please consider this email the formal ***stop the clock*** notice for the Twin Waters West Major planning scheme amendment.

Please do not hesitate to contact me if you wish to discuss the above further.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Danika Cowie
Sent: Tuesday, 13 June 2017 8:36 AM
To: 'Jason Krueger'
Cc: Garth Nolan; Stephen Patey; Roma Stevenson; Crispin Smythe
Subject: RE: Access to flood model for Twin Waters West

Good morning Jason,

Thank you very much for your email.

We greatly appreciate your agreement to provide the flood modelling.

Once we have formally engaged WMA Water, I shall liaise with them about the process to make the request for the flood modelling as per your recommendation.

I will be in touch very soon.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

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From: Jason Krueger [mailto:Jason.Krueger@sunshinecoast.qld.gov.au]
Sent: Tuesday, 13 June 2017 8:12 AM
To: Danika Cowie
Cc: Garth Nolan; Stephen Patey; Roma Stevenson; Crispin Smythe
Subject: Access to flood model for Twin Waters West

Hi Danika,

Further to our discussion yesterday regarding the above subject, I can confirm that council is able to supply the modelling information for Twin Waters West.

Upon engagement, it would be quicker and easier for WMA Water to request the model directly from Crispin Smythe, Coordinator, Flooding and Stormwater Management Team:

Crispin.Smythe@sunshinecoast.qld.gov.au
Phone: (07) 5441 8108

Upon making this request, WMA Water will be required to sign an agreement that goes with the supply of the model, which limits its use to that described in the agreement.

Upon receipt and review of the model, Crispin has also offered to provide a briefing to representatives from WMA Water on the assumptions used in the model.

Kind regards,

Jason Krueger | Coordinator Planning Scheme and Projects
Strategic Planning Branch
Regional Strategy and Planning | Sunshine Coast Council

Phone: 07 5420 8710
Mobile: Refused under section 4
Email: jason.krueger@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

From:	Danika Cowie
To:	"Erin Askew"
Cc:	Mark Babister; Garth Nolan
Subject:	Third party review of the Flood impact assessment and associated modelling for Twin Waters West planning scheme amendment (email 1 of 2)
Date:	Wednesday, 28 June 2017 3:34:31 PM
Attachments:	Flood impact assessment 13.04.2017.pdf

Hi Erin,

As discussed, please find below the email from Sunshine Coast Regional Council outlining how to request a copy of the flood modelling from them.

I have attached a copy of the Flood Impact Assessment that was prepared by Cardno on behalf of Stockland (the developer and land owner of the Twin Waters West site) which was prepared in response to the flood modelling for the Twin Waters West site for your review and comment. As I mentioned on the phone earlier this afternoon, we have received two pieces of correspondence from members of the public, which we would like you to review and provide guidance and comment on an appropriate response as they are quite technical in nature.

Due to the size of the Flood Impact Assessment file, I have to send the documents over to emails, this being email 1 of 2.

If you have any questions or issues with accessing the modelling, please do not hesitate to contact me. We look forward to receiving your review.

Kind regards,

Danika Cowie
Principal Planning Officer
Planning and Development Services | SEQ North
Department of Infrastructure, Local Government and Planning
post PO Box 1129 Maroochydore QLD 4558
visit Level 3, Mike Ahern Centre 12 First Avenue Maroochydore Qld 4558
p. 07 5352 9776 e. danika.cowie@dilgp.qld.gov.au

From: Jason Krueger [mailto:Jason.Krueger@sunshinecoast.qld.gov.au]
Sent: Tuesday, 13 June 2017 8:12 AM
To: Danika Cowie
Cc: Garth Nolan; Stephen Patey; Roma Stevenson; Crispin Smythe
Subject: Access to flood model for Twin Waters West

Hi Danika,

Further to our discussion yesterday regarding the above subject, I can confirm that council is able to supply the modelling information for Twin Waters West.

Upon engagement, it would be quicker and easier for WMA Water to request the model directly from Crispin Smythe, Coordinator, Flooding and Stormwater Management Team:

Crispin.Smythe@sunshinecoast.qld.gov.au

Phone: (07) 5441 8108

Upon making this request, WMA Water will be required to sign an agreement that goes with the supply of the model, which limits its use to that described in the agreement.

Upon receipt and review of the model, Crispin has also offered to provide a briefing to representatives from WMA Water on the assumptions used in the model.

Kind regards,

Jason Krueger | Coordinator Planning Scheme and Projects
Strategic Planning Branch
Regional Strategy and Planning | Sunshine Coast Council

Phone: 07 5420 8710
Mobile: Refused under section
Email: jason.krueger@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Flood Impact Assessment

Twin Waters West

350384

Prepared for
Stockland

13 April 2017

Cardno
Shaping the Future

Contact Information

Cardno (Qld) Pty Ltd
ABN 57 051 074 992

Level 11 Green Square North Tower
515 St Paul's Terrace
Locked Bag 4006
Fortitude Valley Qld 4006

Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 7 3369 9822

cardno@cardno.com.au
www.cardno.com.au

Author(s): Hayden Munck
Engineer

Approved By: Michael Della
Senior Principal

Document Information

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Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	9/03/2017	Original	H Munck	M Della
2	13/04/2017	Updated to include changes made following discussion with SCC	H Munck	M.Della

Table of Contents

Appendices

Tables

Figures

1 Introduction

Cardno was engaged by Stockland to assess any potential flooding implications in relation to the proposed development at Twin Waters West within Sunshine Coast Regional Council. Cardno has previously provided advice in regards to the flooding conditions within the lower Maroochy River catchment as detailed in:

> *'Maroochy Canelands – Flood Study'*, 21 December 2006 (ref: 2760-58);

> *'Sunshine Coast Airport Earthworks Strategy – Flood Study'*, 12 March 2015 (ref: 2500/60 SCA Flood Study); and

> *'Twin Waters West Development – Tuflow Modelling'*, 10 February 2011 (ref: 3503-84/Tuflow Modelling – Summary Report).

The subject site is bounded by the Sunshine Motorway to the west, the existing Twin Waters development to the east, the existing Pacific Paradise development to the north and the Maroochy River to the south. The site is approximately 100 ha and currently consists predominantly of rural open space, as well as an area of 11 ha designated as a Regional Ecosystem under Vegetation Management Status. The site location is illustrated on Figure 1.

The proposed development consists of a lake system contained within residential and open space areas.

In order to achieve a development design which does not cause adverse flooding impacts external to the subject site, extensive hydraulic modelling was carried out in line with best practice approaches. The methodology and findings of the Flood Impact Assessment (FIA) are detailed in this report.

2 Hydraulic Modelling

A TUFLOW hydraulic model was adapted from the model created for the '*Sunshine Coast Airport Earthworks Strategy – Flood Study*', which was in turn set up based on information from Sunshine Coast Council's Maroochy River flood model.

2.1 Pre-Development Scenario TUFLOW Model Setup

2.1.1 Topography

The following minor modifications were made to the model as detailed in the above report:

> Update of the baseline topography data to utilise the 2014 LiDAR data available for the catchment;

> Addition of specific topography modifications to ensure flow controlling features were accurately represented in the model, including the definition of low flow channels and protective bunding around the Pacific Paradise development; and

> Addition of existing drainage culverts under David Low Way at the Sunshine Coast motorway intersection.

The TUFLOW model extents and inflow locations are illustrated on Figure 2.

Two base model scenarios were considered in the assessment:

Scenario 1 (EX29) adopts the current topography within the model extents based on the 2014 LiDAR data described above. Model topography for Scenario 1 is illustrated in Figure 3.

Scenario 2 (EX30) is as per Scenario 1, with the only difference being the adoption of the ultimate regional development scenario, i.e. filling of residential lots to above the 1% AEP flood level including climate change effects. The lots to which the filling criteria was applied were supplied by Council. Model topography for Scenario 2 is illustrated in Figure 4.

2.1.2 Inflows

The existing inflow hydrograph (ID 51) located within the subject site immediately south of the intersection of David Low Way and Ocean Drive was revised. The inflow point, representing runoff produced by the catchment covering the northern portion of the site and a similar area within Pacific Paradise, was considered to be inappropriately located for the purposes of assessing flood level changes due to the proposed development, as it was applied at the centroid of the catchment and hence would need to be fully conveyed through the site.

Following closer investigation into the catchment in question, it was identified that in fact the portion of the catchment within Pacific Paradise actually drains to the dedicated drainage channel to the east of that development. Therefore, the inflow was split into two separate inflows, 51a and 51b, which were applied into the existing low flow channel within the subject site and the eastern drainage channel within Pacific Paradise respectively. In the absence of the underlying hydrologic model, the catchment inflow was distributed based on contributing catchment areas and imperviousness of each revised inflow, with 25% of the catchment flow applied at inflow 51a and 75% applied at 51b.

2.1.3 Hydraulic Structures

In the process of optimising the proposed design solution, it was noted that the two culverts sets (model ID 09A and 08A) under the Sunshine Coast Motorway adjacent to the site were operating in an unstable manner within the hydraulic model. To alleviate this issue, the culverts were updated from the original 1-dimensional schematisation to be modelled as 2-dimensional structures using layered flow constriction shapes.

This methodology was also applied to culvert 07A, located immediately south of the Maroochy River along the Sunshine Coast Motorway.

2.2 Post-Development Scenario TUFLOW Model Setup

2.2.1 Proposed Development Schematisation

Post development models were created for both base case Scenario 1 (DE118) and Scenario 2 (DE117), as illustrated in Figures 5 and 6 respectively.

The distribution of development fill and lake areas was based on the proposed development layout provided by RPS as shown in the reference drawings section of this report. It was quickly identified that the proposed layout required some modifications to facilitate the optimisation of flooding behaviour in the vicinity of the site. After undertaking numerous iterations to achieve an acceptable design solution in regards to flooding impacts, the following was adopted in the TUFLOW model:

> A lake system of approximately 23 ha, with an invert level of -3.0 mAHD, to provide flood storage when required;

> Approximately 60 ha of development area filled to a level above the 1% AEP event peak flood level, with allowance for future climate conditions including 20% increase in rainfall intensity and an 800 mm rise in sea levels at the mouth of the Maroochy River.

2.2.2 Proposed Hydraulic Structures and Mitigation Measures

In order to prevent the occurrence of adverse flooding impacts external to the subject site following the proposed development, necessary mitigation measures were included in the TUFLOW model.

The site is subject to flows from upstream catchments at three separate locations:

> From the rural area to the west of the site, via the two existing separate culvert sets through the Sunshine Coast Motorway; and

> From the north-west via David Low Way, originating from the open drains running between the Sunshine Coast Motorway and Pacific Paradise.

Flows entering the site via the two culvert sets under the Sunshine Coast Motorway will discharge into the proposed lake system. The proposed outlet of the lakes consists of two weirs, located at the existing connection to the Twin Waters lake system and in the south-east corner of the subject site respectively. Details of the proposed weir outlets are provided in Table 2-1.

Table 2-1 Proposed Weir Outlet Configuration

Weir	Weir Length (m)	Weir Crest Level (mAHD)
North	30	1.20
South	230	1.00

It is proposed to manage flow approaching the development from the north-west via David Low Way by providing a series of open channels as illustrated in Figure 4. The major drainage channel running between the Sunshine Coast Motorway and the northern precinct of development, which will provide conveyance in minor events and both conveyance and storage in larger events, is proposed to have a width of 30 metres and a Manning's n value of 0.055 representing light vegetation within the channel.

In addition to the major channel, two channels are proposed to be included between David Low Way and the northern extents of the development footprint. Each channel has been modelled with a width of 20 metres and a Manning's n value of 0.035, representing a maintained turf surface. The channels drain in opposite directions, diverting flows from the north-west inflow location around the proposed development to the major drainage channel to the west and the existing vegetated strip east of the site respectively.

2.3 Results

Both the pre-development and post-development model scenarios were simulated for the 39%, 10% and 1% Annual Exceedance Probability (AEP) flood events. Additionally, the 1% AEP event including climate change effects was assessed.

Results of the pre-development scenario indicate that peak flood levels across the site range from 2.1 mAHD to 2.4 mAHD in the 1% AEP event. Peak flood levels and depths for all AEP events are illustrated in Appendix A.

Peak flood levels of the post-development model scenarios were compared to those of the relevant pre-development scenario to determine predicted affluxes due to the proposed development. Results, as illustrated in Appendices C and F, show that the proposed development will generally not cause any adverse flooding impacts external to the site. Some increases in flood levels are predicted to the south-east of the site in the 1% AEP and 1% AEP including climate change event, however these increases are contained to open space areas and are not considered to be an actionable nuisance.

An increase in flood levels in the 1% and 1% climate change AEP events is evident within the lot existing at the south-west of the site. The magnitude of impact is in the order of 20-40 mm. The affluxes in this location will be resolved during detailed design.

3 Conclusions

An assessment was undertaken to determine any potential flooding implications involved with the proposed development of Twin Waters West within Sunshine Coast Regional Council.

Hydraulic modelling was completed for a range of flood events to determine any potential flooding impacts that may be caused by the proposed development works. Results of the assessment indicate that the proposed development will not cause any adverse impacts to flooding conditions on properties external to the site with the exception of affluxes occurring within one external lot to the south-west of the site, which will be mitigated during detailed design.

FIGURES

DATE PLOTTED: 12 April 2017 2:19 PM BY : HAYDEN MUNCK

NORTH

Legend

Site Boundary

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:20,000

0 200 400 600 800m

CAD FILE: O:\3503-84\ACAD\Figures\R3V2\Figures.dwg
XREFs: cadastre; Tuflow_Results_EX29_topo; Tuflow_Results_EX30_topo

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Figure 1
Locality Plan
Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

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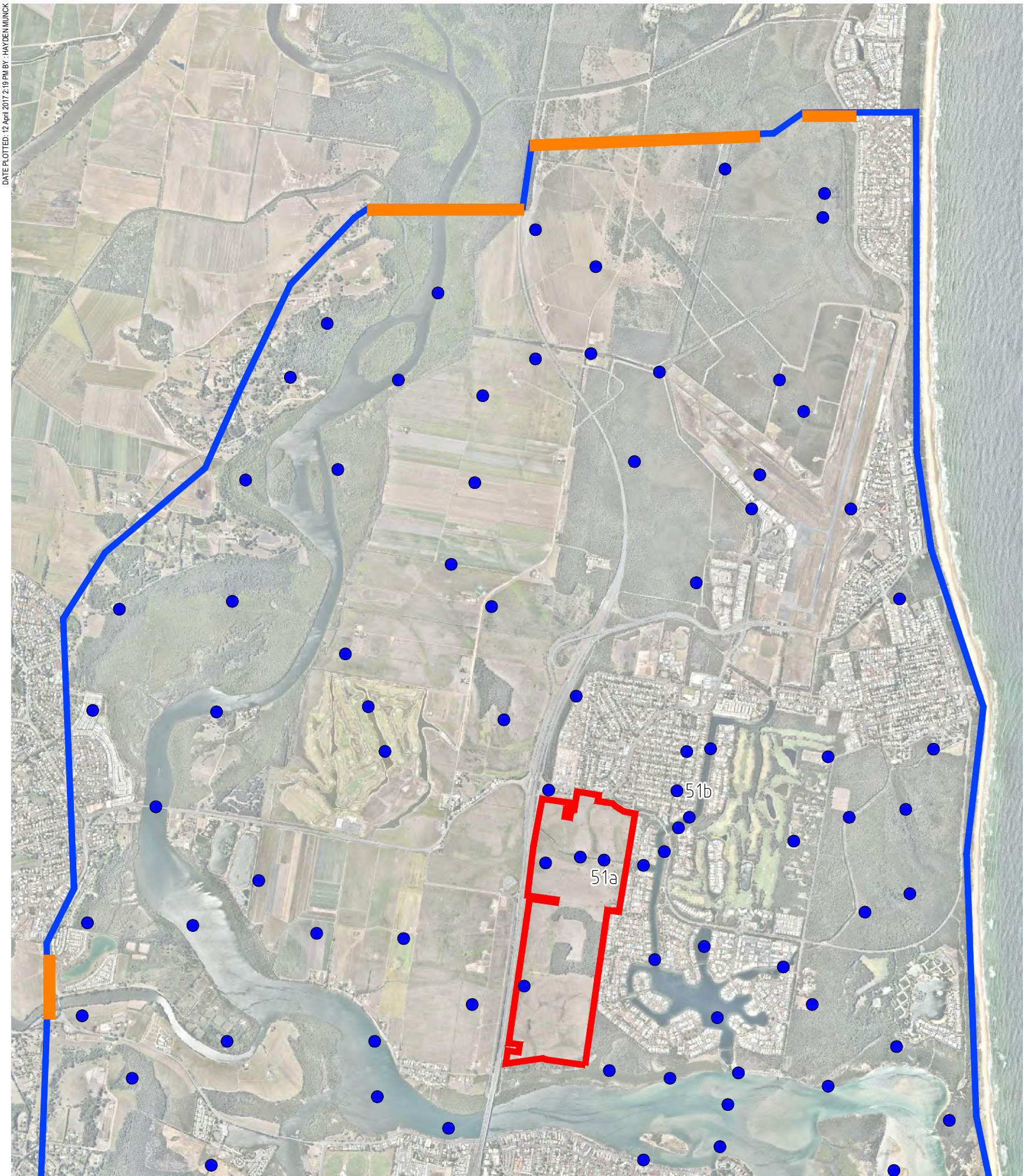

NORTH

Legend

- Site Boundary
- Model Extent
- TWL Condition
- Inflow Boundary
- Inflow Location

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:30,000

0 300 600 900 1200m

CAD FILE: O:\3503-84\ACAD\Figures\R3V2\Figures.dwg
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Figure 2
TUFLOW Model Layout
Twin Waters West
Flood Impact Assessment
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NORTH

Legend

Site Boundary
Model Extent

Topography (mAHD)

Above 10.00
4.25 to 10.00
4.00 to 4.25
3.75 to 4.00
3.50 to 3.75
3.25 to 3.50
3.00 to 3.25
2.75 to 3.00
2.50 to 2.75
2.25 to 2.50
2.00 to 2.25
1.75 to 2.00
1.50 to 1.75
1.25 to 1.50
1.00 to 1.25
0.75 to 1.00
0.50 to 0.75
0.25 to 0.50
0.00 to 0.25
Below 0.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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0 300 600 900 1200m

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XREFs: cadastre, Tuflow_Results_EX29 topo, Tuflow_Results_EX30_topo

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Figure 3

TUFLOW Model Topography - Pre-Development Scenario 1 - Existing Residential Filling

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

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NORTH

Legend

Site Boundary
Model Extent

Topography (mAHD)

Above 10.00
4.25 to 10.00
4.00 to 4.25
3.75 to 4.00
3.50 to 3.75
3.25 to 3.50
3.00 to 3.25
2.75 to 3.00
2.50 to 2.75
2.25 to 2.50
2.00 to 2.25
1.75 to 2.00
1.50 to 1.75
1.25 to 1.50
1.00 to 1.25
0.75 to 1.00
0.50 to 0.75
0.25 to 0.50
0.00 to 0.25
Below 0.00

Date	Size
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350384	0
Project Reference	Revision

Scale
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XREFs: cadastre, Tuflow_Results_EX29 topo, Tuflow_Results_EX30_topo

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Figure 4

TUFLOW Model Topography - Pre-Development Scenario 2 - Ultimate Residential Filling

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

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NORTH

Legend

- Site Boundary
- Weir
- Drainage Channel
- Proposed Fill Pad Area
- Proposed Lake Area

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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Figure5
Post-Developed TUFLOW Model Layout
Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

APPENDIX A

SCENARIO 1 PRE-DEVELOPMENT MODEL RESULTS

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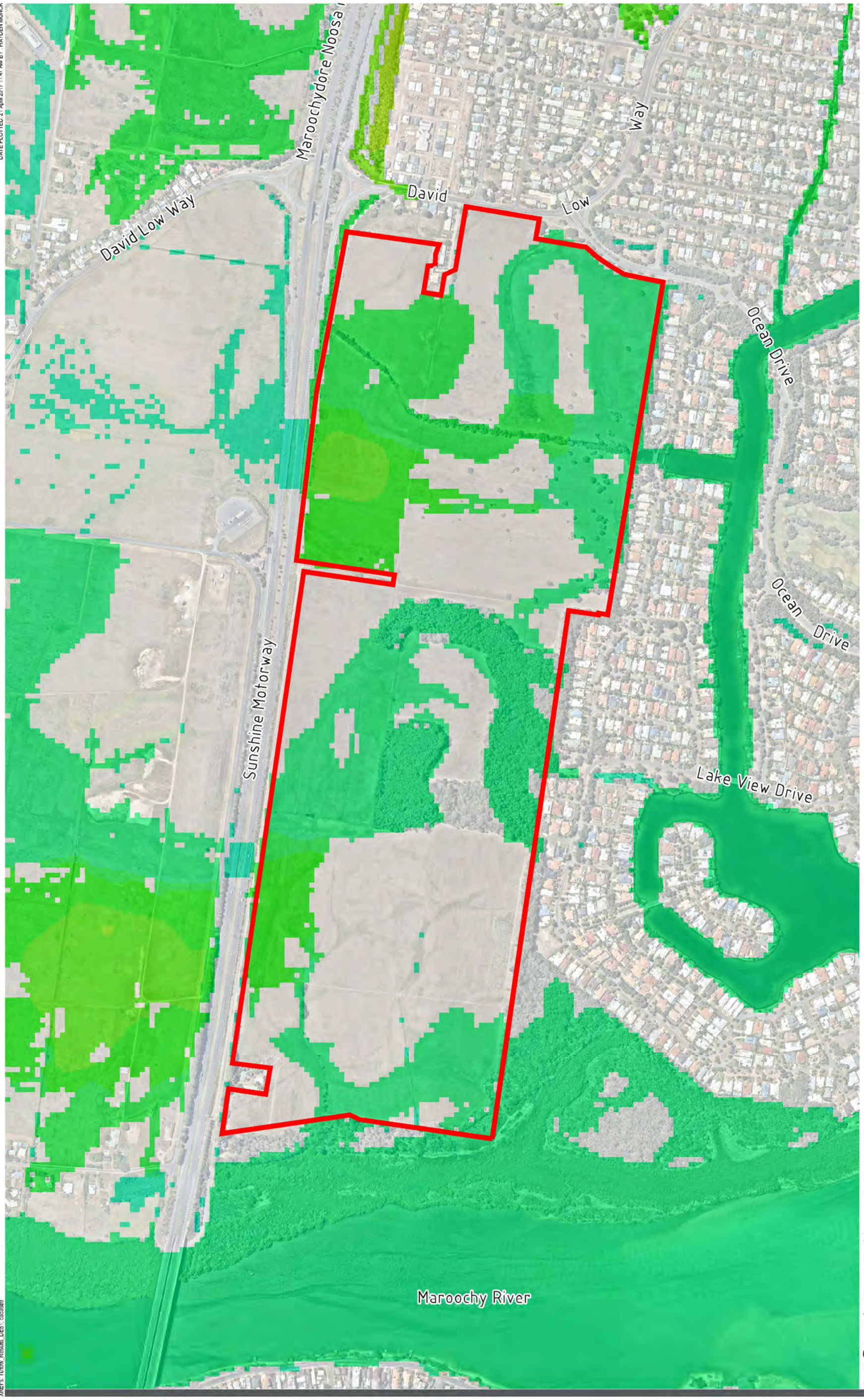

NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
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Project Reference	Revision

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XREFs: Tuflow_Results_DEB1; cadastre

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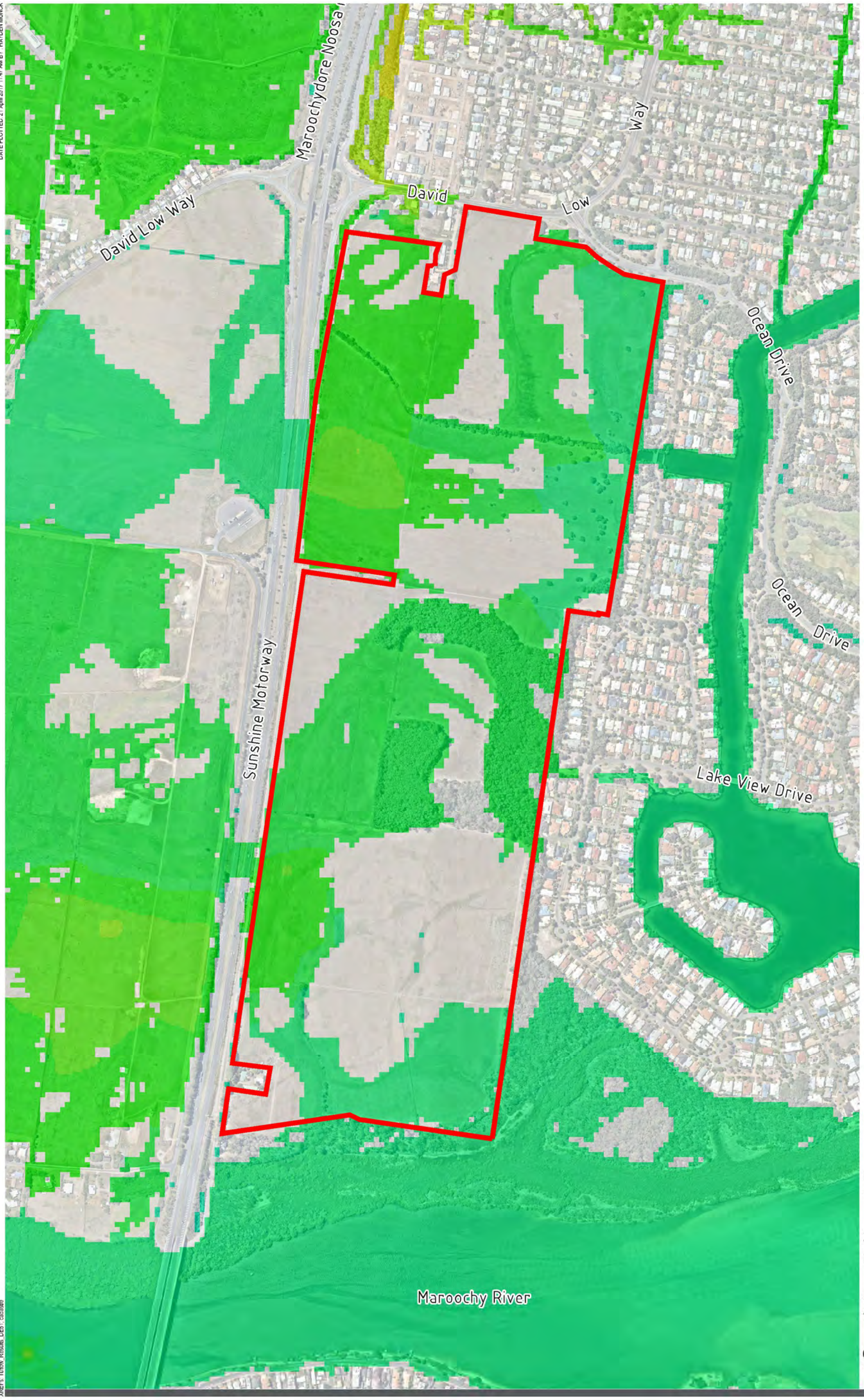
Appendix A.1.1

Pre-Development - Existing Filling Scenario - 39% AEP Event - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 11:47 AM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWEX29.dwg
XREFs: Tuflow_Results_DE81; cadastre

