PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2025/1645

Date: 3 September 2025

Queensland Government

Engineering Report Incl. Stormwater Management

PCYC Aura - Revelry Road, Bells Creek, QLD, 4551

Arcos Project: 241069

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By Email

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Engineering Report Incl. Stormwater Management
PCYC Aura - Revelry Road,
Bells Creek, QLD, 4551

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1 Introduction

Arcos Unit Group Pty Ltd (Arcos) has been commissioned by PCYC Queensland to prepare this Engineering Report and supporting documents/drawings as part of a development application with Sunshine Coast Council (SCC). The subject site is described as Lot 8048 on DP344641 with a site area of 6,500m^2. A site locality plan is presented in **Figure 1**. This report addresses engineering considerations such as site works, servicing provisions, access, and a site-based stormwater management plan to assess the stormwater quality and quantity requirements.

The vision for the site is to provide the local community with a new Police Citizens Youth Club (PCYC) in the developing neighbourhood of Aura in Bells Creek, Queensland. The site is currently vacant and has been cleared for development as part of the larger, surrounding subdivision works to create the lot.



FIGURE 1: SITE LOCALITY (SOURCE: QGLOBE)

2 Proposed Development

The subject site is being developed as part of a larger subdivision, which includes a Police Citizens Youth Club (PCYC) and emergency services precinct which is zoned as a Priority Development Area. The PCYC which is located on the subject site includes a building with an outdoor facility and an associated car park as shown in **Figure 2**.



FIGURE 2: DEVELOPMENT PERSPECTIVE 3D RENDER (SOURCE: TMJ ARCHITECTS)

3 Referenced Documents

The following documents has been supplied or sourced to undertake the engineering assessment:

- Architecture Plans Schematic Design (TMJ Architects 18/12/24)
- Detailed Site Survey (Finer Detail Surveying 02/02/25)
- Aura Town Centre Plan of Development (Urbis 09/11/16)
- Caloundra South Development: Flood Risk Management Strategy (BMT WBM 09/11/16)
- Aura Precincts 6 – 10 & 16 Stormwater Quality Management Plan (DesignFlow 09/11/16)

4 Access

The site will be accessed from Revelry Road, an existing council road that was constructed as part of the surrounding subdivision. The site backs on to (but is not accessible from) Bells Creek Arterial Road, a state-controlled road that will not be impacted by the proposed development.

4.1 Road & Driveway Type

A new 'heavy-duty wide' crossover (to IPWEA specifications) will be provided on Revelry Road. **Table 1** below outlines the design standards that are applicable to site access for the proposed development.

TABLE 1: ROAD & DRIVEWAY TYPE

Description	Standard
Revelry Road (existing)	Local Access Street (SCC Table SC6.14.2B)
Driveway / Access	General wide flared crossover generally in accordance with IPWEA.
Service vehicles	Widened Type A access as per SCC, Transport and Parking Code Table 9.4.8.3.3, with MRV Access. Combined Van/visitor park and WCV servicing via on-street.

4.2 Sight Distances

The Council's Planning Scheme Policy (SCC 6.17 for the Transport and Parking Code) nominates a minimum sight distance of 40m for Access Streets. Aerial imagery has confirmed this requirement is met by the development, as demonstrated in **Figure 3**.

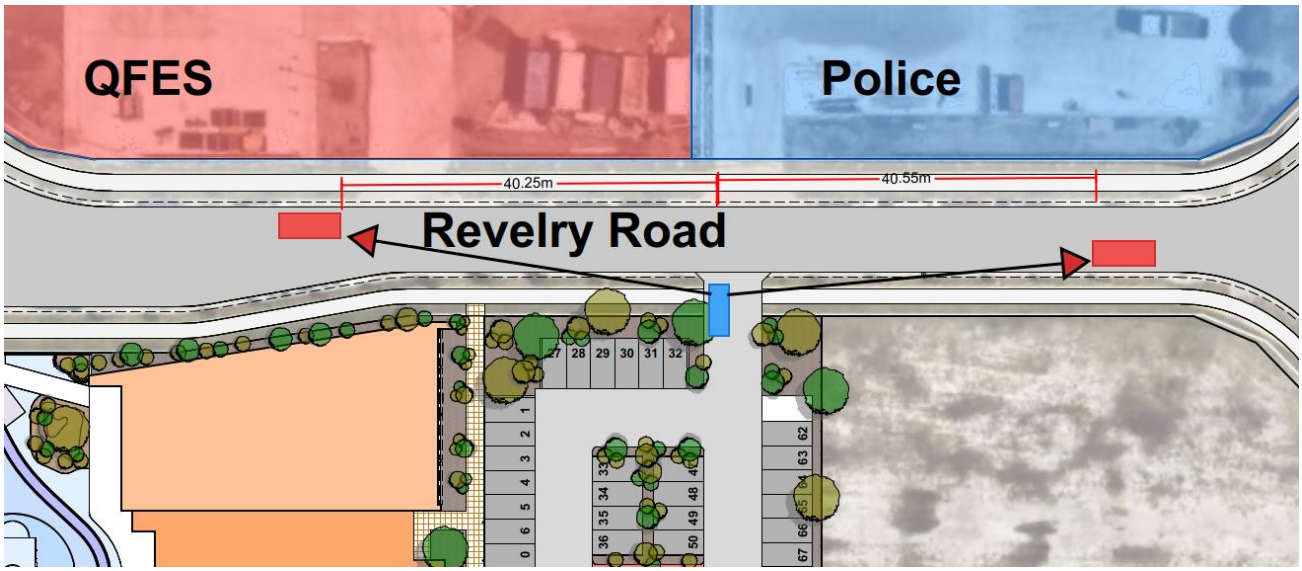


FIGURE 3 - SIGHT DISTANCE CHECK

4.3 Vehicle Turn Paths

The internal car park is to be designed to allow van, medium rigid vehicle (MRV) and waste collection vehicle (WCV) access. Each car park is to be checked that a B99 vehicle can enter and exit.

4.4 Waste Collection

A screened bin storage area is proposed adjacent to the entrance to the car park, which allows for the bulk bins to be manually handled to kerb via the driveway. A restricted no parking area along the kerb is to be nominated with appropriate signage for bin days directly adjacent to the crossover.

5 Earthworks

The existing site has undergone significant earthworks and levelling as part of the surrounding subdivision. As such, the site is generally flat and located on grade to the adjacent road level with a large earthworks bund at the rear of the lot. The internal site levels range from 6.4m AHD to 8.8m AHD, and the site has been lifted to sit well above any adjacent flood zones.

To facilitate the proposed PCYC, only minimal earthworks and lot shaping is expected. The ultimate site will grade towards Revelry Road, shall site above any defined flood levels, and the existing earthworks bund along the eastern boundary is to be removed as part of the site construction works.

All cut and fill is to be carried out in accordance with AS3798 Guidelines on Earthworks for Commercial and Residential Developments. Any site filling will be from site spoil (subject to a Geotechnical Investigation), provided it meets the requirements of AS3798 and is placed with controlled compaction.

The proposed earthworks will not adversely impact the overland flow conditions for adjacent or downstream properties. Nor will they encroach on adjacent properties or alter the function of stormwater catchments external to the site.

All construction activities, including Erosion and Sediment Control (ESC) methods, will be managed under the control measures of a Construction Environmental Management Plan (CEMP) for the development site through the construction phase.

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6 Stormwater Management

The proposed stormwater management strategy for the site shall generally comply with the requirements of the SCC Planning Scheme, the Queensland Urban Drainage Manual 2017 (QUDM) and other relevant codes and guidelines. As such, site flooding, stormwater conveyance, quantity management, and water quality treatment, must be considered for the proposed development.

In accordance with SCC PSP SC6.14.3A, the minor storm event for the development is the 10% Annual Exceedance Probability (AEP), and major storm event is the 1% AEP event.

6.1 Flooding

The subject site is not shown to be directly impacted by flooding but is adjacent to moderate to high risk flood waters as shown in **Figure 4**.

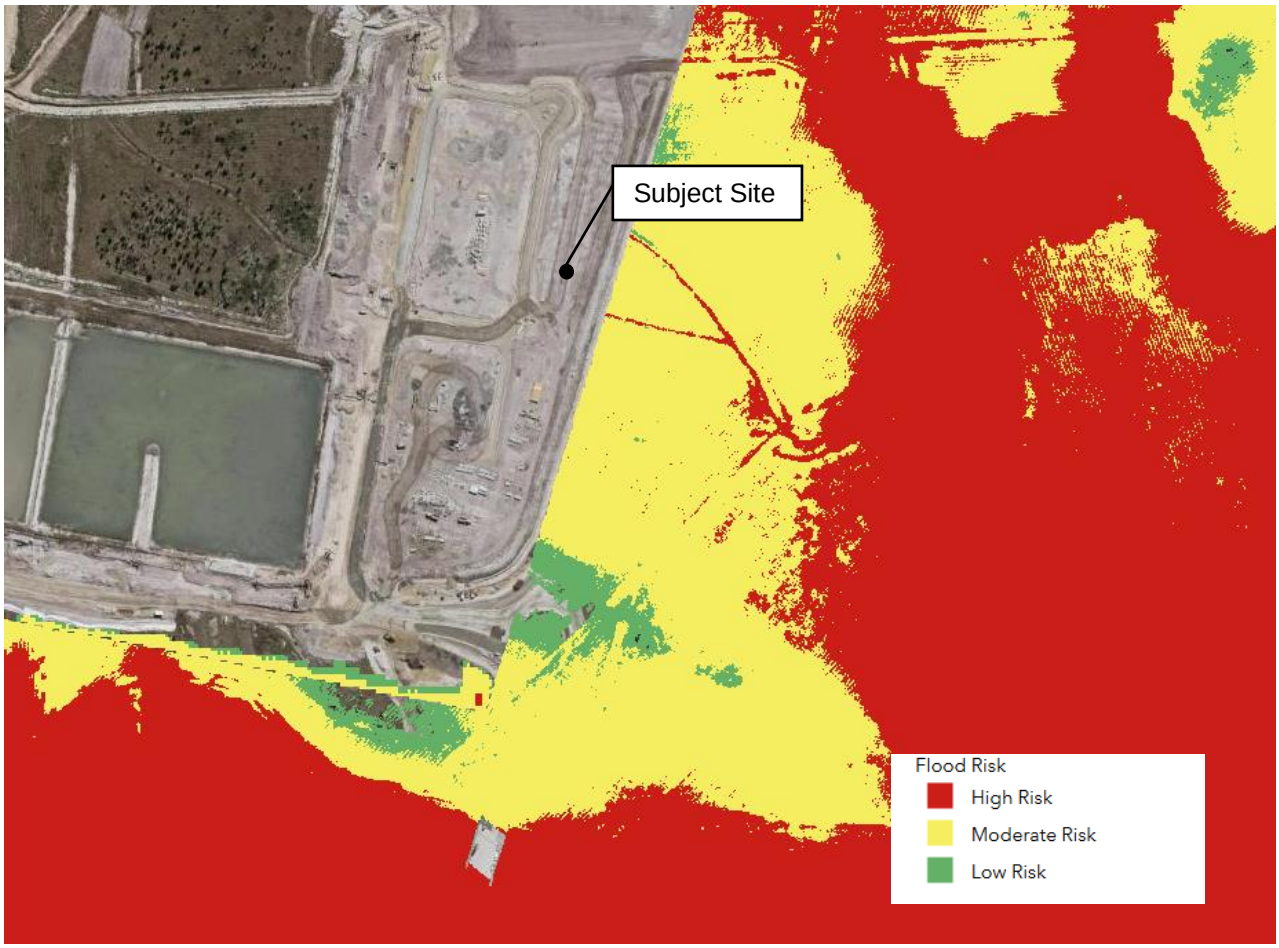


FIGURE 4: FLOOD MAPPING (SCC INTERACTIVE MAPPING)

As per the Flood Caloundra South Flood Risk Management strategy (refer Appendix C), the subject site levels have been raised to be above the 1% AEP flood level as part of the larger subdivision. Flood storage compensation has been completed in the Bells Creek South flood plain with 24Ha being lowered approximately 1.1m.

Surrounding flood waters bypass the site due to the 2m high retaining wall along the eastern boundary.

6.2 Stormwater Drainage

Runoff generated in the minor storm event from within the site shall be conveyed generally via kerb flows, pit inlets, and underground drainage pipes, through to the defined legal point of discharge (LPD), and shall be designed to ensure safe pedestrian and vehicle movements are maintained. The proposed LPD for the

development is the existing 600mm diameter underground stormwater drain within Revelry Road as shown in **Figure 5**.

All flows greater than the minor storm event, and up to and including the major storm even shall be conveyed via designated overland flow routes. For the proposed development, the aisle within the carpark shall convey flows away from the site towards Revelry Road.

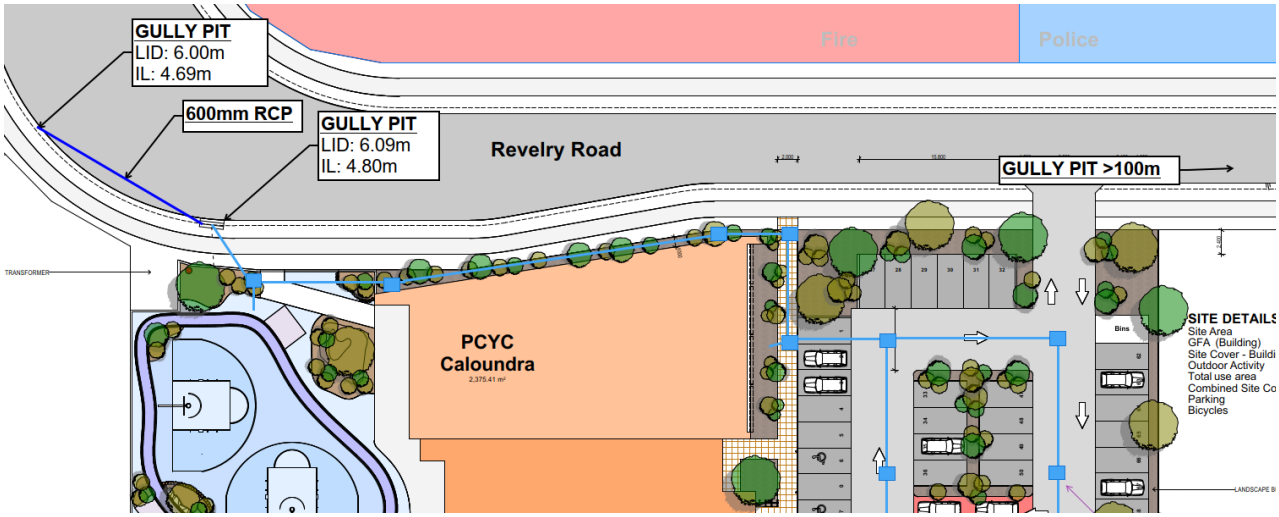


FIGURE 5: EXISTING STORMWATER NETWORK

6.2.1 External Catchments

There are no external catchments associated with the site.

6.2.2 Lawful Point of Discharge

The lawful Point of Discharge (LPD) for the proposed development is the existing gully pit on Revelry Road located to the southwest of the site. This lawful point of discharge is compliant with Section 3.9.1 requirements of QUDM.

6.3 Stormwater Quantity Management

Stormwater quantity management for commercial developments typically utilises underground detention tanks to mitigate the impacts of increasing the fraction of impervious surfaces within the site, as doing so leads to an increase in peak runoff generation. For this development within the 'P8' catchment however, the stormwater management strategy for the surrounding development has been designed to account for this increase in runoff, and therefore no specific on-site stormwater detention is required.

The stormwater management strategy for the Aura Plan of Development (completed by Urbis) is included in Appendix B. The surrounding development provides stormwater detention within nearby wetlands and bio-retention ponds (with approx. 0.80m of detention depth).

Despite stormwater quantity management having been already implemented for the proposed development, it is noted that the site is in the lower third of the Bells Creek waterway catchment. As such, the site would be exempt from peak flow management regardless (as per the SCC Planning Policy for Development Works).

6.4 Stormwater Quality Management

Stormwater quality improvement techniques for commercial developments typically include elements such as gross pollutant traps (GPTs), bio-retention basins, filter media cartridges, landscape buffers, and stormwater harvesting. As with quantity management, the stie's stormwater quality management has been considered by the surrounding subdivision, and specific treatment devices are nominated within the endorsed 'Aura Precincts 6-10 & 16 Stormwater Quality Management Plan' (SQMP) by Design Flow (refer Appendix D).

The SQMP outlines the overall treatment strategy and has been presented in **Figure 6**. As can be seen, The subdivision works shall include the construction of nearby wetlands and bio-retention basins (as shown in

green), however on-site GPTs and stormwater harvesting for re-use (via rainwater tanks) is to be implemented as part of the proposed development works.

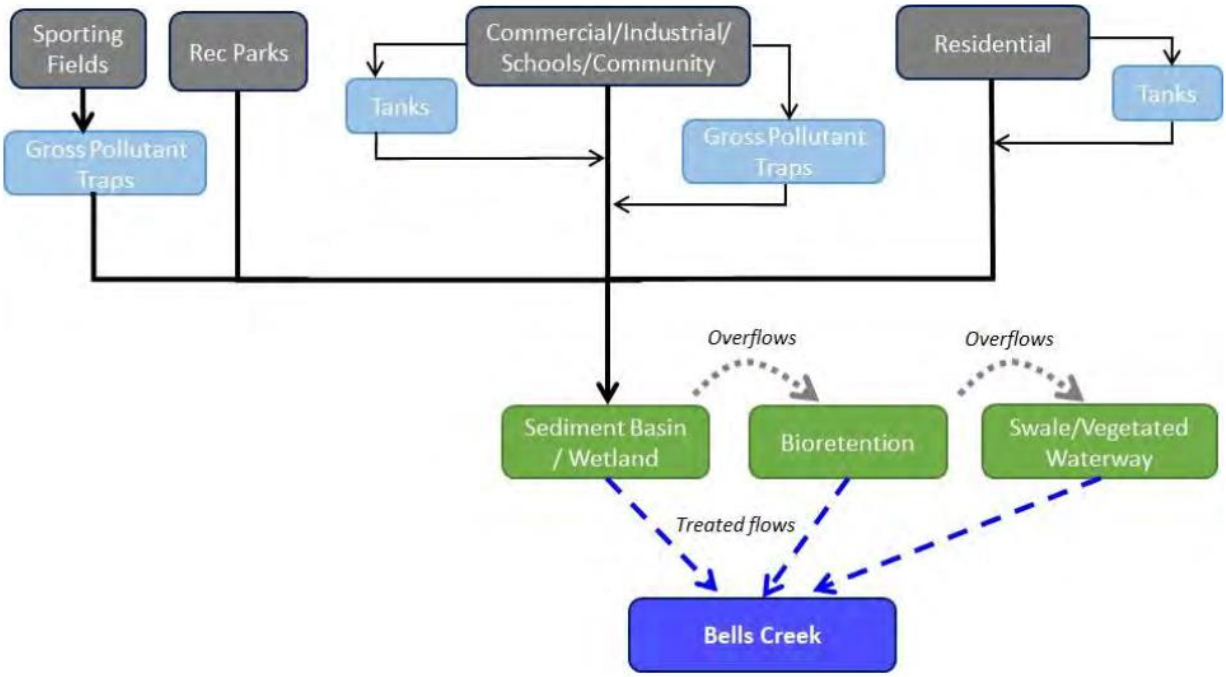


FIGURE 6 - SQMP OVERALL TREATMENT STRATEGY

A MUSIC model was developed (as part of the SQMP) to ensure water quality improvement targets are met by the subdivision, and by extension the subject site (refer Appendix D). The subject site sits within Catchment F in the endorsed SQMP, as can be seen **Figure 7** below.

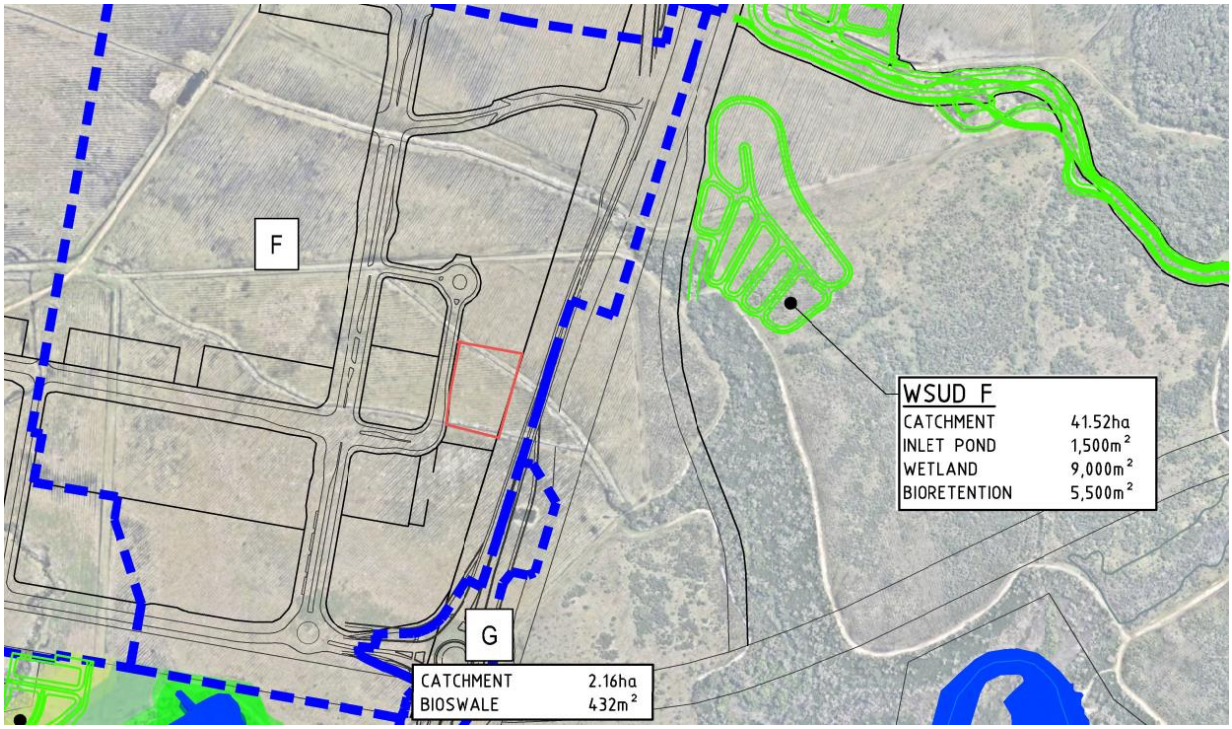


FIGURE 7 - SITE LOCATION WITH SQMP

Table 2 below compares the land use areas of Catchment F as a whole vs the proposed development. This was done to ensure the assumptions made in the modelling for the SQMP is representative of and applicable to the proposed development. As can be seen, the results are broadly in-line with the SQMP, and the increase in landscape area is considered to be an overall improvement for the site and the surrounding environment.

TABLE 2 - COMPARISON OF LAND USE AREAS – SQMP VS PROPOSED DEVELOPMENT

Land Use	SQMP		Proposed Development	
	Area (Ha)	% of site	Subject Site (m^2)	% of site
Roof	11.39	48%	2,240	34%
Ground/Road	9.69	41%	3,122	48%
Landscape	2.7	11%	1,138	18%

6.4.1.1 Gross Pollutant Traps

The endorsed SQMP does not specify a particular GPT product, nor does it outline minimum performance specifications. Moreover, Table 3 in the SQMP (refer Appendix D) states that GPTs were not modelled in MUSIC (despite overall water quality improvement targets being met). As such, a SQIDEP verified GPT will be specified in the OPW design phase of the development.

6.4.1.2 Rainwater Harvesting

The endorsed SQMP notes that at least 50% of all commercial roof area is to be connected to a rainwater tank for the purpose of re-use. Table 4 in the SQMP (refer Appendix D) outlines a minimum rainwater tank volume for commercial sites within the Aura development, which is to be the larger of:

- 1kL of re-use per toilet or urinal; or
- 25kL per ha of roof area; or
- 5kL

Based on preliminary architectural drawings, the proposed development calls for 12 toilets (min. 12kL of re-use), and has a total roof area of approximately 2,200m^2 (min 5.55kL of re-use). As such, 12kL is considered to be the minimum rainwater tank volume for the proposed development. It is noted that this number will be re-confirmed as part of OPW designs, to ensure any alterations to the architectural drawings are considered.

In addition, the endorsed SQMP notes that rainwater tanks must be connected to, and supply water for all non-potable uses and fixtures, including by not limited to toilets, urinals, all laundry taps, and all outdoor taps.

6.4.2 Construction Phase

Water quality management during the construction phase must be managed in order to ensure water quality standards are met for the entire project life cycle. As such, implementing best practice Erosion and Sediment Control techniques is imperative to managing the runoff quality affected by construction works.

Best practice measures shall be utilised during the construction phase to minimise the potential impacts construction of pollutants. Detailed Erosion and Sediment Control Management Plans should be developed in conjunction with the Operational Works design prior to construction works commencing in accordance with the International Erosion Control Association (IECA) - "Best Practice Erosion and Sediment Control (BPESC) document" and overseen by a Certified Professional in Erosion and Sediment Control (CPESC) or Registered Professional Engineer Queensland (RPEQ).

Through their principal contractor, the developer shall be responsible for ensuring that temporary sediment and erosion controls are installed and maintained correctly. **Appendix E** contains a detailed summary of construction phase water quality improvement practices.

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7 Service Provisions

The proposed development will also require the provision of services and utilities, including potable water supply, sewer outfall, communication lines, and electricity.

7.1 Potable Water

The site is to be serviced from the existing DN200 water reticulation main (Unitywater asset) located in the western verge of Revelry Road. An existing property service crosses the road, which has been provided as part of the subdivision works, is to be utilised. Its location generally aligns with the proposed site access. A new master meter will be required to service the development, including the provision of a new fire service.

The internal watermain layout (including fire servicing) shall be designed by others.

7.2 Sewer

The sewer outfall for the site is proposed to be the existing DN160 PE sewer main (Unitywater asset), located near the south western corner of the site, within Revelry Road. The existing sewer main has an invert level of 3.10m AHD, which will be able to provide full lot control to the proposed development.

The internal sewer and plumbing layout is to be designed by others.

7.3 Communications & Electrical

Details of electrical supply and communication infrastructure and services proposed for the development site are outside the scope of this report. However, it is understood that supply to the development can be provided.

8 Conclusion

This Engineering Services Report has been prepared to provide a review and information on the Engineering requirements to support the application for MCU on the proposed PCYC Aura development at Revelry Road, Bells Reach.

The following requirements have been reviewed as part of this report:

- Suitable access can be provided off Revelry Road to access the development;
- The site is not impacted by flooding as confirmed with the SCC flood mapping;
- The proposed habitable levels and access off-street are above the flood level requirements of the site;
- Stormwater quality and quantity requirements for drainage discharge can be provided for the site in accordance with the broader subdivision mitigation strategies;
- Sewerage can be connected to the existing Unitywater sewer main network via gravity flow; and
- Water supply and fire servicing can be provided from the existing Unitywater water main network.

In summary, this report shows that the development site can be adequately serviced, and provision made as currently shown and detailed for this development to be in accordance with Council's code requirements.

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LIMITATIONS

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The required detailed design for the service infrastructure will be subject to the conditions (if any), attached to the Development Approval provided by Council and any nominated referral agencies.

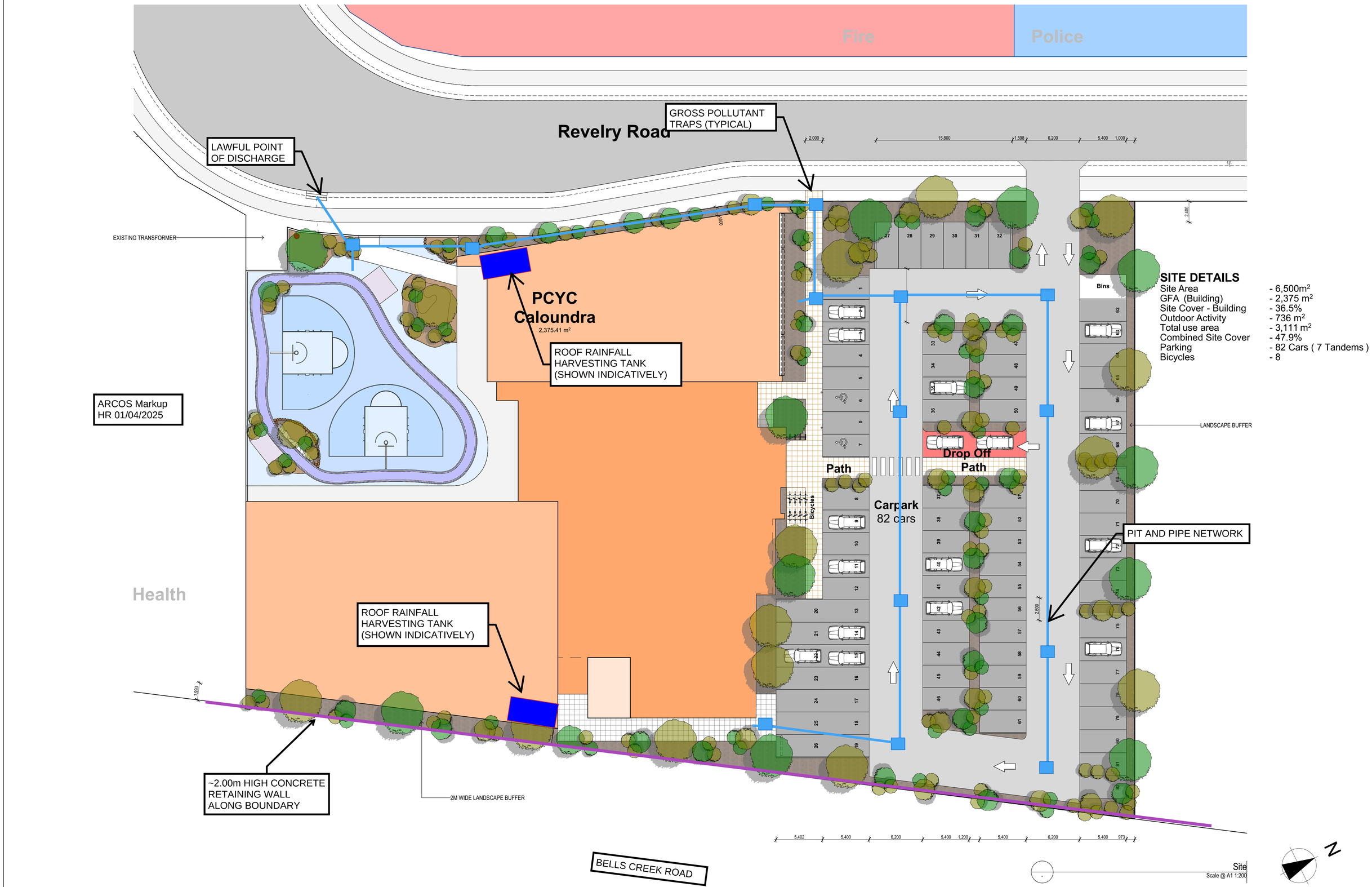
The advice given in this document is based upon the assumed conditions and data outlined herein. The relevance and accuracy of advice given are directly affected by variations in the information supplied and open source information relied upon.

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This document or parts of it should not be used as part of a specification or design for a project without prior review and agreement by Arcos.

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Appendix A – Stormwater Concept Strategy Markup



SITE DETAILS

Site Area	- 6,500m²
GFA (Building)	- 2,375 m²
Site Cover - Building	- 36.5%
Outdoor Activity	- 736 m²
Total use area	- 3,111 m²
Combined Site Cover	- 47.9%
Parking	- 82 Cars (7 Tandems)
Bicycles	- 8

General Notes
The Builder shall check all dimensions and levels on site prior to construction.
Notify any errors, discrepancies or omissions to the architect.
Drawings shall not be used for construction purposes until issued for construction.
Do not scale drawings.

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PROPOSED
PCYC - Aura
AT
Revelry Road - Aura

FOR
PCYC Qld

RevID	ChID	Change Name	Date	RevID	ChID	Change Name	Date
SD 01			20/05/2024				
SD 02			13/06/2024				
SD 03			3/07/2024				
SD 04			27/08/2024				
SD 05			18/12/2024				

DRAWING TITLE :
Site Plan

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Schematic Design	CP	PJ	A1

DRAWING NUMBER	REVISION	JOB NUMBER
A101	SD 05	1557-1

Plot Date: 18/12/2024

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Appendix B – Aura Town Centre Plan of Development (URBIS)

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2013/469

Date: 09/11/2016

Queensland Government

Stockland

AURA
TOWN CENTRE

PLAN OF DEVELOPMENT

PREPARED BY URBIS FOR STOCKLAND
NOVEMBER 2016

urbis

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SECTION 1

EXPLANATORY CONTENT

1.0 EXPLANATORY CONTENT

1.1 PLAN OF DEVELOPMENT PURPOSE

This Plan of Development (PoD) has been prepared in accordance with the requirements of the approved *Caloundra South Master Plan* **(Approved June 2016) and will direct the development of land included within the Town Centre Locality of the Master Plan.**

This PoD refines the outcomes approved in the Master Plan.

This PoD describes the development that may occur and provides the assessment criteria and/or approved plans that development must meet in any future assessment process.

The *Caloundra South Urban Development Area Development Scheme* (approved October 2011) sets the Vision for this community. The *Caloundra South Master Plan* identifies a range of principles, land use areas, localities and precinct entitlements and obligations. This PoD provides the instrument for the delivery of development that seeks to achieve the Vision and Principles outlined by these two documents. This Vision is graphically illustrated by ***Figure 1: Caloundra South – Illustrative Vision Plan***.



FIGURE 1: CALOUNDRA SOUTH – ILLUSTRATIVE VISION PLAN

1.2 LAND TO WHICH THIS POD RELATES

This PoD relates to that part of the *Caloundra South Master Plan* described as the Town Centre Locality – Precinct 6 (part), 7, 8, 9, 10 and 16 (part) by the *Caloundra South Master Plan* (June 2016). ***Figure 2: Land To Which This PoD Relates*** shows the boundary (defined by extent of the PoD area highlighted in blue) of the land to which this PoD relates.

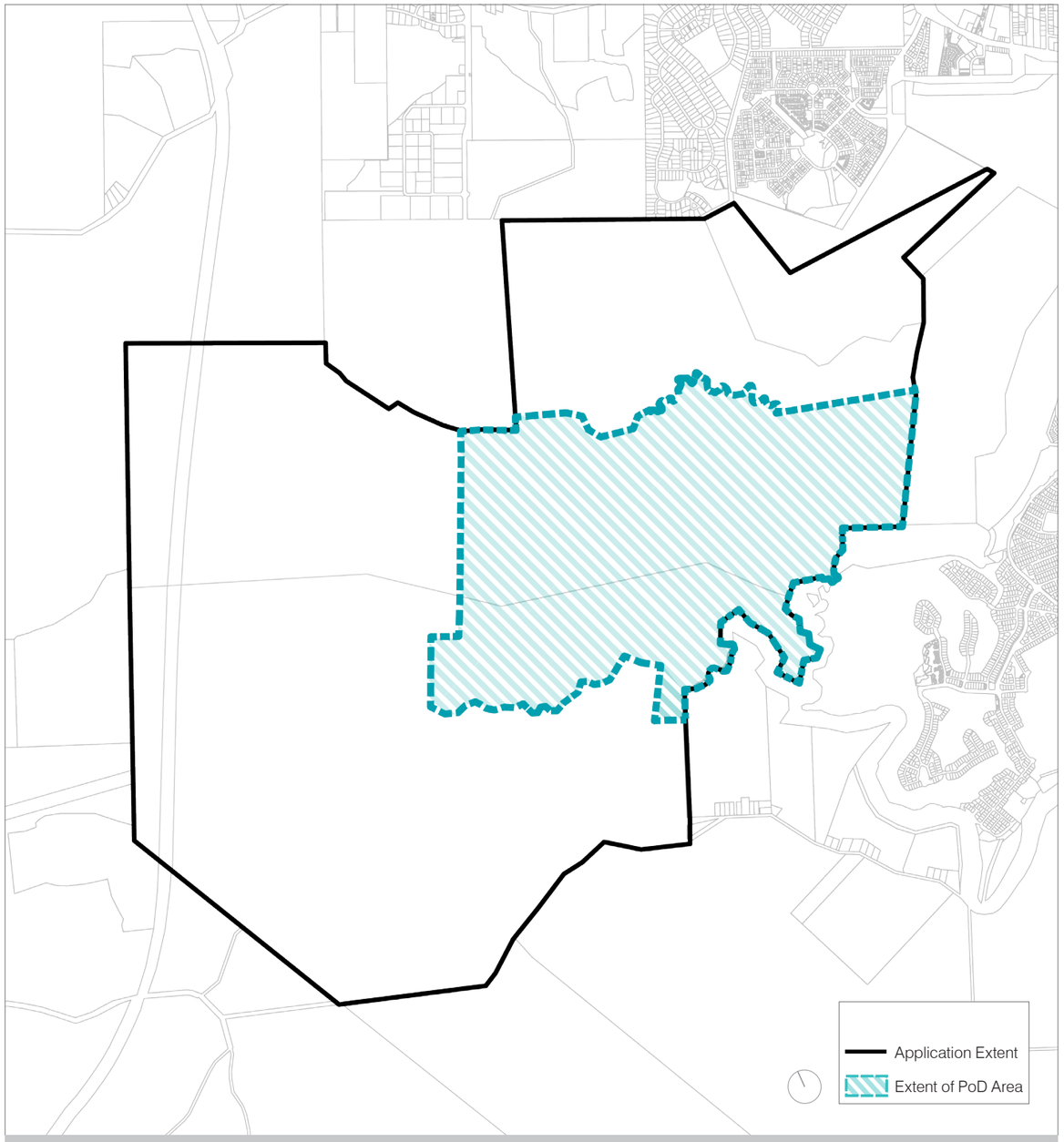


FIGURE 2: LAND TO WHICH THIS POD RELATES

1.3 INTERPRETATION

Terms used in this PoD have the meaning assigned by the Economic Development Act (ED) 2012, the *Caloundra South Development Scheme 2011* and Part 13 of the *Caloundra South Master Plan* (June 2016).

If there are any inconsistencies between the definitions in these documents, the inconsistency is to be resolved by using the definition contained in the documents in the following order:

a) The ED Act; or if there is no definition in the ED Act;
b) The Caloundra South UDA Development Scheme; or if there is no definition in the Caloundra South UDA Development Scheme;
c) Part 13 of the *Caloundra South Master Plan* (June 2016);
d) Any executed infrastructure agreement; and
e) The definitions in ***Appendix A*** of this PoD.

A reference in the PoD to a specific resource document or standard means the current version of that resource document or standard at the date of the approval of this PoD.

A reference to a Nominated Assessing Authority (NAA) means (pursuant to section 88 of the ED Act) for a PDA development condition or approval – the entity so nominated under section 88(a).

1.4 RELATIONSHIPS TO OTHER LEGISLATION

The Council's Planning Scheme only applies to the extent it is adopted into the PDA Development Scheme and Master Plan approval and then only to the extent the provisions so adopted are consistent with the PDA Development Scheme.

1.5 EXPLANATION OF PLAN OF DEVELOPMENT STRUCTURE AND ASSESSMENT PROCESS

The PoD consists of the components outlined by ***Table 1: Plan Of Development Structure*** below:

TABLE 1: PLAN OF DEVELOPMENT STRUCTURE

SECTION		EXPLANATION
Providing non-statutory context and understanding of the PoD and how it is to be used.	**Section 1** Explanatory Content	This section includes general explanatory content regarding the site and how the PoD document is used, including: • Relationship to all heads of power; • Structure of PoD; • How future assessment processes work; • The purpose of this document; • Land to which this PoD relates; • Rules for interpretation; • The relationship of this PoD to other legislation; and • The assessment process sought by this PoD.
Providing development criteria and plans that form the statutory element of the PoD.	**Section 2** Approved Development (No Further Assessment)	This section outlines all development that is Approved Development where in accordance with plans and criteria outlined in the PoD.
	Section 3 Approved Development (Compliance Assessment)	This section outlines all development that can be considered through compliance assessment. This section is organised by precinct or Sub-Precinct and outlines the plans and criteria that are to be used in the compliance assessment process.

1.5.1 OVERALL OPERATION OF THIS POD AND RELATIONSHIPS TO OTHER APPROVALS

This PoD forms one element of the overall approval framework relevant to the Caloundra South Town Centre Locality (CSTCL) – Precinct 6 (part), 7, 8, 9, 10 and 16 (part).

The relationship of this PoD to other approvals or statutory obligations is outlined by ***Figure 3: PoD Relationships and Operational Overview***. This figure also provides a summary of the way in which future development can occur over the CSTCL – Precinct 6 (part), 7, 8, 9, 10 and 16 (part), which are:

1. Approved Development (No Further Assessment): development in accordance with Plans and Development Controls comprising Exempt development, which may proceed to operational works and building works approvals;
2. Approved Development (Compliance Assessment): development in accordance with the PoD subject to Approved Compliance Assessment Process; and
3. Certification of Operational Works: certification of operational works is undertaken in accordance with the Self Certification Procedures Manual.

Further detail regarding each of these processes is outlined by Section 1.5.2 Future Development Delivery Processes.

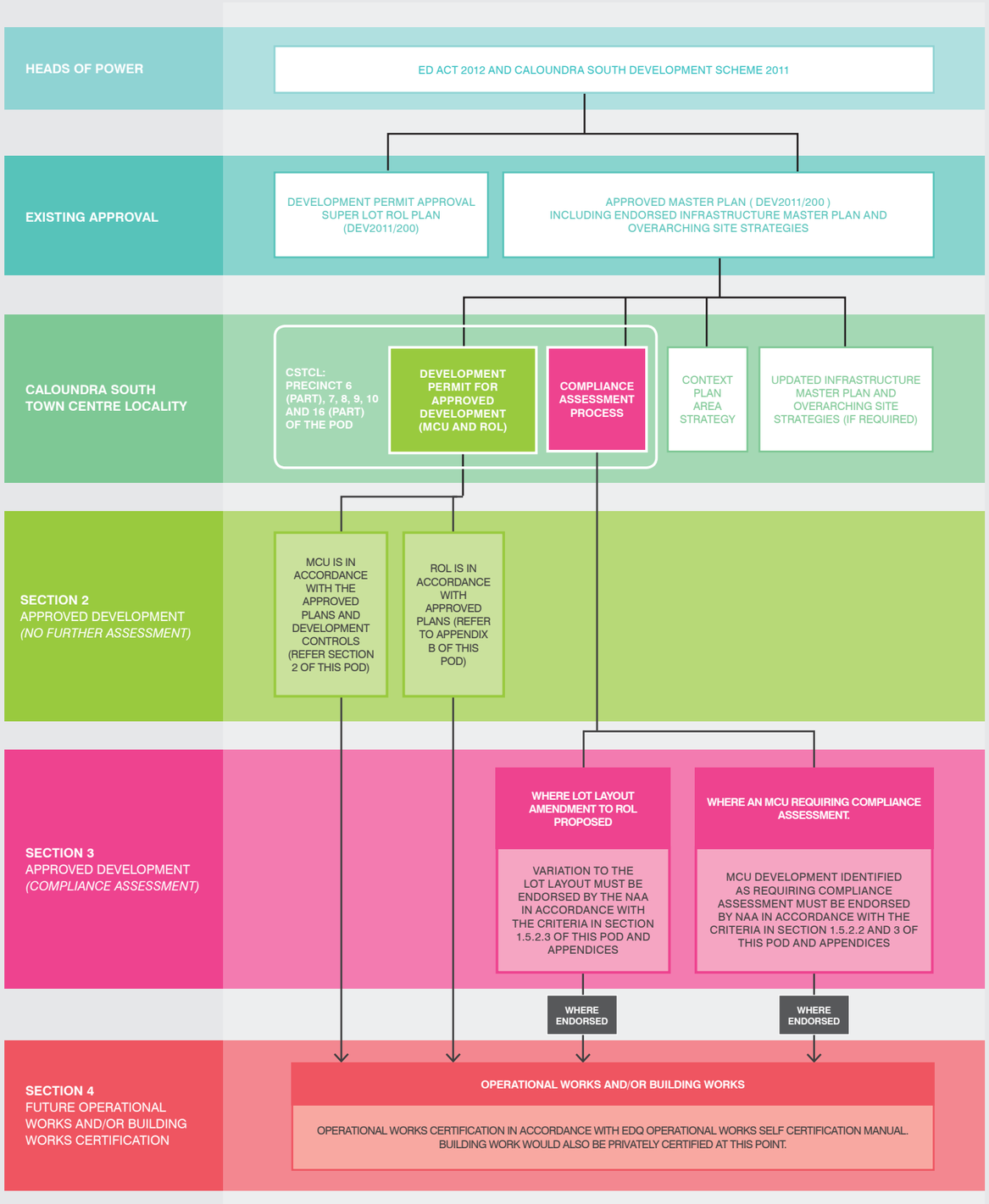


FIGURE 3: POD RELATIONSHIPS AND OPERATIONAL OVERVIEW

1.5.2 FUTURE DEVELOPMENT DELIVERY PROCESSES

1.5.2.1 APPROVED DEVELOPMENT (NO FURTHER ASSESSMENT)

Development within this section that is in accordance with the PoD is Exempt development and may proceed to operational works and building works approvals.

A summary of this process and its intended operation is provided by ***Table 2: Approved Development (No Further Assessment) Process Summary*** and ***Figure 4: Approved Development (No Further Assessment) Operation***.

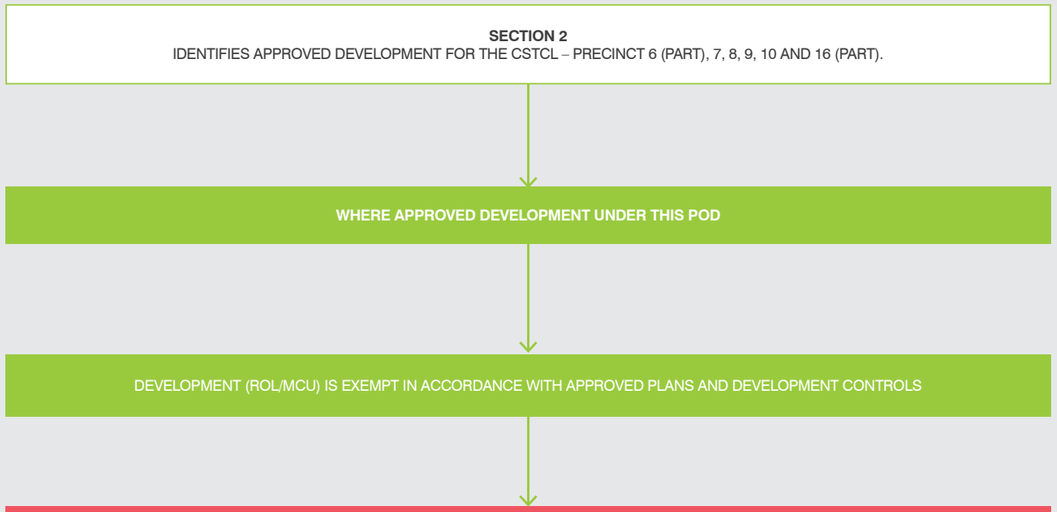


FIGURE 4: APPROVED DEVELOPMENT (NO FURTHER ASSESSMENT) OPERATION

TABLE 2: APPROVED DEVELOPMENT (NO FURTHER ASSESSMENT) PROCESS SUMMARY

SECTION	WHAT IS THE CONTENT?	WHEN DOES THIS SECTION APPLY?	HOW DOES IT WORK?	WHO ADMINISTERS THIS PROCESS?	WHY IS THIS PROCESS NEEDED?
Section 2 For development in accordance with the PoD that is exempt from further assessment.	This section includes:- • Approved Plans for Reconfiguring a Lot; • Approved Plans and development controls for approved uses.	Applies to development identified as Approved Development (RoL and MCU) identified in Section 2.	Approved Development is development that is exempt from further assessment where in accordance with approved plans and development controls.	Development in accordance with these plans and controls will proceed to certification of operational works and building works.	This section identifies development that does not need to undertake a Compliance Assessment process where in accordance with approved plans and development controls.

1.5.2.2 APPROVED DEVELOPMENT (COMPLIANCE ASSESSMENT)

Approved Development (Compliance Assessment) means the process of having Development plans, works, documents, reports, strategies or the like endorsed by the Nominated Assessing Authority (NAA).

A summary of this process and its intended operation is provided by ***Table 3: Approved Development (Compliance Assessment) Process Summary*** and ***Figure 5: Approved Development (Compliance Assessment) Operation***.

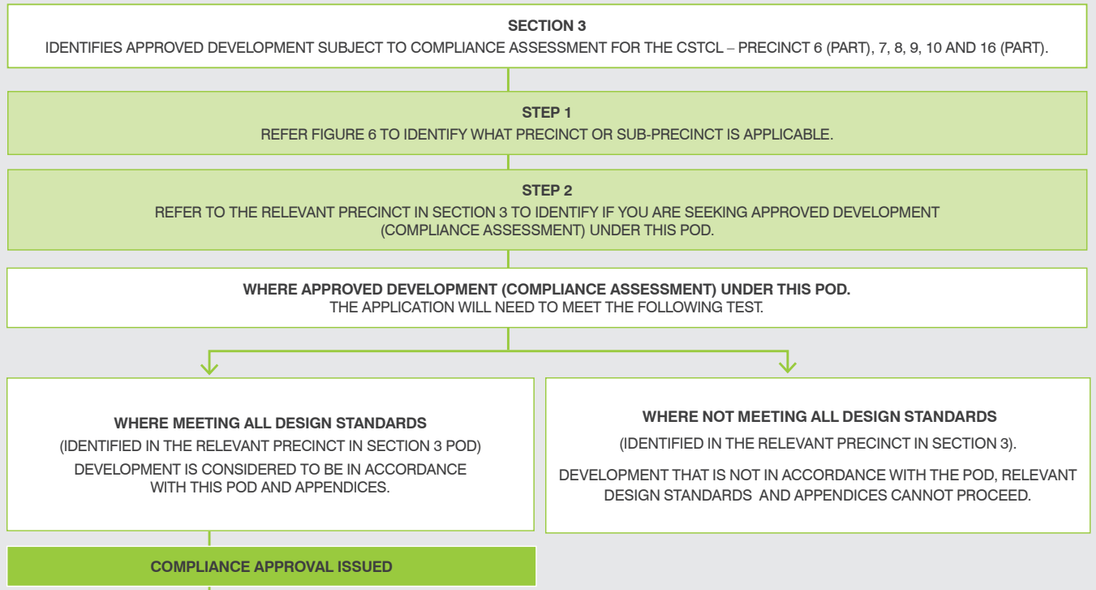


FIGURE 5: APPROVED DEVELOPMENT (COMPLIANCE ASSESSMENT) OPERATION

TABLE 3: APPROVED DEVELOPMENT (COMPLIANCE ASSESSMENT) PROCESS SUMMARY

SECTION	WHAT IS THE CONTENT?	WHEN DOES THIS SECTION APPLY?	HOW DOES IT WORK?	WHO ADMINISTERS THIS PROCESS?	WHY IS THIS PROCESS NEEDED?
Section 3 For development in accordance with the PoD that is Approved Development subject to Compliance Assessment.	This section is organised by precinct and includes:- • Precinct intent statements; • Uses that are Approved Development subject to Compliance Assessment; • Precinct design criteria; • Criteria for changes to The Reconfiguring a Lot Layout; • Specific Use Criteria; and • Appendices	Applies to development identified as Approved Development subject to Compliance Assessment in the relevant precinct in Section 3.	'Compliance Assessment' refers to the assessment process undertaken by NAA and administered by way of a condition of approval.	Administered by the NAA.	This section is intended to facilitate future compliance assessment. Its benefits are:- • A more efficient planning process; • Provides flexibility for Stockland and the community; and • Resolves detailed design and technical requirements

1.5.2.3 VARIATION TO APPROVED RECONFIGURATION OF A LOT

The following criteria must be met for any variation to the lot layout to be endorsed by NAA pursuant to the Approved Development (Compliance Assessment) process set out in Section 1.5.2.2:

1. Any variation to lot layout must be in accordance with the criteria and plans and PoD Appendices;
2. Any variation to lot layout must be accompanied by updated Plans of Development for uses identified in Section 2.2, Section 2.3, Section 2.4, Section 2.5, Section 2.6, Section 2.8, Section 2.9 and Section 2.10 as Approved Development (No Further Assessment) which reflect the amended lot layout;
3. Development endorsed by NAA as part of any request to vary the lot layout replace (where applicable) the existing plans and/or controls in Section 2.2–2.10 of this PoD. Development undertaken in accordance with any updated Plan of Development endorsed by NAA is taken to be Approved Development (No Further Assessment); and
4. The variation must occur before the survey plan is endorsed for the respective stage or super lot*;
5. Fixed elements identified by Sections 3.2.4, 3.3.4, 3.5.4, 3.11.4, 3.13.4, 3.16.4, 3.15.4 of the PoD cannot be changed or altered by a variation to lot layout.

A request for a variation to the lot layout is to be supported by:

- A short form Planning Report;
- An updated Reconfiguring a Lot Plan for the respective stage of development;
- Updated Plans of Development for uses identified in Section 2.2, Section 2.3, Section 2.5, Section 2.6, Section 2.8, Section 2.9 and Section 2.10 as Approved Development (No Further Assessment) where affected by the amended lot layout;
- Updated Transport Technical Advice (where relevant);
- Updated Civil, Drainage & WSUD Assessments (where relevant); and
- Demonstration that the variation is consistent with requirements of any Overarching Site Strategy or Infrastructure Mater Plan.

For compliance assessment plans / supporting information for approved development (compliance assessment) in Section 3 must detail the following:

- site location
- lot size and configuration
- building height
- plot ratio, gross floor area and site cover
- number of dwelling units and bedrooms
- interface with adjoining dwellings
- building design including elevations and materials
- on-site parking and servicing arrangements
- private open space

** Super lots generally refer to larger lots designed for future subdivision.*

SECTION 2

APPROVED DEVELOPMENT

(NO FURTHER ASSESSMENT)

2.0 APPROVED DEVELOPMENT (NO FURTHER ASSESSMENT)

This section of the PoD applies to development that is exempt from further assessment where in accordance with the plans and development controls outlined by this section (and related appendices) and may proceed to operational works and building works approvals.

The relevant process is further explained by Section 1 - Explanatory Content to this PoD. This section of the PoD is relevant to the following:

1. Reconfiguring a Lot;
2. Advertising Devices;
3. Car Park (where associated with Display Home and/or Sales Office);
4. Home Based Business;
5. House or Display Home;
6. Multiple Residential (Duplex and Triplex)
7. Park;
8. Sales Office (where not greater than 400m^2);
9. Shopping Centre where in Sub Precinct 8.1; and
10. Telecommunications Facility.

This section includes the following components:

1. Reconfiguring a Lot Plans;
2. Plans and development controls for Advertising Devices;
3. Plans and development controls for a Car Park (where associated with Display Home and/or Sales Office);
4. Development controls for Home Based Business;
5. Plans and development controls for House or Display Home;
6. Plans and development controls for Multiple Residential (Duplex and Triplex);
7. Development controls for Park;
8. Plans and development controls for Sales Office (where not greater than 400m^2);
9. Shopping Centre where in Sub Precinct 8.1; and
10. Plans and development controls for Telecommunications Facility.

2.1 RECONFIGURATION OF A LOT

Reconfiguring a Lot plans have been prepared for the Town Centre Locality – Precinct 6 (part), 7, 8, 9, 10 and 16 (part) which reflect the proposed lot layout. These plans are included in ***Appendix B*** of the PoD for ease of reference. Reconfiguring a Lot undertaken in accordance with these plans is Approved Development (No Further Assessment) and can proceed to operational works certification and plan sealing in accordance with the process outlined in Section 1.5.2.1 and 1.5.2.3.

2.2 ADVERTISING DEVICES

Advertising devices in accordance with the controls in ***Table 4: Advertising Devices Controls*** is Approved Development (No Further Assessment) and can proceed to certification of operational works and building works.

TABLE 4: ADVERTISING DEVICES CONTROLS

ADVERTISING DEVICE REQUIREMENTS
Advertising Devices are located generally in accordance with the approved PoD included in ***Appendix D*** and are to be in accordance with the criteria identified by ***Appendix D.***
OR
Advertising Devices are to be designed generally in accordance with the Sunshine Coast Council Planning Scheme requirements as set out in the Development Scheme.

2.3 CAR PARK (WHERE ASSOCIATED WITH A DISPLAY HOME AND/OR SALES OFFICE)

A Car Park (where associated with Display Home and/or Sales Office) is Approved Development (No Further Assessment) and can proceed to certification of operational works and building works where:-

- The use is provided in conjunction with a Display Home and/or Sales Office; and
- Complying with car parking in ***Appendix H***

2.4 HOME BASES BUSINESS

A Home Based Business is exempt development where the use is in accordance with the provisions of the Home Based Business definition in ***Appendix A*** and Specific Use Criteria in Section 3.17.

2.5 HOUSE OR DISPLAY HOME

A House or Display Home in accordance with the plans and controls in ***Table 5: House Or Display Home Controls*** is Approved Development (No Further Assessment) and can proceed to certification of operational works and building works.

TABLE 5: HOUSE OR DISPLAY HOME CONTROLS

HOUSE OR DISPLAY HOME CONTROLS
Development for a House or Display Home is generally in accordance with the Approved Plan of Development in ***Appendix E*** and Approved House/Lot Design in ***Appendix I,*** complying with car parking in ***Appendix H.***

2.6 MULTIPLE RESIDENTIAL (DUPLEX / TRIPLEX)

Multiple Residential (duplex and triplex) is Approved Development (No Further Assessment) and can proceed to certification of operational works and building works, where:

- The land is identified on the Approved Plan of Development included at ***Appendix E;*** and
- In accordance with the relevant criteria in ***Appendix I*** (3.17.1 - House & Multiple Residential Allotments).

2.7 PARK

A Park is exempt development in accordance with Schedule 1 of the *Caloundra South Urban Development Area Development Scheme* and can proceed to certification of operational works and building works.

2.8 SALES OFFICE

A Sales Office is Approved Development (No Further Assessment) and can proceed to certification of operational works and building works, where in accordance with controls in ***Table 6: Sales Office Controls***.

TABLE 6: SALES OFFICE CONTROLS

SALES OFFICE CONTROLS
Complies with relevant controls of Section 3.17

2.9 SHOPPING CENTRE

A Shopping Centre in accordance with the plans and controls in ***Table 7: Shopping Centre Controls*** is Approved (No Further Assessment) and can proceed to certification of operational works and building works, subject to compliance assessment of:

- Final site plans, elevations, sections and roof plans;
- Facade treatments;
- External materials; and
- Colours and finishes.

TABLE 7: SHOPPING CENTRE CONTROLS

SHOPPING CENTRE CONTROLS
Generally in accordance with: • ***Appendix F***; and • Specific Use Criteria in Section 3.17.

2.10 TELECOMMUNICATIONS FACILITIES

A Telecommunications Facility in accordance with the plans and controls in ***Table 8: Telecommunications Facilities Controls*** is Approved Development (No Further Assessment) and can proceed to certification of operational works and building works.

TABLE 8: TELECOMMUNICATIONS FACILITIES CONTROLS

TELECOMMUNICATIONS FACILITIES REQUIREMENTS
Freestanding Telecommunications facilities are to be located generally in accordance with the plan contained with the approved PoD plan contained in ***Appendix G.***

SECTION 3

APPROVED DEVELOPMENT

(COMPLIANCE ASSESSMENT)

3.0 APPROVED DEVELOPMENT *(COMPLIANCE ASSESSMENT)*

3.1 INTRODUCTION

This section provides the Design Criteria for Approved Development (Compliance Assessment) for development under the process outlined in Section 1 – Explanatory Content to this PoD.

The land included within this Plan of Development has been divided into precincts and a Sub-Precinct as shown in ***Figure 6: Town Centre Locality Precincts And Sub-Precincts*** to facilitate the delivery of precinct or Sub-Precinct specific approved land uses summarised by Section 3.1.1.

This section of the PoD includes the following components for each Precinct:

1. A statement and illustration of overall intent;
2. Uses that are Approved Development subject to Compliance Assessment;
3. Specific design criteria; and
4. Criteria for changes to the Reconfiguring a Lot layout.

This section also includes Compliance Assessment requirements which apply to all Precincts for specific uses.

Where conflict, the sub precinct design criteria prevail over section 3.17.

Note:

In accordance with section 3.3.2 of the Caloundra South Development Scheme a development application within the Town Centre that seeks to exceed the nominated Retail or Commercial GFAs must be accompanied by an Economic Impact Assessment. This must demonstrate how the proposed centre development will complement and not compromise the network of centres on the Sunshine Coast. Furthermore, any analysis must demonstrate how:

- Transport infrastructure can service the future development and not jeopardise the road hierarchy and movement network.
- Potential increases can be contained within the Sunshine Coast Sub Region and provide opportunities for economic growth and increased employment opportunities.

3.1.1 SUMMARY OF COMPLIANCE ASSESSIBLE USES

TABLE 9: COMPLIANCE ASSESSIBLE USES

PRECINCT	APPROVED USES	TOTAL RESIDENTIAL LOTS (MINIMUM +/-10%)	TOTAL MULTIPLE RESIDENTIAL (MINIMUM +/-10%)	MAX RETAIL USE GFA	MAX COMMERCIAL USE GFA	COMMUNITY FACILITY PROVISION	TOTAL PARK AREA
6.1	• Utility Installation • Telecommunications Facility	NA	NA	0m²	0m²	NA	286 ha Conservation
6.2	• Utility Installation • Telecommunications Facility	NA	NA	0m²	0m²	NA	31 ha Conservation
7.1	• Display Home • House • Home Based Business • Multiple Residential on 'Medium Density Residential' site as identified on ***Figure 12*** and ***Figure 13***. • Multiple Residential (Duplex and Triplex) on sites identified in ***Appendix E*** • Other Residential (Retirement) where located on 'Medium Density Residential' as identified on ***Figure 12*** and ***Figure 13***. • Sales Office	726 standard residential lots 20 Multiple Residential Allotments (60 dwellings max.) Total of 786 max. dwellings including Multiple Residential dwellings	400 dwellings	0m²	0m²	NA	28,039m² Neighbourhood Park 38,298m² Linear Park
7.2	• Community Facility • Outdoor Sport and Recreation • Food Premises (maximum of 1 where adjoining the Community Facility and less than 250m² of GFA)	NA	NA	250m²	0m²	750m² Land Dedication to Community Facility	6ha Land Dedication to Peoples Place
8.1	• Business • Car Park • Child Care Centre • Community Facility • Educational Establishment • Emergency Services • Fast Food Premises • Food Premises • Health Care Services • Home Based Business • Indoor Entertainment • Indoor Sport and Recreation • Market • Multiple Residential • Outdoor Sport and Recreation • Sales Office • Service Station (where within a carpark and not on a street frontage) • Shop • Shopping Centre • Short Term Accommodation • Tourist Attraction • Telecommunications Facility • Utility Installation	NA	NA	86,000m²	5,000m²	3,000m² GFA Dedication to Community Facility	NA
8.2	• Business (where in the Mixed Use Retail land use in ***Figure 19***). • Car Park • Food Premises • Health Care Services • Home Based Business • Indoor Entertainment • Indoor Sport and Recreation (where excluding premises for conducting large scale functions, i.e. Convention Centre, Amusement and Leisure Centre) • Multiple Residential • Other Residential • Sales Office • Short Term Accommodation • Shop • Utility Installation	NA	430 dwellings	750 m²	5,000m²	NA	NA
8.3	Where in People's Place South: • Community Facility • Indoor Entertainment • Indoor Sport and Recreation • Market • Outdoor Sport and Recreation • Tourist Attraction Where not in People's Place South: • Business • Car Park • Child Care Centre • Education Establishment (where located on "University Campus" site) • Emergency Services • Food Premises • Health Care Services • Multiple Residential (where located on a 'Multiple Density Residential' site as identified on ***Figure 21***. • Sales Office • Shop • Short Term Accommodation (where located on a 'Multiple Density Residential' site as identified on ***Figure 21***) • Utility Installation	NA	320 dwellings	750 m²	5,000m²	3,000m² Land Dedication to People Place Plaza 1.5ha Major Civic Centre	6.8 ha Land Dedication to Peoples Place (including Major Civic Centre) + Peoples Place Plaza
8.4	• Business • Car Park • Child Care Centre • Community Facility • Educational Establishment • Emergency Services • Fast Food Premises • Food Premises • Health Care Services • Home Based Business • Hospital • Indoor Entertainment • Indoor Sport and Recreation • Market • Multiple Residential (where located on 'Preferred Residential Node' sites as identified on ***Figure 23***) • Other Residential • Outdoor Sales • Outdoor Sport and Recreation • Place of Assembly • Sales Office • Service Station • Service Industry • Shop • Short Term Accommodation • Telecommunications Facility • Tourist Attraction • Utility Installation • Veterinary hospital	NA	420 dwellings	1,500m²	20,000m²	3.7 ha Community Services	5,000m² Local Park
8.5	• Business (where located in a 'Focus Mixed Use' site as identified on ***Figure 25***) • Food Premises • Indoor Sport and Recreation • Multiple Residential • Other Residential • Outdoor Sport and Recreation • Sales Office • Shop • Short Term Accommodation • Utility Installation	NA	780 dwellings	1,000m²	10,000m²	1,000m² Transit Plaza	5,000m² Neighbourhood Park 2,000m² Local Park
8.6	• Car Park • Community Facility • Emergency Services • Telecommunications Facility • Utility Installation	NA	NA	NA	NA	NA	NA

PRECINCT	APPROVED USES	TOTAL RESIDENTIAL LOTS (MINIMUM +/-10%)	TOTAL MULTIPLE RESIDENTIAL (MINIMUM +/-10%)	MAX RETAIL USE GFA	MAX COMMERCIAL USE GFA	COMMUNITY FACILITY PROVISION	TOTAL PARK AREA
9.1	• Business Use Category (where located on Commercial Uses Hub as identified on ***Figure 29***) • Community Facility • Display Home • Home Based Business • House • Multiple Residential (where located on a 'Medium Density Residential' site as identified on ***Figure 29***) • Other Residential (where located on a 'Medium Density Residential' site as identified on ***Figure 29***)	329 lots No Multiple Residential Allotments	429 dwellings	NA	5,000m²	NA	7,278m² Neighbourhood Park 7,504m² Local Linear Park
9.2	• Educational Establishment	NA	NA	NA	NA	8 ha Private School	NA
10.1	• Child Care Facility • Display Home • Home Based Business • House • Multiple Residential (where located on 'Medium Density Residential' site as indicated on ***Figure 33***) • Multiple Residential (Duplex and Triplex) on sites identified in ***Appendix E*** • Other Residential (where located on 'Retirement Village Residential' site as indicated on ***Figure 33***) • Sales Office	734 standard residential lots 37 Multiple Residential Allotments (111 dwellings max.) Total of 845 max. dwellings including Multiple Residential dwellings	90 dwellings 200 dwellings Retirement Living	NA	NA	NA	19,425m² Neighbourhood Park 16,457m² Local Linear Park 2,475m² Local Park
10.2	• Community Facility • Indoor Sport and Recreation • Outdoor Sport and Recreation • Utility Installation	NA	NA	NA	NA	NA	15 ha Land Dedication to Major Sports Park
16	• Community Facility • Indoor Sport and Recreation • Outdoor Sport and Recreation • Utility Installation	NA	NA	NA	NA	1.8 ha Major Sports Facility	10 ha Land Dedication to Major Sports Facility

TOTAL DWELLINGS - COMPARISON WITH MASTER PLAN

PRECINCT	TOTAL DWELLING YIELD	TOTAL YIELD TARGET (+/- 10%) (MASTER PLAN)
6		
7	**1,186 dw** (786 dw + 400 dw)	1,200 dw (range = 1,080 dw - 1,320 dw)
8	**1,950 dw** (430 dw, 320 dw, 420 dw, 780 dw)	1,900 dw (range = 1,710 dw - 2,090 dw)
9	**732 dw** (329 dw + 429 dw)	800 dw (range = 720 dw - 880dw)
10	**1,135 dw *** (845 dw + 90 dw + 200 dw)	900 dw (range = 810 dw - 990 dw)
16		
Total Application 4		

***** The school shift into Precinct 11 allowed for more developable residential land - so the dwelling yield is over the Master Plan yield maximum target.

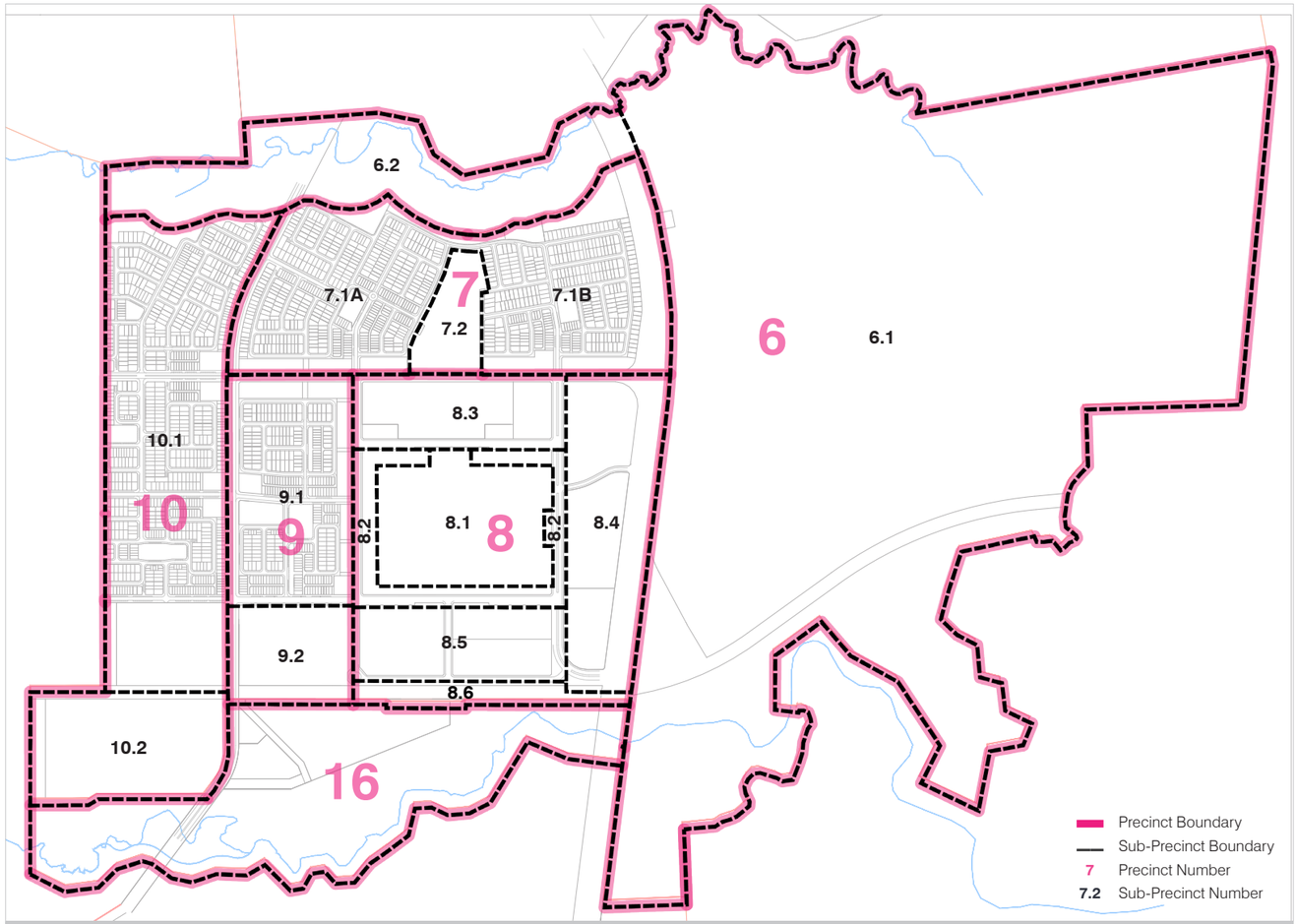
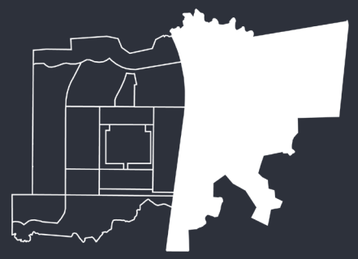


FIGURE 6: TOWN CENTRE LOCALITY PRECINCTS AND SUB-PRECINCTS

3.2 SUB-PRECINCT 6.1

BELLS CREEK ENVIRONMENTAL AREA



3.2.1 SUB-PRECINCT INTENT

This Sub-Precinct has been retained and is to be extensively rehabilitated as an environmental protection and habitat area. It is intended that this Sub-Precinct be protected for conservation and rehabilitation purposes with opportunities for passive recreation, transport corridor (rail), limited opportunities for the provision of infrastructure and water quality and quantity management where appropriate.

The Sub-Precinct includes areas that are of environmental significance and have associated conservation, biodiversity, habitat or scenic amenity values.

The Sub-Precinct allows only a limited range of low impact, low-intensity land uses to protect areas identified as having significant values for biological diversity, water catchment, ecological functioning or cultural values.

Figure 7: Sub-precinct 6.1 Illustrative intent plan provides an illustrative representation of the desired outcome for the precinct.



FIGURE 7: SUB-PRECINCT 6.1 ILLUSTRATIVE INTENT PLAN

3.2.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Precinct 6.1 are outlined in ***Table 10: Uses Subject To Compliance Assessment*** below.

TABLE 10: USES SUBJECT TO COMPLIANCE ASSESSMENT

LAND USES
Uses Subject to Compliance Assessment
• Utility Installation • Telecommunications facility

3.2.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 6.1 are required to be assessed against and fulfil the Design Standards identified in ***Table 11: Sub-Precinct 6.1 Design Standards***.

TABLE 11: SUB-PRECINCT 6.1 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 10***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices
Environment	DS2.1 Buffers are provided in accordance with the Acid Frog Management Code in ***Appendix N.*** DS2.2 Wetlands/Bio-retention Basins are provided subject to detailed design. DS2.3 Landscape buffer to the Utility Installation minimum of 3m in width is provided in accordance with ***Figure 8***.

3.2.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 6.1

The majority of the land within Sub-Precinct 6.1 is to be used as an environmental protection zone or indicative wetlands. As such, variation to the lot layout within Sub-Precinct 6.1 is not intended under this PoD.

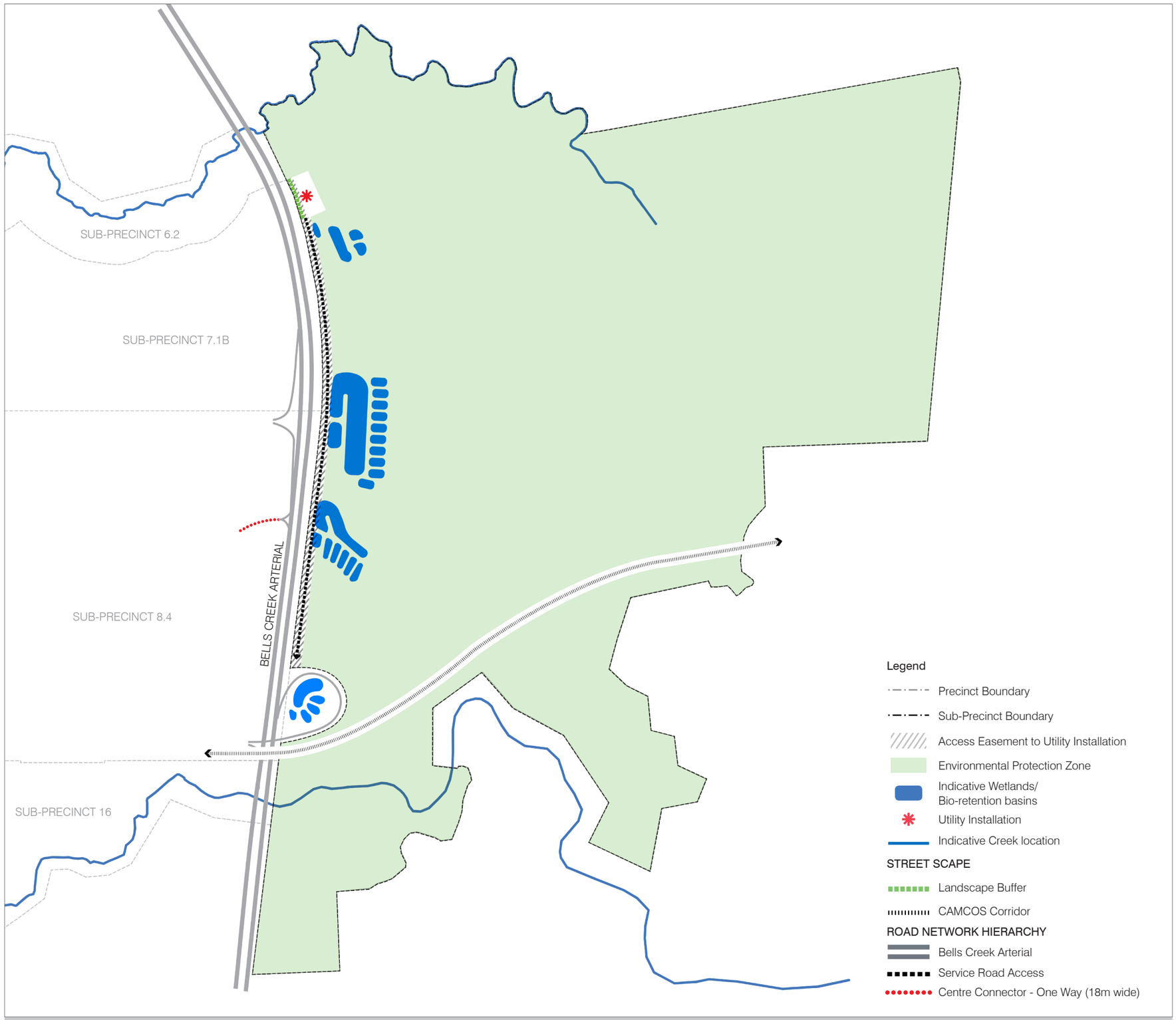
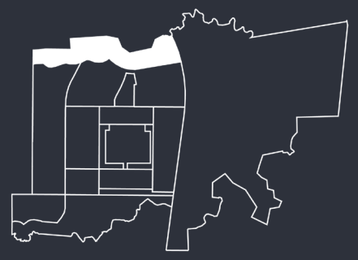


FIGURE 8: SUB-PRECINCT 6.1 FIXED ELEMENTS

3.3 SUB-PRECINCT 6.2

BELLS CREEK NORTH BUFFER



3.3.1 SUB-PRECINCT INTENT

The intent of the Conservation Buffer Sub-Precinct is to provide for the protection and rehabilitation of the major waterways within the site and for a range of located passive recreation, educational activities that promote a diverse lifestyle whilst recognising the ecological values of the area.