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Appendix A.1.2

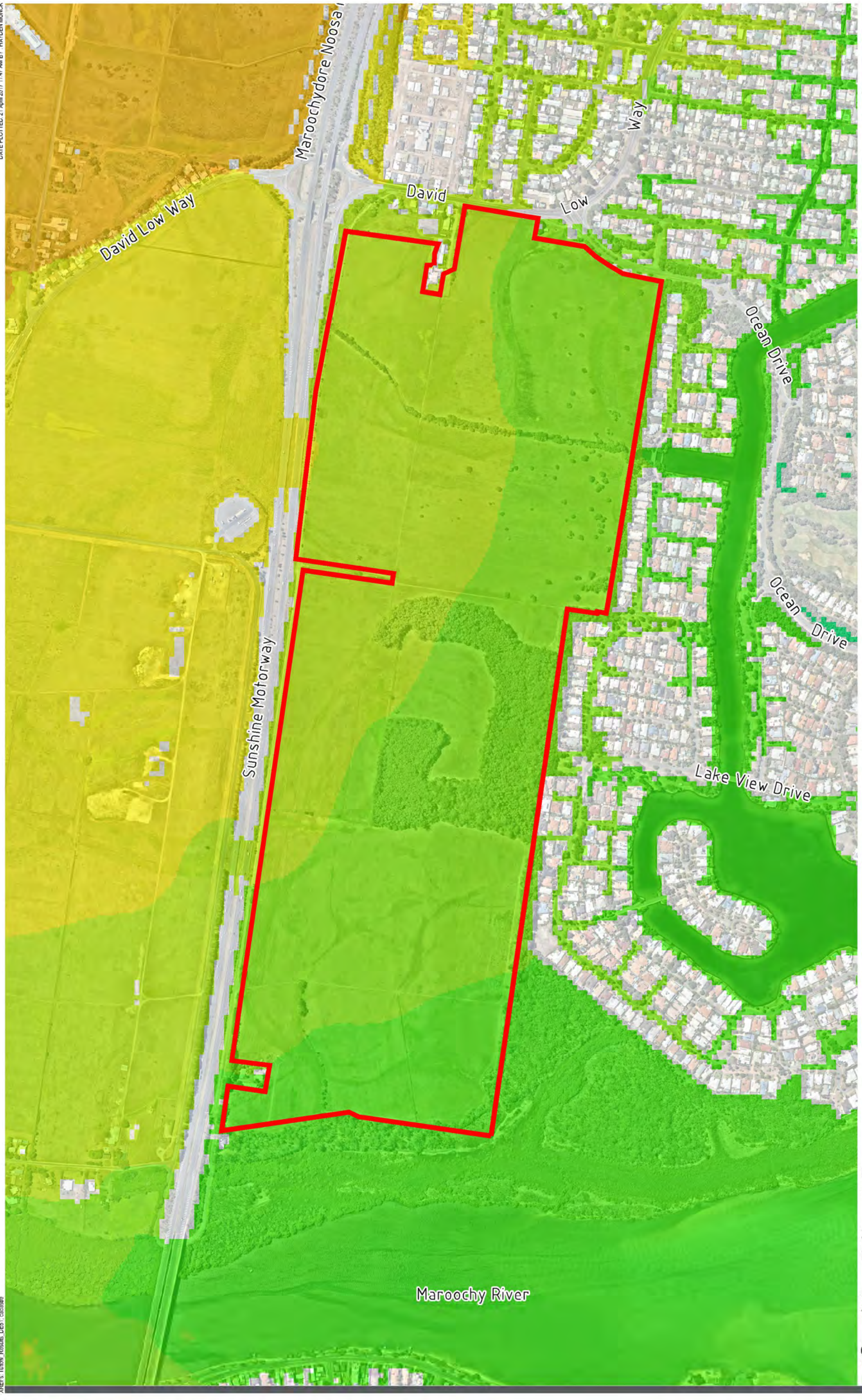
Pre-Development - Existing Filling Scenario - 10% AEP Event - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 11:47 AM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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Appendix A.1.3

Pre-Development - Existing Filling Scenario - 1% AEP Event - Flood Levels

Twin Waters West
Flood Impact Assessment
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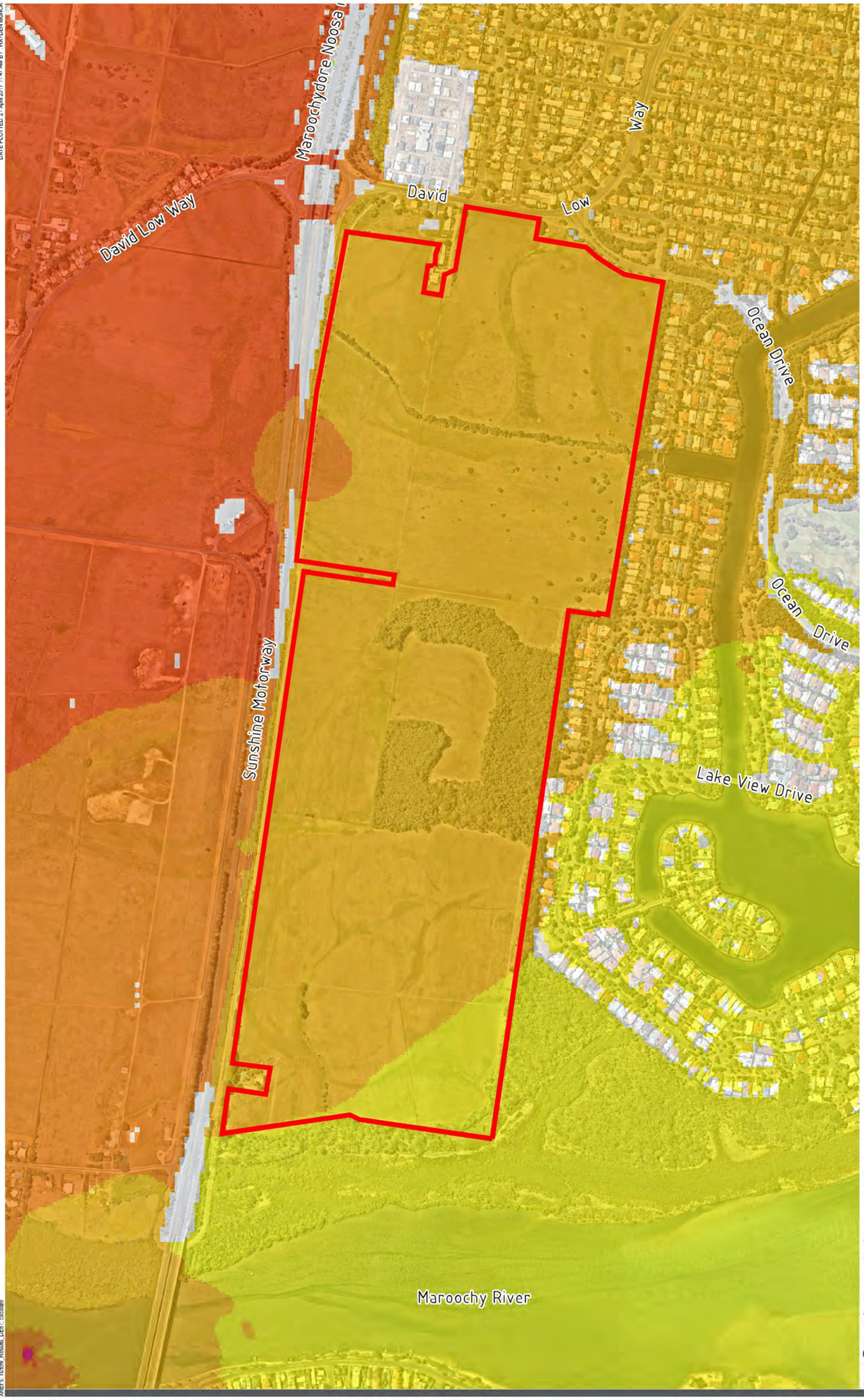
DATE PLOTTED: 21 April 2017 11:47 AM BY: HAYDEN MUNCK



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Project Reference: 350384
Revision: 0

Scale: 1:7,500

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XREFs: Tuflow_Results_DE81; cadastre

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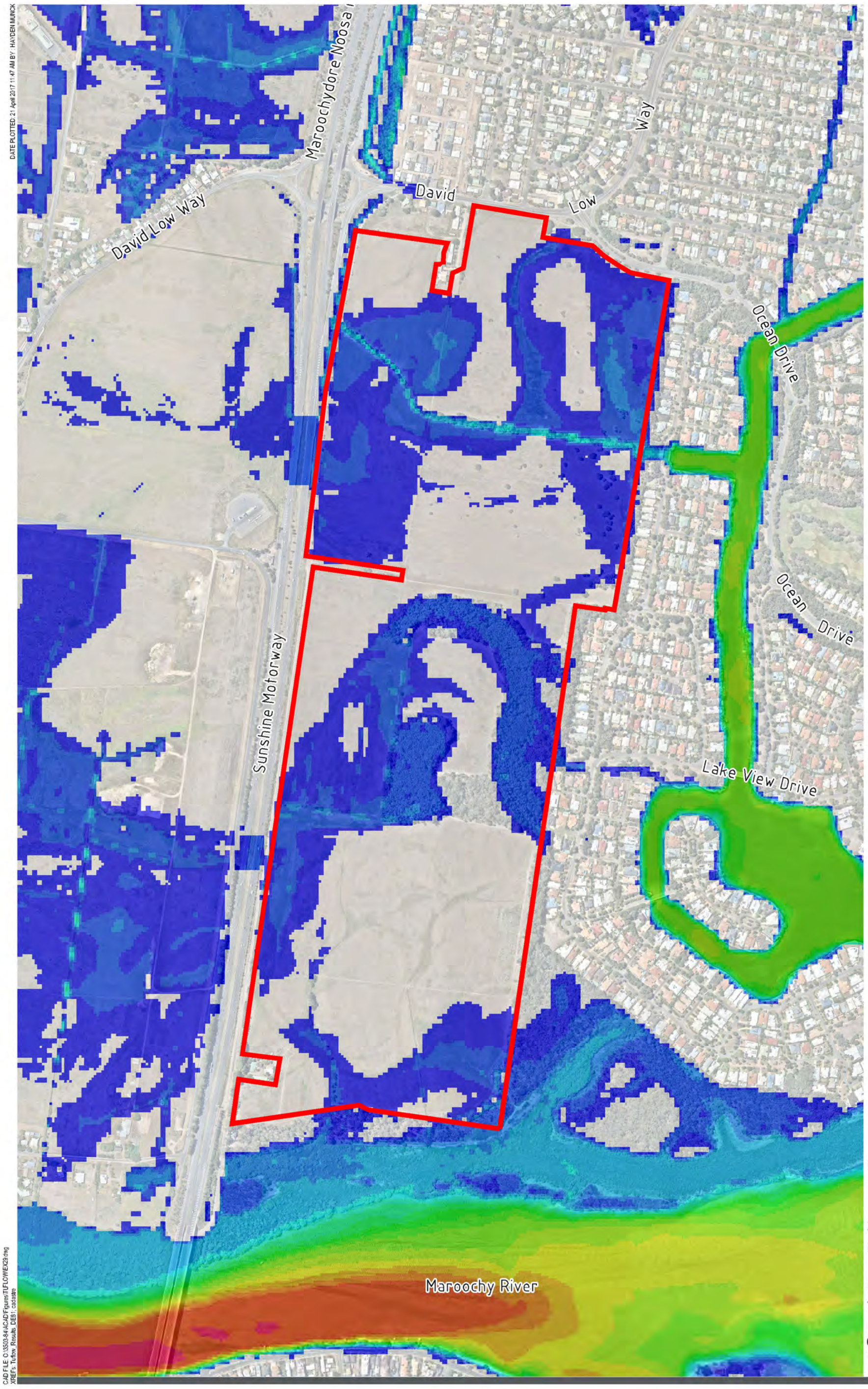
Appendix A.1.4

Pre-Development - Existing Filling Scenario - 1% Climate Change AEP Event - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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Appendix A.2.1

Pre-Development - Existing Filling Scenario - 39% AEP Event - Flood Depths

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

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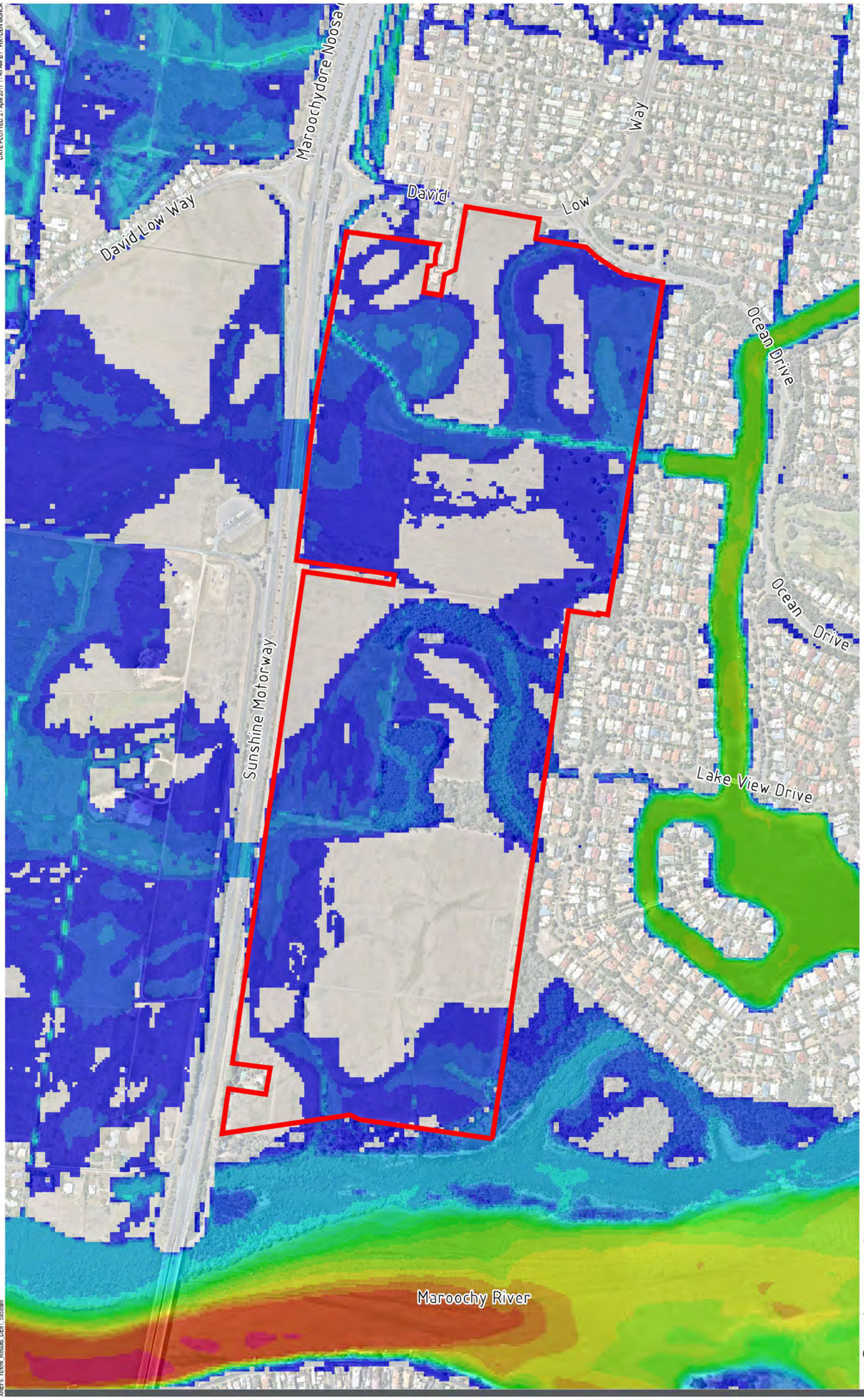

NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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XREFs: Tuflow_Results_DEB1; cadastre

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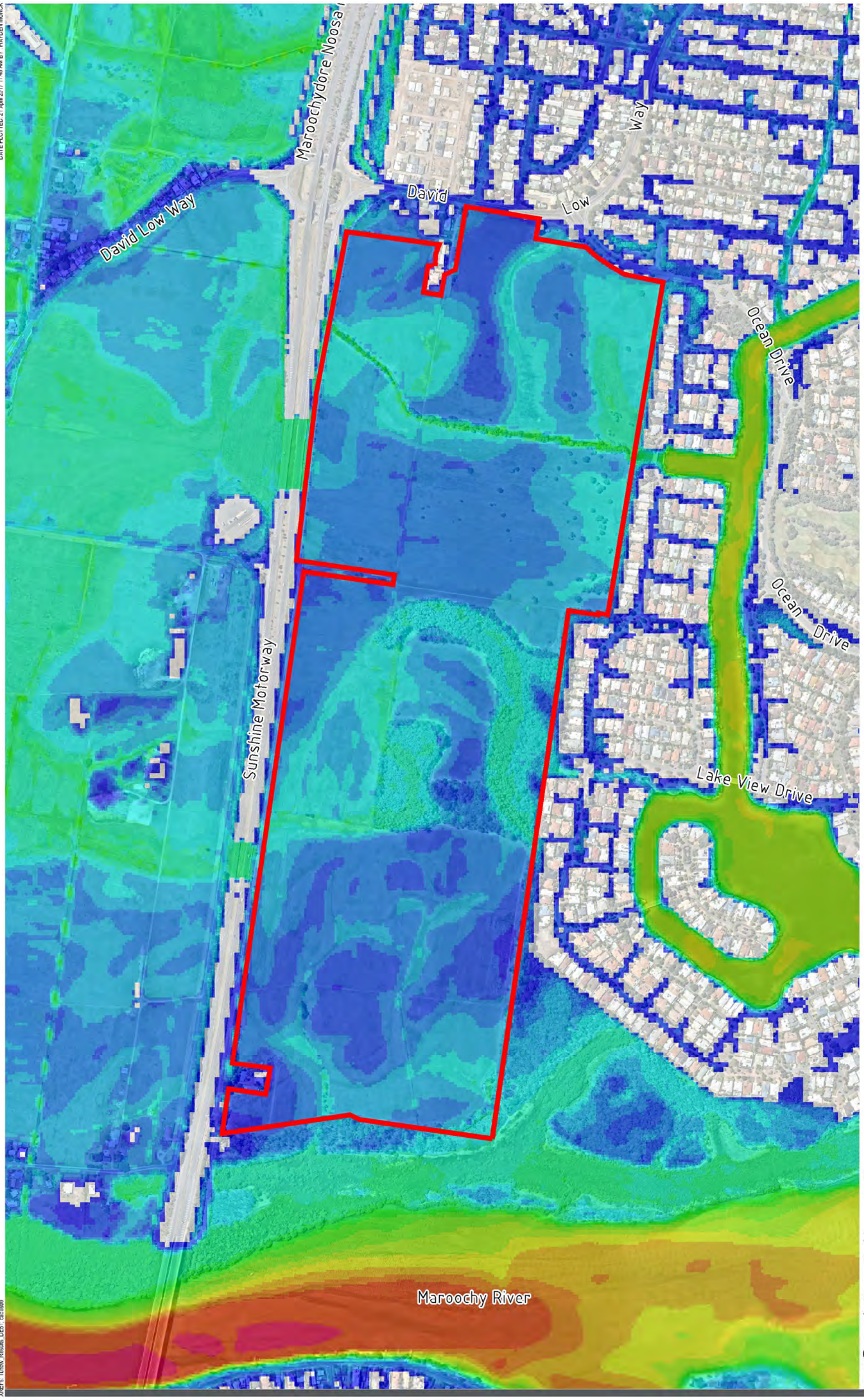
Appendix A.2.2

Pre-Development - Existing Filling Scenario - 10% AEP Event - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd



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Appendix A.2.3

Pre-Development - Existing Filling Scenario - 1% AEP Event - Flood Depths

Twin Waters West

Flood Impact Assessment

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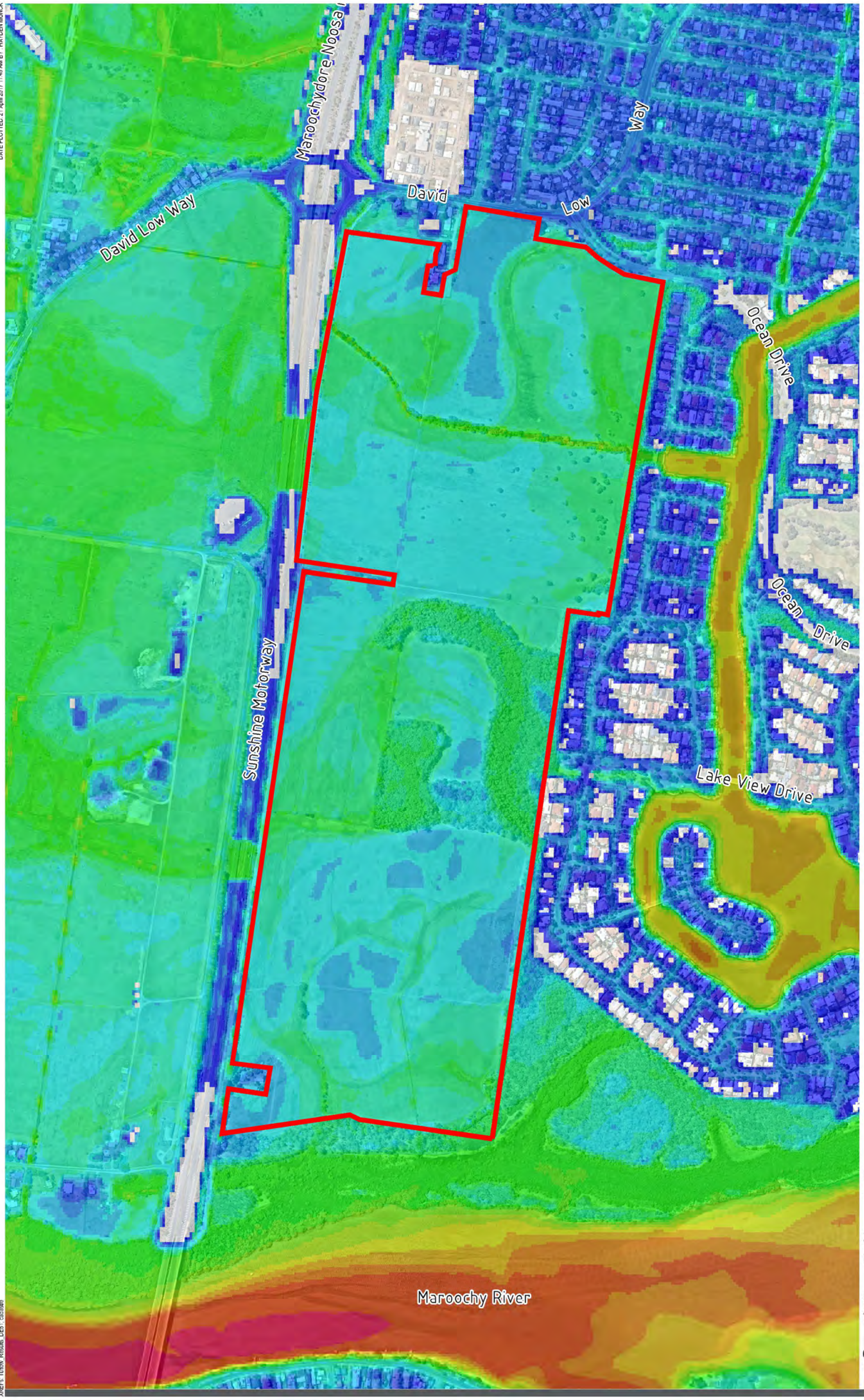
DATE PLOTTED: 21 April 2017 11:48 AM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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XREFs: TuFlow Results_DES1; cadastre

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Appendix A.2.4

Pre-Development - Existing Filling Scenario - 1% Climate Change AEP Event - Flood Depths

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

Twin Waters West

APPENDIX B

SCENARIO 1 POST-DEVELOPMENT MODEL RESULTS

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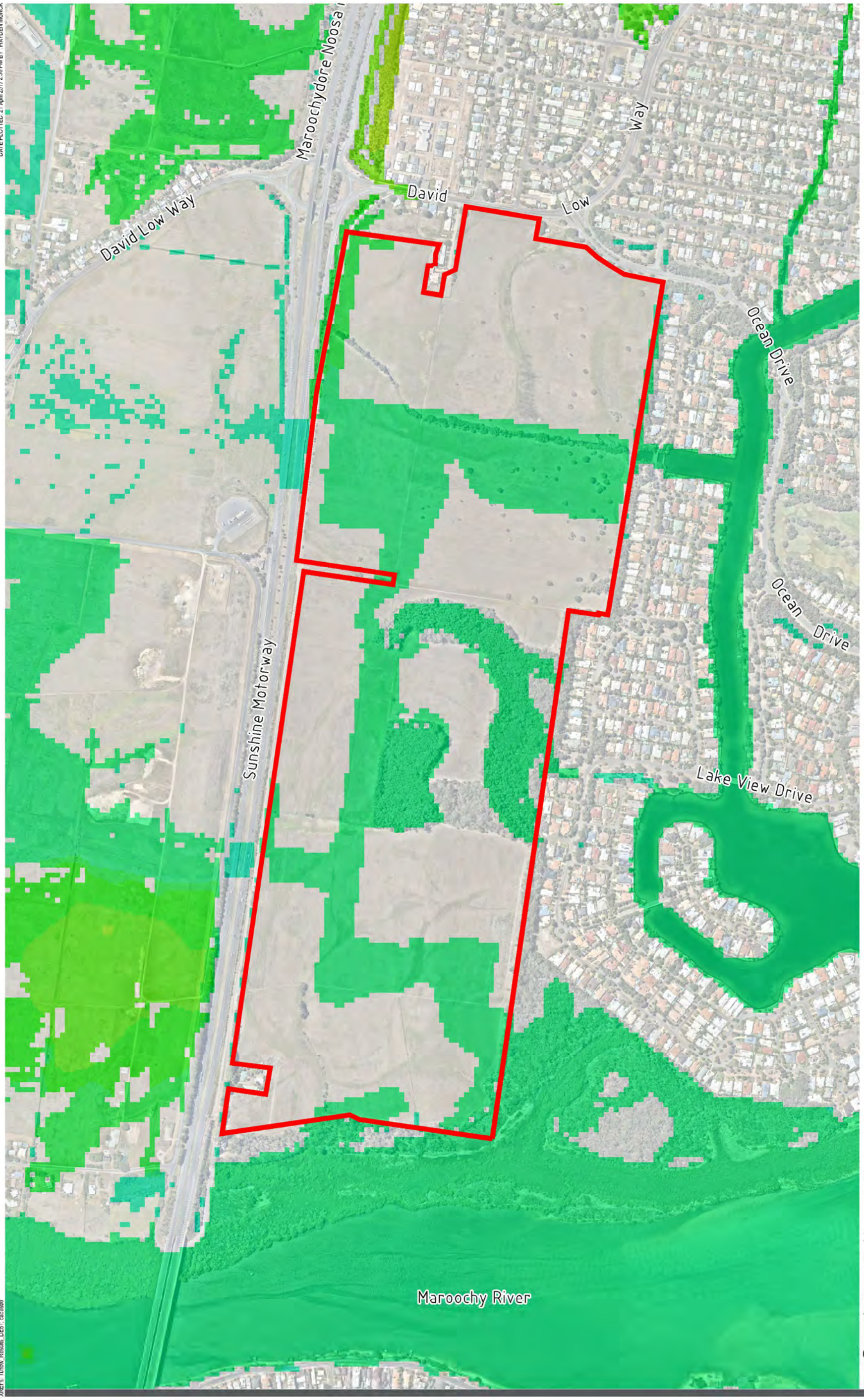

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Appendix B.1.1

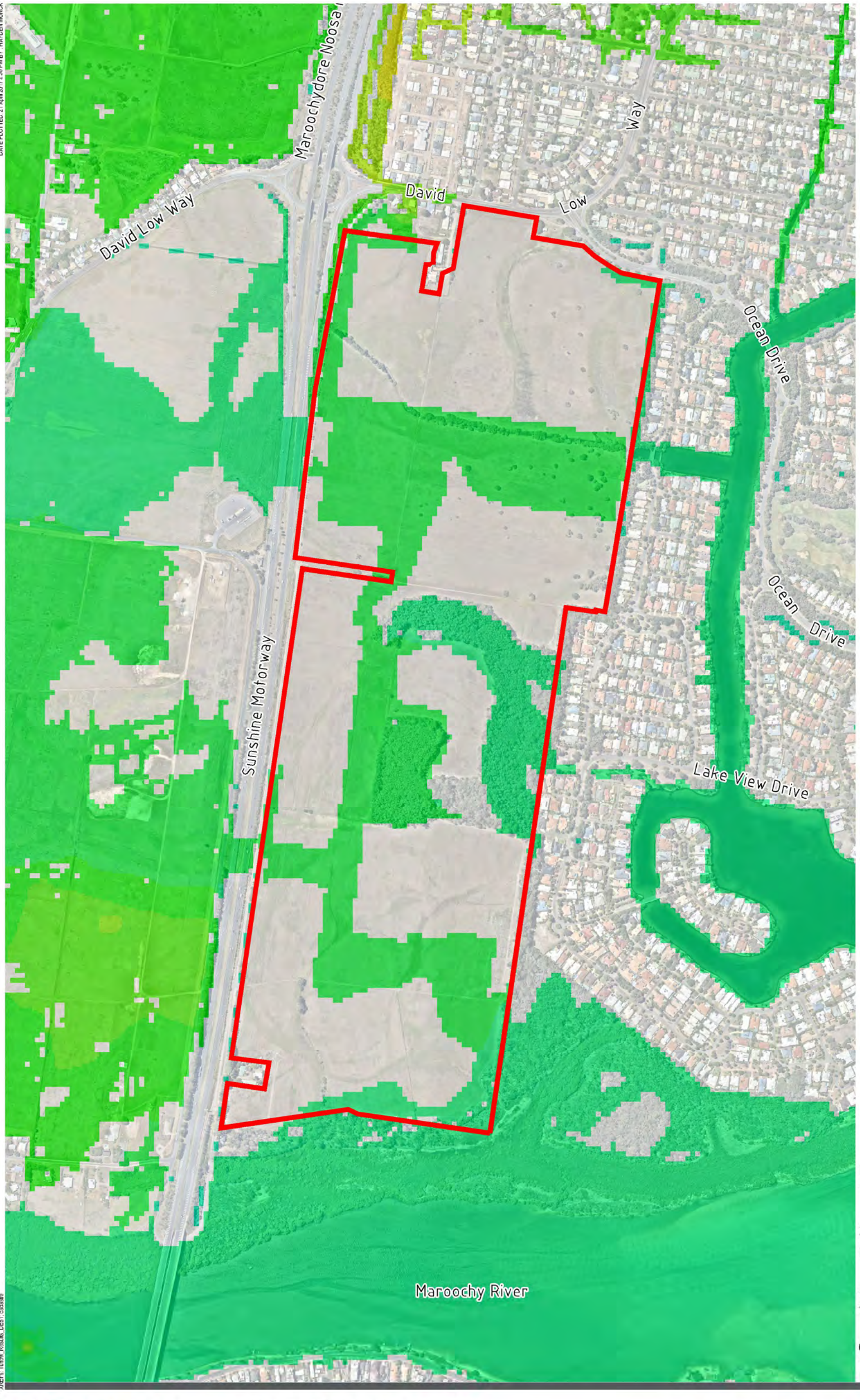
Post-Development - Existing Filling Scenario - 39% AEP - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:56 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.1.2

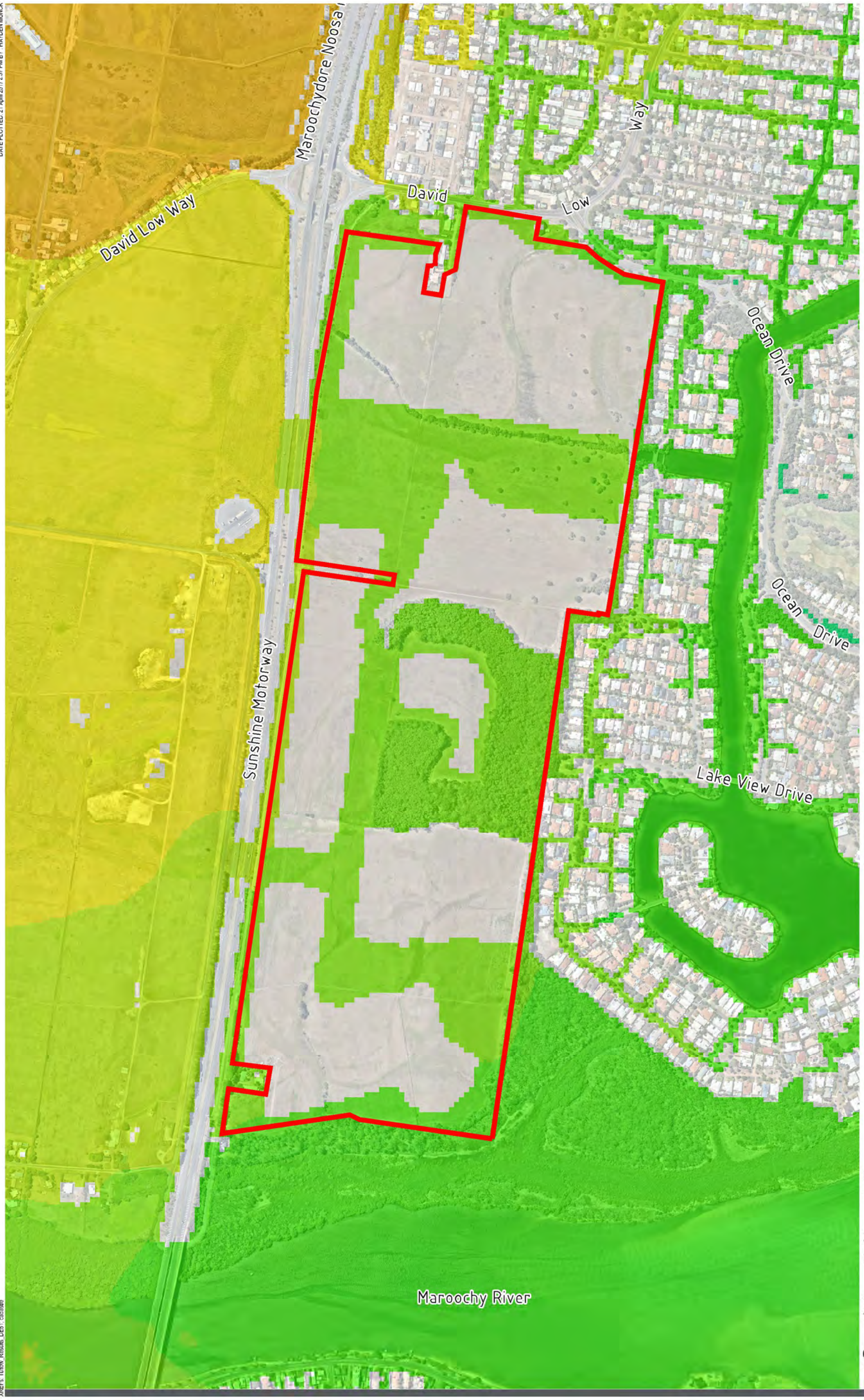
Post-Development - Existing Filling Scenario - 10% AEP - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:57 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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XREFs: Tuflow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.1.3

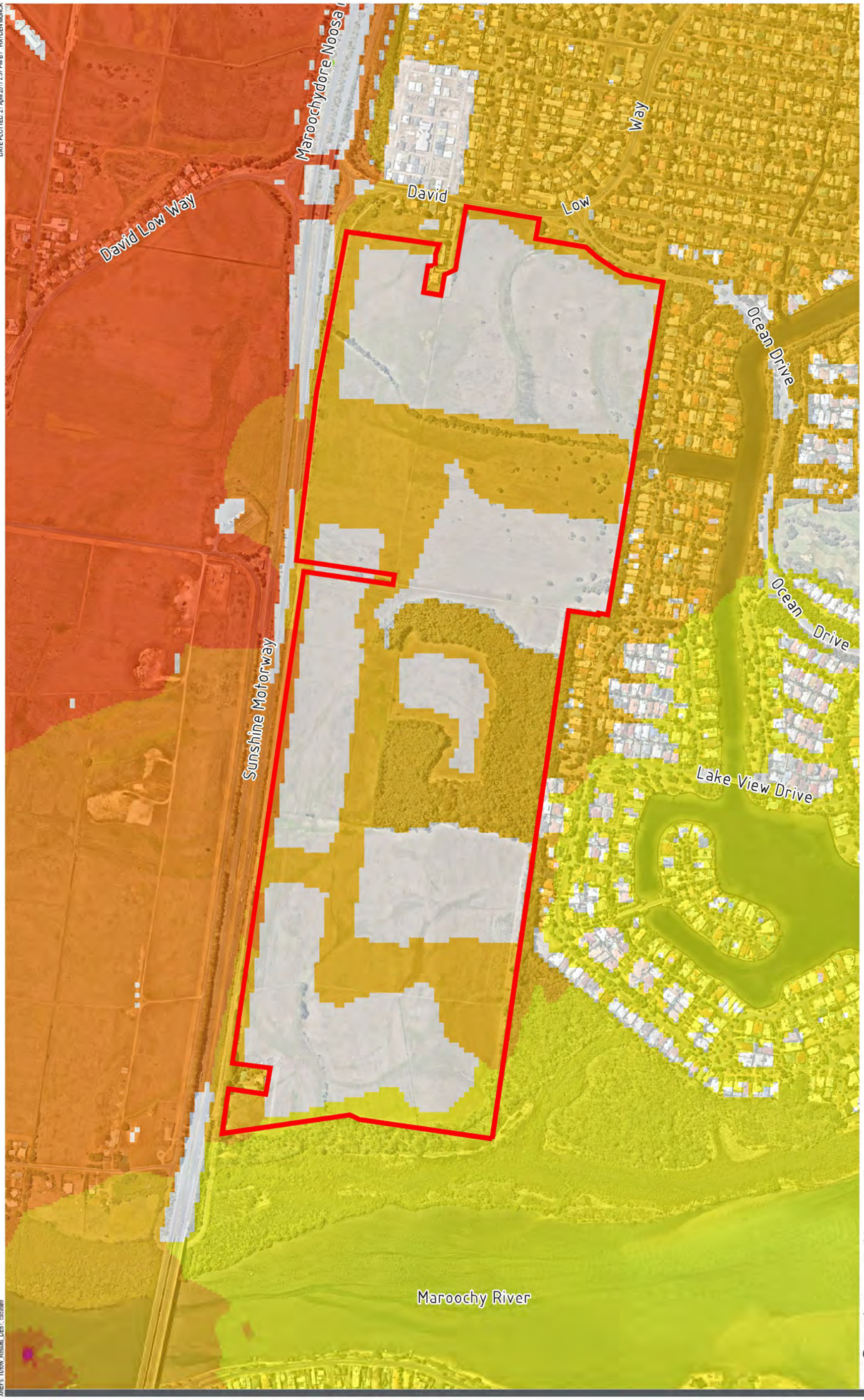
Post-Development - Existing Filling Scenario - 1% AEP - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:57 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

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CAD FILE: O:\3503-84\ACAD\Figures\TUFLOW\DE118.dwg
XREFs: TuFlow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.1.4

Post-Development - Existing Filling Scenario - 1% Climate Change AEP - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:57 PM BY: HAYDEN MUNCK

NORTH

Legend

Site Boundary

Maroochydore Noosa

David Low Way

David Low Way

Ocean Drive

Ocean Drive

Sunshine Motorway

Lake View Drive

Maroochy River

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
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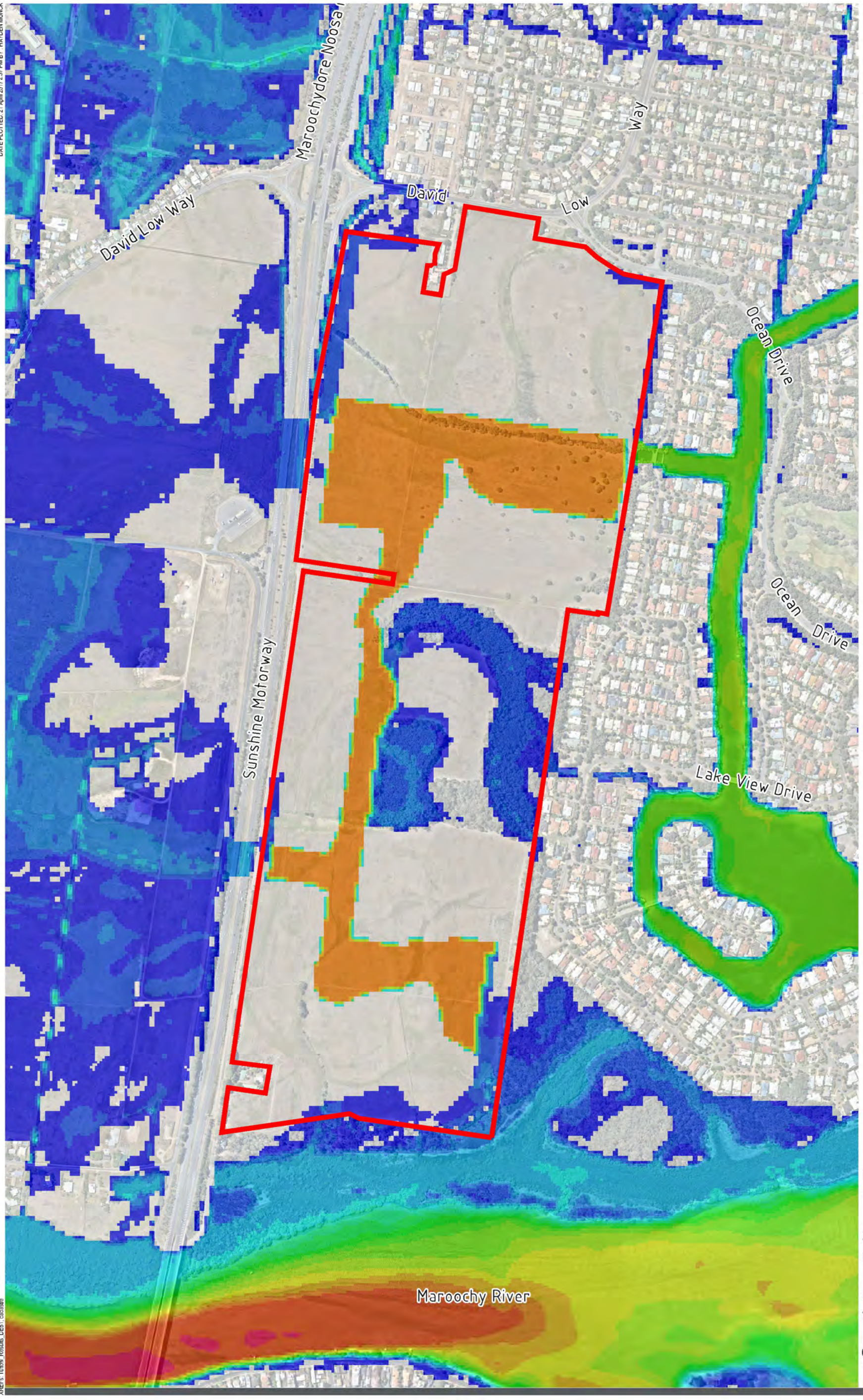
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.2.1

Post-Development - Existing Filling Scenario - 39% AEP - Flood Depths

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:57 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DE81, cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.2.2

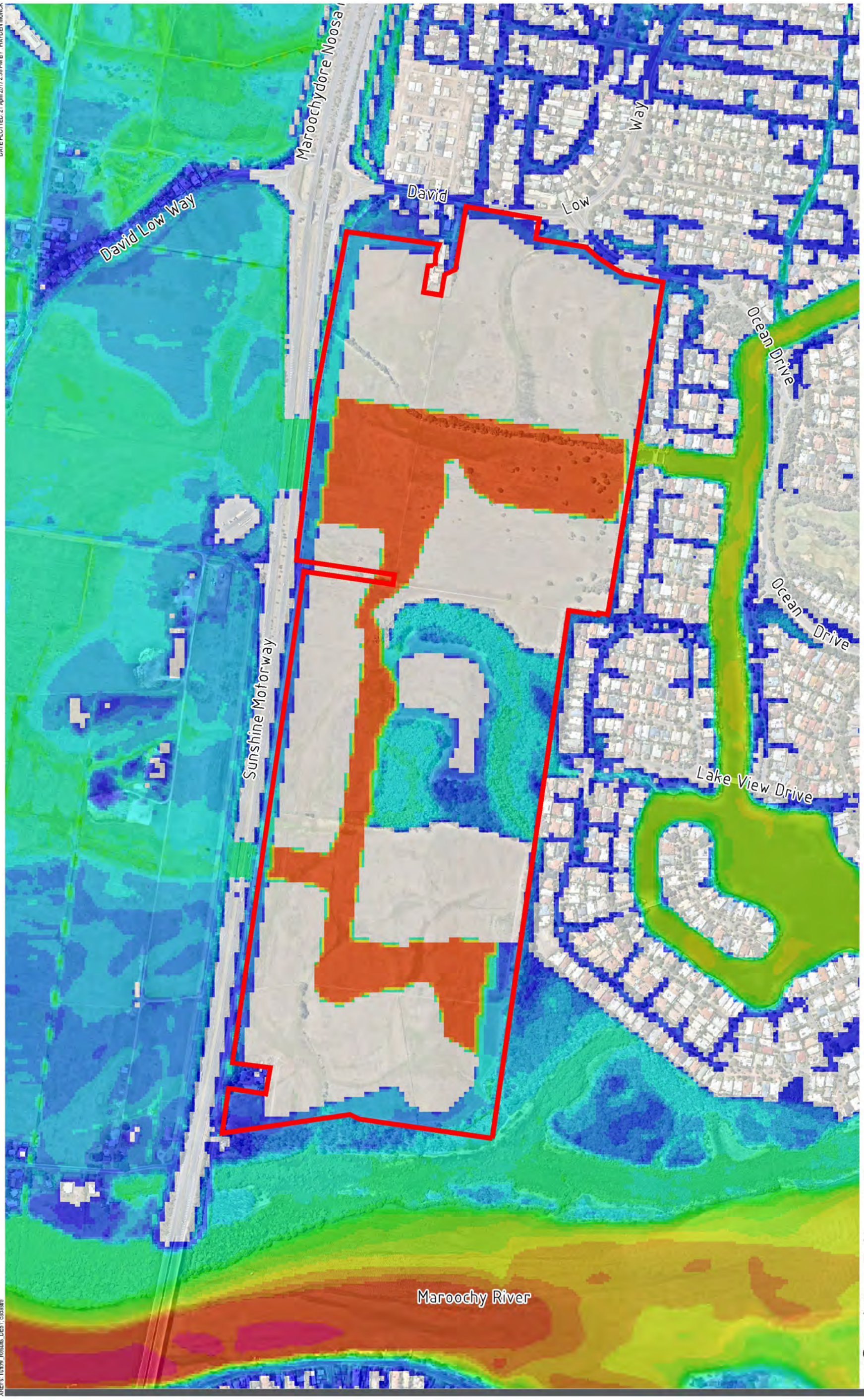
Post-Development - Existing Filling Scenario - 10% AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:58 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84-ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.2.3

Post-Development - Existing Filling Scenario - 1% AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:58 PM BY: HAYDEN MUNCK

NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: Q:\3503-84\ACAD\Figures\TUFLOW\DE118.dwg
XREFs: TuFlow Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix B.2.4

Post-Development - Existing Filling Scenario - 1% Climate Change AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

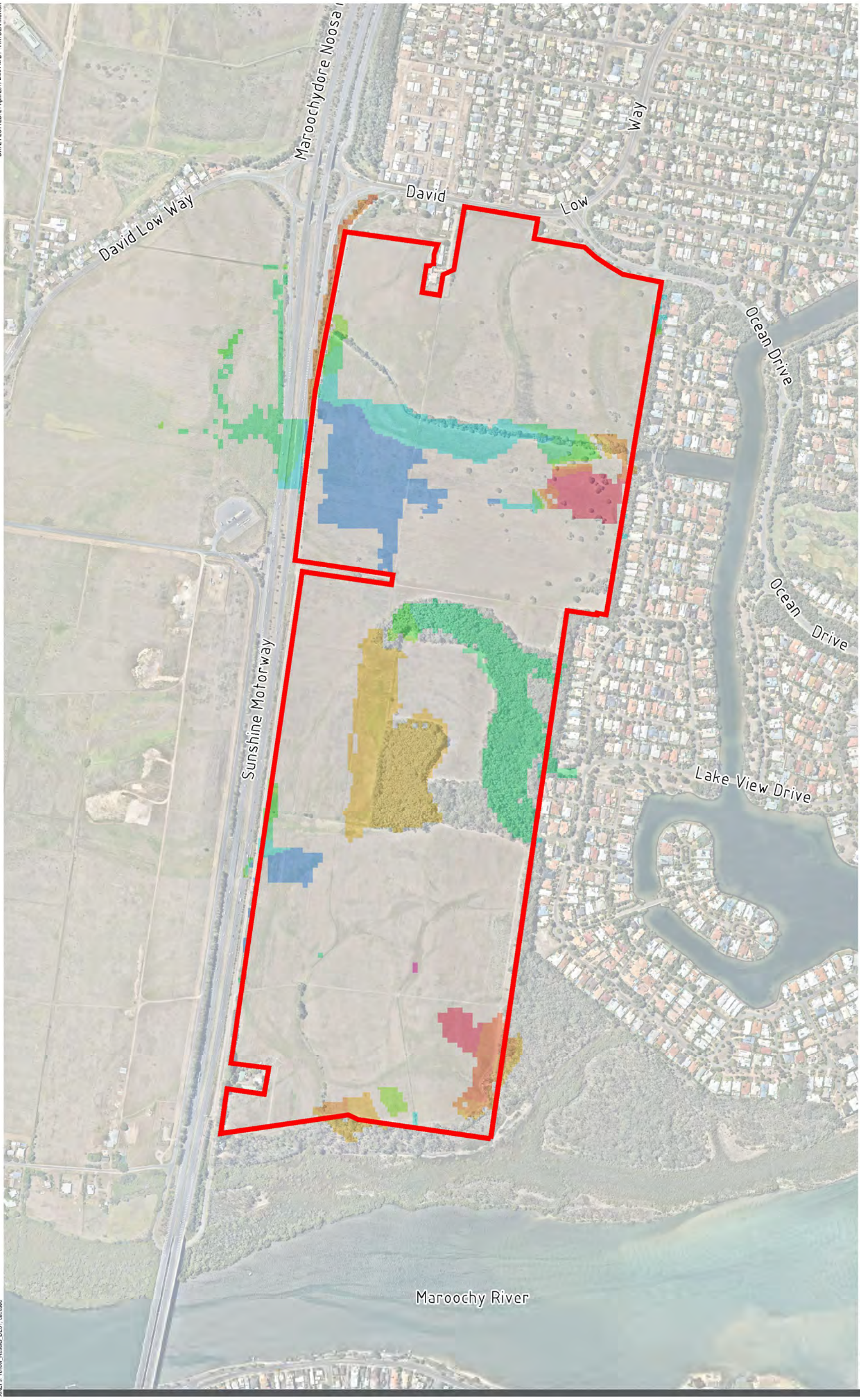
Twin Waters West

APPENDIX

C

SCENARIO 1 PREDICTED FLOODING IMPACTS

DATE PLOTTED: 21 April 2017 2:58 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DES1; cadastre

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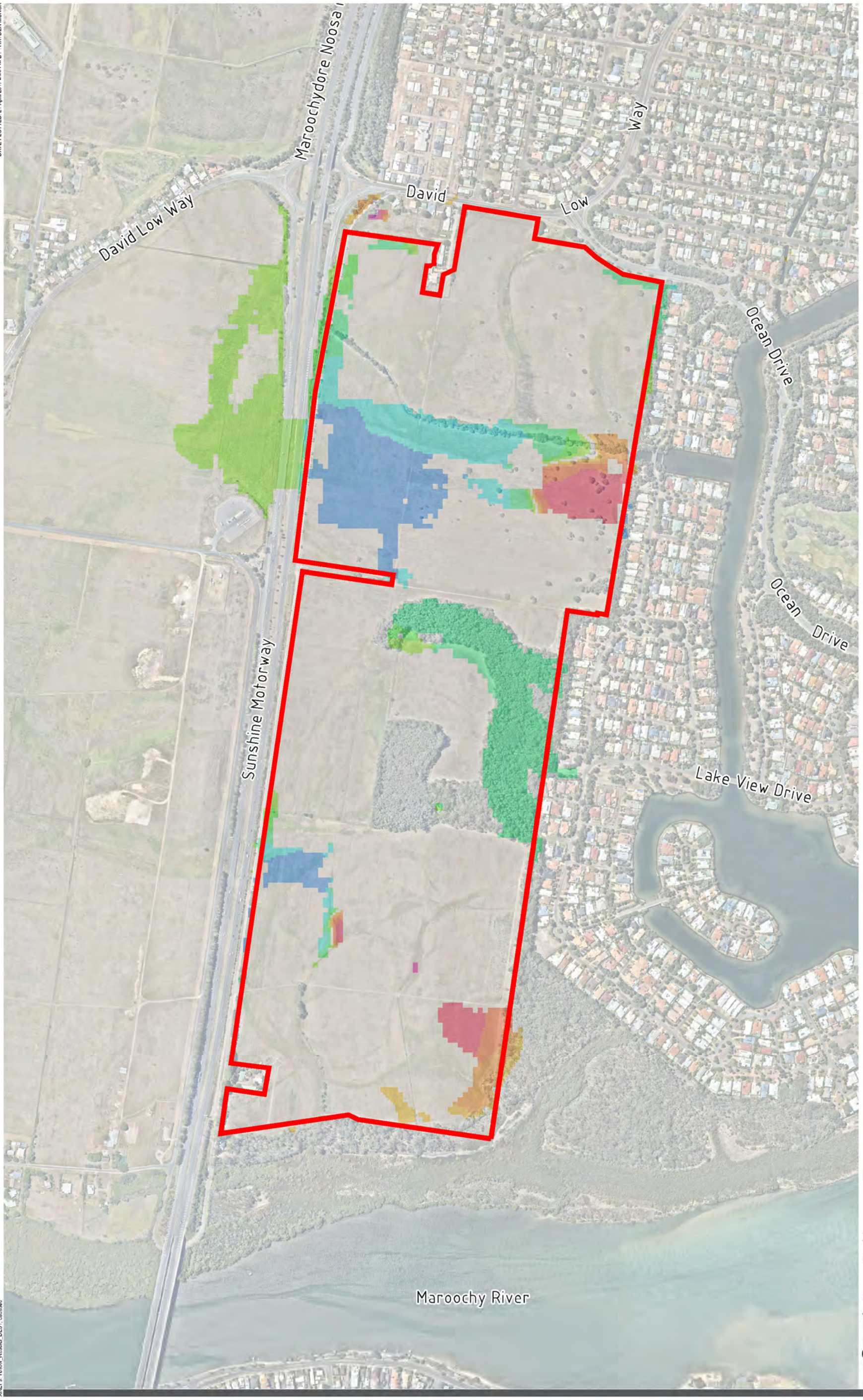
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix C.1.1
Post-Development - Existing Filling Scenario - 39% AEP - Flood Impacts

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:58 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DES1; cadastre

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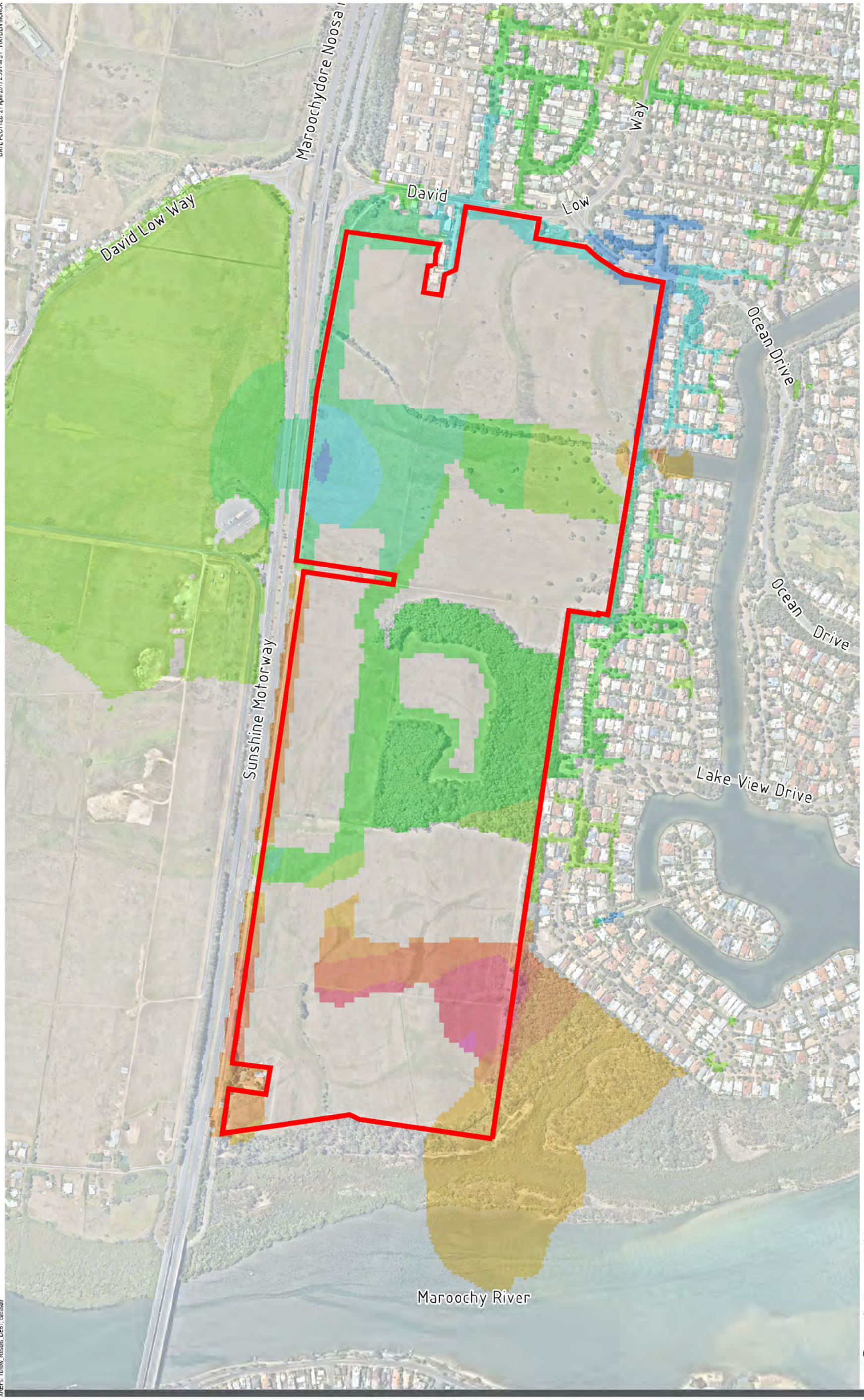
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix C.1.2