The Sub-Precinct allows only a limited range of low impact, low-intensity land uses to protect areas identified as having significant values for biological diversity, water catchment, ecological functioning or cultural values.

Figure 9: Sub-Precinct 6.2 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 9: SUB-PRECINCT 6.2 ILLUSTRATIVE INTENT PLAN

3.3.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 6.2 are outlined in ***Table 12: Uses Subject To Compliance*** below.

TABLE 12: USES SUBJECT TO COMPLIANCE

LAND USES
Uses Subject to Compliance Assessment
• Utility Installation • Telecommunications facility

3.3.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 6.2 are required to be assessed against and fulfil the Design Standards identified in ***Table 13: Sub-Precinct 6.2 Design Standards***.

TABLE 13: SUB-PRECINCT 6.2 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 12***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Public Realm	DS2.1 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 10***. DS2.2 Development ensures that 'Recreation Pathways' are provided in the general locations as identified in ***Figure 10***. DS2.3 A 'Contraflow/Dedicated Cycle Path' is provided in accordance with ***Figure 10***.
Environment	DS3.1 Buffers are provided in accordance with the Acid Frog Management Code in ***Appendix N.*** DS3.2 Wetlands/Bio-retention Basins are provided subject to detailed design.

3.3.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 6.2

Variation to the lot layout within Sub-Precinct 6.2 is not intended under this PoD.

The majority of the land within sub precinct 6.2 is to be used as an environmental protection zone or indicative wetlands. As such, variation to the lot layout within Sub-Precinct 6.2 is not intended under this PoD.

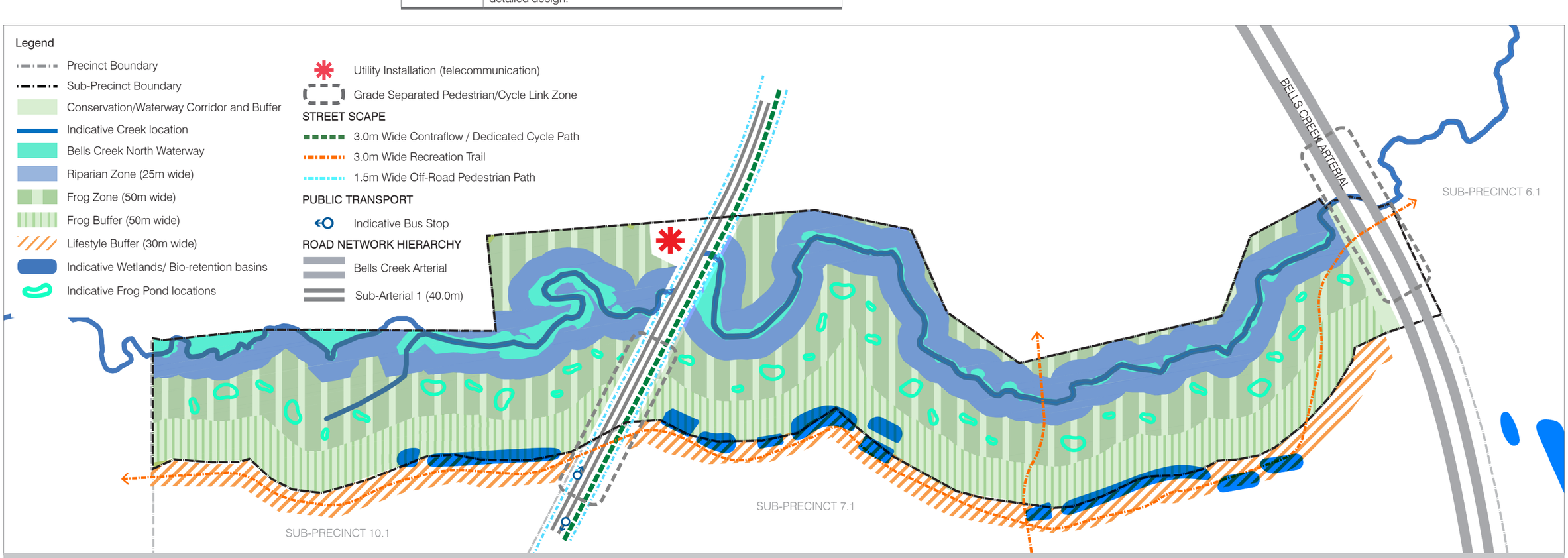
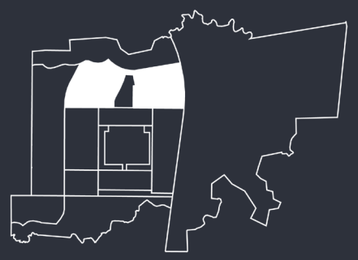


FIGURE 10: SUB-PRECINCT 6.2 FIXED ELEMENTS

3.4 SUB-PRECINCT 7.1

MIXED RESIDENTIAL



3.4.1 SUB-PRECINCT INTENT

The Sub-Precinct comprises a range of residential dwelling types, including Detached and Attached Dwellings that take advantage of the location of the Sub-Precinct in close proximity to the Town Centre. Small scale non-residential and community uses are also located throughout this Sub-Precinct however these uses are of a size which do not compete with the role and function of the Town Centre Core. The Sub-Precinct comprises Multiple Residential dwellings where fronting Landscape Boulevard Streets which frame the Town Centre. Small scale non-residential and community uses address the street or the People's Place. Small scale non-residential uses may also be considered in this precinct where servicing a local need.

The built form of the Sub-Precinct reflects the residential nature of the area and is low-medium rise. Building height is greater close to the Town Centre Core with medium rise apartment buildings concentrated toward the sub-arterial road to the south of the Sub-Precinct. Built form within the Sub-precinct addresses the street and promotes overlooking of the street to maximise casual surveillance.

Public realm within the Sub-Precinct comprises a number of local/ neighbourhood parks located throughout the residential neighbourhoods which provide for passive recreation opportunities.

Vehicular access to the street within the Sub-Precinct is limited to a small number of locations to ensure the streets are promoted for use by pedestrian and cyclists. Vehicular access and car parking for non-residential uses ensure its location and design to not create amenity impacts on surrounding residential dwellings.

Figure 11: Sub-Precinct 7.1 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 11: SUB-PRECINCT 7.1 ILLUSTRATIVE INTENT PLAN



3.4.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 7.1 are outlined in ***Table 14: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 14: USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)

LAND USES
Uses Subject to Compliance Assessment
• Display Home • Home Based Business • House • Multiple Residential on 'Medium Density Residential' site as identified on ***Figure 12*** and ***Figure 13***. • Multiple Residential (Duplex and Triplex) on sites identified in ***Appendix E*** • Other Residential (Retirement) where located on 'Medium Density Residential' as identified on ***Figure 12*** and ***Figure 13***. • Sales Office

3.4.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 7.1 are required to be assessed against and fulfil the Design Standards identified in ***Table 15: Sub-Precinct 7.1 Design Standards***.

TABLE 15: SUB-PRECINCT 7.1 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 14***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 Building height does not exceed the maximum building heights shown in ***Figure 12*** and ***13***. DS2.2 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection is in accordance with Section 3.17 ***Table 49***. DS2.3 Development on a Key Corner Site identified by ***Figure 12*** and ***13*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and c. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm. DS2.4 Minimum building separation distances as per Section 3.17 ***Table 50.***
Public Realm	DS3.1 Neighbourhood Parks are provided in accordance with ***Figure 12*** and ***13***. DS3.2 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 12*** and ***13***. DS3.3 Green links are provided in accordance with ***Figure 12*** and ***13*** and show the intent of a pedestrian / cycle friendly connection through the neighbourhood to the higher order green space network***.*** DS3.4 A 'Grade separated Pedestrian / Cycle link' is provided in general accordance with the location shown in ***Figure 12*** to connect to the east***.*** DS3.5 Development ensures that 'Recreation Pathways' are provided in the general locations as identified in ***Figure 12*** and ***13***. DS3.6 A 'Contraflow/Dedicated Cycle Path' is provided in accordance with ***Figure 12*** and ***13***.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 12*** and ***13***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access and prohibited access locations are provided in accordance with ***Figure 12*** and ***13***. *Note: locations shown are indicative and may vary along the road provided it is demonstrated road safety is not compromised.* DS4.4 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.5 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.
Environment	DS5.1 Buffers are provided generally in the locations identified in ***Figure 12*** and ***13*** and designed in accordance with the Acid Frog Management Code in ***Appendix N.*** DS5.2 Acoustic barriers identified in ***Figure 12*** and ***13*** provide landscape and acoustic treatments in accordance with a relevant acoustic report. DS5.3 Wetlands/Bio-retention Basins are provided in ***Figure 12*** and ***13*** and are subject to detailed design and compliance approval. *Note: In some areas the 30m Lifestyle Buffer is not applied due to the recreational areas or road reserves addressing the same need.*

3.4.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 7.1

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 7.1 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 12 and ***Figure 13*** identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 16: Design Standards For Change To Reconfiguring A Lot In Stage 7.1A & 7.1B*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 7.1A and 7.1B.

TABLE 16: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN STAGE 7.1A & 7.1B

DESIGN STANDARD	
TOTAL - Sub-Precincts 7.1A & 71.B	
Number of Local/ Neighbourhood Parks	4 x Neighbourhood Parks 5 x Local Linear Parks
Total Park Area Required	6.2 ha
Maximum Yield excluding Multiple Residential Sites (+/-10%)	786 dwellings including Multiple Residential dwellings (Duplex or Triplex). (726 Standard Residential Lots plus 20 Multiple Residential Allotments (60 Duplex or Triplex dwellings max.))
Sub-Precinct 7.1A	
Number of Local/ Neighbourhood Parks	2 x Neighbourhood Parks 3 x Local Linear Parks
Total Park Area Required	2.6 ha
Lifestyle Buffer	A 'Lifestyle Buffer' is provided generally in accordance with ***Figure 12***.
Maximum Yield (+/-10%)	440 dwellings including Multiple Residential dwellings (Duplex or Triplex). (413 Standard Residential Lots plus 9 Multiple Residential Allotments (27 Duplex or Triplex dwellings max.))
Maximum Future Multiple Residential Sites	Lot 80010 – 2 Lots Lot 80011 – 2 Lots Lot 80012 – 3 Lots
Sub-Precinct 7.1B	
Number of Local/ Neighbourhood Parks	2 x Neighbourhood Parks 2 x Local Linear Parks
Total Park Area Required	4.0 ha
Lifestyle Buffer	A 'Lifestyle Buffer' is provided generally in accordance with ***Figure 13***.
Maximum Yield excluding Multiple Residential Sites (+/-10%)	346 dwellings including Multiple Residential dwellings (Duplex or Triplex). (313 Standard Residential Lots plus 11 Multiple Residential Allotments (33 Duplex or Triplex dwellings max.))
Multiple Residential Sites	Lot 80008 – 3 Lots Lot 80009 – 3 Lots

General	
Lot Design	Size • No minimum lot size Shape • Typical depth 20.0 - 40.0 metres, but can be less in urban neighbourhoods. Width in multiples of 2.5 metres and 5.0 metres consistent with typical lot dimensions. • Urban lots are typical depth of 13.5 to 15 metres. Slope • Platform construction required when finished slope on lot is 16% or greater
Block Size	• Length 100-200 metres • Depth 40-80 metres
Lot Layout	• No more than eight narrow (less than 10.0 metres) frontage lots in a row. • No more than six lots with a width of 7.5m in a row unless serviced by a rear lane. • Lot corners match or are within 1.0 metre of corners of adjoining lots.
Access	• Maximum 400 metres walk to neighbourhood recreation park or equivalent (see PDA Guideline No.12 Park planning and design). • Ninety percent of all dwellings are within 400 metres of an existing or planned public transport stop
Street Network	• Grid pattern or modified grid responsive to site characteristics. • Where slope allows, orientation within 15 degrees of north-south or east-west. • To minimise cut & fill, streets follow ridges, gullies, and/or are perpendicular to slope. • Minimise cul-de-sacs and where used and limit length to desirably no greater than 10 lots.
Streets	Street network includes: • Neighbourhood connector streets providing connections to neighbourhood destinations; • Neighbourhood access streets provide direct access to properties and neighbourhood lanes; and • Neighbourhood lanes – provide direct property access either at the front or rear of lots.
Road Hierarchy	Roads are designed in accordance with ***Appendix L.***
Car parking	On site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• Guideline No.5 – Neighbourhood Planning and Design (May 2015) • Guideline No.6 – Street and Movement Network (April 2012) • Guideline No.12 – Park Planning and Design (May 2015) • Guideline No.13 – Engineering Standards (May 2015) • Guideline No.18 – Development Interfaces (May 2015) • Practice Note No.7 – Designing for Small Lots (March 2014) • Practice Note No.11 – Parking Analysis Plans (July 2012) • Practice Note No.12 – Rear Lanes: Design and Development (March 2014) • The executed Local Government and DTMR Infrastructure Agreements

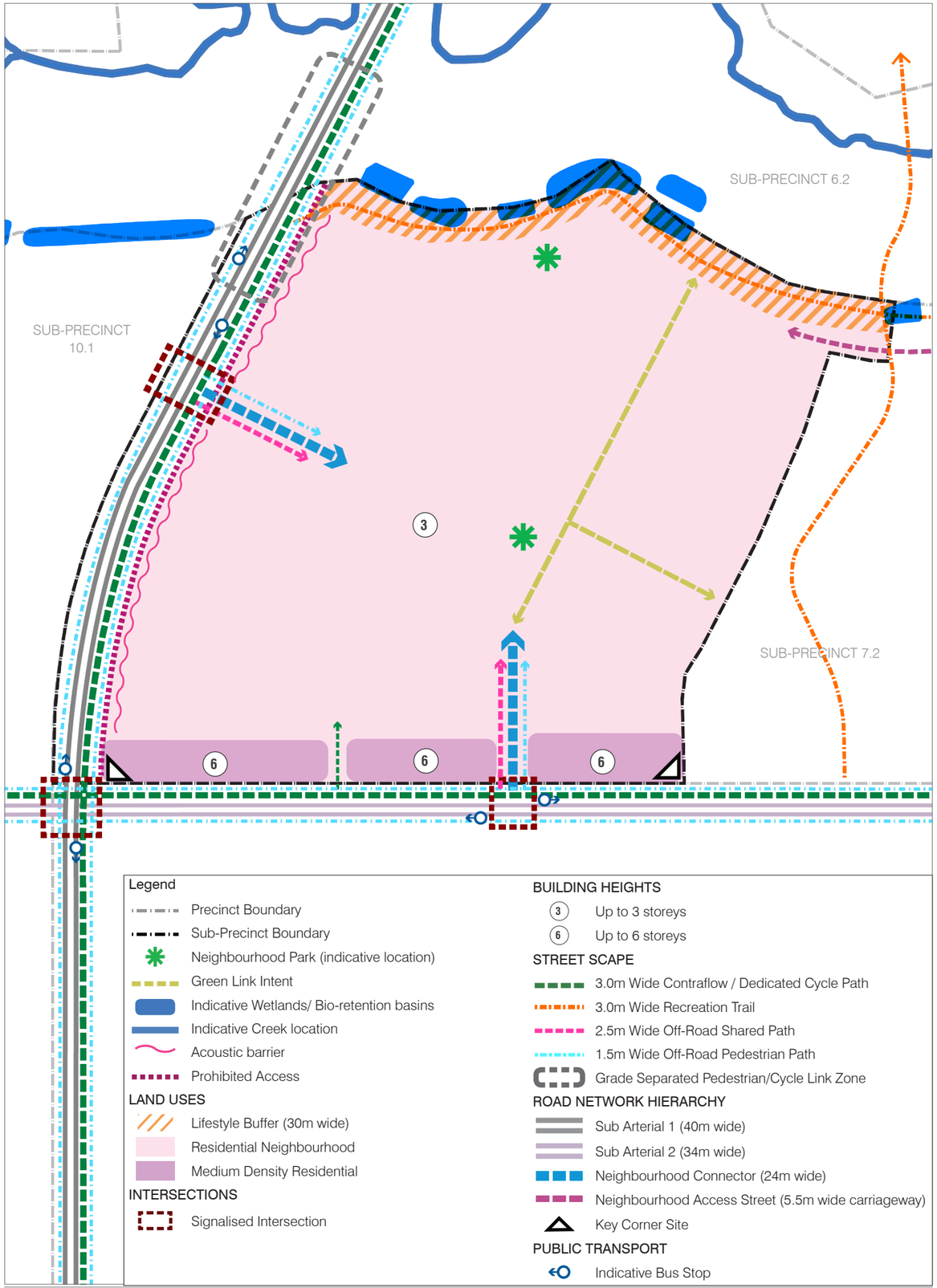


FIGURE 12: SUB-PRECINCT 7.1A FIXED ELEMENTS

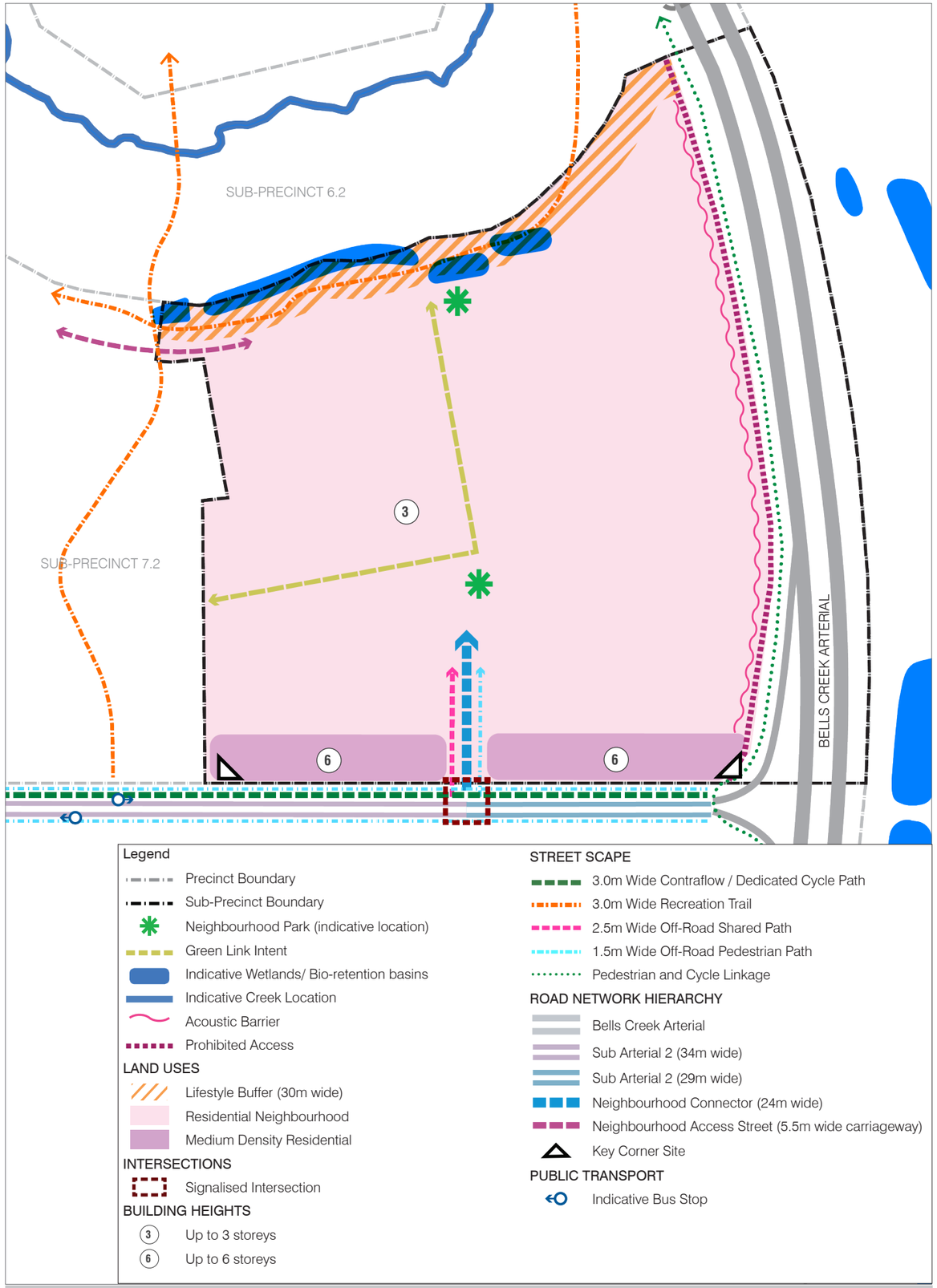
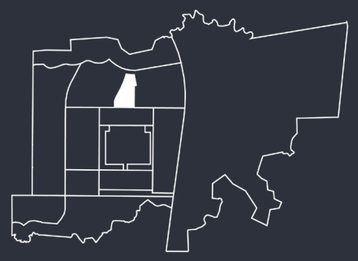


FIGURE 13: SUB-PRECINCT 7.1B FIXED ELEMENTS

3.5 SUB-PRECINCT 7.2

PEOPLE'S PLACE NORTH



3.5.1 SUB-PRECINCT INTENT

This Sub-Precinct comprises the northern section of the People's Place and is to cater for a mixture of passive and active recreational opportunities including formal gardens, local community facility, water features and passive recreation opportunities.

Uses within this Sub-Precinct may comprise community, park and recreation based uses. Other uses (including commercial, residential and retail uses) are not located within this Sub-Precinct. A small kiosk facility may however be provided where adjoining the community facility.

The built form within this Sub-Precinct is minimal and is to be subordinate to the primary uses of the area for recreational uses. Built form is limited to community facilities and any supporting built form for recreational uses.

The People's Place within this Sub-Precinct forms a regional public realm precinct within Caloundra South and an extension to the People's Place located to the South in Precinct 8.

Vehicle access to this Sub-Precinct is limited to access from the streets internal to Sub-Precinct 7.2.

Figure 14: Sub-Precinct 7.2 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 14: SUB-PRECINCT 7.2 ILLUSTRATIVE INTENT PLAN

3.5.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 7.2 are outlined in ***Table 17: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 17: USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)

LAND USES
Uses Subject to Compliance Assessment
• Community Facility • Outdoor Sport and Recreation • Food Premises (maximum of 1 where adjoining the Community Facility and less than 250m^2 of GFA)

3.5.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 7.2 are required to be assessed against and fulfil the Design Standards identified in ***Table 18: Sub-Precinct 7.2 Design Standards***.

TABLE 18: SUB-PRECINCT 7.2 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 17***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The height of buildings and structures do not exceed a maximum of 3 storeys. DS2.2 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.***
Public Realm	DS3.1 A Community Facility as identified on ***Figure 15*** is delivered with development of the People's Place North. DS3.2 A minimum 6.0ha is dedicated as the People's Place North. DS3.3 Development facilitates delivery of onsite parking in accordance with ***Figure 15***. DS3.4 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 15***. DS3.5 A 'Grade Separated Pedestrian Cycle Link' is provided in accordance with ***Figure 15*** to connect the People's Place North to the continuation of People's Place in the south within the adjoining Sub-Precinct 8.3. DS3.6 A 'Contraflow/Dedicated Cycle Path' is provided in accordance with ***Figure 15***. DS3.7 Development ensures that 'Recreation Pathways' are provided in the general locations as identified in ***Figure 15***. DS3.8 Development facilitates on–site waste collection.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 15***.
Environment	DS5.1 Potential Water Sensitive Urban Design Treatment is provided in accordance with ***Figure 15***.

3.5.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 7.2

Precinct 7.2 is to be used for public open space. As such, variation to the lot layout within this precinct is not intended under this PoD.

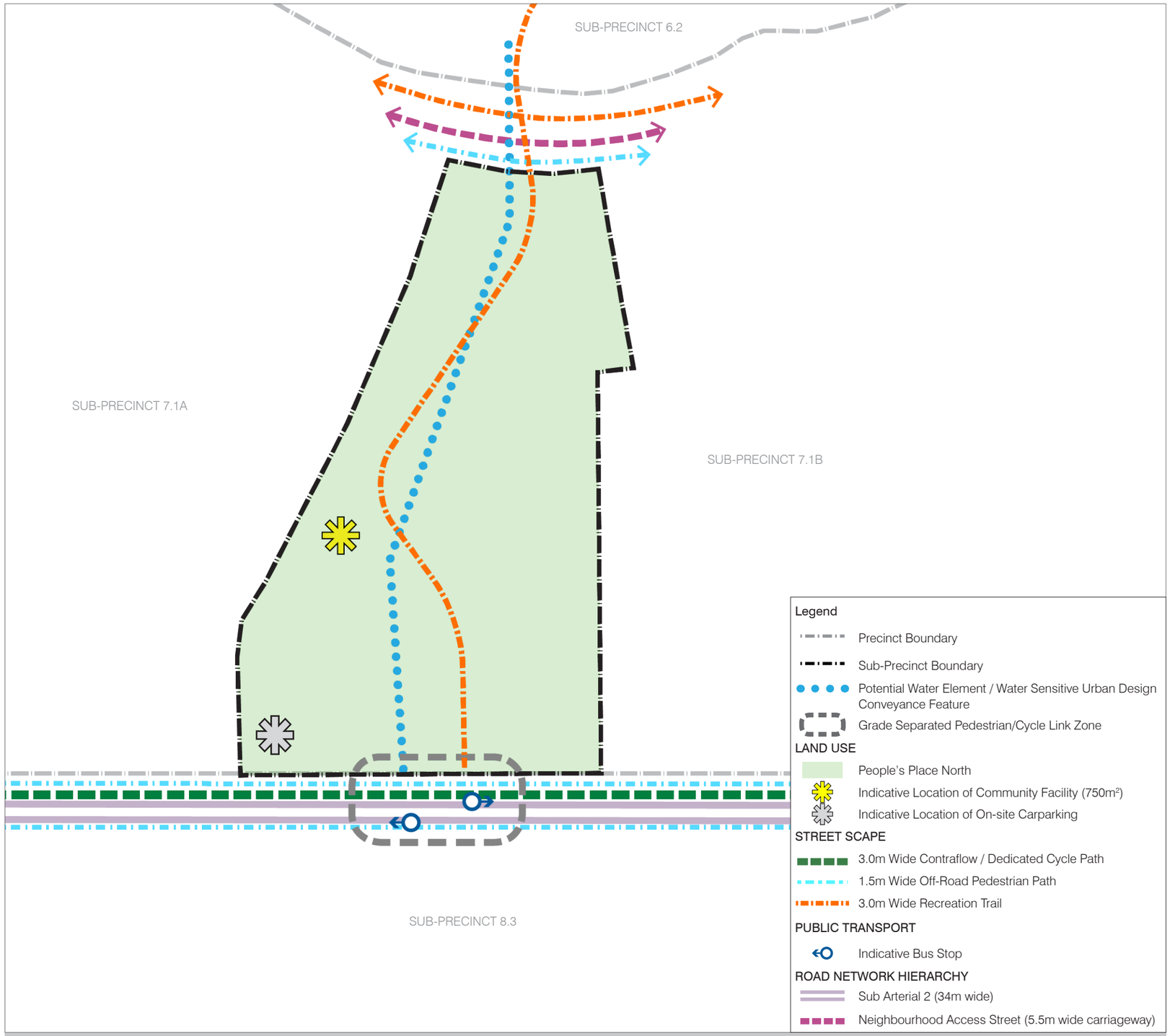
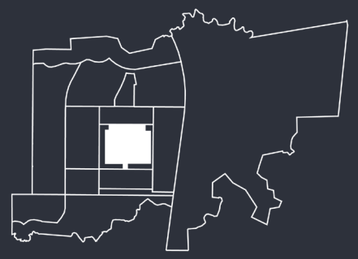


FIGURE 15: SUB-PRECINCT 7.2 FIXED ELEMENTS

3.6 SUB-PRECINCT 8.1

TOWN CENTRE CORE



3.6.1 SUB-PRECINCT INTENT

This Sub-Precinct will be developed as a major retail destination within the region. The core will be supported by a central 'Main Street' to encourage a mix of land uses including retail, commercial, residential, entertainment and community uses.

The built form of the Sub-Precinct achieves a vibrant urban Town Centre. An urban outcome is delivered through the scale of development with a potential for tower development that defines the street. Building height reflects the primacy of the Town Centre. Development provides an active frontage to the Main Street, Square and to the common boundary with the People's Place.

The public realm within this Sub-Precinct is defined by key elements which include:

- **Main Street** – This Active street connects the key elements of this Sub-Precinct and its surrounds. The Main Street provides a privately owned and managed north-south connection with opportunities to cover the connection in response to climatic conditions. The Main Street or parts of it may also be closed for temporary periods where used for events or to improve pedestrian safety.

Vehicle access to the retail core is gained from the surrounding street network and focused on several locations around the Sub-Precinct to consolidate access points. Rear access is encouraged for development fronting the 'Main Street'. A car park area is provided for the retail core that allows for expansion of initial ground level car parking into a multi-deck car park which will ultimately be screened from external streets via landscaping and built form.

Figure 16: A Illustrative Concept Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

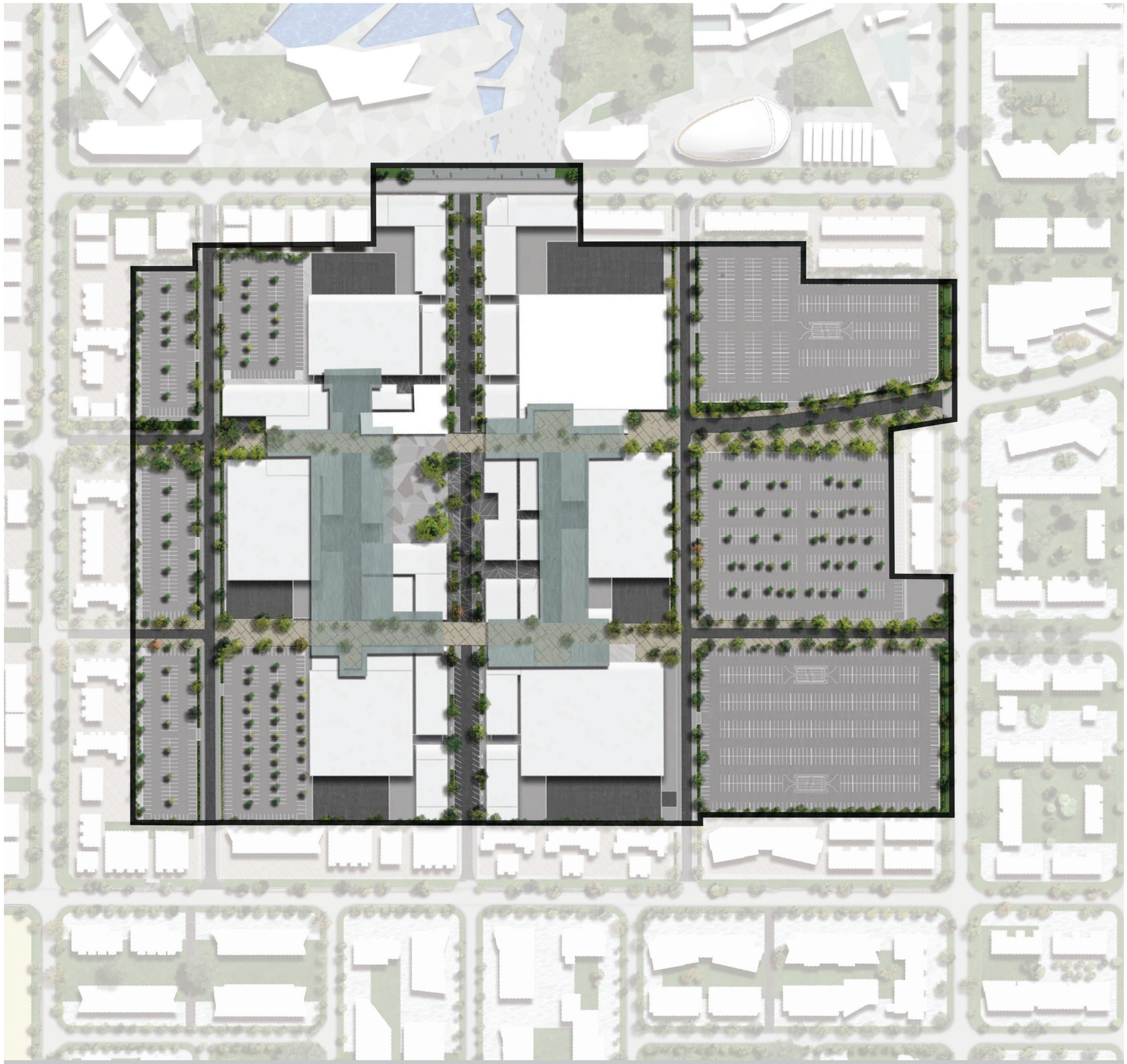


FIGURE 16: A ILLUSTRATIVE CONCEPT PLAN

3.6.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 8.1 are outlined in ***Table 19: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 19: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES	
Uses Subject to Compliance Assessment	
• Business • Car Park • Child Care Centre • Community Facility • Educational Establishment • Emergency Services • Fast Food Premises • Food Premises • Health Care Services • Home Based Business • Indoor Entertainment • Indoor Sport and Recreation	• Market • Multiple Residential • Outdoor Sport and Recreation • Sales Office • Service Station (where within a carpark and not on a street frontage) • Shop • Shopping Centre • Short Term Accommodation • Tourist Attraction • Telecommunications Facility • Utility Installation

3.6.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 8.1 are required to be assessed against and fulfil the Design Standards identified in ***Table 20: Sub-Precinct 8.1 Design Standards***.

TABLE 20: **SUB-PRECINCT 8.1 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 19***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.*** DS2.2 Building height is consistent with that identified in ***Figure 17***. DS2.3 Development provides podiums that are built to the front boundary where located on 'Primary Frontage' sites and have a maximum height of 3 storeys. DS2.4 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection of buildings is in accordance with Section 3.17 ***Table 49***. DS2.5 Where for Multiple Residential (other than Duplex and Triplex), development provides building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50***. DS2.6 Where development is located on a Primary Frontage identified by ***Figure 17***: a. A building must: • Present a minimum of 70% of the building as active frontage; • Include a combination of design elements such as projections, recesses and openings to enhance the sense of arrival to the precinct; • Generates visual interest at the street level, having regard to the proportion of openings, windows, materials and features. Blank walls are avoided; • Address the street frontage or frontages by: i. Providing clear, legible entry points for both pedestrians and vehicles; ii. Maximising opportunities for overlooking and casual surveillance of streets, public spaces, parking areas and pedestrian/cycling paths; iii. Provide a continuous awning to the street 4m in width. b. A car park must: • Provide a soft landscaped strip of at least 2m wide along the boundary. • Provide 1 shade tree per 6 car parking spaces for open air car parks unless otherwise provided by shade structures.
Built Form (cont.)	DS2.7 Where development is located on a Secondary Frontage identified by ***Figure 17:*** a. A building must: • Present a minimum of 70% of the building as active frontage; • Include a combination of design elements such as projections, recesses, and openings to enhance the character of the precinct; • Generate visual interest at street level, having regard to the proportion of openings, windows, materials, and features; and • Not have blank walls or loading bays on their frontage. b. A car park must: • Provide a soft landscaped strip of at least 2m wide along the boundary; and • Provide shade trees and landscaping. DS2.8 Development on a Key Corner Site identified by ***Figure 17*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Service stations and fast food outlets are not located on these corners; c. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses. d. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm.
Public Realm	DS3.1 Development facilitates the delivery of a 'Main Street' as identified on ***Figure 17*** that: a. Reinforces the role of this street as a high-amenity mixed use activity corridor; b. Creates an active, urban edge to the Main Street; c. Provides a podium and vertical tower form; d. At the ground-floor, is built to the Main Street alignment and have a continuous active frontage; e. Provides on-street car parking; f. Is open to the sky. DS3.2 A 'Town Square (Private)' is located as shown on ***Figure 17*** and provides: a. A minimum of 70% open to the sky; b. Access 24 hours a day; c. A minimum 40m frontage to the Main Street; d. Mixture of shade in the form of trees and structured shade; and e. Embellishments including public art, landscaping and street furniture. DS3.3 Development provides 'Landscape Buffers' as identified by ***Figure 17*** which includes: • Minimum 3m wide landscape strip; and • Plant species that reach a minimum height of 10m. DS3.4 Development provides 'Interface Treatments' as identified by ***Figure 17*** which: • make use of screening elements such as planting; • walls are to include a combination of design elements such as projections and recesses; and • walls incorporate horizontal and/or vertical elements through the use of various finishes.
Public Realm (cont.)	DS3.5 'Pedestrian Links' are located in accordance with ***Figure 17***: • The Western Pedestrian Link is to remain open (can be roofed but not enclosed) to pedestrian access 24 hours a day, 7 days a week. • The Eastern Pedestrian Link is to remain open to pedestrian access 7 days a week between the hours of 6am to 10pm as a minimum. DS3.6 Development ensures that 'Through Block Links' with minimum pedestrian corridor widths of 4m are provided in accordance with ***Figure 17*** which may be enclosed, open to the sky and may be in private or public ownership. DS3.7 'On-Road Cycle Lane' is provided in accordance with ***Figure 17***. DS3.8 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 17***. DS3.9 Development provides a 'Shared Zone' which incorporates a. Variation in road surface treatment; b. Priority pedestrian crossing; and c. Signage and landscape treatment to maximise pedestrian safety. DS3.10 Development provides 'Loading and Servicing Areas' in accordance with ***Figure 17*** which are adequately screened. DS3.11 Landscaping to be generally in accordance with the Plant Species List and Main Street landscape concepts.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 17***. DS4.2 On-site parking and service vehicle requirements are provided in accordance with ***Appendix H.*** DS4.3 Access and 'Primary Vehicle Circulation' is provided in accordance with ***Figure 17***. *Note: locations shown are indicative and may vary along the road provided road safety is not compromised.* DS4.4 On-site car parking areas are generally located in accordance with ***Figure 17*** and designed to reduce visual dominance from the public realm through a combination of built form and planted buffers. DS4.5 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.6 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.

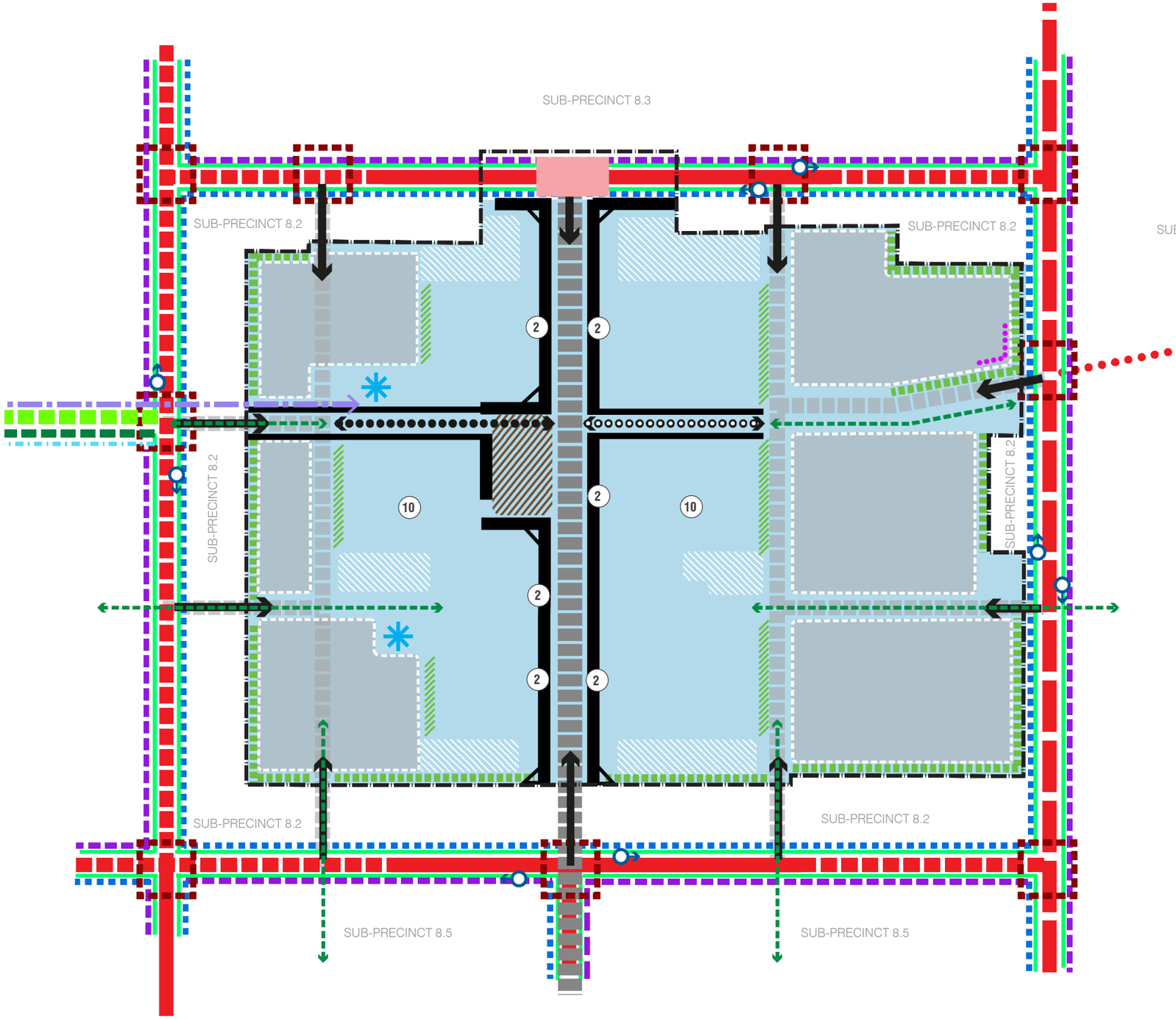
3.6.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 8.1

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 8.1 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 17 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 21: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 8.1*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 8.1.

TABLE 21: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 8.1

DESIGN STANDARD	
Square	1 x Town Square (Private)
Total Town Square (Private) Area Required	2,000m²
Maximum Future Yield	Lot 80032 – 5 Lots in Sub-Precinct 8.1
Lot Design	No minimum lot size.
Road Hierarchy	Roads are designed in accordance with ***Appendix L*** of this PoD.
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• **Guideline No.8** – Medium and High Rise Buildings (May 2015) • **Guideline No.11** – Community facilities (May 2015) • **Guideline No.13** – Engineering Standards (May 2015). • **Guideline No.18** – Development Interfaces (May 2015). • **Practice Note No.11** – Parking Analysis Plans (July 2012). • The executed Local Government and DTMR Infrastructure Agreements.



LEGEND

- Precinct Boundary
- Sub-Precinct Boundary
- Town Square (Private)
- Landscape buffer/screen
- Interface Treatment
- Through Block Linkage
- Eastern Pedestrian Link
- Western Pedestrian Link
- On-site Carparking Areas

LAND USES

- Retail / Commercial
- Loading Areas / Back of House

BUILDING HEIGHTS

- 2 Minimum 2 storeys
- 10 Up to 10 storeys

INTERFACES

- Primary Building Frontage
- Secondary Building Frontage
- Key Corner Site
- Architectural Screen Treatment to Multi-level car park

ROAD NETWORK HIERARCHY

- Access Points
- Main Street (24m wide)
- Centre Connector (36m wide)
- Centre Connector (31m wide)
- Centre Connector (24m wide)
- Centre Connector (18m wide - one way)
- Primary Vehicle Circulation
- Green Street (24m wide)
- Shared Zone

INTERSECTIONS

- Signalised Intersection

PUBLIC TRANSPORT

- Indicative Bus Stop
- End of Trip Facilities

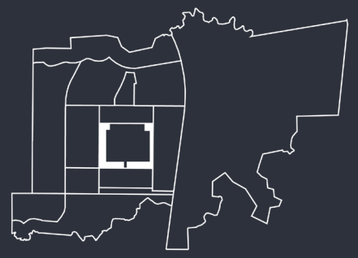
STREET SCAPE

- 3.0m Wide Contraflow / Dedicated Cycle Path
- 4.5m Wide Off-Road Pedestrian Path
- 2.5m Wide Off-Road Pedestrian Path
- 2.0m Wide Off-Road Pedestrian Path
- 1.5m Wide Off-Road Pedestrian Path
- 1.7m Wide On-Road Cycle Lane

FIGURE 17: SUB-PRECINCT 8.1 FIXED ELEMENTS

3.7 SUB-PRECINCT 8.2

TOWN CENTRE CORE FRAME



3.7.1 SUB-PRECINCT INTENT

This Sub-Precinct delivers medium to high density residential development with commercial and or retail at the lower levels within smaller tenancies with residential above. Housing density is maximised within this Sub-Precinct to make best use of its proximity to the Centre Core and amenity attributes whilst minimising conflict with incompatible land uses. Retail and commercial development is to be integrated with residential development in this Sub-Precinct. This Sub-Precinct can accommodate commercial uses.

The built form of this Sub-Precinct plays a transitional role from the intensity of the Retail Core through to the surrounding urban environment and provides the visual 'sleeving' of the Retail Core. This Sub-Precinct provides a range of built form typologies that intersperse views through and into the Core. Building heights reflect and offer a transition from the Core. Built form helps create distinctive urban edged and arrival nodes at key intersections.

Development is oriented to face streets and maximise views to the Glass House Mountains, People's Place or Central Park. Development contributes to the creation of a shady streetscape that achieves a green, attractive and walkable environment that facilitates pedestrian movement to adjoining Sub-Precincts.

Development utilises shared access and waste management facilities to reduce impacts onto the streetscape. Similarly, car parking is not to be a dominant feature of the development from the street and should be located either behind buildings, within podiums, or basements to achieve an appropriately sleeved design response.

Figure 18: Sub-Precinct 8.2 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

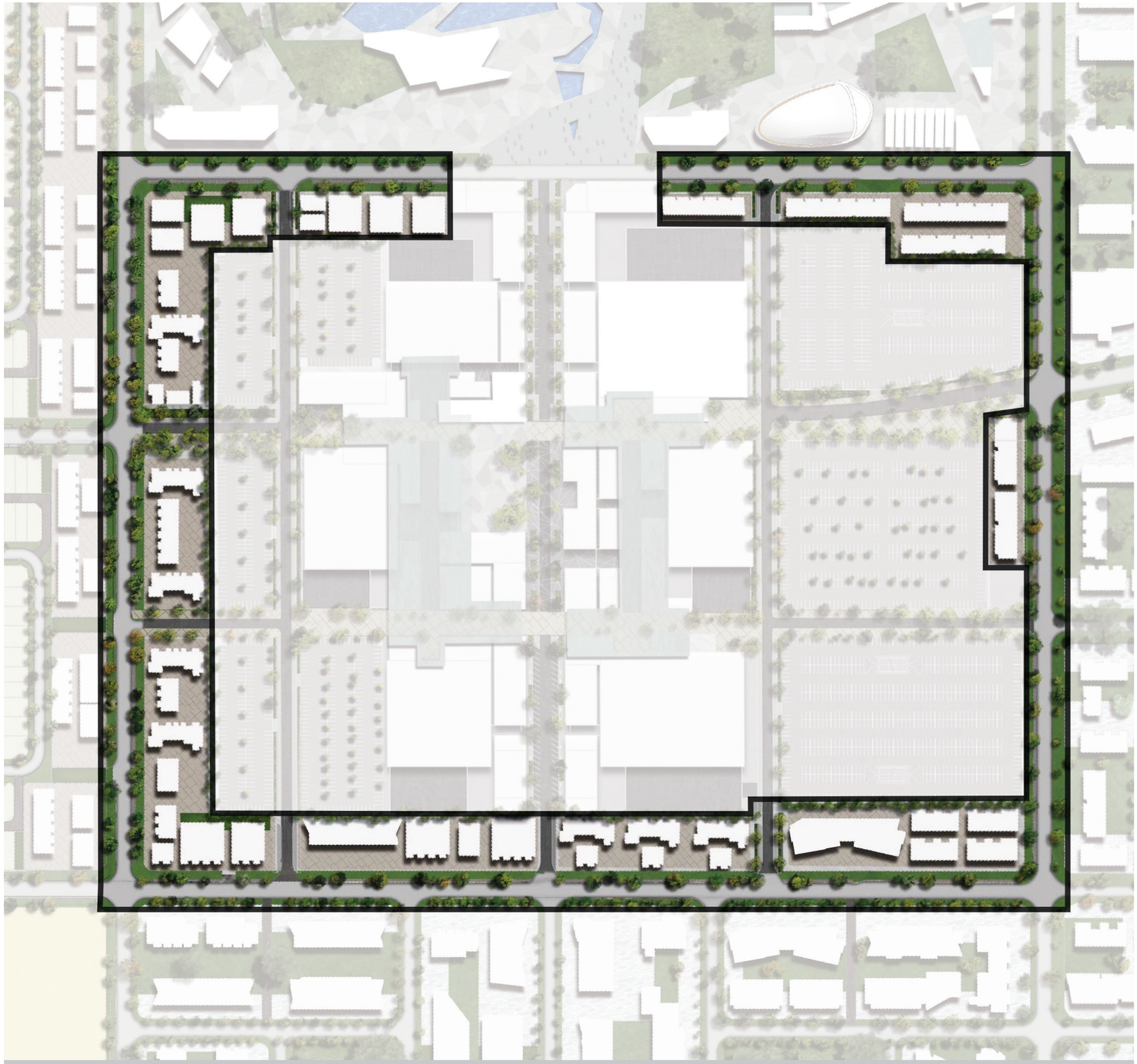


FIGURE 18: SUB-PRECINCT 8.2 ILLUSTRATIVE INTENT PLAN

3.7.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 8.2 are outlined in ***Table 22: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 22: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
• Business (where in the Mixed Use Retail land use in ***Figure 19***). • Car Park • Food Premises • Health Care Services • Home Based Business • Indoor Entertainment • Indoor Sport and Recreation (where excluding premises for conducting large scale functions, i.e. Convention Centre, Amusement and Leisure Centre) • Multiple Residential • Other Residential • Sales Office • Short Term Accommodation • Shop • Utility Installation

3.7.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 8.2 are required to be assessed against and fulfil the Design Standards identified in ***Table 23: Sub-Precinct 8.2 Design Standards***.

TABLE 23: **SUB-PRECINCT 8.2 DESIGN STANDARDS**

DESIGN STANDARD	
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 22***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.*** DS2.2 Building height does not exceed the maximum building height shown in ***Figure 19***. DS2.3 Development provides podiums that have a maximum height of 2 storeys on 'Primary Frontage' sites. DS2.4 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection of buildings are in accordance with Section 3.17 ***Table 49*** and the following: a. Built to boundary (0m) on all sides where located on 'Primary Frontage' sites; and b. Point DS2.7 below where located on 'Secondary Frontage' sites. DS2.5 Where for Multiple Residential (other than Duplex and Triplex), development provides the following minimum building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50*** DS2.6 Where development on a Primary Frontage identified by ***Figure 19***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the sense of arrival to the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features. Blank walls are avoided; d. Address the street frontage or frontages by: - Providing clear, legible entry points for both pedestrians and vehicles; - Maximising opportunities for overlooking and casual surveillance of streets, public spaces, parking areas and pedestrian/cycling paths; e. Provide an awning to the street 4m in width.
	DS2.7 Where development on a Secondary Frontage identified by ***Figure 19***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the character of the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features; and d. Not have blank walls or loading bays on this frontage. DS2.8 Development on a Key Corner Site identified by ***Figure 19*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and c. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm.
Public Realm	DS3.1 Development ensures that a 'Through Block Link' with a minimum pedestrian corridor width of 4m is provided in accordance with ***Figure 19*** which may be enclosed, open to the sky and may be in private or public ownership. DS3.2 'On-Road Cycle Lane' is provided in accordance with ***Figure 19***. DS3.3 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 19***. DS3.4 Development provides 'Loading and Servicing Areas' in accordance with ***Figure 19*** which are adequately screened. DS3.5 Development provides a 'Shared Zone' which incorporates a. Variation in road surface treatment; b. Priority pedestrian crossing; and c. Signage and landscape treatment to maximise pedestrian safety.

DESIGN STANDARD	
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 19***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access Points are provided in accordance with ***Figure 19***. *Note: locations shown are indicative and may vary along the road provided road safety is not compromised.* DS4.4 On-site vehicle car parking areas are generally located within a basement, behind the building or within a Podium. DS4.5 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.6 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads. DS4.7 Access to Multiple Residential sites will be granted through rear access as demonstrated on ***Figure 17*** and ***Figure 19*** and access easements provided as required.

3.7.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 8.2

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 8.2 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 19 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 24: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 8.2*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 8.2.

TABLE 24: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 8.2

DESIGN STANDARD	
Maximum Yield	Lot 80032 – 12 Lots in Sub-Precinct 8.2
Lot Design	No minimum lot size
Road Hierarchy	Roads are designed in accordance with ***Appendix L*** of this PoD.
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• Guideline No.8 – Medium and High Rise Buildings (May 2015) • Guideline No.9 – Centres (May 2015) • Guideline No.13 – Engineering Standards (May 2015) • Guideline No.18 – Development Interfaces (May 2015) • Practice Note No.11 – Parking Analysis Plans (July 2012) • The executed Local Government and DTMR Infrastructure Agreements.

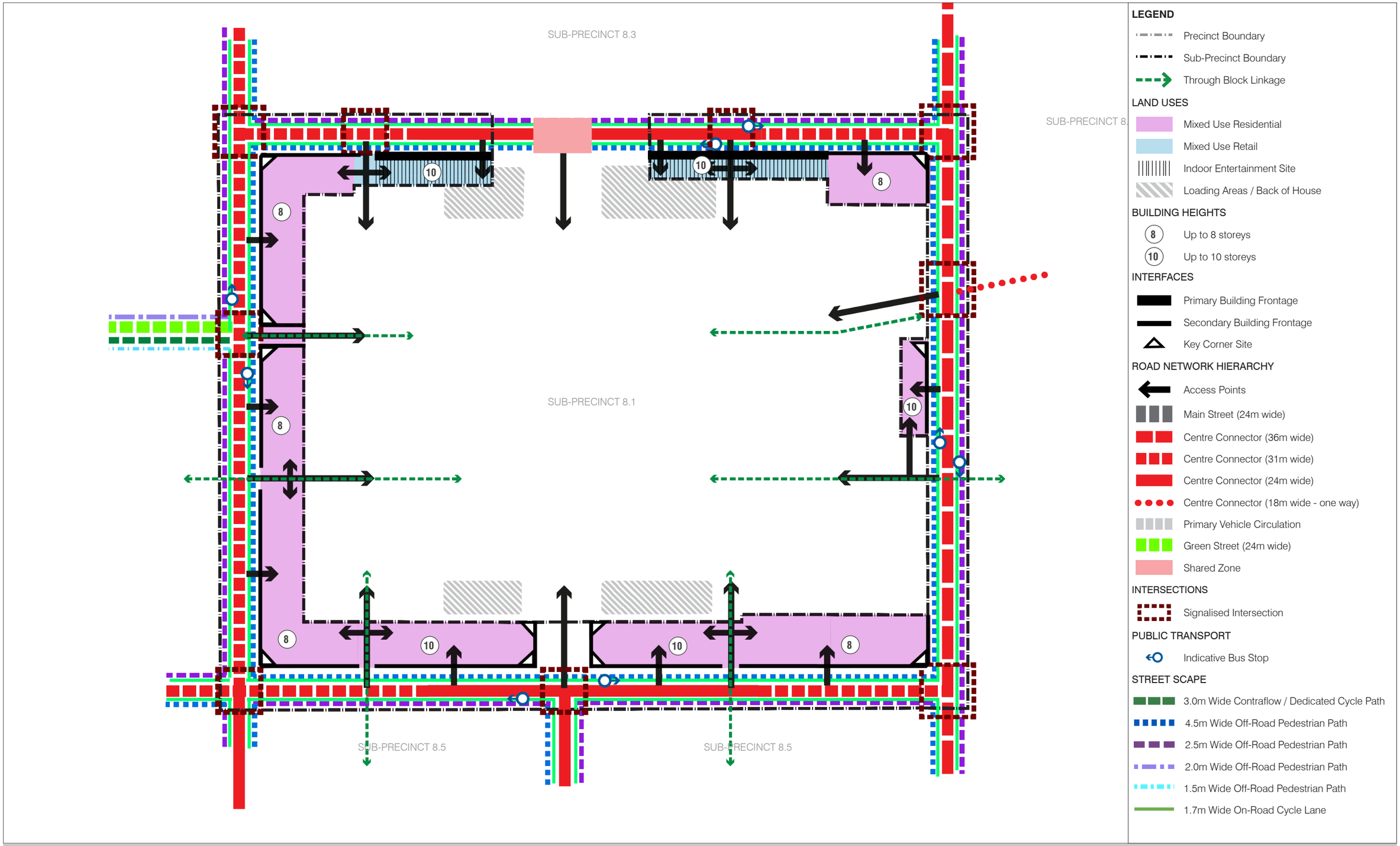
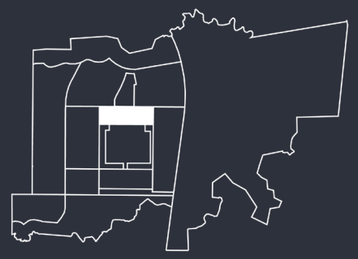


FIGURE 19: SUB-PRECINCT 8.2 FIXED ELEMENTS

3.8 SUB-PRECINCT 8.3

PEOPLES PLACE SOUTH



3.8.1 SUB-PRECINCT INTENT

This Sub-Precinct is to cater for a mixture of recreational opportunities including formal gardens, major community facilities, aquatic facilities and events spaces. This Sub- precinct provides the location for a 6.8 hectare 'People's Place' which will provide Caloundra South with a higher order entertainment, leisure and cultural hub providing a community focus for:

- Potential creative, cultural and community meeting spaces; and
- Potential aquatic and water play facilities.

Uses within this Sub-Precinct may also include commercial, residential and educational (preferably tertiary) development where located on the edges of this Sub-Precinct and where not compromising the primary role and function of this sub precinct as the People's Place. Retail use category uses will be supported and commercial use categories will be supported where not located in the Peoples Place.

The built form within this Sub-Precinct is to be located and penetrate into the space along the edges of the Sub-Precinct in tall slim forms that promote the People's Place and its significance within the Town Centre.

Sub-Precinct are to present an 'iconic' built form outcome that signals arrival to the Caloundra South Community. Buildings may comprise mixed use development consisting of retail and commercial development on ground floor with residential uses above.

The People's Place within this Sub-Precinct forms the primary community space within Caloundra South. Development ensures that the design of buildings reflects an urban built form while incorporating open space and landscaping appropriate to the use and scale of the development which contributes to the Sub-Precinct character and identity.

Pedestrian access to and through this Sub-Precinct is encourage from all edges of the precinct. Vehicular access is to be limited to key access points only so as to preserve the continuity of the streetscape for pedestrian movement.

Figure 20: Sub-Precinct 8.3 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 20: SUB-PRECINCT 8.3 ILLUSTRATIVE INTENT PLAN

3.8.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 8.3 are outlined in ***Table 25: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 25: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
Where in People's Place South: • Community Facility • Indoor Entertainment • Indoor Sport and Recreation • Market • Outdoor Sport and Recreation • Tourist Attraction **Where not in People's Place South:** • Business • Car Park • Child Care Centre • Education Establishment (where located on "University Campus" site) • Emergency Services • Food Premises • Health Care Services • Multiple Residential (where located on a 'Multiple Density Residential' site as identified on ***Figure 21***. • Sales Office • Shop • Short Term Accommodation (where located on a 'Multiple Density Residential' site as identified on ***Figure 21***) • Utility Installation

3.8.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 8.3 are required to be assessed against and fulfil the Design Standards identified in ***Table 26: Sub-Precinct 8.3 Design Standards***.

TABLE 26: **SUB-PRECINCT 8.3 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 25***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.*** DS2.2 Building height does not exceed the maximum building height shown in ***Figure 21***. DS2.3 Development provides podiums that are a maximum height of 2 storeys. DS2.4 Where for Multiple Residential (Other than a Duplex and Triplex), the minimum setbacks from the outermost projection of buildings are in accordance with Section 3.17 ***Table 49*** DS2.5 Multiple Residential (Other than a Duplex and Triplex), development provides the following minimum building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50*** DS2.6 Where development on a Primary Frontage identified by ***Figure 21***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the sense of arrival to the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features. Blank walls are avoided; d. Address the street frontage or frontages by: - Providing clear, legible entry points for both pedestrians and vehicles; - Maximising opportunities for overlooking and casual surveillance of streets, public spaces, parking areas and pedestrian/cycling paths; e. Provide an awning to the street 4m in width. DS2.7 Where development on a Secondary Frontage identified by ***Figure 21***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the character of the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features; and d. Not have blank walls or loading bays on this frontage.
Built Form (cont.)	DS2.8 Development on a Key Corner Site identified by ***Figure 21*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Service stations and fast food outlets are not located on these corners; c. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and d. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm. DS2.9 The scale of development protects 'View Lines' through the site as identified by ***Figure 21***.
Public Realm	DS3.1 'People's Place Plaza' with a minimum size of 3,000m^2 is located as shown on the ***Figure 21*** and provides: a. A minimum of 70% open to the sky; b. A minimum 60m frontage to the Main Street; c. A mix of informal plaza space and outdoor dining uses; and d. Embellishments may include public art, landscaping and street furniture. DS3.2 A 'Plaza (within University Campus / Commercial / Retail land use)' is located as shown on ***Figure 21*** and provides: a. A minimum of 50% open to the sky; b. A minimum 40m frontage to the internal or external thoroughfare; c. A mix of informal plaza space and dedicated outdoor dining uses; and d. Embellishments may include public art, landscaping and street furniture. DS3.3 A potential Aquatic play node is delivered through the development of the People's Place in accordance with ***Figure 21***. DS3.4 A 'Grade Separated Pedestrian Cycle Link' is provided in accordance with ***Figure 21*** to connect the People's Place South to the northern continuation of People's Place in the North within the adjoining Sub-Precinct. DS3.5 Development ensures that a 'Through Block Link' with a minimum pedestrian corridor width of 4m is provided in accordance with ***Figure 21*** which may be enclosed, open to the sky and may be in private or public ownership. DS3.6 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 21***. DS3.7 Development provides a 'Shared Zone' which incorporates a. Variation in road surface treatment; b. Priority pedestrian crossing; and c. Signage and landscape treatment to maximise pedestrian safety.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 21***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access locations are provided in accordance with ***Figure 21***. *Note locations shown are indicative and may vary along the road provided road safety is not compromised.* DS4.4 On-site at-grade car parking areas are to provide bus layby areas and generally be screened from view from surrounding streets by a combination of built form and planted buffers. DS4.5 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.6 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.

3.8.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 8.3

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 8.3 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 21 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 27: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 8.3*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 8.3.

TABLE 27: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 8.3

DESIGN STANDARD	
Plazas	1 x People's Place Plaza 1 x Plaza (within University Campus / Commercial / Retail land use)
Total Area Required	People's Place Plaza - 3,000m^2 Major Civic Centre - 1.5 ha
Total Park Area	6.8ha People's Place South (includes Major Civic Centre and People's Place Plaza)
Maximum Future Yield	Lot 80028 – 3 Lots Lot 80030 – 2 Lots Lot 80031 – 2 Lots
Lot Design	No minimum lot size
Road Hierarchy	Roads are designed in accordance with ***Appendix L*** of this PoD.
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• **Guideline No.8** – Medium and High Rise Buildings (May 2015) • **Guideline No.11** – Community Facilities (May 2015) • **Guideline No.12** – Park Planning and Design (May 2015) • **Guideline No.13** – Engineering Standards (May 2015) • **Guideline No.18** – Development Interfaces (May 2015) • **Practice Note No.11** – Parking Analysis Plans (July 2012) • The executed Local Government and DTMR Infrastructure Agreements

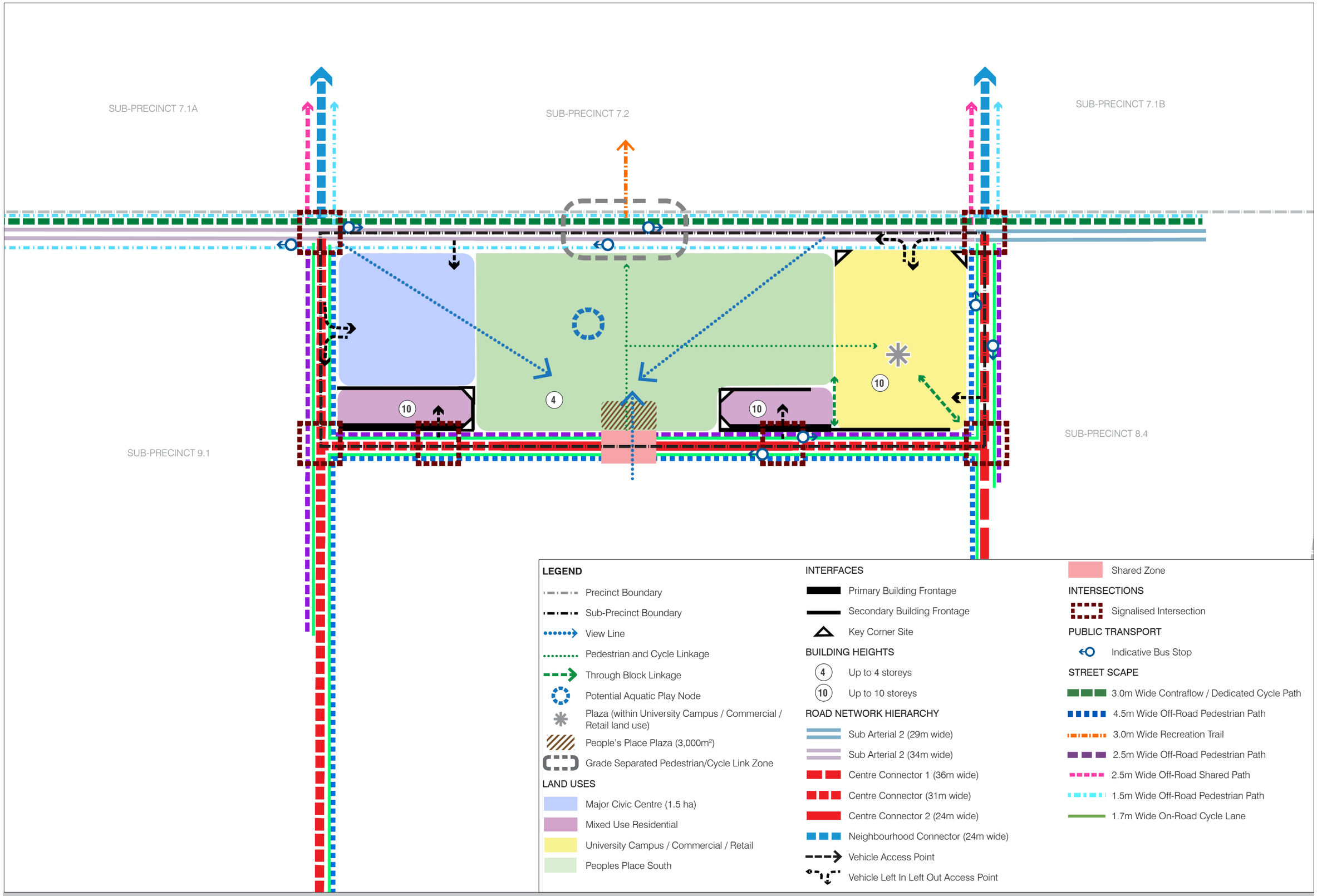
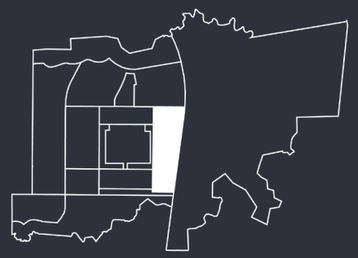


FIGURE 21: **SUB-PRECINCT 8.3 FIXED ELEMENTS**

3.9 SUB-PRECINCT 8.4

MIXED USE EDGE



3.9.1 SUB-PRECINCT INTENT

This Sub-Precinct is to cater for a mixture of education, business, small scale retail, health and community uses, residential, and short term accommodation. Commercial use categories are supported by this Sub- precinct. Land uses within this Sub-Precinct do not compromise the intended role or successful functioning of the Town Centre Core (Sub-Precinct 8.1). Land uses cannot include full line supermarkets, discount department stores or department stores within this Sub-Precinct. Uses such as showrooms and outdoor sales may occur. Community uses such as health facilities, emergency services and police station are also compatible within this Sub-Precinct and are envisaged to be located in the southern portion of this Sub-Precinct to benefit from ease of access to the transit hub and key roads. Two parks are provided throughout this precinct to enhance community amenity and recreation.

Built form and landscaping create an attractive, pedestrian oriented streetscape, and visual amenity along the interface with the Bells Creek Arterial is enhanced through the use of landscape planting. Building height reinforces the transition from the core by stepping building height and intensity down from the Town Centre. This transition is to be reinforced by the design of development to provide for a transition from a strong urban edge on the western boundary of this Sub-Precinct, through to pavilion buildings within a landscaped setting on the eastern edge of the Sub-Precinct ensuring an attractive edge is presented to the Bells Creek Arterial. Where they occur, residential uses are designed to minimise adverse impacts on occupants as a result of noise and other characteristics of the local environment.

This Sub-Precinct presents as one of the key entry gateways to Caloundra South. Development is to be designed to encourage a consolidation of built form and activities.

Public realm within the Sub-Precinct is designed to facilitate movement of pedestrians in a comfortable environment with a focus on creating strong links to the People's Place, Transit Interchange and Retail Core.

Vehicle access through the site links with important visual gateways that are to be treated through building design, whilst not compromising on vehicle movement. The accessibility of this Sub-Precinct may also make it suitable for heavily trafficked (vehicle or pedestrian) uses such as tertiary education, display spaces, home maker centre or commercial office for example.

Figure 22: A Illustrative Concept Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

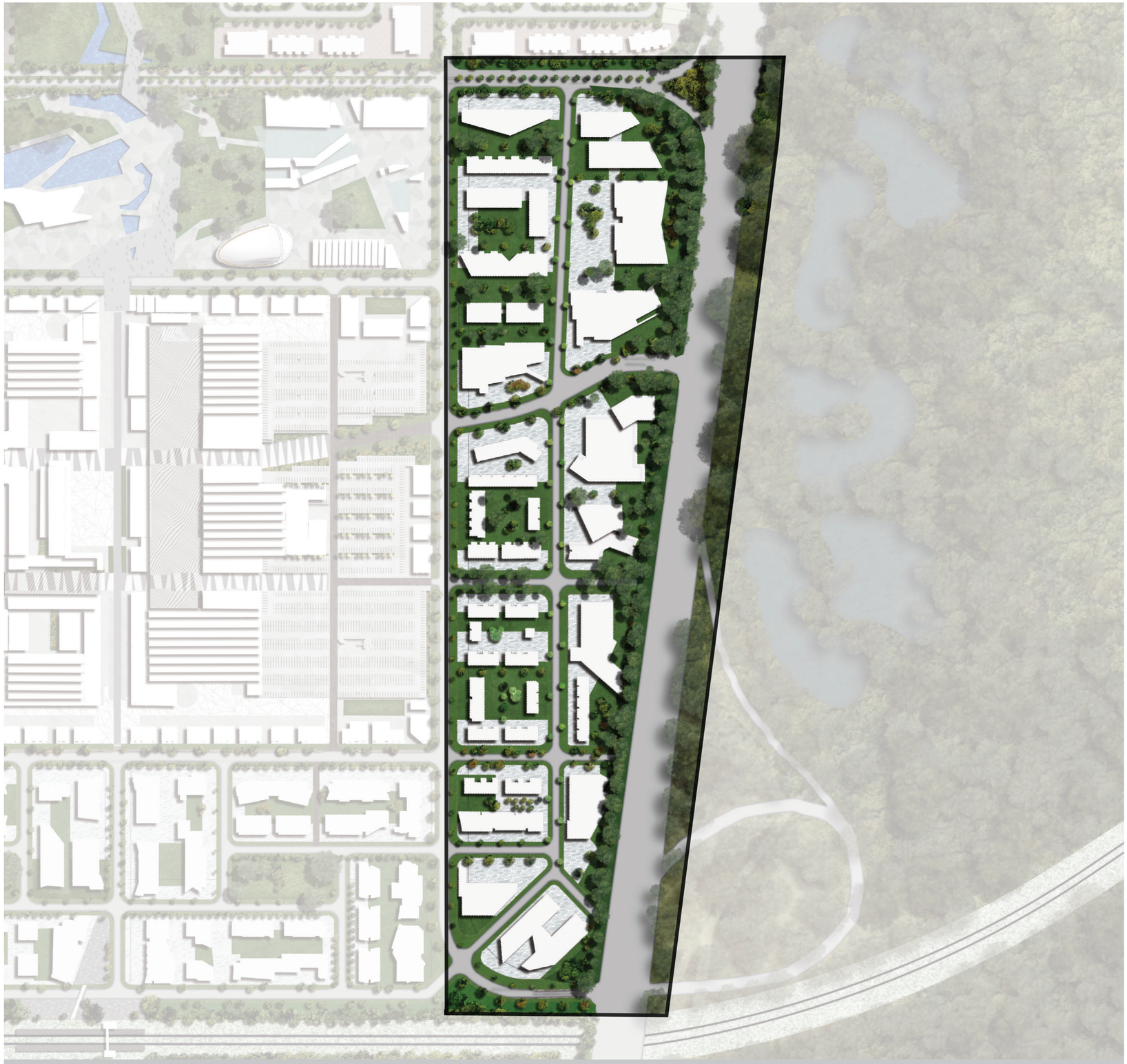


FIGURE 22: A ILLUSTRATIVE CONCEPT PLAN

3.9.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 8.4 are outlined in ***Table 28: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 28: USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)

LAND USES
Uses Subject to Compliance Assessment
• Business • Car Park • Child Care Centre • Community Facility • Educational Establishment • Emergency Services • Fast Food Premises • Food Premises • Health Care Services • Home Based Business • Hospital • Indoor Entertainment • Indoor Sport and Recreation • Market • Multiple Residential (where located on 'Preferred Residential Node' sites as identified on ***Figure 23***) • Other Residential • Outdoor Sales • Outdoor Sport and Recreation • Place of Assembly • Sales Office • Service Station • Service Industry • Shop • Short Term Accommodation • Telecommunications Facility • Tourist Attraction • Utility Installation • Veterinary hospital

3.9.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 8.4 are required to be assessed against and fulfil the Design Standards identified in ***Table 29: Sub-Precinct 8.4 Design Standards***.

TABLE 29: SUB-PRECINCT 8.4 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 28***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.*** DS2.2 Building height does not exceed the maximum building height shown in ***Figure 23***. DS2.3 Development provides podiums for non-residential elements which have a maximum height of 2 storeys. DS2.4 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection of buildings are in accordance with Section 3.17 ***Table 49***. DS2.5 Where for Multiple Residential (other than Duplex and Triplex), development provides the following minimum building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50***. DS2.6 Where development on a Secondary Frontage identified by ***Figure 23***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the character of the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features; and d. Not have blank walls or loading bays on this frontage. DS2.7 Development on a Key Corner Site identified by ***Figure 23*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Service stations and fast food outlets are not located on these corners; c. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and d. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm.
Public Realm	DS3.1 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 23***. DS3.2 Development along 'Bells Creek Arterial Landscape Edge' as identified by ***Figure 23*** creates a pleasant green landscaped edge to the Bells Creek Arterial corridor which: a. Provides an attractive gateway statement; and b. Presents development to the road as being pavilion buildings within a green landscaped setting. DS3.3 Development fronting 'Gateway Landscape Edge' as identified by ***Figure 23*** provides a landscape treatment that offers: a. A high quality landscape treatment; b. Dense groundcover planting; c. Advanced tree planting; d. Feature tree species; e. Minimum 3m wide landscape strip; and f. Buildings are to be orientated to the internally away from Bells Creek Arterial Road. DS3.4 A 3m landscape buffer/screen is provided on property frontage as shown in ***Figure 23***.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 23***. DS4.2 'Primary Vehicle Circulation' is provided in accordance with the indicative layout shown on ***Figure 23***. DS4.3 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.4 Access and prohibited access locations are provided in accordance with ***Figure 23***. Note locations shown are indicative and may vary along the road provided road safety is not compromised. DS4.5 On-site at-grade car parking areas are generally screened from view from surrounding streets by a combination of built form and planted buffers. DS4.6 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.7 Direct vehicular access to Bell's Creek Arterial Road is prohibited.