Post-Development - Existing Filling Scenario - 10% AEP - Flood Impacts

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:59 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

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XREFs: Tuflow_Results_DE81; cadastre

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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix C.1.3

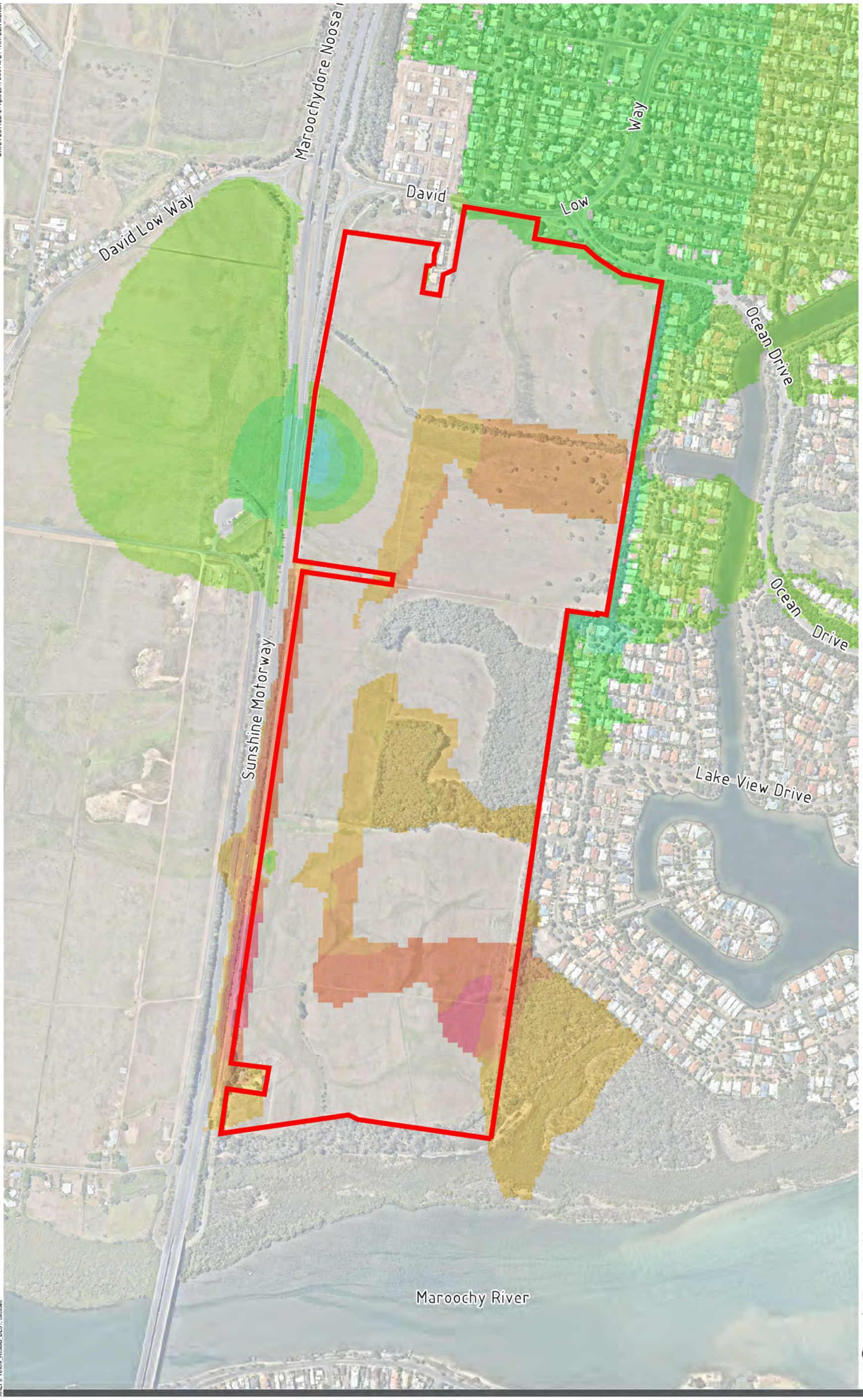
Post-Development - Existing Filling Scenario - 1% AEP - Flood Impacts

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:59 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE118.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix C.1.4

Post-Development - Existing Filling Scenario - 1% Climate Change AEP - Flood Impacts

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

Twin Waters West

APPENDIX

D

SCENARIO 2 PRE-DEVELOPMENT MODEL RESULTS

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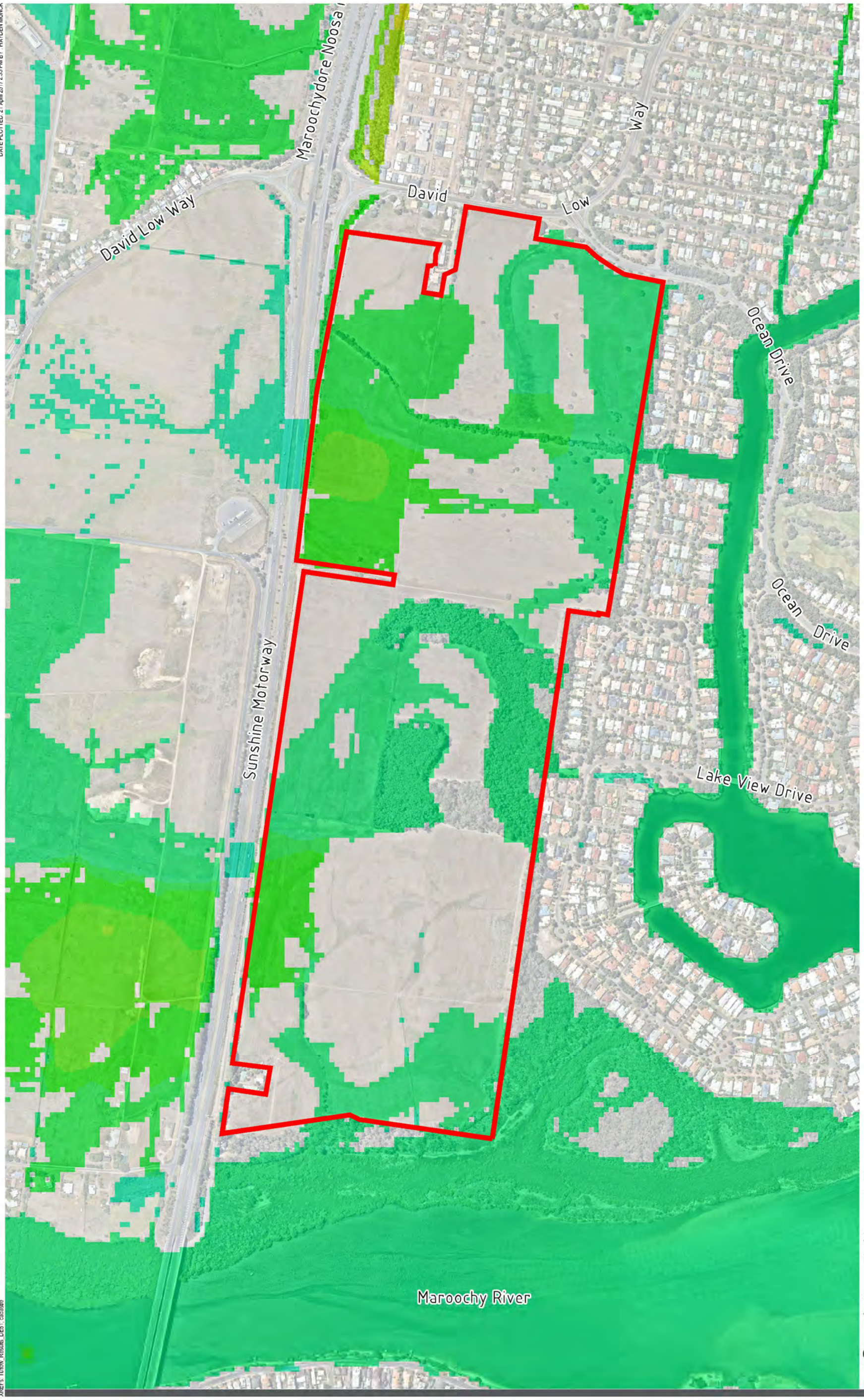
DATE PLOTTED: 21 April 2017 2:35 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
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Project Reference	Revision

Scale
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XREFs: Tuflow_Results_DEB1; cadastre

Cardno
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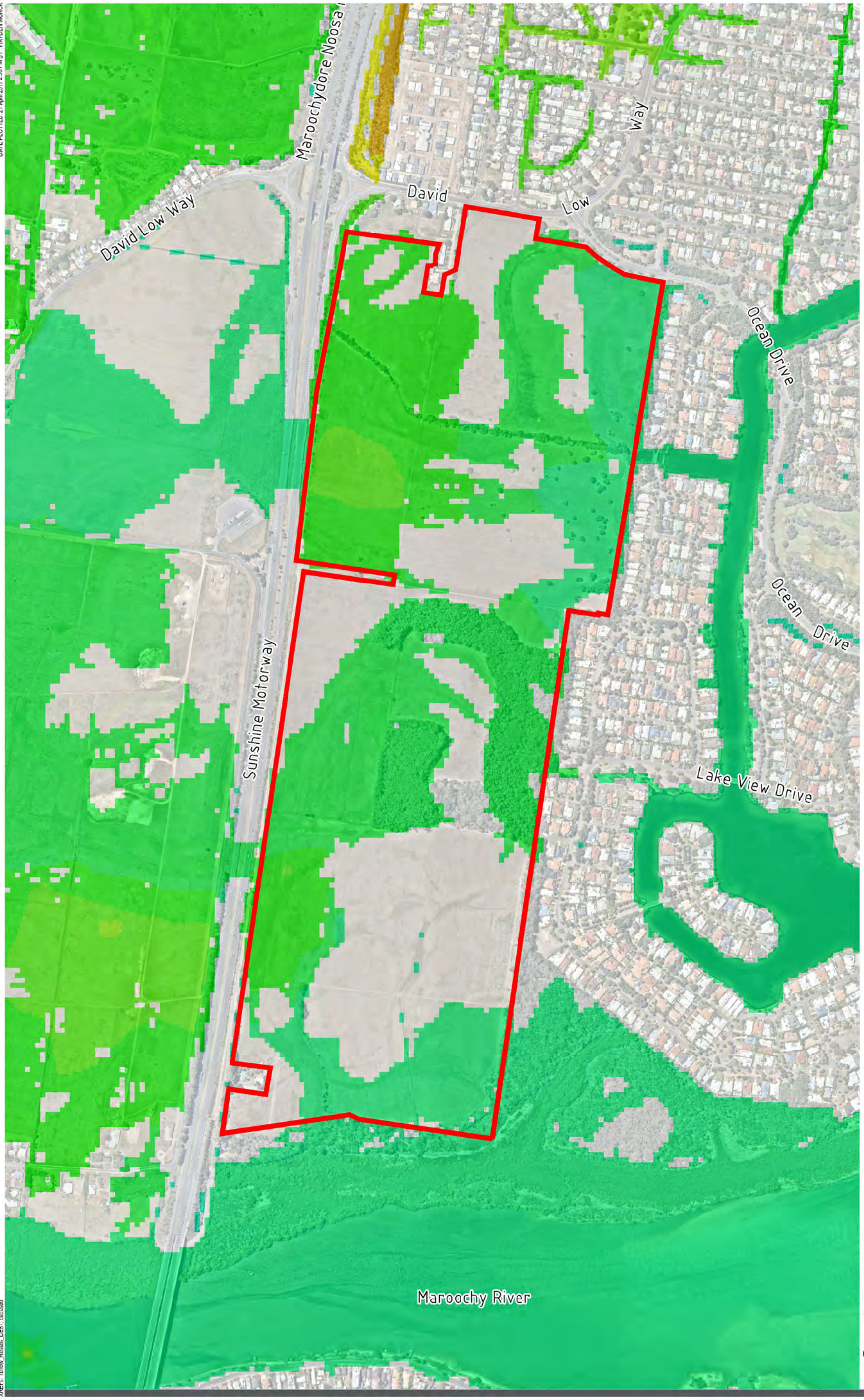
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.1.1

Pre-Development - Ultimate Filling Scenario - 39% AEP Event - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:36 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWEX30.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.1.2

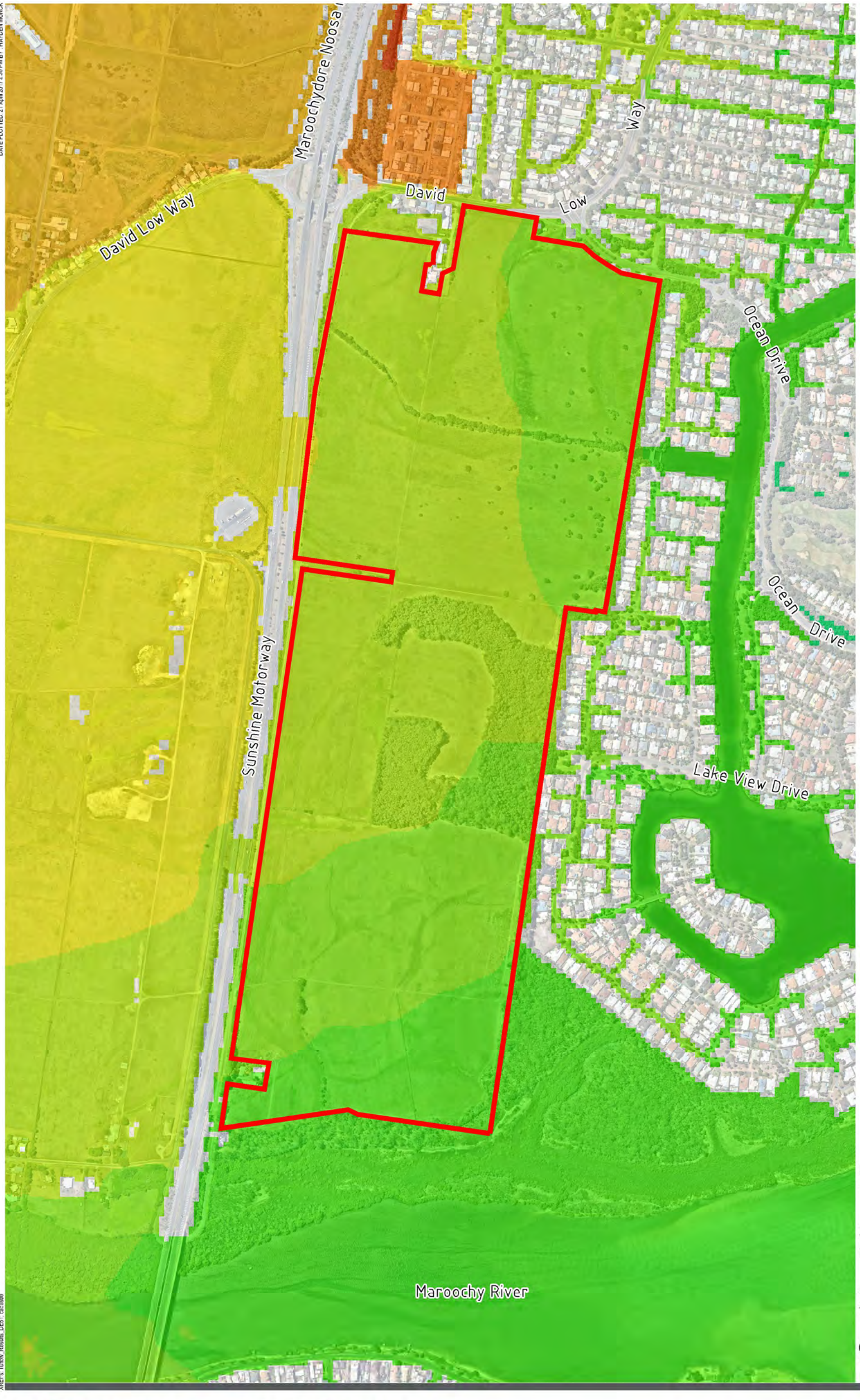
Pre-Development - Ultimate Filling Scenario - 10% AEP Event - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:36 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWEX30.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

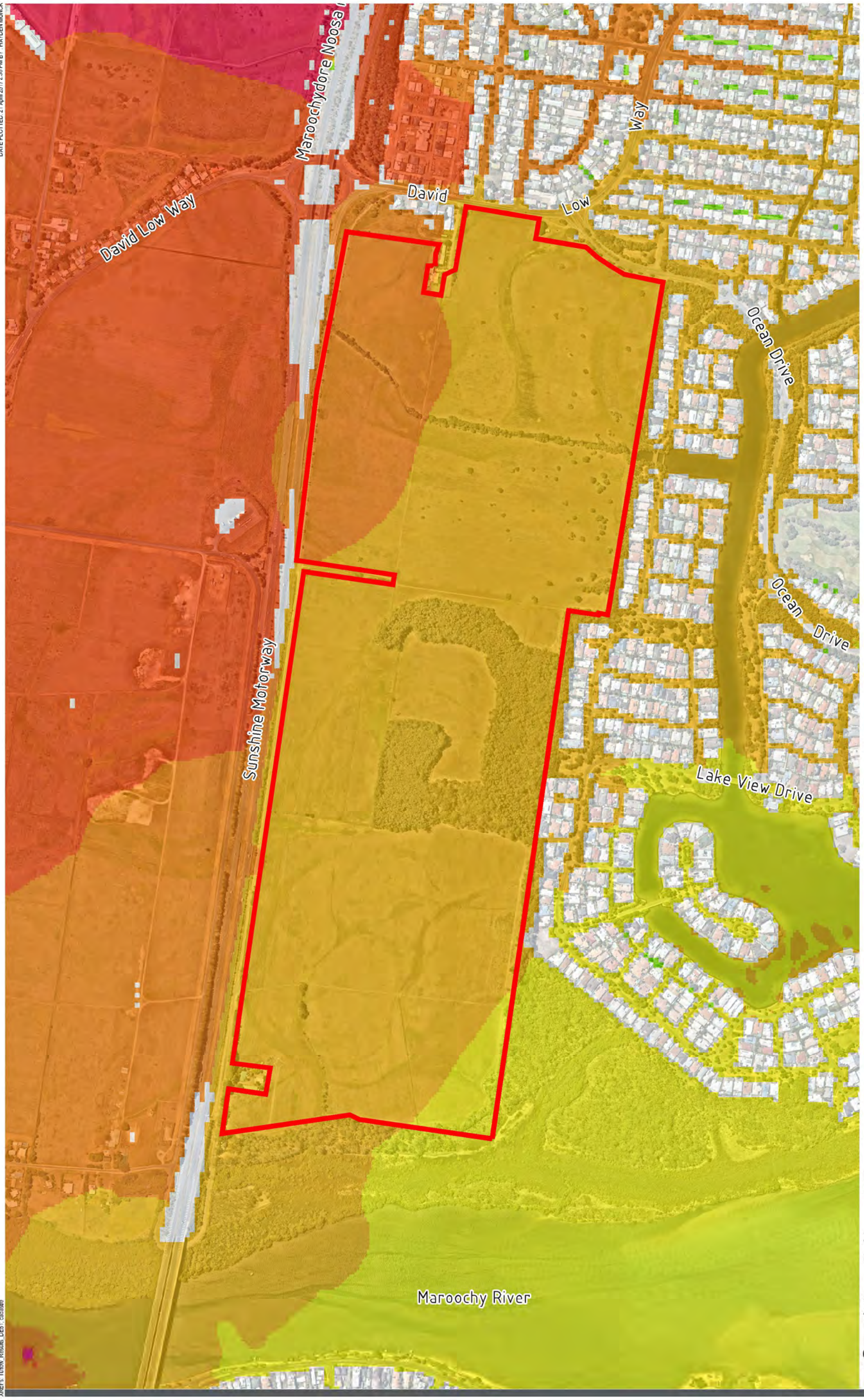
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.1.3

Pre-Development - Ultimate Filling Scenario - 1% AEP Event - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:36 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
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0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWEX30.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

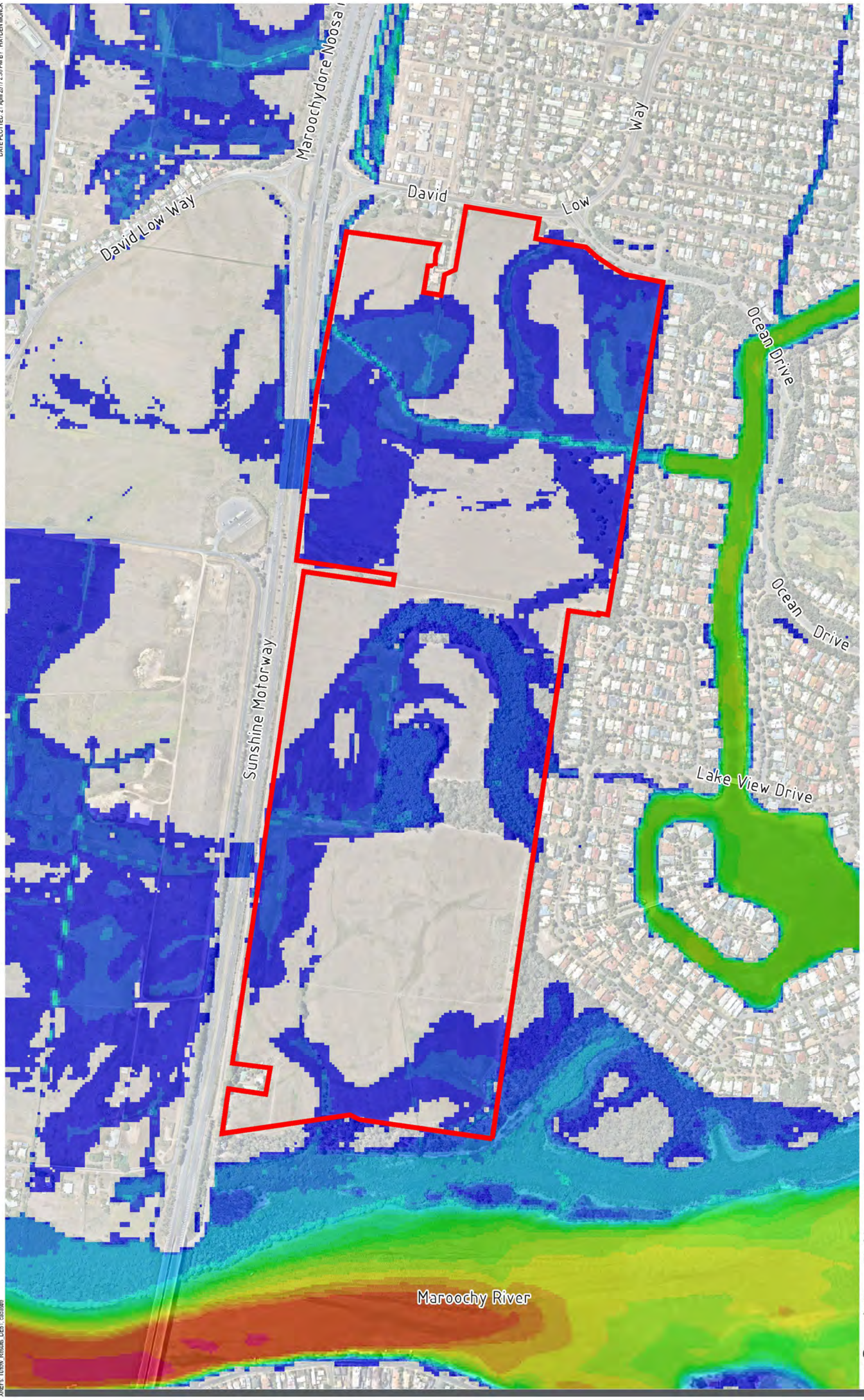
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.1.4

Pre-Development - Ultimate Filling Scenario - 1% Climate Change AEP Event - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:36 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWEX30.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

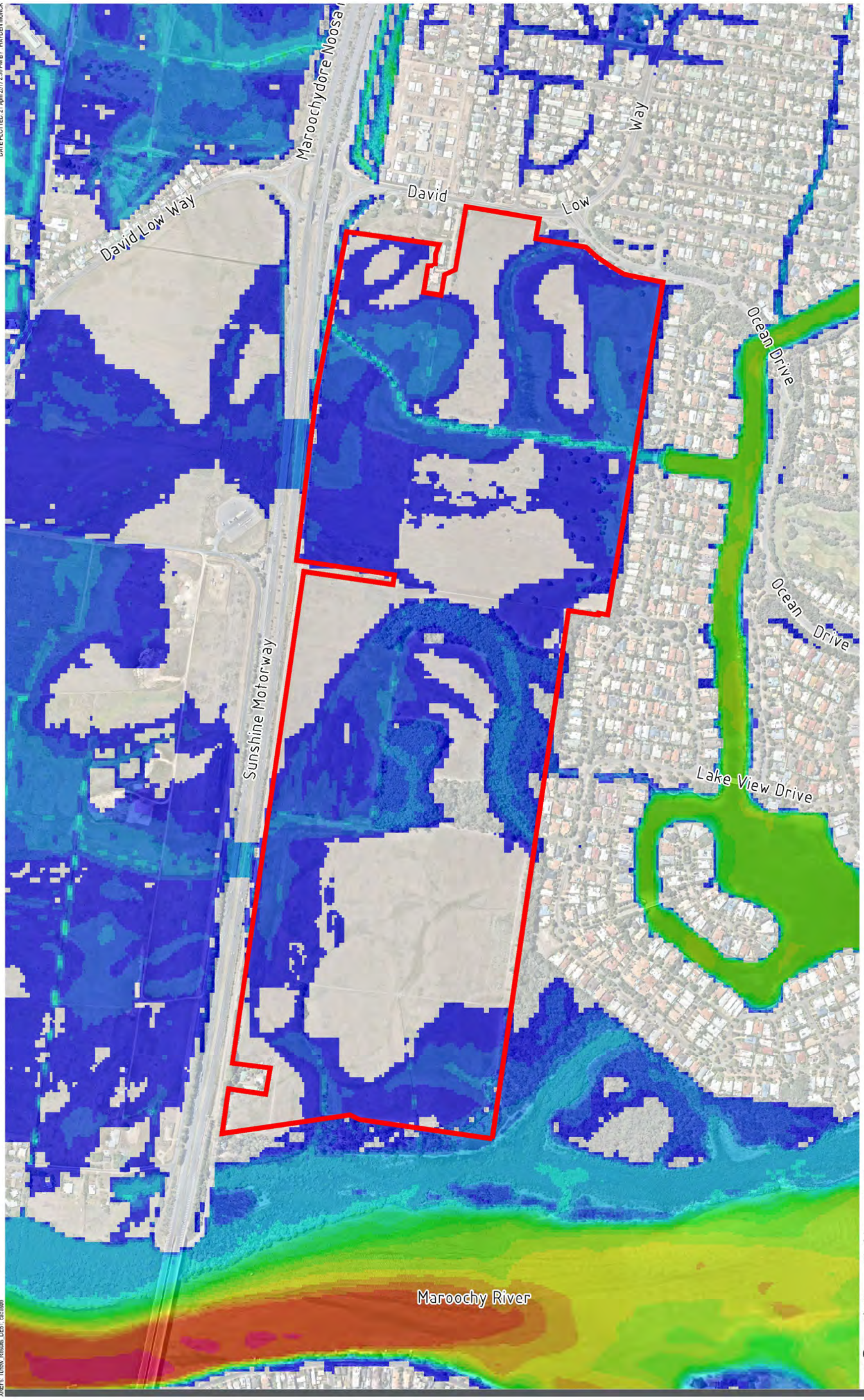
Appendix D.2.1

Pre-Development - Ultimate Filling Scenario - 39% AEP Event - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd



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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.2.2

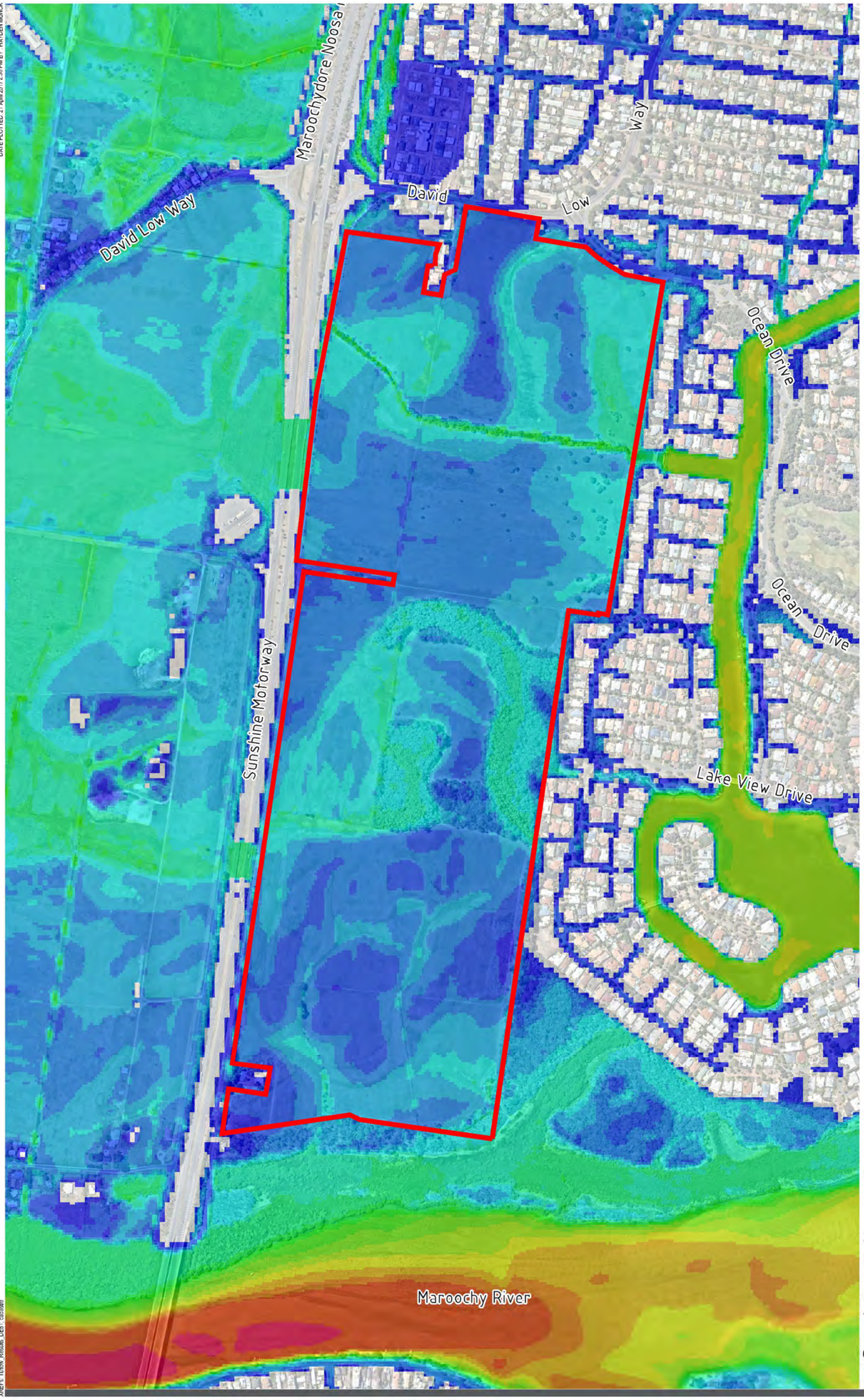
Pre-Development - Ultimate Filling Scenario - 10% AEP Event - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:36 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84-ACAD\Figures\TUFLOWEX30.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.2.3

Pre-Development - Ultimate Filling Scenario - 1% AEP Event - Flood Depths

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:37 PM BY : HAYDEN MUNCK

NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: Q:\3503-844\ACAD\Figures\TUFLOWEX30.dwg
XREFs: TuFlow Results, DES1, Cadastre

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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix D.2.4

Pre-Development - Ultimate Filling Scenario - 1% Climate Change AEP Event - Flood Depths

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

Twin Waters West

APPENDIX

E

SCENARIO 2 POST-DEVELOPMENT MODEL RESULTS

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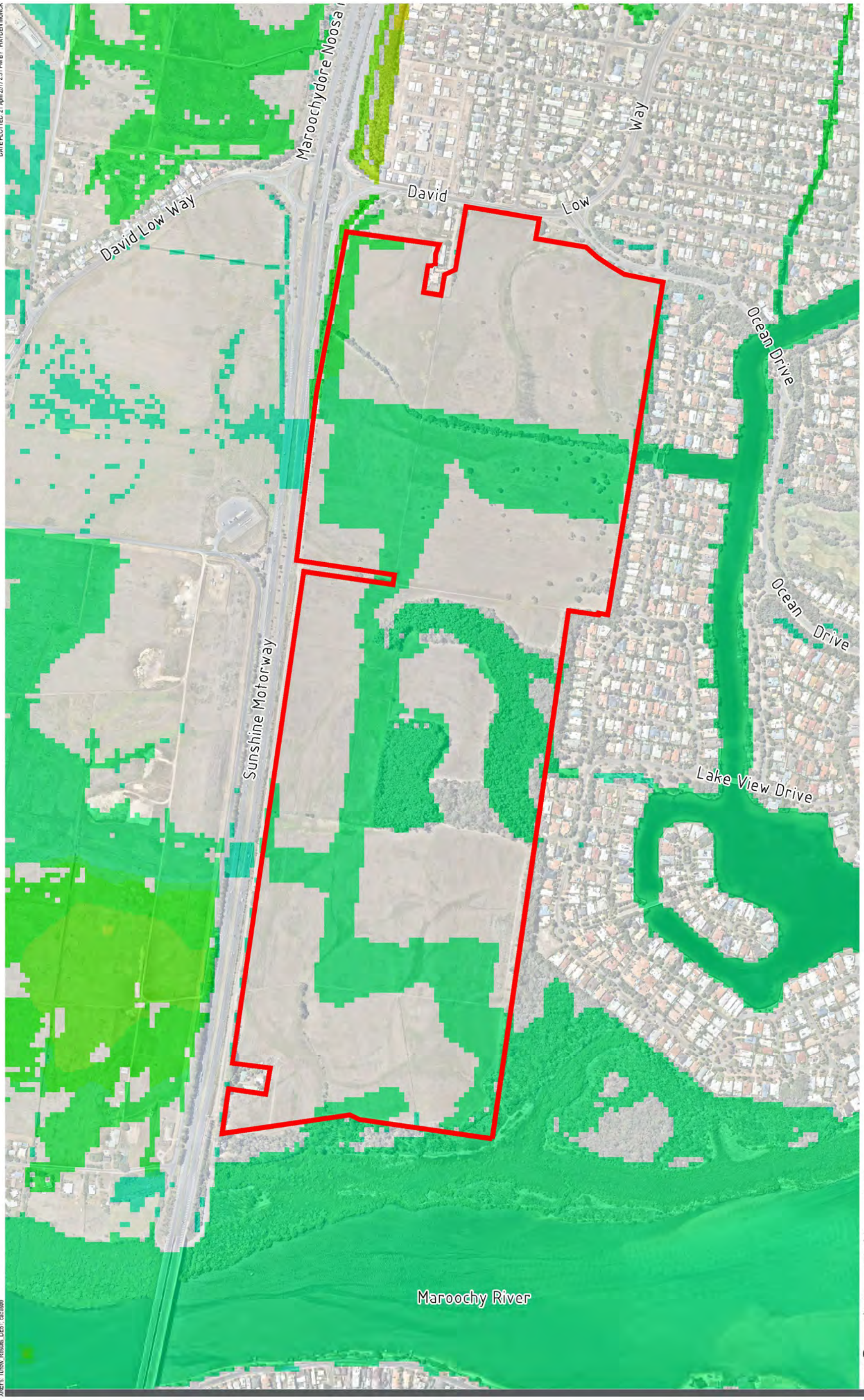
DATE PLOTTED: 21 April 2017 2:51 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOW\DE117.dwg
XREFs: TuFlow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix E.1.1

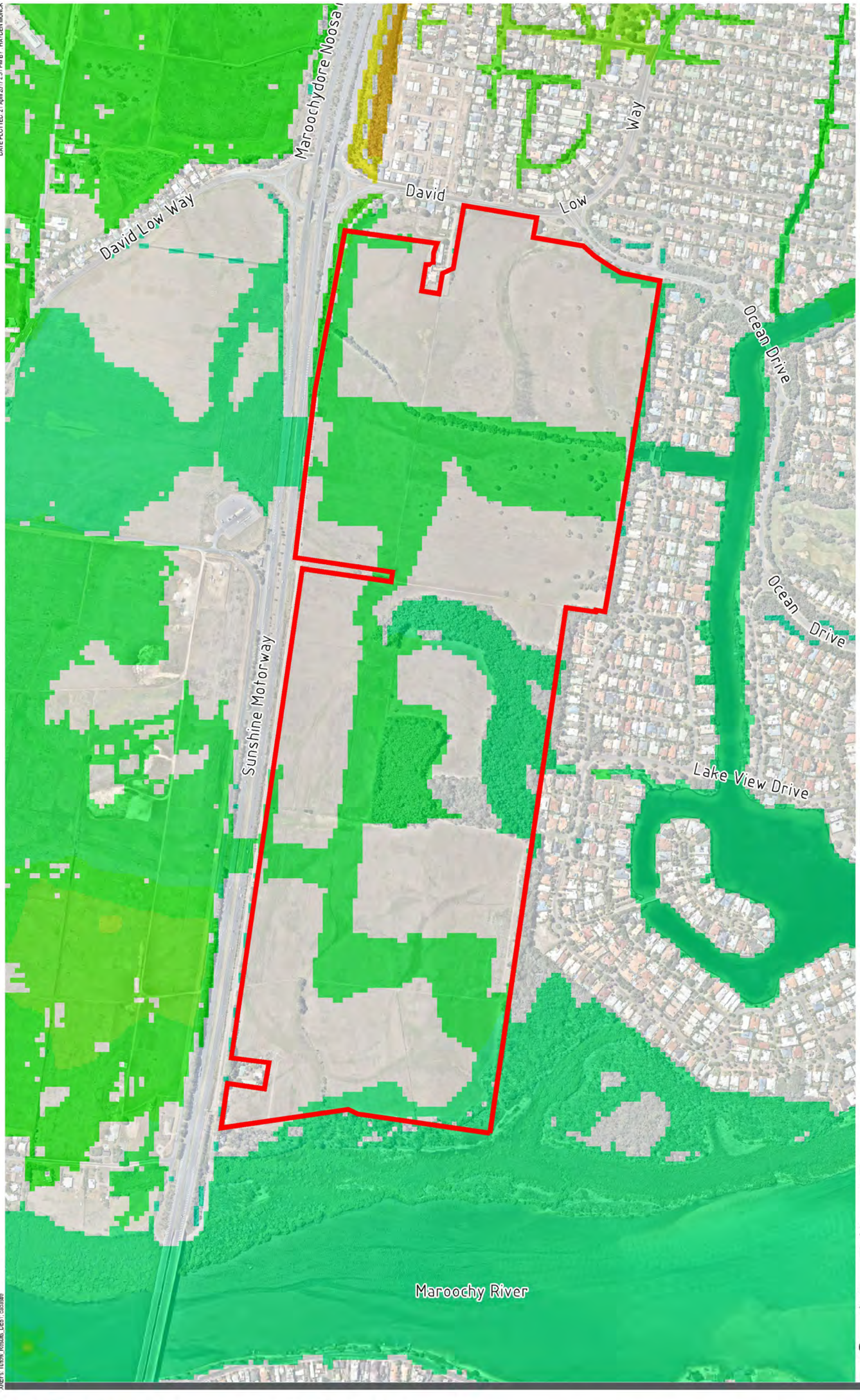
Post-Development - Ultimate Filling Scenario - 39% AEP - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:51 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE1 17.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

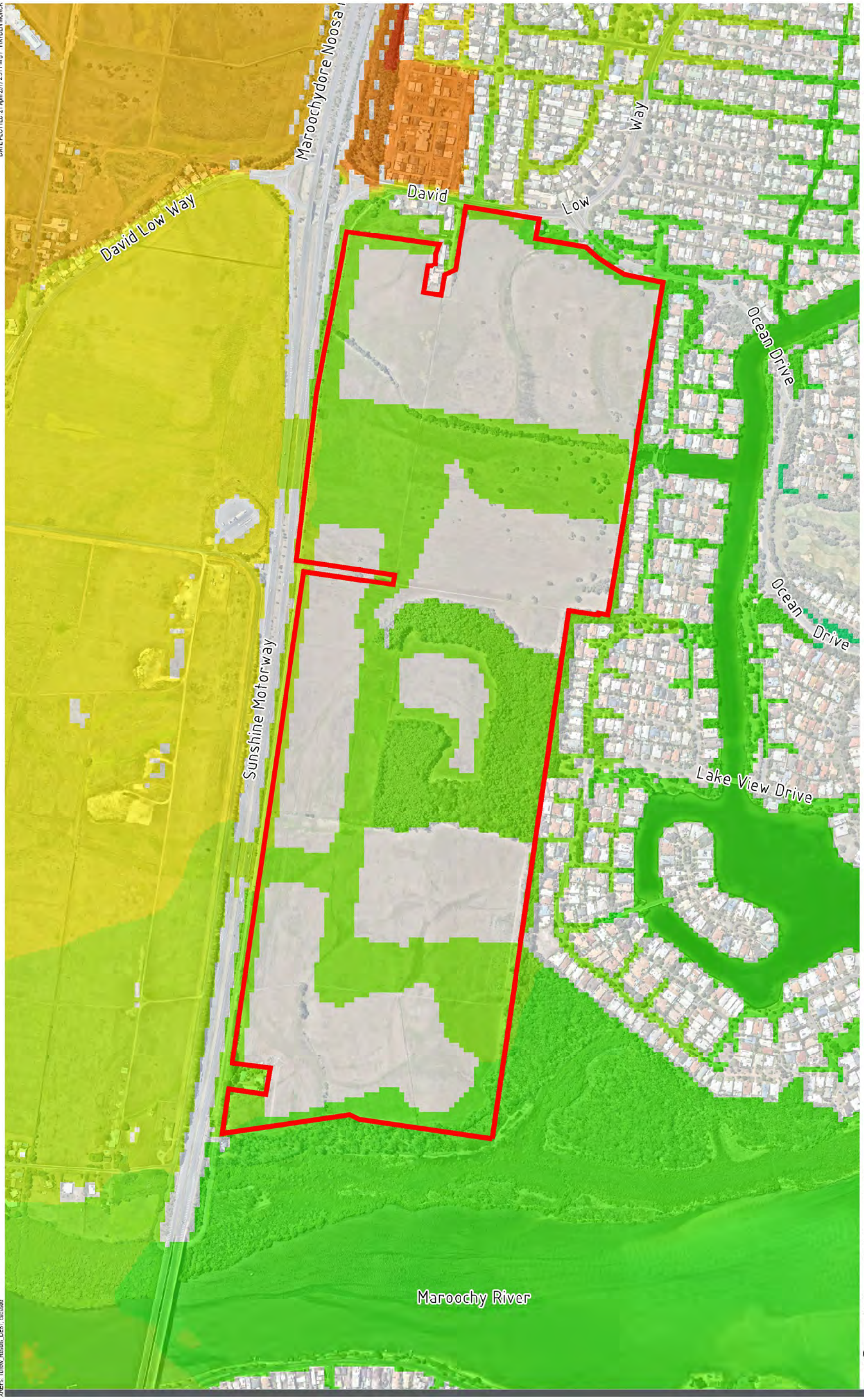
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix E.1.2

Post-Development - Ultimate Filling Scenario - 10% AEP - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:51 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-64\ACAD\Figures\TUFLOWDE1 17.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix E.1.3

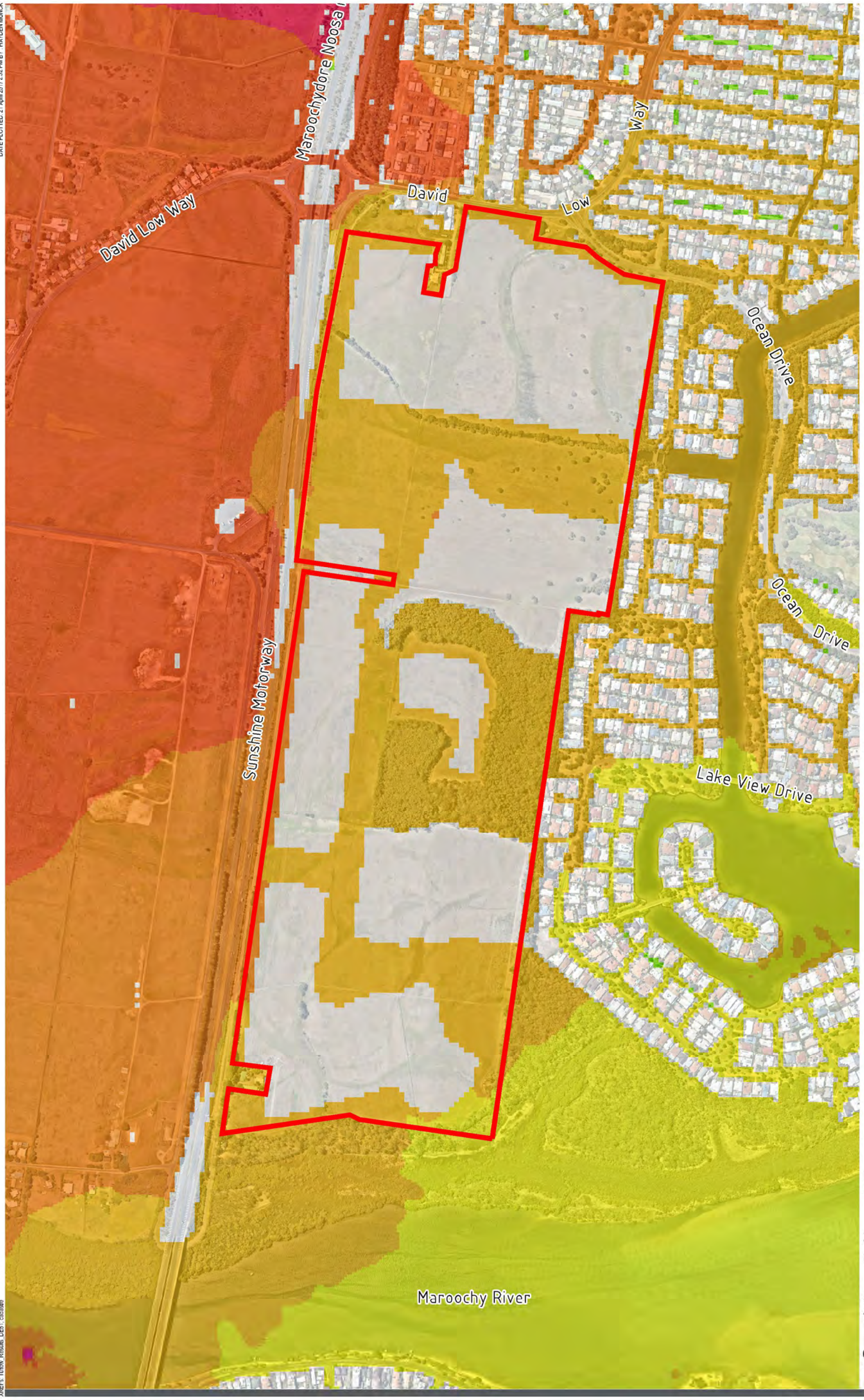
Post-Development - Ultimate Filling Scenario - 1% AEP - Flood Levels

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:52 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Levels (mAHD)

- Above 4.35
- 4.15 to 4.35
- 3.95 to 4.15
- 3.75 to 3.95
- 3.55 to 3.75
- 3.35 to 3.55
- 3.15 to 3.35
- 2.95 to 3.15
- 2.75 to 2.95
- 2.55 to 2.75
- 2.35 to 2.55
- 2.15 to 2.35
- 1.95 to 2.15
- 1.75 to 1.95
- 1.55 to 1.75
- 1.35 to 1.55
- 1.15 to 1.35
- 1.00 to 1.15
- Below 1.00

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOW\DE117.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
Shaping the Future

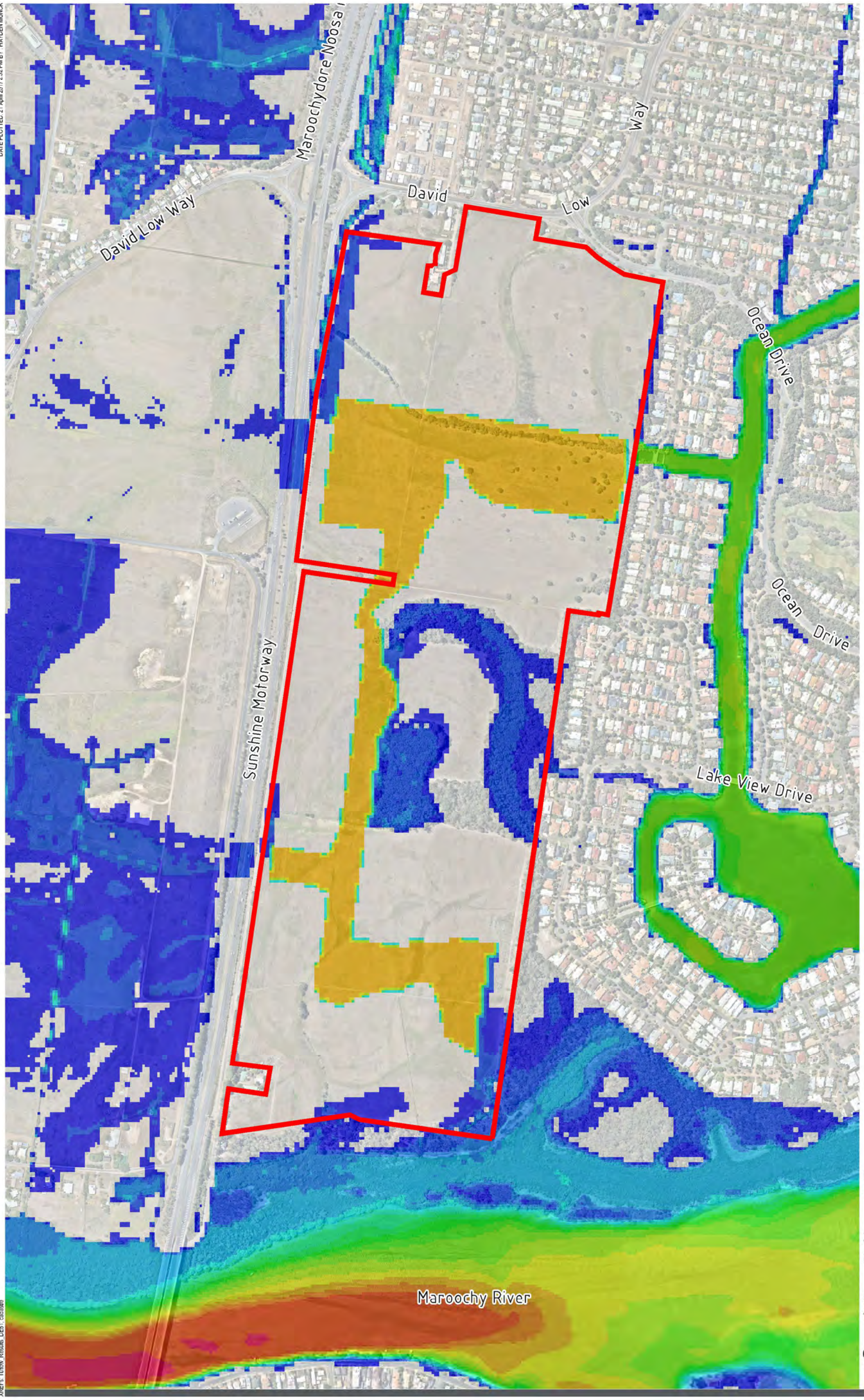
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix E.1.4

Post-Development - Ultimate Filling Scenario - 1% Climate Change AEP - Flood Levels

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:52 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE1\17.dwg
XREFs: Tuflow_Results_DE81; cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

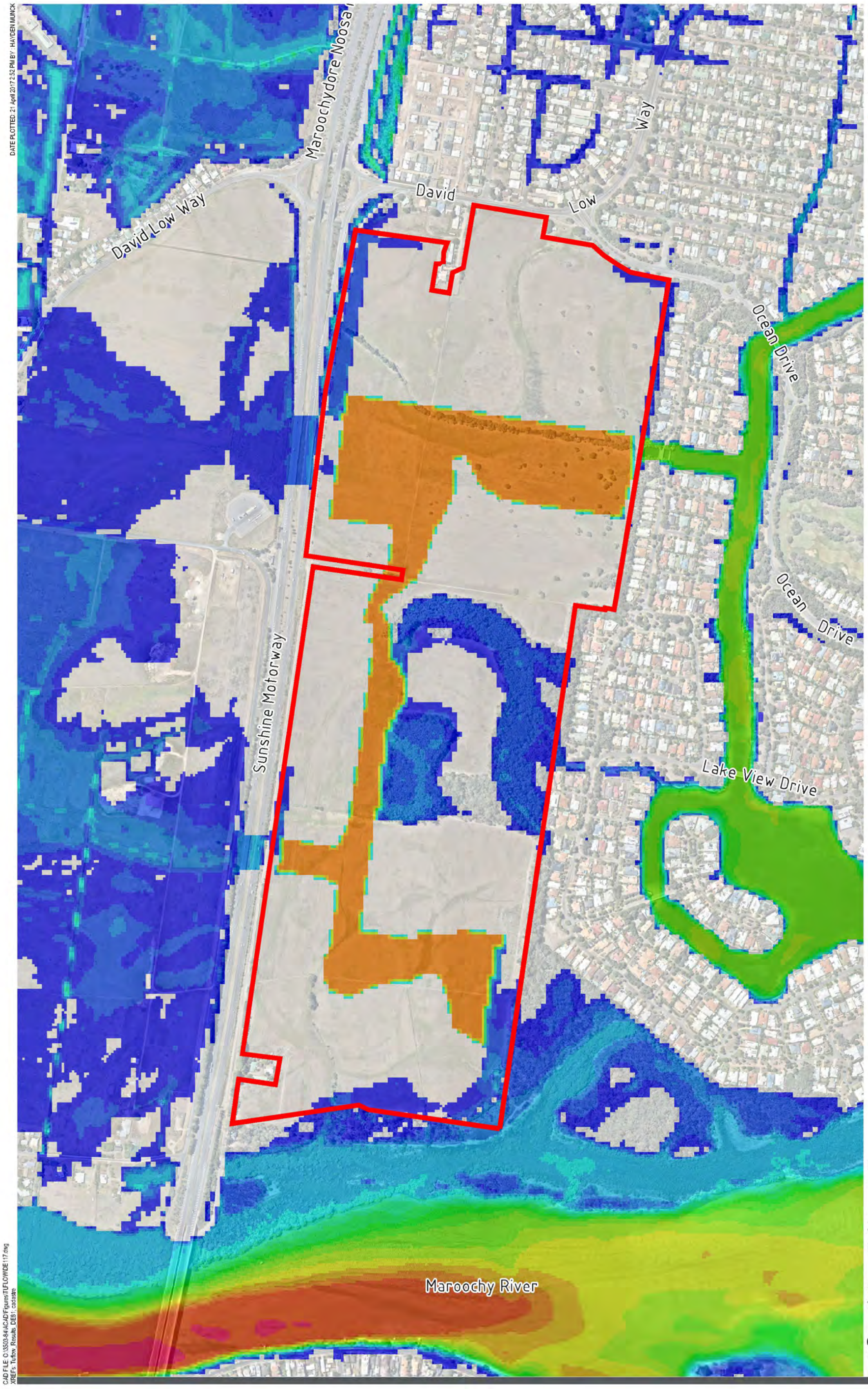
Appendix E.2.1

Post-Development - Ultimate Filling Scenario - 39% AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd



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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