3.9.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 8.4

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 8.4 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 23 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 30: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 8.4*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 8.4.

TABLE 30: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 8.4

DESIGN STANDARD	
Number of Local/ Neighbourhood Parks	2 x Local Parks
Total Park Area Required	5,000m²
Maximum Future Yield	Lot 80027 – 28 Lots Lot 80026 – 27 Lots Lot 80025 - 16 lots
Lot Design	No minimum lot size
Road Hierarchy	Roads are designed in accordance with ***Appendix L*** of this PoD.
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• Guideline No.8 – Medium and High Rise Buildings (May 2015) • Guideline No.11 – Community Facilities (May 2015) • Guideline No.12 – Park Planning and Design (May 2015) • Guideline No.13 – Engineering Standards (May 2015) • Guideline No.18 – Development Interfaces (May 2015) • Practice Note No.11 – Parking Analysis Plans (July 2012) • The executed Local Government and DTMR Infrastructure Agreements

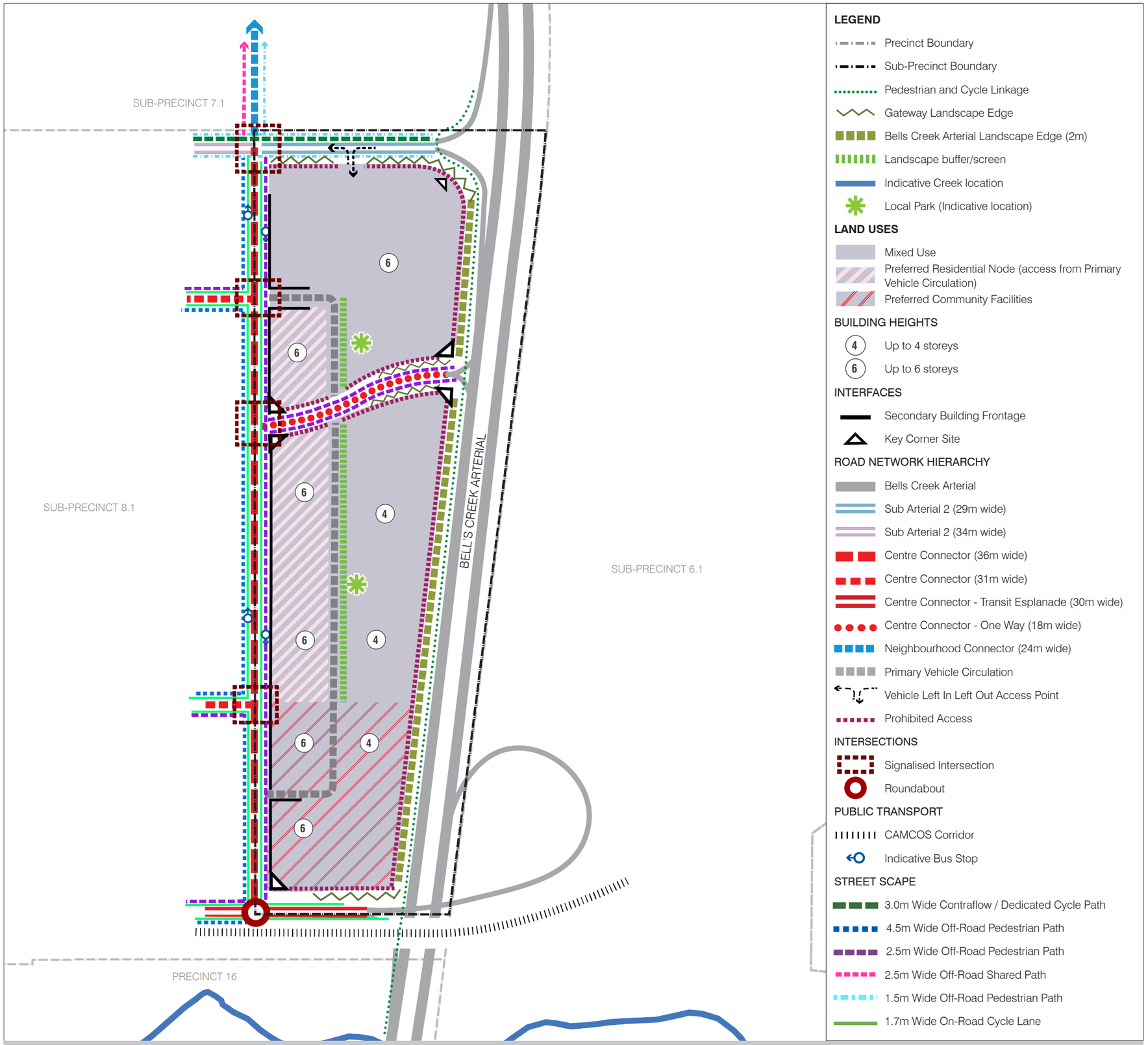
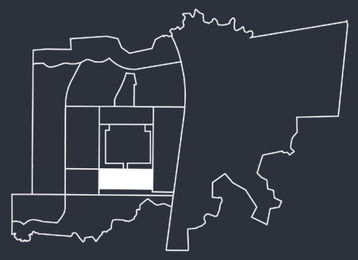


FIGURE 23: **SUB-PRECINCT 8.4 FIXED ELEMENTS**

3.10 SUB-PRECINCT 8.5

TRANSIT PRECINCT



3.10.1 SUB-PRECINCT INTENT

This Sub-Precinct is located within easy walking distance of the Transit Interchange and accommodates primarily residential uses in a mixed density urban environment. A mixture of housing density is provided within the Sub- precinct primarily in a mid to high rise form. Attached terrace housing on the edges of this Sub-Precinct may also be provided. Buildings fronting the Main Street incorporate fine-grain retail and commercial uses to generate activity along these pedestrian spines and to capitalise on the accessibility to public transport. Mixed use development may also occur on the edges of this Sub-Precinct.

The Main Street will offer high intensity development with building heights transitioning down towards the east and west.

Development comprises tower and podium form where fronting the Main Street. The podium element of a tower is to have a strong interface with the street and create a consistent active frontage at a human scale along the street that is supported by landscaping at the street frontage to enhance the pedestrian environment and reinforce the residential nature of this Sub-Precinct. A building in planted streetscape treatment is otherwise achieved in the balance of the Sub-Precinct.

Public realm within the Sub-Precinct comprises a number of local neighbourhood parks located throughout the residential neighbourhoods which provide for passive recreation opportunities.

The entrance to the Transit Interchange from the Main Street is prominent in the streetscape and provides for convenient and legible paths for pedestrians and cyclists to access the Transit Interchange and provides a transit plaza to facilitate pedestrian access.

Figure 24: Sub-Precinct 8.5 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 24: SUB-PRECINCT 8.5 ILLUSTRATIVE INTENT PLAN

3.10.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 8.5 are outlined in ***Table 31: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 31: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
• Business (where located in a 'Focus Mixed Use' site as identified on ***Figure 25***) • Food Premises • Indoor Sport and Recreation • Multiple Residential • Other Residential • Outdoor Sport and Recreation • Sales Office • Shop • Short Term Accommodation • Utility Installation

3.10.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 8.5 are required to be assessed against and fulfil the Design Standards identified in ***Table 32: Sub-Precinct 8.5 Design Standards***.

TABLE 32: **SUB-PRECINCT 8.5 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 31***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.*** DS2.2 Building height does not exceed the maximum building height shown in ***Figure 25***. DS2.3 Development provides podiums that have a maximum height of: a. 3 storeys on 'Primary Frontage; or b. 1 storey on other sites.
Built Form (cont.)	DS2.4 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection of buildings where are in accordance with Section 3.17 ***Table 49***. DS2.5 Where for Multiple Residential (other than Duplex and Triplex), development provides the following minimum building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50***. DS2.6 Where development on a Primary Frontage identified by ***Figure 25***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the sense of arrival to the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features. Blank walls are avoided; d. Address the street frontage or frontages by: - Providing clear, legible entry points for both pedestrians and vehicles; - Maximising opportunities for overlooking and casual surveillance of streets, public spaces, parking areas and pedestrian/cycling paths; e. Provide an awning to the street 4m in width. DS2.7 Where development on a Secondary Frontage identified by ***Figure 25***, a building must: a. Present a minimum of 70% of the building as active frontage; b. Include a combination of design elements such as projections, recesses and openings to enhance the character of the precinct; c. Generate visual interest at the street level, having regard to the proportion of openings, windows, materials and features; and d. Not have blank walls or loading bays on this frontage. DS2.8 Development on a Key Corner Site identified by ***Figure 25*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Service stations and fast food outlets are not located on these corners; c. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and d. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm.

ELEMENT	DESIGN STANDARD
Public Realm	DS3.1 A 'Transit Plaza' with a minimum size of 1,000m^2 is located as shown on ***Figure 25*** and provides: a. A minimum of 70% open to the sky; b. A direct view line to the transit interchange; c. A minimum 40m frontage to the Main Street; d. A mix of informal plaza space and outdoor dining uses; and e. Embellishments including public art, landscaping and street furniture. DS3.2 Development ensures that a 'Through Block Link' with a minimum pedestrian corridor width of 4m is provided in accordance with ***Figure 25*** which may be enclosed, open to the sky and may be in private or public ownership. DS3.3 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 25***.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 25***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access and 'Primary Vehicle Circulation' are provided in accordance with ***Figure 25***. Note locations shown are indicative and may vary along the road provided road safety is not compromised. DS4.4 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.5 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.

3.10.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 8.5

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 8.5 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 25 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 33: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 8.5*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 8.5.

TABLE 33: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 8.5

DESIGN STANDARD	
Number of Local/ Neighbourhood Parks	1 x Neighbourhood Park 1 x Local Park
Total Park Area Required	7,000m^2
Transit Plaza	1,000m^2 transit plaza
Maximum Future Yield (+/-10%)	Lot 80022 – 27 Lots Lot 80023 – 16 Lots Lot 80024 – 16 Lots
Lot Design	No minimum lot size
Road Hierarchy	Roads are designed in accordance with ***Appendix L***.
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• **Guideline No.6** – Street and Movement Network (April 2012) • **Guideline No.8** – Medium and High Rise Buildings (May 2015) • **Guideline No.9** – Centres (May 2015) • **Guideline No.12** – Park Planning and Design (May 2015) • **Guideline No.13** – Engineering Standards (May 2015) • **Guideline No.18** – Development Interfaces (May 2015) • **Practice Note No.11** – Parking Analysis Plans (July 2012) • The executed Local Government and DTMR Infrastructure Agreements

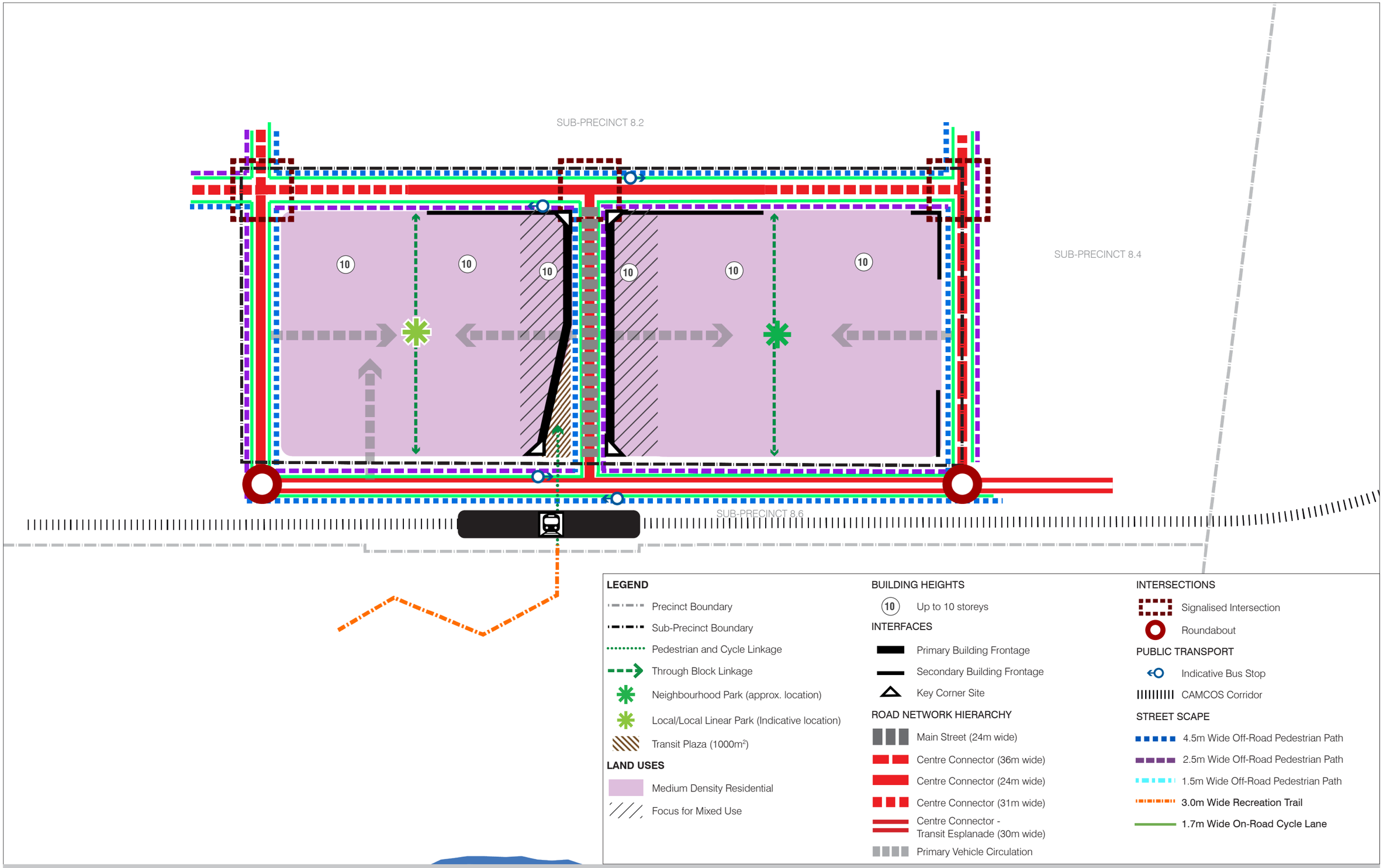
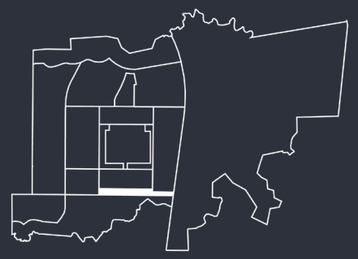


FIGURE 25: SUB-PRECINCT 8.5 FIXED ELEMENTS

3.11 SUB-PRECINCT 8.6

TRANSIT INTERCHANGE



3.11.1 SUB-PRECINCT INTENT

This Sub-Precinct forms the key Transit Interchange for Caloundra South. The ultimate use of the Sub-Precinct is envisaged to be for a rail corridor and rail/bus interchange. Interim arrangements may include a bus transit station until such time as more intensive infrastructure is provided.

The built form of this Sub-Precinct is limited to public transit infrastructure which delivers an feature to the public realm.

The Public realm provides a grade separated access linking the Transit Interchange to the Transit Plaza in the adjoining Sub-Precinct.

The street frontage facilitates ease of movement for private vehicles and buses.

Figure 26: Sub-Precinct 8.6 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

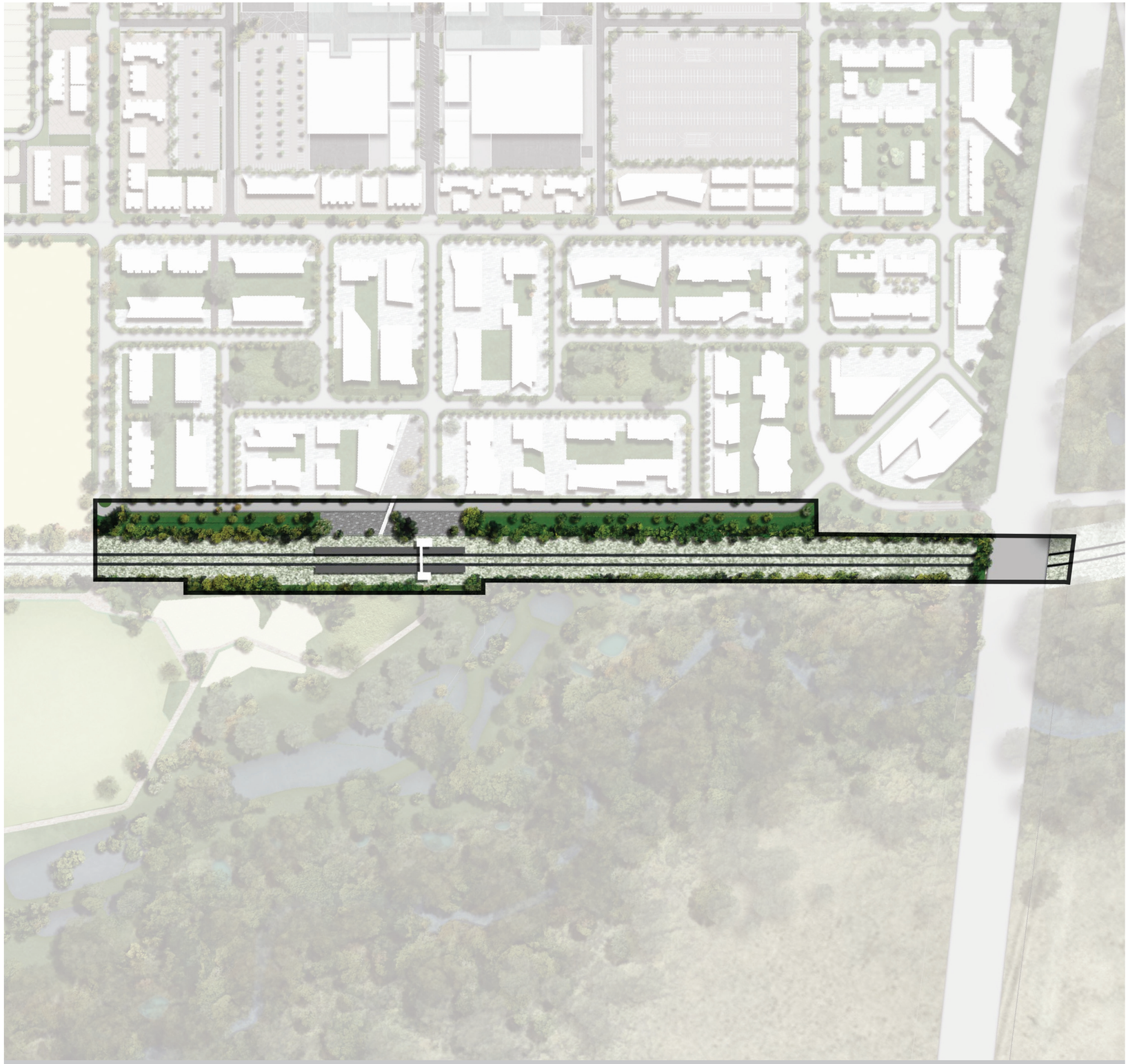


FIGURE 26: SUB-PRECINCT 8.6 ILLUSTRATIVE INTENT PLAN

3.11.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 8.6 are outlined in ***Table 34: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 34: USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)

LAND USES
Uses Subject to Compliance Assessment
• Car Park • Community Facility • Emergency Services • Telecommunications Facility • Utility Installation

3.11.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 8.6 are required to be assessed against and fulfil the Design Standards identified in ***Table 35: Sub-Precinct 8.6 Design Standards***.

TABLE 35: SUB-PRECINCT 8.6 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 34***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 Building height does not exceed 6 storeys.
Public Realm	DS3.1 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 27***.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 27***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.***

3.11.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 8.6

Variation to the lot layout within Sub-Precinct 8.6 is not intended under this PoD.

Sub-Precinct 8.6 is intended to be used for public transportation purposes. It is not intended that any variation to the lot layout within Sub-Precinct 8.6 take place under this PoD.

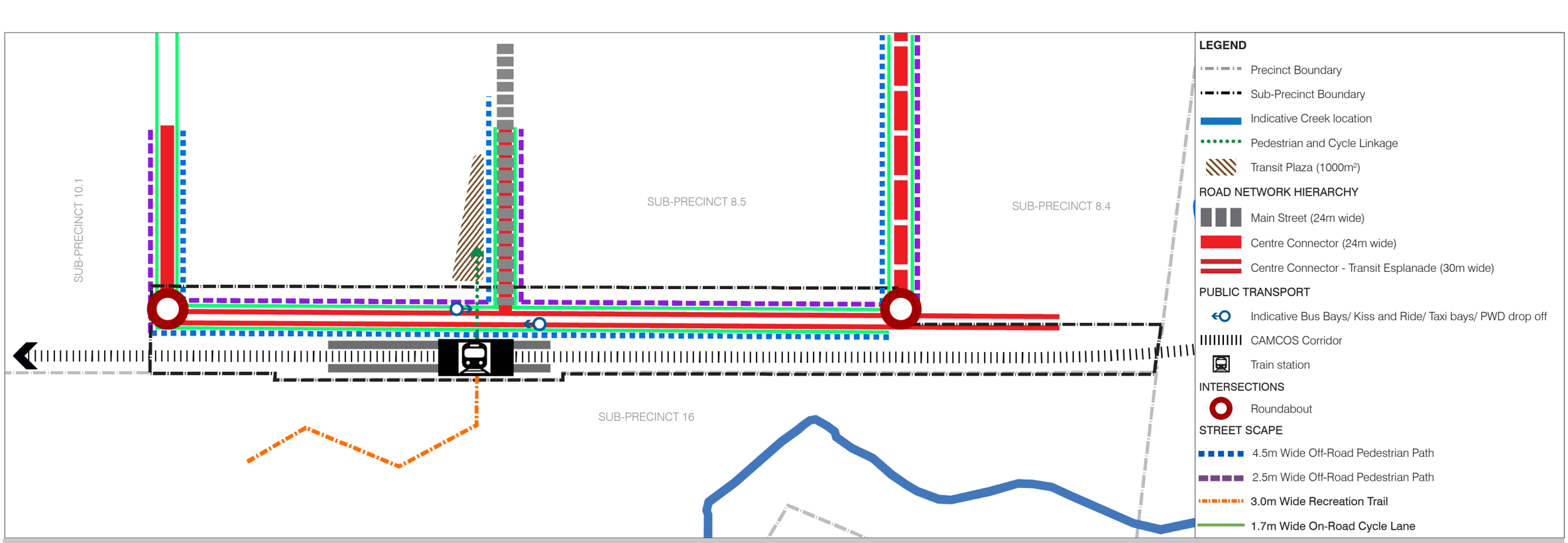
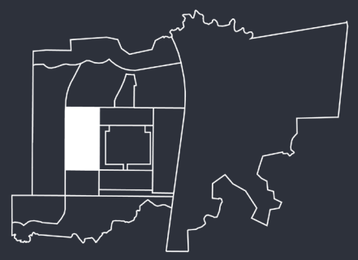


FIGURE 27: SUB-PRECINCT 8.6 FIXED ELEMENTS

3.12 SUB-PRECINCT 9.1

TOWN CENTRE VILLAGE WEST



3.12.1 SUB-PRECINCT INTENT

The Sub-Precinct comprises a range of residential dwelling types, including detached and attached dwellings that take advantage of the location of the Sub-Precinct in close proximity to the Town Centre Core. Small scale non-residential and community uses are also located throughout this Sub-Precinct however these uses are of a size which does not compete with the role and function of the Town Centre Core.

The Sub-Precinct comprises medium density residential dwellings fronting the eastern and part of the western edges of the Sub-Precinct. Non-residential uses are of a size which does not compete with the role and function of the Town Centre Core. A commercial hub accommodating commercial category uses is located in this Sub-Precinct.

The built form of the Sub-Precinct reflects the residential nature of the area and is low-medium rise. Taller development is concentrated along the edge of the Town Centre Core and at key locations at the junction of major roads. Urban design and built form outcomes are to create a functional and attractive streetscape with buildings addressing the street and promoting overlooking of the street to maximise casual surveillance.

Public realm with the Sub-Precinct comprises one Neighbourhood Park located throughout the residential neighbourhoods which provide for passive recreation opportunities.

Vehicular access to the neighbourhoods within the Sub-Precinct is limited to a small number of locations to ensure the streets are promoted for use by pedestrian and cyclists. Vehicular access and car parking for non-residential uses ensure its location and design to not create amenity impacts on surrounding residential dwellings.

Figure 28: Sub-Precinct 9.1 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

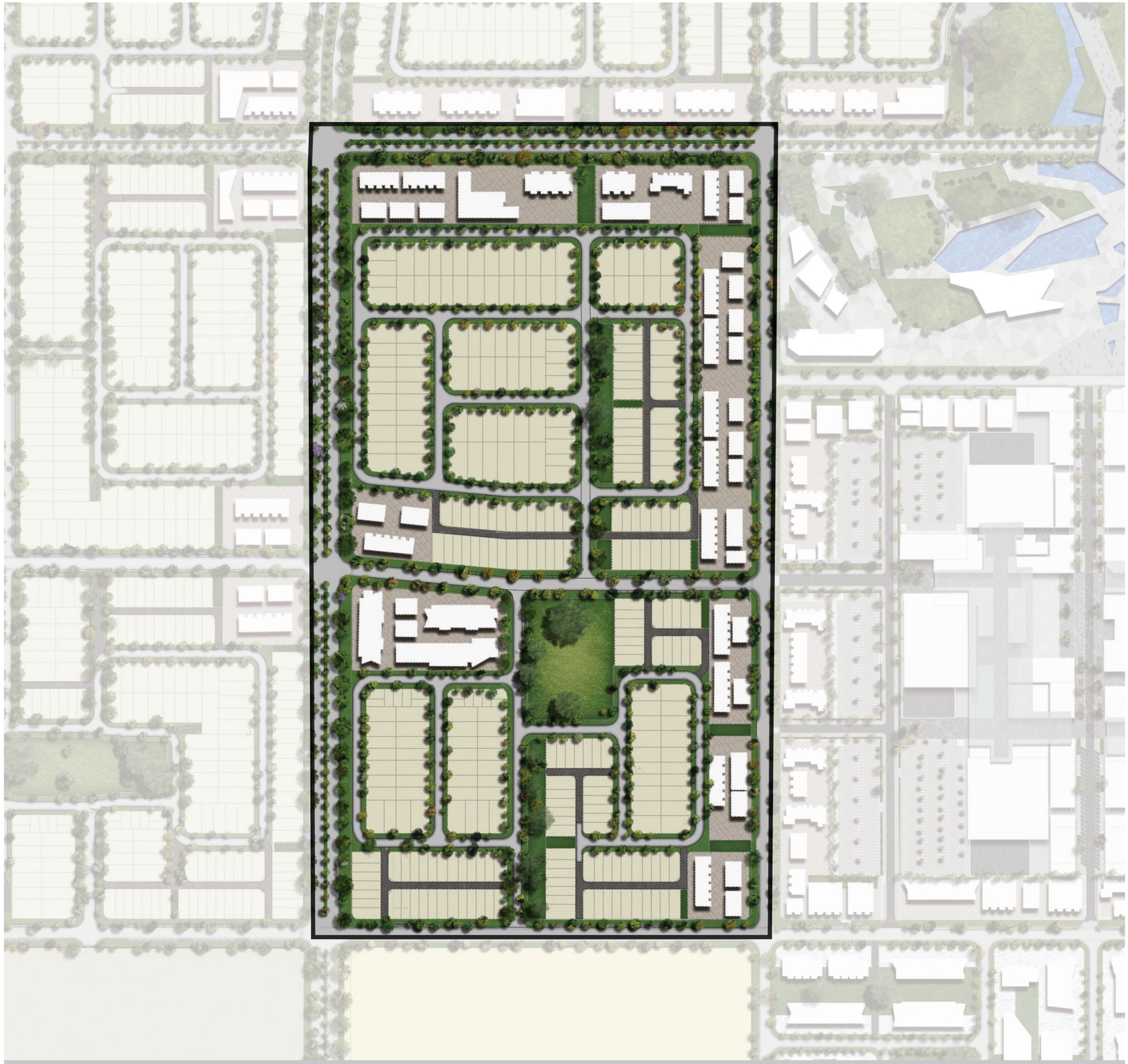


FIGURE 28: SUB-PRECINCT 9.1 ILLUSTRATIVE INTENT PLAN

3.12.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 9.1 are outlined in ***Table 36: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 36: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
• Business Use Category (where located on Commercial Uses Hub as identified on ***Figure 29***). • Community Facility • Display Home • Food Outlet (where located within Commercial Uses Hub as identified on ***Figure 29***). • Home Based Business • House • Multiple Residential (where located on a 'Medium Density Residential' site as identified on ***Figure 29***) • Other Residential (where located on a 'Medium Density Residential' site as identified on ***Figure 29***)

3.12.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 9.1 are required to be assessed against and fulfil the Design Standards identified in ***Table 37: Sub-Precinct 9.1 Design Standards***.

TABLE 37: **SUB-PRECINCT 9.1 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 36***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 The GFA of uses in accordance with ***Table 9: Compliance Assessible Uses.*** DS2.2 Building height does not exceed the maximum building height shown in ***Figure 29***. DS2.3 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection is in accordance with Section 3.17 ***Table 49***. DS2.4 Where for Multiple Residential (other than Duplex and Triplex), development provides the following minimum building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50***. DS2.5 Where development is located on a Secondary Frontage identified by ***Figure 29:*** a. A building must: • Include a combination of design elements such as projections, recesses and openings to enhance the character of the precinct; • Incorporate horizontal and vertical variations in the façade through use of various finishes such as timber, glass and tin; and • Not have blank walls or loading bays on this street frontage. b. A car park must: • Provide a soft landscaped strip of at least 2m wide along the boundary. DS2.6 Development on a Key Corner Site identified by ***Figure 29*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and c. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm.
Public Realm	DS3.1 'Local / Local Linear Park' and 'Neighbourhood Parks' are provided in accordance with ***Figure 29***. DS3.2 Green links are provided in accordance with ***Figure 29*** and show the intent of a pedestrian / cycle friendly connection through the neighbourhood to the higher order green space network. DS3.3 Development ensures that 'Through Block Links' with minimum pedestrian corridor widths of 4m are provided in accordance with ***Figure 29*** which may be enclosed, open to the sky and may be in private or public ownership. DS3.4 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 29***.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 29***. DS4.2 Direct vehicle access is prohibited as per ***Figure 29***. DS4.3 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.4 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.5 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.

3.12.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 9.1

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 9.1 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 29 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 38: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 9.1*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 9.1.

TABLE 38: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 9.1

DESIGN STANDARD	
Number of Local/ Neighbourhood Parks	1 x Neighbourhood Park
Total Park Area Required	1.48 ha (including any Local Linear Parks)
Maximum Yield Excluding Multiple Residential Sites (+/-10%)	329 Lots (no Multiple Residential Allotments)
Maximum Future Multiple Residential Sites	Lot 80001 – 2 Lots Lot 80002 – 2 Lots Lot 80003 – 2 Lots Lot 80004 – 3 Lots Lot 80005 – 3 Lots Lot 80006 – 3 Lots Lot 80007 – 5 Lots Lot 80016 – 2 Lots Lot 80018 - 4 Lots
Lot Design	Size • No minimum lot size Shape • Typical depth 20 – 40m, but can be less in urban neighbourhoods. Width in multiples of 2.5m and 5.0m consistent with typical lot dimensions • Urban lots are typical depth of 13.5 to 15m Slope • Platform construction required when finished slope on lot is 16% or greater
Block Size	• Length 100 - 200m • Depth 40 - 80m
Lot Layout	• No more than eight narrow (less than 10m) frontage lots in a row • No more than six lots with a width of 7.5m in a row unless serviced by a rear lane • Lot corners match or are within 1m of corners of adjoining lots
Access	• Maximum 400 metres walk to neighbourhood recreation park or equivalent (see PDA Guideline No.12 Park planning and design) • Ninety percent of all dwellings are within 400 metres of an existing or planned public transport stop

DESIGN STANDARD	
Street Network	• Grid pattern or modified grid responsive to site characteristics • Where slope allows, orientation within 15 degrees of north-south or east-west • Connector and main streets of centres orientated to landmarks • To minimise cut & fill, streets follow ridges, gullies, and/or are perpendicular to slope • Minimise cul-de-sacs and limit length to no greater than 10 lots
Streets	Street network includes: • Neighbourhood connector streets providing connections to neighbourhood destinations • Neighbourhood access streets provide direct access to properties and neighbourhood lanes; and • Neighbourhood lanes – provide direct property access either at the front or rear of lots.
Road Hierarchy	Roads are designed in accordance with ***Appendix L.***
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• Guideline No.5 – Neighbourhood Planning and Design (May 2015) • Guideline No.6 – Street and Movement Network (April 2012) • Guideline No.9 – Centres (May 2015) • Guideline No.11 – Community Facilities (May 2015) • Guideline No.12 – Park Planning and Design (May 2015) • Guideline No.13 – Engineering Standards (May 2015) • Guideline No.18 – Development Interfaces (May 2015) • Practice Note No.7 – Designing for Small Lots (March 2014) • Practice Note No.11 – Parking Analysis Plans (July 2012) • Practice Note No.12 – Rear Lanes: Design and Development (March 2014) • Guideline No.8 – Medium and High Rise Buildings (May 2015) • The executed Local Government and DTMR Infrastructure Agreements

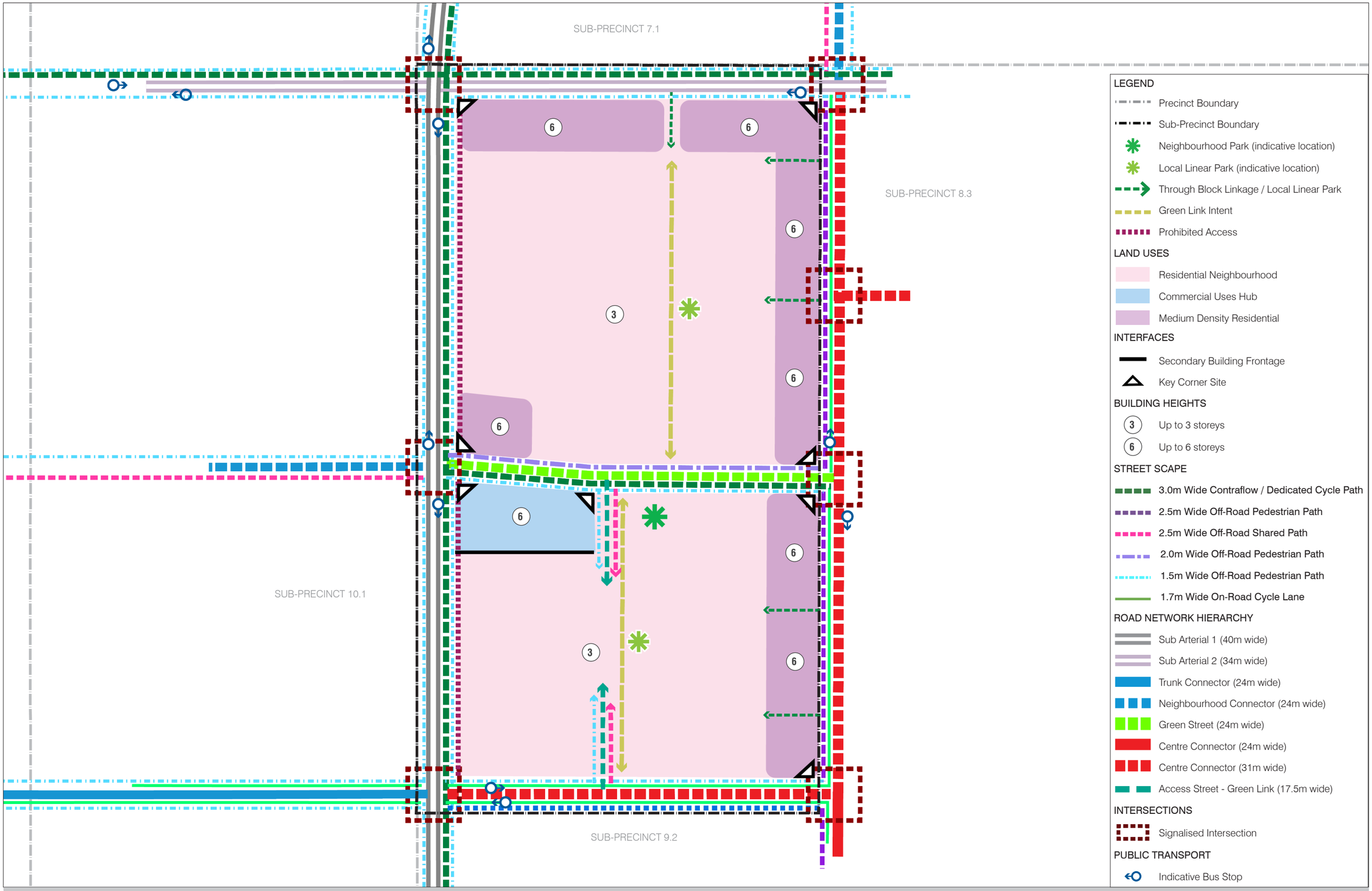
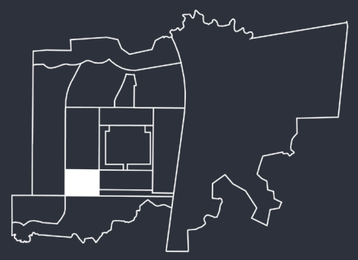


FIGURE 29: SUB-PRECINCT 9.1 FIXED ELEMENTS

3.13 SUB-PRECINCT 9.2

TOWN CENTRE WEST SCHOOL



3.13.1 SUB-PRECINCT INTENT

This Sub-Precinct accommodates a major educational establishment use in Caloundra South.

The built form of the Sub-Precinct respects the residential nature of the balance of the Sub-Precinct. Building heights within the Sub-Precinct are medium rise and deliver an urban outcome. Urban design and built form outcomes are to create a functional and attractive streetscape with buildings addressing the street.

Vehicular access to the Sub-Precinct is minimised and access locations are provided only where required.

Figure 30: Sub-Precinct 9.2 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

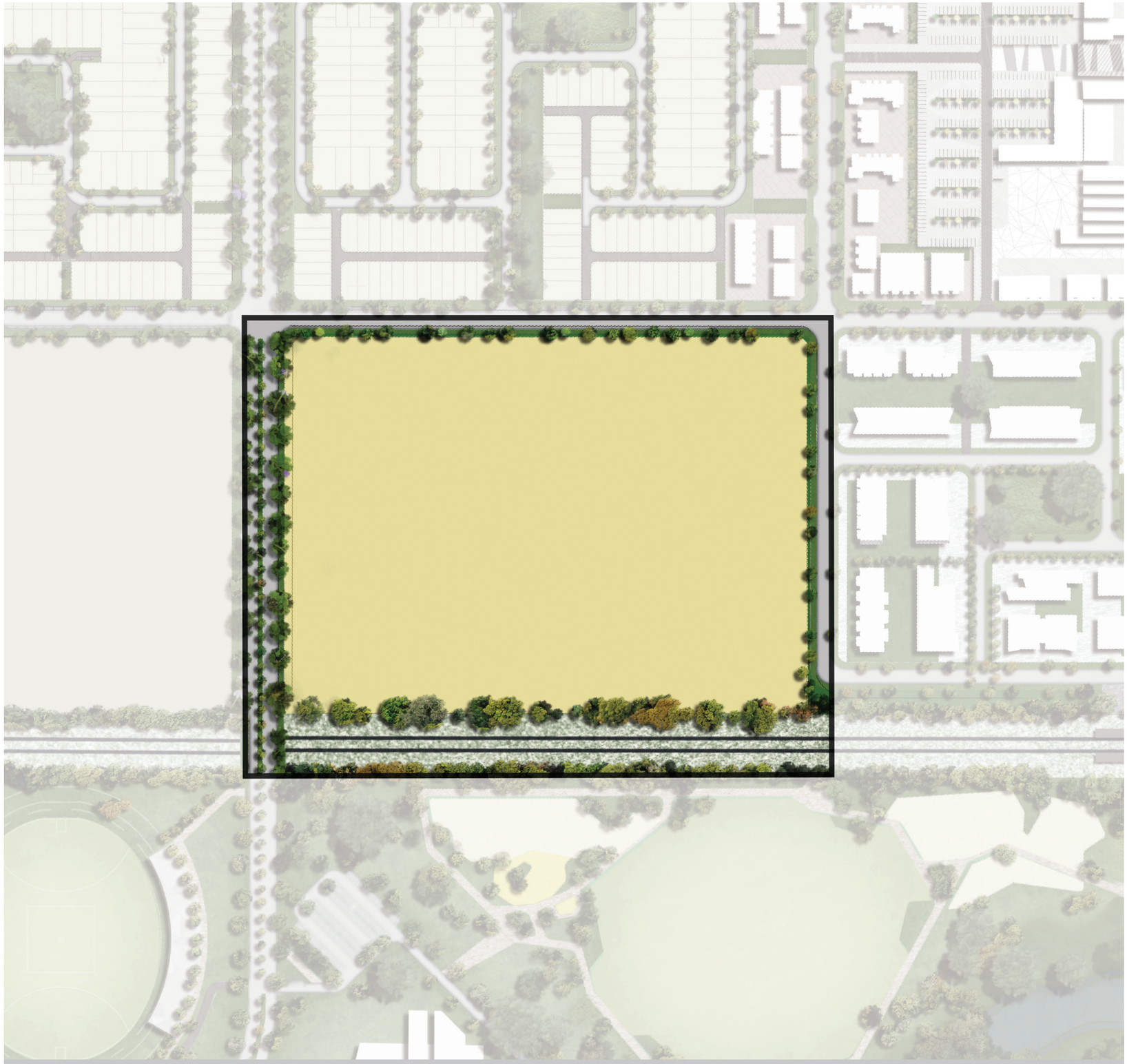


FIGURE 30: SUB-PRECINCT 9.2 ILLUSTRATIVE INTENT PLAN

3.13.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 9.2 are outlined in ***Table 39: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 39: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
• Educational Establishment

3.13.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 9.2 are required to be assessed against and fulfil the Design Standards identified in ***Table 40: Sub-Precinct 9.2 Design Standards***.

TABLE 40: **SUB-PRECINCT 9.2 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 39***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices. DS1.3 Capacity of the Education Establishment is limited to 1,100 enrollments. Enrollments may exceed this capacity only if supported by a Transport Impact Assessment Report, that has consideration of the Town Centre Traffic Model (vissum).
Built Form	DS2.1 Building height does not exceed 6 storeys. DS2.2 Development on a Key Corner Site identified by ***Figure 31*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; and b. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses.
Public Realm	DS3.1 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 31***.
Parking and Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 31***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access and prohibited access locations are provided in accordance with ***Figure 31***. *Note locations shown are indicative and may vary along the road provided road safety is not compromised.* DS4.4 On-site at-grade car parking areas are generally screened from view from surrounding streets by a combination of built form and planted buffers. DS4.5 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle.

3.13.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 9.2

The majority of the land within Sub-Precinct 9.2 is to be used for education purposes. As such, variation to the lot layout within Sub-Precinct 9.2 is not intended under this PoD.

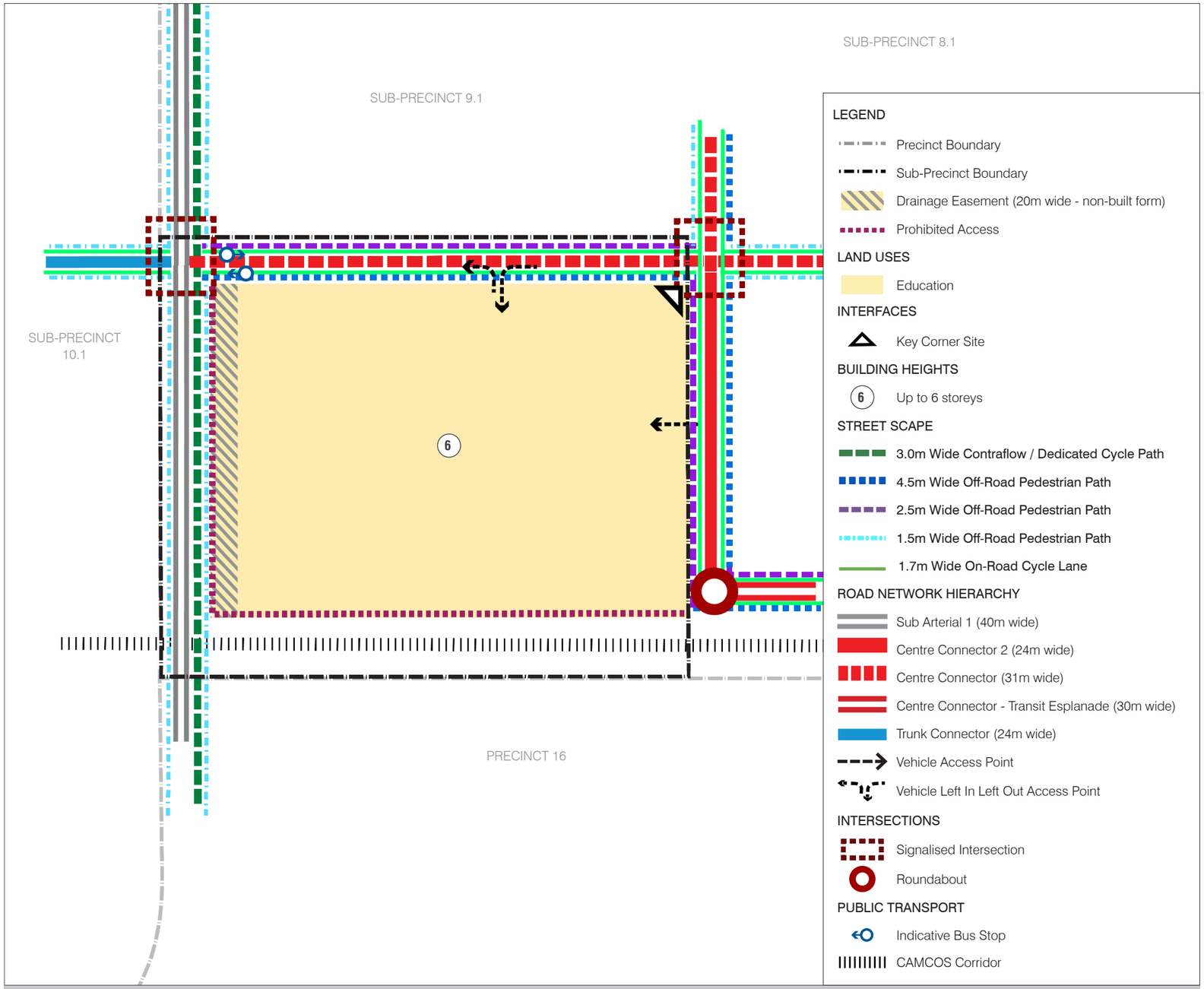


FIGURE 31: **SUB-PRECINCT 9.2 FIXED ELEMENTS**

3.14 SUB-PRECINCT 10.1

RESIDENTIAL COMMUNITY



3.14.1 SUB-PRECINCT INTENT

The Sub-Precinct is to provide for a diverse mix of housing, comprised predominantly of dwelling houses, which are supported by a range of community uses and small-scale non-residential uses including Business, Shop and Food Premises.

The built form of the Sub-Precinct reflects the residential nature of the area and is low rise. Urban design and built form outcomes are to create a functional and attractive streetscape with buildings addressing the street and promoting overlooking of the street to maximise casual surveillance.

Public realm with the Sub-Precinct comprises two Neighbourhood Parks and two local parks located throughout the residential neighbourhoods which provide for passive recreation opportunities.

Vehicular access to the street within the Sub-Precinct is limited to a small number of locations to ensure the streets are promoted for use by pedestrian and cyclists. Vehicular access and car parking for non-residential uses ensure its location and design to not create amenity impacts on surrounding residential.

Figure 32: Sub-Precinct 31 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 32: SUB-PRECINCT 31 ILLUSTRATIVE INTENT PLAN

3.14.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 10.1 are outlined in ***Table 41: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 41: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
• Child Care Facility • Display Home • Home Based Business • House • Multiple Residential (where located on 'Medium Density Residential' site as indicated on ***Figure 33***) • Multiple Residential (Duplex and Triplex) on sites identified in ***Appendix E*** • Other Residential (where located on 'Retirement Village Residential' site as indicated on ***Figure 33***) • Sales Office

3.14.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 10.1 are required to be assessed against and fulfil the Design Standards identified in Section 3.17.

TABLE 42: **SUB-PRECINCT 10.1 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 41***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 Building height does not exceed the maximum building height shown in ***Figure 33***. DS2.2 Where for Multiple Residential (other than Duplex and Triplex), the minimum setback from the outermost projection is in accordance with Section 3.17 ***Table 49***. DS2.3 Where for Multiple Residential (other than Duplex and Triplex), development provides the following minimum building separation distances to minimise impacts on residential amenity and privacy in accordance with Section 3.17 ***Table 50***. DS2.4 Development on a Key Corner Site identified by ***Figure 33*** provides a landscape or built form statement to this corner which: a. Ensures that blank walls of buildings or back of house areas are not located on these corners; b. Built form, is provided to this corner and is articulated through use of glass, openings, and recesses; and c. 4m wide awnings and public realm treatments at the ground plan to celebrate the corner and contributed to the public realm.
Public Realm	DS3.1 'Local Park' and 'Neighbourhood Parks' are provided in accordance with ***Figure 33***. DS3.2 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified in ***Figure 33***. DS3.3 Development ensures that 'Recreation Pathways' are provided in the general locations as identified in ***Figure 33***. DS3.4 Green links are provided in accordance with ***Figure 33*** and show the intent of a pedestrian / cycle friendly connection through the neighbourhood to the higher order green space network**.** DS3.5 A 2,000m^2 park is provided with the redevelopment of lot 80020 (Retirement Village Residential).
Parking And Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 33***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access and prohibited access locations are provided in accordance with ***Figure 33***. Note locations shown are indicative and may vary along the road provided road safety is not compromised. DS4.4 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle.
Environment	DS5.1 Lifestyle Buffers are provided generally in the locations identified on ***Figure 33*** and designed in accordance with the Acid Frog Management Code in ***Appendix N.*** *Note: In some areas the 30m Lifestyle Buffer is not applied due to the recreational areas or road reserves addressing the same need.*

3.14.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 10.1

Applications for Compliance Assessment to vary the lot layout in Sub-Precinct 10.1 must be in accordance with the Plans and Design Standards outlined in this section.

Figure 33 identifies those fixed elements of the PoD that cannot be adversely impacted or changed. ***Table 43: Design Standards For Change To Reconfiguring A Lot In Sub-Precinct 10.1*** identifies the applicable Design Standards for a lot layout in Sub-Precinct 10.1.

TABLE 43: DESIGN STANDARDS FOR CHANGE TO RECONFIGURING A LOT IN SUB-PRECINCT 10.1

DESIGN STANDARD	
Number of Local/ Neighbourhood Parks	3 x Neighbourhood Parks 3 x Local / Local Linear Parks
Total Park Area Required	3.83 ha
Lifestyle Buffer	A 'Lifestyle Buffer' is provided generally in accordance with ***Figure 33***.
Maximum Yield (+/-10%)	845 dwellings including Multiple Residential dwellings. (734 Standard Residential Lots plus 37 Multiple Residential Allotments (111 Duplex or Triplex dwellings max.))
Maximum Future Multiple Residential Sites (excludes Retirement Living and Future Residential)	Lot 80013 – 2 Lots Lot 80014 – 2 Lots Lot 80015 – 2 Lots Lot 80017 – 2 Lots
Lot Design	Size • No minimum lot size Shape • Typical depth 20 – 40m, but can be less in urban neighbourhoods. Width in multiples of 2.5m and 5.0m consistent with typical lot dimensions • Urban lots are typical depth of 13.5 to 15m Slope • Platform construction required when finished slope on lot is 16% or greater
Block Size	• Length 100 - 200m • Depth 40 - 80m
Lot Layout	• No more than eight narrow (less than 10m) frontage lots in a row • No more than six lots with a width of 7.5m in a row unless serviced by a rear lane • Lot corners match or are within 1m of corners of adjoining lots
Access	• Maximum 400 metres walk to neighbourhood recreation park or equivalent (see PDA Guideline No.12 Park planning and design) • Ninety percent of all dwellings are within 400 metres of an existing or planned public transport stop

DESIGN STANDARD	
Street Network	• Grid pattern or modified grid responsive to site characteristics • Where slope allows, orientation within 15 degrees of north-south or east-west • Connector and main streets of centres orientated to landmarks • To minimise cut & fill, streets follow ridges, gullies, and/or are perpendicular to slope • Minimise cul-de-sacs and where used and limit length to desirably no greater than 10 lots
Streets	Street network includes: • Neighbourhood connector streets providing connections to neighbourhood destinations • Neighbourhood access streets provide direct access to properties and neighbourhood lanes; and • Neighbourhood lanes – provide direct property access either at the front or rear of lots.
Road Hierarchy	Roads are designed in accordance with ***Appendix L.***
Car parking	On-site parking and service vehicles are provided in accordance with ***Appendix H.***
PDA Guidelines and Practice Notes	• Guideline No 5 – Neighbourhood Planning and Design (May 2015) • Guideline No.6 – Street and Movement Network (April 2012) • Guideline No.11 – Community Facilities (May 2015) • Guideline No.12 – Park Planning and Design (May 2015) • Guideline No.13 – Engineering Standards (May 2015) • Guideline No.18 – Development Interfaces (May 2015) • Practice Note No.7 – Designing for Small Lots (March 2014) • Practice Note No.11 – Parking Analysis Plans (July 2012) • Practice Note No.12 – Rear Lanes: Design and Development (March 2014) • Guideline No.8 – Medium and High Rise Buildings (May 2015) • The executed Local Government and DTMR Infrastructure Agreements

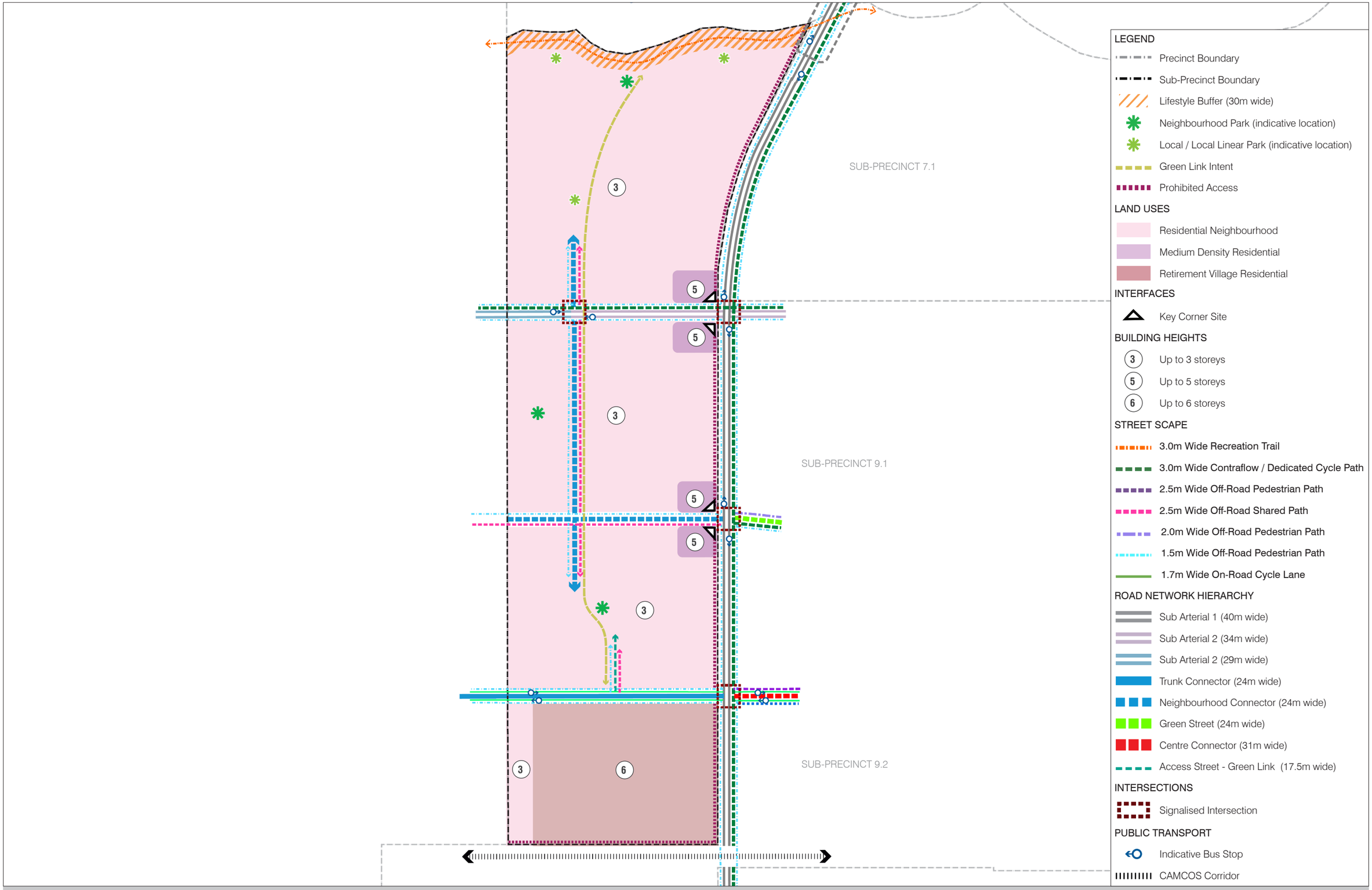
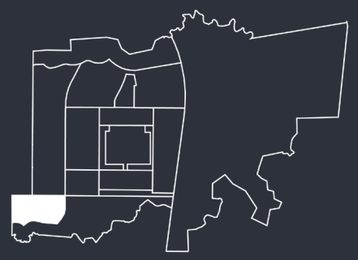


FIGURE 33: SUB-PRECINCT 10.1 FIXED ELEMENTS

3.15 SUB-PRECINCT 10.2

MAJOR SPORTS FACILITY



3.15.1 SUB-PRECINCT INTENT

This Sub-Precinct incorporates a Major Sports Facility, which provide for a range of sporting, recreation, leisure, cultural and educational facilities and community meeting spaces that provide for a diverse and active lifestyle.

The Sub-Precinct allows only a limited range of low impact, low-intensity land uses which are developed as part of the Major Sports facility. Building height and structures support the establishment of major sports infrastructure.

Vehicular access to the site is limited to one location. Pedestrian and cyclist connections are established through the site to provide connections to Precinct 16, Town Centre and the Transit Interchange.

Figure 34: Sub-Precinct 10.2 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.

FIGURE 34: SUB-PRECINCT 10.2 ILLUSTRATIVE INTENT PLAN

3.15.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 10.2 are outlined in ***Table 44: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 44: USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)

LAND USES
Uses Subject to Compliance Assessment
• Community Facility • Indoor Sport and Recreation • Outdoor Sport and Recreation • Utility Installation

3.15.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 10.2 are required to be assessed against and fulfil the Design Standards identified in ***Table 45: Sub-Precinct 10.2 Design Standards***.

TABLE 45: SUB-PRECINCT 10.2 DESIGN STANDARDS

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 44***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 A 'Major Sports Park' with a minimum size of 15ha is located as generally shown on ***Figure 35***. DS2.2 A 'Potential Club House' is located as generally shown on ***Figure 35***. DS2.3 Development ensures that 'Pedestrian and Cycle Links' are provided in the general location as identified on ***Figure 35***. DS2.4 Building height is limited to 30m maximum.
Public Realm	DS3.1 'Indicative Sports Fields' are located as generally shown in the Sports Network Plan in the executed Local Government Infrastructure Agreement. DS3.2 Development ensures that 'Recreation Pathways' are provided in the general locations as identified in ***Figure 35***. DS3.3 Development ensures that 'Pedestrian and Cycle Links' are provided in the general locations as identified in ***Figure 35***.
Parking And Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 35***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access locations are provided in accordance with ***Figure 35***. Note locations shown are indicative and may vary along the road provided road safety is not compromised. DS4.4 'Car Parking Locations' are generally located as identified on ***Figure 35***. DS4.5 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.6 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.
Environment	DS5.1 A 'Drainage Reserve' is provided in accordance with ***Figure 35***.

3.15.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 10.2

Variation to the lot layout within Sub-Precinct 10.2 is not intended under this PoD.

The majority of the land within sub precinct 10.2 is to be used as a Major Sports Park. As such, variation to the lot layout within Sub-Precinct 10.2 is not intended under this PoD.

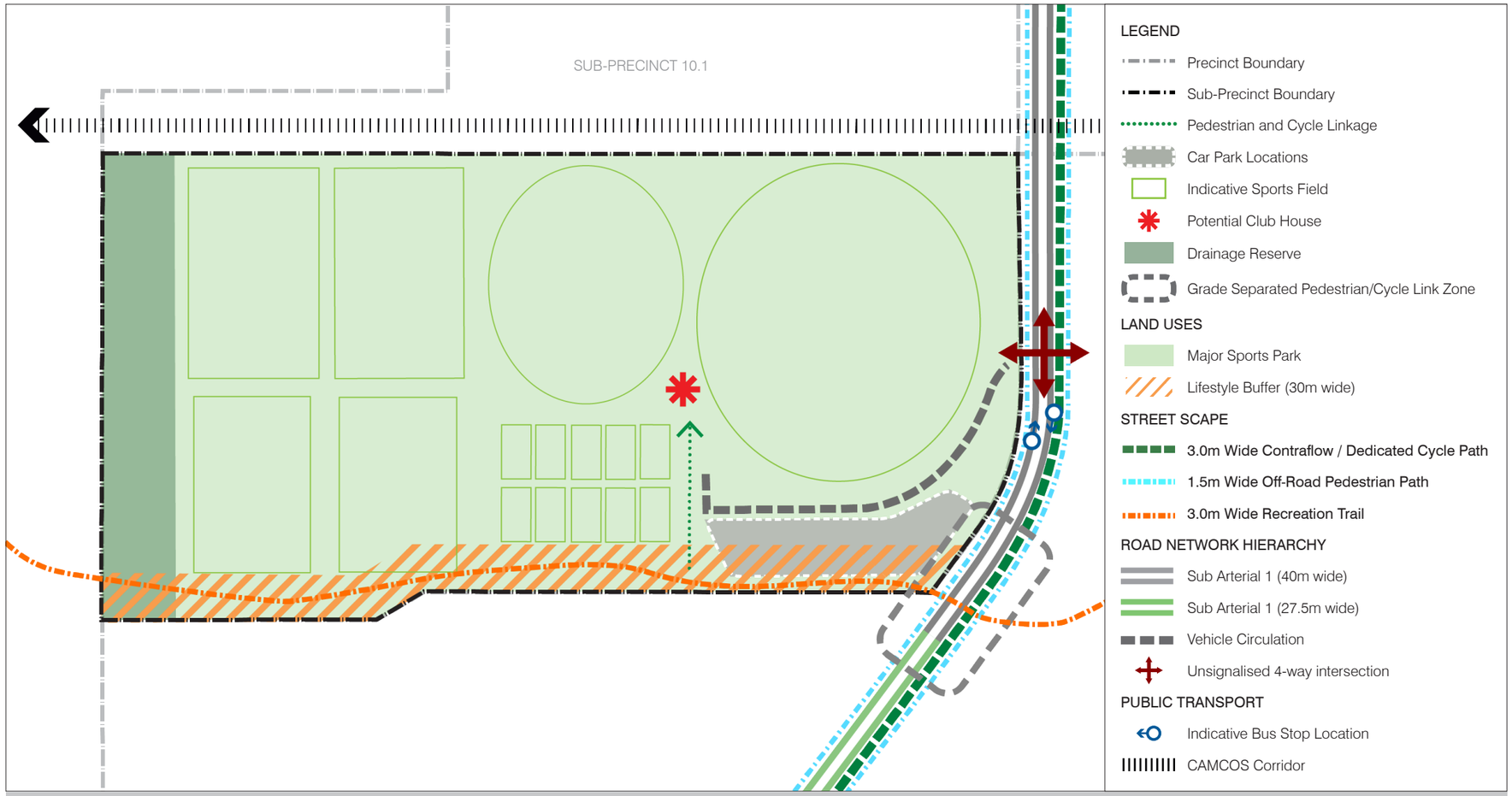
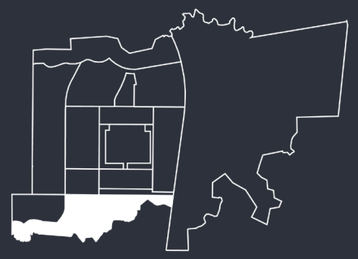


FIGURE 35: SUB-PRECINCT 10.2 FIXED ELEMENTS

3.16 PRECINCT 16

CENTRAL PARK



3.16.1 SUB-PRECINCT INTENT

This Sub-Precinct incorporates active and passive recreation spaces, which provide for a range of sporting, recreation, leisure, cultural and educational facilities and community meeting spaces that provide for a diverse and active lifestyle. The Conservation buffer areas protect areas identified as having significant values for biological diversity, water catchment, ecological functioning or cultural values.

The Sub-Precinct allows only a limited range of low impact, low-intensity land uses. Building height is limited to a low rise form typically not exceeding two storeys.

Vehicular access to the site is limited to one location. Pedestrian and cyclist connections are established through the site to provide connections to the Town Centre and the Transit Interchange.

Figure 36: Sub-Precinct 16 Illustrative Intent Plan provides an illustrative representation of the desired outcome for the Sub-Precinct.



FIGURE 36: SUB-PRECINCT 16 ILLUSTRATIVE INTENT PLAN

3.16.2 USES SUBJECT TO COMPLIANCE ASSESSMENT

The uses that comprise Approved Development subject to Compliance Assessment for Sub-Precinct 16 are outlined in ***Table 46: Uses Subject To Compliance Assessment (Where Not Exempt Or Where Not Meeting Exempt Criteria Under Section 2)*** below.

TABLE 46: **USES SUBJECT TO COMPLIANCE ASSESSMENT (WHERE NOT EXEMPT OR WHERE NOT MEETING EXEMPT CRITERIA UNDER SECTION 2)**

LAND USES
Uses Subject to Compliance Assessment
• Community Facility • Indoor Sport and Recreation • Outdoor Sport and Recreation • Utility Installation

3.16.3 SPECIFIC DESIGN CRITERIA

Applications for Compliance Assessment in Sub-Precinct 16 are required to be assessed against and fulfil the Design Standards identified in ***Table 47: Sub-Precinct 16 Design Standards***.

TABLE 47: **SUB-PRECINCT 16 DESIGN STANDARDS**

ELEMENT	DESIGN STANDARD
Use	DS1.1 Land uses comprise the uses specified for the Sub-Precinct in ***Table 46***. DS1.2 In addition to the following Sub-Precinct design standards, the use is in accordance with the relevant provisions of Section 3.17 Specific Use Criteria and relevant Appendices.
Built Form	DS2.1 Building height does not exceed the maximum building of 4 storeys.
Public Realm	DS3.1 An 'Major Sports Facility' is located as generally shown on ***Figure 37*** with a site area of 1.8ha. DS3.2 A 'Major Recreation Park' of 10ha is provided exclusive of Indoor Sports Facility. DS3.3 Development ensures that 'Pedestrian and Cycle Links' are provided in the general locations as identified in ***Figure 37***. DS3.4 Development ensures that a 'Grade Separated Pedestrian/Cycle Link Zone' is provided in the general locations as identified on ***Figure 37***. DS3.5 Development ensures that 'Recreation Pathways' are provided in the general locations as identified in ***Figure 37***.
Parking And Access	DS4.1 Development facilitates delivery of a road network hierarchy in accordance with ***Figure 37***. DS4.2 On-site parking and service vehicles are provided in accordance with ***Appendix H.*** DS4.3 Access locations are provided in accordance with ***Figure 37***. Note locations shown are indicative and may vary along the road provided road safety is not compromised. DS4.4 'Car Parking Locations' are generally located as identified on ***Figure 37***. DS4.5 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS4.6 Vehicular access points do not result in queuing across pedestrian/cycle paths and do not cause interruption to traffic on surrounding roads.
Environment	DS5.1 Buffers are provided generally in the locations identified in ***Figure 37*** and designed in accordance with the Acid Frog Management Code in ***Appendix N.*** DS5.2 Wetlands/Bio-retention Basins are provided in ***Figure 37*** and are subject to detailed design and compliance approval.
Infrastructure	DS6.1 A 'Drainage Reserve' is provided in accordance with ***Figure 37***.

3.16.4 CRITERIA FOR A CHANGE TO APPROVED RECONFIGURING A LOT LAYOUT FOR SUB-PRECINCT 16

Compliance Assessment to vary the lot layout in Sub-Precinct 16 is not intended under this PoD.

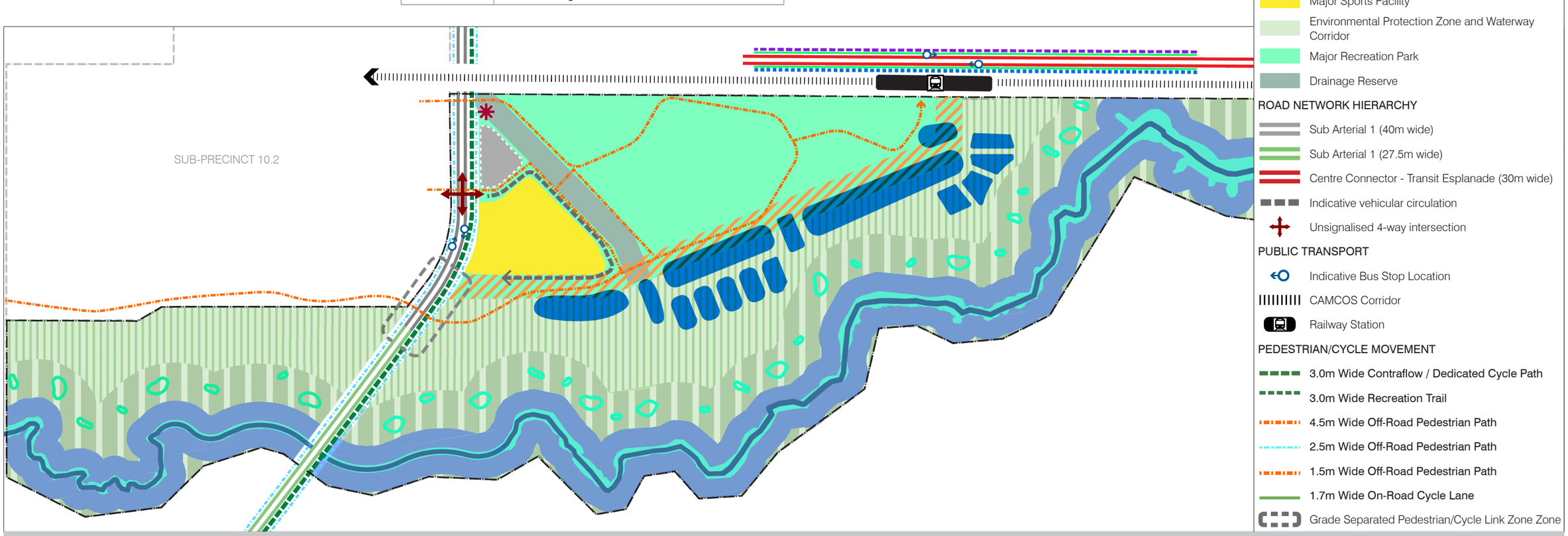


FIGURE 37: **SUB-PRECINCT 16 FIXED ELEMENTS**

3.17 SPECIFIC USE CRITERIA

ALL PRECINCTS



In addition to the detailed provisions for each precinct, the following land use specific provisions in ***Table 48: Specific Use Design Standards*** below are applicable to development undertaking the Compliance Assessment process under Section 1.5.2.2 of the Plan of Development. These provisions are only applicable as relevant to the specific use being assessed. It is noted that where provisions under Section 3.17 conflict with provisions under the design standards of the relevant Sub-Precincts, the Sub-Precinct design standards prevail to the extent of the conflict.

TABLE 48: SPECIFIC USE DESIGN STANDARDS

DESIGN STANDARD	
General	
Built Form	DS1.1 Building design is climatically responsive. Buildings include the following: • Buildings have cross ventilation through habitable rooms • Buildings are orientated to promote seasonal solar heat gain or loss taking into consideration major site views and vistas • Large building facades incorporate architectural wall shading to reduce solar heat gain • External windows have sun shading DS1.2 Mechanical plant, equipment and storage areas equipment are: • If on the roof: - Screened and designed as an architectural feature of buildings; and - Incorporated into the roof form. • Effectively screened from view from adjoining streets so as to provide an attractive address to streets and adjoining properties. DS1.3 Buildings are to provide an entrance awning or canopy at the principal public entrance which is clearly legible from the street. DS1.4 External facade materials include a mix of two or more of the following: a. Glazing clear tinted or colour backed; b. Brickwork; c. Timber; d. Coloured rendered/bagged finish or split face concrete block work; e. Precast concrete panels; f. Economical panel systems including prefinished metal panels, tiles, stones; or g. Recycled materials (e.g. timber). DS1.5 The maximum length of a uniform elevation treatment above ground storey without variation or articulation is 40m. DS1.6 Buildings are designed to have balconies, windows and building openings oriented and/or overlook streets and other areas which are accessible to the public to provide casual surveillance. DS1.7 Car parking may be located on ground or above ground where sleeved or screened.
Public Realm	DS2.1 A minimum of 10% of the site is comprised of planted landscapes. DS2.2 Street frontages are unfenced or where street frontage fencing is required for security and CPTED purposes, it should be transparent (minimum 70% open).
Parking and Access	DS3.1 On site vehicle parking is provided at the rates outlined in ***Appendix H.***

DESIGN STANDARD	
Parking and Access (cont.)	DS3.2 Parking bays, manoeuvring areas, queuing areas, set down/pickup areas, aisles and driveways are designed in accordance with the dimensions and to the standards specified in: • AS2890.1 Parking Facilities – Off-street Car Parking, as amended; and • AS2890.2 Parking Facilities – Off-street Commercial Vehicle facilities. DS3.3 The location of visitor or customer parking is not behind a security barrier. DS3.4 On-site parking and manoeuvring areas provide for all vehicles to enter and leave in a forward motion. DS3.5 The lot has physical access to a road. DS3.6 Access to the site provides separation of a minimum 10m to an intersecting street where the driveway is on the same side of the street. DS3.7 Where an on-site waste collection area is provided, access and manoeuvring areas must provide for the specified vehicle. DS3.8 Bicycle parking spaces are provided in accordance with ***Appendix H.*** DS3.9 Bicycle parking and storage facilities are easily accessible and provided in the building, or on-site within 100 metres of an entrance to the building, in accordance with five percent (5%) of the number of employees, based on workforce numbers. DS3.10 End of trip facilities for bicycles, involving dedicated amenities that are publicly accessible for bike storage areas, lockers, toilets and change facility, must be provided in accordance with ***Appendix H.*** DS3.11 For buildings less than 1,000m^2, engineering design of all parking and manoeuvring areas is in accordance with Councils adopted standards.
Environment	DS4.1 Development achieves the noise generation levels set out in the Environmental Protection (Noise) Policy 2008, as amended. DS4.2 Development achieves the air quality objectives set out in the Environmental Protection (Air) Policy 2008, as amended. DS4.3 Light emanating from any source complies with Australian Standard AS4282 Control of the Obtrusive Effects of Outdoor Lighting, as amended. DS4.4 Outdoor lighting is provided in accordance with Australian Standard AS 1158.1.1 –Road Lighting – Vehicular Traffic (Category V) Lighting – Performance and Installation Design Requirements, as amended. DS4.5 Any reflective glass material has: a. A level of light reflectivity of not greater than 20%; and b. A level of heat transmission of not less than 20%.