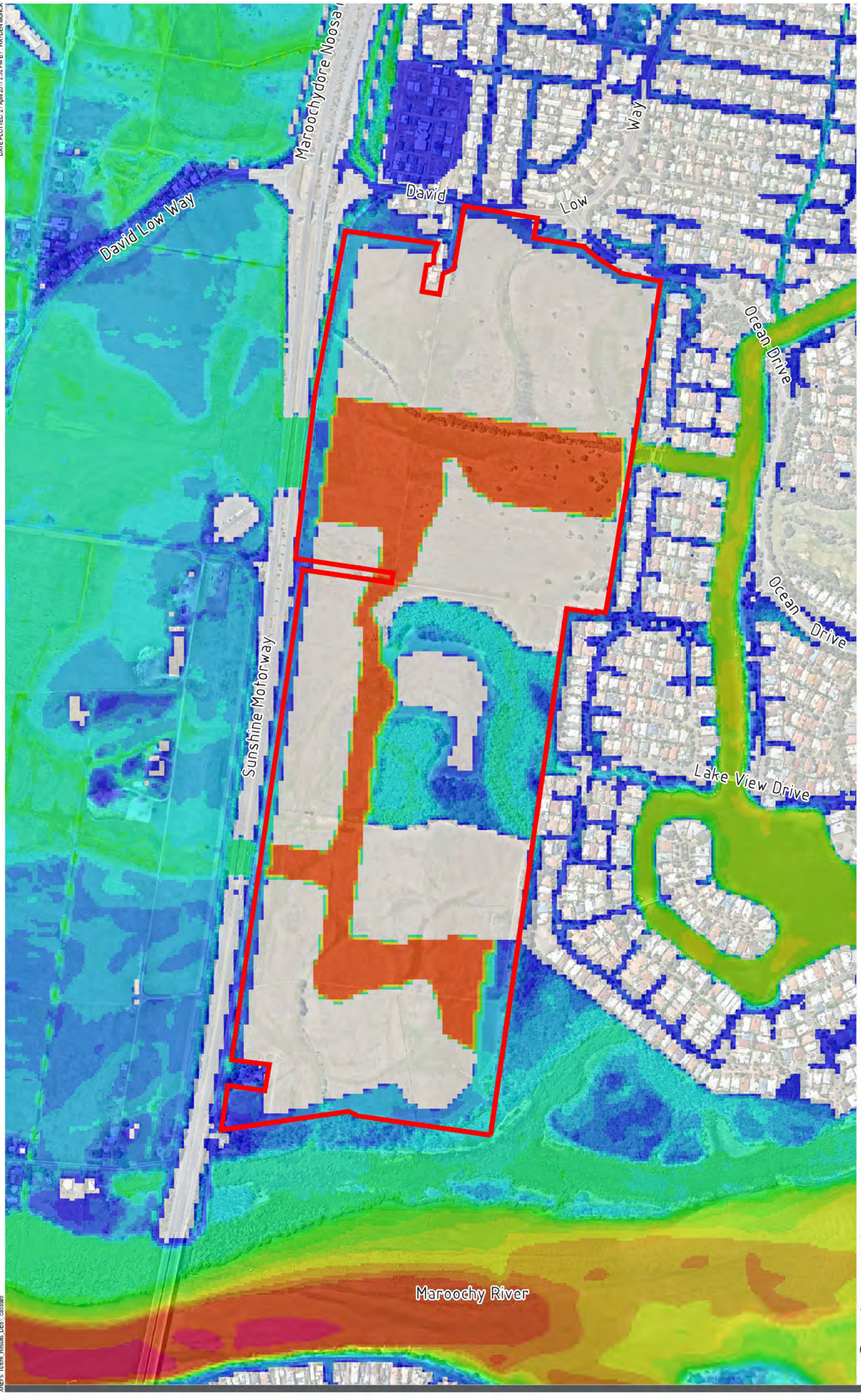
Appendix E.2.2

Post-Development - Ultimate Filling Scenario - 10% AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd



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Appendix E.2.3

Post-Development - Ultimate Filling Scenario - 1% AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:53 PM BY: HAYDEN MUNCK

NORTH

Legend

Site Boundary

Flood Depths (m)

- Above 7.50
- 5.00 to 7.50
- 4.50 to 5.00
- 4.00 to 4.50
- 3.50 to 4.00
- 3.00 to 3.50
- 2.50 to 3.00
- 2.25 to 2.50
- 2.00 to 2.25
- 1.75 to 2.00
- 1.50 to 1.75
- 1.25 to 1.50
- 1.00 to 1.25
- 0.75 to 1.00
- 0.50 to 0.75
- 0.25 to 0.50
- 0.01 to 0.25

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOW\DE1\17.dwg
XREFs: Tuflow_Results_DE81_cadastre

Cardno
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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix E.2.4

Post-Development - Ultimate Filling Scenario - 1% Climate Change AEP - Flood Depths

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

Twin Waters West

APPENDIX

F

SCENARIO 2 PREDICTED FLOODING IMPACTS

Cardno
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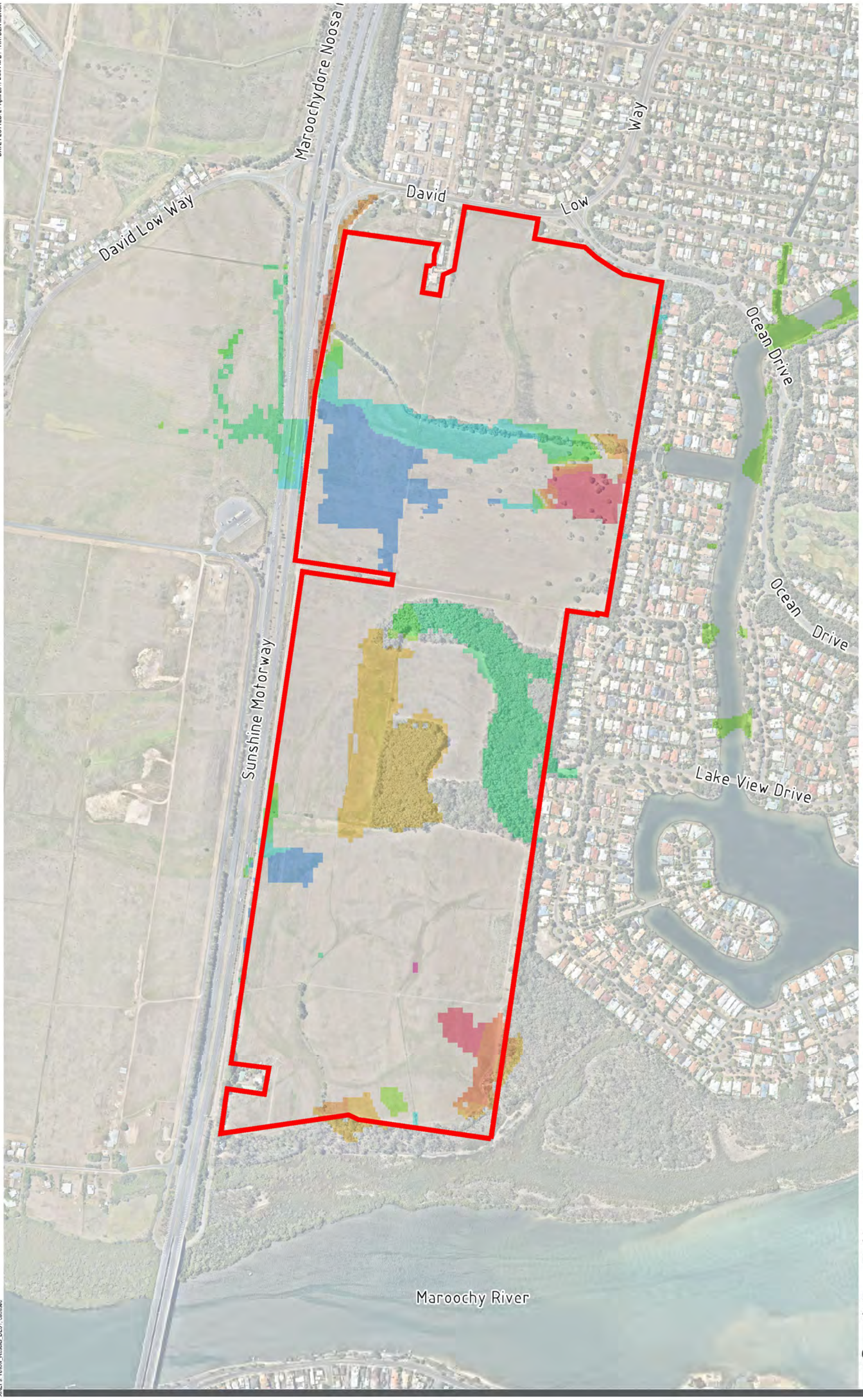
DATE PLOTTED: 21 April 2017 2:53 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE1\17.dwg
XREFs: Tuflow_Results_DES1; cadastre

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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

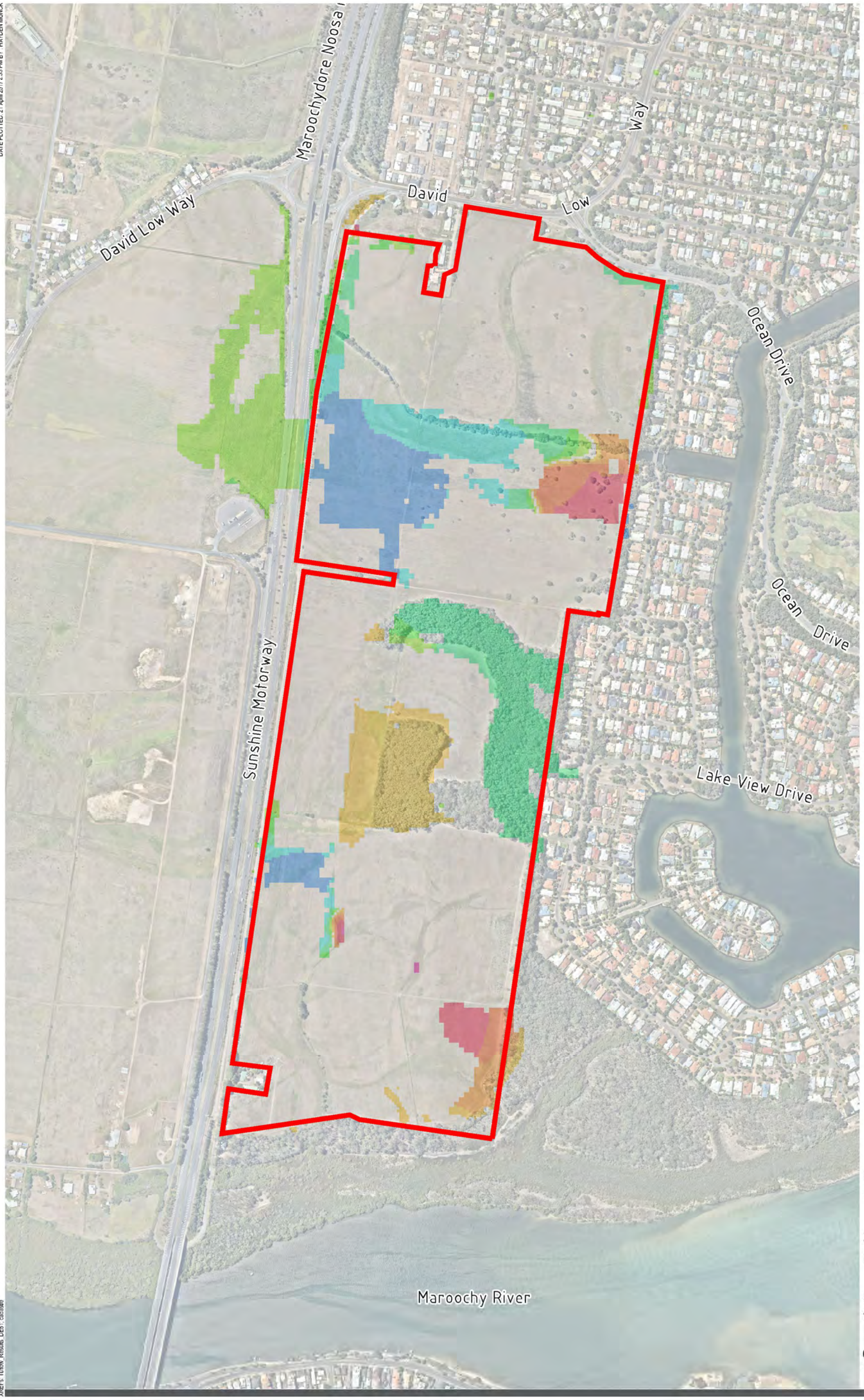
Appendix F.1.1

Post-Development - Ultimate Filling Scenario - 39% AEP - Flood Impact

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd



DATE PLOTTED: 21 April 2017 2:53 PM BY : HAYDEN MUNCK

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE117.dwg
XREFs: Tuflow_Results_DE81, cadastre

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

Cardno
Shaping the Future

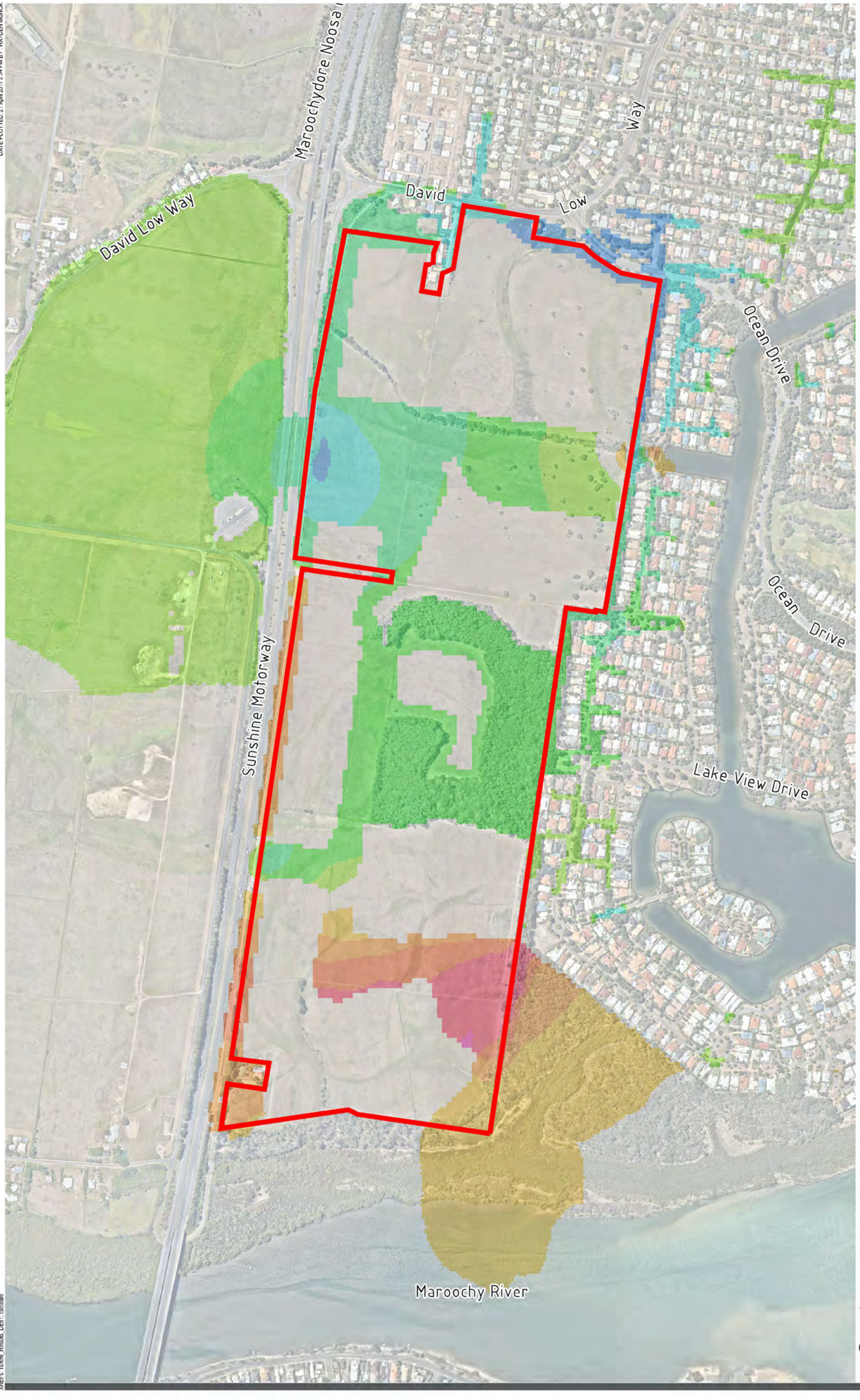
Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix F.1.2

Post-Development - Ultimate Filling Scenario - 10% AEP - Flood Impact

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:54 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOW\DE1\17.dwg
XREFs: Tuflow_Results_DE81; cadastre

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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix F.1.3

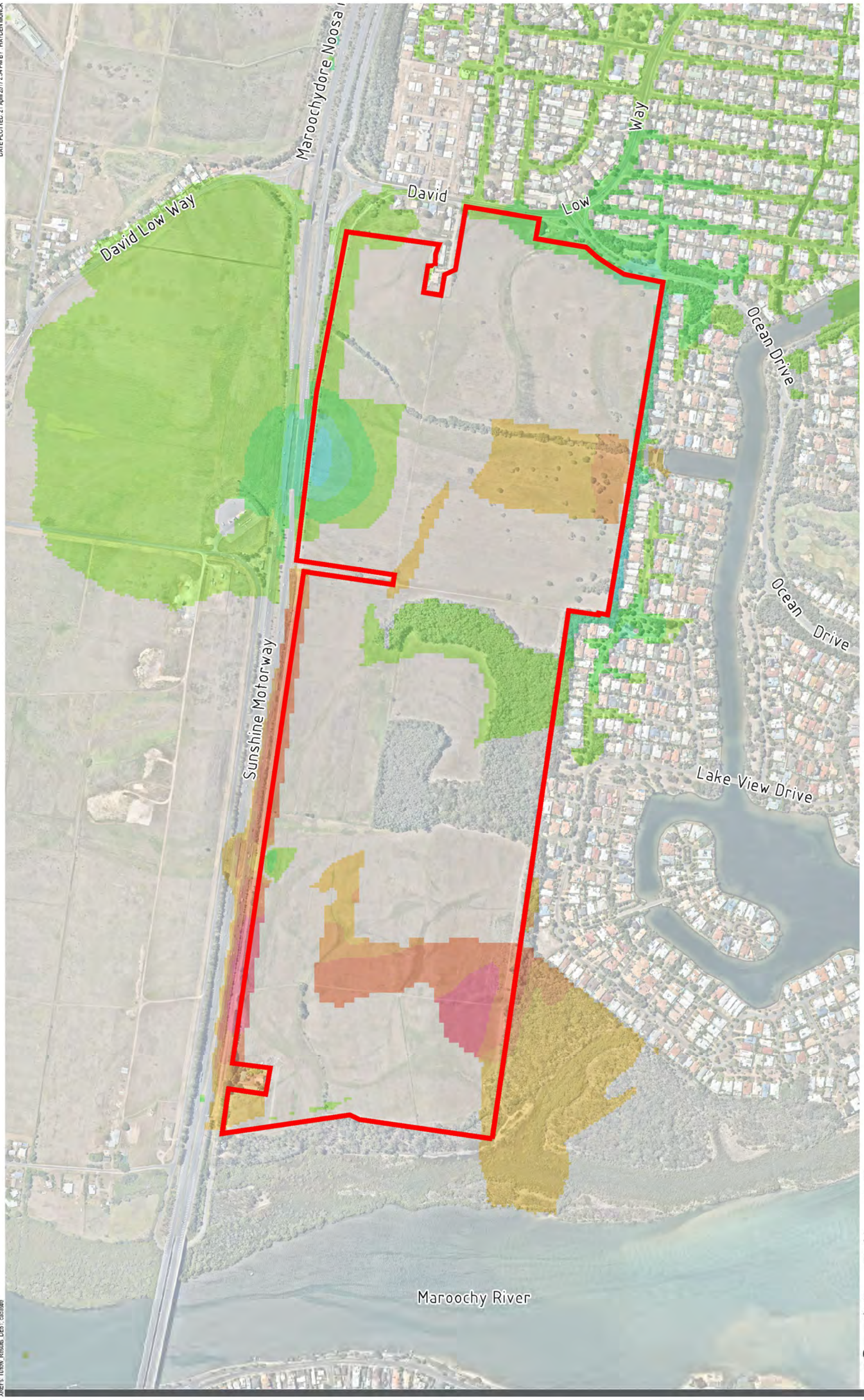
Post-Development - Ultimate Filling Scenario - 1% AEP - Flood Impact

Twin Waters West

Flood Impact Assessment

Stockland Pty Ltd

DATE PLOTTED: 21 April 2017 2:54 PM BY: HAYDEN MUNCK



NORTH

Legend

Site Boundary

Flood Impact (mm)

- Above 200
- 100 to 200
- 50 to 100
- 25 to 50
- 10 to 25
- -25 to -10
- -50 to -25
- -100 to -50
- -200 to -100
- Below -200

Date	Size
13/04/2017	A3
350384	0
Project Reference	Revision

Scale
1:7,500

0 75 150 225 300m

CAD FILE: O:\3503-84\ACAD\Figures\TUFLOWDE1\17.dwg
XREFs: Tuflow_Results_DE81; cadastre

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Cardno (Qld) Pty Ltd | ABN 57 051 074 992

Appendix F.1.4

Post-Development - Ultimate Filling Scenario - 1% Climate Change AEP - Flood Impact

Twin Waters West
Flood Impact Assessment
Stockland Pty Ltd

From:	Jason Krueger
To:	Danika Cowie
Cc:	Garth Nolan; Stephen Patey; Roma Stevenson; Crispin Smythe
Subject:	Access to flood model for Twin Waters West
Date:	Tuesday, 13 June 2017 8:12:36 AM

Hi Danika,

Further to our discussion yesterday regarding the above subject, I can confirm that council is able to supply the modelling information for Twin Waters West.

Upon engagement, it would be quicker and easier for WMA Water to request the model directly from Crispin Smythe, Coordinator, Flooding and Stormwater Management Team:

Crispin.Smythe@sunshinecoast.qld.gov.au
Phone: (07) 5441 8108

Upon making this request, WMA Water will be required to sign an agreement that goes with the supply of the model, which limits its use to that described in the agreement.

Upon receipt and review of the model, Crispin has also offered to provide a briefing to representatives from WMA Water on the assumptions used in the model.

Kind regards,

Jason Krueger | Coordinator Planning Scheme and Projects
Strategic Planning Branch
Regional Strategy and Planning | Sunshine Coast Council

Phone: 07 5420 8710
Mobile: Refused under section 4
Email: jason.krueger@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Garth Nolan

From: Stephen Patey <Stephen.Patey@sunshinecoast.qld.gov.au>
Sent: Tuesday, 29 August 2017 11:01 AM
To: Garth Nolan
Cc: Jason Krueger; Roma Stevenson; Crispin Smythe; Geoffrey Newell; Danika Cowie
Subject: Request for meeting with WMA Water regarding flood issues associated with proposed planning scheme amendment

Hi Garth,

Thanks for the opportunity to meet with yourself and Danika last week

As discussed at that meeting I would like the opportunity for Council's and Stockland's flooding technical experts to meet with the Department's Peer Review Consultant (WMA Water) to further discuss the issues raised in the preliminary report.

I see this as the shortest and most effective way to achieve a better understanding on behalf of all parties and to ensure that Council's response fully addresses the issues that have been raised.

I would anticipate that this meeting should probably involve the following participants:-

- Departmental representatives as you see fit;
- WMA Water representatives;
- Crispin Smythe and Geoff Newell from SCRC;
- Trevor Johnson and Kevin Covey representing Stockland;
- Either myself or Jason Krueger as planning representatives from SCRC.

As you would appreciate, Council is keen to move this matter forward and in this regard, I would be appreciative if a suitable meeting time could be arranged as soon as practicable.

Please don't hesitate to contact me if you have any queries or wish to discuss further.

Kind regards,

Stephen Patey | Manager
Strategic Planning Branch
Planning and Environment Department | Sunshine Coast Council

Phone: 07 5420 8785
Mobile: Refused under section
Mailcode: CR17
Email: stephen.patey@sunshinecoast.qld.gov.au
Website: www.sunshinecoast.qld.gov.au
Mail: Locked Bag 72 Sunshine Coast Mail Centre Qld 4560

Garth Nolan

From: Danika Cowie
Sent: Thursday, 17 August 2017 4:22 PM
To: Garth Nolan
Subject: FW: Updated Draft
Attachments: 11179.pdf

Hi Garth,

Who should I send the invoice too?

Cheers,
Danika

From: Erin Askew [mailto Refused und wmawater.com.au]
Sent: Thursday, 17 August 2017 4:11 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Mark Babister Refused under s wmawater.com.au>
Subject: Updated Draft

Hi Danika,
I have just sent you via our filesender an updated draft. Following some clarity from stepping away from the document for a few days – I have made quite a few edits to clarify and simplify the outcomes.

As discussed I am on leave from Monday so I have attached our invoice for the review.

Mark would be your best contact for questions while I am away.
Kind Regards,
Erin

Erin Askew
Director

E: Refused un wmawater.com.au
T: (02) 9299 2855
P: Level 2, 160 Clarence St Sydney, NSW, 2000

Level 2, 160 Clarence Street, Sydney NSW 2000 ph (02) 92992855
ABN 14 600 315 053

TAX INVOICE

Department of Infrastructure, Local Government and Planning
PO Box 15009 City East
BRISBANE QLD 4000
ABN: 25166523889

Invoice No: 11179

Thursday, August 17, 2017

Attention: Mr G NOLAN

In Reference to: Twin Waters West Review

Job No: 117056 00 **Order No:**

Claim No. 1 for the period 02-Jul-17 to 17-Aug-17

Lump Sum for work completed:	$15,680.00
GST:	$1,568.00
Total Amount of this Invoice (including GST):	**$17,248.00**

Total Fees Owing: $17,248.00

For EFT payments : Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balar
Refused under section 47(3)(b) of the RTI Act. Disclosure would, o

Please note that WMAwater is now trading as WMA Water P/L and has a new ABN and bank account.

Terms Strictly 14 Days Nett

Sue-Ellen Goldfinch

From: Danika Cowie
Sent: Thursday, 17 August 2017 4:21 PM
To: Nathan Rule; Garth Nolan
Subject: FW: WMAwater FileSender: Draft Review - Twin Waters West

FYI

From: Refused unde wmawater.com.au [mailto: Refused unde wmawater.com.au]
Sent: Thursday, 17 August 2017 4:11 PM
To: Danika Cowie <Danika.Cowie@dilgp.qld.gov.au>
Cc: Refused und wmawater.com.au
Subject: WMAwater FileSender: Draft Review - Twin Waters West

Dear Sir, Madam,

The file below has been uploaded to WMAwater FileSender by Refused unde wmawater.com.au and you have been granted permission to download this file.

Filename	Filesize	Download link	Valid until
PreliminaryDraftMemo_TWWReview_170817_Rev2_withFig.pdf	51.98 MB	Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under sectio	15-11-2017
Personal message from Refused und wmawater.com.au**:**			
Hi Danika, *Please find attached for download our draft review.* *Kind Regards,* *Erin*			

Best regards,

WMAwater FileSender

Sue-Ellen Goldfinch

From: Danika Cowie
Sent: Thursday, 10 August 2017 1:20 PM
To: Garth Nolan
Subject: RE: WMAwater FileSender: Preliminary Draft Review - Figures

Here is the second link

From: Refused unde wmawater.com.au [mailto Refused unde wmawater.com.au]
Sent: Thursday, 10 August 2017 8:25 AM
To: Danika Cowie
Cc: Refused unde wmawater.com.au
Subject: WMAwater FileSender: Preliminary Draft Review - Figures

Dear Sir, Madam,

The file below has been uploaded to WMAwater FileSender by Refused unde wmawater.com.au and you have been granted permission to download this file.

Filename	Filesize	Download link	Valid until
PreliminaryWorkingMemo_TWWReview_170809_FIG.pdf	50.74 MB	Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under section 49	08-11-2017

Personal message from Refused unde wmawater.com.au:

Hi Danika,
I have attached for download our preliminary draft review Figures. The text will be sent separately.
I will send a separate email setting out a way forward.
This link can be forwarded to others for download.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

Sue-Ellen Goldfinch

From: Danika Cowie
Sent: Thursday, 10 August 2017 1:20 PM
To: Garth Nolan
Subject: FW: WMAwater FileSender: PreliminaryWorkingMemo_TWWReview_170809_TEXT_APP.pdf

Hi Garth,

I have received to download links from WMA Water. I think the files are too big for me to email to you, so I am forwarding the links to you to down load the files to look at. Let me know if you have any issues with trying to download the files and I will see what I can do.

I haven't read anything yet (it took a while to download) so I have no feedback back.

Kind regards,
Danika

From: Refused under wmawater.com.au [mailto Refused under wmawater.com.au]
Sent: Thursday, 10 August 2017 8:05 AM
To: Danika Cowie
Cc: Refused under wmawater.com.au
Subject: WMAwater FileSender: PreliminaryWorkingMemo_TWWReview_170809_TEXT_APP.pdf

Dear Sir, Madam,

The file below has been uploaded to WMAwater FileSender by Refused under wmawater.com.au and you have been granted permission to download this file.

Filename	Filesize	Download link	Valid until
PreliminaryWorkingMemo_TWWReview_170809_TEXT_APP.pdf	1.3 MB	Refused under section 47(3)(b) of the RTI Act. Disclosure would, on balance, be contrary to the public interest under se	08-11-2017
Personal message from Refused under wmawater.com.au:			

Hi Danika,
I have attached for download our preliminary draft review Text. The figures will be sent separately.
I will send a separate email setting out a way forward.
This link can be forwarded to others for download.
Kind Regards,
Erin

Best regards,

WMAwater FileSender

TWIN WATERS WEST

FLOOD MODELLING

Responses to the queries raised by WMA Water are provided in the Table below.

Updated flood model have also been provided. These flood models include:

- revisions to the Existing Case model to improve the definition of flow through 1D culverts;
- a revised development layout; and
- sensitivity analysis of the inflow hydrograph from subcatchment 51.

WMA Comment	SLR Response
Section 4.3. Topographic Data and Table A1. Topographic Data	
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.
4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are “thin” breaklines. The TUFLOW model reads the GIS layer using the “gully” parameter which ensures a continuous flowpath. It is also incorrect to say it is a “poor representation of a 20m wide channel” because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.
5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.
7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).

8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.
Table A2. Topographic Layers for Twin Waters Development	
1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model.. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.
2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a "weir". The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.
3. Conservative approach to modeling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.

Section 4.4.2. Local Inflow

The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behavior at the site.

These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.

Peak Flood Levels Within Subject Site (mAHD)

Flood Event	Northern End	Southern End
Existing 1% AEP (without 4 local inflows)	2.402	2.124
Existing 1% AEP (with 4 local inflows)	2.402	2.125
Existing 1% AEP + CC (without 4 local inflows)	2.903	2.757
Existing 1% AEP + CC (with 4 local inflows)	2.903	2.758

Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.

Subcatchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of subcatchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake.

A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.

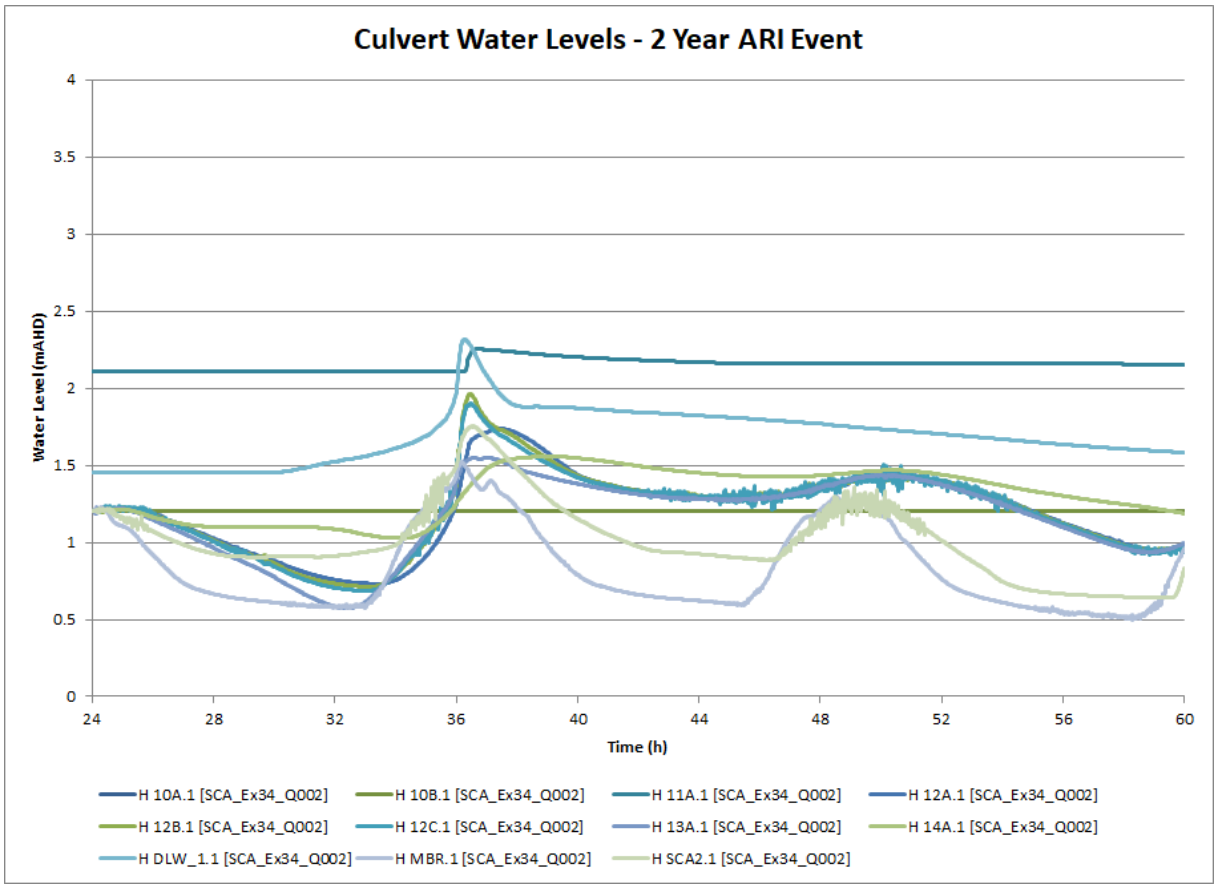
Section 4.4.4. Initial Water Level

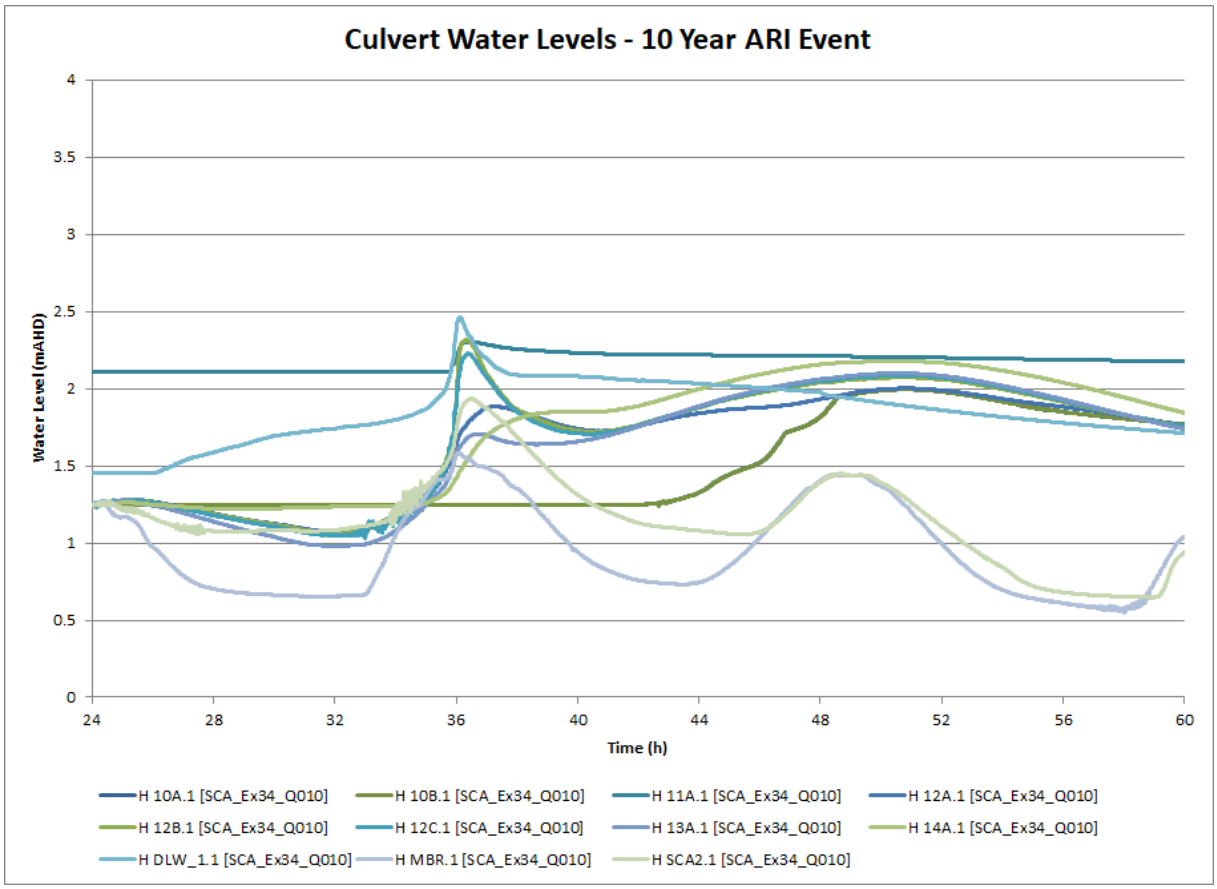
The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.

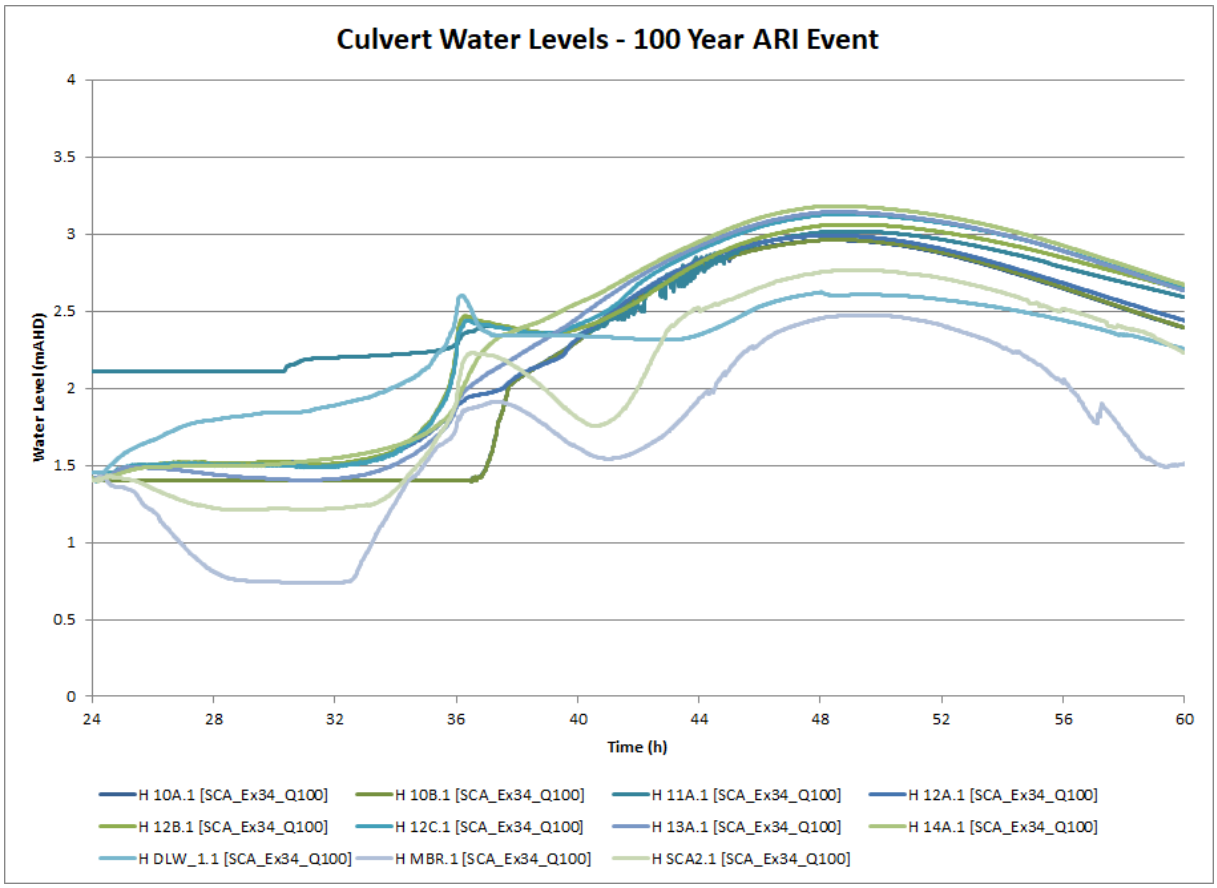
The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.

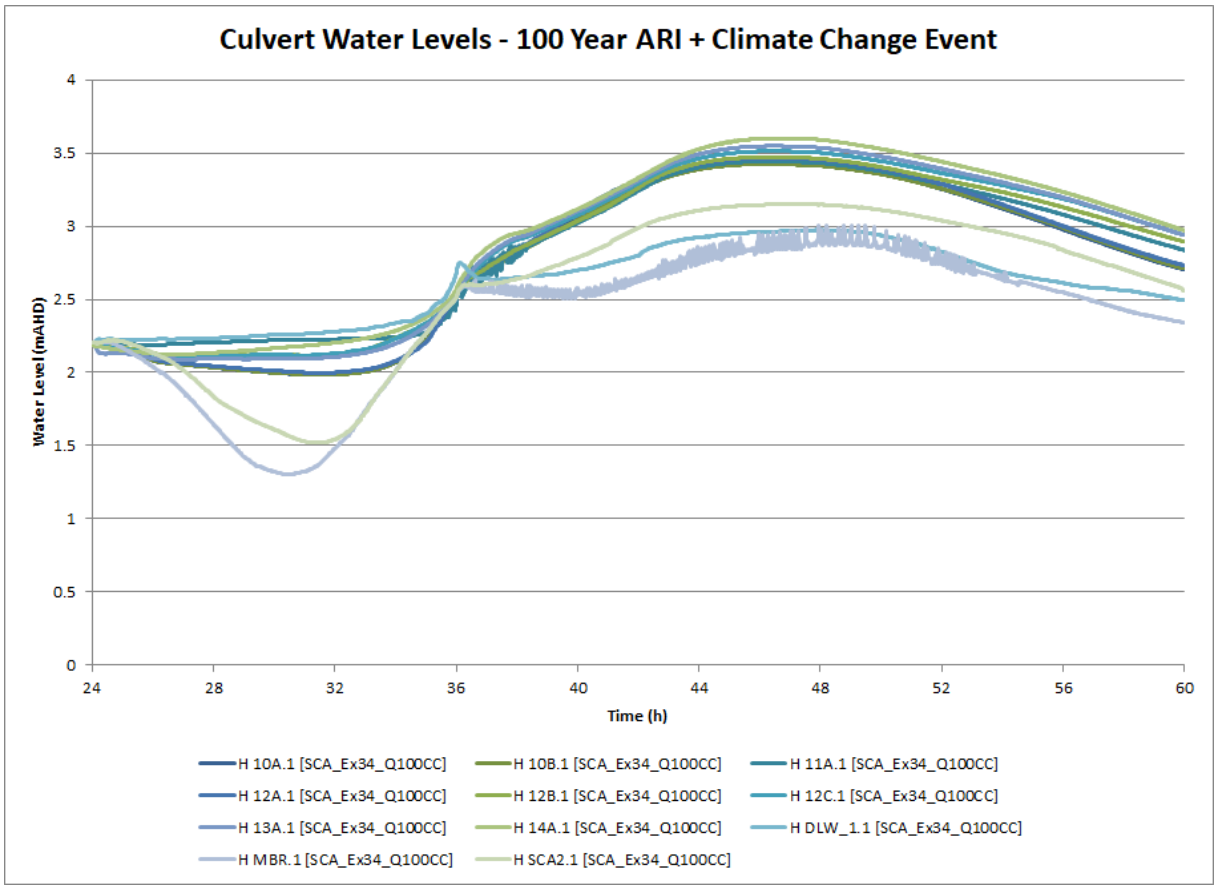
<table>
<tr><th colspan="2">Section 4.6. Hydraulic Structures & Table C1: Hydraulic Structures</th></tr>
<tr><td>There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.</td><td>Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1.
The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly.

Hydraulic Structures – 1% AEP Flood Event
<table><tr><th>Structure</th><th>Peak Discharge (m^3/s)</th><th>Structure Head Loss (m)</th></tr><tr><td>12A (Northern Culverts)</td><td>84.6</td><td>TUFLOW = 30 mm
HEC-RAS = 30 mm</td></tr><tr><td>11E (Southern Culverts)</td><td>53.0</td><td>TUFLOW = 50 mm
HEC-RAS = 50 mm</td></tr></table></td></tr>
<tr><td>A number of structures within the TUFLOW model have instability issues.</td><td>The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs.
The noted structures are remote from the subject site and do not affect the calculated results.
The results at the structures are generally stable around the peak of the flood event.
The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.</td></tr>
<tr><td>Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts</td><td>In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.</td></tr>
<tr><td>Structures not included from MIKE model (but within TUFLOW model extent).</td><td>• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event.
• Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event.
• Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.</td></tr>
<tr><td>Structures only included in TUFLOW Model</td><td>Details of these structures were provided by SCC:
• 12A is located under the Sunshine Motorway near Finland Road.
• DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters.
• SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.</td></tr>
</table>


Culvert Water Levels - 2 Year ARI Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q002]
H 10B.1 [SCA_Ex34_Q002]
H 11A.1 [SCA_Ex34_Q002]
H 12A.1 [SCA_Ex34_Q002]
H 12B.1 [SCA_Ex34_Q002]
H 12C.1 [SCA_Ex34_Q002]
H 13A.1 [SCA_Ex34_Q002]
H 14A.1 [SCA_Ex34_Q002]
H DLW_1.1 [SCA_Ex34_Q002]
H MBR.1 [SCA_Ex34_Q002]
H SCA2.1 [SCA_Ex34_Q002]


Culvert Water Levels - 10 Year ARI Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q010]
H 10B.1 [SCA_Ex34_Q010]
H 11A.1 [SCA_Ex34_Q010]
H 12A.1 [SCA_Ex34_Q010]
H 12B.1 [SCA_Ex34_Q010]
H 12C.1 [SCA_Ex34_Q010]
H 13A.1 [SCA_Ex34_Q010]
H 14A.1 [SCA_Ex34_Q010]
H DLW_1.1 [SCA_Ex34_Q010]
H MBR.1 [SCA_Ex34_Q010]
H SCA2.1 [SCA_Ex34_Q010]


Culvert Water Levels - 100 Year ARI Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q100]
H 10B.1 [SCA_Ex34_Q100]
H 11A.1 [SCA_Ex34_Q100]
H 12A.1 [SCA_Ex34_Q100]
H 12B.1 [SCA_Ex34_Q100]
H 12C.1 [SCA_Ex34_Q100]
H 13A.1 [SCA_Ex34_Q100]
H 14A.1 [SCA_Ex34_Q100]
H DLW_1.1 [SCA_Ex34_Q100]
H MBR.1 [SCA_Ex34_Q100]
H SCA2.1 [SCA_Ex34_Q100]


Culvert Water Levels - 100 Year ARI + Climate Change Event
Water Level (mAHD)
Time (h)
H 10A.1 [SCA_Ex34_Q100CC]
H 10B.1 [SCA_Ex34_Q100CC]
H 11A.1 [SCA_Ex34_Q100CC]
H 12A.1 [SCA_Ex34_Q100CC]
H 12B.1 [SCA_Ex34_Q100CC]
H 12C.1 [SCA_Ex34_Q100CC]
H 13A.1 [SCA_Ex34_Q100CC]
H 14A.1 [SCA_Ex34_Q100CC]
H DLW_1.1 [SCA_Ex34_Q100CC]
H MBR.1 [SCA_Ex34_Q100CC]
H SCA2.1 [SCA_Ex34_Q100CC]

Memorandum

TO: Danika Cowie
FROM: Mark Babister
DATE: 25 October 2017
SUBJECT: Twin Waters West – Preliminary Draft Review Response
PROJECT NUMBER: 117056

1. EXECUTIVE SUMMARY

WMAwater has undertaken an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of a rezoning concept for the site. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for the proposed rezoning of the Twin Waters West site.

WMAwater undertook an initial review of the modelling and associated reporting submitted with the rezoning application. A number of recommendations and requests for clarifications were made as part of this review covering elements related to the specifics of the model structure and reasoning behind some implementations. The findings of independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council, the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken. SLR provided formal documentation of clarifications and undertook updates to the model.

WMAwater has assessed the model changes and justifications provided by SLR in response to the Twin Waters West – Preliminary Draft Review Memorandum. The majority of items have either been addressed by model updates or clarified with justification. WMAwater finds that the revised modelling and associated reporting meets the needs of the assessment for the purposes of a rezoning application.

In addition, WMAwater recommends that several key items not updated for this stage of the assessment be addressed prior to future or more detailed design modelling of the site for the purposes of a specific development application.

In order for the modelling and reporting to fulfil the requirement of informing the detailed design and be suitable for the assessment of impacts for future more development specific application stages, the following critical tasks must be undertaken:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Provide further documentation regarding the split of inflow 51 or provide supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network,
- Further supporting documentation on model development and validation.

2. TWIN WATERS WEST FLOOD MODEL REVIEW

2.1. Context

WMAwater has been engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review is to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development in the context of a rezoning application. The high level impact assessment will then be used to help inform the rezoning application for the Twin Waters West site. The preliminary findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council (SCC), the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken. SLR provided formal documentation of clarifications and undertook updates to the model. Several of the key issues and deficits have been revised. These revisions are captured in the appropriate sections of this memorandum.

The purpose of this memorandum is to assess the subsequent changes and responses from SLR made to address and respond to the preliminary review and to provide recommendations as to the suitability of the model for assessing the viability of the development in the context of a rezoning application.

2.2. Initial Review Summary

The initial report and model review (Reference 1) concluded that the Cardno TUFLOW model (Reference 2), used to assess the impact of the Twin Waters West development, was largely constructed from the SCC MIKEFLOOD model (Reference 3 and 4), utilising elements like inflow and roughness. The model diverged from the SCC model in some key areas including missing culverts or bridges, missing or diverted local runoff inflow locations and terrain elevation modifications which appeared questionable. Additionally, the provided reporting did not appropriately justify the exclusion or changes to these elements nor did the reporting adequately document the model development and validations against SCC's model. It was also found that a number of culverts or bridges within the TUFLOW model were producing unstable flow results which may be impacting on the wider model results.

Based on these facts it was found that the modelling and reporting (at the time of the review) were not adequate to determine the suitability of the modelling for assessing the impact on flood behaviour as a result of the proposed development. Furthermore, the following tasks were advised to be undertaken:

- Inclusion of missing localised inflows,
- Justification including sensitivity analysis for adopting a constant initial water level, as opposed to the spatially varying layer used in the MIKEFLOOD model,
- Sensitivity analysis of different bathymetry at the Maroochy River mouth,
- Sensitivity analysis of the changes of starting the model at timestep 0,
- Correction to the hydraulic structure instability issues,
- Justification of, or removal of questionable topographic modifications (where justification is not provided or deemed unacceptable),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification of, or inclusion of missing hydraulic structures,
- Provide further documentation regarding the split of inflow 51,
- Further supporting documentation on model development and validation.

Further details of the review are provided in Twin Waters West – Preliminary Draft Review Memorandum (Reference 1).

3. MODEL REVIEW RESPONSE

3.1. Summary of SLR Response

SLR have aimed to address or provide commentary/justification for several of the key issues outlined in Section 2.2. Details of the response/changes, including WMAwater comments, are provided in Appendix A.

The changes SLR have made to the model include the following:

- Update or justification for the use (of most) of questionable topographic modifications,
- Inclusion of missing inflow sources (please note this does not include sub-catchment 51).

Instability within the model representation of bridges and culverts (hydraulic structures) can artificially increase or decrease surrounding model results and tends to indicate that the structure representation is not appropriately functioning across a range of flood levels. While the structure may be stable at the peak of a particular event, instability at lower levels may limit the future use of the model for these smaller events. The unstable flow results at 1D hydraulic structures has not been resolved and is still present in the model. In this instance SLR has presented sound arguments regarding the impact of these flow instabilities on the water levels for the event assessed and the overall model health. Based on the purpose of the modelling in the context of a rezoning application, limited instability issues at the peak of the event assessed, WMAwater accepts that these issues do not require addressing at this stage of the modelling. However, it is still recommended that they be investigated and addressed in future assessment stages.

Additionally, in response to queries regarding missing and additional culverts when compared to the previous SCC modelling, SLR has confirmed that the culvert data included in the modelling process has been provided by SCC and is expected to be the most up to date. It was noted that existing culverts are represented equally in both the design and existing scenarios. Therefore, any missing culverts are unlikely to impact the results of this stage of the assessment.

Several key issues were not addressed by SLR. Further details of these issues are outlined in Section 3.2 and Appendix A.

3.2. WMA Response

Given the purpose of the modelling, WMAwater has found that the modelling is largely adequate for the purposes of informing the rezoning application. With that said, there are several key issues that should be resolved to improve the integrity of the model for future more detailed assessment stages. These items include:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Further supporting documentation on model development and validation.

Additional information regarding the splitting of sub-catchment 51 inflows (in comparison to the MIKEFLOOD model) was provided as part of SLR's response, whereby an argument was made that the Pacific Paradise stormwater infrastructure conveys runoff to the eastern canal system. It is unlikely that the stormwater network in this area has been designed to convey the 100 year ARI event or has the ability to capture the entirety of the runoff for this event. Further documentation regarding the split of inflow 51 or supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network should be provided in future assessment stages.

4. CONCLUSION AND RECOMMENDATIONS

WMAwater was engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for Twin Waters West. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impacts on flood behaviour as a result of the proposed development in the context of a rezoning application. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for the proposed rezoning of the Twin Waters West site. The findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

Due to the high-level nature of the assessment, WMAwater has found that the modelling is largely adequate for the purpose of informing the rezoning application. It is however recommended that the following critical tasks be undertaken or provided in order for the modelling and reporting to fulfil the requirement of informing the detailed design and assessment of impacts for future application stages:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),
- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Provide further documentation regarding the split of inflow 51 or provide supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network,
- Further supporting documentation on model development and validation.

5. REFERENCES

1. Twin Waters West – Preliminary Draft Review
WMAwater, August 2017

2. Flood Impact Assessment Twin Waters West Report
Cardno, April 2017

3. Maroochy River Flood Study
Sunshine Coast Regional Council, February 2010

4. Maroochy River Flood Study – Flood Hazard Mapping Project 2013/2014
Sunshine Coast Regional Council, July 2013

5. IFD 2013 Increases (%) Mapping
Sunshine Coast Regional Council, July 2013

6. B5 Airport and Surrounds – Flooding
Sunshine Coast Council & Sunshine Coast Airport

7.TUFLOW User Manual, TUFLOW.2016-03-AA
BMT WBM, April 2016

Appendix A

The queries raised by WMAwater, the responses from SLR and the subsequent response from WMAwater are provided in the tables below.

Table A1: Topographic Data

WMA Comment	SLR Response	WMA Response
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.	It is correctly noted that if the river mouth bathymetry was updated, it would likely impact both the existing and design scenarios equally. Therefore, it is unlikely to directly impact the assessment. WMAwater does recommend that an update to the river mouth bathymetry be taken in future assessment stages for the purposes of ensuring a more accurate representation of flood characteristics.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.	Noted and accepted. Refinement should be made as part of future assessment stages.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.	It is noted that 2d_zpt_Roads_Ex29 has been updated to 2d_zpt_Roads_Ex30 and has been correctly shifted to align with aerial imagery of the existing roadway.

4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are "thin" breaklines. The TUFLOW model reads the GIS layer using the "gully" parameter which ensures a continuous flowpath. It is also incorrect to say it is a "poor representation of a 20m wide channel" because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.	Section 6.8.3 of the TUFLOW manual (TUFLOW 2016-03-AA) notes the following: "The Read GIS Z Line default is to model a "thin" line which modify the ZH, ZU and ZV Zpt elevations only. If the THICK option occurs, interpolated Z values are applied to whole cells (ie. at the cell centres (ZC), all cell sides and cell corners). Other optional flags such as MAX, MIN, RIDGE or GULLY are also available." Please note that TUFLOW treats 2d_zln, 2d_zlr and 2d_zlg the same. Additionally, no "THICK" option has been applied to the 2d_zlg_Drain layer. Also note that the "GULLY" parameter does not ensure a continuous flowpath but instead only changes a Zpt elevation if the Z Shape elevation at the Zpt is lower. The above has only been included to justify the inclusion of original comments and explain how the 2d_zlg is applied by the model. It should be noted that it has minimal impact and therefore is not required in the model as the Lidar and 10m DEM appropriately represents the channels in these areas.