DESIGN STANDARD	
Environment (cont.)	**DS4.6** Development does not include the storage of dangerous goods as defined by the Work Health and Safety Act 2011, as amended. **DS4.7** All rain water tanks to non-residential buildings are designed to ensure 75% roof capture and reuse, with collected water used for all suitable applications within the property. **DS4.8** For non-residential sites, each site demonstrates how it can satisfy best practice pollutant load removal targets.
Infrastructure	**DS5.1** All development is connected to reticulated water supply, sewerage, stormwater drainage and telecommunication infrastructure and has an electricity supply.
Uses	
Child Care Centre	**DS6.1** Where a standalone use, the Child care centre has a maximum site cover of 50%. **DS6.2** Child care centres are to be located on a Connector or Access Street. **DS6.3** Child care centres are to be located on a site having: a. A slope of not more than 10%; b. A regular shape; and c. A minimum area of 1,500m² **DS6.4** All buildings, structures and outdoor play areas are set back at least 3 metres from all site boundaries adjoining a residential use (or future residential use). **DS6.5** A minimum 1.8m high solid acoustic screen fence is erected along the full length of all site boundaries adjoining a residential use (or future residential use). **DS6.6** The Child care centre is setback from the most proximate boundary of an electricity transmission line easement as follows: a. A 20 metre separation distance for transmission lines between 33kV and 132kV; b. A 30 metre separation distance for transmission lines between 133kV and 275kV; and c. A 40 metre separation distance for transmission lines greater than 275kV. **DS6.7** Convenient, safe and clearly visible pedestrian access is available within and to the site which does not cross across driveways. **DS6.8** Where adjoining a residential use (or future residential use), the minimum setback from the outermost projection of any building is in accordance with following table:

Setbacks (Minimum)	
Front (Primary frontage)	6m
Side	2m
Rear	4.5m

DESIGN STANDARD	
Community Facility	**DS7.1** Where a standalone use and not located in Precinct 8, the community activity has a maximum site cover of 50%. OR Where not a standalone use or where located in Precinct 8 - no acceptable outcome provided. **DS7.2** Where adjoining a residential use, a minimum 1.8m high solid acoustic screen fence is provided along the full length of all common site boundaries. **DS7.3** Intrusive outdoor activities are located and orientated away from residential premise. **DS7.4** The Community facility is setback from the most proximate boundary of an electricity transmission line easement as follows: a. A 20 metre separation distance for transmission lines between 33kV and132kV; b. A 30 metre separation distance for transmission lines between 133kV and 275kV; and c. A 40 metre separation distance for transmission lines greater than 275kV. **DS7.5** A minimum 2m wide landscaping strip is to be provided along the site frontage.
Emergency Services	**DS8.1** Emergency Services are located to enable easy access to a Sub-arterial or Connector Road. **DS8.2** Where adjoining a residential use, a minimum 1.8 metre high solid acoustic screen fence and a 2 metre wide landscape strip is provided along the full length of all common site boundaries.
Fast Food Premises	**DS9.1** Loading areas are not able to be viewed from the road or any public space and are appropriately screened. **DS9.2** Vehicle queuing for 10 cars is provided within a drive-through facility. The location of the vehicle queuing does not impact on internal vehicle movements or access to the site.
Home Based Business	**DS10.1** For a Home Based Business, other than a bed and breakfast, the hours of operation are limited to: a. 8.00am and 6.00pm, Mondays to Saturdays; and b. Not at all on Sundays or public holidays. *Note – office administration functions and activities that do not involve visitors by customers or clients, deliveries or noise related activities may occur outside of the hours of operation.*

DESIGN STANDARD	
Home Based Business (cont.)	**DS10.2** For a Home Based Business, the standards of operation the following standards of operation apply: a. The floor area used specifically for the home business does not exceed 50m². b. Any visitor accommodation does not exceed 4 visitors. c. There is no hiring out of materials, goods, appliances or vehicles. d. There is only one sign related to the Home business, located within the premises or on a fence facing the road. e. There is no repairing or servicing of vehicles not normally associated with a residential use. f. There is no industrial use of premises. g. The maximum height of a new building, structure or object does not exceed the height of the House or Multiple residential and the setback is the same as, or greater than, buildings on adjoining properties. h. Car parking is in accordance with ***Appendix H.*** i. There is no display of goods. j. Number of employees does not exceed 4.
Indoor Entertainment (Tavern/Hotel)	**DS11.1** Indoor Entertainment (Tavern/Hotel) uses are located only within Mixed Use designated lots.
Indoor Sport and Recreation	**DS12.1** Indoor Sport and Recreation uses exclude premises for conducting large scale functions.
Market	**DS13.1** Where market stalls are proposed to be located adjacent to existing shops the market is not held on more than 1 day per week. **DS13.2** The market is conducted, including setup and pack-up time, between the hours of 5.00am and 10.00pm. **DS13.3** A clear movement path, at least 3 metres in width, is maintained through or around the market to allow emergency vehicle access. **DS13.4** Public toilets: • Are provided within the area of the market, or are located within 250 metres of the market; and • Remain open and accessible for use during market hours. **DS13.5** Directional signage is provided to identify the location of, and entry to, public toilet facilities.

DESIGN STANDARD	
Multiple Residential (other than Duplex and Triplex)	**DS14.1** For all Multiple Residential uses involving more than two units, the building is sited and designed such that: a. The main pedestrian entrance to the building (or group of buildings) is located on the higher order street; b. Access from the street to the entrance of the building(s) or individual dwellings is easily discerned; c. Vehicular access to the site is separate from the pedestrian access; d. Street and parkland frontages comprise 'semi-active uses/spaces' such as habitable rooms of dwellings or rooming units, common recreation areas (indoor and outdoor) and landscaped areas, to facilitate casual surveillance; e. The number of dwellings, windows and balconies of habitable rooms that address adjoining streets, communal recreation areas and open spaces is optimised. **DS14.2** Non-habitable rooms of one dwelling are not located opposite windows of another dwelling unless views are controlled by screening devices, distance, landscaping or design of the opening. **DS14.3** Where habitable room windows look directly at habitable room windows and adjacent dwelling within 2 metres at the ground storey, or 9 metres at levels above the ground storey, privacy is protected by: a. Window will heights being a minimum of 1.5 metres above floor level; or b. Fixed translucent glazing being applied to any part of a window below 1.5 metres above floor level; or c. Fixed external screens; or d. If at ground level screen fencing to a minimum height of 1.8 metres. **DS14.4** The length of any unarticulated elevation of a building, fence or other structure visible from the street does not exceed 15 metres. **DS14.5** Any car parking area or other associated structures are integrated into the design of the development such that: a. They are screened from view from frontages to streets, parks and adjoining land; and b. They are not located between the building and the street address. **DS14.6** Building setbacks comply with those specified in any applicable Sub-Precinct which it is located and ***Table 49*** and ***Table 50***.

DESIGN STANDARD	
Multiple Residential (other than Duplex and Triplex) (cont.)	**DS14.7** Except where specified otherwise in a Sub-Precinct provision: a. A 2 metre wide landscaped buffer strip is provided along the full frontage of the site; b. At least 10% of the site area is provided as communal open space exclusive required buffer strips and clothes drying areas; c. A minimum 1.8 metre high solid screen fence is provided and maintained along the full length of any side or rear boundary; **DS14.8** For all Multiple Residential uses involving more than two units: a. Each ground floor dwelling has a courtyard or similar private open space of not less than 15m^2 with a minimum dimension of 3m directly accessible from the main living area; b. Each dwelling above ground level has a balcony or similar private open space area of not less than 9m^2 for a 1 bedroom unit, and 16m^2 for 2+ bedroom units (with a minimum dimension of 3m) directly accessible from the living area of the dwelling or rooming unit. **DS14.9** The site cover for Multiple Residential buildings does not exceed: a. 60% if within Precincts 7, 9, & 10 and b. 80% if within Precinct 8. **DS14.10** For multiple residential uses front fences and walls: a. Have a maximum height of not more than: b. 1.8 metres if 50% transparent; or c. 1.2 metres if solid. **DS14.11** Building bulk is reduced by incorporating a combination of the following elements in building design: a. Variations in plan shape, such as curves, steps, recesses, projections or splays; b. Variations in vertical profile, with steps or slopes at different levels; c. Variations in the treatment and patterning of windows, sun protection and shading devices, or other elements of a façade treatment at a finer scale than the overall building structure; d. Balconies, verandahs or terraces; and e. Planting, particularly on podiums, terraces and low level roof decks. **DS14.12** Entry areas for the residents and visitors are provided separately from entrances for other building users and provide: a. For safe entry from streets, car parking areas and servicing areas; b. Clearly marked, safe and secure parking areas are provided for residents and visitors which is separate from parking areas provided for other building users; and c. Security measures are installed such that building users do not have access to areas that are intended for the exclusive use of residents and visitors.

DESIGN STANDARD	
Other Residential (retirement living)	**DS15.1** Except where otherwise specified in an approved PoD, the site cover of the buildings does not exceed 60%. **DS15.2** The length of any unarticulated elevation of a building, fence or other structure visible from the street does not exceed 15 metres. **DS15.3** Building bulk is reduced by incorporating a combination of the following elements in building design: a. Verandahs; b. Recesses; c. Variation in materials, colours and/or textures including between levels; and d. Variation in building form. e. Screening of balconies is limited to the side and rear of boundaries, and the sides of balconies where needed, to prevent noise and overlooking of other dwellings and recreation areas. f. Any building does not exceed 40 metres in length, with separation between buildings, for the purposes of cross ventilation, articulation and light, of at least 6 metres. **DS15.4** Any car parking area or other associated structures are integrated into the design of the development such that they are screened from view from frontages to streets, parks and adjoining land. **DS15.5** At least 10% of the area of the site is provided as communal and private open space, with : a. Each ground floor dwelling having a courtyard or similar private open space area, not less than 15m^2 and with a minimum dimension of 3 metres, directly accessible from the living area of the dwelling; b. Each dwelling above ground level having a balcony or similar private open space area, not less than 9m^2 and with a minimum dimension of 2.5 metres, directly accessible from the living area of the dwelling. **DS15.6** A landscape strip at least 2 metres wide is provided within the boundaries of the site, adjacent to the full frontage of the site. **DS15.7** A 1.8 metre high solid screen fence is provided along the full length of all side and rear boundaries of the site. **DS15.8** Unless required to ameliorate traffic noise or headlight flare, high solid fences or walls are avoided along street frontages.

DESIGN STANDARD	
Other Residential (retirement living) (cont.)	**DS15.9** The development provides management facilities, supervised care facilities and social and recreational facilities in the form of: a. A live-in manager's residence and office; b. 24 hour nursing station and/or 24 hour monitored alert system; c. Communal dining room; d. Communal indoor social/recreation space; and e. A diversity of informal indoor and outdoor social spaces. **DS15.10** Communal buildings are easily accessible and centrally located, and residents are able to easily navigate the site on foot or with the assistance of mobility aids. **DS15.11** No dwelling is more than 250 metres walking distance from a site entry or exit point, or any central community facilities building. **DS15.12** All pathways and land use for outdoor recreation have grades of 5% or less, with paths having hard, slip resistant surfaces. **DS15.13** Internal paths, ramps and hallways are capable of accommodating two wheelchairs (side by side) at any one time. **DS15.14** The development has access to a reliable alternative power supply in the event of prolonged power outage or disconnection from grid supplied electricity. **DS15.15** Dwellings are configured in clusters with each cluster having a clearly defined street address or access corridor and each dwelling having clearly defined private open space and a prominent front door. **DS15.16** 2 Clusters of dwellings are supported by unique design features that help identify and individualise them and assists residents and visitors to easily find their way. **DS15.17** Logical, direct and separated pedestrian and vehicle routes are provided between dwellings, communal buildings and other on-site facilities and facilities in the neighbourhood. **DS15.18** Building setbacks comply with those specified in any applicable Sub-Precinct which it is located in ***Table 49*** and ***Table 50***.

DESIGN STANDARD	
Outdoor Sport and Recreating (excluding Golf Course)	**DS16.1** The use is located and designed so as to be: a. Convenient to users; and b. Compatible with the preferred character of the local area. **DS16.2** The use: a. Is effectively designed to meet the needs of users, having regard to the scale and nature of the use; b. Has buildings and structures that are fit for purpose; and c. Has buildings and structures that incorporate passive design responses that acknowledge and reflect the region's sub-tropical climate.
Sales Office	**DS17.1** The hours of operation of the sales office do not commence before 8.00am or extend later than 6.00pm. **DS17.2** The maximum GFA for a Sales Office is 400m^2. **DS17.3** A minimum of 2 on-site car parking spaces are provided. **DS17.4** Private and public open space areas are turfed and landscaped. **DS17.5** A 1.8 metre high solid screen fence is provided to each side and rear boundary that has residential uses adjoining. **DS17.6** If the sales office is in conjunction with a Display Village which comprises 4 or more Display Homes, public toilet facilities are to be provided. **DS17.7** Any temporary building or structure associated with the operation of the sales office is removed from the site within 14 days of the end of the period of operation and the site is left in a clean and tidy condition.
Service Station	**DS18.1** The service station site is located on a site that: a. Is at least 1,500m^2 in area; b. Does not adjoin a sensitive use, as defined in ***Appendix A;*** and has a street frontage of at least: - 35 metres where the site is a corner site; or - 40 metres otherwise. **DS18.2** The minimum setbacks for all buildings and other structures are in accordance with following table:

Setbacks (Minimum)		
Front (Primary frontage)	Fuel Pumps and Canopies	4.5m
	Buildings and Structures	
Side	2m	
Rear	2m	

DESIGN STANDARD	
Service Station (cont.)	**DS18.3** The gross floor area used for the associated retail sale of goods is limited to 150m^2. **DS18.4** Separate entrances to and exits from the site are provided, and these are clearly marked for their intended use. **DS18.5** No part of a vehicle crossover is closer than: a. 14 metres from any other vehicle crossover on the same site; b. 12 metres from an intersection; and c. 3 metres from any property boundary. **DS18.6** Sealed impervious surfaces are provided in areas where potential spills of contaminants may occur. **DS18.7** Grease and oil arrestors or other infrastructure is provided to prevent the movement of contaminants from the site. **DS18.8** Fuel pumps are located in accordance with Australian Standard AS1940 – The storage and handling of flammable and combustible liquids. **DS18.9** Inlets to bulk fuel storage tanks are located to ensure that tankers, while discharging fuel, are standing wholly within the site and are on level ground.
Shop, Business, Health Care Services and Food Premises	**DS19.1** Buildings setbacks for Shops, Businesses, Health Care Services and Food Premises comply with those prescribed for the Sub-Precinct which it is located. **DS19.2** The site cover of a Shops, Businesses, Health Care Services and Food Premises does not exceed: a. 70% for that part of a building up to 2 storeys in height; and b. 50% for that part of a building exceeding 2 storeys in height. **DS19.3** The building incorporates vertical and horizontal articulation such that no blank wall is longer than 15 metres. **DS19.4** Where a building exceeds 2 storeys in height, the building is designed so as to avoid the creation of adverse micro-climatic impacts on any nearby public space by way of overshadowing, wind tunnelling or reflective glare. **DS19.5** Building materials and hard surfaces used in landscape works are not highly reflective, or likely to create glare, slippery or otherwise hazardous conditions. **DS19.6** Any outdoor public or semi-public open space has a minimum of 50% of its area covered or shaded. **DS19.7** Development provides for a minimum of 70% of the building frontage to a public street, or other public or semi-public space, to present with clear or relatively clear windows and glazed doors.

DESIGN STANDARD	
Shop, Business, Health Care Services and Food Premises (cont.)	**DS19.8** The building has articulated and textured facades that incorporate some or all of the following design features to create a high level of openness and visual interest, and provide shading to walls and windows: a. Wide colonnades, verandahs, awnings, balconies and eaves; b. Recesses, screens and shutters; and **DS19.9** Landscapes are provided on-site in accordance with the following: a. Shade trees, low planting and hard landscapes are provided along street frontages not occupied by building or driveways; b. Shade trees are provided in car parks; c. A landscape strip is provided between the business use and any adjacent residential use which: - Is planted with a variety of screening trees and shrubs; and - Incorporates a minimum 1.8 metre high solid screen fence where acoustic attenuation is required; and - Planting is provided on top of podium levels. **DS19.10** Undesirable visual, noise and odour impacts on public spaces and residential uses are avoided or minimised by: a. Where appropriate, limiting the hours of operation of the business use to maintain acceptable levels of residential amenity relative to the site's context and setting; b. Providing vehicle loading/unloading and refuse storage/collection facilities within enclosed serviced yards or courtyards; and c. Locating site service facilities and areas such that they are not adjacent to the frontage of a street or public space. **DS19.11** Glare conditions or excessive 'light spill' on to adjacent sites and public spaces are avoided or minimised through measures such are: a. Careful selection and location of light fixtures; b. Use of building design/architectural elements or landscape treatments to block or reduce excessive light spill to locations where it would cause a nuisance to residents or the general public; and c. Alignment of streets, driveways and servicing areas to minimise vehicle headlight impacts on adjacent residential accommodation.
Short Term Accommodation	**DS20.1** For Short Term Accommodation involving more than two units, density is to be a minimum of 35 dwellings/ha, calculated over the site on which it is located. **DS20.2** For all Short Term Accommodation uses involving more than two units, the building is sited and designed such that: a. The main pedestrian entrance to the building (or group of buildings) is located on the primary street frontage; b. Access from the street to the entrance of the building(s) or individual dwellings is easily discerned; c. Vehicular access to the site is separate from the pedestrian access;

DESIGN STANDARD	
Short Term Accommodation (cont.)	d. Street and parkland frontages comprise 'semi-active uses/spaces such as habitable rooms of dwellings or rooming units, common recreating areas (indoor and outdoor) and landscaped areas, to facilitate casual surveillance; and e. The number of dwellings, rooming units, windows and balconies of habitable rooms that address adjoining streets communal recreation areas and open spaces is optimised. **DS20.3** Non-habitable room widows of one rooming unit is not located opposite windows of another dwelling or rooming unit unless views are controlled by screening devices, distance, landscaping or design of the opening. **DS20.4** Where habitable room windows look directly at habitable room windows in an adjacent rooming unit within 2 metres at the ground storey, or 9 metres at levels above the ground storey, privacy is protected by: a. Window will heights being a minimum of 1.5 metres above floor level; or b. Fixed translucent glazing being applied to any part of a window below 1.5 metres above floor level; or c. Fixed external screens; or d. If at ground level, screen fencing to a minimum height of 1.8 metres. **DS20.5** The length of any unarticulated elevation of a building, fence or other structure visible from the street does not exceed 15 metres. **DS20.6** Any car parking area or other associated structures are integrated into the design of the development such that: a. They are screened from view from frontages to streets, parks and adjoining land; b. They are not located between the building and the street address; and c. A basement or undercroft car parking area does not protrude above the adjacent ground level by more than 1m. **DS20.7** The site cover of Short Term Accommodation buildings does not exceed 70%. **DS20.8** Building setbacks comply with those specified for the Precinct which it is located and ***Table 49, 50***. **DS20.9** Except where specified otherwise in a Sub-Precinct specific provisions; a. A 2 metre wide landscaped buffer strip is provided along the full frontage of the site; b. At least 10% of the site area is provided as communal open space exclusive of required buffer strips and clothes drying areas; and c. A minimum 1.8 metre high solid screen fence is provided and maintained along the full length of any side or rear boundary.

DESIGN STANDARD	
Short Term Accommodation (cont.)	DS20.10 For all Short Term Accommodation involving more than two units: a. Each ground floor rooming unit has a courtyard or similar private open space or not less than 15m² with a minimum dimension of 3m directly accessible from the main living area; b. Each rooming unit above ground level has a balcony or similar private open space area of not less than 9m² with a minimum dimension of 3m directly accessible from the living area of the dwelling or rooming unit. DS20.11 Building bulk is reduced by incorporating a combination of the following elements in building design: a. Variations in plan shape, such as curves, steps, recesses, projections or splays; b. Variations in vertical profile, with steps or slopes at different levels; c. Variations in the treatment and patterning of windows, sun protection and shading devices, or other elements of a façade treatment at a finer scale than the overall building structure; d. Balconies, verandahs or terraces; and e. Planning, particularly on podiums, terraces and low level roof decks. DS20.12 Entry areas for the residents and visitors are provided separately from entrances for other building users and provide: a. For safe entry from streets, car parking areas and servicing areas; b. Clearly marked, safe and secure parking areas are provided for residents and visitors which is separate from parking areas provided for other building users; and c. Security measures are installed such that building users do not have access to areas that are intended for the exclusive use of residents and visitors.
Showroom	DS21.1 Where in a complex, not more than 20% of the gross floor area is occupied by uses other than showrooms. DS21.2 Where addressing a Primary Frontage the ground level: a. Presents a minimum 50% of the building as openings and windows; and b. Provides an awning to the street 3m in width. DS21.3 Where addressing a Secondary Frontage the ground level: a. Presents a minimum 50% of the building as openings and windows; and b. Provides an awning to the street 3m in width.

DESIGN STANDARD	
Tele-communications Facility	DS22.1 Telecommunications facilities co-locations are to be located on an existing or proposed building and to be integrated within the building and are not to adjoin a residential use.
Utility Installation	DS23.1 Where practicable, the utility is co-located with another utility of a similar or compatible type. DS23.2 The utility is located in a position where it can be easily accessed for maintenance purposes or at times of emergency. DS23.3 Security fencing is provided to prevent unauthorised entry to the utility. DS23.4 Safety and warning signage is displayed where necessary. DS23.5 The location of any Utility Installation does not impact on the functionality of verges or public open space and is not in visually prominent areas.

TABLE 49: HIGH RISE AND MEDIUM RISE SETBACKS

	HIGH RISE (7+ STOREYS)		MEDIUM RISE (3-6 STOREYS)	
	Residential elements	**Non-residential elements**	**Residential elements**	**Non-residential elements**
Maximum podium height	3 storeys		2 storeys	
Front setbacks (min)				
Ground Floor				
• Active frontage*	0.0m	0.0m	0.0m	0.0m
• Non-active frontage	2m	2m	2m	2m
Tower				
• Tower setbacks	6m	4m	3m	3m
Side setbacks (min)				
• Levels 1-3**	Where adjoining a non-residential use or the minimum setback on the adjoining boundary is 0.0m, rear setback is 0.0m Otherwise: • 1.5m for a wall up to 4.5m high • 2m for a wall up to 7.5m high • 2m plus 0.5m for every 3m (or part thereof) over 7.5m high for a wall over 7.5m high, except that a wall may be built to a side boundary where the wall has a maximum height of 3m and a maximum length of 15m, unless it abuts a higher or longer existing or simultaneously constructed wall.			
• Levels 4-8	3.0m			
• Levels 9+	6.0m			
Rear setbacks (min)				
• Levels 1-3**	Where adjoining a non-residential use or where the existing minimum setback on the adjoining boundary is 0.0m, rear setback is 0.0m. Otherwise: 3.0m			
• Levels 4+	6.0m			

* A site may have more than one active frontage as identified in a development scheme or approved plan of development. An active frontage can include a frontage to a park.

** Or such higher podium level as may be specified in a development scheme or approved plan of development

TABLE 50: BUILDING SEPARATION DISTANCES

	HIGH RISE (7+ STOREYS)		MEDIUM RISE (3-6 STOREYS)	
	Residential elements	**Non-residential elements**	**Residential elements**	**Non-residential elements**
Privacy	Building design must ensure privacy for habitable spaces in dwellings. Acceptable treatments include: • Providing a minimum separation distance of: - Where 7 storeys and greater, 18m between balconies that are offset by less than 45 degrees or 12m between balconies that are offset by 45 degrees or more - Where 6 storeys or less, 12m between windows or between a window and a balcony that are offset by less than 45 degrees, or 9m between windows or between a window and a balcony that are offset by 45 degrees or more, or - For a wall containing windows or balconies, 6m to a side or rear boundary where there is no existing or approved development and the future privacy and development potential of the adjoining site should be protected. • Window sill heights a minimum of 1.5m above floor level • Fixed opaque glazing in any part of a window below 1.5m above floor level • Fixed external screens to balconies or windows (or intermediate fencing at ground level). External screens or fences provided to ensure privacy should be either solid, of translucent material or present an appearance of no more than 25% openings when viewed from the nearby balcony or window.			

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Appendix C – Caloundra South Development Flood Risk Management Strategy (BMT)

BMT WBM

"Where will our knowledge take you?"

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2013/469

Date: 09/11/2016

Queensland Government

Caloundra South Development:
Flood Risk Management Strategy

October 2015



Stockland

Caloundra South: Flood Risk Management Strategy

Prepared for:	Stockland
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Synopsis: This report presents the flood risk management strategy for the proposed 'Caloundra South' master-planned community.

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Executive Summary

BMT WBM has been commissioned by Stockland (in support of a Development Application to the Minister for Economic Development Queensland) to prepare a Flood Risk Mitigation Strategy for the 'Caloundra South' master-planned community (hereafter referred to as 'the site'), located on the Sunshine Coast. This report has been prepared in support of a Reconfiguration of Lot application for the Town Centre of the proposed Caloundra South development.

While this report supports the Town Centre application, the flood impacts for the full Caloundra South development have been assessed. This ensures that the flood strategy for the overall development mitigates the overall flooding constraints. However, the flood impacts for the Town Centre area and previous RoL application areas without the remaining proposed development across the PDA have also been checked to ensure that the proposed development works (from a flooding perspective) in isolation. The proposed development will include a variety of land uses including residential lots, retail and commercial areas, sports and recreational areas, and public open spaces.

A portion of the broader Priority Development Area (PDA) drains to Lamerough Creek, which discharges to the Pelican Waters canal estate and subsequently Pumicestone Passage. The remainder of the PDA and the Town Centre area flows towards Bells Creek (via Bells Creek North and Bells Creek South) and subsequently Pumicestone Passage.

This flood risk management strategy describes what areas of the site are susceptible to flooding and what strategies can be implemented to manage the flood risk of the proposed development. It is the objective of this assessment to ensure no adverse impact on flood inundation of properties outside the site, whilst simultaneously providing appropriate levels of flood immunity for those areas of the site to be developed for urban uses.

This investigation includes the following key activities:

- Development of site hydrologic and hydraulic models for the existing and developed site
- Testing and evaluation of a range of potential site development/floodplain management scenarios to support the selection and design of an appropriate flood risk management strategy
- Refinement of the preferred design solution to ensure no adverse offsite impacts and to optimise site design characteristics.

This study has shown that portions of the existing site are flood prone, but flood risk in areas outside the immediate proximity of waterway corridors is extremely low.

Having identified the above and developed robust numerical models of key flooding processes, evaluations were conducted on mitigation measures to ensure the development can proceed without unacceptable or detectable offsite impacts. In summary, these proposed mitigation measures are as follows:

- The site will be configured with relevant dedicated flood detention storage, flood conveyance and other appropriate mitigation measures to ensure no offsite impacts
- Land within the site boundary, proposed for development, will be filled (where required) to ensure flood immunity in the 100 year average recurrence interval flood event with consideration of climate change.

The site can be developed in a manner which will provide appropriate levels of flood immunity within Caloundra South (including the potential influences of future climate change factors such as sea level rise and increases in rainfall intensities). Furthermore, the development can occur with no adverse offsite flooding impacts.

Small impacts in flood level (50mm) upstream of the Bruce Highway on Bells Creek North do occur when considering the overall development across the full PDA; peak flood levels remain below the Bruce Highway road level. However, these impacts are not caused by the Town Centre development. Also, an application for a borrow pit west of the Bruce Highway is being lodged separately with Council. This borrow pit will eliminate the flood impacts in the vicinity of the highway by creating additional flood storage. The flood impact, and opportunities to reduce them, will be revisited in this area prior to the RoL application for this area.

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1 Introduction

BMT WBM has undertaken numerous flooding assessments of the proposed mixed use development for the Caloundra South Priority Development Area. The previous assessments were undertaken to support EPBC Act, Material Change of Use (MCU) and Reconfiguration of Lot (RoL) approvals, as well as to inform the design of proposed development. The work documented in this report builds on the previous work in support of a RoL application for the Town Centre area.

The purpose of this Flood Risk Management Strategy is to inform Stockland and Economic Development Queensland (EDQ) about the strategies that have been developed to manage flood risk within the proposed Caloundra South Priority Development Area (PDA), and the impact these strategies have on flooding. As such, the Flood Risk Management Strategy aims to ensure:

- The proposed development is not subject to an unacceptable level of flood risk (including consideration of climate change);
- The proposed development does not worsen flood risk or flood warning times external to the PDA; and
- Peak flows downstream of the site are not increased by the proposed development.

The main elements of the flood risk management strategy are as follows:

- Develop flood models to define the flooding characteristics of the pre and post developed Caloundra South site;
- Determine the flood impacts caused by the proposed development;
- Develop strategies to mitigate flood impacts; and
- Identify what actions are required to manage flood risk.

While this report has been prepared specifically to support the RoL application for the Town Centre area, the broader Caloundra South development has been considered to ensure that flooding constraints have been mitigated within the context of the broader development. However, the flood impacts for the Town Centre area and previous RoL application areas excluding the remaining proposed development across the PDA have also been checked to ensure that the proposed development works (from a flooding perspective) in isolation.

2 Site Description

2.1 Location

The Caloundra South site is located within the Sunshine Coast Regional Council area, to the east of the Bruce Highway and to the south-west of Caloundra. This report supports a RoL application for the Town Centre area. The locality of the site surrounding the Town Centre is presented in Figure 2-1, and the broader PDA in Figure 2-2.

The Caloundra South PDA covers an area of approximately 2,400 hectares and has been identified under the SEQ Regional Plan as being contained within the Urban Footprint.

2.2 Site Topography and Drainage

There are three watercourses that flow through the Caloundra South PDA – Lamerough Creek, Bells Creek North and Bells Creek South. On site, these three watercourses are characterised by a network of smaller channels with a relatively wide and flat floodplain. The site generally slopes downwards to the east with a typical channel slope of about 1 in 400 to 1 in 500 in the upper reaches (western part of the Caloundra South PDA).

Further downstream, the eastern part of the Caloundra South PDA is characterised as typical coastal plains. In this area, the site is relatively flat with ground levels generally ranging between 1m AHD and 2m AHD (around the eastern boundary of the site).

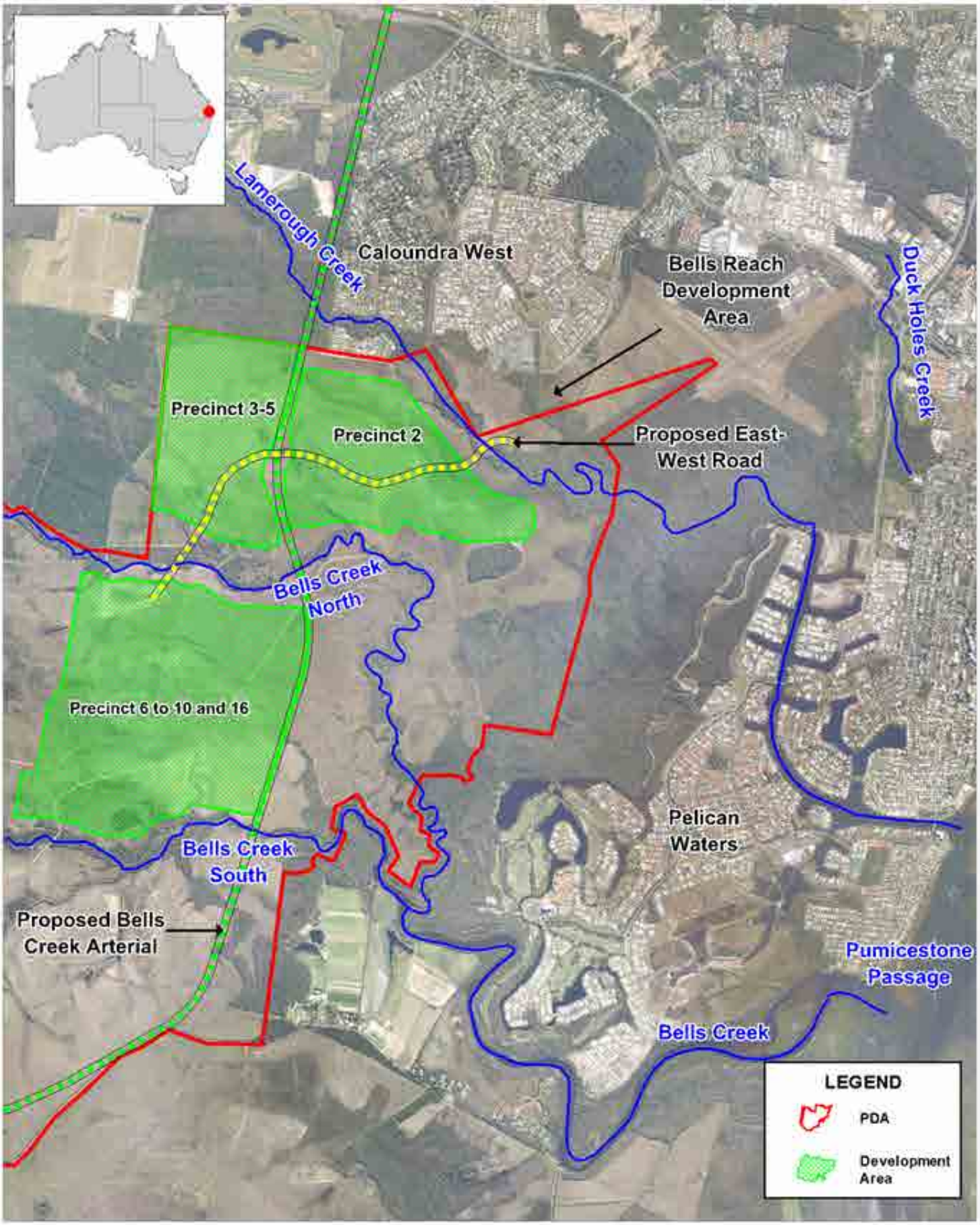
The highest ground elevations on the Caloundra South site occur adjacent to the Bruce Highway with levels of up to approximately 31m AHD in these areas.

The topography of the existing site is shown in Figure 2-2 (based on a LiDAR survey flown in 2012).

2.3 Existing Land Usage

The existing site is a highly modified catchment largely cleared and denuded of vegetation through previous forestry and grazing practices. The site is currently being actively grazed by cattle. Landuse downstream of the site includes a turf farm, golf course and urban development. The BMT WBM (2011)"*Caloundra South Consolidated Water Report*" further describes the temporal land use changes across the Caloundra South area.

An aerial photo of the site is provided in Figure 2-1. Images of the existing site are presented in Figure 2-3.



Title:

Locality Map

Figure: 2-1

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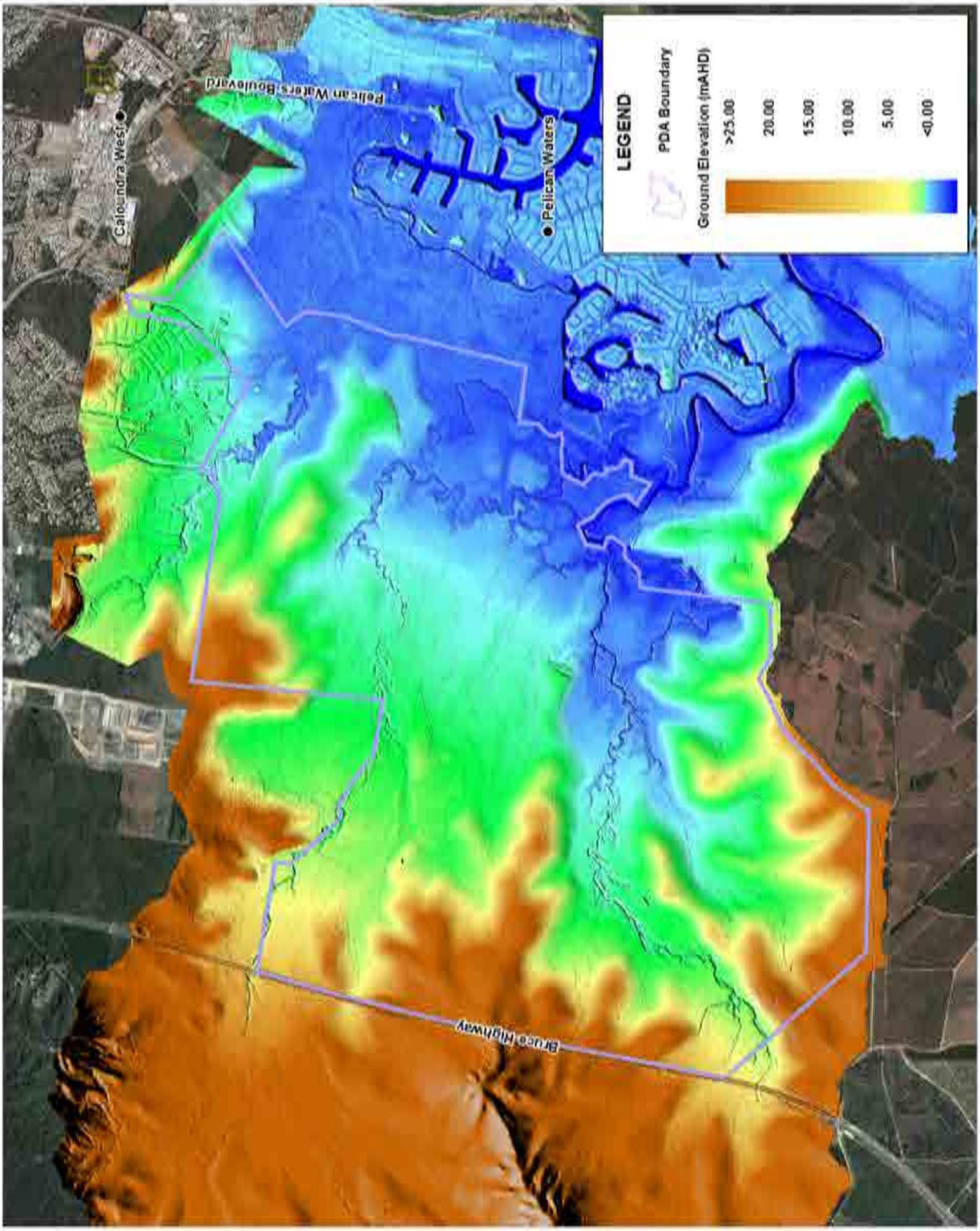
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Title:
Existing Topography of Site

Figure:
2-2

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Figure 2-3 Images of the Caloundra South PDA

2.4 Proposed Development

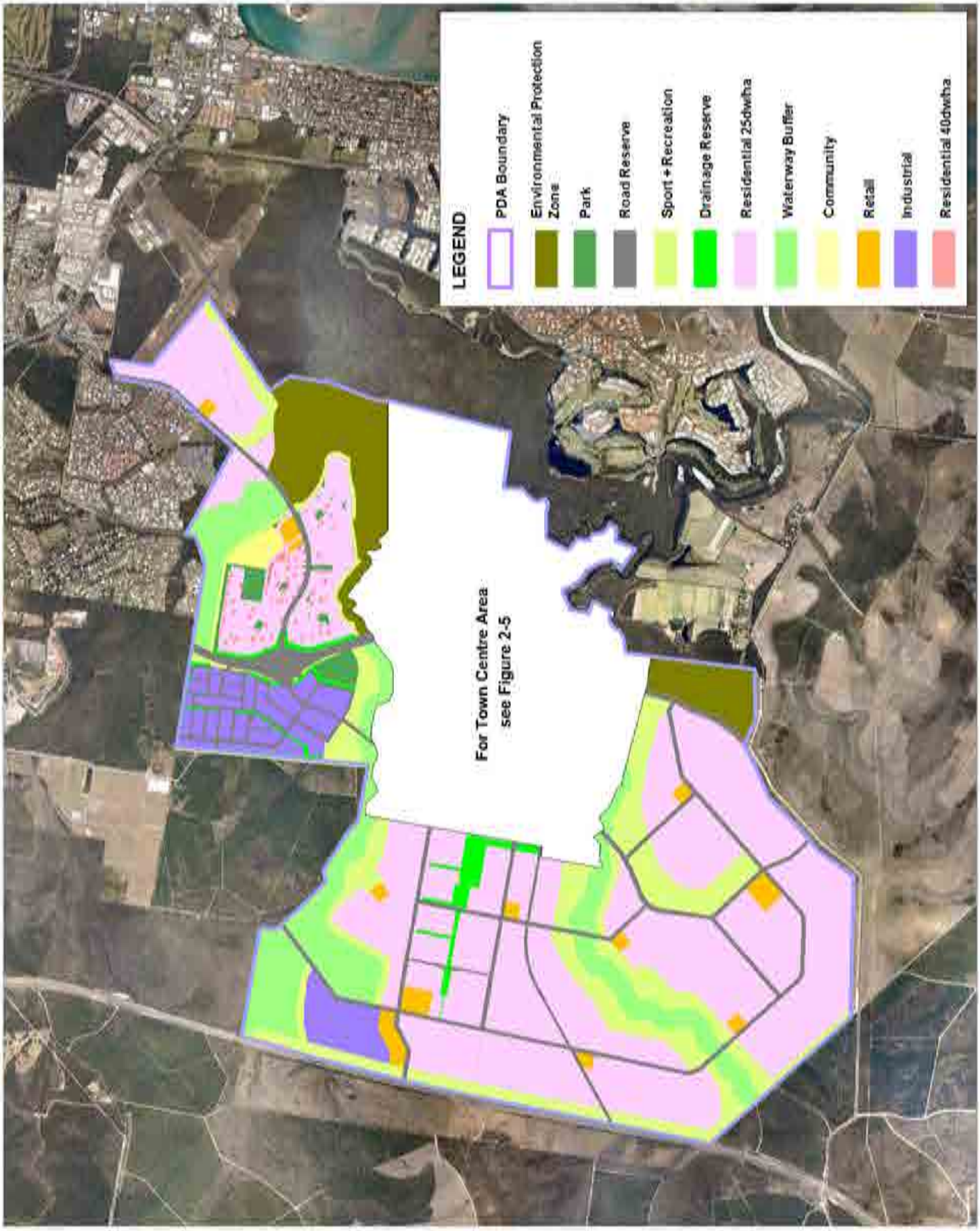
The proposed development of the site includes a variety of land uses including residential and commercial areas, sports and recreational areas and public open spaces. A general layout plan of the proposed development over the Caloundra South PDA is provided in Figure 2-4 and Figure 2-5 shows the layout for the Town Centre area. Features of the development that constitute components of the flood mitigation strategy are discussed in Section 5.

The creek frontages along the northern and southern edges of the Town Centre include proposed recreational areas. The proposed ground levels moving from the urban development through the recreational areas and into the floodplain are proposed to cascade through diminishing flood immunities. The flood immunities are shown in Figure 5-1.

The proposed Bells Creek Arterial road crosses Bells Creek North on the northern side of the Town Centre and Bells Creek South on the Southern side of the Town Centre. The Bells Creek South crossing is a key component of the flood mitigation strategy as discussed in Section 5. The Bells Creek North crossing comprises a 100m span bridge. While it's not a specific component of the flood mitigation strategy, the Bells Creek North crossing restricts the passage of flood flows through Bells Creek North, thereby providing additional flood detention and a flood risk benefit to downstream communities.

The proposed development also includes an overland flow reconfiguration along a section of Bells Creek South immediately south of the Town Centre. The aim of the reconfiguration is to create additional wetland immediately south west of the Town Centre. The impact of this proposal was investigated prior to this RoL application. The investigation showed that the proposed reconfiguration did not cause an increase in velocity downstream of the proposed reconfiguration. See Appendix D for a discussion on the investigation.

It is noted that the configuration of the overland flow path has been adjusted since the worked discussed in this report was completed. The adjustment includes a bend in the alignment. This change makes no difference to the outcomes of this report, as changes in flood levels will be small and only occur in close proximity to the reconfigured overland flow path. Small localised changes in flood level can easily be accommodated by adjustments to the flood planning level (and fil level) on the southern side of the Town Centre. The future proposed alignment will be subject to detailed design and will be reassessed at Operational Works Stage.



Title:
Proposed Site Layout

Figure: 2-4

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Title:
Town Centre Layout

Figure: 2-5

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3 Assessment Approach

3.1 Preamble

This flood risk assessment utilises a number of computer based flood models in determining flood risk and developing mitigation strategies. The term 'flood model' is used in this report to refer to the hydrological and hydraulic models in combination. The hydrological models were used to estimate runoff rates through the site based on design rainfall events, and the hydraulic models to estimate the hydraulic properties of flood flows (such as flood levels and depths) within the site based on the runoff rates derived from the hydrological models.

The reason for developing flood models of the site is that they were essential tools for assessing flood risk within the vicinity of the proposed development, as well as the effects of the development on flood risk external to the Caloundra South PDA.

The river systems through the Caloundra South PDA are ungauged. Therefore, it has not been possible to calibrate the model against observed catchment rainfall runoff conditions. Appropriate, conservative model parameters have been adopted.

Appendix C provides a detailed description of the modelling methodology applied in this assessment.

3.2 Flooding Mechanisms

Two flooding mechanisms have been considered in the analysis:

- Fluvial flooding derived from precipitation over the Bells Creek and Lamerough Creek catchment; and
- Tidal flooding derived from ocean storm surges.

These two flooding mechanisms were considered to occur independently. This approach is consistent with a previous SKM flood study of the site, which justifies the approach on outcomes from a joint probability analysis undertaken by Connell Wagner (SKM 2006, Connell Wagner 2005).

The 100 year ocean storm surge in the vicinity of Golden Beach has been reported as 1.95mAHD (Connell Wagner 2003) and 1.65mAHD based on "*Sunshine Coast Storm Tide Study*" (Aurecon, 2013). The latter, more contemporary, 1.65mAHD level has been adopted. Fluvial flood levels are much higher in the vicinity of the proposed development. The creek banks in the vicinity of the proposed development are higher than the 100 year ocean storm surge flood level. Thus, tidal flooding does not pose a significant flood risk to the proposed development and has not been modelled under current climate conditions.

However, the 100 year ocean storm surge level under a future climate (with sea level rise) results in a more notable flood risk in the vicinity of the site. Thus, for the climate change scenario the 100 year ocean storm tide level was merged with the 100 year fluvial peak flood level to establish the overall 100 year peak flood level. This approach ensures that the proposed development is above the 100 year flood level including climate change for both flooding mechanisms.

For the fluvial flooding mechanism, two critical storm durations were modelled. The critical storm durations adopted in the 2006 SKM flood study (i.e. 6 hours and 12 hours) was used for this flooding assessment. These storm durations were verified by BMT WBM via a critical duration assessment on the 100 year ARI flood event.

The two critical durations were modelled independently. The 6 hour storm duration results in higher flood levels along Bells Creek North, upstream of the detention basin on Bells Creek South and Lamerough Creek. The 12 hour duration storm results in higher flood levels in the Environmental Protection Zone downstream of the proposed development and at the detention basin on Bells Creek South (proposed as part of the development of the site).

4 Pre-developed Flooding Conditions

4.1 Preamble

The flood model for the Base Case (i.e. pre-developed situation) was simulated for the 1, 2, 5, 10, 20, 50 and 100 year ARI design fluvial flood events. The resulting peak flood levels (also showing flood extent), peak flood depth and peak flood velocity are presented in Appendix D. Results were derived by merging the peak 6 hour storm duration model results with the peak 12 hour storm duration model results.

4.2 Pre-developed flooding results

The existing flooding behaviour of the Caloundra South PDA and surroundings is characterised as follows:

- The critical storm duration varies throughout the site with the shorter events critical in the upper part (Bells Creek North, Bells Creek South and Lamerough Creek) and storm tides critical in the low lying areas (downstream of the site).
- The general flooding pattern for larger flood events is characterised by diffuse overland flows with relatively wide and shallow inundated areas. The inundated areas are generally centred around Bells Creek North, Bells Creek South and Lamerough Creek.
- The area downstream of the proposed development area, (i.e. adjacent to Pelican Waters and the airstrip) is characterised by extensive flooding that stores large volumes of flood water. Flood depths in this area reach up to approximately 4m during the 100 year ARI event. Flood water is mostly slow flowing in this area with flow velocities generally less than about 0.1m/s during most events.
- The maximum inundation depth within the proposed development area is generally low and less than 0.5m at most locations during the 100 year ARI event. An exception is the area located directly west of the proposed town centre, where there is an overland flow path during major events.
- Flow velocities of overland flood flows are generally low, with peak flow velocities during the 5 year ARI flood event typically less than 0.2m/s and peak velocities during the 100 year ARI event typically less than 0.3m/s. An exception is the area immediately to the west of the proposed town centre where, during major flood events, flow velocities up to about 0.5 m/s are predicted.

5 Flood Risk Mitigation Strategy

5.1 Preamble

In general, without mitigation measures, proposed development has the potential to affect flooding in the following ways:

- The paved areas associated with urban areas of proposed development have the tendency to reduce infiltration of rainfall into the ground and cause a quicker and more intense flood water runoff response during storm events. This can lead to earlier and greater peak creek inflows.
- In areas where fill is proposed in the floodplain to provide onsite flood immunity, existing floodplain flow paths may be obstructed. This can impact on the hydraulic conveyance of the creek systems and distort flooding behaviour offsite. In addition, fill can reduce the floodwater storage capacity of a floodplain, resulting in an increase in flood levels both onsite and in areas upstream and downstream of the development.

This flood risk management strategy report shows how the Caloundra South PDA development can be implemented without causing adverse implications for flood risk such as those described above.

5.2 Flood Risk Mitigation Strategy

The flood model was iteratively adapted during this study to develop the proposed flood mitigation concepts. Several key flood mitigation features are included in the proposed site layout (see Figure 5-1):

- Raise developed ground levels (fill) within the proposed development to mitigate flooding to the proposed development. Flood immunities are shown on Figure 5-1.
- Implementation of drainage channels to drain flood water from the various Bruce Highway culvert crossings to the creeks.
- The Bells Creek Arterial road embankment has been used to form an ‘online’ detention basin on Bells Creek South. The culvert configuration has been designed to ensure low flows can pass through the basin while high flows are ‘throttled’, minimising flooding impacts downstream of the site. One set of culverts consisting of three 3000 x 900 RCBCs is proposed to be located within the creek channel and one set of culverts consisting of five 3000 x 900 RCBCs is proposed to be located on the flood plain.
- An area of 24ha within the Bells Creek South floodplain is proposed to be lowered to provide additional floodwater storage capacity. Proposed ground elevations in this detention area vary between 2.75mAHD and 3.75mAHD (an average lowering of about 1.1m).

Title:
Proposed Flood Mitigation Strategy

Figure:
5-1

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6 Developed Case Flood Conditions

6.1 Caloundra South PDA Development

The results of the developed case flooding assessment are presented in Appendix E of this report. Appendix E shows the peak flood surface levels, peak flood depths and peak flood velocities for the developed case with development layout and mitigation strategy outlined above. The following points are made in this regard:

- Flood flows are generally contained within Bells Creek North during major flood events. Of particular note in this regard is the obstruction of flood flows through the proposed Caloundra South development. The pre-developed flood simulations predicted diffuse overland flow through this area. Due to filling within the proposed urban footprint, flood flows will be contained within the Bells Creek North drainage corridor.
- The detention basin within Bells Creek South is predicted to detain flows during major flood events, causing inundation of the floodplain west of the proposed Bells Creek Arterial.

6.2 RoL Application Area (Precincts 1 to 10 and 16)

A developed case flooding assessment was also undertaken excluding the full Caloundra South PDA development. These results account only for development for which RoL applications have been lodged and the Town Centre area. The proposed development for this scenario includes the following:

- Precinct 1 – Bells Reach area off the eastern bank of Lamerough Creek;
- Precinct 2 – Residential development area off the western bank of Lamerough Creek;
- Precinct 3 to 5 – Commercial development area east of Precinct 2 (divided by the Bells Creek Arterial) and off the northern bank of Bells Creek North;
- Precinct 6 – Bells Creek North corridor along northern edge of the Town Centre;
- Precinct 7 to 10 – Town Centre area;
- Precinct 16 – Bells Creek South corridor along southern edge of the Town Centre area;
- The Bells Creek Arterial Crossing over both Bells Creek North and Bells Creek South; and
- Ground lowering in the Bells Creek South floodplain to create flood storage.

This assessment was undertaken primarily as a check on flood impacts. Therefore, only flood impact maps for this case have been presented in this report (see Section 7.2).

7 Flood Assessment

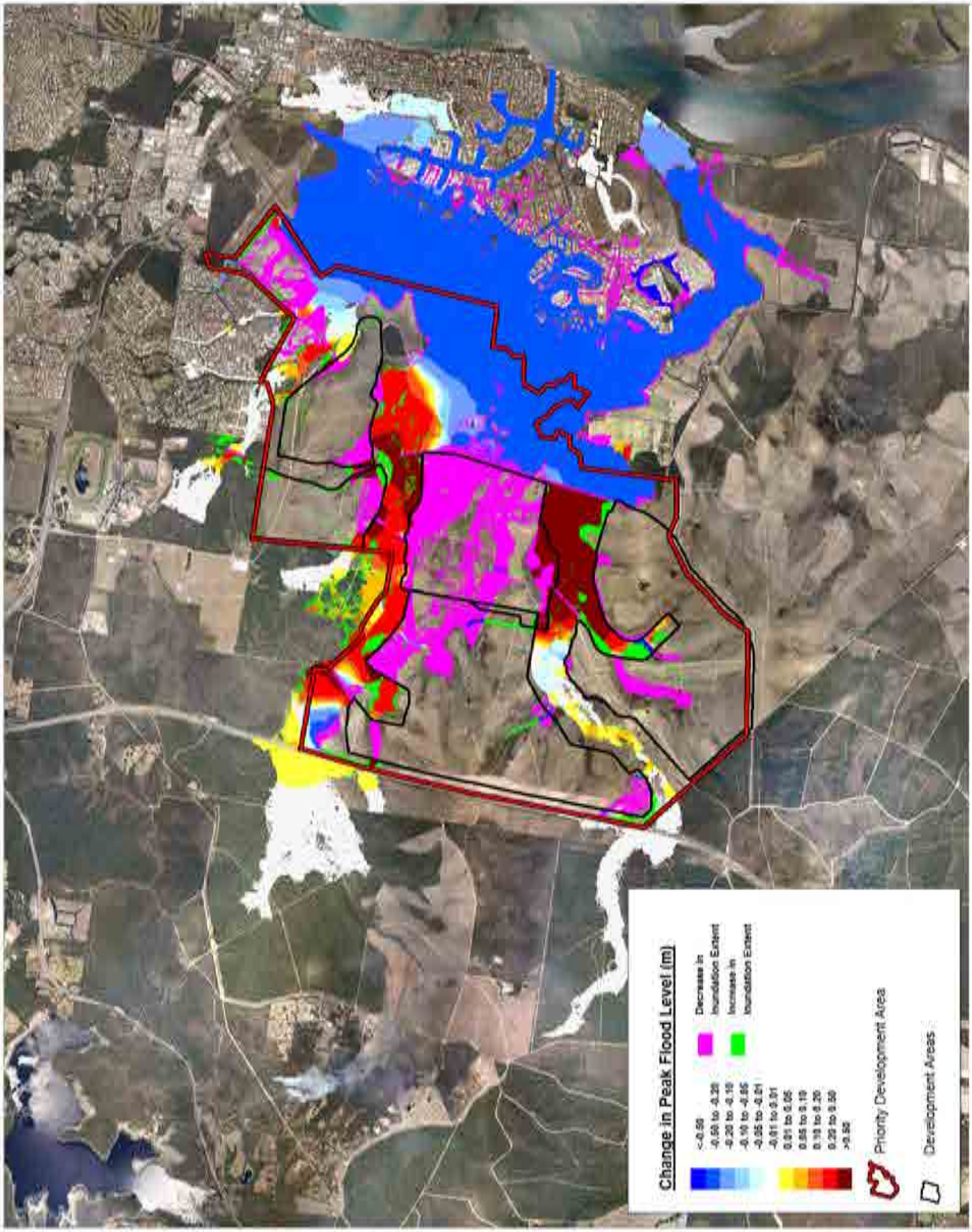
7.1 Flood Impact Assessment – Full Caloundra South PDA

Peak flood levels for the developed case were compared with those of the Base Case to investigate the influence of the proposed development on flood risk. Figure 7-1 shows the impacts of the proposed works on peak flood levels.

The flood modelling indicates that 100 year ARI peak flood levels in the areas adjacent to Pelican Waters will generally decrease by 200mm to 250mm. There are generally no adverse flood impacts outside the PDA, apart from two areas:

- Upstream of the Bruce Highway on Bells Creek North impacts of up to 50mm occur and peak flood levels remain below the Bruce Highway road level. Much of this land is owned by Stockland. However, a small portion belongs to another landholder. The impact is caused by a combination of backup from a proposed road crossing 1km downstream of the Bruce Highway and proposed riparian vegetation reestablishment. The relative contribution of these influences has not been investigated at this stage. The flood impact, and opportunities to reduce them, will be revisited in this area prior to the RoL application for this area. The proposed Town Centre development does not cause flood impacts in this area (see Figure 7-4). An application for a borrow pit west of the Bruce Highway is being lodged separately with Council. This borrow pit will eliminate the flood impacts in the vicinity of the highway by creating additional flood storage.
- The undeveloped floodplain on land currently owned by Council, external to the PDA on the northern bank of Bells Creek North shows some flooding impacts. The following comments are made in regard to this area:
    - There are three flooding mechanisms:
        - A drainage path flowing in a south easterly direction draining the local sub-catchment runoff towards Bells Creek North. The lower part of this drainage path, where it meets the proposed development, incurs flood impacts of up to 250mm at the PDA boundary. The impact abates to negligible impact 200m upstream.
        - A floodplain (100m to 150m wide) off the northern bank of Bells Creek north conveying floodwaters parallel to the creek. The flood impacts are generally less than 100mm.
        - Diffuse flooding in the forest caused by flood waters breaking out of Bells Creek North flowing in a northerly direction into the forest along forest tracks and depressions. The impacts associated with this mechanism are generally less than 150mm for the 100 year and 50 year events.
    - These flood impacts are caused by proposed raised ground levels (fill) in the floodplain and the link road crossing across Bells Creek North. Modifications to the proposed development have been implemented to abate these impacts. This includes, truncating a portion of the developable footprint and adding culverts to the Link Road crossing.
    - The extent of flooding in this area is predicted to increase by approximately 30% in the 100 year event.

- Given that the subject area is used for pine plantation, the flood impact caused by the proposed development will not significantly increase the potential for actionable nuisance and real flood damage arising from flood events over the existing situation.
- The predicted flood impacts are small and mostly on land that is currently under risk of flooding. Future development on this land would require flood mitigation regardless of the Caloundra South development, and the flood risk strategy developed for this area could easily account for the increases in flood levels. Therefore, the proposed Caloundra South development is not expected to inhibit the future development potential of the subject area.
- While there are slight differences in the flood impacts across Council's land (due to the use of more contemporary topographic data and alterations to the Town Centre concept design) **the flood impacts are, on average, no different to that assessed for the previous Precincts 3 to 5 RoL approval**.



Title:
100 Year ARI Difference in Peak Flood Levels

Figure: 7-1

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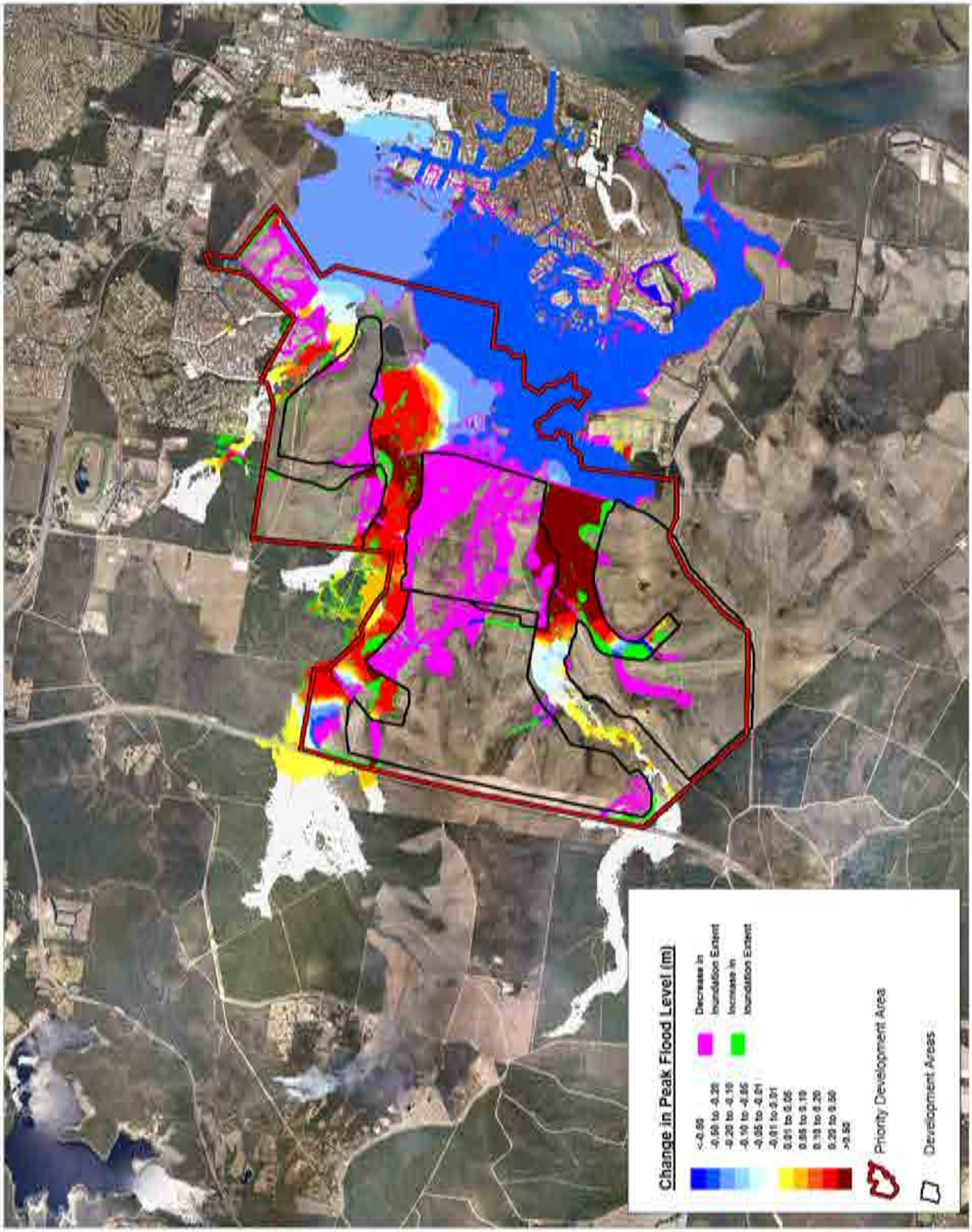
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Title:
50 Year ARI Difference in Peak Flood Levels

Figure: 7-2

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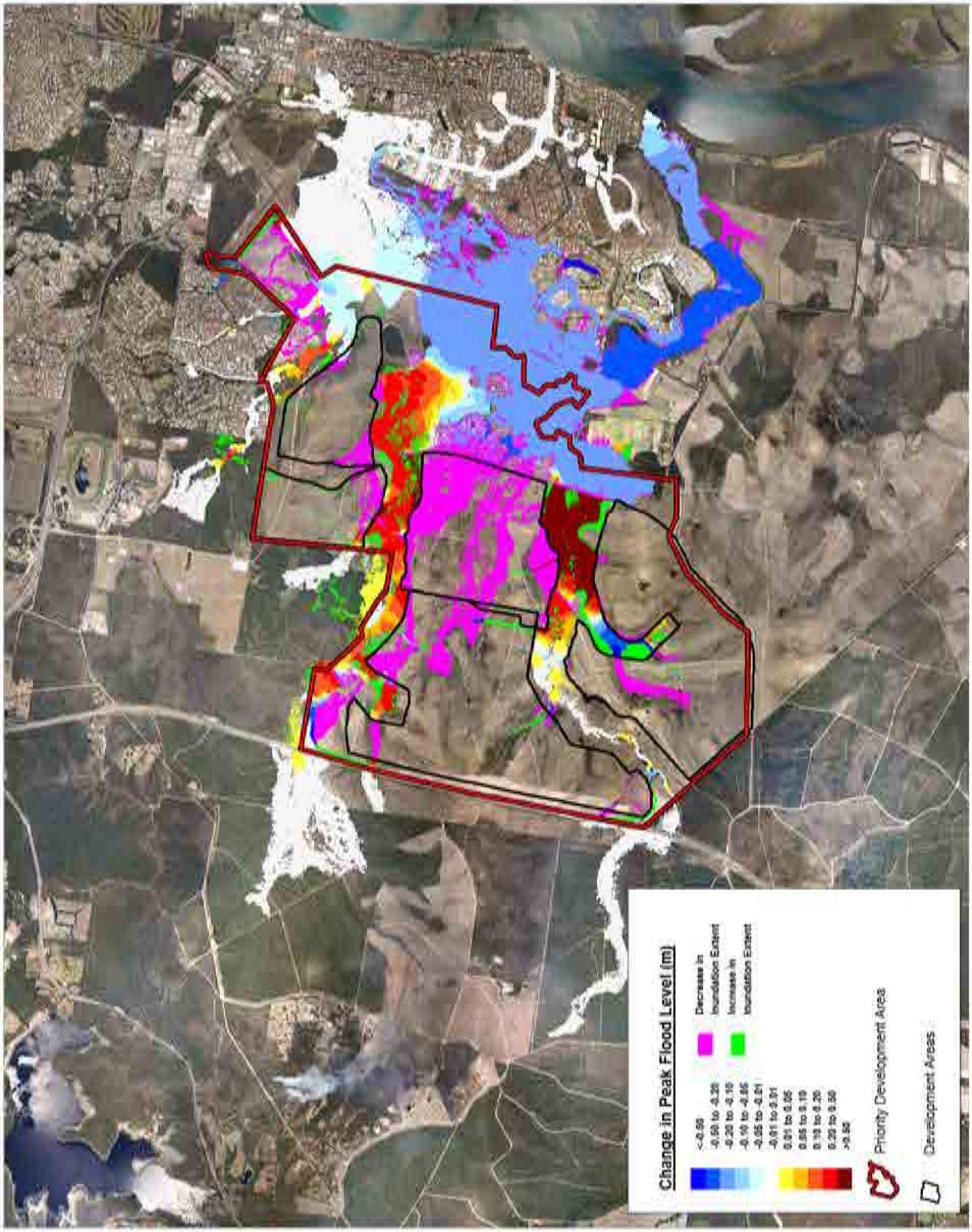
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Title:

5 Year ARI Difference in Peak Flood Levels

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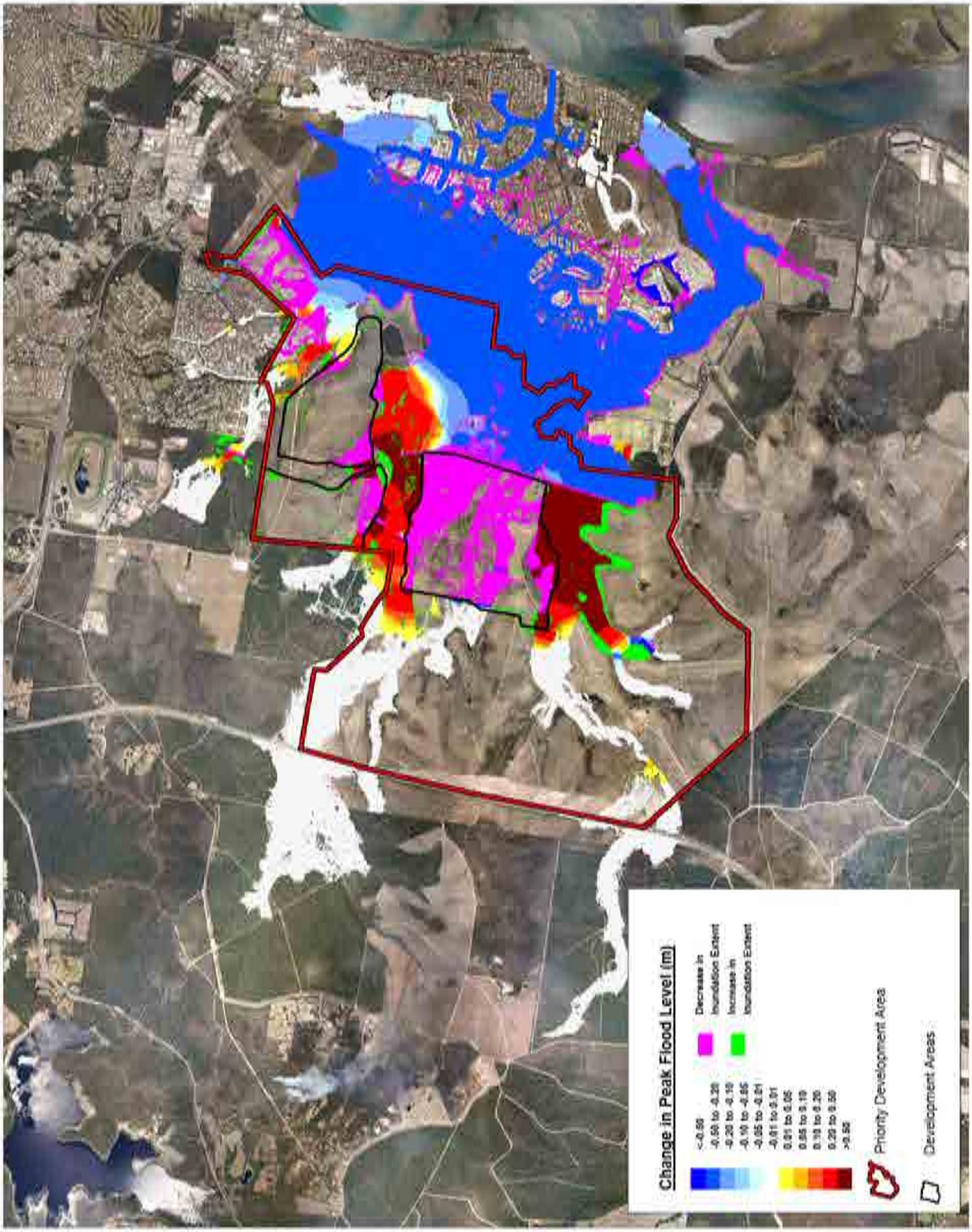
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7.2 Flood Impact Assessment – RoL Application Areas

The flood impacts have also been investigated for the RoL application areas in isolation from the remaining development. The results are presented in Figure 7-4 to Figure 7-6.

The following comments on the flood impacts are made:

- Similar to the full PDA development assessment, increases in flood levels are generally contained within the PDA
- Similar to the full PDA development assessment, flood levels are predicted to reduced downstream of the proposed development
- There are no flood impacts in the vicinity of the Bruce Highway
- Similar to the full PDA development assessment, there is predicted to be an increase in peak flood level in a small area external to the PDA on land owned by Council. However, the impact is less pronounced than for the full PDA assessment and is consistent with the RoL approval for Precincts 3 to 5.



Title:

100 Year ARI Difference in Peak Flood Levels Development Areas

Figure: 7-4

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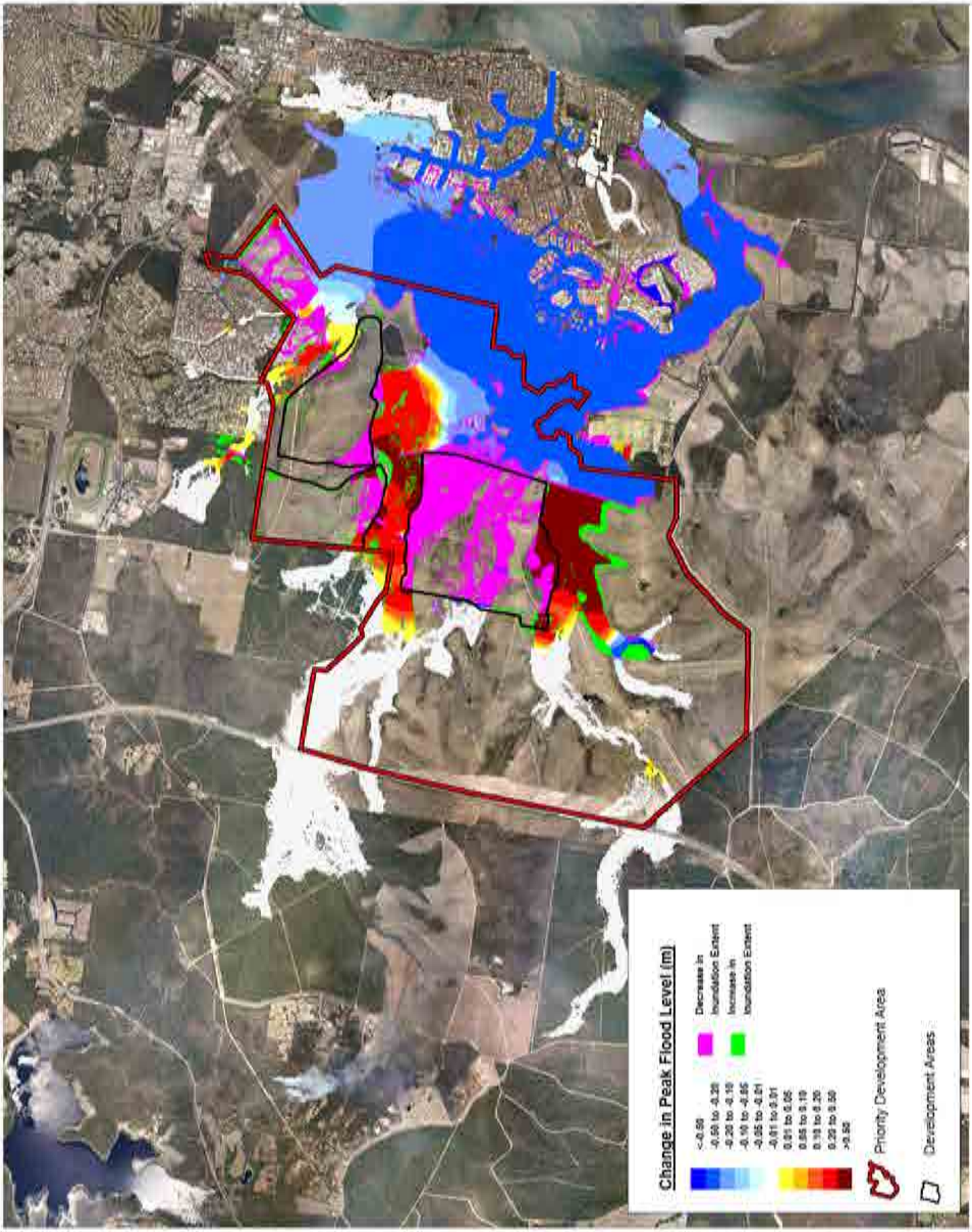
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Title:
50 Year ARI Difference in Peak Flood Levels Development Areas

Figure: 7-5

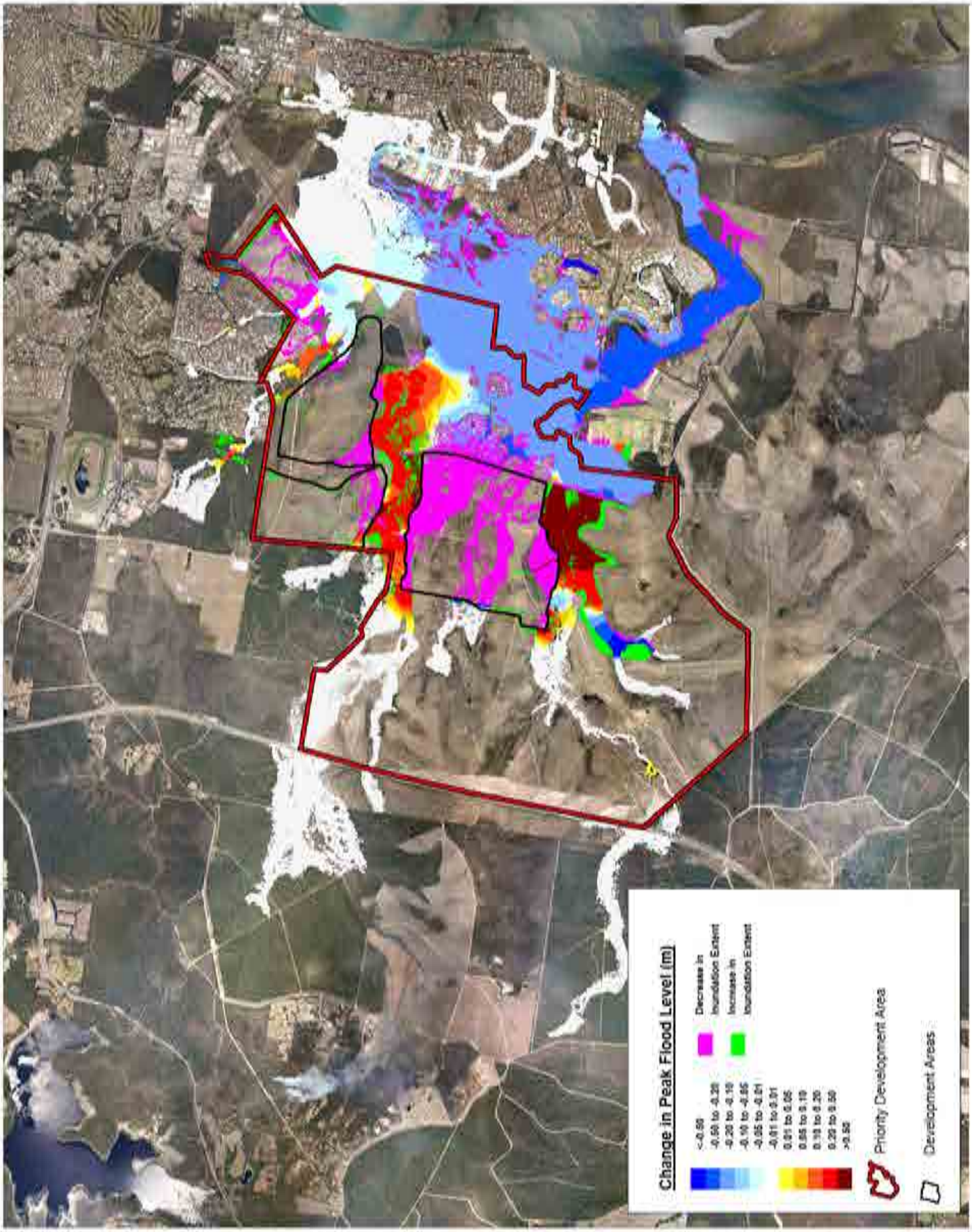
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Title:

5 Year ARI Difference in Peak Flood Levels Development Areas

Figure: 7-6

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7.3 Changes in Flow Magnitudes and Timing

As previously noted, the proposed development has reduced downstream flood levels by confining flows along Bells Creek North and South through the PDA. This has resulted in later and smaller peak flows downstream of the development. Flows entering the Pelican Waters area downstream of the development are plotted in Figure 7-7 and Figure 7-8. Flows peak 3.5 hours later for the Bells Creek catchment. For the Lamerough Creek catchment the existing flow hydrograph is peaky, and the proposed development causes a much reduced flow and flattened hydrograph.