5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.	The primary concern of the inclusion of this layer is demonstrated in the image below. Please note that the depicted mapinfo file will create a channel from the sunshine coast motorway to the canal system (based on the placement of the nodes). This method has been included at other locations where the area is smoothed to then include a 2d layered flow constriction representation of the structure. In this case there is no 2d layered flow constriction.  As stated previously, no evidence could be found to support the inclusion of this channel. If culvert structures are located in this area, they should be included for completeness. It is noted that this inclusion is located south of the Twin Waters West site and unlikely to affect the model results at the development, however should be included for model completeness as part of future assessment stages. Additionally, this shapefile is included in both the existing and design scenario and therefore is unlikely to influence the impact assessment.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.	Noted and accepted.

7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).	Noted. This layer should be updated as part of future assessment stages as it is unlikely that a uniformly elevated bund would be constructed. The bund is currently containing water to the north of the site and may potential affect flood levels at the site.
8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.	Noted and accepted.

Table A2: Topographic Layers for Twin Waters Development

1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.	Noted and accepted. Any future assessment stages should include a representation of the lake design.

2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a “weir”. The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.	Noted and accepted. The 2d_zsh obstruction at the northern (eastern) weir location should be updated to the correct level during future assessment stages to ensure that the efficiency of the weir is correctly represented and not potentially overstated.
3. Conservative approach to modelling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.	Noted and accepted. Any future assessment stages should include a representation of the site design.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.	Noted and accepted. During future assessment stages the modelling of the bridge structure (as the current design removes the existing bridge) should be modelled.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.

Table A3: Local Inflow

<table>
<tr>
<td>The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behaviour at the site.</td>
<td>These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.
Peak Flood Levels Within Subject Site (mAHD)
<table>
<tr><th>Flood Event</th><th>Northern End</th><th>Southern End</th></tr>
<tr><td>Existing 1% AEP (without 4 local inflows)</td><td>2.402</td><td>2.124</td></tr>
<tr><td>Existing 1% AEP (with 4 local inflows)</td><td>2.402</td><td>2.125</td></tr>
<tr><td>Existing 1% AEP + CC (without 4 local inflows)</td><td>2.903</td><td>2.757</td></tr>
<tr><td>Existing 1% AEP + CC (with 4 local inflows)</td><td>2.903</td><td>2.758</td></tr>
</table>
</td>
<td>Noted and accepted.

Please note that providing the location of the extracted values on a figure (with the table) would provide further context.</td>
</tr>
<tr>
<td>Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.</td>
<td>Sub-catchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of sub-catchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake. A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.</td>
<td>It is noted that there is a stormwater network within the Pacific Paradise development that includes a 1200mm discharge pipe to the canal system but it is unlikely that the stormwater network would be designed to convey the 100 year ARI event.

Further justification for this choice is required as part of future assessment stages – (as a minimum) supporting calculations showing that the 100 year ARI event runoff is captured and conveyed by the existing stormwater network/overland flow system should be provided.

If this is undertaken and it is found that the system does not capture the significant portion of stormwater runoff and convey it to the canal system, an update to the hydrology should be undertaken. Consequently, the hydraulic model would need to be updated accordingly.</td>
</tr>
</table>

Table A4: Initial Water Level

The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.	The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.	Noted. As this methodology is applied in both the existing and design scenarios it is unlikely to impact the purpose of the assessment. It should be noted that running the model for the full duration and adopting the spatially varying initial water level would remove this issue. Similarly, justification (or comparison to the full length run scenario) regarding the choice to reduce the model run time should be provided with future assessment stages.

Table A5: Hydraulic Structures

There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.	Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1. The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly. ***Hydraulic Structures – 1% AEP Flood Event*** **Structure** / **Peak Discharge (m^3/s)** / **Structure Head Loss (m)** 12A (Northern Culverts) / 84.6 / TUFLOW = 30 mm, HEC-RAS = 30 mm 11E (Southern Culverts) / 53.0 / TUFLOW = 50 mm, HEC-RAS = 50 mm	Noted and accepted. Details of these calculations should be documented in the reporting accompanying any future assessment stages.

A number of structures within the TUFLOW model have instability issues.	The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs. The noted structures are remote from the subject site and do not affect the calculated results. The results at the structures are generally stable around the peak of the flood event. The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.	It is noted that the flow instabilities are not proportional to the water level instabilities. Additionally, as stated, the instabilities do not tend to occur during the peak of the assessed event. The cumulative model error is low and the peak error is also reasonably low indicating a healthy model. With these points noted, instabilities should not be ignored and WMAwater recommends that these issues be fixed for any future assessment stages. It is not reasonable to state that the culverts are not near to the site and therefore should have minimal impact on the assessment. The culverts have a direct impact on flow conveyance from west to east (under the sunshine coast motorway) and therefore are likely to directly impact areas around the motorway – particularly in events where the motorway is not overtopped.
Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts	In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.	Noted and accepted.
Structures not included from MIKE model (but within TUFLOW model extent).	• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event. • Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event. • Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.	Noted. Confirmation of culvert sizing to determine significance should be undertaken and detailed included in future assessment stages.
Structures only included in TUFLOW Model	Details of these structures were provided by SCC: • 12A is located under the Sunshine Motorway near Finland Road. • DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters. • SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.	Noted and accepted.

Memorandum

TO: Danika Cowie
FROM: Mark Babister
DATE: 17 November 2017
SUBJECT: Twin Waters West – Preliminary Draft Review Response
PROJECT NUMBER: 117056

1. EXECUTIVE SUMMARY

WMAwater has undertaken an independent third party review of the Flood Impact Assessment for the Twin Waters West site submitted in support of a proposed Sunshine Coast Planning Scheme amendment. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of the rezoning process. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for a planning scheme amendment of the Twin Waters West site.

WMAwater undertook an initial review of the modelling and associated reporting submitted as part of the rezoning process. A number of recommendations and requests for clarifications were made as part of this initial review covering elements related to the specifics of the model structure and reasoning behind some implementations. The findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council, the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential updates to be undertaken for the rezoning process. SLR provided formal documentation of clarifications and undertook updates to the model.

WMAwater has assessed the model updates and documentation provided by SLR in response to the Twin Waters West – Preliminary Draft Review Memorandum. The majority of items have either been addressed by model updates or clarified with justification. WMAwater finds that the revised modelling and associated reporting is suitable for use in the context of the rezoning process.

In addition, WMAwater has made recommendations for model improvements that should be addressed prior to use of the model for assessment to support future development applications for a proposed master plan.

2. TWIN WATERS WEST FLOOD MODEL REVIEW

2.1. Context

WMAwater has been engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for the Twin Waters West site. The primary aim of the review is to determine the suitability of the modelling and associated reporting for the purpose of determining impact on flood behaviour as a result of the proposed development within the context of a rezoning process via an amendment to the Sunshine Coast Planning Scheme. The high level impact assessment will then be used to help inform the planning scheme amendment process for the Twin Waters West site. The preliminary findings of the independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

A meeting was held with the Department, Sunshine Coast Council (SCC), the proponent and their consultant, SLR on the 7th September to discuss the initial review, provide some clarification and agree on essential model updates to be undertaken for the rezoning process. SLR provided formal documentation of clarifications and undertook updates to the model. Several of the key issues and deficits have been revised or updated. These revisions are captured in the appropriate sections of this memorandum.

The purpose of this memorandum is to assess the subsequent changes and responses from SLR made to address and respond to the preliminary review and to provide recommendations as to the suitability of the model for assessing the viability of the development in the context of the planning scheme amendment process.

2.2. Initial Review Summary

The initial report and model review (Reference 1) concluded that the Cardno TUFLOW model (Reference 2), used to assess the flood behaviour impact of the Twin Waters West development, was largely constructed from the SCC MIKEFLOOD model (Reference 3 and 4), utilising elements like inflow and roughness. The model diverged from the SCC model in some key areas including missing culverts or bridges, missing or diverted local runoff inflow locations and terrain elevation modifications which appeared questionable. Additionally, the provided reporting did not appropriately justify the exclusion or changes to these elements nor did the reporting adequately document the model development and validations against SCC's model. It was also found that a number of culverts or bridges within the TUFLOW model were producing unstable flow results which may impact on the wider model results.

Based on these facts it was found that the modelling and reporting (at the time of the review) were not adequate to determine the suitability of the modelling for assessing the impact on flood behaviour as a result of the proposed development in the context of a planning scheme amendment. Furthermore, the following tasks were advised to be undertaken:

- Inclusion of missing localised inflows,
- Justification including sensitivity analysis for adopting a constant initial water level, as opposed to the spatially varying layer used in the MIKEFLOOD model,
- Sensitivity analysis of different bathymetry at the Maroochy River mouth,
- Sensitivity analysis of the changes of starting the model at timestep 0,
- Correction to the hydraulic structure instability issues,
- Justification of, or removal of questionable topographic modifications (where justification is not provided or deemed unacceptable),

- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification of, or inclusion of missing hydraulic structures,
- Provide further documentation regarding the split of inflow 51,
- Further supporting documentation on model development and validation.

Further details of the review are provided in Twin Waters West – Preliminary Draft Review Memorandum (Reference 1).

3. MODEL REVIEW RESPONSE

3.1. Summary of SLR Response

SLR have aimed to address or provide commentary/justification for several of the issues outlined in Section 2.2. Details of the response/changes, including WMAwater comments, are provided in Appendix A.

The changes SLR have made to the model include the following:

- Update or justification for the use (of most) of questionable topographic modifications,
- Inclusion of missing inflow sources (please note this does not include sub-catchment 51).

Instability within the model representation of bridges and culverts (hydraulic structures) can artificially increase or decrease surrounding model results and tends to indicate that the structure representation is not appropriately functioning across a range of flood levels. While the structure may be stable at the peak of a particular event, instability at lower levels may limit the future use of the model for assessment during these smaller events. The unstable flow results at 1D hydraulic structures has not been resolved and is still present in the model. In this instance SLR has presented sound arguments regarding the impact of these flow instabilities on the water levels for the event assessed as part of the current work and the overall model health. Based on the purpose of the modelling in the context of the rezoning process, limited instability issues at the peak of the event assessed, WMAwater accepts that these issues do not require addressing at this stage of the modelling. However, it is still recommended that they be investigated and addressed prior to use of the model in assessment to support future development applications for a proposed master plan.

Additionally, in response to queries regarding missing and additional culverts when compared to the previous SCC modelling, SLR has confirmed that the culvert data included in the modelling process has been provided by SCC and is expected to be the most up to date. It was noted that existing culverts are represented equally in both the design and existing scenarios. Therefore, any missing culverts are unlikely to impact the results of the assessment for the purposes of the rezoning process.

Several items were not addressed by SLR. Further details of these are outlined in Section 3.2 and Appendix A.

3.2. WMA Response

Given the purpose of the modelling, WMAwater has found that the modelling is largely adequate for the purposes of informing the planning scheme amendment process. With that said, there are several items that should be addressed to improve the integrity of the model for use in a site specific assessment to support future development applications for the proposed master plan. These items include:

- Correction to the hydraulic structure instability issues,
- Inclusion of higher detailed topographic modifications (particularly bund and channel structures),

- Investigation into lower water levels east of the motorway (compared to MIKEFLOOD outputs) and rectification of any issues highlighted,
- Justification and documentation of, or inclusion of missing hydraulic structures,
- Inclusion of spatially varying initial water levels and for either the model to start at timestep 0 or sensitivity analysis be undertaken for the changed start time,
- Update Maroochy River mouth bathymetry,
- Refinement of development concept including the lake system,
- Further supporting documentation on model development and validation.

Additional information regarding the splitting of sub-catchment 51 inflows (in comparison to the MIKEFLOOD model) was provided as part of SLR's response, whereby an argument was made that the Pacific Paradise stormwater infrastructure conveys runoff to the eastern canal system. It is unlikely that the stormwater network in this area has been designed to convey the 100 year ARI event or has the ability to capture the entirety of the runoff for this event. Further documentation regarding the split of inflow 51 or supporting calculations/modelling showing that the 100 year ARI event is captured by the Pacific Paradise stormwater network should be provided if the model is used for a site specific assessment to support future development applications for the proposed master plan.

4. CONCLUSION AND RECOMMENDATIONS

WMAwater was engaged by the Department of Infrastructure, Local Government and Planning to undertake an independent third party review of the Flood Impact Assessment for the Twin Waters West site. The primary aim of the review was to determine the suitability of the modelling and associated reporting for the purpose of determining impacts on flood behaviour as a result of the proposed development within the context of a rezoning process via an amendment to the Sunshine Coast Planning Scheme. The information from the modelling and associated reporting is intended to inform the government with regards to the viability of the concept for a planning scheme amendment of the Twin Waters West site. The findings of the initial independent third party review are contained within the Twin Waters West – Preliminary Draft Review Memorandum (Reference 1) which was provided to the Department of Infrastructure, Local Government and Planning on the 17 August 2017.

Further documentation and model updates were undertaken, and subsequently reviewed. It was determined for the purposes of a planning scheme amendment process, WMAwater are satisfied that the modelling and assessment are suitable.

To improve the integrity of the model for use in a site specific assessment to support future development applications for the proposed master plan, a number of updates and assessments are recommended. These are detailed in Section 3.2 above.

5. REFERENCES

1. Twin Waters West – Preliminary Draft Review
WMAwater, August 2017

2. Flood Impact Assessment Twin Waters West Report
Cardno, April 2017

3. Maroochy River Flood Study
Sunshine Coast Regional Council, February 2010

4. Maroochy River Flood Study – Flood Hazard Mapping Project 2013/2014
Sunshine Coast Regional Council, July 2013

5. IFD 2013 Increases (%) Mapping
Sunshine Coast Regional Council, July 2013

6. B5 Airport and Surrounds – Flooding
Sunshine Coast Council & Sunshine Coast Airport

7.TUFLOW User Manual, TUFLOW.2016-03-AA
BMT WBM, April 2016

Appendix A

The queries raised by WMAwater, the responses from SLR and the subsequent response from WMAwater are provided in the tables below.

Table A1: Topographic Data

WMA Comment	SLR Response	WMA Response
1. The Maroochy River mouth, as noted in Maroochy River Flood Study Report, is highly active. Comparison to Google imagery and the 2014 Lidar dataset shows discrepancies in the 2004 dataset. This is particularly evident at sand bar and island locations	The Maroochy River bathymetry was provided by Sunshine Coast Council (SCC) for the current flood analysis. The objective of the analysis was to determine the relative impact of any proposed development. Thus, conditions at the mouth of the River will affect the existing and developed site equally. It is also noted that the peak flood levels within the subject site for the 1% AEP flood event is approximately one metre higher than the peak storm surge level at the River mouth.	It is correctly noted that if the river mouth bathymetry was updated, it would likely impact both the existing and design scenarios equally. Therefore, it is unlikely to directly impact the assessment. WMAwater does recommend that an update to the river mouth bathymetry be taken in future assessment stages for the purposes of ensuring a more accurate representation of flood characteristics.
2. Use of this layer is only appropriate for use up to the 100 year ARI Climate Change event. For rarer events, the appropriate immunity level for each allotment should be used to model correct elevation and storage.	The GIS layer (2d_zpt_ResFill2100) has only been used to carry out a cumulative impact assessment, for floods up to the 100 year ARI Climate Change event.	Noted and accepted. Refinement should be made as part of future assessment stages.
3. Purpose of this layer is unknown. Currently used in all scenarios (including existing) but cannot be located. Further details regarding the inclusion of this file are required.	The GIS layer (2d_zpt_Roads_Ex29) sets a road level for Mudjimba Beach Road, because the Lidar data did not include the road.	It is noted that 2d_zpt_Roads_Ex29 has been updated to 2d_zpt_Roads_Ex30 and has been correctly shifted to align with aerial imagery of the existing roadway.

4. Layer is a very simple representation of the channels with single elevation points used for spans of up to 2.75km. It is also a thin breakline and therefore a poor representation of a (for the majority) 20m wide channel.	The GIS layer (2d_zlg_Drain) delineates some minor drainage channels, to ensure the model has continuous flow paths along the channels. It is incorrect to say they are "thin" breaklines. The TUFLOW model reads the GIS layer using the "gully" parameter which ensures a continuous flowpath. It is also incorrect to say it is a "poor representation of a 20m wide channel" because this GIS layer does not preclude the channel from being its full width as defined by the Lidar survey.	Section 6.8.3 of the TUFLOW manual (TUFLOW 2016-03-AA) notes the following: "The Read GIS Z Line default is to model a "thin" line which modify the ZH, ZU and ZV Zpt elevations only. If the THICK option occurs, interpolated Z values are applied to whole cells (ie. at the cell centres (ZC), all cell sides and cell corners). Other optional flags such as MAX, MIN, RIDGE or GULLY are also available." Please note that TUFLOW treats 2d_zln, 2d_zlr and 2d_zlg the same. Additionally, no "THICK" option has been applied to the 2d_zlg_Drain layer. Also note that the "GULLY" parameter does not ensure a continuous flowpath but instead only changes a Zpt elevation if the Z Shape elevation at the Zpt is lower. The above has only been included to justify the inclusion of original comments and explain how the 2d_zlg is applied by the model. It should be noted that it has minimal impact and therefore is not required in the model as the Lidar and 10m DEM appropriately represents the channels in these areas.

5. It was not possible to validate the use of this layer, particularly the shape used to create a 10-12m wide channel through the Motorway and Maroochy Waters Drive. It is recommended that this layer be removed from the model unless it is a correct physical representation.	The GIS layer (2d_zsh_Culvert) smooths out some of the topography in the Lidar data. The flow through this area is controlled by the culverts under the Sunshine Motorway.	The primary concern of the inclusion of this layer is demonstrated in the image below. Please note that the depicted mapinfo file will create a channel from the sunshine coast motorway to the canal system (based on the placement of the nodes). This method has been included at other locations where the area is smoothed to then include a 2d layered flow constriction representation of the structure. In this case there is no 2d layered flow constriction.  As stated previously, no evidence could be found to support the inclusion of this channel. If culvert structures are located in this area, they should be included for completeness. It is noted that this inclusion is located south of the Twin Waters West site and unlikely to affect the model results at the development, however should be included for model completeness as part of future assessment stages. Additionally, this shapefile is included in both the existing and design scenario and therefore is unlikely to influence the impact assessment.
6. This layer has been used at locations where the Motorway has been removed from the ALS data. There does not appear to be a requirement for this layer.	The GIS layer (2d_zsh_ALSGapFix_Ex29) smooths out some of the topography in the Lidar data at three major culvert locations under the Sunshine Motorway, so that the culverts can be properly represented as 2d layer flow constriction shapes. In addition, this GIS layer defines some road levels that were missing from the Lidar.	Noted and accepted.

7. Single elevation values for each string have been used and confirmation of bund location/elevation could not be made. It is recommended that a more detailed/accurate representation of the bund structure is made in the model.	The GIS layer (2d_zsh_ALSGapFix_Bunds_De71) ensures that the existing bunds, which are shown in the Lidar data, form a continuous line in the model representation (given the confines of a 10 metre grid).	Noted. This layer should be updated as part of future assessment stages as it is unlikely that a uniformly elevated bund would be constructed. The bund is currently containing water to the north of the site and may potential affect flood levels at the site.
8. Similar to the "2d_zlg_Drain.mif", the layer is a very simple representation of the channels with single elevation points used for long spans. Likewise, it is a thin breakline and therefore a poor representation of wide channels.	Refer response to Item 4.	Refer response to Item 4.
9. This is not an accurate representation of the development area and by filling to a level potentially higher than the finished surface level, the impact upstream, downstream and in this area is not correctly represented. It is recommended that survey for this location be undertaken or (if available) newer ALS data be used.	The development of this site within Pacific Paradise occurred recently, and was therefore designed to be located above the relevant flood level. It is therefore a reasonable representation of this site.	Noted and accepted.

Table A2: Topographic Layers for Twin Waters Development

1. Simplistic representation of the lake system within the developed area (with a uniform level). It is noted in the report that the level was chosen to represent the lake storage but this is ineffective due to the initial water level in the model. It is recommended that a more detailed representation of the lake system be used.	The adoption of a uniform lake invert level of -3.0 mAHD is considered appropriate. The lake will generally have a uniform invert level when constructed.	Noted and accepted. Any future assessment stages should include a representation of the lake design.

2. This layer contains two polygons. The southern polygon is roughly at existing ground level and does not represent a “weir”. The eastern polygon has been used to form a blockage and prevent 2D flow from overtopping the weir. Instead flow from Twin Waters lake system to the canal system is conveyed by a 1D weir.	The GIS layer has been applied correctly. The southern polygon fixes the ground levels within the polygon to 1.0 mAHD. The northern (eastern) polygon fixes the ground levels in the model to a very high level, so that the weir can be represented using a 1D link. It is agreed that no 2D flow occurs at the northern weir.	Noted and accepted. The 2d_zsh obstruction at the northern (eastern) weir location should be updated to the correct level during future assessment stages to ensure that the efficiency of the weir is correctly represented and not potentially overstated.
3. Conservative approach to modelling the impact of developing the allotments.	It is agreed that the approach used is conservative and therefore overstates any potential impacts due to the development.	Noted and accepted. Any future assessment stages should include a representation of the site design.
4. Does not incorporate bridge structure along Wattlebird Drive – although this has been removed from the Lidar the proposed extent of 2d_zpt_TWcanal removes existing bridge abutments.	The Wattlebird Drive bridge was not included in either the existing or developed cases. Thus, adding in the structure will affect the existing and developed cases equally. It is proposed to include the Wattlebird Drive bridge structure in the detailed flood modeling for the site.	Noted and accepted. During future assessment stages the modelling of the bridge structure (as the current design removes the existing bridge) should be modelled.
5. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.
6. Should only be used for high level assessment (lacking details).	The flood analysis completed to date has been for high level assessment. A more detailed design of this drainage line will be carried out during the detailed flood modeling for the site.	Noted and accepted.

Table A3: Local Inflow

<table>
<tr>
<td>The localized inflows 2, 5, 6 and 218 are not included in the TUFLOW model… The noted localized inflows are located in the canal system south of the Maroochy River and are therefore not unlikely to impact flood behaviour at the site.</td>
<td>These four local inflows were added to both the existing and developed case models. The results tabulated below show that there was no significant impact on flood levels within the subject site.
Peak Flood Levels Within Subject Site (mAHD)
<table>
<tr><th>Flood Event</th><th>Northern End</th><th>Southern End</th></tr>
<tr><td>Existing 1% AEP (without 4 local inflows)</td><td>2.402</td><td>2.124</td></tr>
<tr><td>Existing 1% AEP (with 4 local inflows)</td><td>2.402</td><td>2.125</td></tr>
<tr><td>Existing 1% AEP + CC (without 4 local inflows)</td><td>2.903</td><td>2.757</td></tr>
<tr><td>Existing 1% AEP + CC (with 4 local inflows)</td><td>2.903</td><td>2.758</td></tr>
</table>
</td>
<td>Noted and accepted.

Please note that providing the location of the extracted values on a figure (with the table) would provide further context.</td>
</tr>
<tr>
<td>Inflow 51 from the MIKEFLOOD model is located at the northern end of the development site. It is represented in TUFLOW as Inflow 51A and 51B, with a 25%/75% split. Further justification for this change should be made.</td>
<td>Sub-catchment 51 comprises an area of Pacific Paradise (to the north of the subject site) and the northern tip of the subject site. SCC's mapping system shows that a stormwater system is located in Pacific Paradise (to the north of David Low Way) which conveys runoff in an easterly direction to a tributary of the Twin Waters canal system. Thus, this catchment does not discharge through the subject site. Consequently, the inflow location for this part of the catchment (51B) was relocated to the aforementioned tributary. The remainder of sub-catchment 51 is located within the subject site. The local drainage system for the site will be designed in accordance with QUDM, and direct the stormwater runoff to the new lake. Consequently, the inflow location for this part of the catchment (51A) was relocated to the lake. A scenario was also modelled, based on the original location of Inflow 51. This scenario includes a dedicated overland flowpath through the subject site to convey the runoff. This scenario is not realistic, but has been modelled to demonstrate an acceptable outcome can be achieved.</td>
<td>It is noted that there is a stormwater network within the Pacific Paradise development that includes a 1200mm discharge pipe to the canal system but it is unlikely that the stormwater network would be designed to convey the 100 year ARI event.

Further justification for this choice is required as part of future assessment stages – (as a minimum) supporting calculations showing that the 100 year ARI event runoff is captured and conveyed by the existing stormwater network/overland flow system should be provided.

If this is undertaken and it is found that the system does not capture the significant portion of stormwater runoff and convey it to the canal system, an update to the hydrology should be undertaken. Consequently, the hydraulic model would need to be updated accordingly.</td>
</tr>
</table>

Table A4: Initial Water Level

The TUFLOW model adopts a constant initial water level across the model domain. Analysis of the provided data from SCC shows the MIKEFLOOD model used a spatially varying initial water level.	The TUFLOW model started at 24 hours. Consequently, the tailwater boundary condition (i.e. the storm tide level at the mouth of the River) at 24 hours was used as the initial water level throughout the TUFLOW model.	Noted. As this methodology is applied in both the existing and design scenarios it is unlikely to impact the purpose of the assessment. It should be noted that running the model for the full duration and adopting the spatially varying initial water level would remove this issue. Similarly, justification (or comparison to the full length run scenario) regarding the choice to reduce the model run time should be provided with future assessment stages.

Table A5: Hydraulic Structures

There are a number of structures included in the MIKEFLOOD model that are excluded from the TUFLOW model, particularly Structure 11E and 12A through the Sunshine Motorway. These structures are immediately adjacent to the development site.	Structures 11E and 12A are included in the TUFLOW model as 2d layered flow constrictions, as acknowledged by WMA Water in their report in Table C1. The head loss through these two major structures was checked using HEC-RAS. The results are tabulated below for the 1% AEP flood event, demonstrating that the culverts in TUFLOW are operating correctly. ***Hydraulic Structures – 1% AEP Flood Event*** **Structure** / **Peak Discharge (m^3/s)** / **Structure Head Loss (m)** 12A (Northern Culverts) / 84.6 / TUFLOW = 30 mm, HEC-RAS = 30 mm 11E (Southern Culverts) / 53.0 / TUFLOW = 50 mm, HEC-RAS = 50 mm	Noted and accepted. Details of these calculations should be documented in the reporting accompanying any future assessment stages.

A number of structures within the TUFLOW model have instability issues.	The noted instabilities are minor, particularly when considering the water level hydrographs rather than the flow hydrographs. The noted structures are remote from the subject site and do not affect the calculated results. The results at the structures are generally stable around the peak of the flood event. The water level hydrographs on the upstream side of all 1D structures are shown below. These graphs show that there are no significant instabilities in the model. Further results are available from the model output files.	It is noted that the flow instabilities are not proportional to the water level instabilities. Additionally, as stated, the instabilities do not tend to occur during the peak of the assessed event. The cumulative model error is low and the peak error is also reasonably low indicating a healthy model. With these points noted, instabilities should not be ignored and WMAwater recommends that these issues be fixed for any future assessment stages. It is not reasonable to state that the culverts are not near to the site and therefore should have minimal impact on the assessment. The culverts have a direct impact on flow conveyance from west to east (under the sunshine coast motorway) and therefore are likely to directly impact areas around the motorway – particularly in events where the motorway is not overtopped.
Structure 10A – Single MIKE culvert represented in TUFLOW as two separate culverts	In the TUFLOW model, Structure 10A is located under the Sunshine Motorway, and Structure 10B is located under the off ramp to North Shore Connection Road.	Noted and accepted.
Structures not included from MIKE model (but within TUFLOW model extent).	• BY-STR2 – details of this structure were not provided, but appears to be a minor drainage structure on the Sunshine Motorway, and thus is insignificant in a Maroochy River flood event. • Run_Culv – details of this structure were not provided, but appears to be a minor drainage structure on David Low Way, and thus is insignificant in a Maroochy River flood event. • Struc27739 – structure was modeled as an open channel along Airport Drain, however it is insignificant in a Maroochy River flood event.	Noted. Confirmation of culvert sizing to determine significance should be undertaken and detailed included in future assessment stages.
Structures only included in TUFLOW Model	Details of these structures were provided by SCC: • 12A is located under the Sunshine Motorway near Finland Road. • DLW1 is located under Mudjimba Beach Road at the northern end of Twin Waters. • SCA2 is located under David Low Way approximately 400 metres upstream of DLW1.	Noted and accepted.