Thus, the proposed development is not considered to adversely impact flood warning times for downstream development.

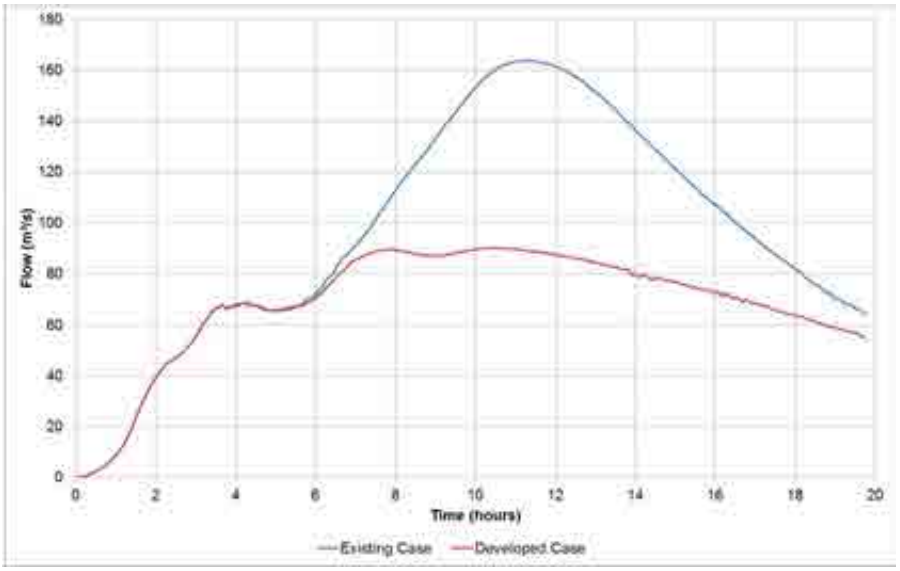


Figure 7-7 Flow Entering Northern Pelican Waters Area from Lamerough Creek Catchment – 100 Year 12 Hour Storm Duration

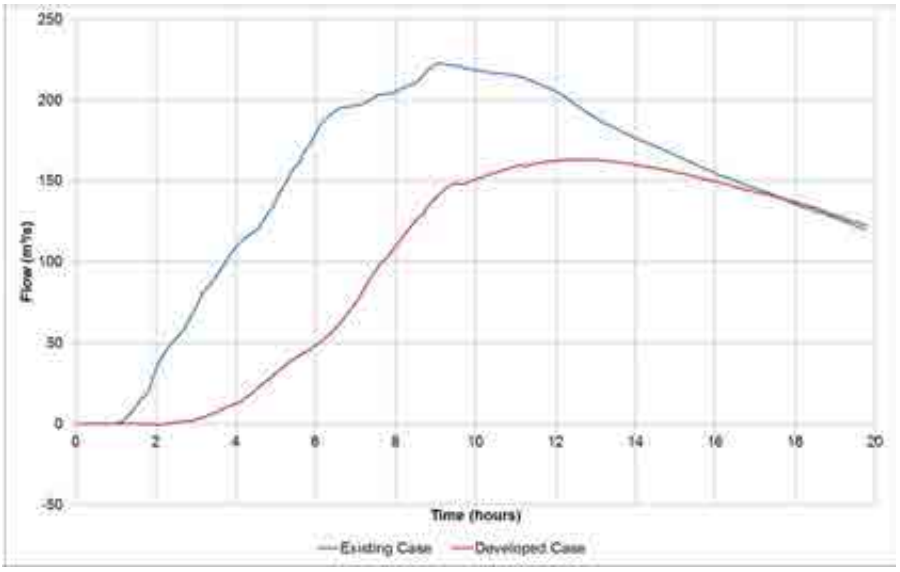


Figure 7-8 Flow in the lower reaches of the Bells Creek Catchment – 100 Year 12 Hour Storm Duration

Figure 7-9 shows that there has been negligible change in peak flood levels downstream at Pelican Water during the 1 year ARI event.

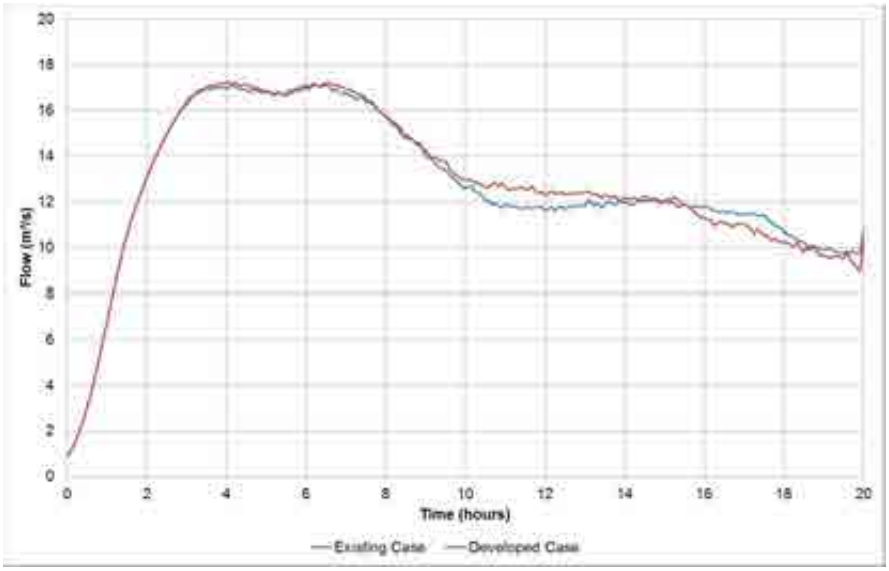


Figure 7-9 Flow Through Pelican Waters Canal near Outlet – 1 Year ARI 12 Hour Storm Duration

7.4 Flood Hazard and Emergency Management

The developed case flood hazard for the 100 year ARI fluvial flooding has been assessed. Flood hazard has been defined according to the AR&R Project 10 – *Appropriate Safety Criteria for People* (AR&R, 2010). The hazard categories are presented in Table 7-1. This table was used with the following additional limitation criteria, which are also specified in the AR&R Project 10 report:

- Limiting depth of 0.5m for children and 1.2m for adults in low flow areas; and
- Limiting velocity of 3m/s at shallow depths.

Table 7-1 Flow Hazard Regimes for Infants, Children and Adults

Depth x Velocity (m^2/s)	Infants, Small Children and Frail/Older Persons	Children	Adults
0	Safe	Safe	Safe
0-0.4	Extreme Hazard	Low Hazard	Low Hazard
0.4-0.6		Significant Hazard	
0.6-0.8		Extreme Hazard	Moderate Hazard
0.8-1.2			Significant Hazard
>1.2			Extreme Hazard

The resulting flood hazard for adults for the developed case 100 year ARI flood event is shown in Figure 7-10.

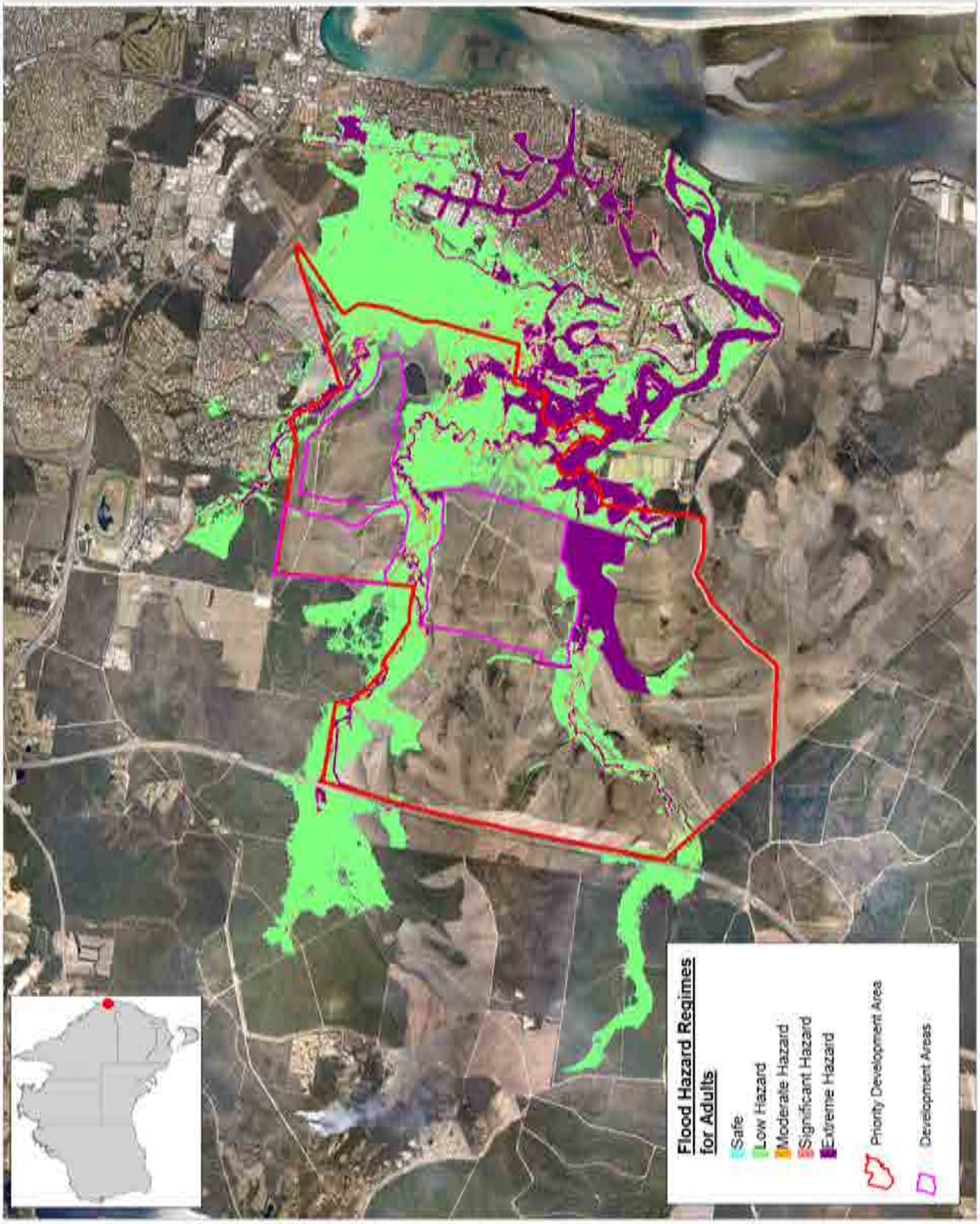
The results show that most of the inundated areas through the site are low hazard for adults. Extreme hazards occur within the river channels and detention basin areas, and moderate hazards occur along some drainage paths. Some of the low hazard areas are planned to be used for recreational purposes. Given that these areas abut developed areas with low flood risk, there is generally an escape route to high ground from recreational areas.

BMT WBM undertook a flood assessment in September 2014 (BMT WBM, 2014c) that investigated the extreme flood risk within the PDA. For this assessment, the 200 year, 500 year, 200 year and Probable Maximum Flood PMF were simulated. While it has not been possible to revise the extreme events modelling for this report, it is anticipated that the results will be similar as only minor changes to the development have occurred.

The results of this assessment suggest that:

- The adopted flood planning levels are generally higher than PMF flood levels. Some shallow flooding occurs on the outskirts of the development, but most of the development remains flood immune. Therefore, there is little residual flood risk.
- Apart from the Bells Creek Arterial crossing on Bells Creek South, all other access roads are flood immune up to the 2000 year event. Therefore, there is no isolation up to the 2000 year ARI flood event.
- Shallow flooding of road crossings occurs in the PMF event. This causes the central portion (between Bells Creek North and Bells Creek South including the Town Centre) of the development to become isolated. Without implementation of the proposed development west of the Town Centre, the Town Centre will become isolated. As stated above, the Bells Creek Arterial crossing and Link Road crossing are flood immune in the 2000 year event. Therefore, the Town Centre will only become isolated in an extreme flood event. However, the town centre area will be relatively self-sustaining and the road access will only be cut for approximately 7 hours.

In conclusion, the residual flood risk is manageable and emergency management concepts will be developed at the precinct scale.



Title:

Developed Case 100 Year ARI Flood Hazard For Adults

Figure: 7-10

Rev: -

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0 1.5 3km

Approx. Scale

BMT WBM

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7.5 Floodplain Storage

A comparison of floodplain storage in the vicinity of the proposed development has been undertaken on the 100 year peak flood depth results. Based on the peak flood depths pre and post development within the portion of the catchment where development is proposed, there is 36% increase in floodplain storage volume. This is likely to be due to higher flood depths within the developed area, caused by the detention basin on Bells Creek South and constrictions/crossings on Bells Creek North. Therefore, it is concluded that the proposed development has not reduced the floodplain storage capacity.

7.6 Conclusions

The flood risk impacts of the proposed development were assessed by comparing modelled peak flood levels of the developed case with the base case. Various development schemes have been investigated to derive a scheme that has no adverse flood impacts off site.

The modelling demonstrates that the potential impacts of the development can generally be mitigated through the implementation of a series of flood mitigation measures. A key component of the Flood Risk Management Strategy presented in this report is the provision of additional floodwater storage capacity at Bells Creek South through the implementation of hydraulic controls on the Bells Creek Arterial crossing and lowering of the natural ground surface levels.

8 Climate Change Assessment and Flood Planning Levels

8.1 Preamble

To ensure that the proposed development has appropriate flood immunity now and in the future, the ground elevations of the proposed urban areas (i.e. roads, commercial and residential allotments) will be set to a minimum level that incorporates an allowance for climate change impacts. This minimum level is referred to as the Flood Planning Level (FPL).

To assess how climate change impacts could affect flood levels surrounding the development, the potential impacts of climate change on the flood risk of the Caloundra South site have been assessed. For the climate change impact assessment, a planning horizon to the year 2100 has been adopted.

8.2 Potential Impacts of Climate Change

Scientific research documented by the *Intergovernmental Panel on Climate Change* IPCC (2007) and the *Department of Environment and Resource Management* DEHP (2010) indicates future climate change resulting from global warming is likely to result in:

- Changes in extreme rainfall intensity;
- Sea level rise; and
- Changes to storm occurrences and storm wind intensity, affecting storm surge levels.

The predicted changes in extreme rainfall intensity, sea level rise and storm surge levels to the 2100 planning horizon have been documented below.

8.2.1 Extreme Rainfall Intensity

Rainfall intensity is likely to vary as a result of global warming. Guidance on expected rainfall intensity increases in Queensland is discussed in Increasing Queensland's resilience to inland flooding in a changing climate: Final report on the Inland Flooding Study (Queensland Government 2010). This report recommends that rainfall intensities are increased by 5% per degree increase in global mean temperature.

For the 2100 planning horizon timeframes, the predicted increase in global mean temperature is 4.0˚C. Therefore, in the climate change assessment the design rainfall intensity utilised by the Caloundra South hydrology model was increased by 20%.

8.2.2 Future Sea Level Rise

For planning purposes, a 0.8m mean sea level rise has been adopted. This is consistent with the sea level rise factor adopted by the Department of Environment and Heritage Protection for the updated coastal hazard mapping of the Queensland Coast (released on 8th July 2015).

8.2.3 Changes to Storm Occurrences and Storm Intensities

The potential impacts of increased frequency and intensity of tropical cyclones at Golden Beach due to climate change were investigated in the *Oceans Hazard Assessment Stage 2 Report* (Hardy

et al 2004). Hardy et al (2004) assessed the likely impact of a 10% increase in cyclone intensity and frequency including a poleward shift in cyclone track by 1.3 degrees. Hardy et al (2004) indicate these changes to cyclone intensity, frequency and path may increase the 100 year ARI storm tide level around Bribie Island by approximately 0.15 m. This is in addition to the mean sea level rise.

8.2.4 Summary

A climate change assessment has been undertaken for the Caloundra South PDA development. The assessment accounted for a predicted increase in extreme rainfall intensity, sea level rise and changes to storm occurrences and storm intensities (storm surge). The values adopted, to represent to likely variation in these parameters to 2100, are outlined in Table 8-1.

Table 8-1 Adopted Climate Change Variation Estimates (Reference year 2100)

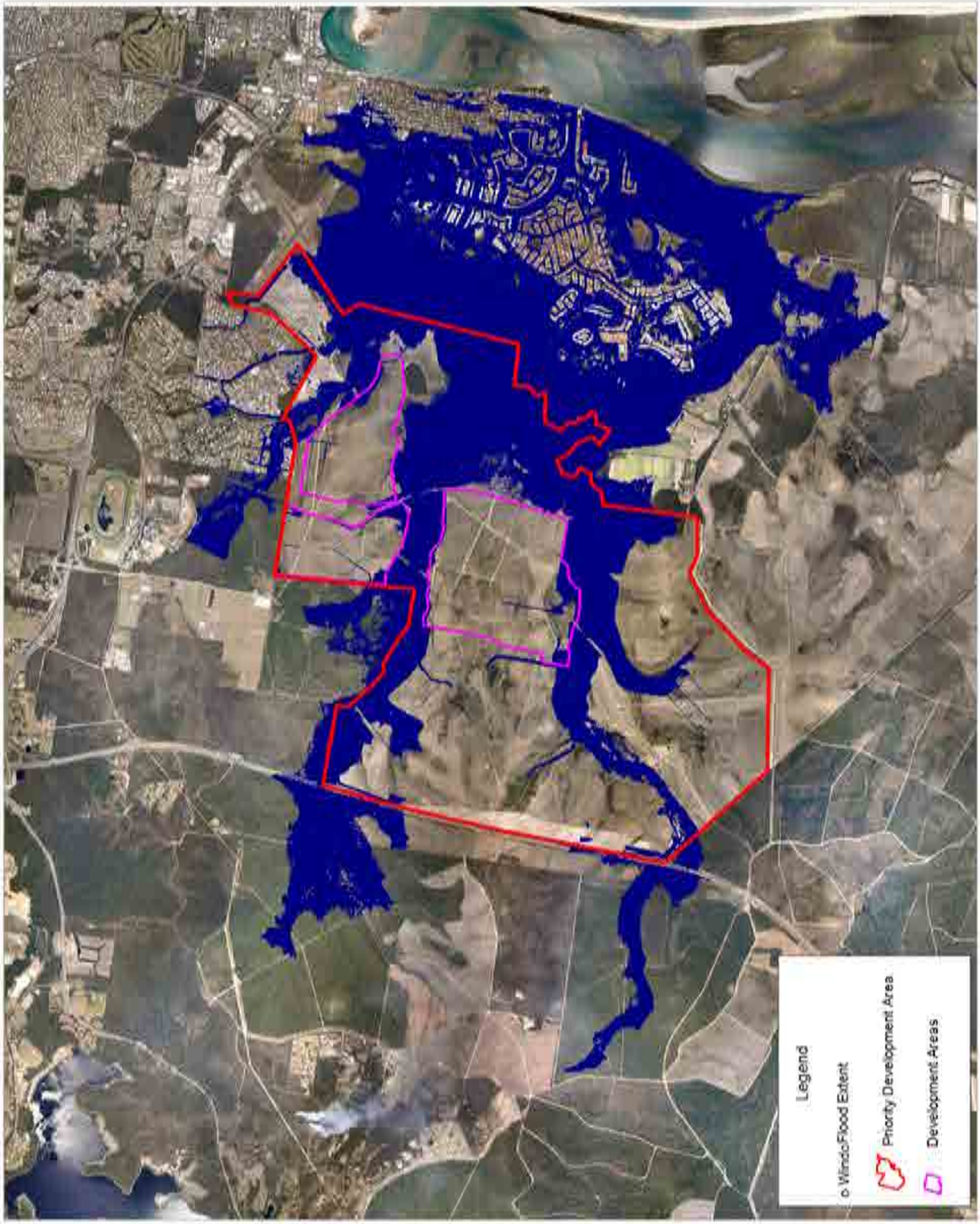
Environmental Forcing	Adopted Climate Change Variation Estimate
Extreme rainfall intensity / depth	+20%
Mean sea level rise	+0.80m
Increase in design storm tide levels	+0.95m (0.8m + 0.15m)

8.3 Climate Change and Flood Planning Levels

To establish the minimum ground elevations of the development, the flood impacts of the potential climate change variations have been determined as follows:

- For the fluvial flood events the rainfall depth was increased by 20% and the downstream boundary condition, which is a static Mean High Water Spring level in Pumicestone Passage, was raised by 0.8m; and
- The 100 year ARI design storm tide level of 1.65mAHD (Aurecon, 2013) was raised by 0.95mAHD to 2.60mAHD.

It is recommended that the FPLs are set according to the flood levels produced as part of this 100 year ARI climate change assessment with an additional freeboard allowance. It is understood that a freeboard of 0.35m has been adopted for the fill levels in proposed urban areas, and that the finished slab levels of buildings will be higher (with 0.5m freeboard) to facilitate the building services.



Title:
100 Year ARI Including Climate Change Flood Extent

Figure: 8-1

Rev: -

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0 1.5 3km
Approx. Scale

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Appendix A Responses to Model Review

A.1 Preamble

BMT WBM was commissioned by Stockland (in support of a Material Change of Use Master Plan Application to the Urban Land Development Authority) to prepare an Integrated Water Management Plan (IWMP) for the 'Caloundra South' development.

This IWMP provided a holistic approach to water management for the proposed master-planned community. The main elements of this IWMP were a flood risk management strategy, stormwater management plan and groundwater quantity and quality assessment.

On 15 June 2012, Urban Land Development Authority (ULDA) provided an approval for a material change of use for the Caloundra South Master Plan (ULDA Ref No.: DEV2011/200) based on a number of conditions.

A.2 Responses to Conditions

Conditions related to flooding are listed in Table A-1 along with a response on how each condition has been achieved.

Table A-1 Responses to Material Change of Use Application Conditions

	Condition	Response
34b – Flooding		
	A Flood Risk Management Strategy Report shall be prepared which includes an appropriate flood model to determine a flood assessment of the pre and post development scenario. The Flood Risk Management Strategy Report shall be generally in accordance Section 3 of the approved Integrated Water Management Plan prepared by BMT WBM dated May 2012, with the following additional requirements	This report has been prepared in response to this condition, and this condition is subsequently satisfied.
(i)	No increase in flood level for events up to and including the 100 year event external to the site in areas other than open space unless the written consent of affected property owners is obtained. Afflux plots and the level of model accuracy for the purpose of determining impacts shall be+-10mm unless agreed otherwise.	This has been completed, Section 7.1.
(ii)	Flood modelling shall be completed with a grid spacing appropriate to the level of detail of the application	A grid spacing of 5m has been used, which is appropriate for the level of application (Appendix C)
(iii)	No increase in flood level at the boundary of the flood model. Flood model to be extended as required to achieve this outcome.	This condition has been satisfied by extending the model extent to ensure that there are no increases in flood levels at the Duck Holes Creek and Lamerough Creek boundaries.

	Condition	Response
(iv)	No increase in peak flow downstream of the site in Bells Creek or Lamerough Creek (upstream of the Pelican Waters canal) for events with recurrence levels of between 1 year and 100 years inclusive.	This has been completed, Section 7.3.
(v)	Flood modelling completed in support of the report shall consider the 1, 2, 5, 10, 20, 50 and 100 year recurrence interval events.	This has been completed see Appendix C, Appendix D, Appendix E and Appendix F.
(vi)	Community infrastructure shall be provided an appropriate level of flood immunity as defined in Appendix 9 of the State Planning Policy 1/03 Guideline 'Mitigating the Adverse Impacts of Flood, Bushfire and Landslide' or subsequent updated document. In accordance with the recommendations of the Queensland Flood Commission, the risk management strategy shall consider issues of resident egress from Caloundra South under flood conditions that exceed the defined flood event.	Community infrastructure such as schools and libraries have been located above the 100 year ARI flood level including allowances for climate change with a 2100 year horizon and a 500mm freeboard. It is acknowledged that Appendix 9 of SPP Guideline 1/03 provides a guide for selecting minimum flood levels appropriate to specific community infrastructure. This will be considered during detailed design and adjustments to the bulk earthworks design made as necessary.
(vii)	Demonstrate that development will not result in a significant reduction in the flood warning time in existing developed areas subject to inundation.	This has been completed, see Section 7.3.
(viii)	The report shall include flood hazard mapping and shall address and provide appropriate risk management strategies for low, medium and high hazard areas. The strategy will need to consider velocity and depth of flow, rate of rise, and warning times. In particular, appropriate strategies shall be defined for recreational areas where a level of immunity less than 100 years is being proposed (for example the proposed lake area) prior to the use being permitted.	This has been completed, see Section 7.4.
(ix)	The allowance to be made for climate change (in terms of sea level rise and impacts of rainfall intensity) shall be in accordance with guidelines current or likely to be adopted in the short term at the time of preparation of the report.	This has been completed, see Section 8.
(x)	Minimum lot, non-habitable and habitable floor levels shall be identified based on the results of the flood modelling in accordance with the requirements of the Sunshine Coast Regional Council relative to the peak flood levels calculated for the climate change.	This has been completed, see Section 8.

	Condition	Response
(xi)	The report shall nominate the cross-drainage requirements at each crossing (road and pedestrian) of a watercourse.	This has been completed, see Appendix C Section C.4.3
	The report shall also nominate the proposed conditions under which the crossing will be over-topped.	The crossings are flood immune up to and including the 100 year ARI design flood event including allowances for climate change.
	In the event of over-topping occurring for the 100 year event, the depth and velocity of any overflow shall satisfy the requirements of the 'Queensland Urban Drainage Manual' (2007 or later version).	Not Applicable
	It shall be demonstrated that lots do not become inundated in the event of the crossing (other than bridges) being 50 percent blocked by debris.	This has been completed see Appendix C.5
	In all cases, the minimum level of the crossings shall be less than the minimum ground level of upstream lots unless a bridge crossing is proposed.	Road embankments crossing the river are proposed to be lower than the minimum ground level of upstream lots.
(xii)	For each nominated crossing point, measures taken to protect the Environmental Values of the watercourse (including fish passage as appropriate) shall be nominated.	Achieved – see Natural Environment Strategy.
(xiii)	Flood modelling will include all proposed works in the floodplain. In particular, the modelling shall include the ephemeral wetlands (and other treatment measures) proposed for the development. Ephemeral wetlands shall be immune to inundation for Bells and/ or Lamerough Creek flooding for events up to and including the 10 year event unless an alternative immunity is demonstrated to be satisfactory.	An alternative immunity of 1 year ARI has been demonstrated to be satisfactory. Treatment devices are included in the modelling – see Appendix C in Section C.4.5.
(xiv)	The flood modelling shall confirm that the peak flow velocity in treatment devices during regional flooding does not exceed the limits nominated in the Healthy Waterways publication 'Water Sensitive Urban Design Technical Design Guidelines' (2006 or later version) unless it can be demonstrated that higher velocities can be tolerated.	This has been completed see Appendix E.

	Condition	Response
(xv)	The report shall include a description of any water level data available for the catchment to allow the calibration of flood models. In the absence of calibration date, recourse shall be made to the following: a. Comparison/ adjustment of hydrologic model to suit parameters derived from a hydrologically similar catchment b. Comparison/ adjustment of hydrologic model to peak flow rates calculated using empirical methods such as the Rational Method. c. Completion of a sensitivity analysis in relation to the hydraulic model by considering the 100 Year Post-Development Case with Mannings 'n' roughness values increased by 20 percent. In cases where the resultant levels could inundate floor areas, minimum lot and floor levels shall be raised accordingly	Calibration is not possible due to insufficient historical flood data in the catchment. The MCU application hydrological modelling builds on modelling undertaken for a prior flood study which used recourse (a). Further to this, recourse (b) and (c) have been undertaken – see Appendix C.
	Electronic copies of the hydrologic and hydraulic models shall be submitted for review.	RoL Modelling was provided previously. The revised modelling reported in this document can be provided on request.

Appendix B Responses to Third Party Peer Review Comments (November 2013)

B.1 Preamble

Cardno has been commissioned by the Department of State Development, Infrastructure and Planning (DSDIP) to undertake a review of previous stormwater-related reporting in relation to the Caloundra South project, including the following reports (by BMT WBM):

- "*Caloundra South Development: Integrated Water Management Plan*" (May 2012).
- "*Precinct 1, Caloundra South Development: Stormwater Quality Management Plan*" (December 2012).
- "*Precinct 2, Caloundra South Development: Stormwater Quality Management Plan*" (March 2013).
- "*Precincts 3 to 5, Caloundra South Development: Stormwater Quality Management Plan*" (March 2013).
- "*Caloundra South Precincts 6 to 10 & 16: Stormwater Quality Management Plan*" (August 2013).

In correspondence 26th November 2013 (to DSDIP) Cardno have provided a list of the items that that they consider require attention prior to the finalisation of approvals for the stormwater management strategy for the Caloundra South project.

B.2 Responses to Comments

Items requiring attention (as outlined in the aforementioned correspondence) are given below in *black italics*, whilst responses from BMT WBM to these items are provided below in blue text.

B.2.1 Item 1: Overarching Report

While the modelling detailed in the ROL application (Precincts 2-5 and 7-10) is generally acceptable, the modelling only deals with the precincts under consideration. Given the changes to the modelling that have occurred since the preparation of the previous site wide report, it is necessary to prepare an overarching report for the whole site that demonstrates that development can occur without unacceptable impacts to satisfy the condition of approval.

This report constitutes the requested overarching report for the whole site.

B.2.2 Item 2: Western Detention Basin

In lieu of an approval from Council in relation to the construction of the western detention basin, it will be necessary to demonstrate that development of the site can occur without producing unacceptable flood impacts if the Western Basin is not in place. The approval can then allow for the construction of the basin when approval has been received from council.

Further, the modelling of the western basin will need to include appropriate provision for those areas where is not to pond freely drain.

Inclusion of the basin is not a requirement from a flood risk management strategy perspective; it is simply a potential enhancement to the flood risk management strategy. The Western Detention Basin has not been considered in this report. A separate flooding assessment for the Western Detention Basin is being prepared to support an application to Council.

B.2.3 Item 3: Future Lake Area

Modelling of the future lake area on Bells Creek South will need to include provision for the area to be free draining and a description of the measures required to support the adopted ground slope in the period prior to approval and construction of the lakes provided.

The lake is located in an area of lowered ground for provision of additional flood storage. This ground lowering slopes towards the river corridor (approximately 1m drop over 1km). The model assumes that the future lake area is full prior to a flood event. Therefore, the lake does not provide additional flood storage and is not part of the flood risk management strategy. As such, this comment is not relevant to the flood risk management strategy.

B.2.4 Item 4: Water Quality Treatment Devices in Waterway Corridor

As noted in the comments provided in relation to the flood modelling, any water quality treatment devices (and the level of bunding proposed to protect the devices from frequent inundation) will need to be included in the hydraulic model. Based on advice from BMT WBM it is understood that this modelling has indicated that the impact of the treatment devices minimal and acceptable.

It is also noted that the acceptance of flood modelling completed on the basis is based on the assumption that the stormwater management (water quality) report will contain justification for the nominated immunity level and that the infrastructure agreement being reached with Council is also based on the level. The stromwater management report will also need to detail the flow velocities and depths calculated to occur within the treatment devices during minor and major flood events to confirm the level if impact to the treatment device (eg scour, removal of collected material) during such events. Commentary and justification is to be provided in relation to flow velocities that are in excess of excess of those nominated in Healthy Waterways Guidelines.

The treatment devices have been included in the hydraulic model with a flood immunity of 1 year ARI. Velocities are illustrated in the mapping in this report in Appendix E.

B.2.5 Item 5: Bells Creek North

An increase in flood level is predicted to occur in Bells Creek North within the PDA external to the upstream boundary of the site. The report will need to include justification that the increase, if it cannot be reasonable be reasonably removed, does not result in an actionable nuisance or reduce the development potential of the affected land.

See Section 7.1.

B.2.6 Item 6: Flood Hazard

The flood hazard work completed with respect to the BMT WBM report Precincts 2-5 and 7-10; Caloundra South: Flood Risk Management Study (Version 2, January 2013) provides the basis fo the work to be included in the overarching document do the site. This will include:

- *Section 3.4 of the January 2013 report to confirm that the development will not impact on flood warning times for external developments and comply with Condition 34b (vii).*
- *Section 3.3 of the January 2013 report to provide flood hazard mapping to comply with Condition 34b (viii)*

Appendix C Model Methodology

This Appendix outlines the flood modelling methodology for the Caloundra South site.

C.1 Previous Studies

A number of previous flooding investigations of the Caloundra South region have been completed including:

- Caloundra South Informal Land Use Investigation Flooding Assessment - Supporting Technical Study no.5 (Cardno MBK, 1999);
- Caloundra South 2 Hydrological & Hydraulic Analysis Supplementary Report - Supporting Technical Study no.17 (Cardno MBK, 2000);
- Caloundra City Storm Tide Study – Development Report (Connell Wagner, 2003a);
- Caloundra City Storm Tide Study – Counter Disaster Planning Report (Connell Wagner, 2003b);
- Lamerough Creek and Duckholes Creek Flood Study and Stormwater Management Plan; Volumes 1, 2 & 3 (Cardno MBK, 2003);
- Joint Probability Assessment – Storm Tide and Freshwater Flooding, Caloundra City and Maroochy Shire Councils, in Draft (Connell Wagner, 2005);
- Caloundra South Flood Study – Caloundra Local Growth Management Strategy (SKM, 2006);
- Caloundra South Development: Flood Risk Management Strategy (BMT WBM, 2011a);
- Bellvista II Development Reconfiguration of a Lot Application: Flood Impact Assessment (BMT WBM, 2011b);
- Precincts 2-5 and 6-10 and 16, Caloundra South: Flood Risk Management Strategy (BMT WBM, 2013);
- Caloundra South Development: Flood Risk Management Strategy (BMT WBM 2014b); and
- Caloundra South: Flood Risk Management Strategy – September 2014 Update (BMT WBM, 2014c).

Apart from the recent BMT WBM studies, the SKM study is the most recent flooding investigation and includes a review of all the aforementioned investigations. The study area of the SKM study included the Bells Creek and Lamerough Creek catchments (the catchments in which the Caloundra South site is located). The study was undertaken as part of the development of a Local Growth Management Strategy for Caloundra City, and used hydrological and hydraulic models to investigate flooding characteristics of seven coastal catchments that discharge into Pumicestone Passage. This study formed the basis of the BMT WBM studies that followed.

C.2 Flood Modelling Overview

C.2.1 Data Summary

C.2.1.1 Digital Elevation Model

A three dimensional Digital Elevation Model (DEM) of the terrain across the site and surrounding catchment is essential for development of hydrological and hydraulic models. The DEM used in this assessment was derived from two sources:

- A Light Detection and Ranging (LiDAR) survey flown in November 2012 that covers the Caloundra South PDA. This LiDAR survey was processed and issued by RPS, who also verified the LiDAR by ground survey in selected areas across the site.
- In portions of the catchment beyond the 2012 LiDAR coverage, the SKM flood study (SKM 2006) DEM was used.

SKM developed the DEM, which has a grid resolution of 5m, using the following:

- AAM Hatch undertook a LiDAR survey for the SKM flood study. The vertical and horizontal accuracy of this data was reported as ±0.11m and 0.35m respectively. SKM triangulated and converted this survey to a grid with 5m resolution. This data is the primary survey used to develop the DEM. The lasers used for LiDAR survey do not penetrate water. Hence, additional assumptions and survey were used in inundated areas (see below).
- Pre-existing cross section data were extracted from an existing 1D hydraulic model (MIKE11). These cross-sections covered Bells Creek North, Bells Creek South, Bells Creek and Lamerough Creek east of the Bruce Highway. This data was used to inform bathymetry data for Bells Creek.
- A bed level of -3.0mAHD was used through the Pelican Waters canals.

Figure 2-2 illustrates the DEM of the existing terrain used in the assessment. For the proposed development, a proposed DEM for the development was provided by Stockland's civil design consultants. This was supplemented with terrain modifications based on the conceptual layout of the development.

C.2.1.2 Land Use Mapping

Aerial photography was used to digitise different land use classes across the catchment. This land use data were used to inform the roughness and percentage impervious parameters for the hydrological and hydraulic modelling. The aerial photography was obtained from NearMap, and relates to May 2011. Figure C-1 illustrates the existing land use mapping used in the assessment.

Land use mapping for the proposed development were provided by Stockland's civil design consultants.

C.2.1.3 Existing Structures

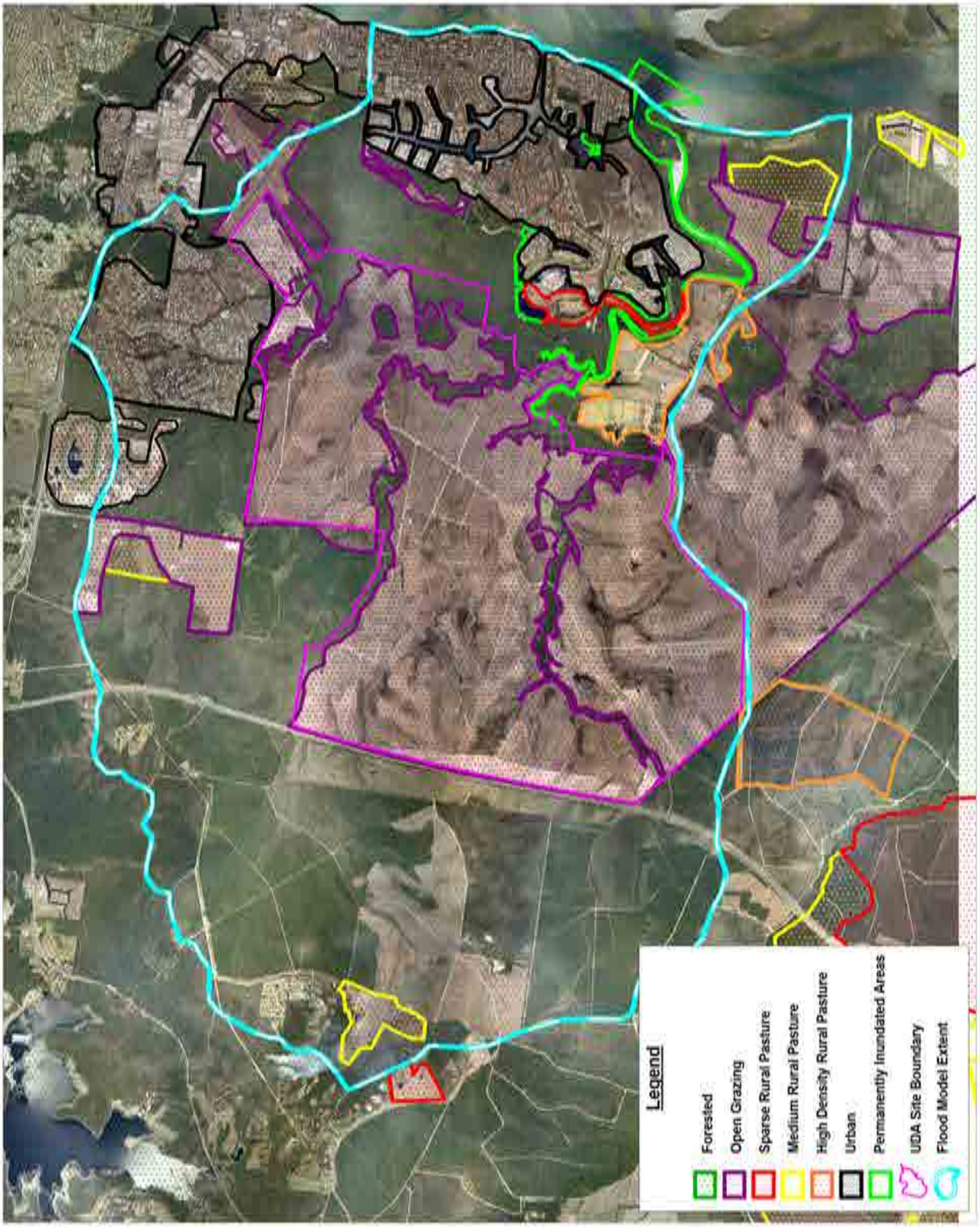
The Bruce Highway forms a significant obstruction to natural flow patterns across the highway. The highway embankment was inserted as a breakline in the topography of the model to ensure it was

accurately represented in the model. The elevations used in the breakline were interrogated from the DEM.

To accurately represent drainage through the existing Bruce Highway road embankments, culvert crossings were incorporated as one-dimensional structures in the TUFLOW model and dynamically linked to the 2D model domain at the inlet and outlet. Surveys were conducted to determine the length, location and dimensions of the culvert crossings. These surveys were undertaken by RPS and the culvert dimensions are presented in Table C-1. The locations of the Bruce Highway structures are shown in Figure C-7. Structures in the vicinity of Bells Reach were captured by incorporating the modelling undertaken for the Bells Reach ROL application (BMT WBM 2011b).

Table C-1 Bruce Highway Culvert Dimensions

Culvert ID	Type	Length	Upstream Invert	Downstream Invert	Width or Diameter	Height	Number
BH19	Box Culvert	21.7	11.064	10.854	2.4	3	3
BH20	Box Culvert	21.6	10.854	10.836	2.6	3.8	3
BH36_037	Circular Culvert	42.4	12.097	11.949	1.3	N/A	3
BH38	Box Culvert	40	10.758	10.607	3.3	3.2	3
BH40	Circular Culvert	18.2	23.997	23.667	0.825	N/A	4
BH41	Circular Culvert	22.2	23.667	23.369	0.85	N/A	4
BH42_43	Box Culvert	37.6	24.234	24.108	2.1	1.5	3
BH21	Circular Culvert	27	12.831	12.646	0.75	N/A	1
BH22	Circular Culvert	26.6	12.646	12.474	0.75	N/A	1
BH_BCS6_1	Circular Culvert	18	13.7	13.5	1.3	N/A	5
BH_BCS6_2	Circular Culvert	18	13.5	13.3	1.3	N/A	5



Title:
Existing Land Use Mapping

Figure:
C-1

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C.2.2 Modelling Approach

The flood modelling undertaken in this study builds upon flood modelling developed during previous BMT WBM studies, which, in turn, are based on flood modelling developed during the SKM study.

The SKM study employed RAFTS-XP for the hydrological modelling and the MIKE FLOOD software for developing 1D-2D hydraulic models. BMT WBM subsequently re-established the SKM models using RAFTS-XP for the hydrological modelling and TUFLOW for the hydraulic modelling (BMT WBM 2011c). This work was done to enable BMT WBM to develop a preliminary flood risk management strategy for the Caloundra South PDA.

BMT WBM have also completed a flood study for a Stockland development that lies adjacent to the Caloundra South PDA in the vicinity of Bellvista, called Bells Reach (previously called Bellvista II) (BMT WBM 2011b). This modelling has been incorporated into the flood model. It should be noted that the Bells Reach development does not form part of the current application, and approval has already been granted.

C.3 Hydrological Model Development

C.3.1 Model Schematisation

The RAFTS-XP model includes the following catchments, Bells Creek North, Bells Creek South, Lamerough Creek and Duck Holes Creek. The sub-catchment delineation is presented in Figure C-2 and Figure C-3 for the existing and developed cases respectively.

The adopted percent impervious and Manning's n values for existing land use types are presented in Table C-2. The land use delineation for the 'existing case' RAFTS-XP model is shown in Figure C-2.

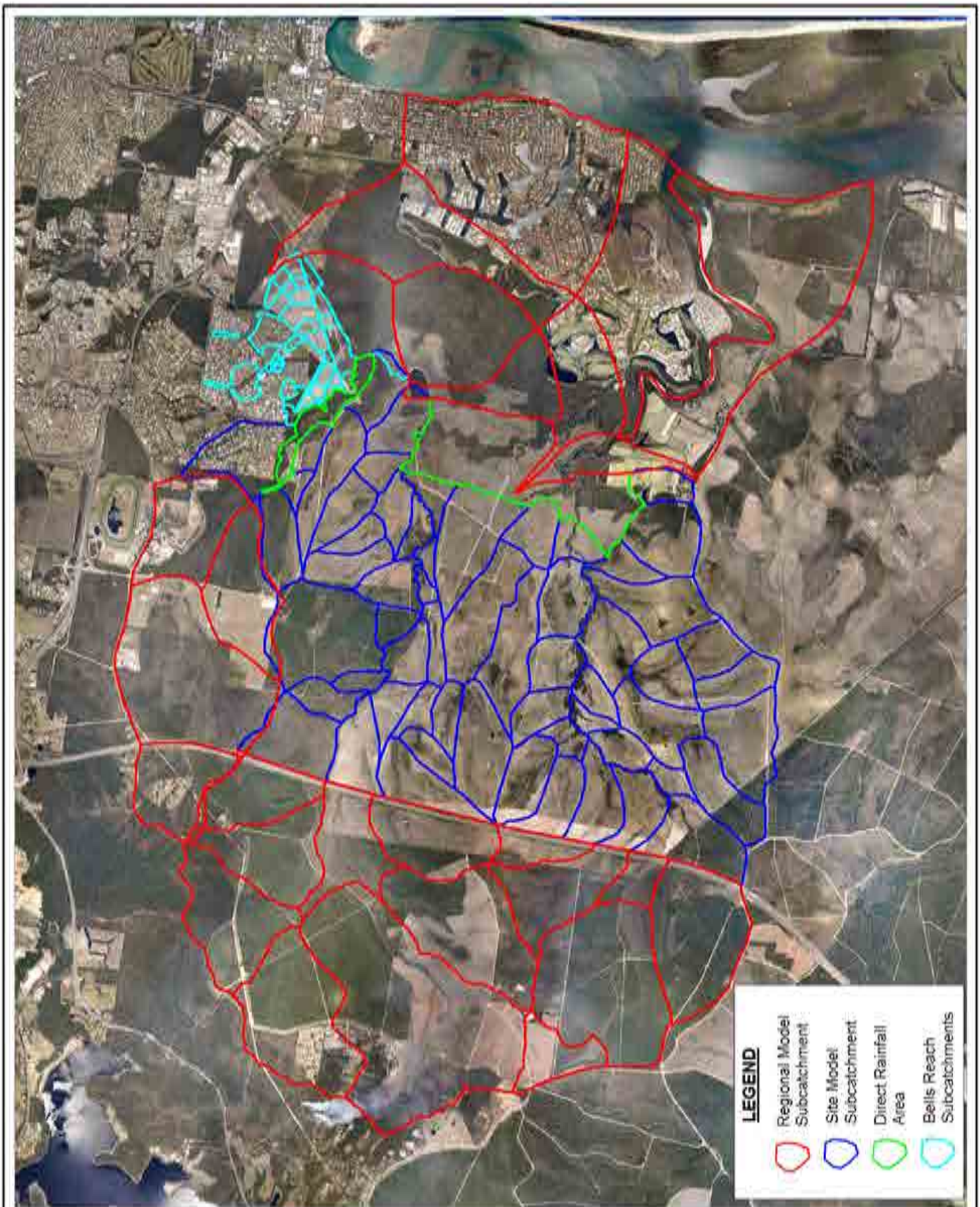
The existing case RAFTS-XP model formed the basis of the developed case hydrological model; sub-catchment roughness, pervious area and percentage impervious were adjusted to reflect the proposed development. Percent impervious for developed land use types was based on land use and density data provided by Stockland. Manning's 'n' for developed land use types has been estimated using typical industry values.

The pervious Manning's 'n', and impervious and pervious areas for each of the sub-catchments for the 'existing case' and 'developed case' RAFTS-XP models are presented in Table C-2.

Table C-2 Pervious Percent and Manning's 'n' for Existing Land Use Types

Land Use Type	Percent Pervious	Pervious Manning's 'n'
Sparse Rural Pasture	100%	0.050
Medium Rural Pasture	100%	0.060
Very High Dense Rural Pasture	100%	0.080
Permanently Inundated Areas	0%	-
Forested	100%	0.100

Land Use Type	Percent Pervious	Pervious Manning's 'n'
Urban	40%	0.025
Sparse Urban	90%	0.035
Open Grazing	100%	0.05



Title:
Existing Case Hydrological Modelling Extents and Sub-Catchment Delineation

Figure: C-2

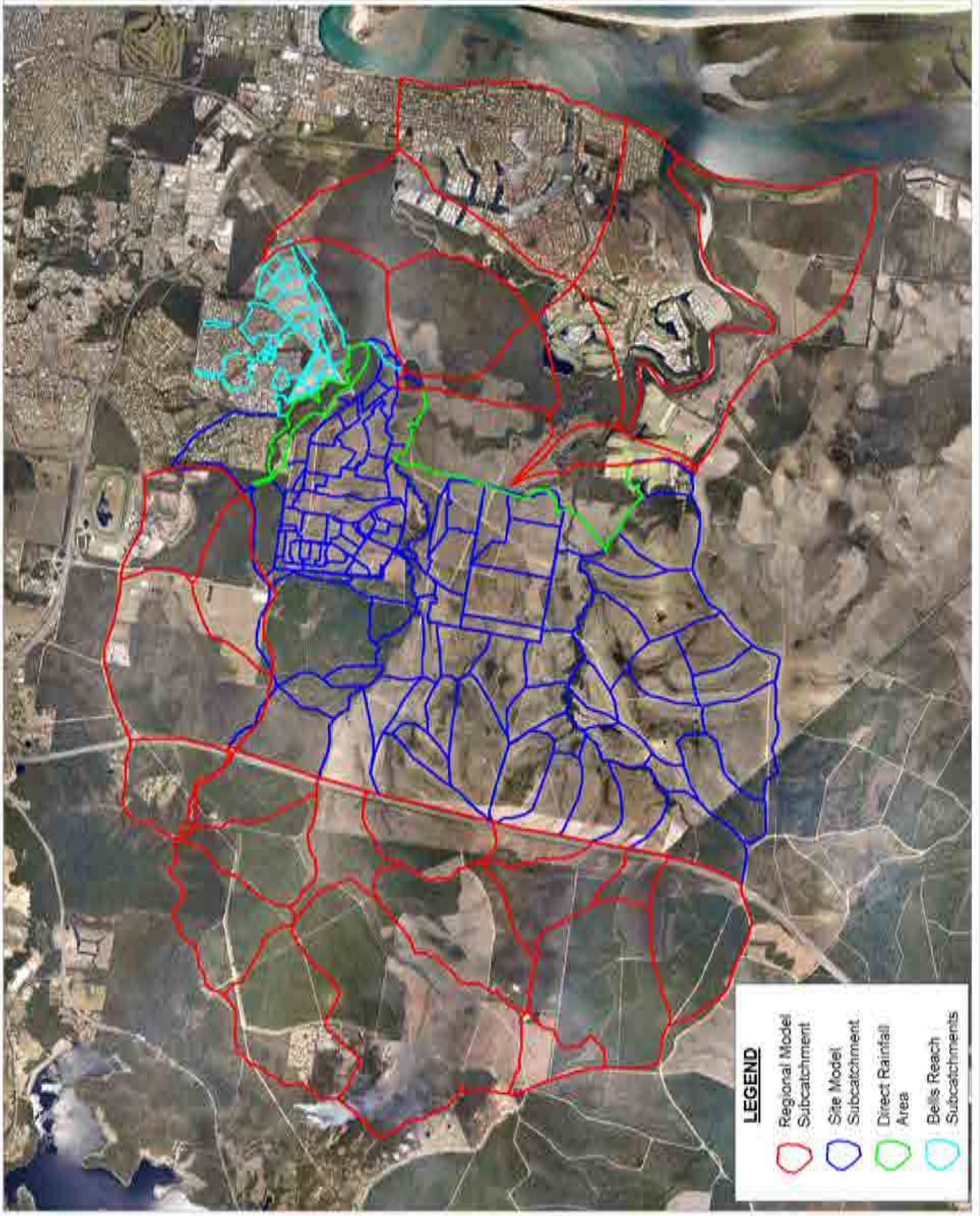
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Title:

Developed Case Hydrological Modelling Extents and Sub-Catchment Delineation

Figure: C-3

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C.3.2 Hydrological Design Conditions

C.3.2.1 Design Rainfall Intensities

The CRC-Forge method was used to estimate design rainfall intensities. CRC-Forge and AR&R rainfalls were compared in the Caloundra South Flood Study (SKM, 2006) and the CRC-Forge was found to result in slightly higher design rainfall depths. The design rainfall intensities adopted in this study are presented in Table C-3.

Table C-3 Design Rainfall Intensities (mm/hr)

Event Duration	Average Recurrence Interval (years)				
	5	10	20	50	100
3 hours	33.0	37.7	43.8	52.1	59.7
6 hours	21.5	24.9	29.3	35.2	40.3
12 hours	14.0	16.4	19.5	23.8	27.3

C.3.2.2 Areal Reduction Factors

In contrast to the Caloundra South Flood Study (SKM, 2006), no areal reduction was used in this investigation (i.e. an areal reduction factor of 1 was adopted). This is a conservative approach. The areal reduction factors used in the Caloundra South Flood Study varied between 0.98 and 1 (SKM, 2006).

C.3.2.3 Design Rainfall Depths

The CRC-Forge method was used to derive design rainfall depths up to the 2000 year design storm.

The Probable Maximum Precipitation (PMP) was used to derive the PMF event. The theoretical definition of the PMP is “the greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical location at a certain time of year” (World Meteorological Organisation, 1986). The ARI of a PMP/PMF event ranges between 10^4 and 10^7 years and is beyond the “credible limit of extrapolation”. That is, it is not possible to use rainfall depths determined for the more frequent events (100 year ARI and less) to extrapolate the PMP.

The PMP design rainfall depths and temporal patterns were derived from the Bureau of Meteorology’s Generalised Short Duration Method (GSDM) for storm durations up to and including 6 hours and the Revised Generalised Tropical Storm Method (GTSMR) for storm durations equal to and greater than 24 hours. The design rainfall depth estimate for the 12 hour storm duration was interpolated from the GSDM 6 hour and GTSMR 24 hour design rainfall estimates.

The design rainfall depths used in the study are listed in Table C-4.

Table C-4 Design Rainfall Depths (mm)

Event Duration	Average Recurrence Interval (years)								
	5	10	20	50	100	200	500	2000	PMP
3 hours	99.0	113.0	131.5	156.4	179.1	203.4	237.8	295.9	600.0
6 hours	128.9	149.1	175.5	211.3	242.0	274.8	321.3	399.9	800.0
12 hours	168.1	197.0	234.5	286.1	327.6	372.0	435.0	541.3	1070.0

C.3.2.4 Design Temporal Rainfall Pattern

Design temporal rainfall patterns from Australian Rainfall and Runoff (AR&R, 2000) Zone 3 were used in this investigation. This is consistent with the Caloundra South Flood Study (SKM, 2006). Both the GSDM and GTSMR temporal patterns were adopted independently for the 12 hour storm duration and the GSDM temporal pattern was used for the 6 hour PMP.

C.3.2.5 Runoff Losses

The rainfall losses used in the SKM study for pervious areas were 10mm initial loss and 5mm continuing loss. This was based on the dominant land-use in the catchment being forested. In this study, however, the rainfall losses have been reduced to an initial loss of 0mm and continuing loss of 2.5mm for the following two reasons:

- In this study, design storm bursts are being modelled, which are theoretically preceded by lower intensity rainfall. It is typical, therefore, to assume that the catchment is relatively saturated at the start of the storm burst; and
- The portion of the catchment where the development is proposed was covered by pine plantation at the time that the SKM study was undertaken. However, this plantation has been cleared, which has led to lower infiltration rates within the proposed development area east of the Bruce Highway.

Water sensitive urbane design measures will occupy approximately 4.5% of the developed area, and will typically store 0.25m depth of water for a few hours after any rainfall event. This equates to an additional initial loss of 0.011m across the site. This conservatively ignores the additional influence of the more than 20,000 rainwater tanks that will eventually be deployed across the site. However, to be conservative, the initial water losses within the site associated with water sensitive urban design measures has not been considered in the flood modelling.

C.3.3 Proposed Works Affecting Runoff Behaviour

The proposed development includes changes to the characteristics of the catchment. The majority of the catchment is currently undeveloped. The development of the catchment will increase impervious surfaces and reduce catchment 'roughness' (i.e. decrease Manning's 'n') with the addition of roads, houses and other developments (except in area where revegetation is proposed). Both of these changes will increase peak runoff rates. The approximate proposed development footprint is presented in Figure 5-1.

The pervious Manning's 'n', and impervious and pervious areas, for each of the sub-catchments in the RAFTS-XP model are detailed in Table C-2.

C.3.4 Hydrological Modelling Results

The relatively flat nature of the site means that runoff in the existing case is comparatively slow to respond. The increase in impervious area and reduced Manning's 'n' in the developed case mean that the affected catchments respond more quickly to rainfall. This can be seen in the existing and post-development runoff hydrographs (100 year ARI, 6 hour event) for sub-catchment BCN1 (Bells Creek North) and BCS1 (Bells Creek South); which are both located just downstream of the development area (refer Figure C-4 and Figure C-5 respectively).

Peak flows at each sub-catchment for the 5, 50 and 100 year ARI events (existing and developed) are provided in Appendix F. The peak flows for the climate change events are also provided in Appendix F.

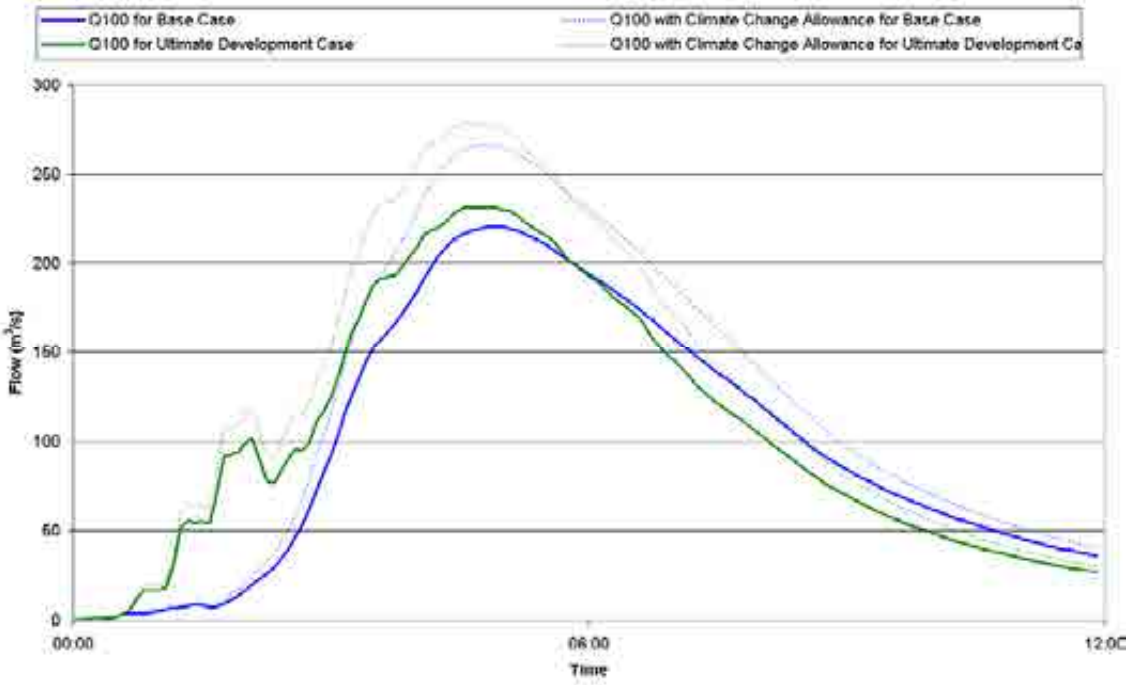


Figure C-4 Modelled RAFTS-XP Flow Hydrographs at Sub-catchment BCN1

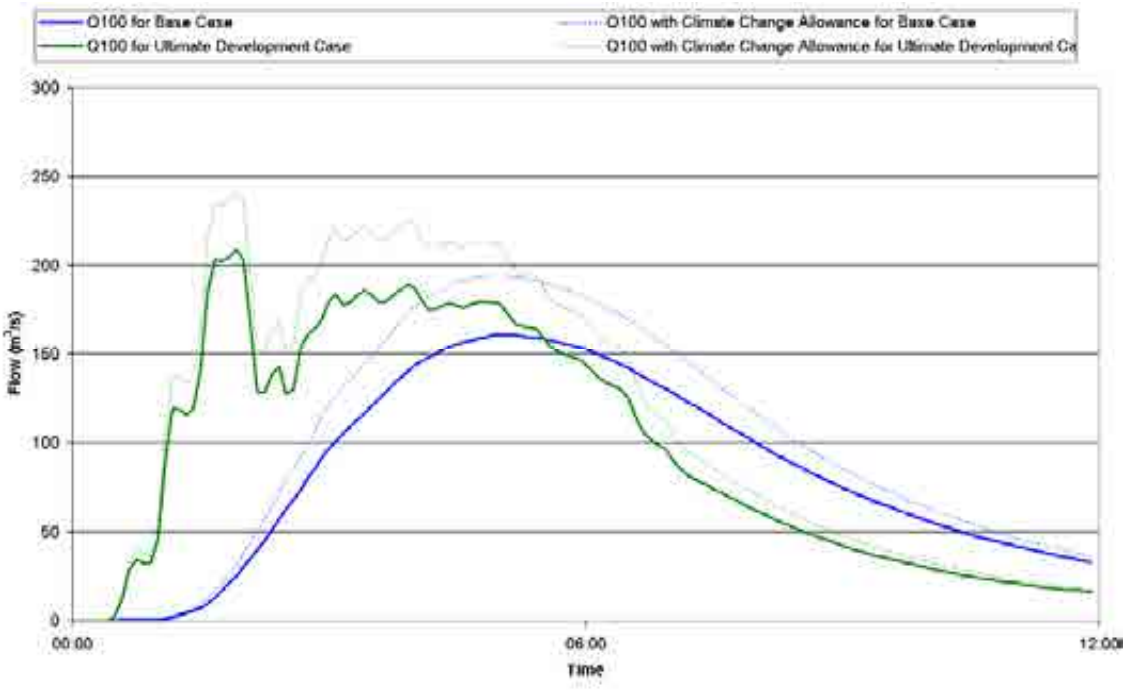


Figure C-5 Modelled RAFTS-XP Flow Hydrographs at Sub-catchment BCS1

C.3.5 Hydrological Model Verification

The SKM study verified the adopted hydrological modelling assumptions against a regional flood frequency analysis and a historical rainfall event (March/April 1989) in the nearby Upper Mooloolah River catchment.

Further verification of the flows has not been possible due to the lack of available data in the area. As such, an indicative check of the flow was undertaken comparing the Rational Method approach against the existing case broader hydrologic model developed for the MCU application (BMT WBM, 2011a). This check was undertaken on the Bells Creek North catchment, which encompasses an area of approximately 2,270ha. Table C-5 shows the design flows and the rational method check for a storm event with a duration of 12 hours.

Table C-5 Design Flow Check for Bells Creek North

Event	Design Flow (m3/s)	Rational Method Flow (m3/s)
5 year ARI	120	90
50 year ARI	220	180
100 year ARI	260	210

The Rational Method approach predicts flows that are 18% to 25% lower than the RAFTS-XP model, which has been considered conservative and acceptable for the purposes of this study, and the RAFTS model has been adopted in this study without further adjustment to the model assumptions. The sub-catchment delineation has been refined since this work, to capture more detail in the catchment run-off for the RoL applications.

C.3.6 Flood Modelling of Increased Rainfall Intensities

To investigate the impacts of increased extreme rainfall intensities due to climate change, the RAFTS-XP hydrological model was run with increased rainfall intensities. The design rainfall depths as determined by CRC-FORGE (Table C-3) were increased by an additional 20%.

The RAFTS-XP model results for the developed case with climate change allowance (refer to Appendix F) suggest that the peak inflows may increase by about 25% on average as a result of climate change impacts.

The revised RAFTS-XP inflow hydrographs were then used as inflow boundaries in the TUFLOW model. In the simulations of the climate change scenarios (increased rainfall intensities), a constant water level of 1.25 mAHD was used as a downstream boundary condition. This water level represents a predicted mean high water spring level at Pumicestone Passage in 2100.

C.4 Hydraulic Model Development

C.4.1 Introduction

The SKM MIKE-FLOOD model was not made available to BMT WBM by Sunshine Coast Regional Council for use in the BMT WBM studies. However, a Digital Elevation Model (DEM) of the study area together with the peak flood levels for the three design flood events modelled in the Caloundra South Flood Study was obtained. Furthermore, the Caloundra South Flood Study report was used to obtain further information in relation to the Caloundra South MIKE-FLOOD model.

On the basis of the information obtained, a TUFLOW model of the Bells Creek and Lamerough Creek catchments was developed during the previous BMT WBM flooding assessment for the Caloundra South development. This formed the basis of the hydraulic model developed for this flood assessment. Furthermore, the model was updated to run on recent version of TUFLOW (version 2013-12-AD double precision).

C.4.2 Model Area

The modelled area covers the entire Bells Creek and Lamerough Creek catchments, extending from Pumicestone Passage in the east to upstream of the Glasshouse Mountains Road in the west. The extent of the TUFLOW model is shown in Figure C-6.

The floodplain area and watercourses within the model area have been represented within a 2D model domain. The 2D model domain covers an area of approximately 67.5 km2. To the west of the Bruce Highway and in the lower reaches of Bells North and South, adjecnt to Pelican Waters, the model uses a 15m grid resolution. A finer scale 5m by 5m square grid is used around the Bellvista area (based on BMT WBM, 2011b) and throughout the central section of the model domain, which was dynamically linked to the 15m grid domains using a 2D domain linking technique. Each square grid element contains information on ground topography (sampled from a DEM), surface resistance to flow (Manning's 'n' roughness coefficient) and initial water level.

The ground topography of the TUFLOW model was sampled from the DEM. The topography of the Caloundra South area is presented in Figure 2-2.

Linear features that potentially influence the flow behaviour, such as natural gullies and creeks, levees and embankments, were incorporated into the model using 3D 'breaklines' to ensure that these were contained within the model grids and accurately represented in the model.

C.4.3 Hydraulic Structures

The Glasshouse Mountains Road and the Bruce Highway form significant obstructions to natural flow patterns and convey flood waters at numerous bridge and culvert crossings.

To accurately represent drainage through existing embankments, bridge and culvert crossings were incorporated as one-dimensional structures in the TUFLOW model and dynamically linked to the 2D model domain.

Surveys were conducted to determine the length, location and dimensions of the culvert crossings. These surveys were undertaken by RPS (formerly Conics Ltd). Invert levels and loss coefficients were based on information provided in the Caloundra South Flood Study. Details on the exiting hydraulic structures included in the TUFLOW model are provided in Table C-1. Their locations are shown in Figure C-7.

A series of culverts have ben modelled at the downstream end of the proposed Bells Creek South detention basin to serve as an outlet control mechanism. Culvert dimensions are presented in Table C-6 and culvert locations are shown in Figure C-7.

Table C-6 Bells Creek South Basin Culvert Dimensions

Culvert ID	Type	Length	Upstream Invert	Downstream Invert	Width or Diameter	Height	Number
Culv_01	Box	50	2.15	1.4	3	0.9	3
Culv_02	Box	50	2.3	2	3	0.9	5
KD1	Circular	80	2.95	0.88	0.9	N/A	2

A waterway opening optimisation assessment was carried out on all bridge crossings associated with the proposed development. An iterative approach was adopted in this regard whereby the peak flood water surface level, associated with a trial opening width, was assessed. If the trial opening width resulted in an unacceptable outcome in terms of peak water levels, either within the development boundary or external to the site, the effective opening was adjusted accordingly. The final waterway opening widths are presented in Table C-7 and their locations shown on Figure C-7.

Table C-7 Waterway Crossings Open Widths

Crossing ID	Waterway Opening Width (m)	Description
BCN_EW	120	Bells Creek North East West Link Road Crossing
BCN_US	60	Bells Creek North Upstream Crossing
LC_EW	70	Lamerough Creek East West Link Road Crossing
BCS_EW	40	Bells Creek South East West Link Road Crossing
BCS_US	40	Bells Creek South Upstream Crossing

Crossing ID	Waterway Opening Width (m)	Description
BCN_KA	100	Bells Creek North Bells Creek Arterial Crossing
	50	Lamerough Creek Bells Creek Arterial Crossing

The waterway crossings listed above were supplemented with the culverts listed in Table C-8.

Location	Type	Length	Upstream Invert	Downstream Invert	Width or Diameter	Height	Number
Bells Creek Arterial over Lamerough Creek	Circular	44	6.2mAHD	6.017mAHD	0.9m		2
East-West Link over Lamerough Creek	Circular	50	2.6mAHD	2.55mAHD	0.9m		3
East-West Link over Bells Creek North	Box	54	6.5mAHD	6.3mAHD	2.1m	1.5m	20

Title:
TUFLOW Model Setup

Figure:
C-6

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Structure Locations

Figure:
C-7

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C.4.4 Hydraulic Roughness

Roughness coefficients represent the resistance to flood flows in channels and floodplains. In the hydraulic model, the adopted Manning's 'n' roughness coefficients were based on the Caloundra South Flood Study. The adopted Manning's 'n' roughness coefficients for the land uses within the proposed development are also listed in Table C-8. The land use delineation of the Base Case model is based on aerial photography and presented Figure C-1.

Table C-8 Adopted Manning's 'n' Roughness Coefficients in TUFLOW Model

Land Use	Manning's 'n' Coefficients
Existing Land Uses	
Forested	0.120
Very high dense rural	0.100
Urban	0.090
Medium rural pasture	0.050
Permanently inundated areas	0.045
Sparse rural pasture	0.040
Proposed Land Uses	
Forested	0.120
Urban	0.100
Conservation and open space	0.080
Roads	0.020
Maintained parkland / playing fields	0.045

C.4.5 Water Quality Treatment Devices

An extensive series of water quality treatment devices are planned to be incorporated into the Caloundra South development. The purpose of these is to ensure the proposed development meets its obligations with regard to stormwater runoff water quality. To this end, a number of treatment devices, such as bioretention systems and wetlands are proposed to be constructed within the drainage corridors of Bells Creek South and Bells Creek North.

There are 2 design requirements that may influence flooding considerations, namely that devices remain immune in a 1 year ARI event and that flow velocities do not exceed 1m/s in a 100 year ARI event. The hydraulic model topography has been modified to ensure elevations at the devices are marginally greater than the predicted 1 Year ARI flood level (see Figure 5-1). As such, the treatment devices are flood immune in the 1 year ARI event. Furthermore, the results also indicate that peak flood flow velocities in the 100 year ARI event do not exceed 1m/s within treatment devices.

C.4.6 Boundary Conditions

The TUFLOW model includes various inflow boundaries and a downstream water level boundary. The boundary conditions used in the TUFLOW model are discussed below. The inflow boundaries applied in the TUFLOW model are shown in Figure C-6.

C.4.6.1 Local Inflow Boundaries

RAFTS-XP local inflows from the sub-catchments within the Bells Creek and Lamerough Creek catchments were specified as 'source-area' inflow boundaries in the TUFLOW model. These boundaries distribute inflows over the 2D domain, and are based on the sub-catchments from the RAFTS-XP model. The initial drainage locations for the source-area inflows for the base case are shown in Figure C-6.

C.4.6.2 Lamerough Creek Inflow Boundary

The hydraulic model does not include the upper catchment of Lamerough Creek. The upstream model extent on Lamerough Creek is in the vicinity of the Bells Creek Arterial crossing. Therefore, it was necessary to derive flow hydrographs to simulate flow into Lamerough Creek at the upstream boundary.

A single 12m 2D domain version of the existing case hydraulic model that included the full extent of the Lamerough Creek catchment was run for all design runs. Flows at the location corresponding to the upstream boundary on Lamerough Creek in the multi-domain model were extracted from the single domain model results, and applied as upstream boundary conditions in the multi-domain model.

C.4.6.3 Duck Holes Creek Inflow Boundary

The inflows from the Duck Holes Creek catchment were applied as an inflow hydrograph in the TUFLOW model. The inflows were based on the RAFTS-XP total flow results at the outlet of Duck Holes Creek.

C.4.6.4 Downstream Boundary Condition

At the downstream end of the TUFLOW model, a static water level boundary condition was specified. The water level specified represents the tide within Pumicestone Passage. The water levels used are discussed below.

C.4.6.5 Downstream Water Levels during Freshwater Flood Events

Based on SKM (2006), storm tide events and freshwater flood events have been considered to be statistically independent and it has been assumed that there is a minimal correlation between storm tide events and freshwater flood events. Consequently, for the modelling of freshwater flood events, ocean levels are not assumed to be affected by storm surge. For the modelling of freshwater flood events, a constant water level of 0.45mAHD was used as a downstream boundary condition. This water level represents a mean high water spring level at Golden Beach (from the Tide Tables and Boating Safety Guide (MSQ, 2007)).

C.4.6.6 Storm Tide Levels

The flood risk at the low lying land adjacent to Pumicestone Passage is dominated by inundation due to storm surge events. To assess the flood risk of these parts of the site, design storm levels at the proposed development site have been assessed. As discussed above, storm tide events have been assumed to be statistically independent of catchment flooding. A present-day 100 year ARI design storm tide level of 1.65mAHD has been adopted based on the "*Sunshine Coast Storm Tide Study*" (Aurecon, 2013).

C.4.7 Model Verification

As part of a previous BMT WBM flood assessment of the Caloundra South development (in 2009), the TUFLOW model was simulated using the same design flood events and assumptions as per the SKM 2006 *Caloundra South Flood Study*. The results of the Caloundra South TUFLOW model were compared with results from the Caloundra South Flood Study MIKE-FLOOD model.

Overall, the results showed a relatively high level of consistency, with differences in modelled peak flood levels on-site generally within 0.1m for all design events modelled. This is considered to be a good comparison. However, there were some areas where model results deviated.

The differences in flood extent were likely to be related to the different approach adopted for applying the RAFTS-XP sub-catchment inflows. In the MIKE-FLOOD model, inflow boundaries were applied as source points at the centre point of the sub-catchment, whilst in the TULFOW model the inflows were distributed over wetted areas of the sub-catchment. The adopted approach in the TUFLOW model is considered to be more appropriate.

Differences in predicted peak flood levels upstream of the Bruce Highway were likely to be related to differences in culvert structures in the TUFLOW and MIKE-FLOOD model. (Culverts in the TUFLOW model were based on structure survey.) In addition, the RAFTS-XP sub-catchment at the highway, BCS5, was divided into two sub-catchments in the refined BMT WBM RAFTS-XP model.

The Caloundra South Flood Study MIKE-FLOOD model was not calibrated to historical flood events due to the absence of reliable data. Consequently, this analysis simply demonstrates that the previous TUFLOW model was predicting similar results to the un-calibrated MIKE-FLOOD model.

The current TUFLOW model that has been used in this study is a refined and updated version of the previous TUFLOW models, with changes to the underlying land use classification, more contemporary topographic data and refined model detail.

C.5 Sensitivity Analysis

C.5.1 Overview

In ungauged catchments, where it is not possible to undertake model calibration, it is prudent to undertake a sensitivity analysis to understand how sensitive the model is to the assumptions and uncertainty in the modelling. For the purposes of this assessment, the following parameters have been tested:

(1) Sensitivity of flood levels to inflow and downstream boundary conditions (as per climate change);

(2) Sensitivity of flood levels to Manning's n; and

(3) Sensitivity of flood levels to structure blockage.

It should be noted that the differences reported in the following sections are due to changes in the parameters tested and not as a result of the proposed development.

C.5.2 Boundary Conditions

The results of the climate change assessment have been compared to the current climate results to quantify the sensitivity of the developed case model to the selected boundary conditions. Thus, this assessment assumes a 20% increase in rainfall depth and a 0.8m increase in the downstream boundary level. The differences on peak flood levels for the 100 year ARI flood event are shown in Figure C-8.

Downstream of the development, where the terrain is relatively low lying and flat, flood levels have increased by approximately 0.2m. Within the Pelican Waters canal, flood levels are particularly sensitive to the downstream boundary, and have increased by approximately 0.4m.

On Bells Creek North and Bells Creek South the flood levels are less sensitive; levels have increased by less than 0.1m. Lamerough Creek is slightly more sensitive, with levels increasing by approximately 0.15m.

Areas where flood waters are attenuated behind a structure, such as the Bells Creek South detention basin, upstream of the Bells Creek Arterial, the East-West Link Road and the Bruce Highway, are most sensitive to the increased rainfall depths with increases of 0.56m in the detention basin.

C.5.3 Manning's n

The sensitivity of the developed case model to the assumed hydraulic roughness assumptions has been tested by increasing Manning's n values by 20% for the 100 year ARI flood event. The change in peak flood level is shown in Figure C-9.

The increase in Manning's n generally increases flood levels by less than 0.1m. The detention basin areas are not sensitive to Manning's n. Increases in flood levels do not impact on the flood extent within the proposed development. Thus, flood level uncertainties related to hydraulic roughness are smaller in magnitude than the freeboard between the adopted fill levels and 100 year ARI flood level.

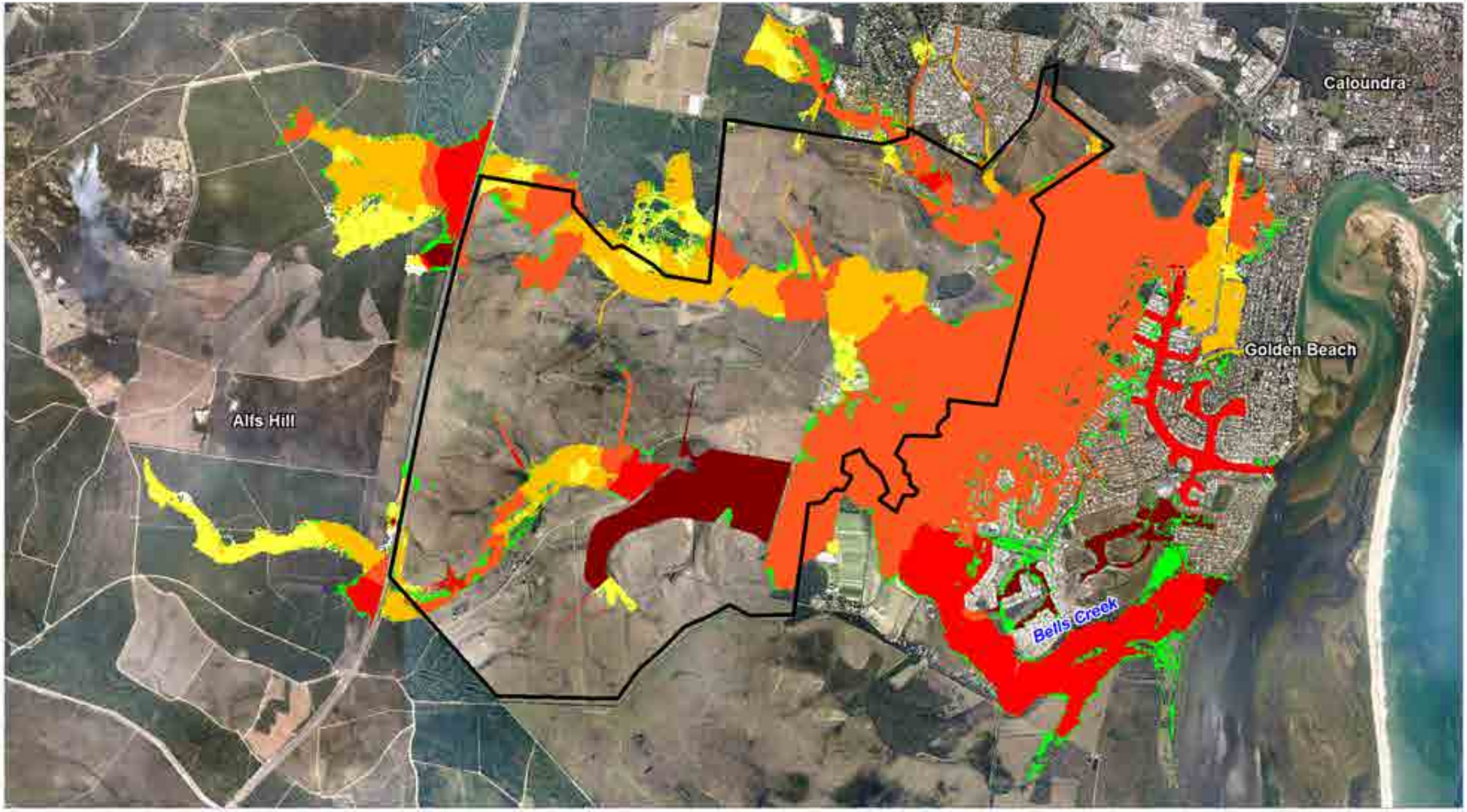
C.5.4 Structure Blockage

Structures in the model were assumed to be unblocked. The sensitivity of the developed case model to blockage of structures has been tested by applying a blockage to culvert structures for the 100 year ARI flood event. The percentage blockage has been selected based on *"AR&R Revision Project 11: Blockage of Hydraulic Structures"* (Weeks et al., 2013).

Based on the source area characteristics of the catchment, the debris potential is considered to be medium. For culverts, it has been assumed that the opening diameter/width is less than the length of the longest 10% of debris (L_{10}) and therefore a 50% blockage factor has been applied for culverts. For bridge openings, it has been assumed that the opening width is greater than 3 times the L_{10} and therefore a 0% blockage factor has been applied. The existing culverts under the Bruce Highway were not blocked as this would attenuate flows into the Caloundra South PDA and mask potential increases in flood levels caused by blockages at proposed structures further downstream. The results of the analysis are shown in Figure C-10.

Flood levels in the detention basin outlet on Bells Creek South are highly sensitive to blockage. Here, flood levels have risen by 0.86m. This is 0.3m higher than the climate change level, and 0.05m below the Flood Planning Level. As such, the blockage is not expected to result in flooding to the proposed development. Nevertheless, the flood levels do get close to the Flood Planning Level and blockage mitigation measures, such as blockage prevention devices and overflows, should be incorporated in the detention basin outlet design during the detailed design stage.

The blockage of the culverts under the East-West Link Road on Bells Creek North has caused an increase in water levels upstream of the road crossing. The flood level increases by 0.12m immediately upstream of the road crossing.



Change in Peak Flood Level (m)

- <-0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- >0.50

Decrease in Inundation Extent

Increase in Inundation Extent

Priority Development Area

Title:

Flood Level Sensitivity to Boundary Conditions 100 Year ARI

Figure: C-8

Rev: B

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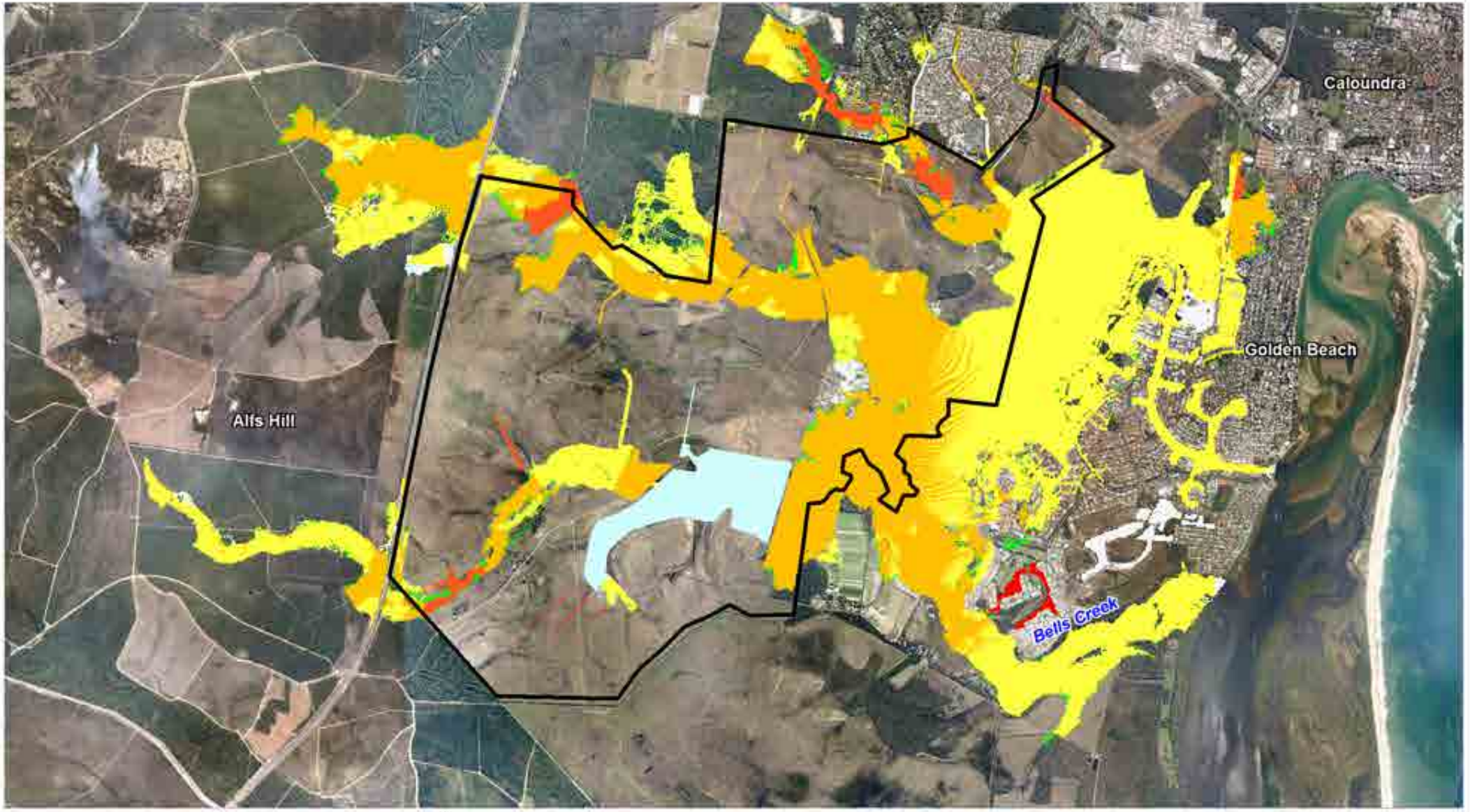
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0 1 2km

Approx.Scale

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Filepath : I:\B20047_I_BRH Cal Sth DA Assistance ABM\DRG\R.B20047.020.00.Flooding\FLD_016_sensitivity_boundaries_RevB.wor



Change in Peak Flood Level (m)

- <-0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- >0.50

Decrease in Inundation Extent

Increase in Inundation Extent

Priority Development Area

Title:

Flood Level Sensitivity to Manning's n
100 Year ARI

Figure: C-9

Rev: B

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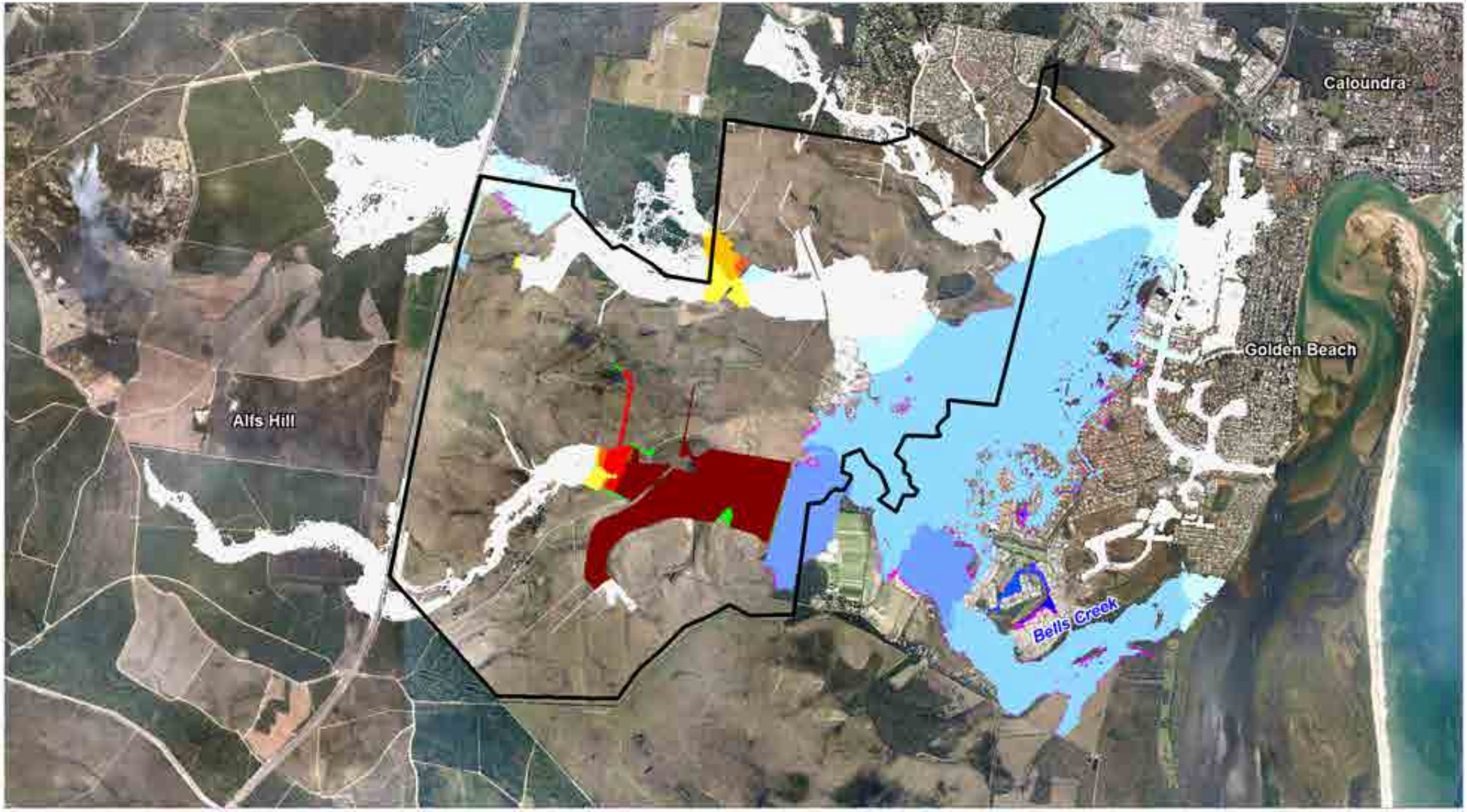
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0 1 2km

Approx.Scale

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Filepath : I:\B20047_I_BRH Cal Sth DA Assistance ABM\DRG\R.B20047.020.00.Flooding\FLD_017_sensitivity_mannings_RevB.wor



Change in Peak Flood Level (m)

- <-0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- >0.50

Decrease in Inundation Extent

Increase in Inundation Extent

Priority Development Area

Title:

Flood Level Sensitivity to Structural Blockage
100 Year ARI

Figure: C-10

Rev: B

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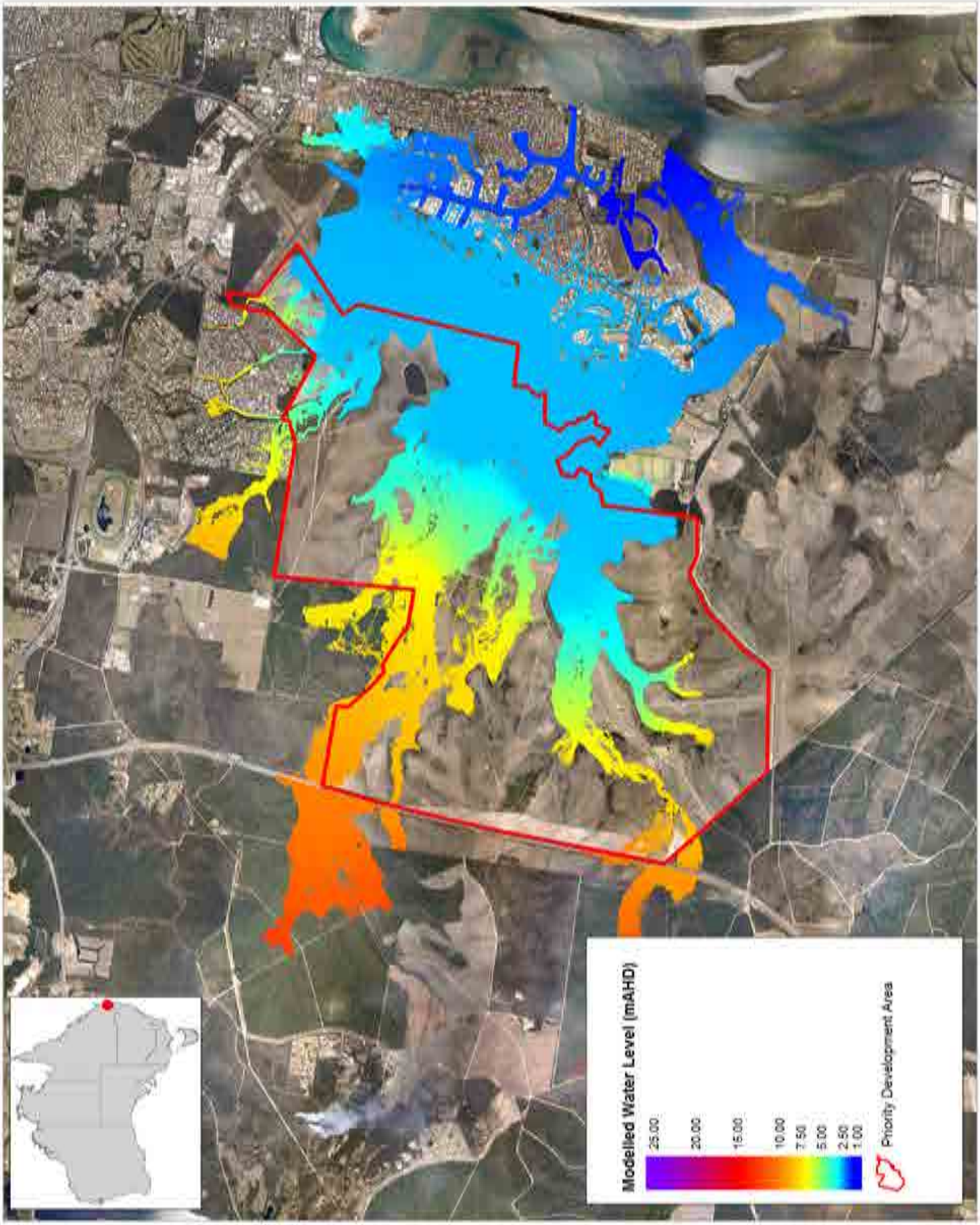
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Approx.Scale

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Filepath : I:\B20047_I_BRH Cal Sth DA Assistance ABM\DRG\R.B20047.020.00.Flooding\FLD_018_sensitivity_blockage_RevB.wor

Appendix D Existing Case Results



Title:
Existing Case Peak Fluvial 100 Year ARI Flood Level

Figure: D-1

Rev: -

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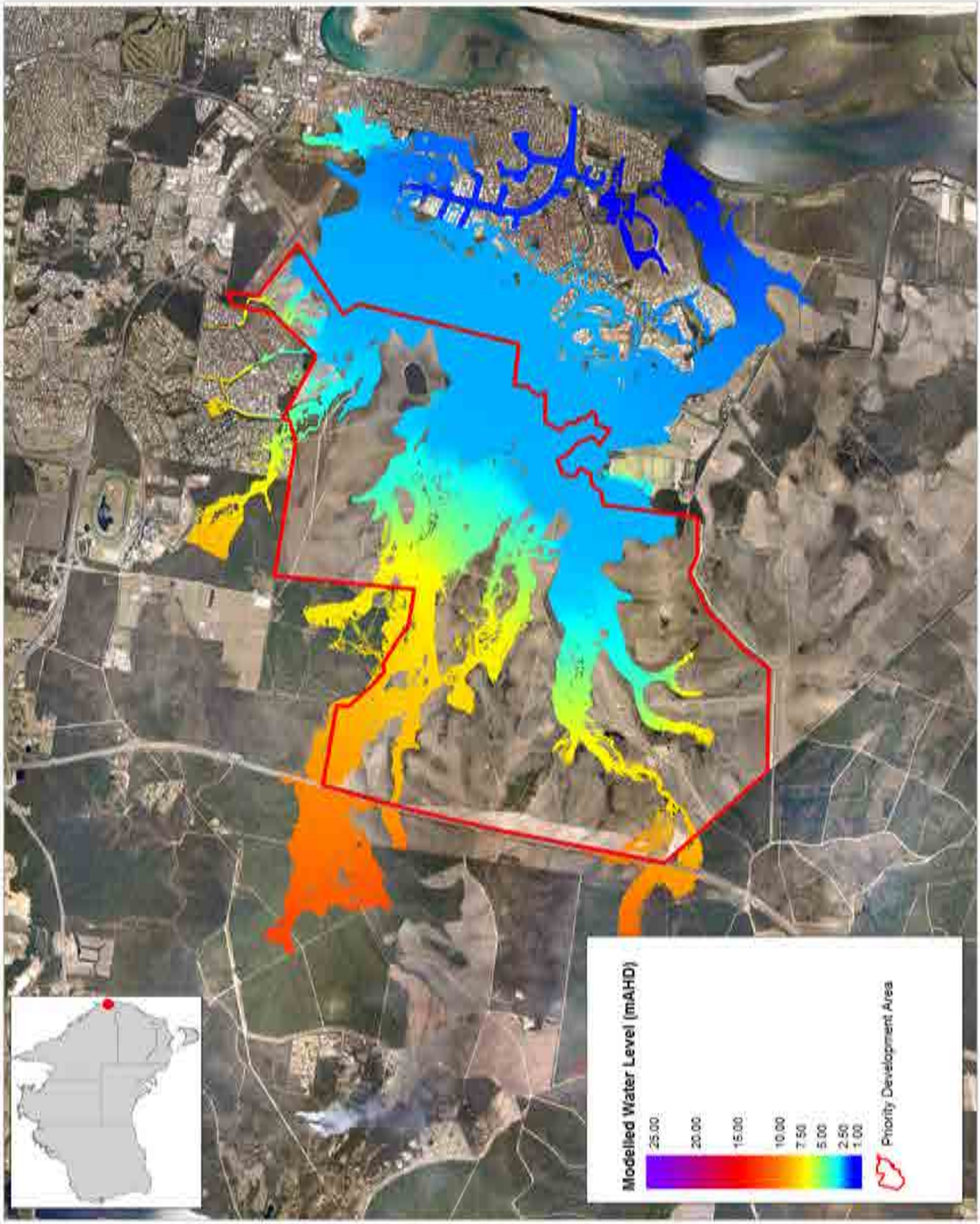
0 1.5 3km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_100_150813_Base_Q100_Levels.wor"



Title:
Existing Case Peak Fluvial 50 Year ARI Flood Level

Figure: D-2

Rev: -

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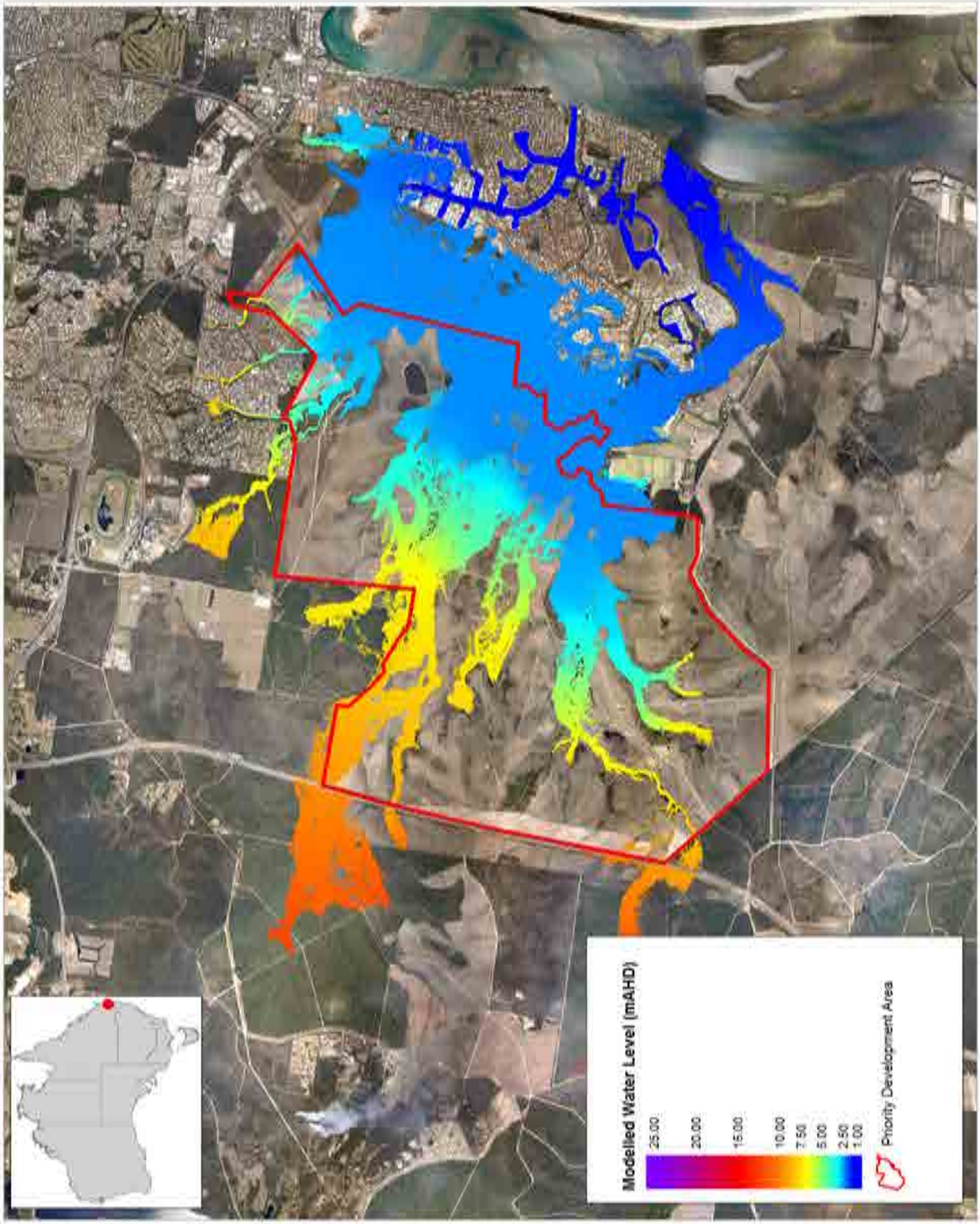
0 1.5 3km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_101_150813_Base_Q050_Levels.wor"



Title:
Existing Case Peak Fluvial 10 Year ARI Flood Level

Figure:
D-4

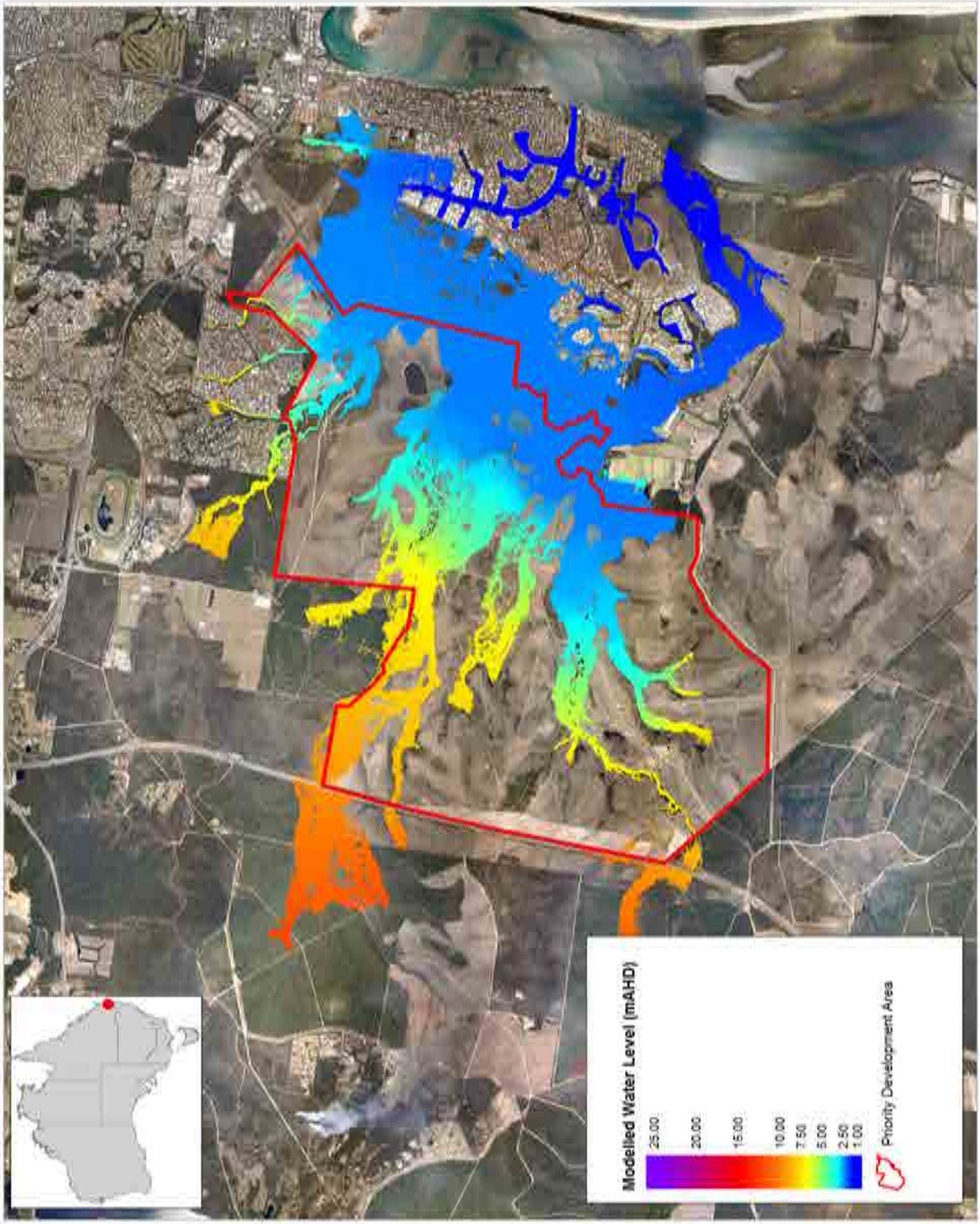
Rev:
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0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGW\B20047.020.00.Flooding\Appendix\FLD_103_150813_Base_Q010_Levels.wor"



Title:
Existing Case Peak Fluvial 5 Year ARI Flood Level

Figure:
D-5

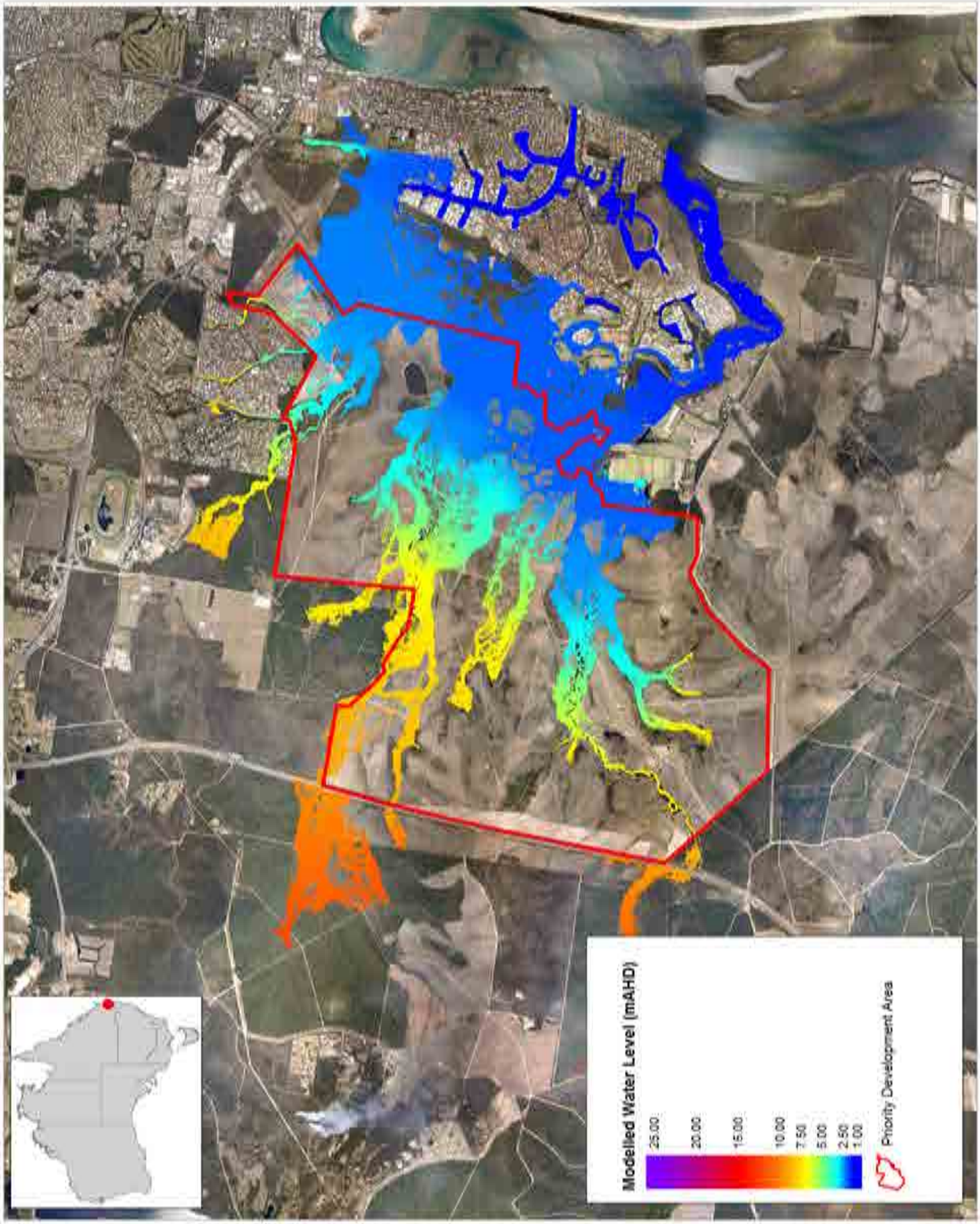
Rev:
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0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_104_150813_Base_Q005_Levels.wor"



Title:
Existing Case Peak Fluvial 2 Year ARI Flood Level

Figure:
D-6

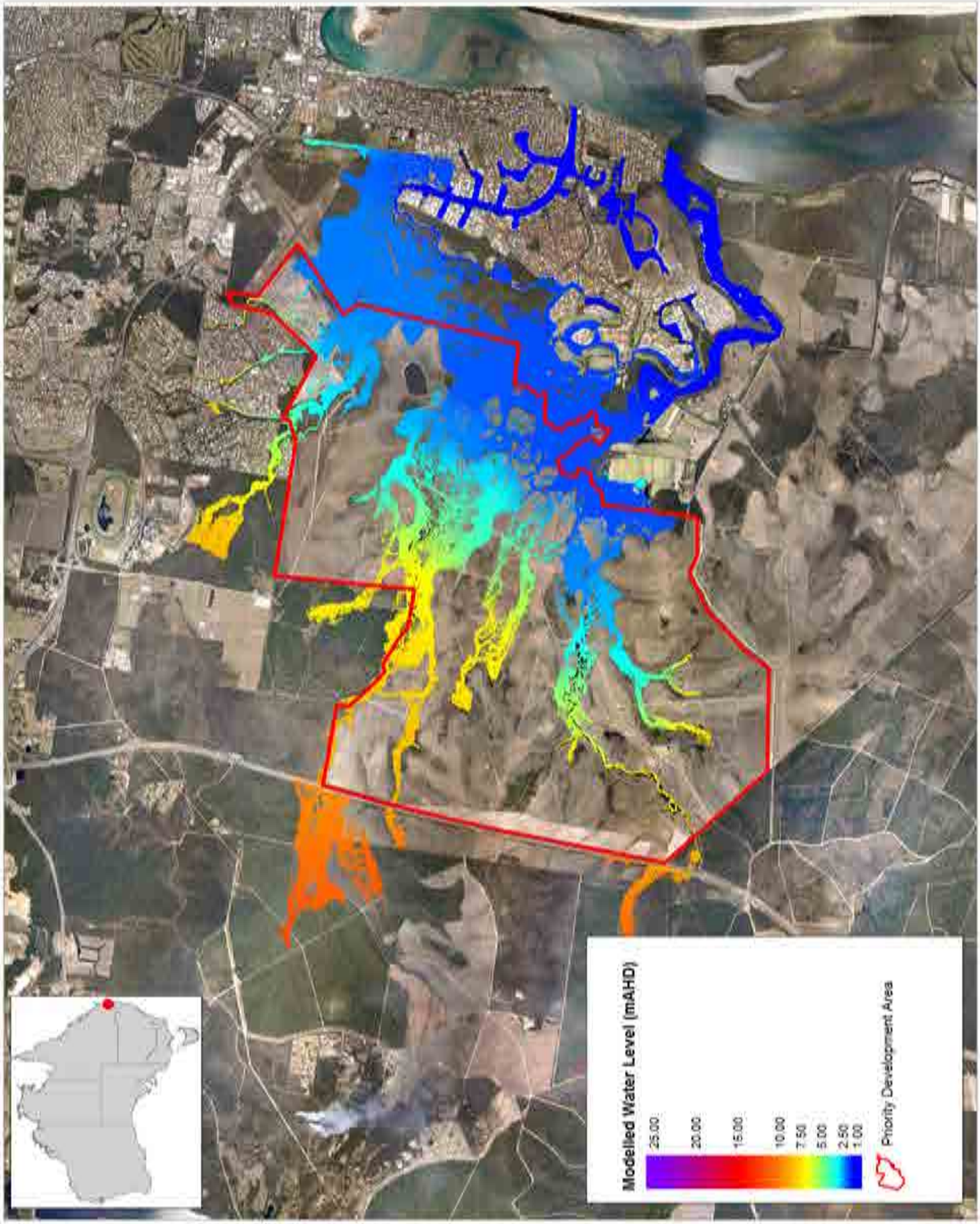
Rev:
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0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_105_150813_Base_Q002_Levels.wor"



Title:
Existing Case Peak Fluvial 1 Year ARI Flood Level

Figure: D-7

Rev: -

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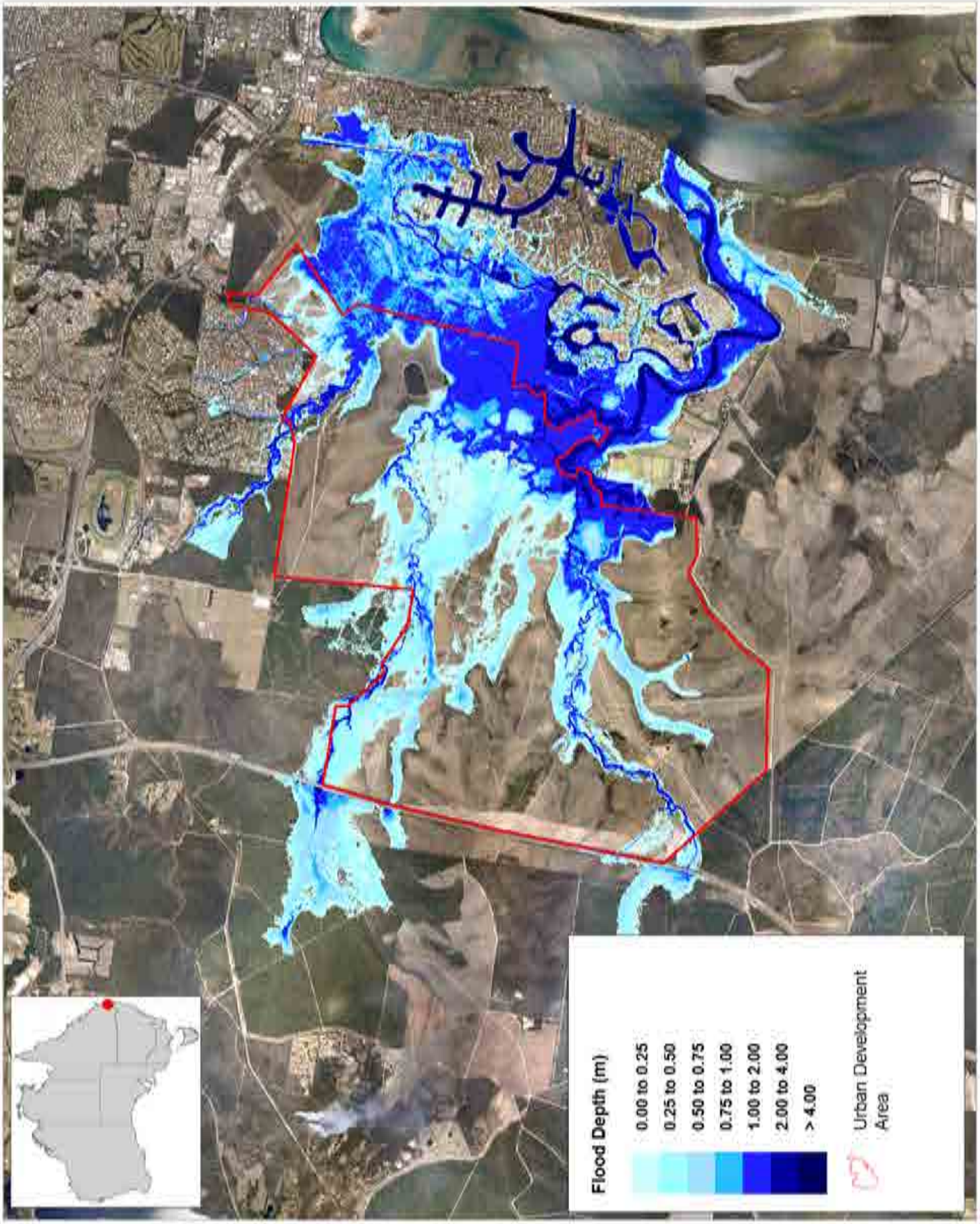
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Approx. Scale

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Title:
Existing Case Peak 100 Year ARI Flood Depth

Figure: D-8

Rev: -

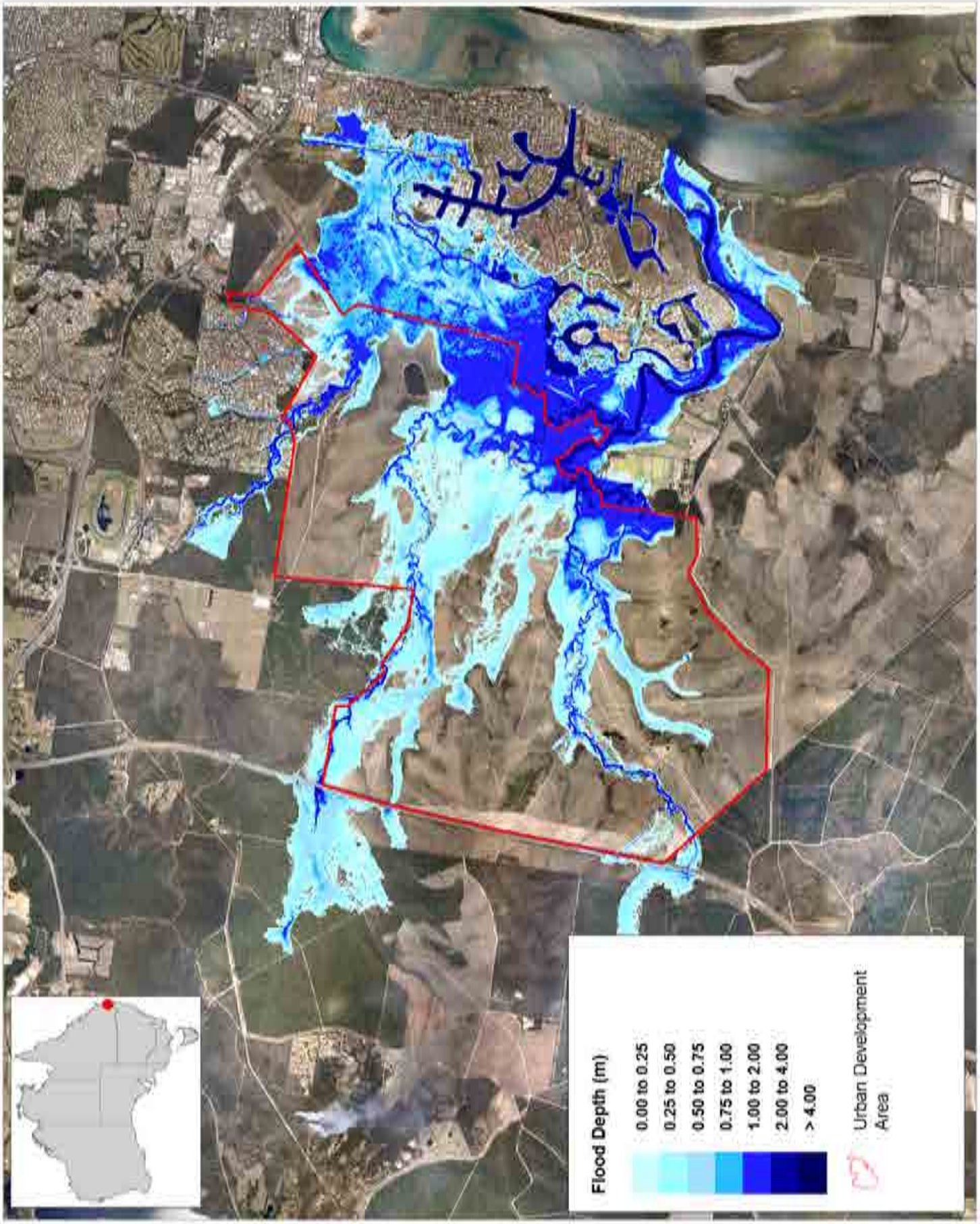
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0 1.5 3km

Approx. Scale

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Filepath: "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_107_150813_Base_Q100_Depths.wor"



Title:
Existing Case Peak 50 Year ARI Flood Depth

Figure: D-9

Rev: -

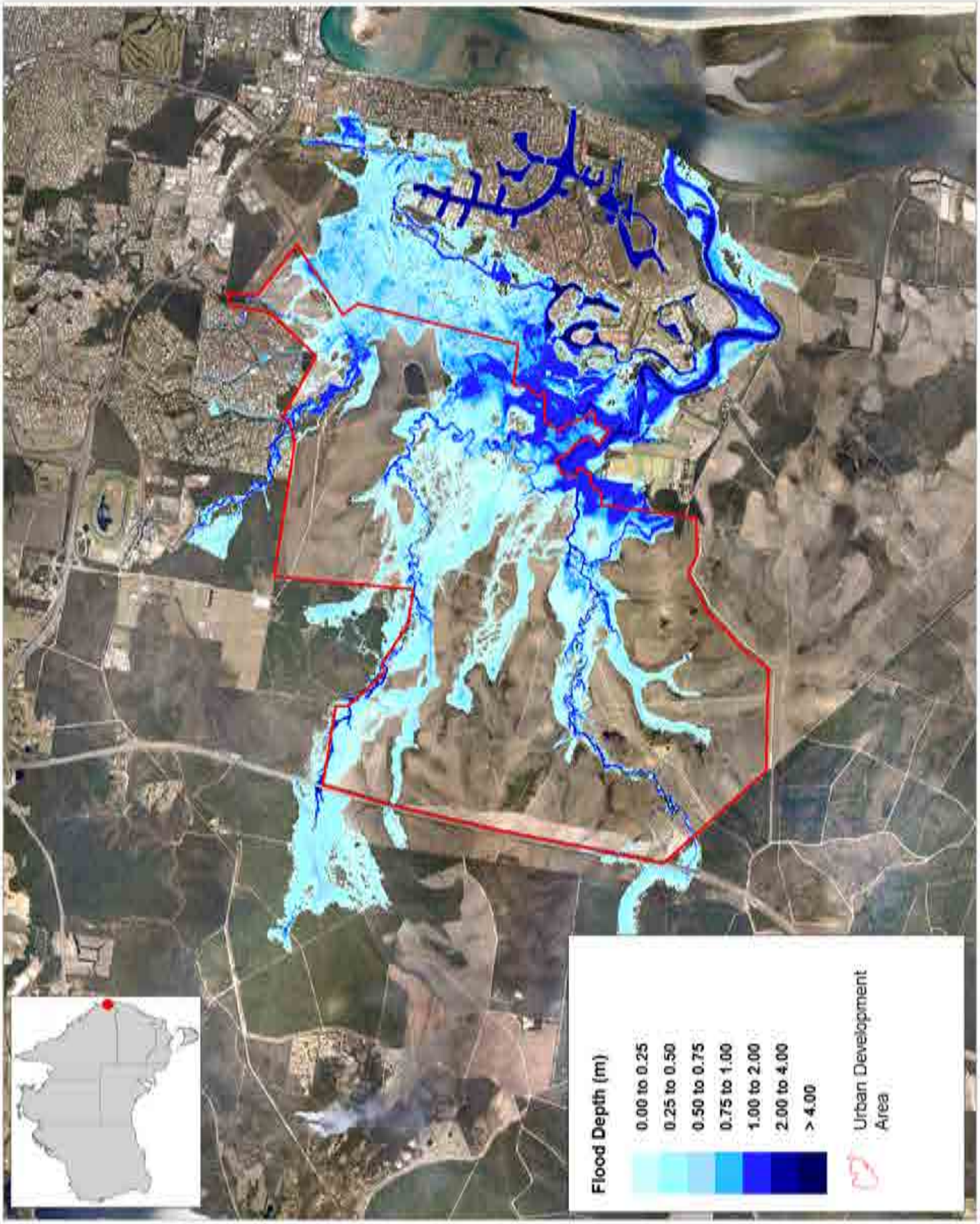
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\ERG\R.B20047.020.00 Flooding\Appendix\FLD_106_150813_Base_Q050_Depths.wor"



Title:
Existing Case Peak 10 Year ARI Flood Depth

Figure: D-11

Rev: -

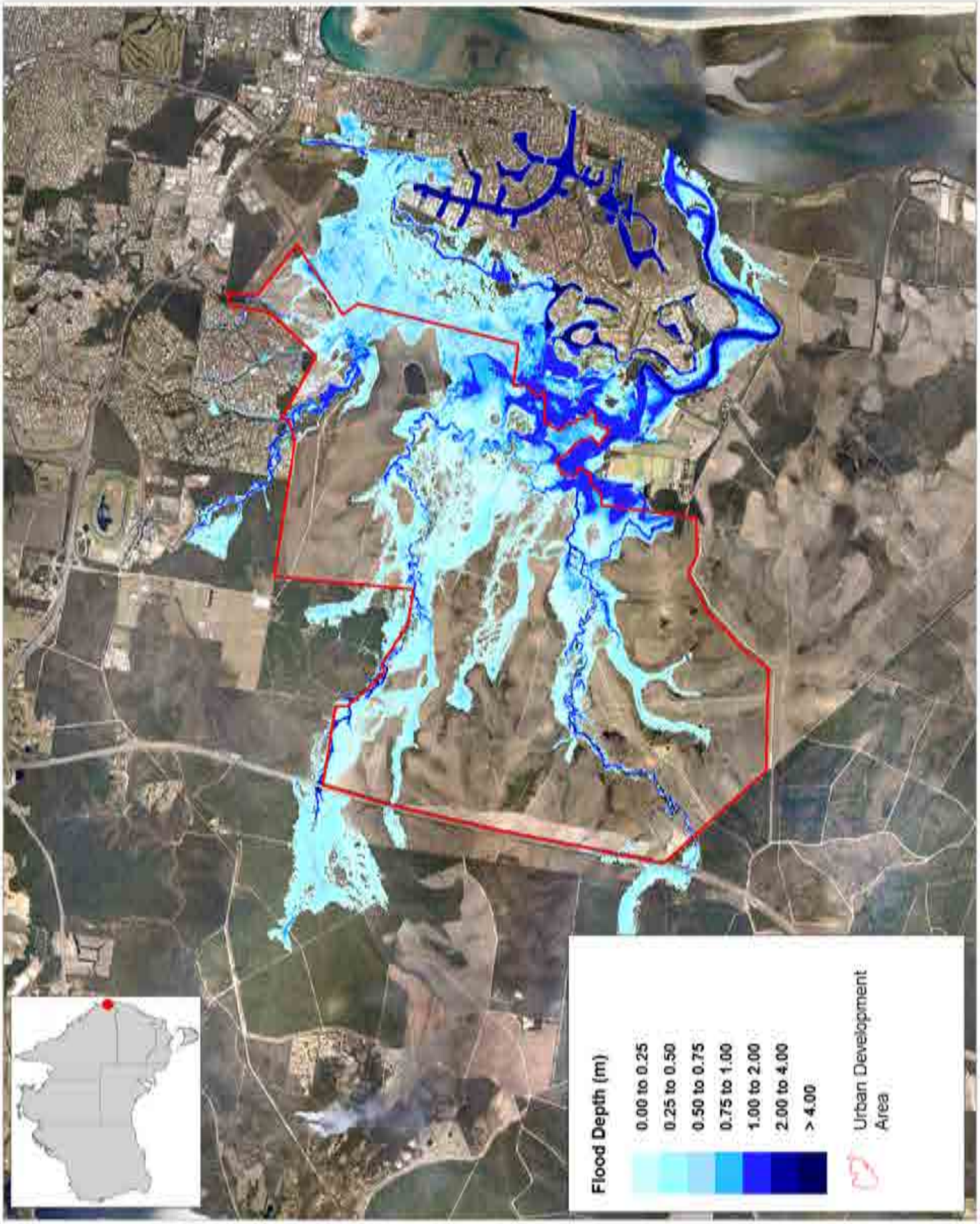
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_110_150813_Base_Q010_Depths.wor"



Title:
Existing Case Peak 5 Year ARI Flood Depth

Figure: D-12

Rev: -

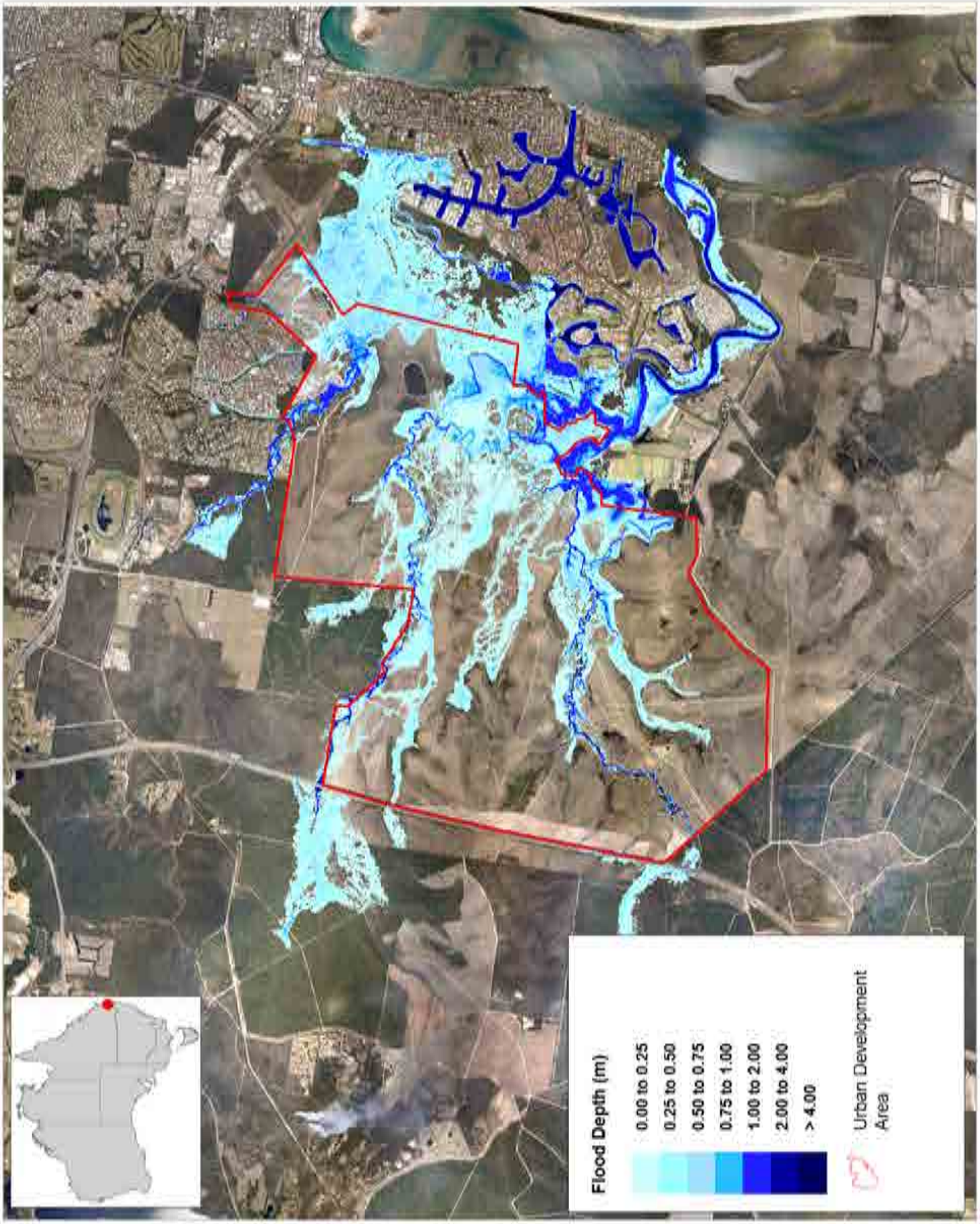
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_1_BRH Cal 5th DA Assistance ABM\ERG\R.B20047.020.00 Flooding\Appendix\FLD_111_150813_Base_Q005_Depths.wor"



Title:
Existing Case Peak 2 Year ARI Flood Depth

Figure: D-13

Rev: -

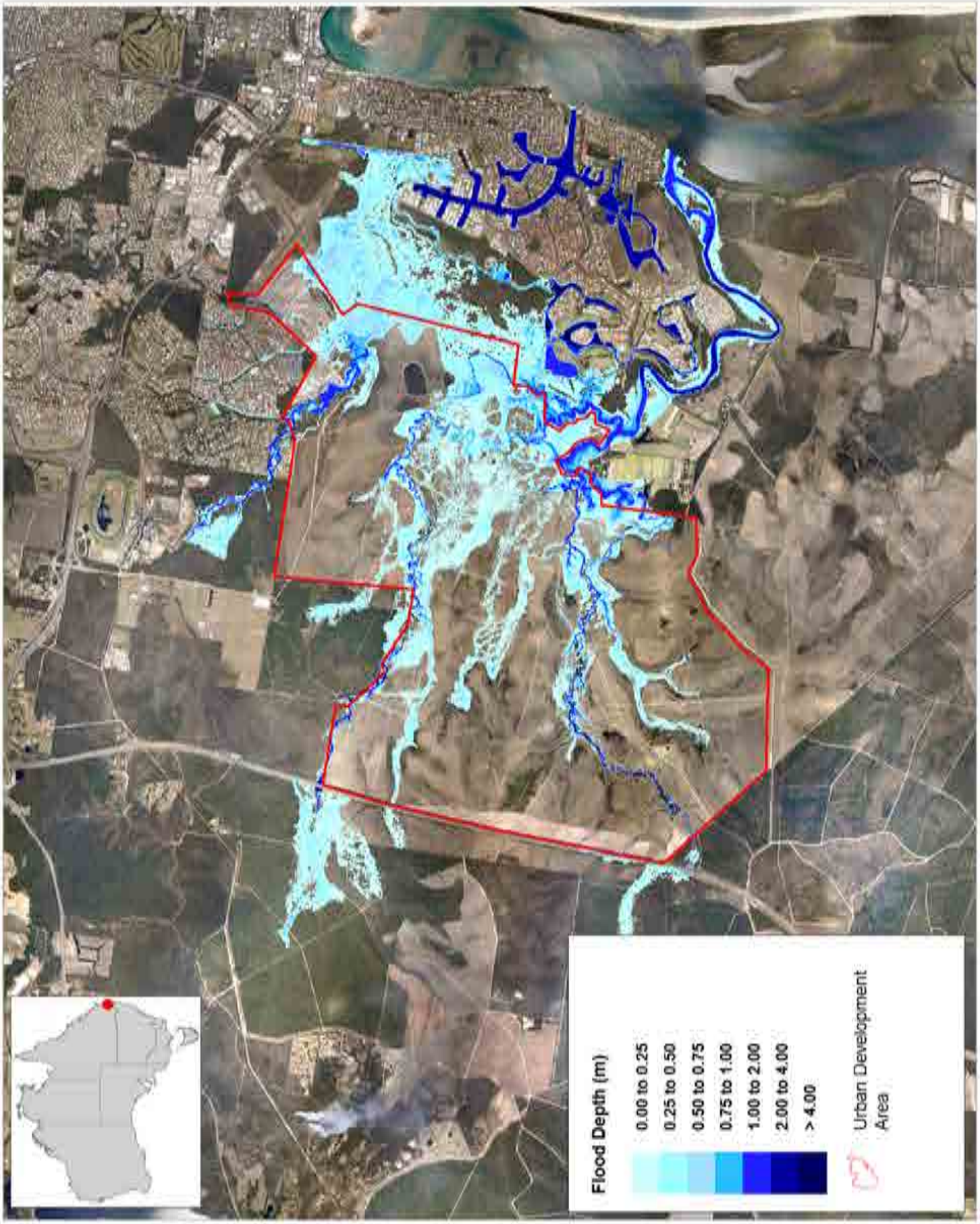
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0 1.5 3km

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_112_150813_Base_Q002_Depths.wor"



Title:
Existing Case Peak 1 Year ARI Flood Depth

Figure: D-14

Rev: -

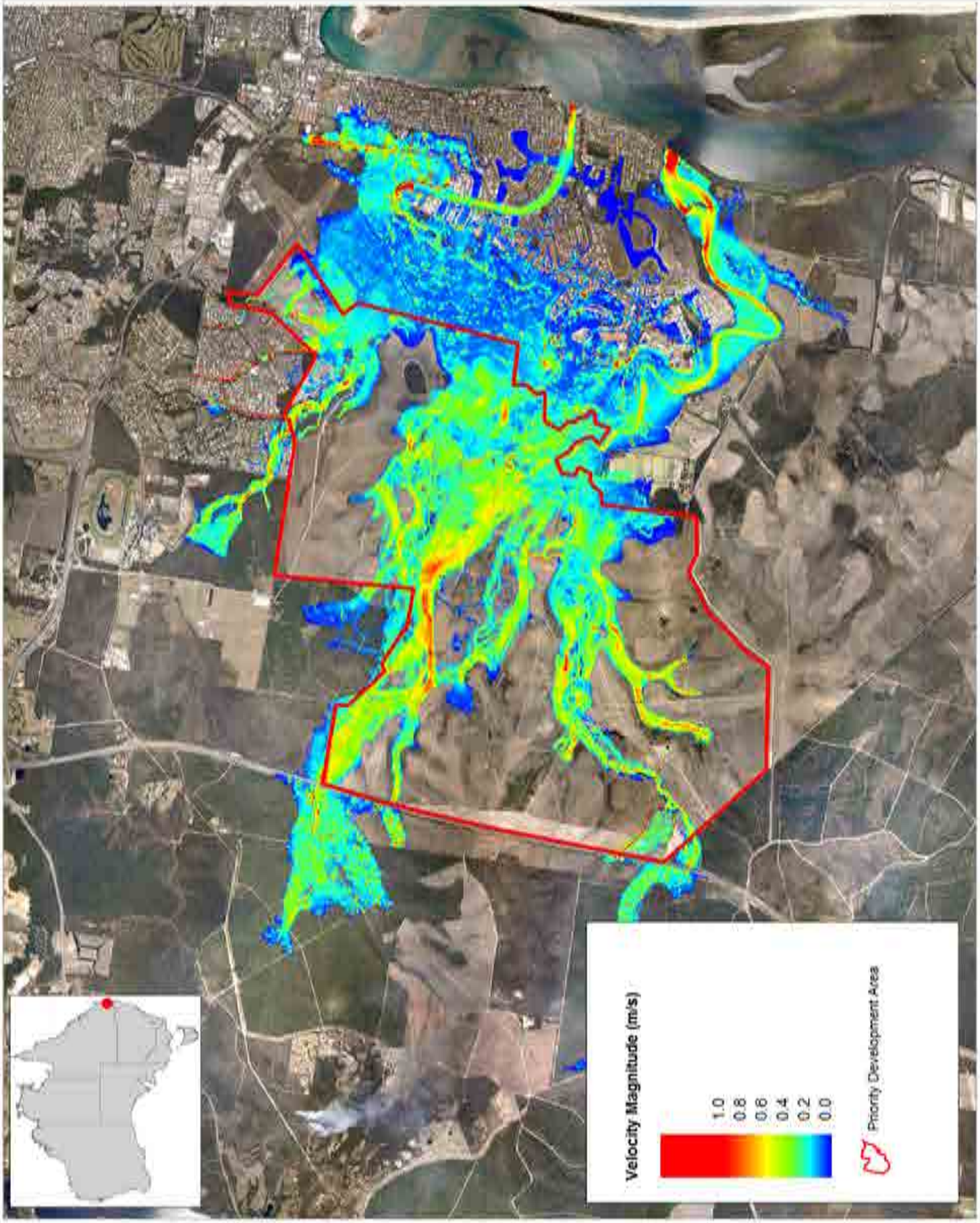
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_113_150813_Base_Q001_Depths.wor"



Title:
Existing Case Peak 100 Year Flow Velocity

Figure:
D-15

Rev:
-

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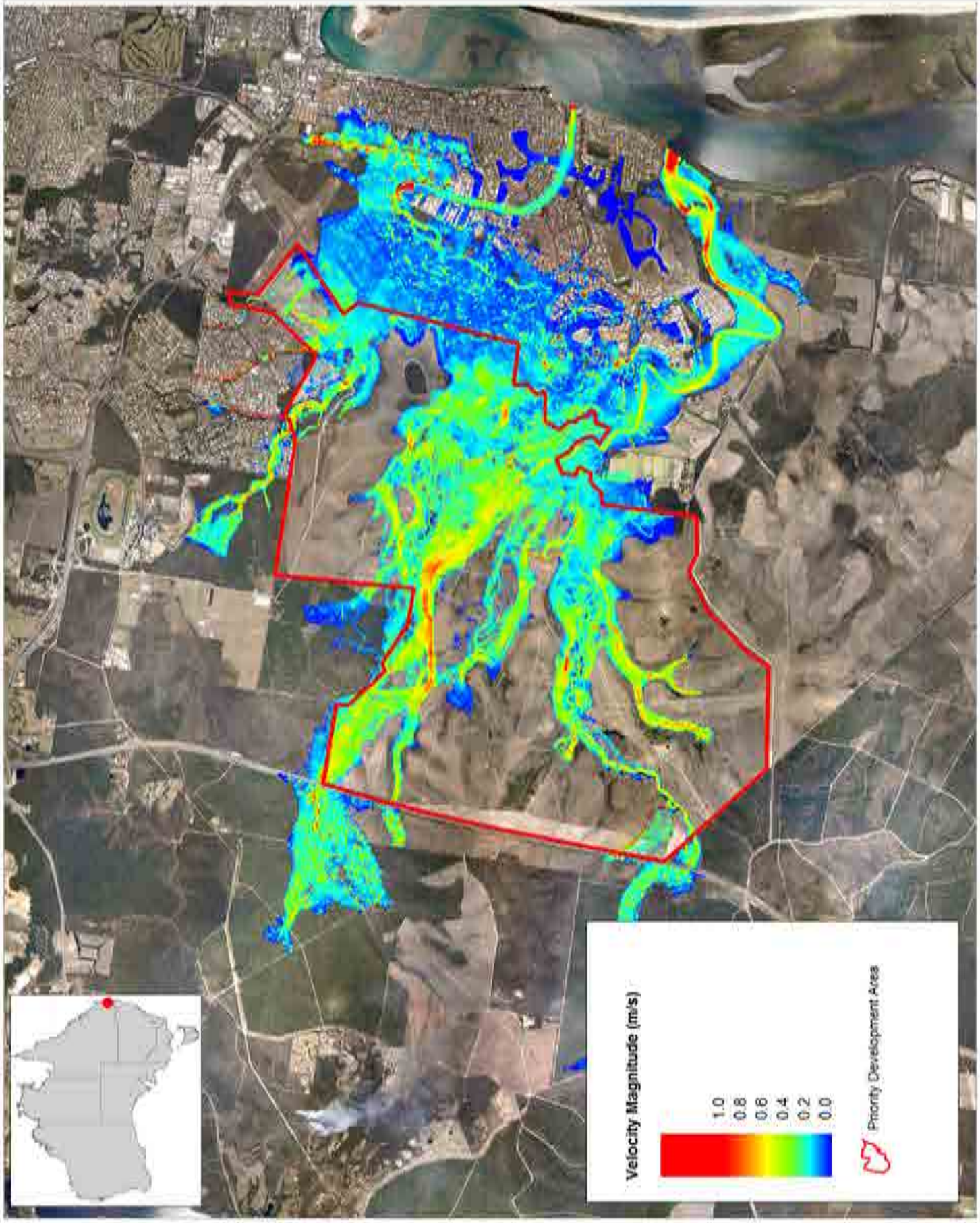
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0 1.5 3km

Approx. Scale

BMT WBM
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Filepath : *:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_114_150813_Base_Q100_Velocity.wor*



Title:
Existing Case Peak 50 Year Flow Velocity

Figure:
D-16

Rev:
-

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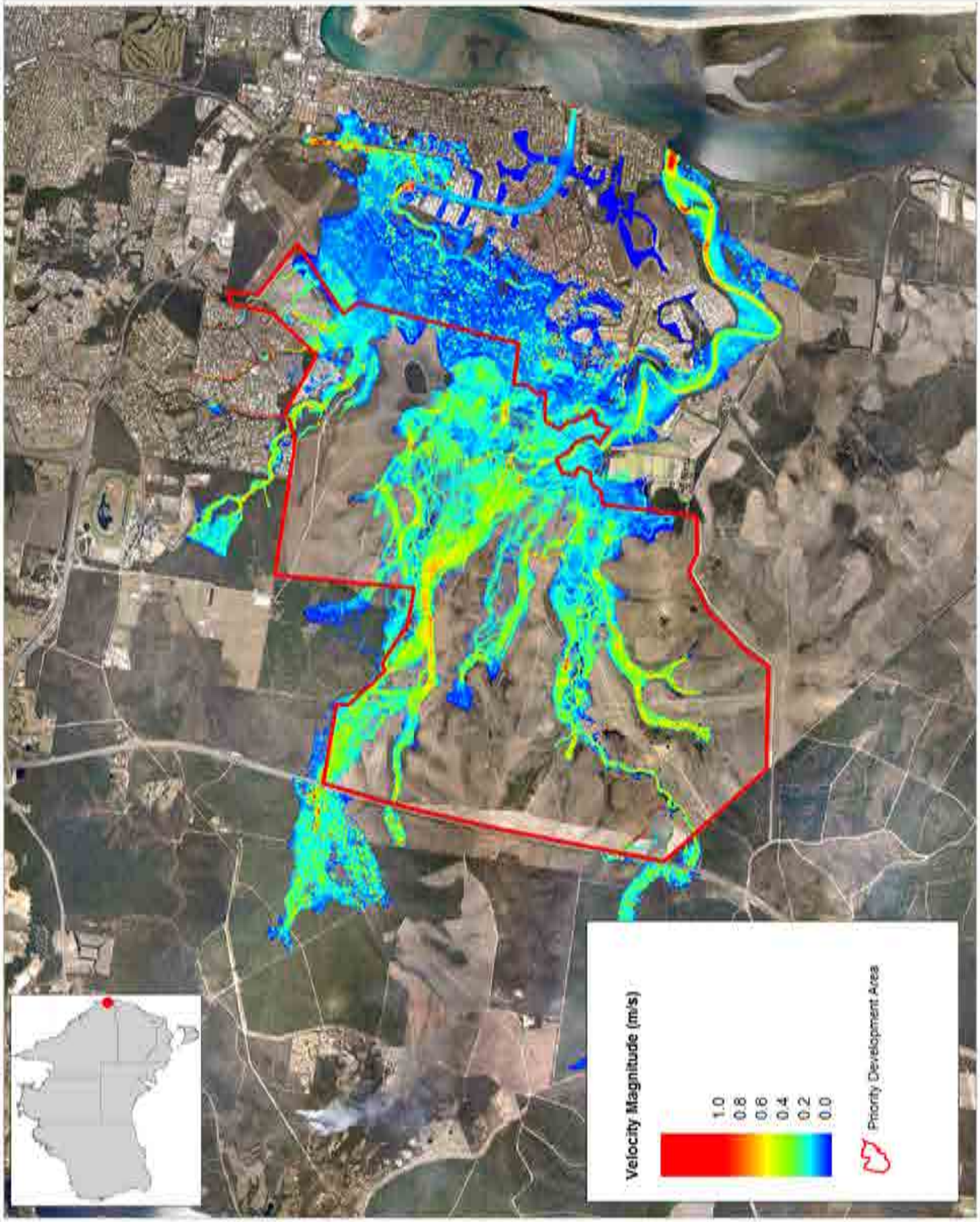
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0 1.5 3km

Approx. Scale

BMT WBM
www.bmtwbm.com.au

Filepath : *:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_115_150813_Base_Q050_Velocity.wor*



Title:
Existing Case Peak 10 Year Flow Velocity

Figure:
D-18

Rev:
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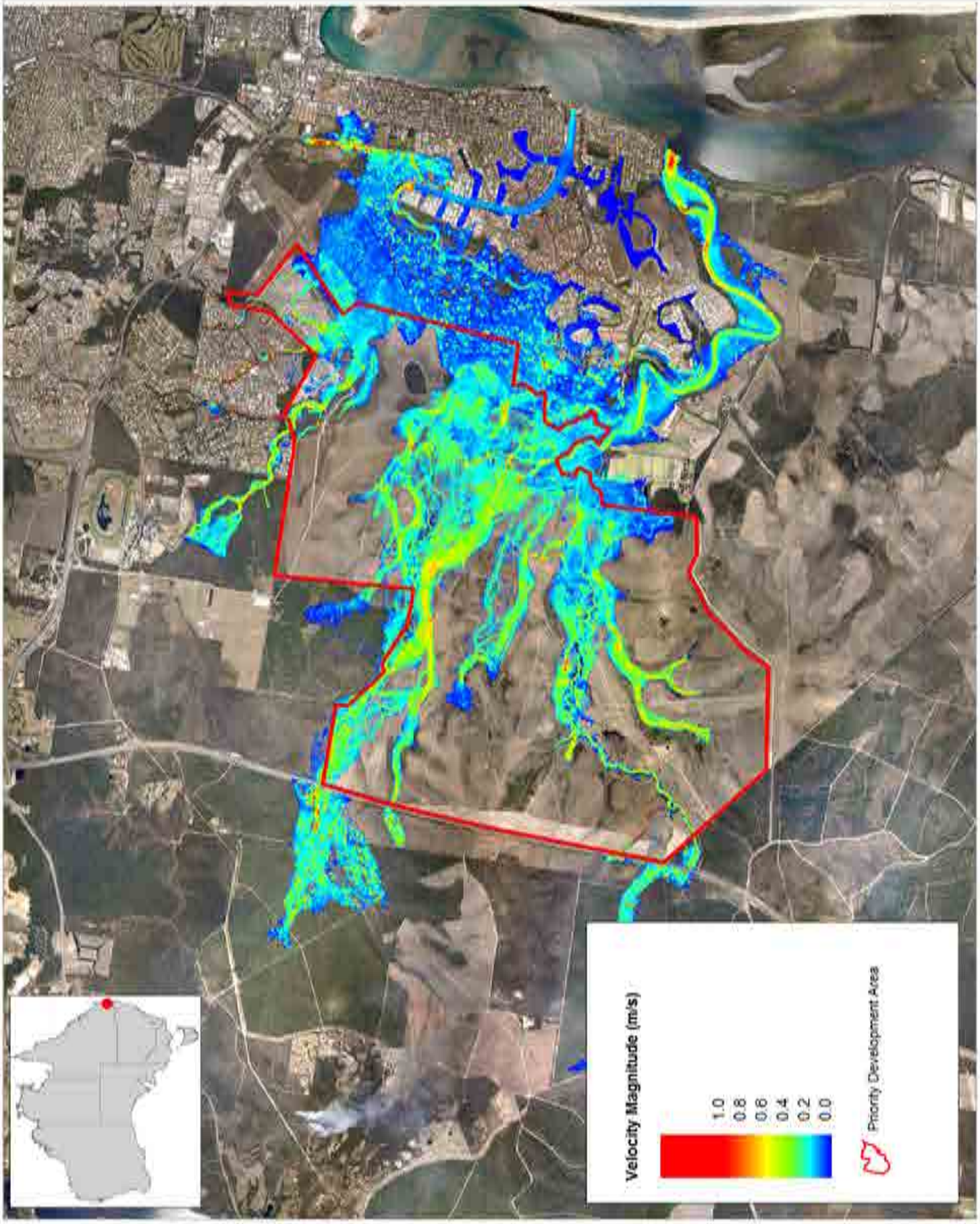
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0 1.5 3km

Approx. Scale

BMT WBM
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Filepath : *:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_117_150813_Base_Q010_Velocity.wor*



Title:
Existing Case Peak 5 Year Flow Velocity

Figure:
D-19

Rev:
-

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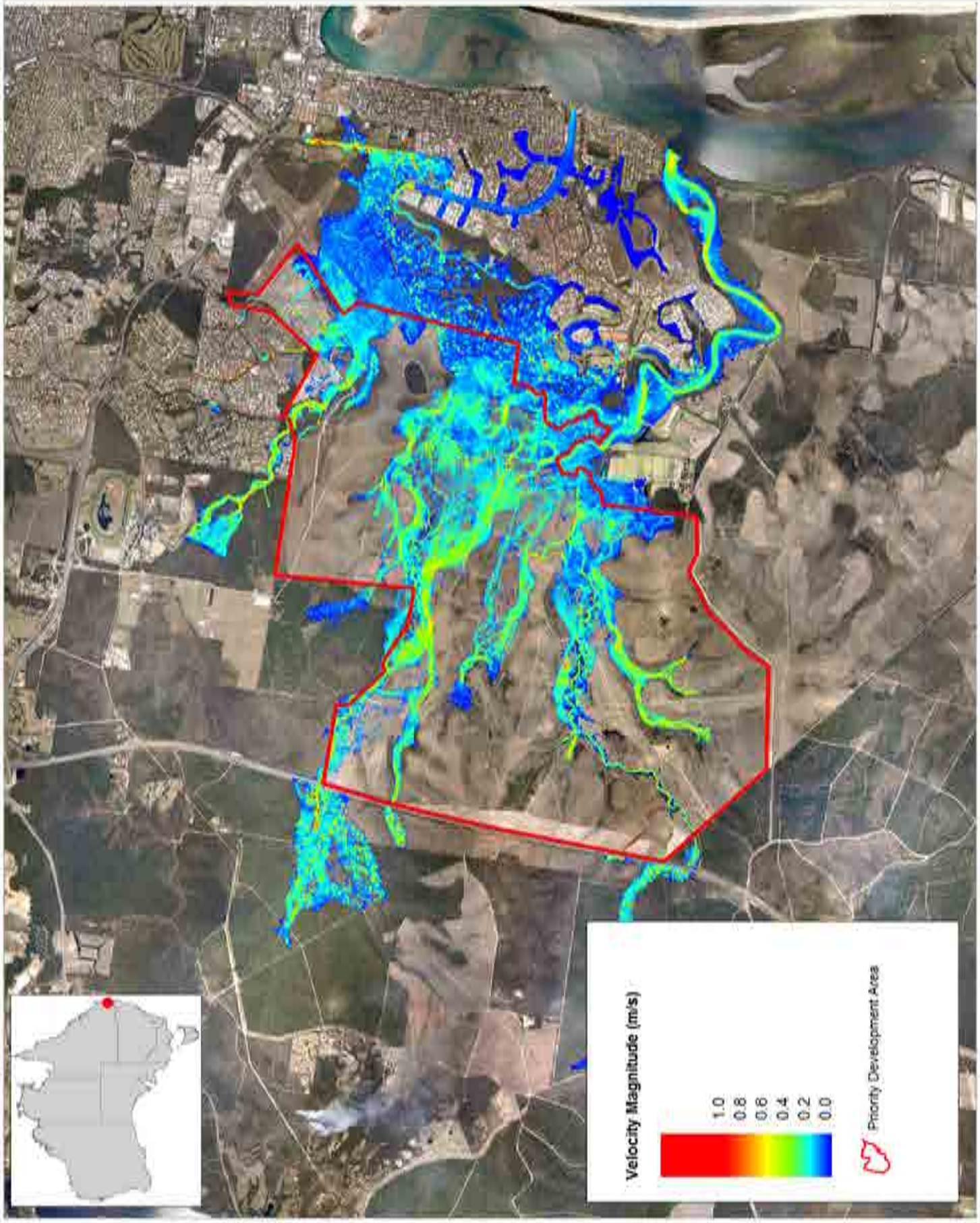
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0 1.5 3km

Approx. Scale

BMT WBM
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Filepath : *\\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_116_150813_Base_Q005_Velocity.wor*



Title:
Existing Case Peak 2 Year Flow Velocity

Figure:
D-20

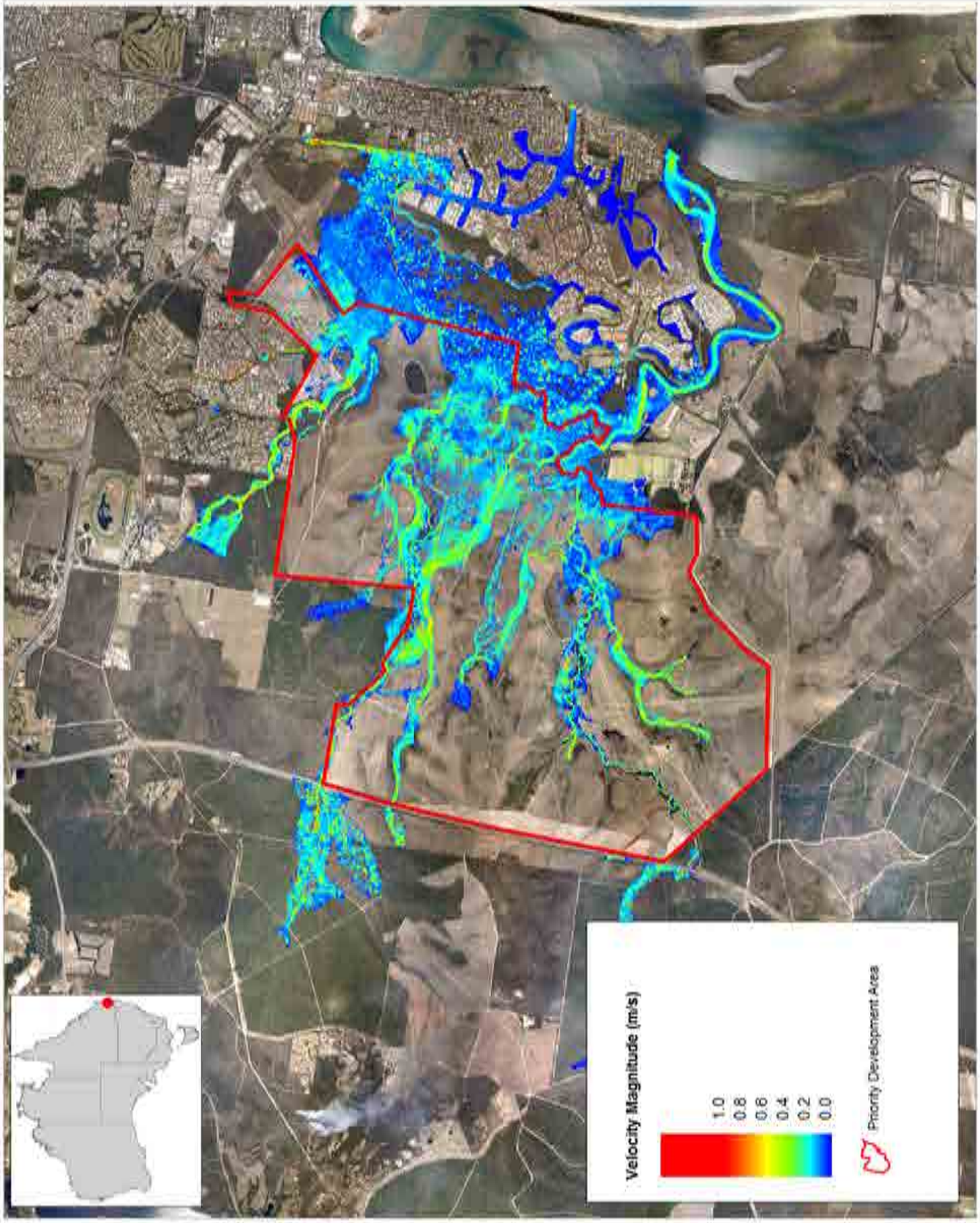
Rev:
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0 1.5 3km
Approx. Scale

BMT WBM
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Filepath : *\\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_119_150813_Base_Q002_Velocity.wor*



Title:
Existing Case Peak 1 Year Flow Velocity

Figure:
D-21

Rev:
-

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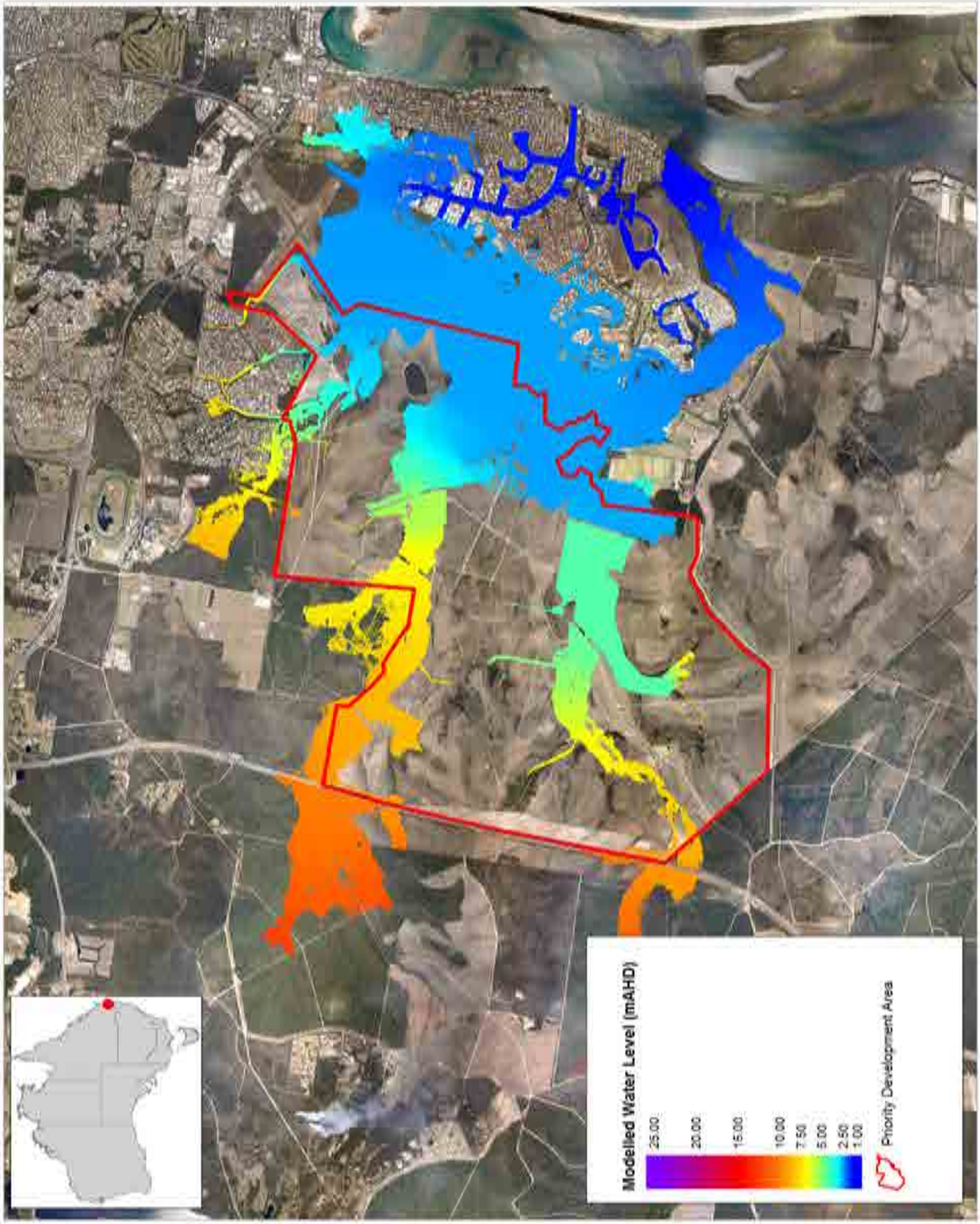
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Approx. Scale

BMT WBM
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Filepath : *\\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_120_150813_Base_Q001_Velocity.wor*

Appendix E Developed Case Results



Title:
Developed Case Peak Fluvial 100 Year ARI Flood Level

Figure:
E-1

Rev:
-

BMT WBM endeavours to ensure that the information provided in this map is correct at the time of publication. BMT WBM does not warrant, guarantee or make representations regarding the currency and accuracy of information contained in this map.

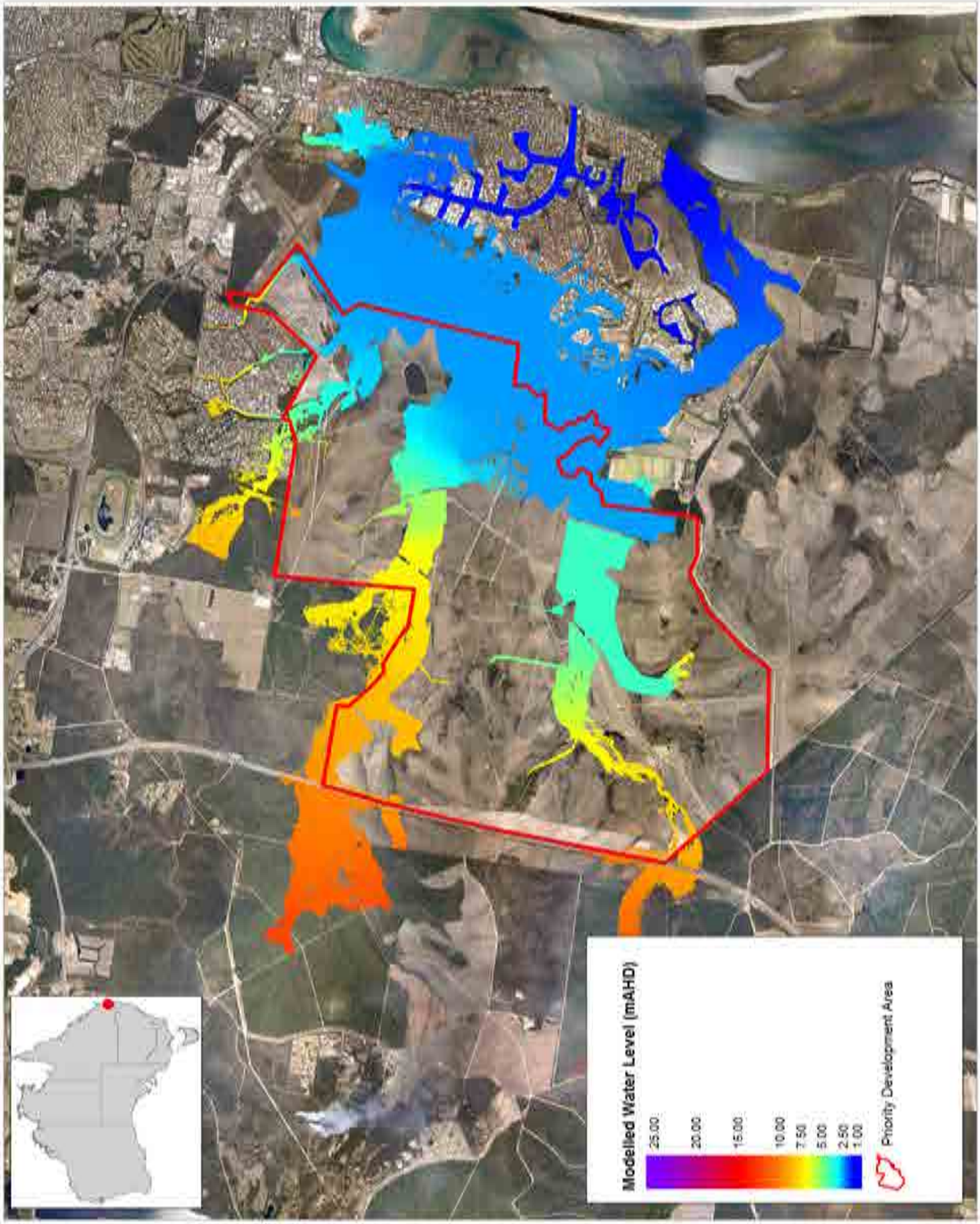
0 1.5 3km

Approx. Scale

BMT WBM

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_150_150813_Dev_Q100_Levels.wor"



Title:
Developed Case Peak Fluvial 50 Year ARI Flood Level

Figure:
E-2

Rev:
-

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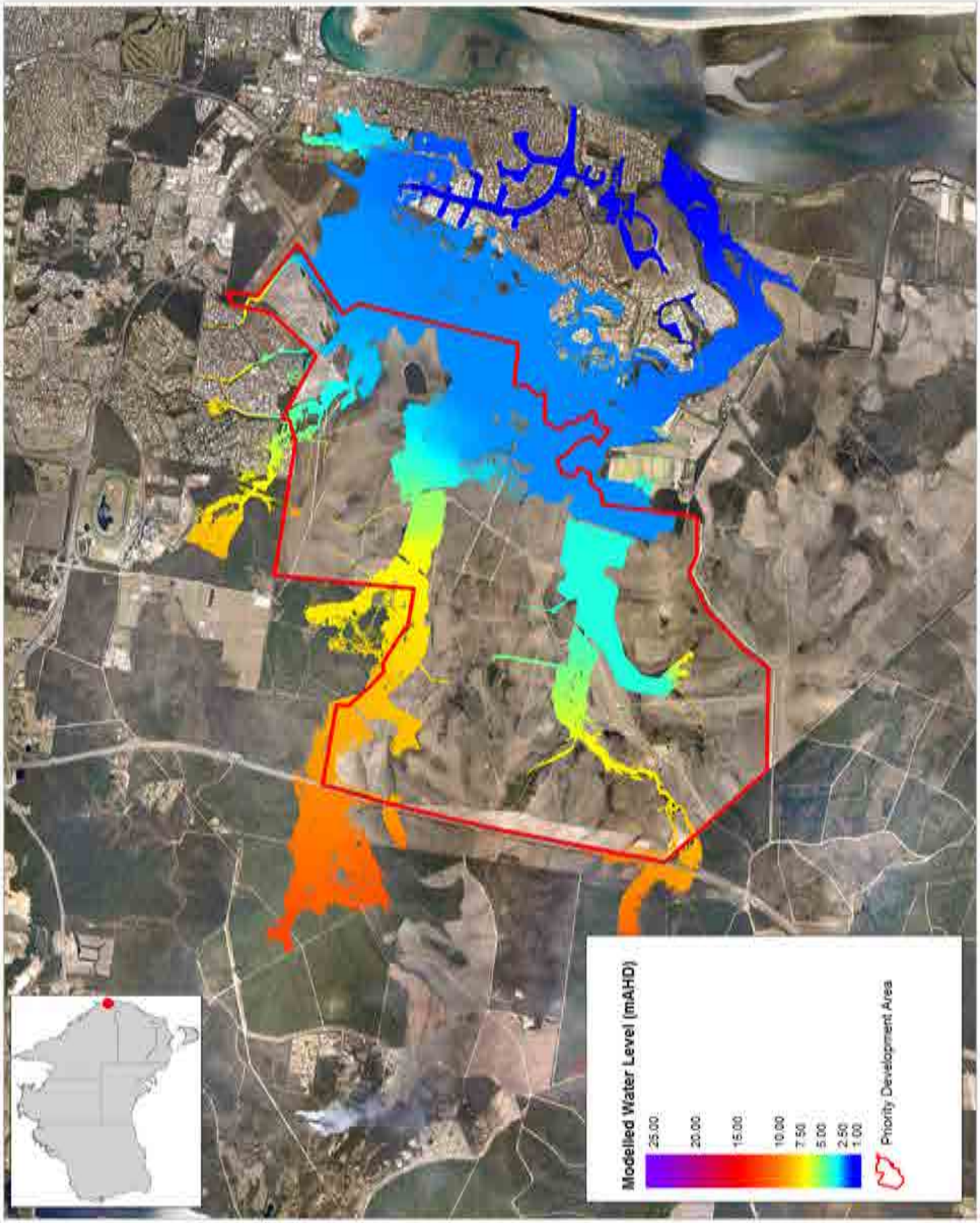
0 1.5 3km

Approx. Scale

BMT WBM

www.bmtwbm.com.au

Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_151_150813_Dev_Q050_Levels.wor"



Title:
Developed Case Peak Fluvial 20 Year ARI Flood Level

Figure:
E-3

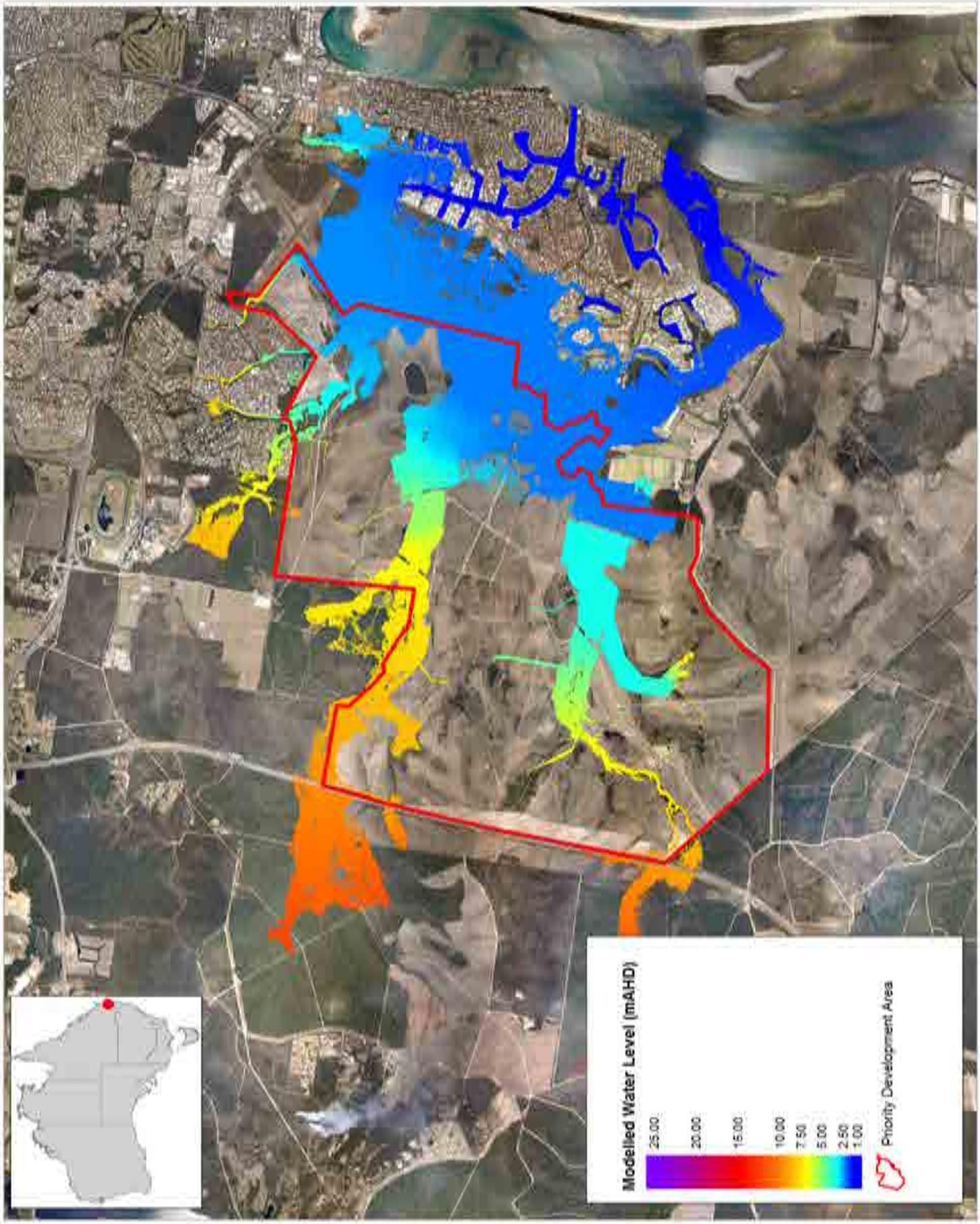
Rev:
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0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_152_150813_Dev_Q020_Levels.wor"



Title:
Developed Case Peak Fluvial 10 Year ARI Flood Level

Figure:
E-4

Rev:
-

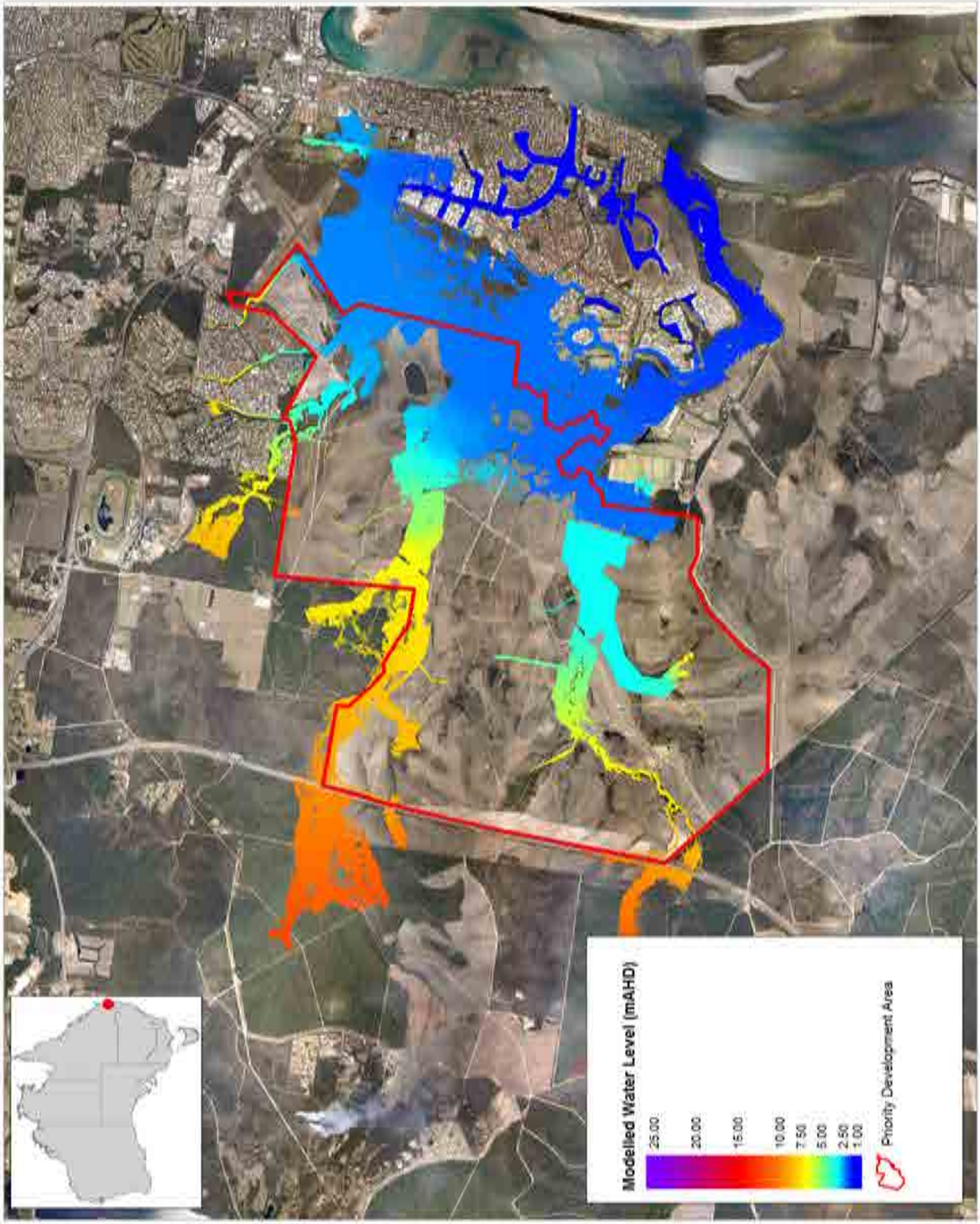
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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_153_150813_Dev_Q010_Levels.wor"



Title:
Developed Case Peak Fluvial 5 Year ARI Flood Level

Figure:
E-5

Rev:
-

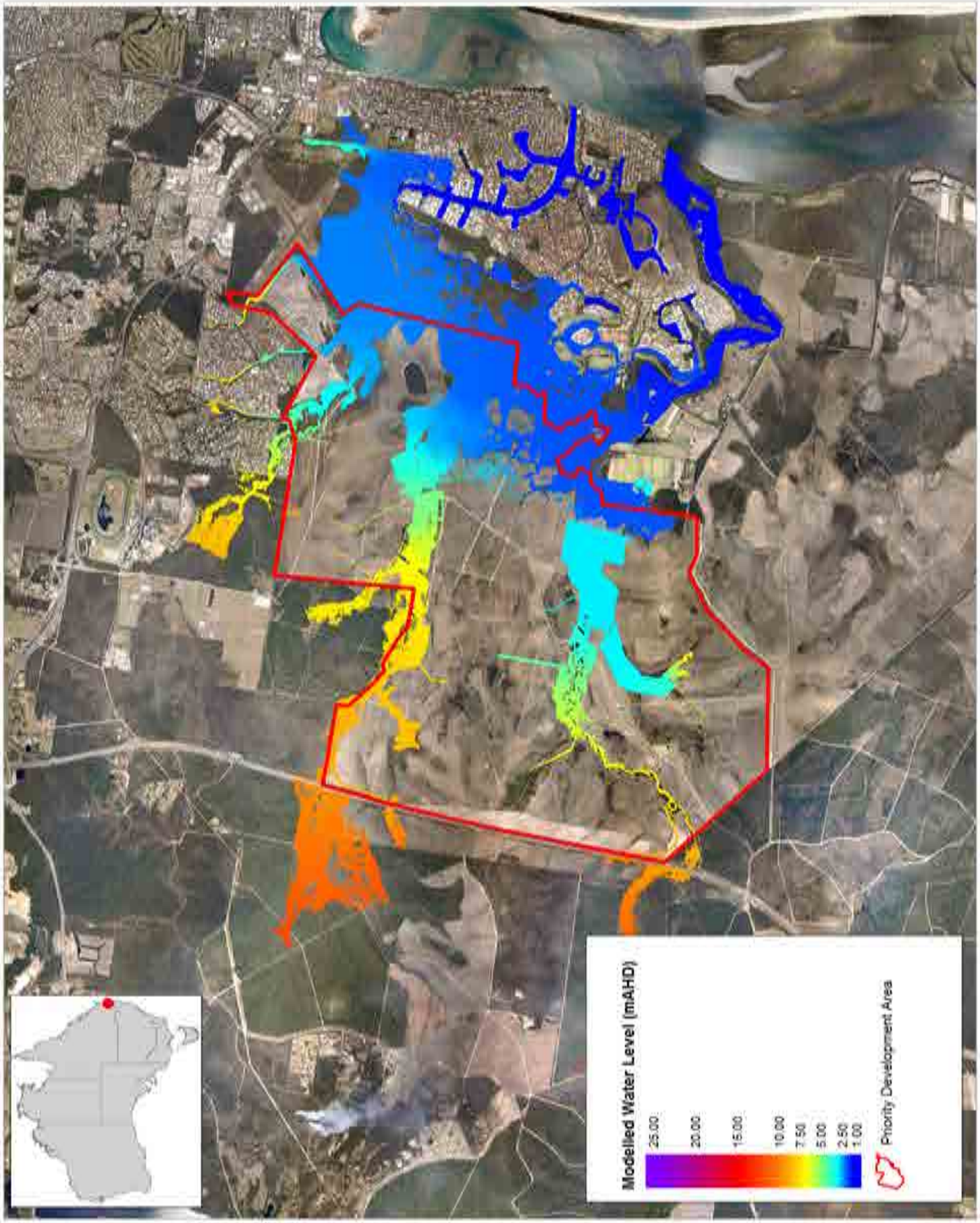
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_154_150813_Dev_Q005_Levels.wor"



Title:
Developed Case Peak Fluvial 2 Year ARI Flood Level

Figure:
E-6

Rev:
-

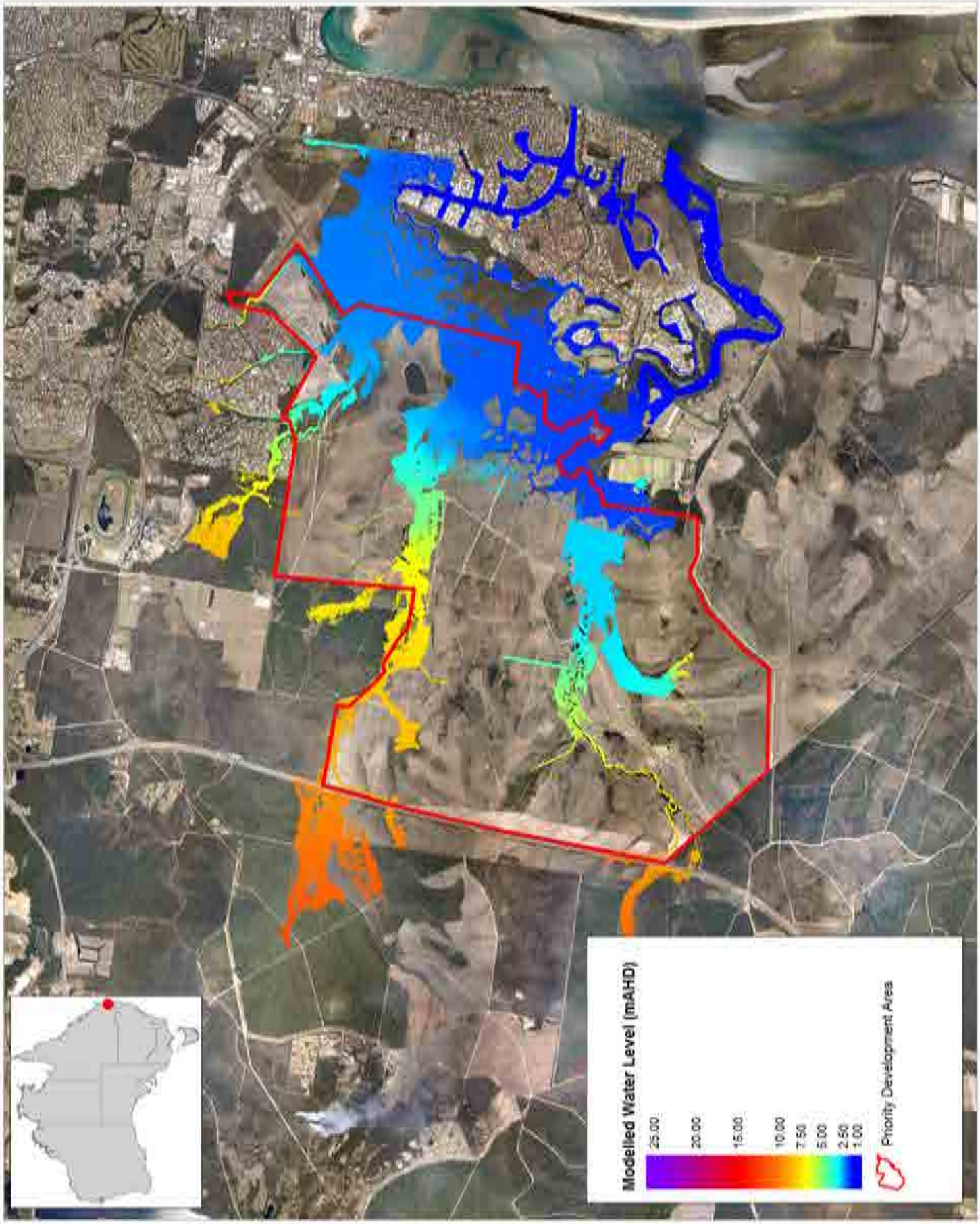
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGW\B20047.020.00.Flooding\Appendix\FLD_155_150813_Dev_Q002_Levels.wor"



Title:
Developed Case Peak Fluvial 1 Year ARI Flood Level

Figure:
E-7

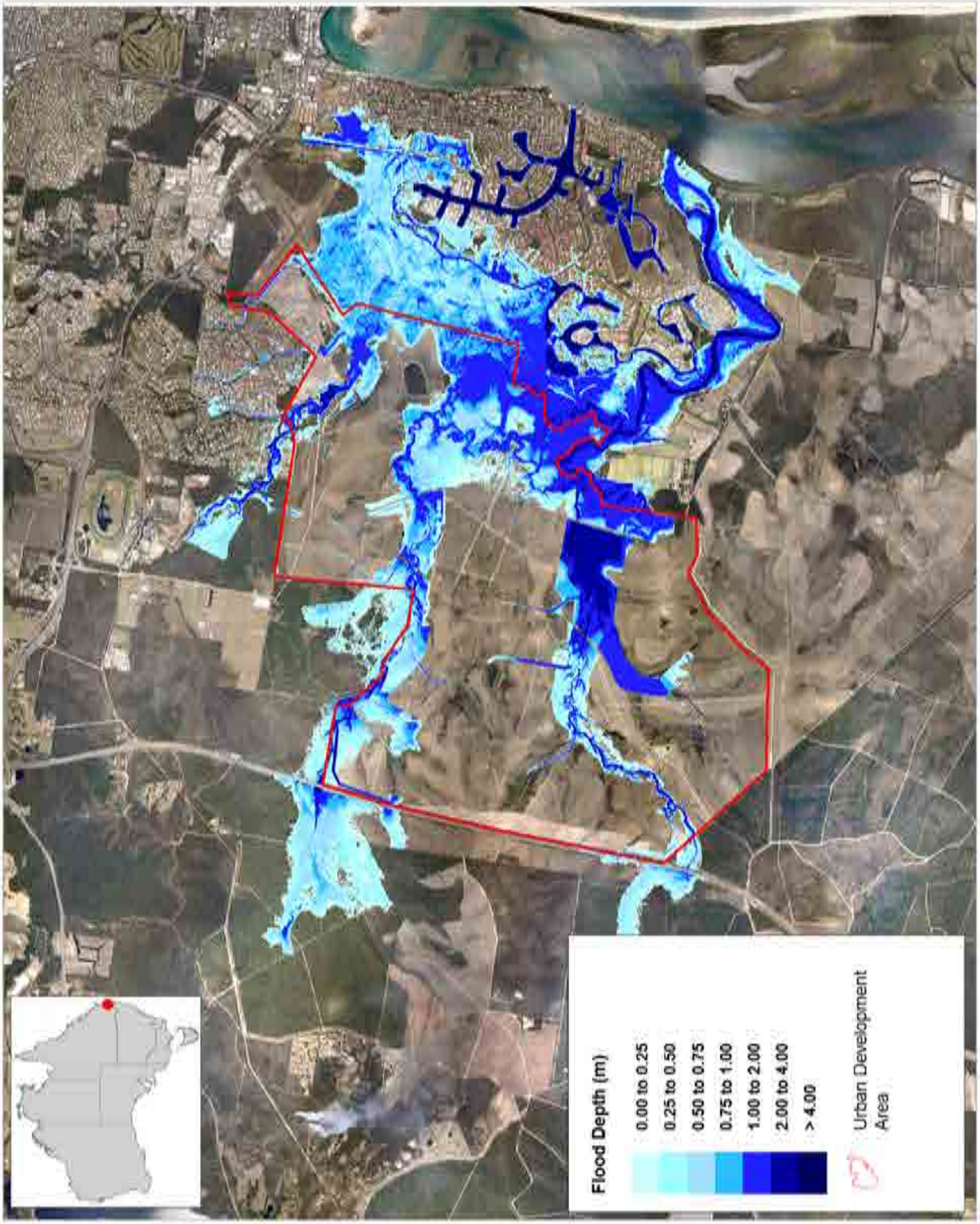
Rev:
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0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cat 5th DA Assistance ABM\DRGVR.B20047.020.00.Flooding\Appendix\FLD_156_150813_Dev_Q001_Levels.wor"



Title:
Developed Case Peak 100 Year ARI Flood Depth

Figure: E-8

Rev: -

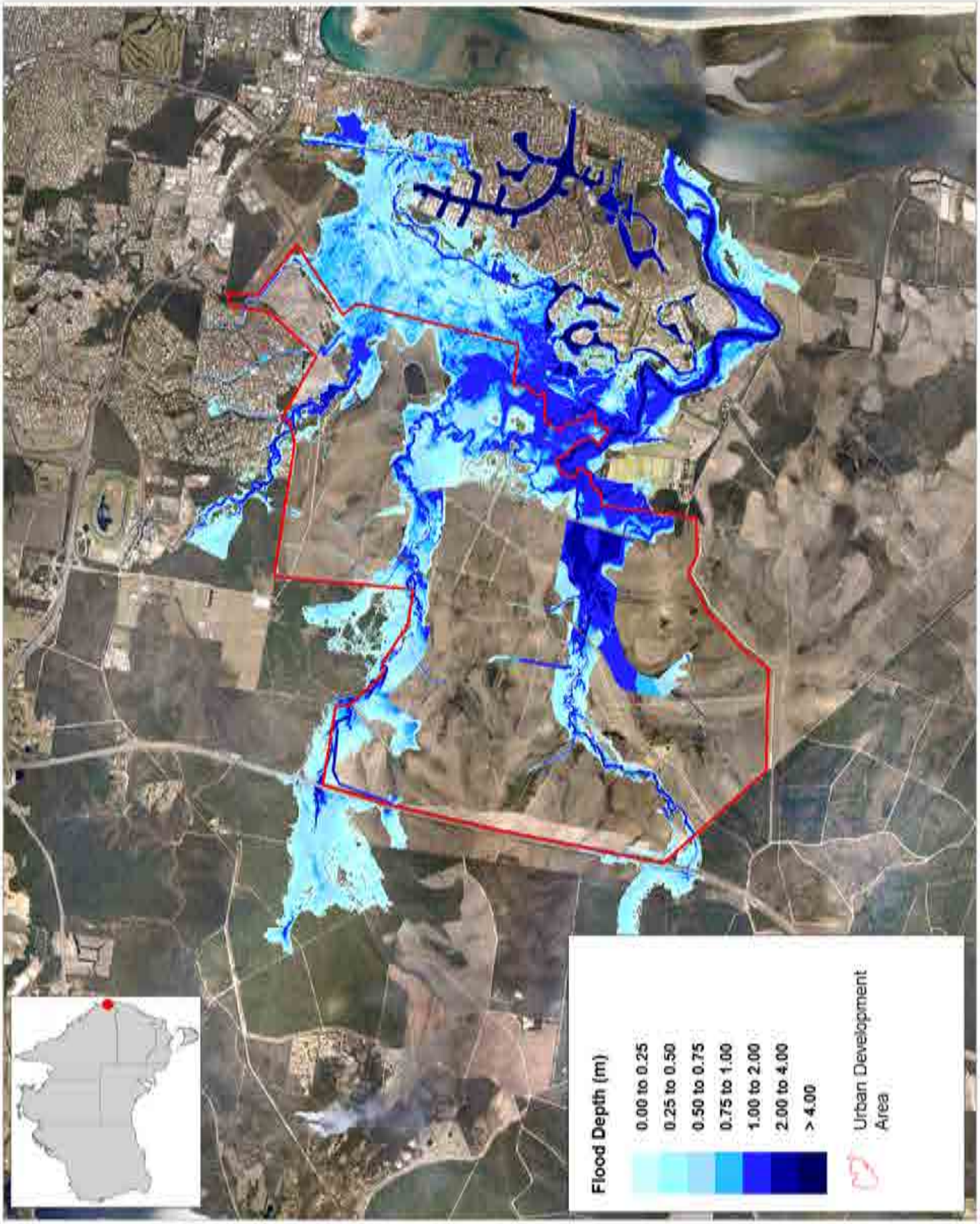
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_157_150813_Dev_Q100_Depths.wor"



Title:
Developed Case Peak 50 Year ARI Flood Depth

Figure: E-9

Rev: -

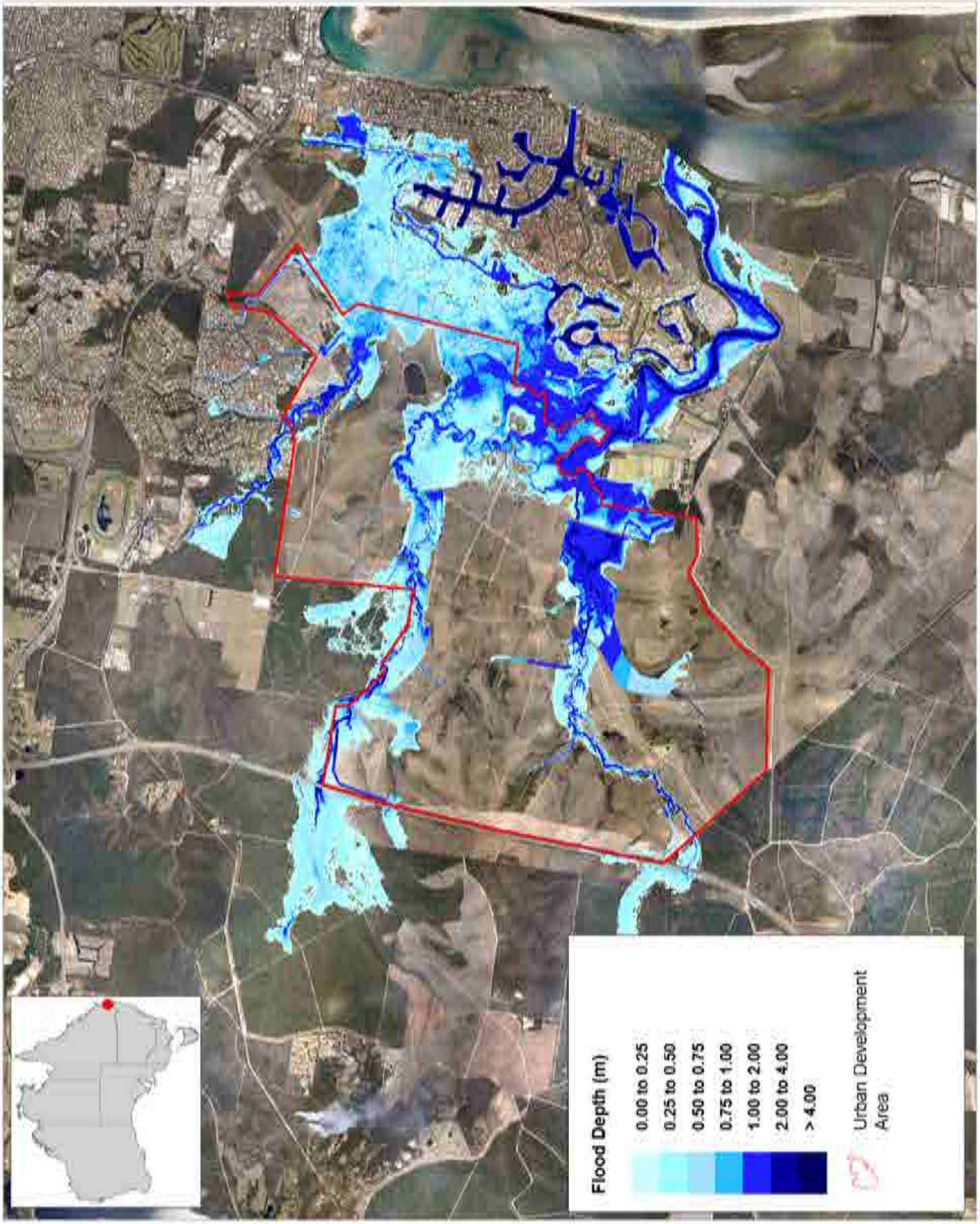
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_156_150813_Dev_Q050_Depths.wor"



Title:
Developed Case Peak 20 Year ARI Flood Depth

Figure: E-10

Rev: -

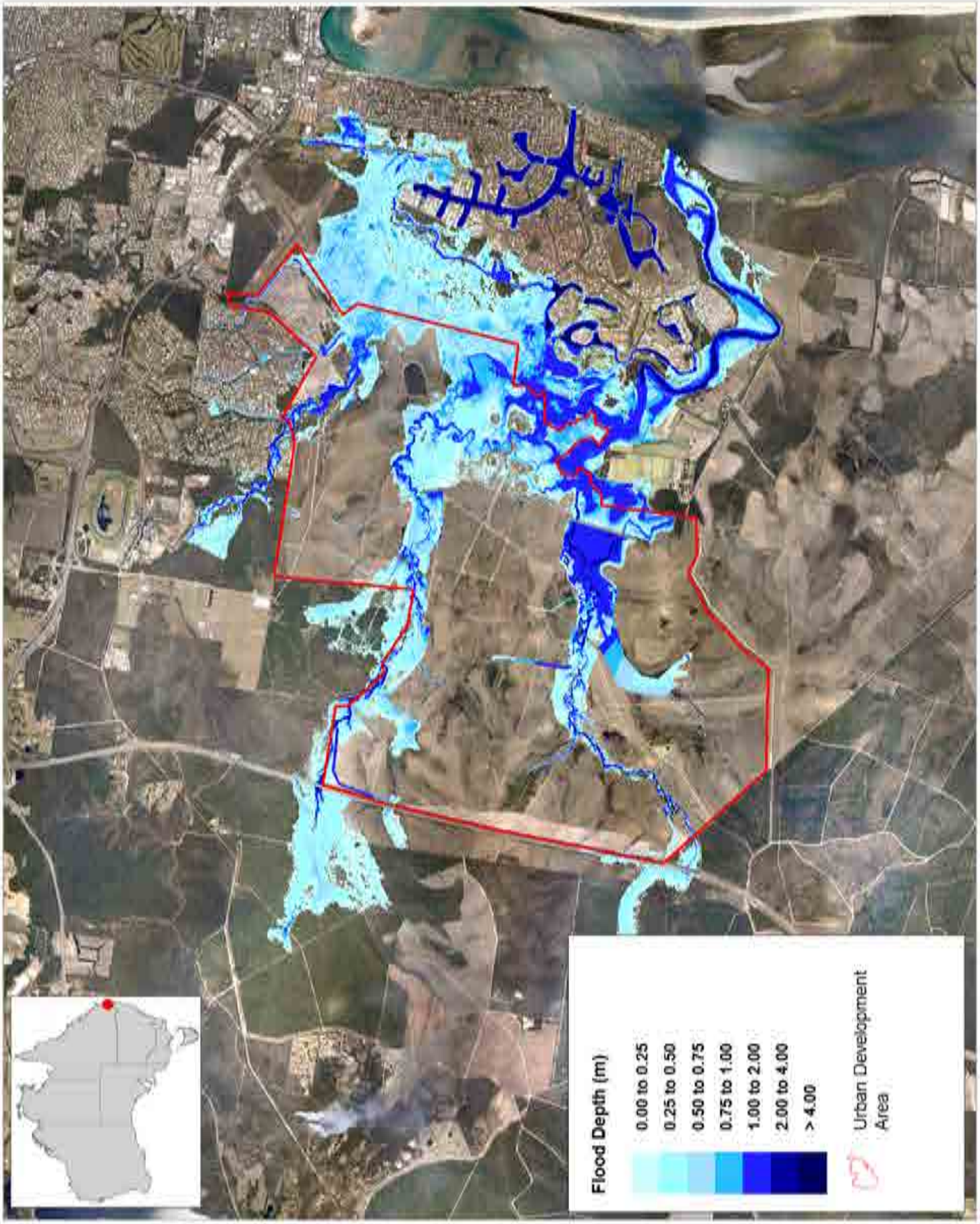
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_159_150813_Dev_Q020_Depths.wor"



Title:
Developed Case Peak 10 Year ARI Flood Depth

Figure: E-11

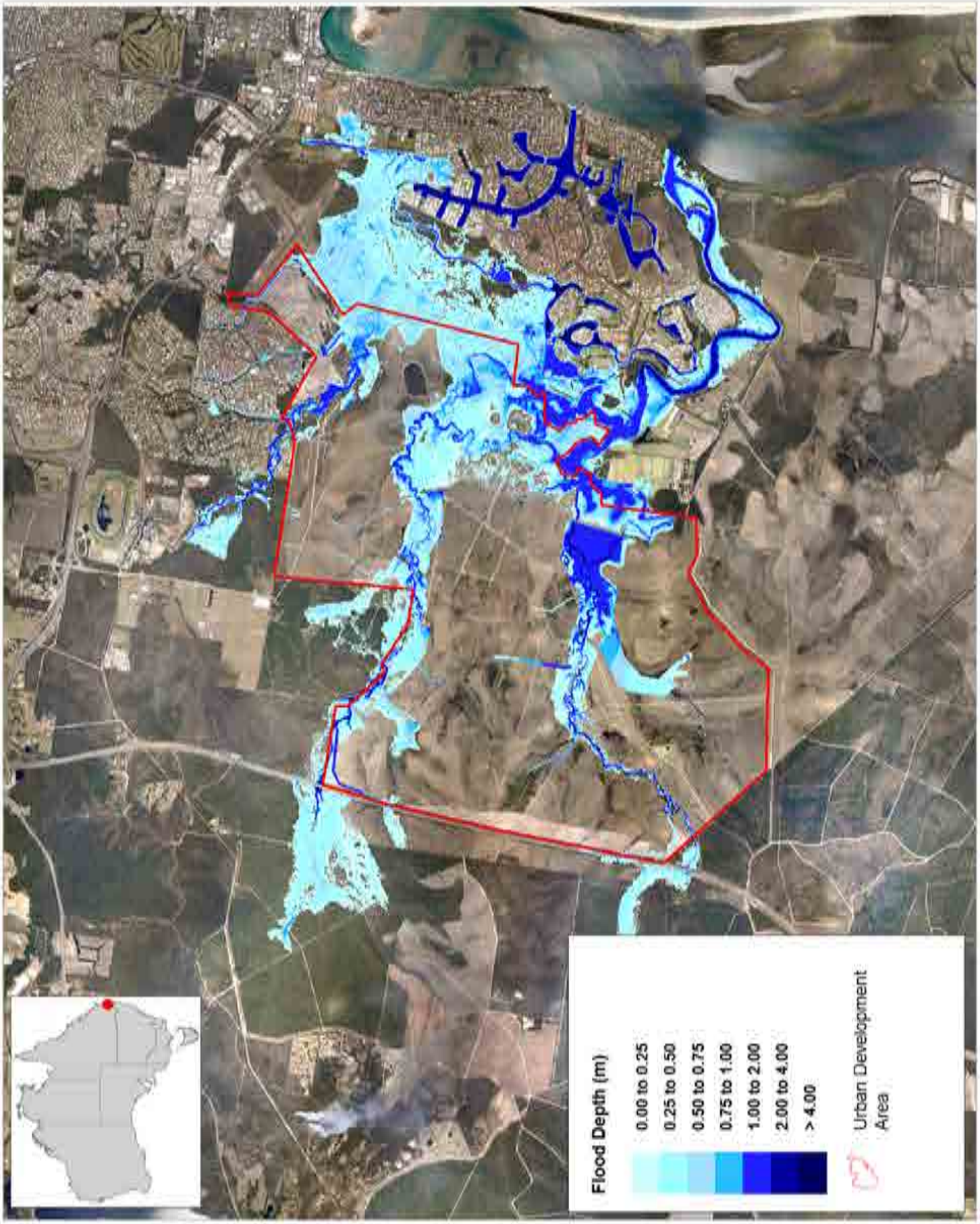
Rev: -

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0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\ERG\R.B20047.020.00 Flooding\Appendix\FLD_100_150813_Dev_Q010_Depths.wor"



Title:
Developed Case Peak 5 Year ARI Flood Depth

Figure: E-12

Rev: -

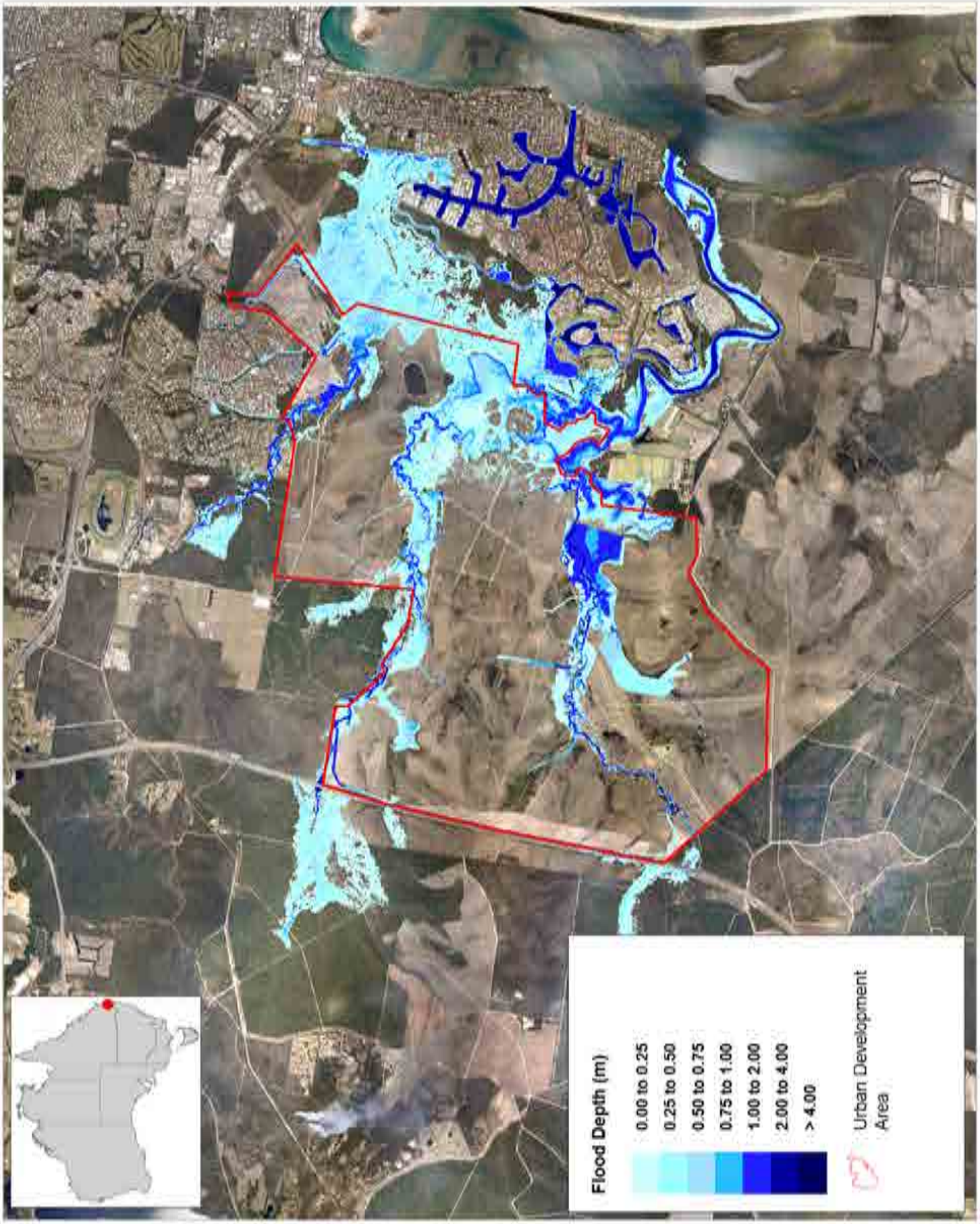
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\ERG\R.B20047.020.00 Flooding\Appendix\FLD_161_150813_Dev_Q005_Depths.wor"



Title:
Developed Case Peak 2 Year ARI Flood Depth

Figure: E-13

Rev: -

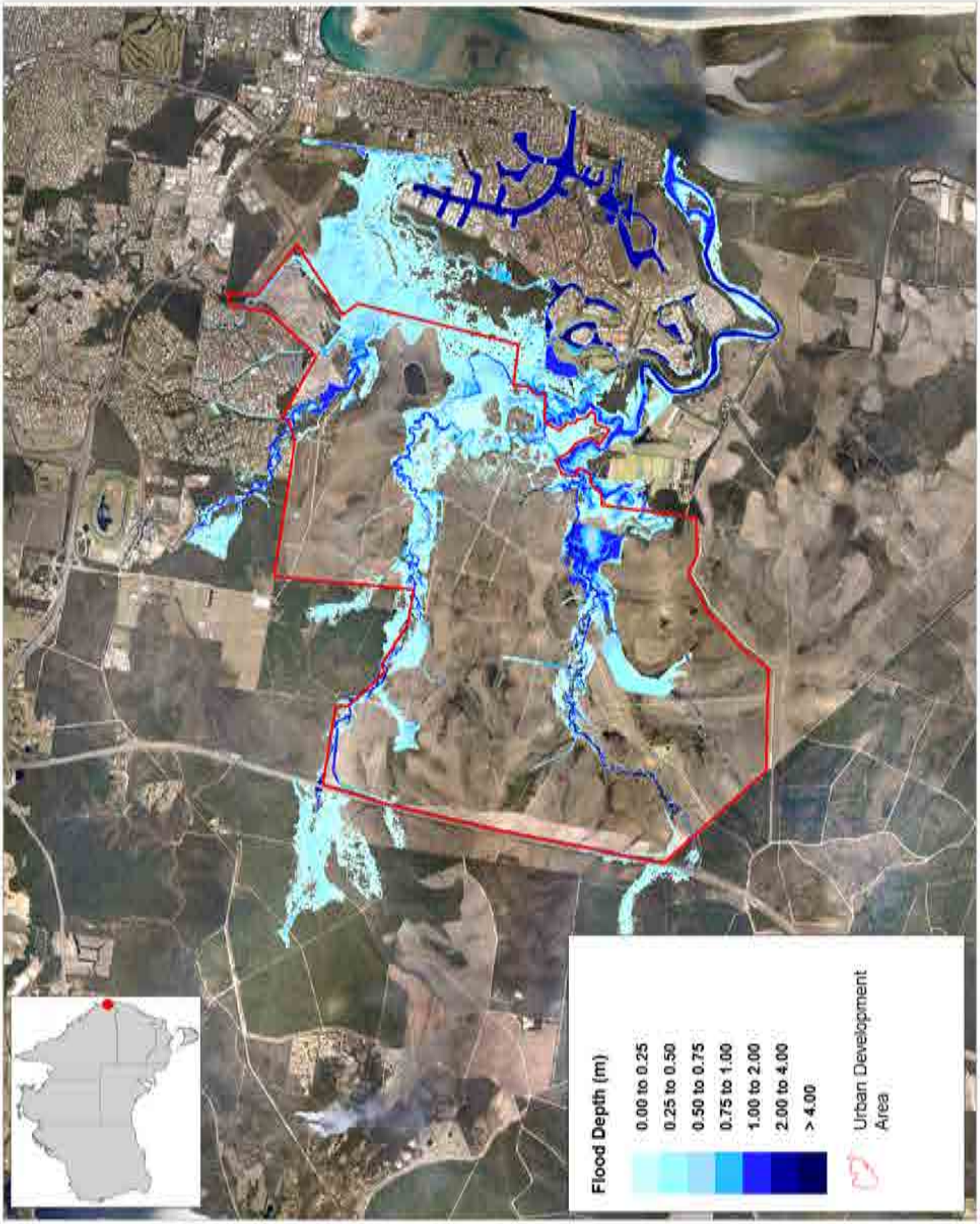
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00 Flooding\Appendix\FLD_162_150813_Dev_Q002_Depths.wor"



Title:
Developed Case Peak 1 Year ARI Flood Depth

Figure: E-14

Rev: -

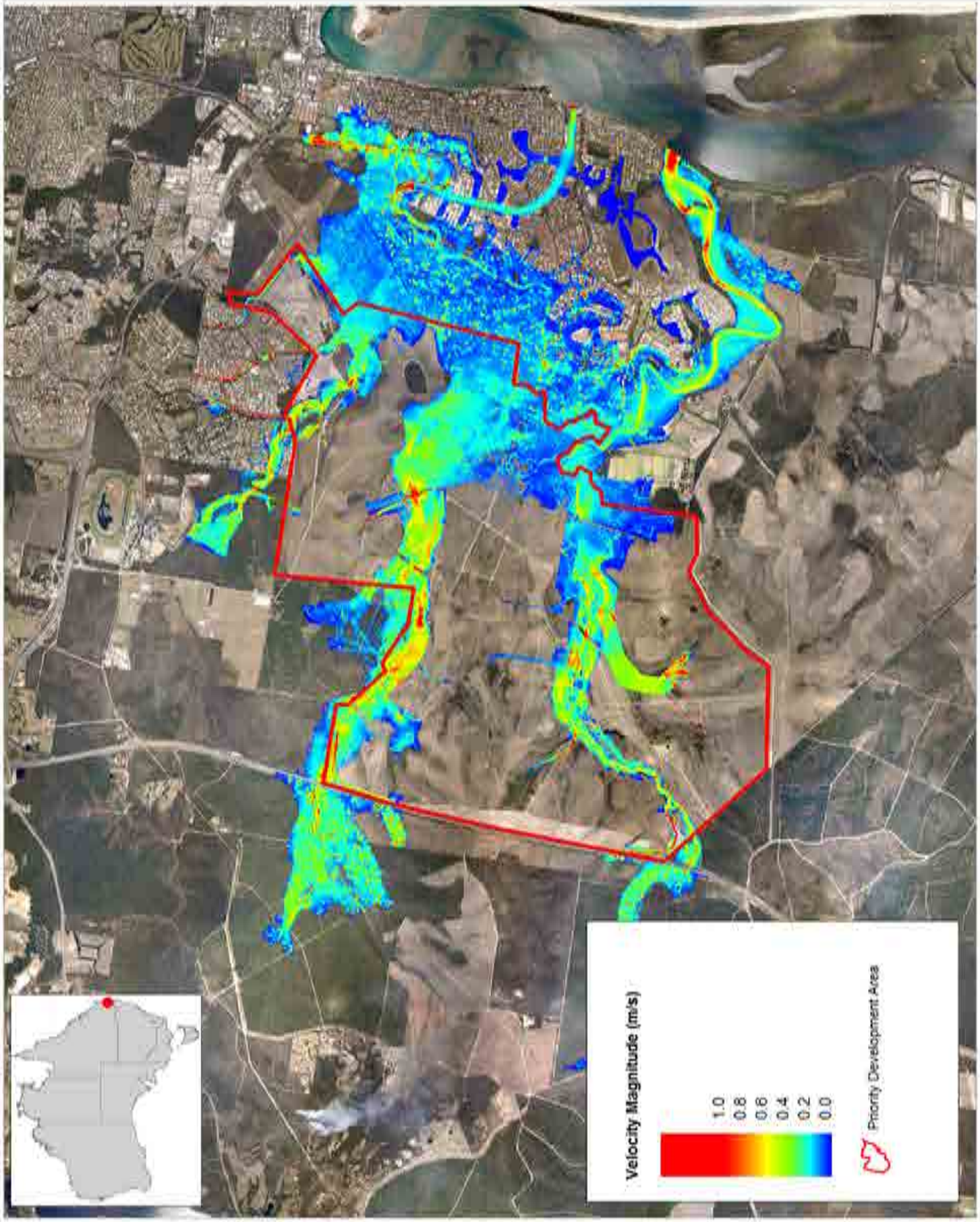
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\ERG\R.B20047.020.00 Flooding\Appendix\FLD_163_150813_Dev_Q001_Depths.wor"



Title:
Developed Case Peak 100 Year Flow Velocity

Figure: **E-15**

Rev: **-**

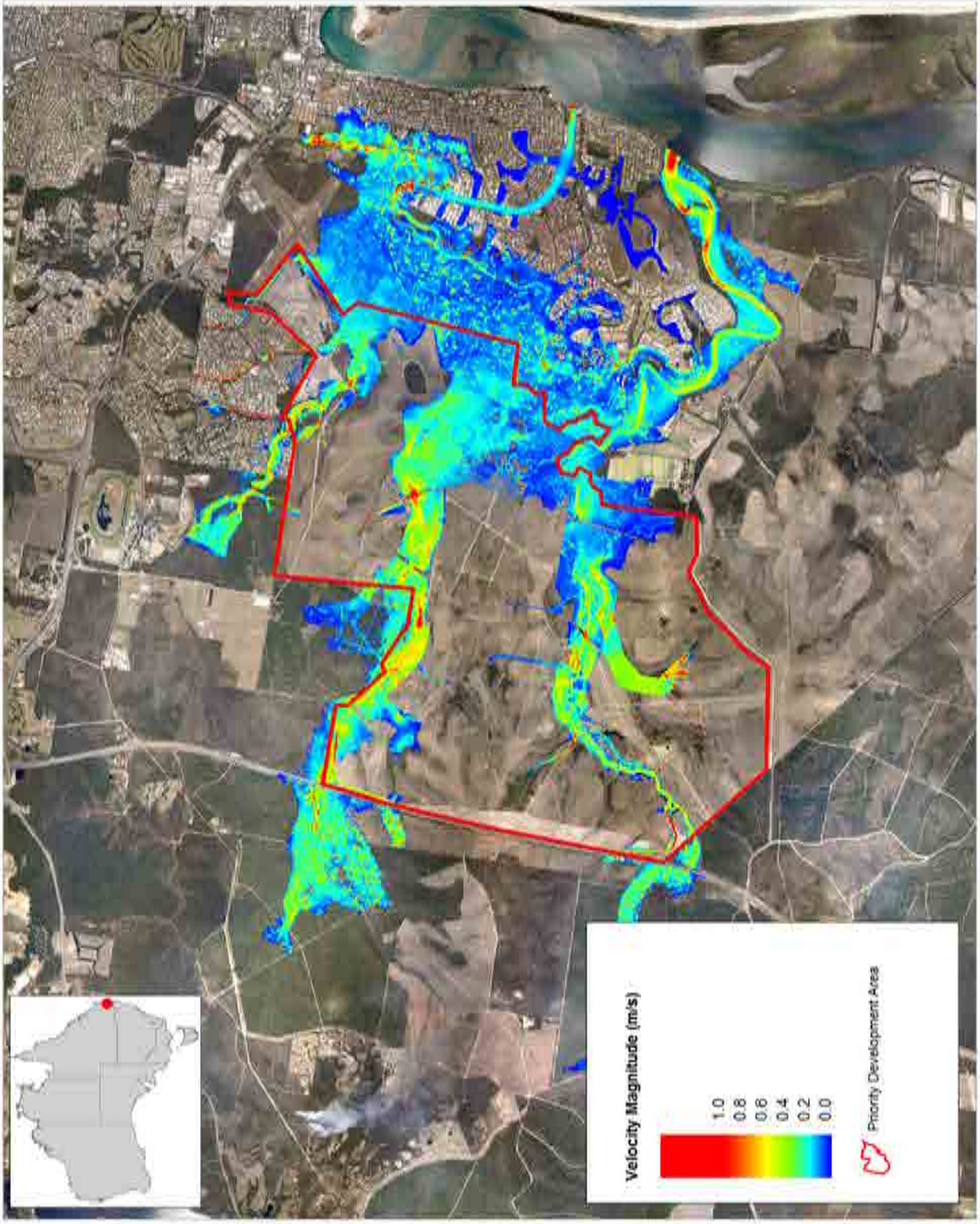
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_164_150813_Dev_Q100_Velocity.wor"



Title:
Developed Case Peak 50 Year Flow Velocity

Figure: **E-16**

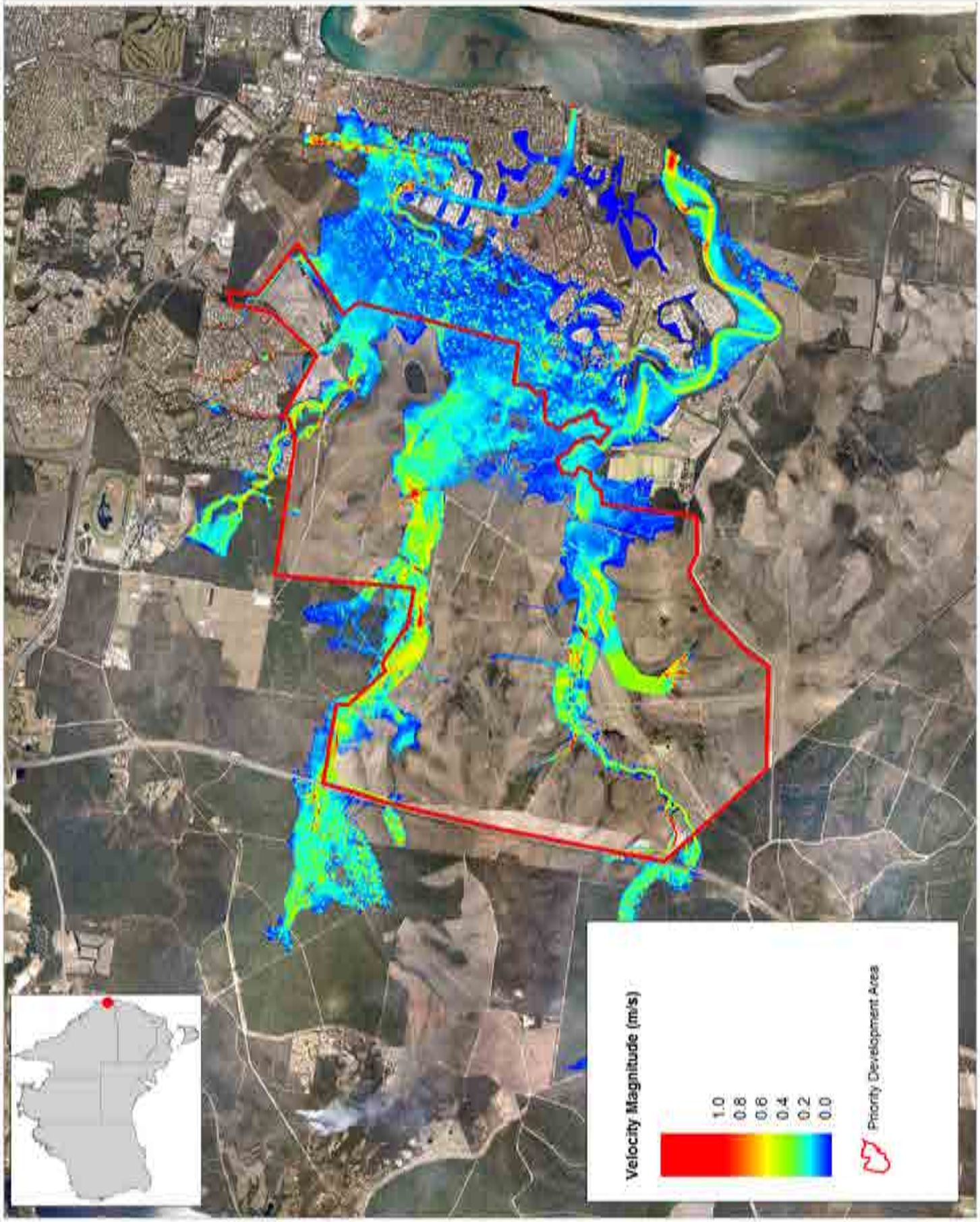
Rev: **-**

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N 0 1.5 3km
Approx. Scale

BMT WBM
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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_165_150813_Dev_Q050_Velocity.wor"



Title:
Developed Case Peak 20 Year Flow Velocity

Figure: E-17

Rev: -

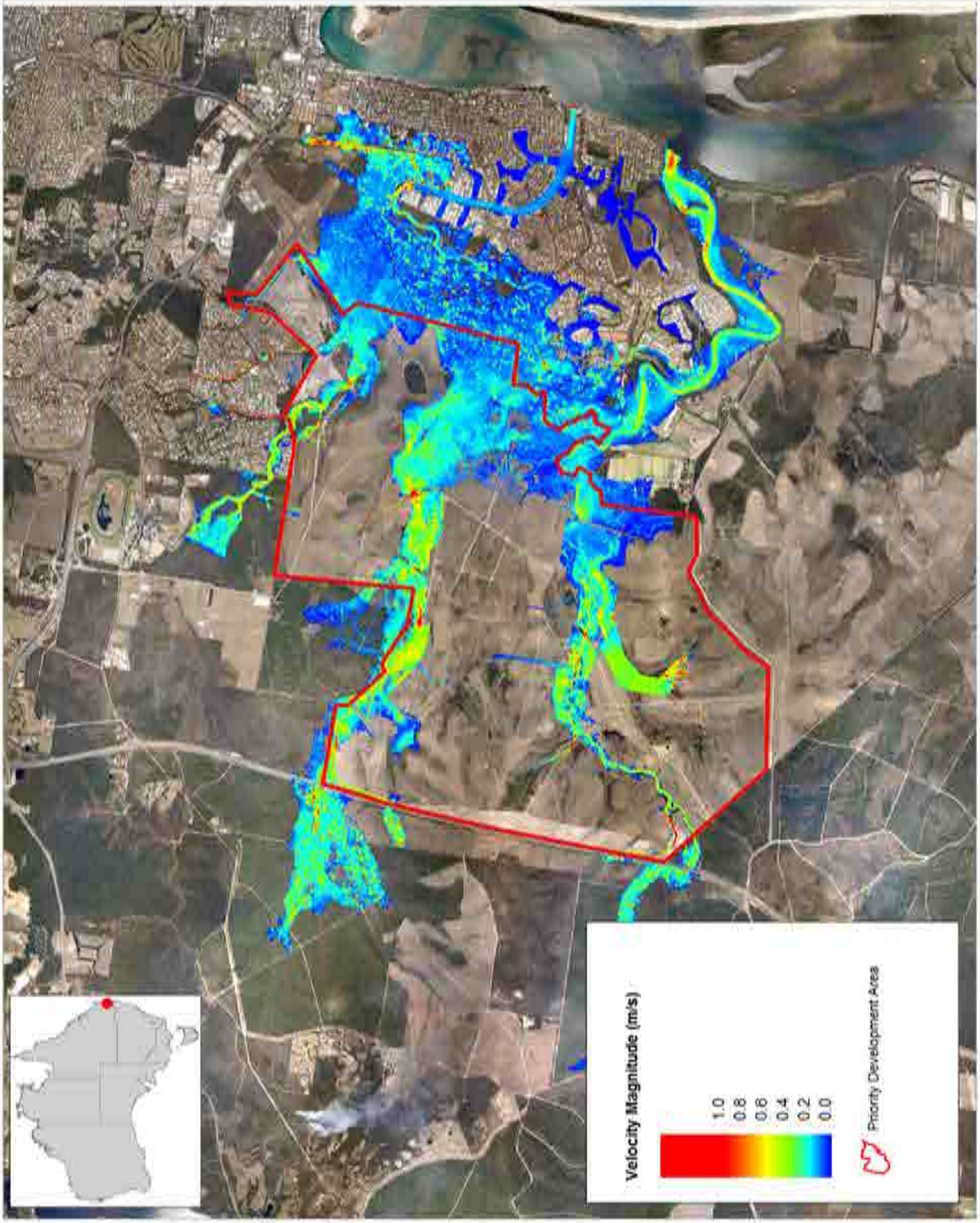
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_166_150813_Dev_Q020_Velocity.wor"



Title:
Developed Case Peak 10 Year Flow Velocity

Figure: **E-18**

Rev: **-**

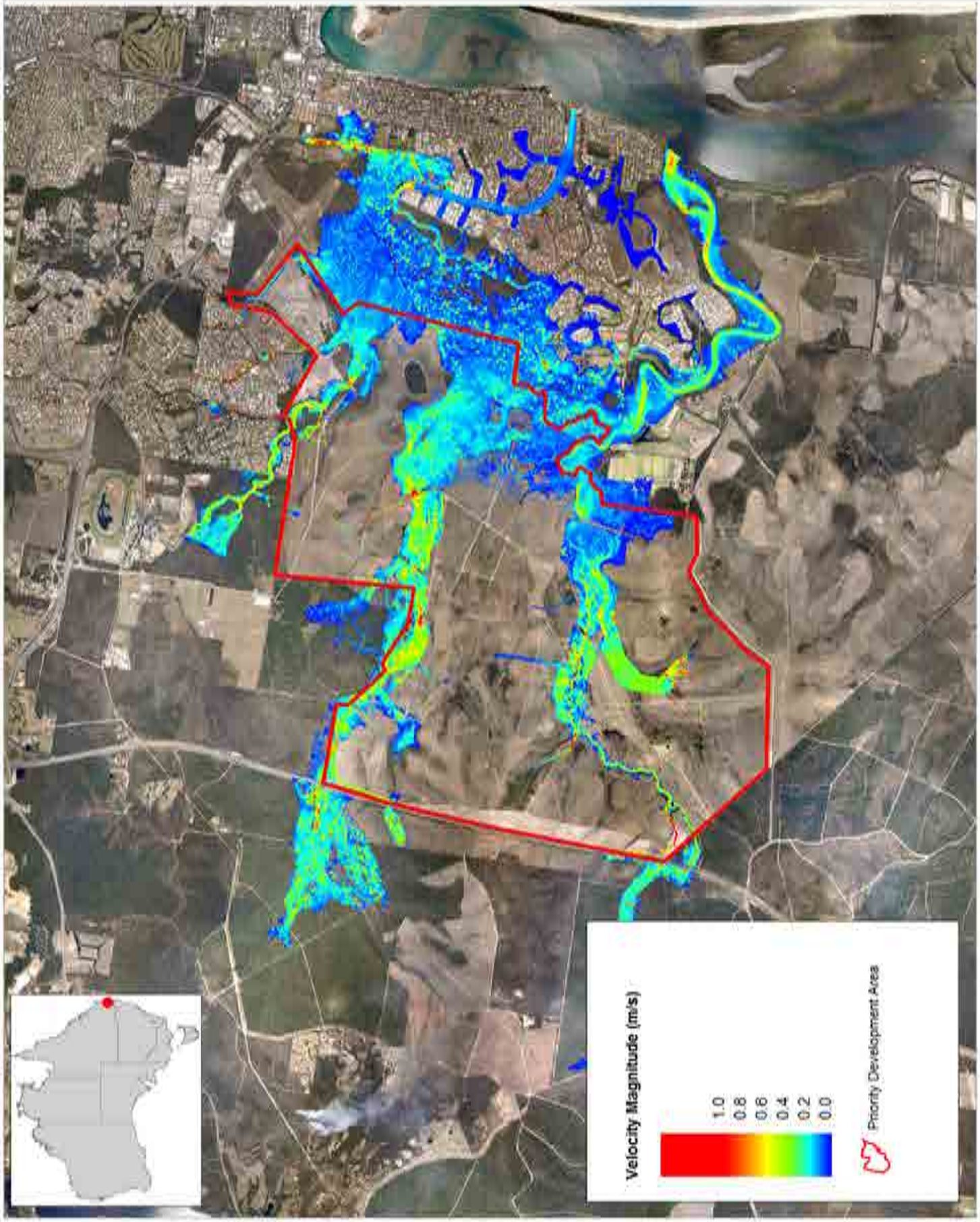
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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_167_150813_Dev_Q010_Velocity.wor"



Title:
Developed Case Peak 5 Year Flow Velocity

Figure: E-19

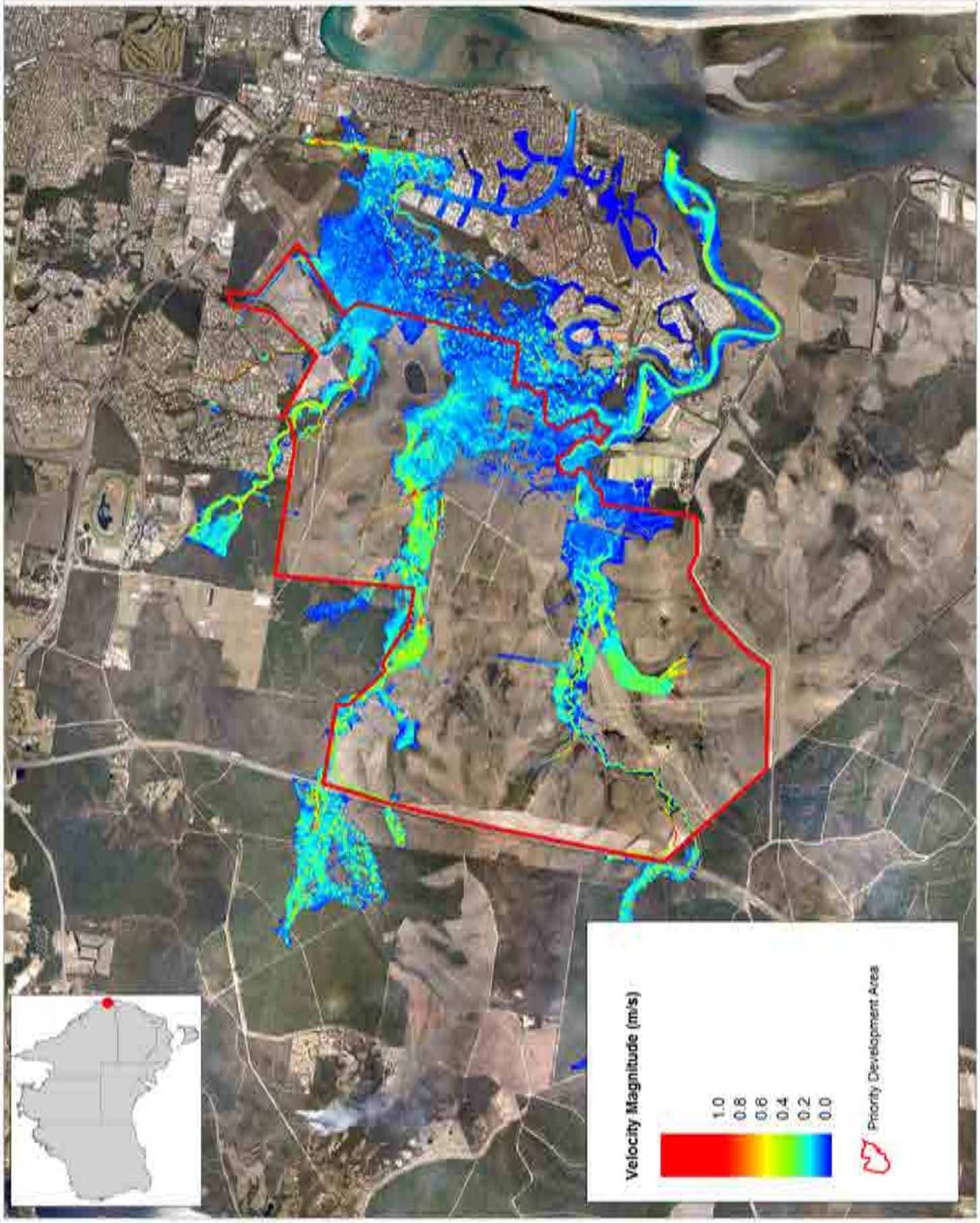
Rev: -

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N 0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_166_150813_Dev_Q005_Velocity.wor"



Title:
Developed Case Peak 2 Year Flow Velocity

Figure: **E-20**

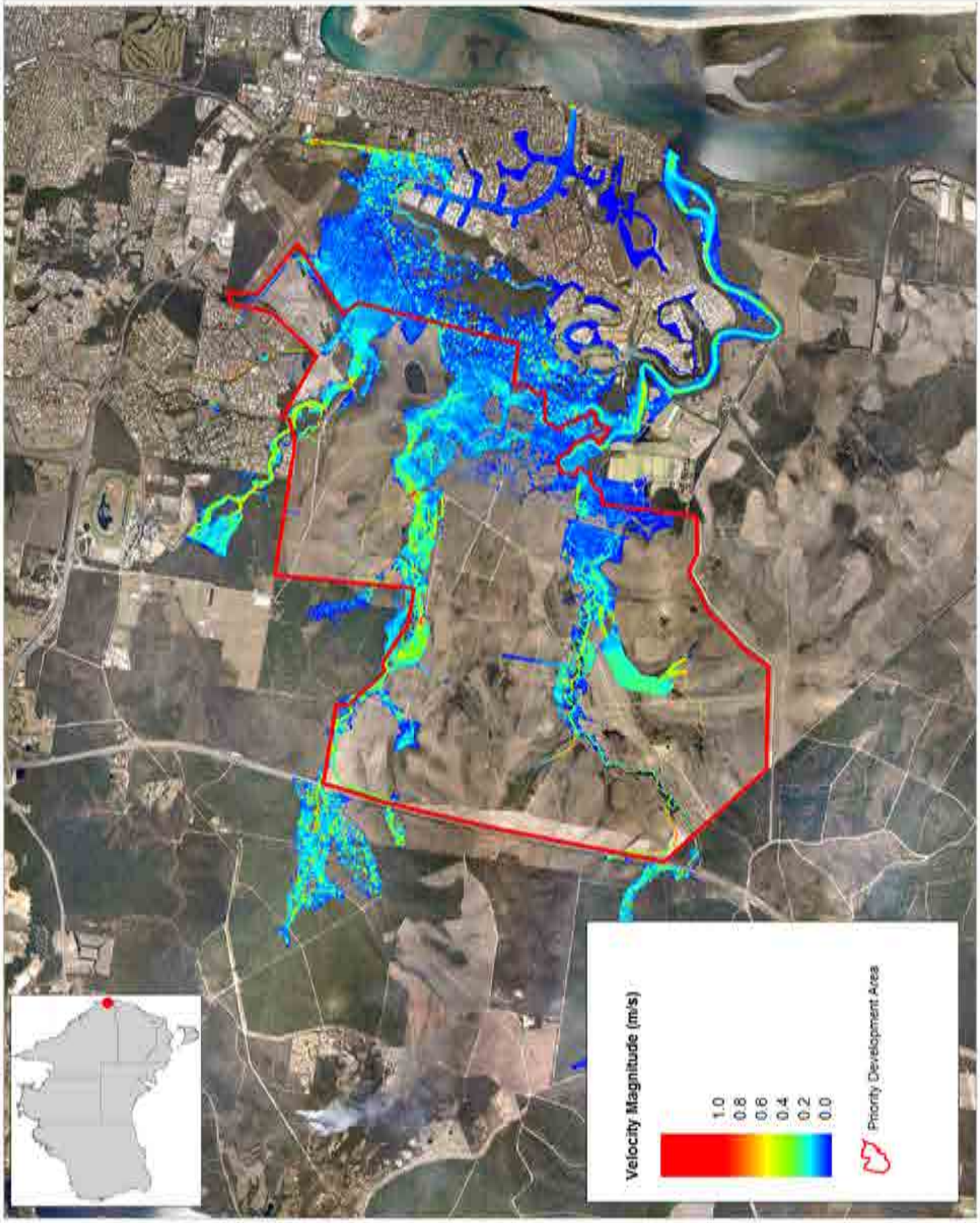
Rev: **-**

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N 0 1.5 3km
Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_169_150813_Dev_Q002_Velocity.wor"



Title:
Developed Case Peak 1 Year Flow Velocity

Figure: E-21

Rev: -

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0 1.5 3km

Approx. Scale

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Filepath : "I:\B20047_I_BRH Cal 5th DA Assistance ABM\DRG\R.B20047.020.00.FloodingAppendix\FLD_170_150813_Dev_Q001_Velocity.wor"

Appendix F Rafts XP Peak Flow Summary

Table F-1 RAFTS-XP Peak Inflows without Climate Change Allowance (m3/s)

Event Magnitude	5 Year ARI				50 Year ARI				100 Year ARI			
Event Duration	6 Hour Duration		12 Hour Duration		6 Hour Duration		12 Hour Duration		6 Hour Duration		12 Hour Duration	
Subcatchment ID	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case
BC01	12	12	12	12	17	18	18	19	20	21	21	22
BC02	7.8	8.7	8.6	9.2	17	17	20	20	21	21	24	25
BCN1	3.5	3.5	3.6	3.6	5.4	5.4	5.7	5.7	6.3	6.3	6.6	6.6
BCN2	1	1	1.2	1.2	2.4	2.4	3	3	2.9	2.9	3.7	3.7
BCN3	13	37	14	38	30	56	33	59	37	65	41	68
BCN4	9.7	24	10	24	22	37	22	38	27	42	26	44
BCN5	11	11	11	12	22	22	23	25	26	26	28	30
BCN6	29	29	30	30	57	57	61	61	68	68	73	73
BCN7	29	29	31	31	54	54	59	59	65	65	71	71
BCS1	0.81	0.81	0.95	0.96	2	2	2.4	2.4	2.4	2.4	2.9	2.9
BCS2	7	37	7.8	39	17	55	18	58	21	63	22	67
BCS3	14	57	15	59	33	85	35	90	41	98	43	100
BCS4	12	38	13	39	27	57	26	60	33	67	32	69
BCS5	24	24	23	23	46	46	48	48	56	56	58	58
BCS6	8.3	8.8	9	10	16	17	17	19	19	20	20	22
DC01	18	18	20	20	30	30	38	38	36	36	45	45
DC02	11	11	11	11	20	20	20	20	24	24	23	23
DC03	22	22	23	23	32	32	35	35	37	37	40	40
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Rafts XP Peak Flow Summary

Event Magnitude	5 Year ARI				50 Year ARI				100 Year ARI			
Event Magnitude	5 Year ARI				50 Year ARI				100 Year ARI			
Event Duration	6 Hour Duration		12 Hour Duration		6 Hour Duration		12 Hour Duration		6 Hour Duration		12 Hour Duration	
Subcatchment ID	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case
LC01	37	37	37	37	56	56	58	58	65	65	67	67
LC02	3.1	3.2	3.8	3.9	7.9	8	9.7	9.8	9.8	10	12	12
LC03	2.1	2.1	2.5	2.5	5.1	5.1	6.6	6.6	6.4	6.4	8.2	8.2
LC04	5.3	6.1	5	7	11	12	11	14	13	14	13	16
LC05	5	14	4.4	14	10	21	9.7	22	13	25	12	26
LC06	37	37	36	36	63	63	62	62	75	75	75	75
LC07	23	25	23	25	38	41	38	41	45	48	45	49
LC08	4.4	4.4	3.8	3.8	9.1	9.1	8.6	8.6	11	11	10	10
LC09	5.8	5.8	5.8	5.8	11	11	12	12	14	14	15	15
LC10	11	11	9.4	9.4	22	22	21	21	27	27	25	25
LC11	9.1	9.1	8.1	8.1	17	17	17	17	21	21	20	20
K:\B17427.k.JGJ.CaloundraDowns_FIA\Hydrology\RAFTS_XP\OUTPUT\Summary\[Summary_Q_Loc_Exg_Dev_008.xls]Peak_Q_Summary_no_CC_008												

Table F-2 RAFTS-XP Peak Inflows with Climate Change Allowance (m3/s)

Event Magnitude	5 Year ARI				50 Year ARI				100 Year ARI			
Event Duration	6 Hour		12 Hour		6 Hour		12 Hour		6 Hour		12 Hour	
Subcatchment ID	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case
BC01	14	14	14	15	21	22	22	23	24	25	25	26
BC02	10	11	12	12	23	23	26	26	28	28	31	32
BCN1	4.3	4.3	4.4	4.4	6.6	6.6	6.9	6.9	7.7	7.7	8.0	8.0
BCN2	1.4	1.4	1.7	1.7	3.2	3.2	4.0	4.0	3.9	3.9	4.9	5.0
BCN3	18	45	19	46	40	69	43	71	49	80	52	83
BCN4	13	29	14	29	28	45	28	46	35	52	33	54
BCN5	15	15	15	17	28	28	29	32	33	33	36	38
BCN6	38	38	41	41	72	72	78	78	86	86	93	93
BCN7	38	38	41	41	69	69	75	75	82	82	89	89
BCS1	1.1	1.2	1.3	1.3	2.6	2.6	3.1	3.1	3.2	3.2	3.7	3.7
BCS2	10	45	11	46	22	66	24	70	27	76	29	80
BCS3	20	69	21	71	44	103	45	108	53	119	54	125
BCS4	17	46	17	47	35	70	33	73	43	81	40	84
BCS5	31	31	31	31	59	59	62	62	70	70	75	75
BCS6	11	12	12	13	20	21	21	23	23	25	25	27
DC01	23	23	26	26	38	38	47	47	46	46	56	56
DC02	15	15	14	14	25	25	25	25	30	30	30	30
DC03	26	26	27	27	39	39	42	42	45	45	48	48

Rafts XP Peak Flow Summary

Event Magnitude	5 Year ARI				50 Year ARI				100 Year ARI			
Event Duration	6 Hour		12 Hour		6 Hour		12 Hour		6 Hour		12 Hour	
Subcatchment ID	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case	Base Case	Developed Case
LC01	45	46	45	45	69	69	71	71	79	79	82	82
LC02	4.4	4.5	5.4	5.5	11	11	13	13	13	13	15	16
LC03	2.9	2.9	3.5	3.5	6.8	6.9	8.8	8.8	8.7	8.7	11	11
LC04	7.1	8.0	6.8	9.2	14	15	14	18	17	18	17	21
LC05	6.7	17	6.1	17	13	26	13	27	16	31	16	32
LC06	47	47	46	46	79	79	80	80	93	93	93	93
LC07	29	31	29	31	48	51	48	51	56	60	57	61
LC08	5.9	5.9	5.4	5.4	12	12	11	11	14	14	14	14
LC09	7.7	7.7	8.0	8.0	14	14	16	16	17	17	19	19
LC10	14	14	13	13	28	28	27	27	34	34	33	33
LC11	12	12	11	11	22	22	22	22	26	26	26	26
K:\B17427.k.JGJ.CaloundraDowns_FIA\Hydrology\RAFTS_XP\OUTPUT\Summary\[Summary_Q_Loc_Exg_Dev_008.xls]Peak_Q_Summary_inc_CC_008												

Appendix G Overland Flow Reconfiguration Assessment

1 Introduction

As part of the proposed Caloundra South master-planned community, Stockland is considering undertaking modifications to the structure of a section of the Bells Creek South corridor, comprising a modified low-flow/overflow channel configuration and the creation of some wetlands immediately south-west of the proposed Town Centre. The approximate extent of the reconfiguration is illustrated in Figure 1-1.



Figure 1-1 Approximate Extent of Proposed Flow Path Reconfiguration

The aim of this study is to undertake a hydraulic assessment of the proposed reconfiguration. Specifically, the assessment aims to determine if the proposed reconfiguration will:

- Cause any increase in flow velocities (and associated risk of scour/erosion) downstream of the proposed reconfiguration during the Q100 storm event
- Cause any change in maximum water level during the Q5 event that may impact on the habitat of the Wallum Sedgefrog.

2 Site Characteristics

The study area is located on Bells Creek South, approximately 2km upstream of the junction with Bells Creek North. Elevations within the study area vary from 1.5m AHD in the east to 7.6m AHD in the north-west.

Soils within the study site are expected to be consistent with those of the greater extend of the Caloundra South Development site. As outlined in '*Caloundra South Development: Groundwater Assessment*' (BMT WBM, 2014), shallow boreholes constructed on the site revealed soils with very sandy A horizons over clayey subsoil layers to a depth of 0.75m.

3 Methodology

BMT WBM has previously undertaken a number of flood assessments associated with the proposed Caloundra South Development. The regional Tuflow hydraulic model used in these assessments has a 5m resolution, and incorporates a model area of 7000 hectares. Technical details of the most recent assessment using this model are described in '*Caloundra South: Flood Risk Management Strategy – September 2014 Update'* (BMT WBM, 2014).

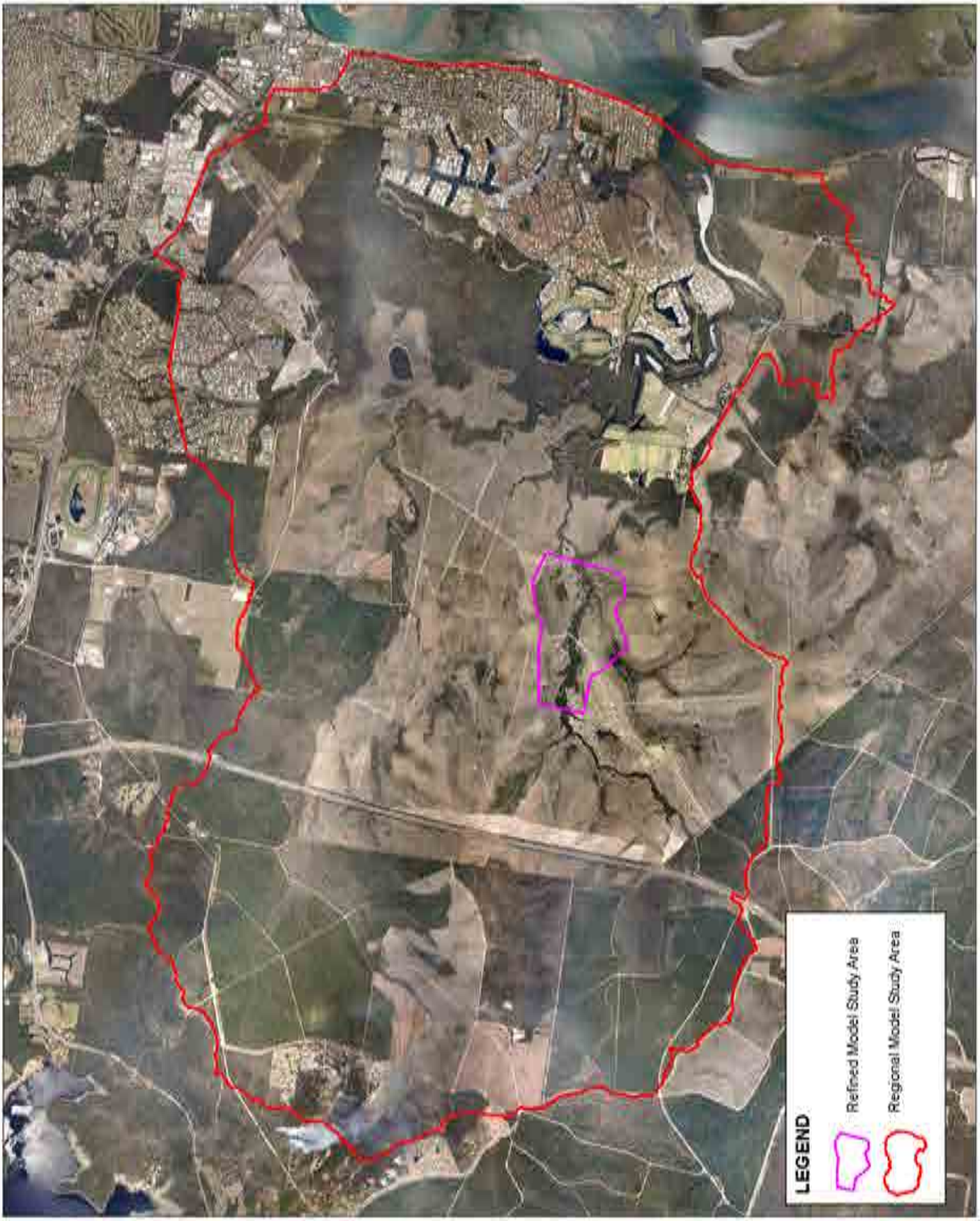
For this assessment, a refined Tuflow hydraulic model with a resolution of 2m was created using the latest 1m LiDar data supplied by RPS. The model extends 700m downstream, and 900m upstream from the proposed modified channel, and covers an area of 133 hectares. The extent of the model used in this study, and the regional model are presented in Figure 3-1.

Three scenarios were modelled during the study:

- Pre-development land usage with existing overland flow path
- Post-development land usage with existing overland flow path
- Post-development land usage with proposed modified overland flow path.

Digital elevation models of the three scenarios are presented in Figures 3-2 to 3-4.

For each of the scenarios, flood impacts were evaluated for the 1 in 5 year (Q5), and the 1 in 100 (Q100) ARI design storms. Inflow and downstream boundary conditions for these events were derived from the regional model.



Title:

Comparison of Refined Model and Regional Model Area

Figure: 3-1

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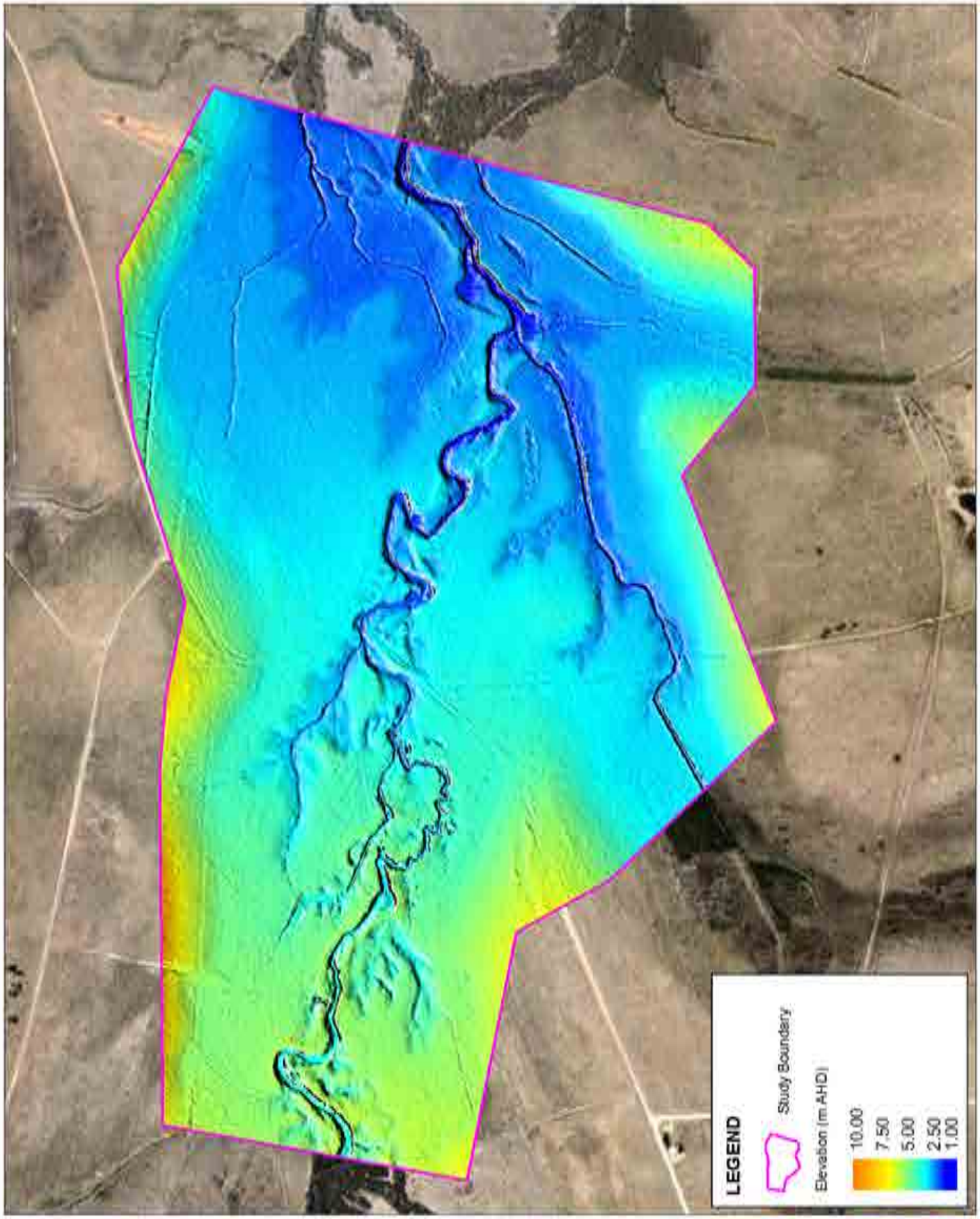
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Title:

Digital Elevation Model of Pre-Development with Existing Overland Flow Path

Figure: 3-2

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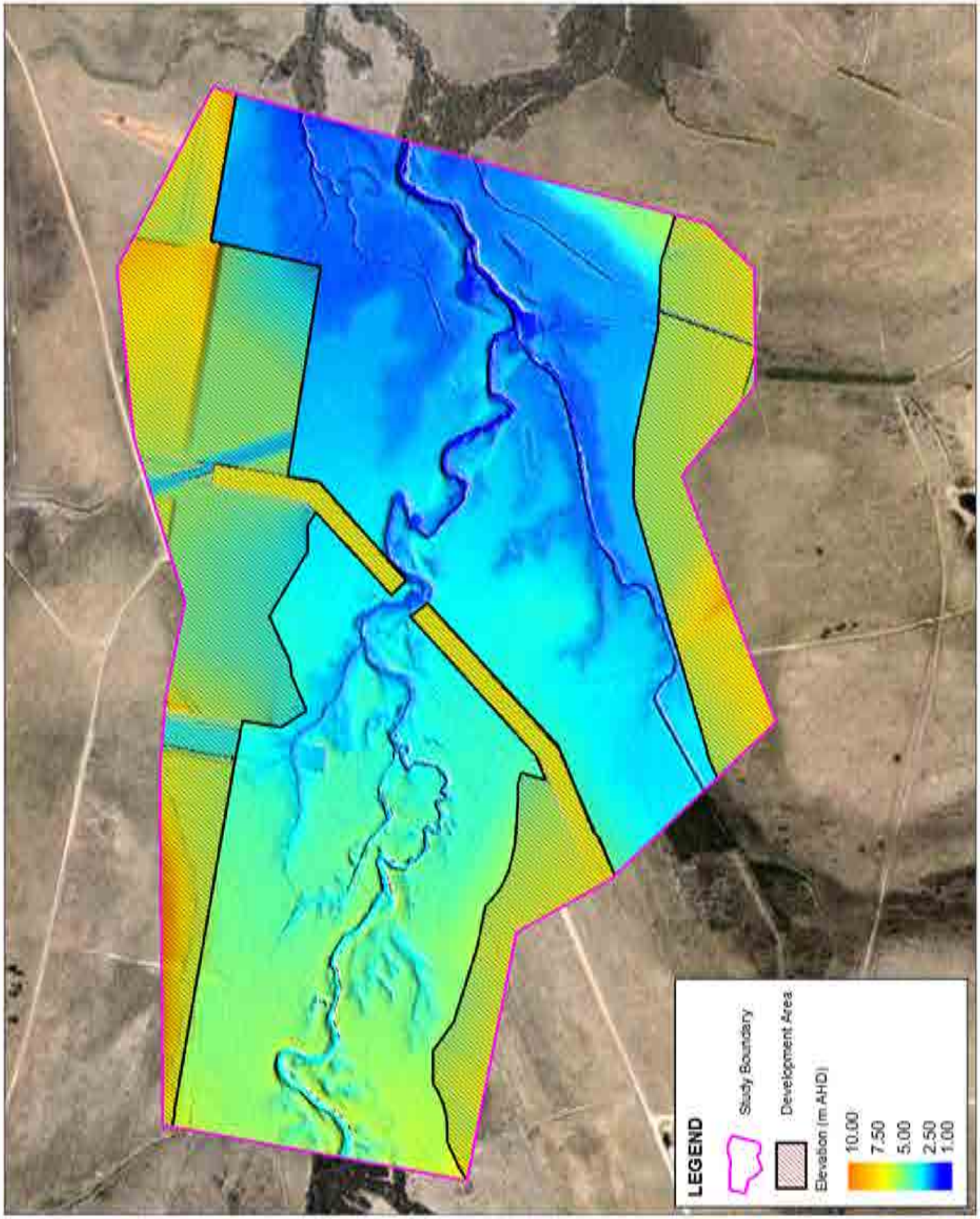
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Title:

Digital Elevation Model of Post-Development with Existing Overland Flow Path

Figure: 3-3

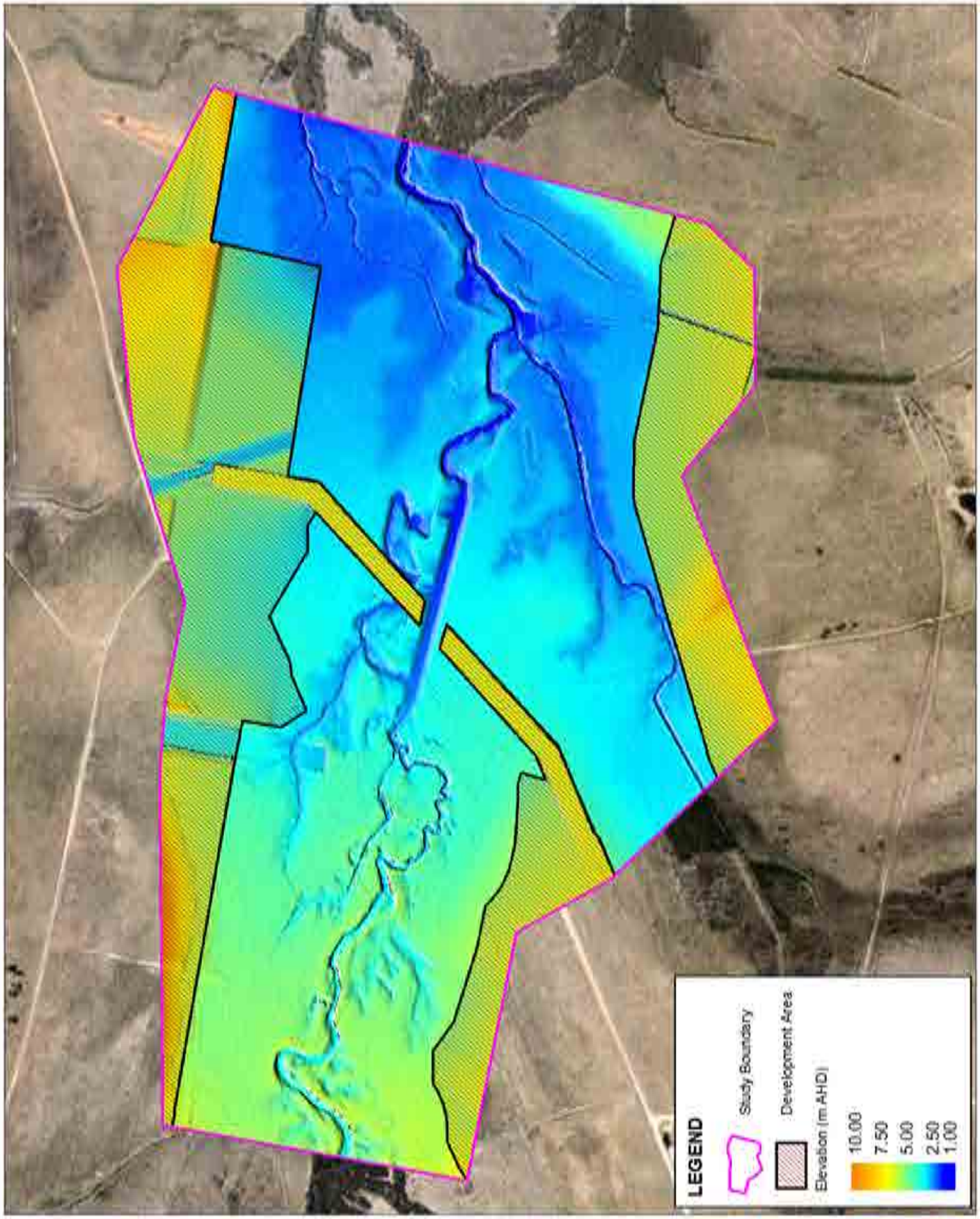
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Title:

Digital Elevation Model of Post-Development with Proposed Overland Flow Path

Figure: 3-4

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4 Design Parameters

As described in Section 1, key parameters in this assessment are:

- Velocity
- Water level.

4.1 Velocity

Maximum water velocity during the Q100 event was chosen as the key design parameter to determine the scour/erosion potential for each scenario.

From the Queensland Urban Drainage Manual (QUDM), a guideline value of 1.2m/s water velocity was chosen based on the soils in the channel being easily eroded, the bed slope less than 1%, and the channel having 50% vegetation cover.

4.2 Water Level

From the '*Caloundra South Public Environment Report Environmental Management Plan – Final Draft*' (BMT WBM, 2012), the Wallum Sedgefrog mitigation strategy include the conservation of existing habitats that are to be retained on site, and habitat creation and enhancement along identified frog movement corridors.

From the '*Caloundra South Public Environment Report Environmental Management Plan – Final Draft*' (BMT WBM, 2012), Wallum Sedgefrog habitat areas need to be above the Q5 flood level.

5 Results

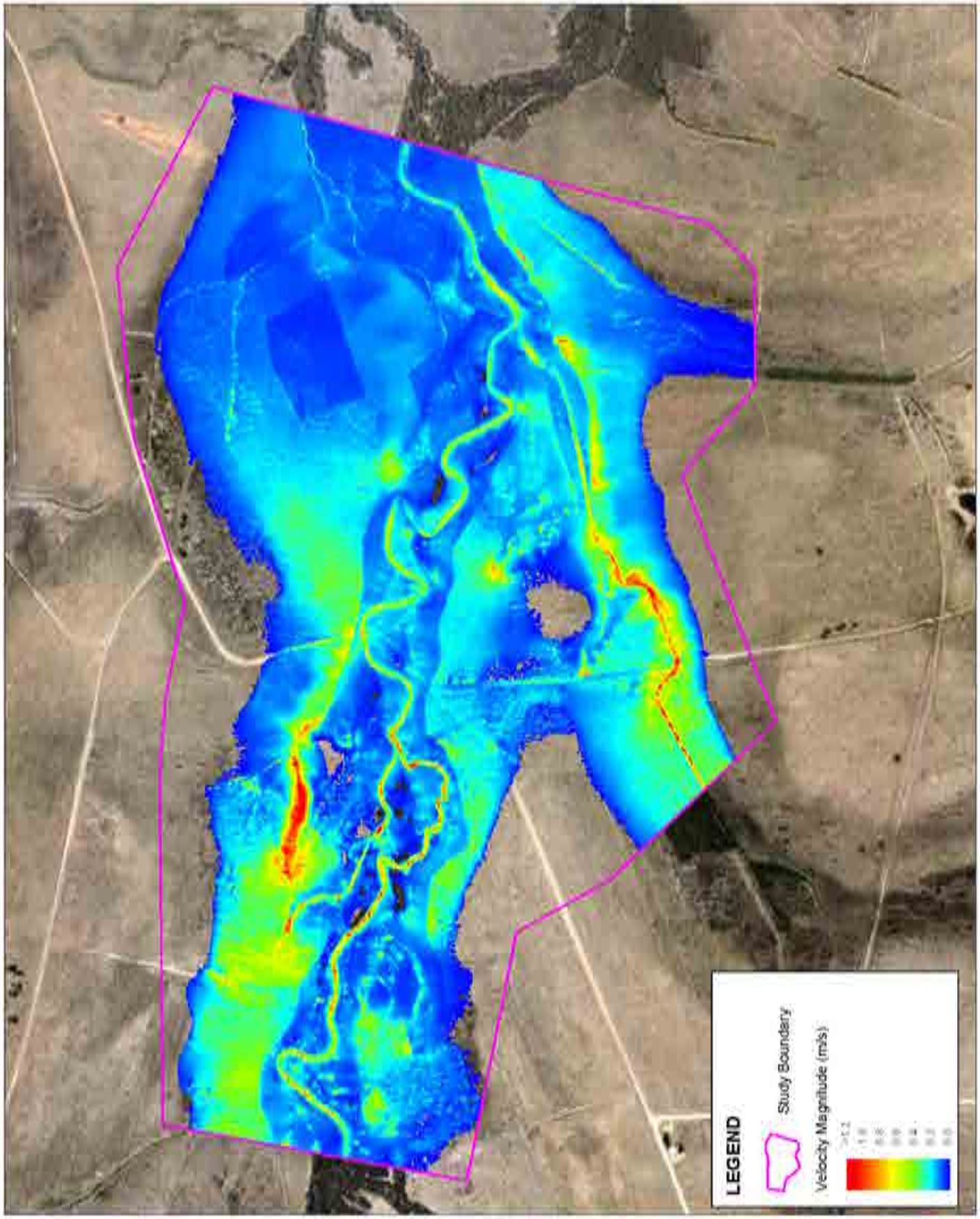
Figures 5-1, 5-3 and 5-5 provide Q100 water velocity plots for each modelled scenario, for the whole study area.

Figures 5-2, 5-4 and 5-6 provide Q100 water velocity plots with velocity vectors, for the area around the proposed overland flow path.

On each of the velocity plots, velocities equal to or above 1.2m/s are shown in red.

The change in peak water velocity between the proposed and existing overland flow path (both with post-development land usage) is shown in Figure 5-7 for the Q100 design storm event.

The change in peak water level between the proposed and existing overland flow path (both with post-development land usage) is shown in Figures 5-8 and 5-9 for the Q100 and Q5 design storm events.



Title:

Peak Water Velocities for Pre-Development with Existing Overland Flow Path; Bells Creek South Q100

Figure: 5-1

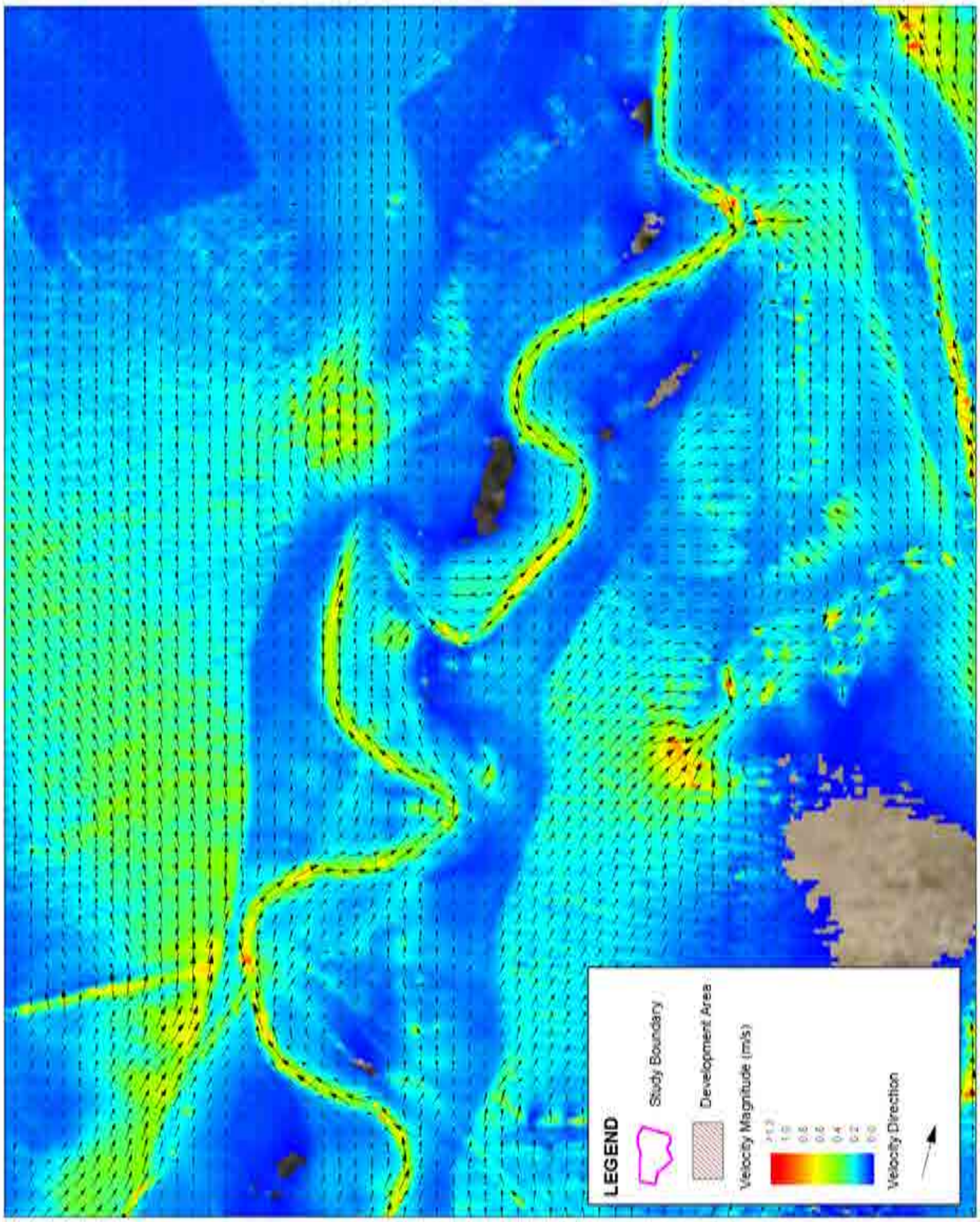
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Title:
Peak Water Velocity Vectors Pre-Development with Existing Overland Flow Path; Bells Creek South Q100

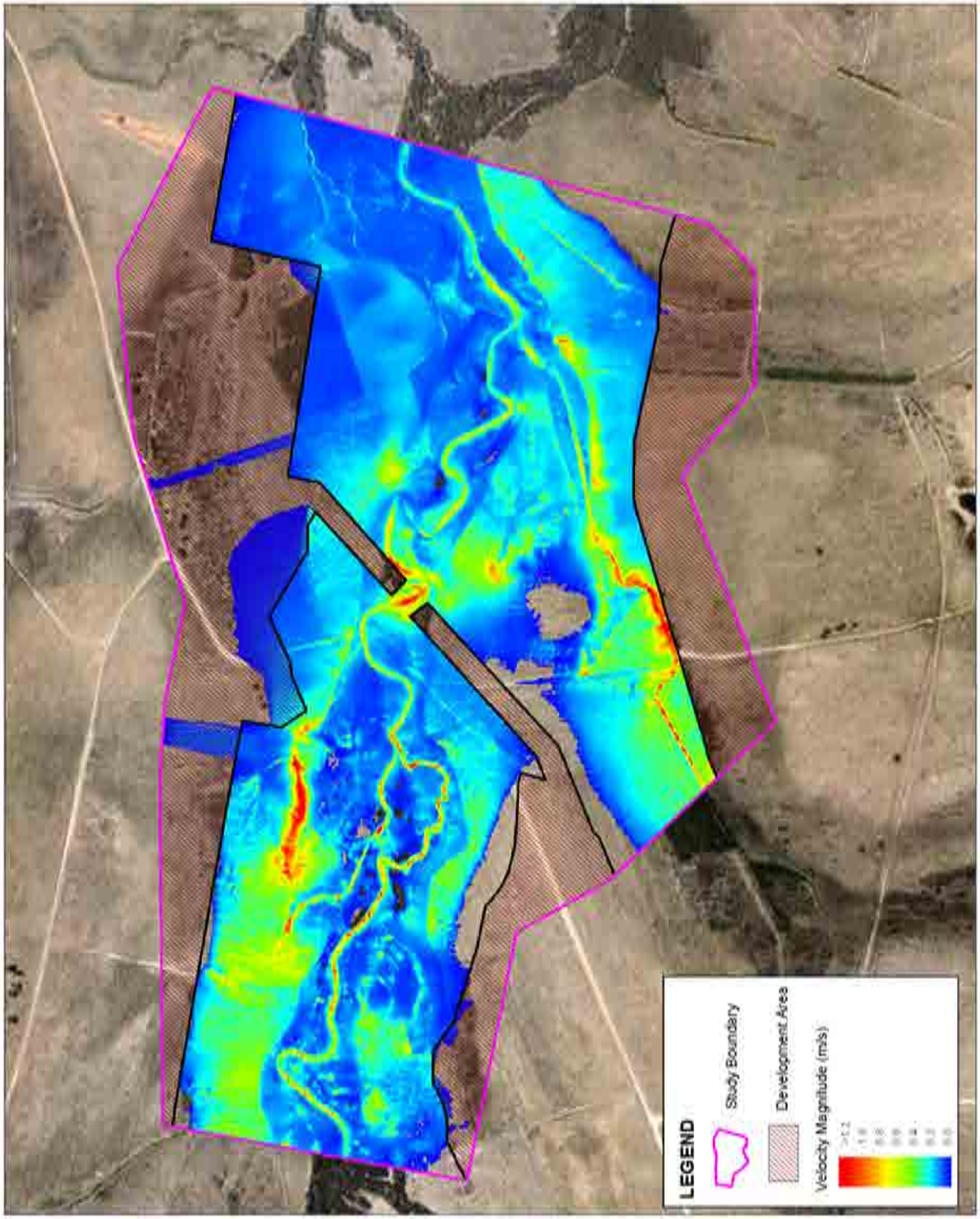
Figure: **5-2**

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Title:

Peak Water Velocities for Post-Development with Existing Overland Flow Path; Bells Creek South Q100

Figure: 5-3

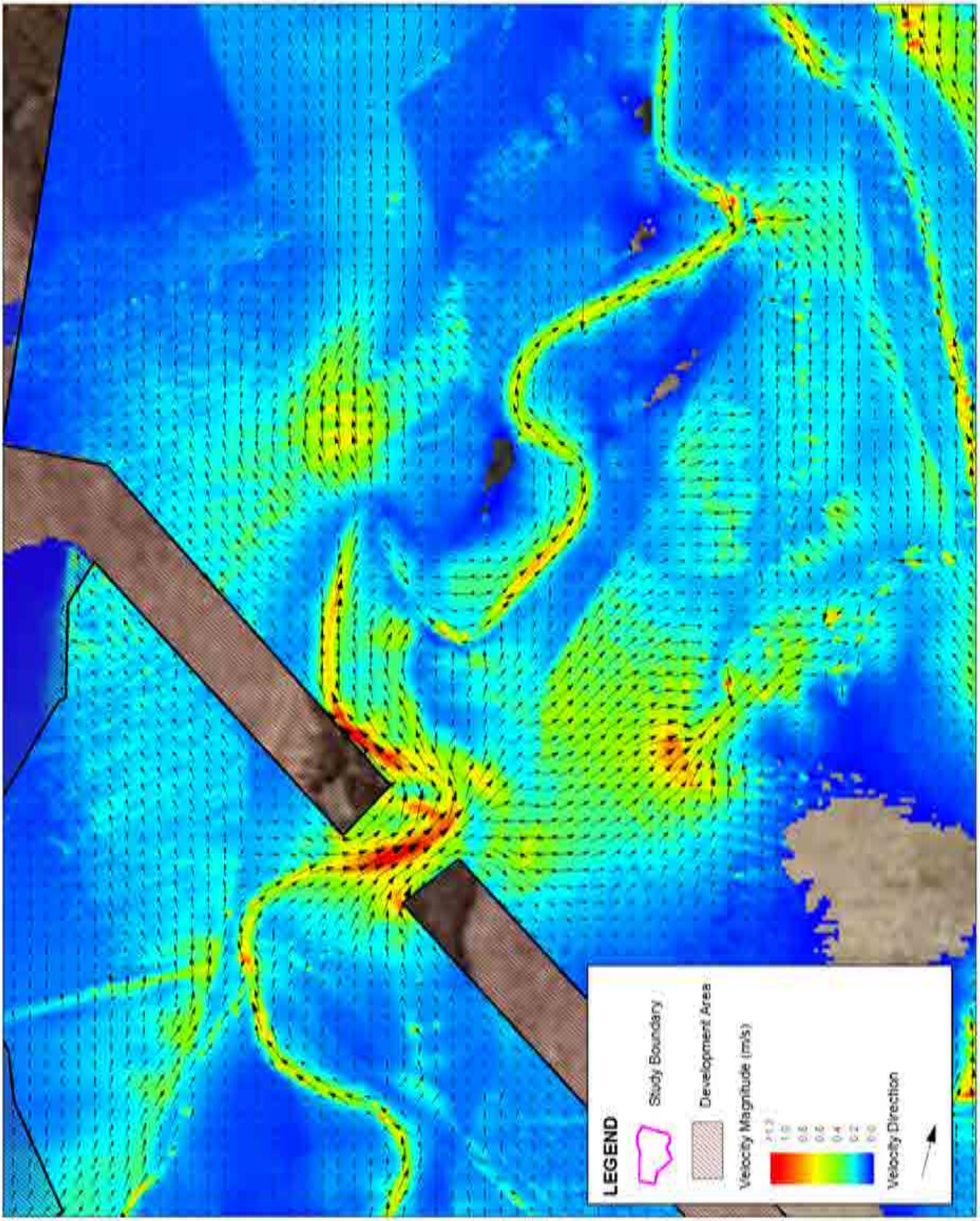
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Title:
Peak Water Velocity Vectors Post-Development with Existing Overland Flow Path; Bells Creek South Q100

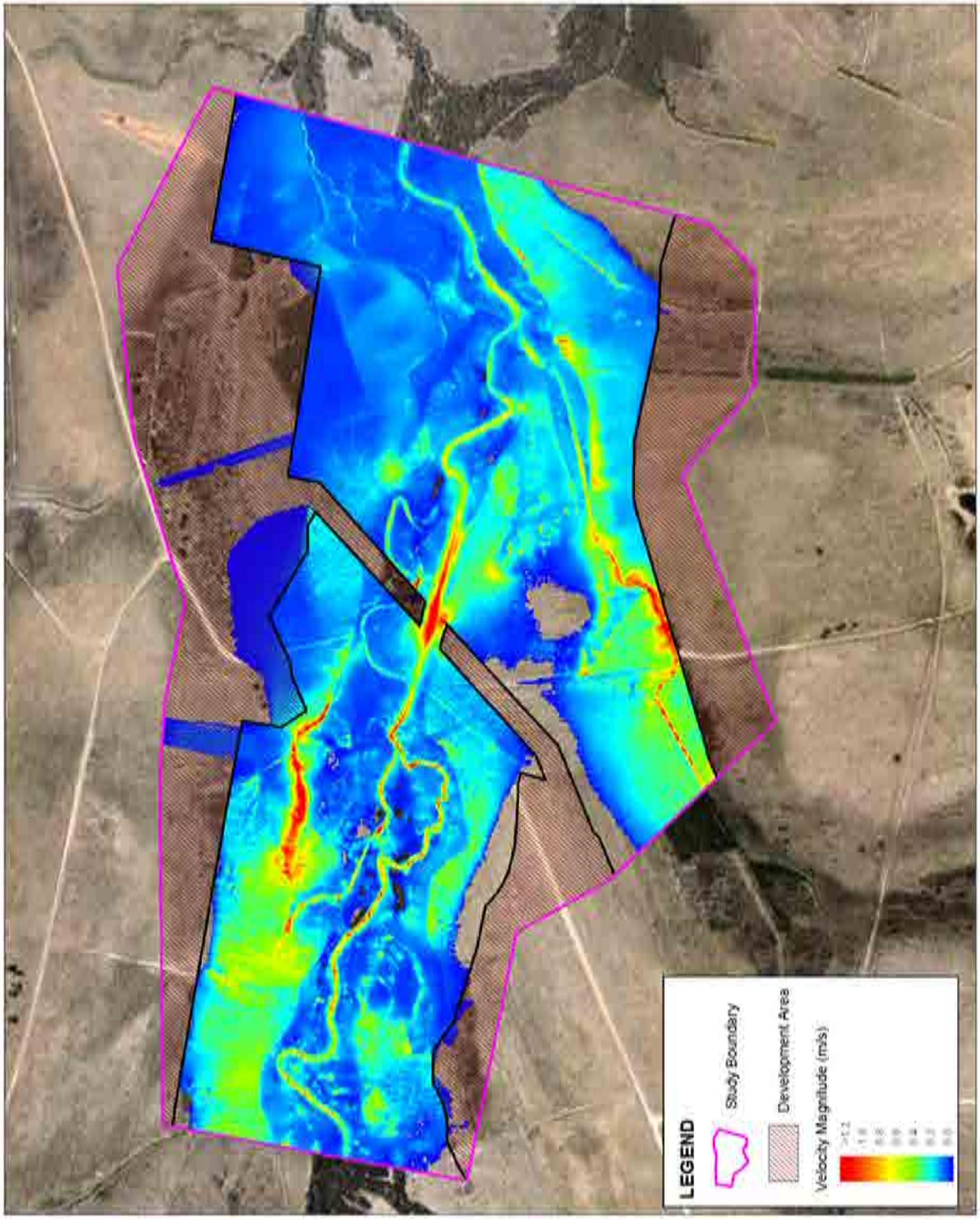
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Title:

Peak Water Velocities for Post-Development with Proposed Overland Flow Path; Bells Creek South Q100

Figure: 5-5

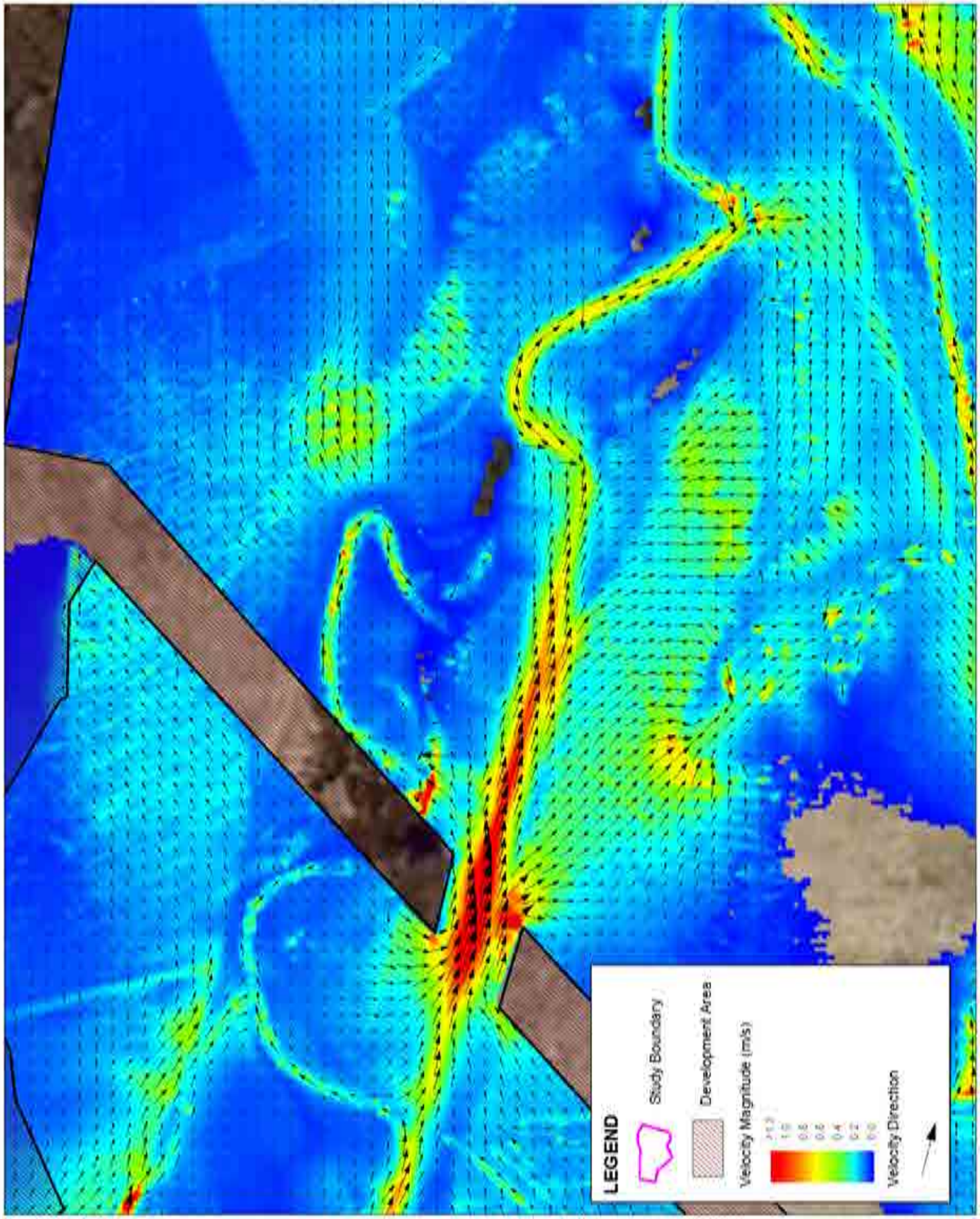
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Title:

Peak Water Velocity Vectors Post-Development with Proposed Overland Flow Path; Bells Creek South Q100

Figure: **5-6**

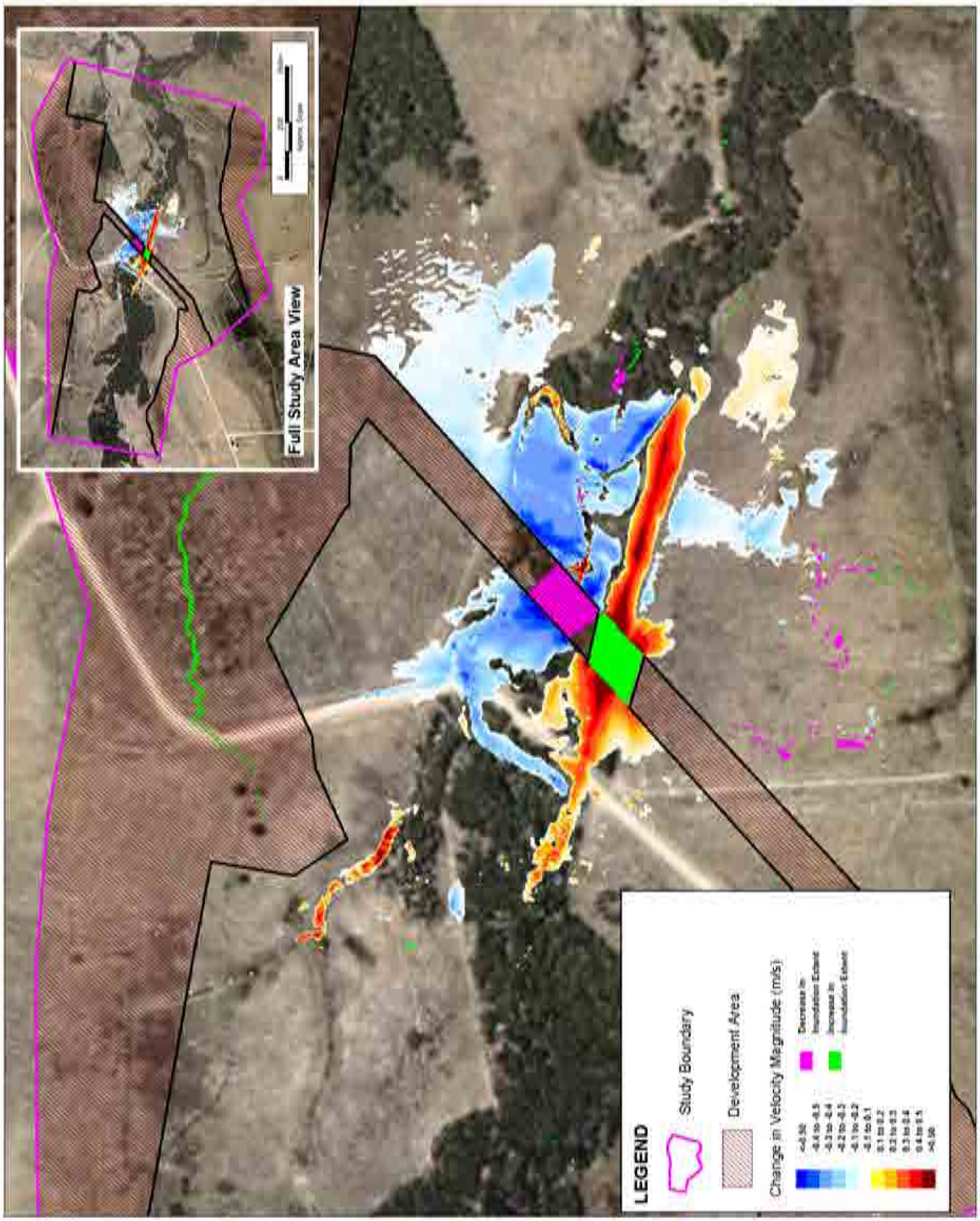
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Title:
Peak Water Velocity Impact between Existing and Proposed Overland Flow Path for Post-Development; Bells Creek South Q100

Figure: **5-7**

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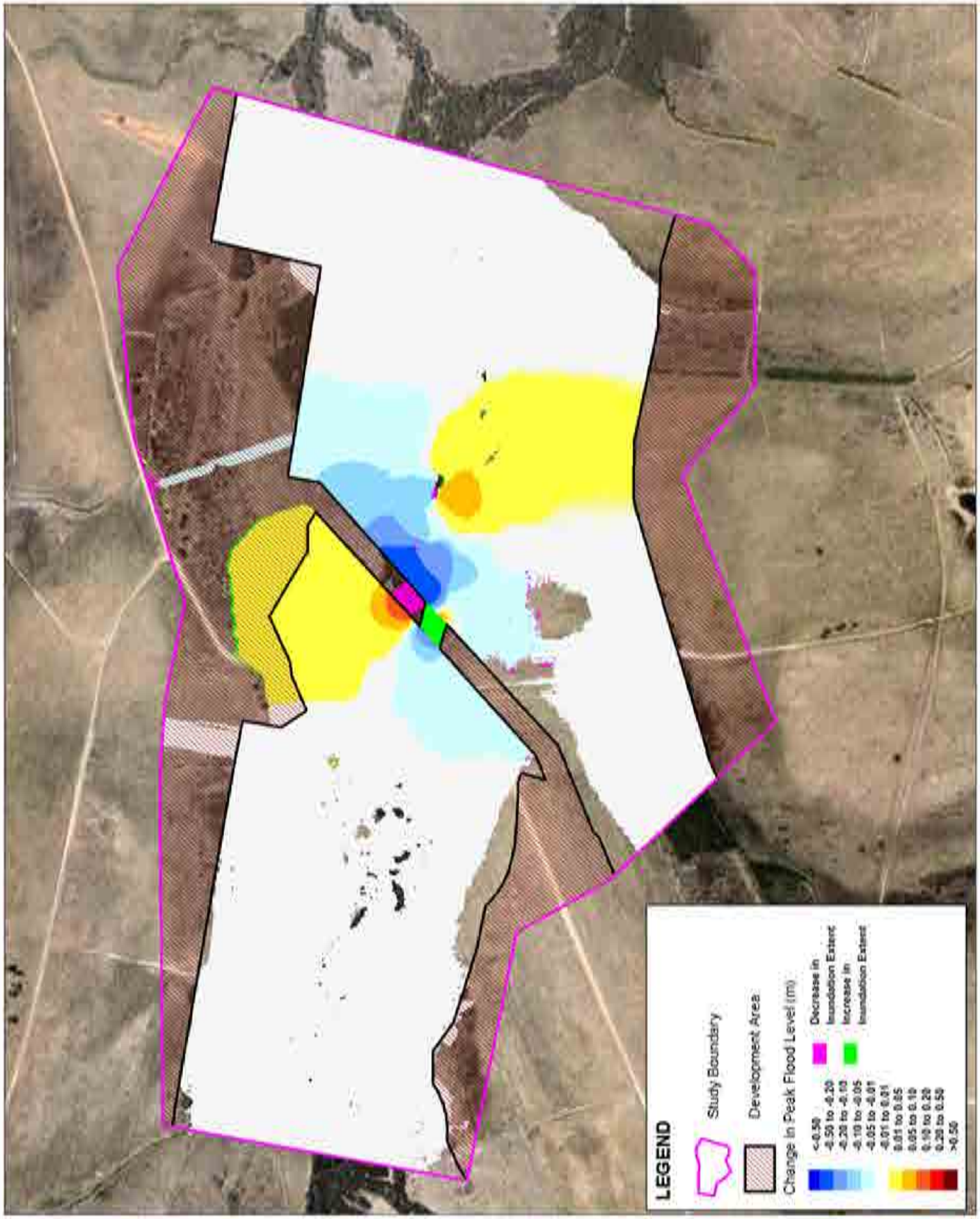
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Title:
Peak Water Level Afflux between Existing and Proposed Overland Flow Path for Post-Development; Bells Creek South Q100

Figure: **5-8**

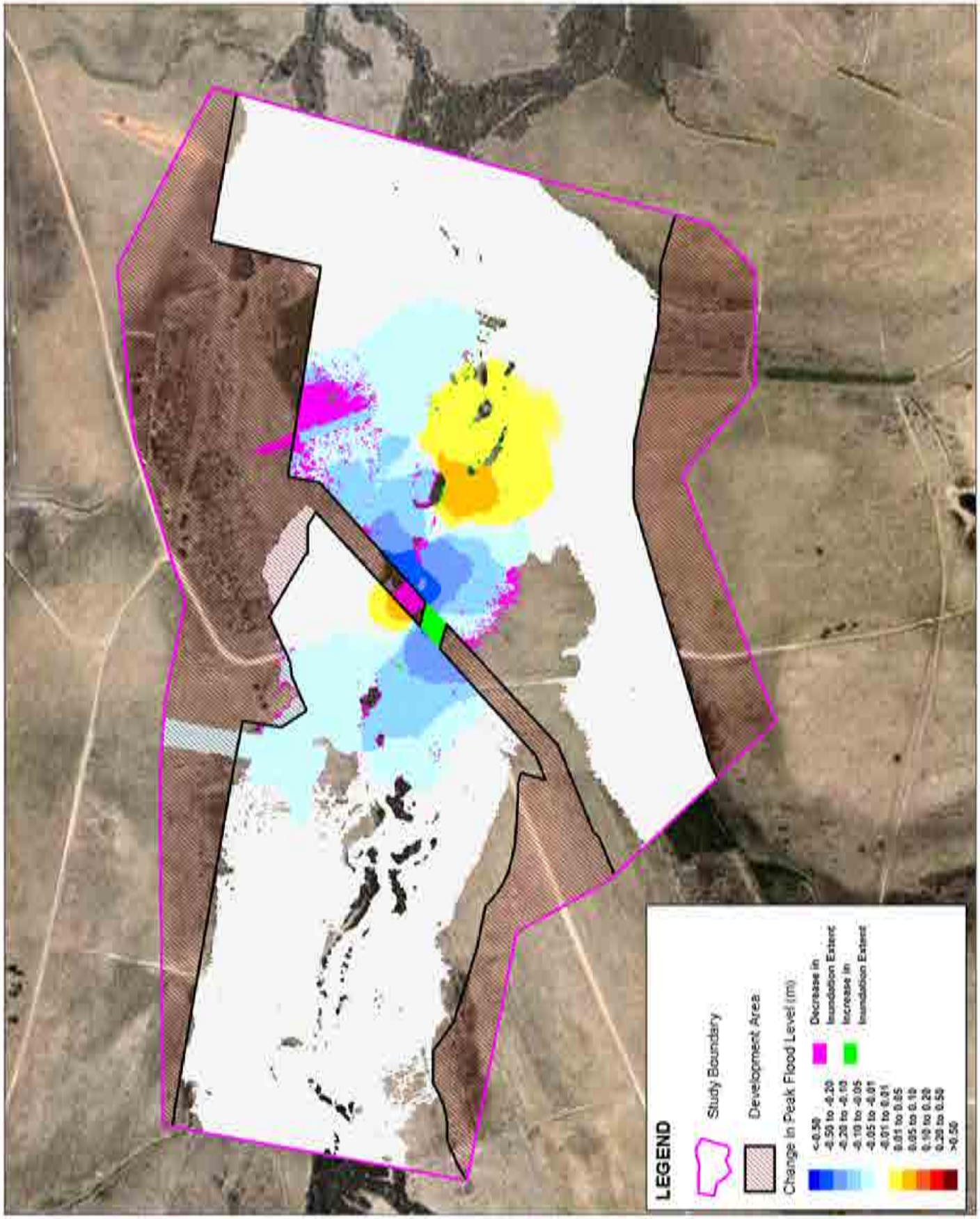
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Title:
Peak Water Level Afflux between Existing and Proposed Overland Flow Path for Post-Development; Bells Creek South Q5

Figure:
5-9

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6 Discussion

6.1 Velocity

Key velocity-related findings from our assessment include the following:

- In all scenarios (including the pre-development scenario) there are areas of velocity above 1.2m/s during the Q100 event.
- Velocities at the bridge crossing (for both existing and proposed flow paths) experience velocities above 1.2m/s
- The impact plots indicate the proposed reconfiguration will not cause any significant increase in velocity (greater than 0.1m/s) downstream of the proposed reconfiguration. Some minor increases are shown upstream, with an isolated area to the north-west a result of a secondary flow path draining more efficiently causing a small area of increased velocity.
- Since there is no significant increase in water velocities above 1.2m/s, there is no significant risk of an increase in scour/erosion associated with modifying the overland flow path.

6.2 Peak Water Levels

Key water level-related findings from our assessment include the following:

- There is no significant change in the Q100 flood inundation extent associated with modifying the overland flow path.
- There is a slight reduction in the Q5 flood inundation extent associated with modifying the overland flow path.
- Since the Q5 inundation extent decreases with modifying the overland flow path, there is potential for an increase in Wallum Sedgefrog habitat.

7 Conclusion

Our hydraulic assessment has demonstrated:

- The proposed reconfiguration will not cause any increase in flow velocities (and associated risk of scour/ erosion) downstream of the proposed reconfiguration during the Q100 storm event
- The proposed reconfiguration will cause a slight decrease in the Q5 inundation extent, which may result in an increase in Wallum Sedgefrog habitat.



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Appendix D – Stormwater Quality Management Plan (Design Flow)

AURA PRECINCTS 6 - 10 & 16

STORMWATER QUALITY MANAGEMENT PLAN

VERSION 4

COMPLIANCE ENDORSEMENT
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2013/469

Date: 2 May 2023

Queensland Government

DesignFlow

Prepared for Stockland

November 2022

Document Control Sheet

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Author(s):	Robin Allison, Shaun Leinster
Approved By:	Shaun Leinster (RPEQ 15637) 
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Date: 2 May 2023

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SUMMARY

This document describes the stormwater quality management strategy for Aura Precincts 6 – 10 and 16 to meet the stormwater quality objectives for the site. This strategy builds on previous stormwater quality management plans for the site by proposing wetland and bioretention systems around the perimeter of the development which treat stormwater prior to discharge into Bells Creek. The strategy does not rely on at source or streetscape stormwater treatments to achieve the stormwater treatment objectives for Aura. The adoption of at source and streetscape systems being at the discretion of Stockland.

Precincts 6-10 & 16 of the Aura masterplan development cover 642ha of which ~260ha is to be a mix of residential, town centre, commercial, school and parkland. The area drains into a State Government declared High Ecological Value area (Pumicestone Passage) as well as Ramsar listed wetland. Consequently, the treatment of stormwater from the site to a high level is important. Stormwater quality objectives for development runoff from Aura have been determined as part of a wider water quality assessment of Bells Creek and Pumicestone Passage.

The principles of the strategy focus on not treating already treated water. The end of pipe wetlands direct treated flows into nearby waterways and pass their overflows into bioretention systems. The bioretention systems direct treated flows to the creeks and overflows pass through swales before entering the creeks. This approach for the treatment systems requires low hydraulic head to operate and has been integrated with the earthworks and drainage for the site to ensure these systems can function. The treatment systems have been all be located within the constraints of available space and requirements for environmental buffers (e.g. frog zone, buffers and ponds).

In addition to the end of pipe systems, rainwater tanks are proposed for most residential dwellings (for toilets, laundry and outdoor uses) as well commercial, school and community buildings. GPTs are proposed for ground level runoff from commercial lots.

The treatment strategy for Precincts 6-10 and 16 meets the stormwater objectives established for the Aura development to ensure no adverse impacts to Bells Creek and Pumicestone Passage. This includes reducing annual pollutant loads by the required 95% for total suspended solids (TSS), 89% for total phosphorus (TP) and 68% for total nitrogen (TN). These stormwater objectives were established as part of the stormwater planning and waterway modelling for the whole Aura development as documented in *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019).

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1 Introduction

The Aura development site has been the focus of extensive water quality and stormwater quality management investigations over the last 12 years. This work has established the water quality characteristics of the receiving waterways (i.e. Pumicestone Passage, Bells Creek), monitored the quality of stormwater quality exiting the site, completed extensive catchment and receiving waterway modelling, established water quality objectives and defined stormwater treatment strategies to meet these objectives. These requirements are now included in Federal and State Government approvals for the site.

Precinct 6 – 10 & 16 is located in the middle of the Aura development site and south of Precinct 2 (Figure 1). The development will involve the creation of ~260 ha of urban development including residential, commercial, town centre and major parkland areas (Figure 2). The remaining ~382ha area will consist of conservation including Environmental Protection Zone, waterways, waterway buffers, frog zones and frog buffers.

This report presents the updated SQMP for Precincts 6-10 and 16 of Aura reflecting recent investigations and consideration of site constraints and proposed development land uses and levels. The strategy ensures the stormwater quality objectives for Aura are achieved using treatment measures that respond to the site constraints. This SQMP supersedes the previous documents including:

- *Aura Precincts 6 - 10 & 16 Stormwater Quality Management Plan – Version 2* (DesignFlow, 2018)
- *Aura Precincts 6 - 10 & 16 Stormwater Quality Management Plan – Version 1* (DesignFlow, 2016)
- *Caloundra South Precincts 6 to 10, 16: Stormwater Quality Management Plan Version 6 (*BMT-WBM, July 2015).

The treatment strategy for Precinct 6-10 and 16 is consistent with the stormwater objectives, planning and modelling documented in *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019). This report defines stormwater management objectives for the Aura development (i.e. reduction in annual pollutant loads by the required 95% for total suspended solids, 89% for total phosphorus, and 68% for total nitrogen) to ensure no adverse impacts to Bells Creek and Pumicestone Passage. The stormwater treatment strategy for Precincts 6-10 and 16 ensures these objectives are achieved.

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Figure 1 Aura Precincts 6 - 10 & 16 Location

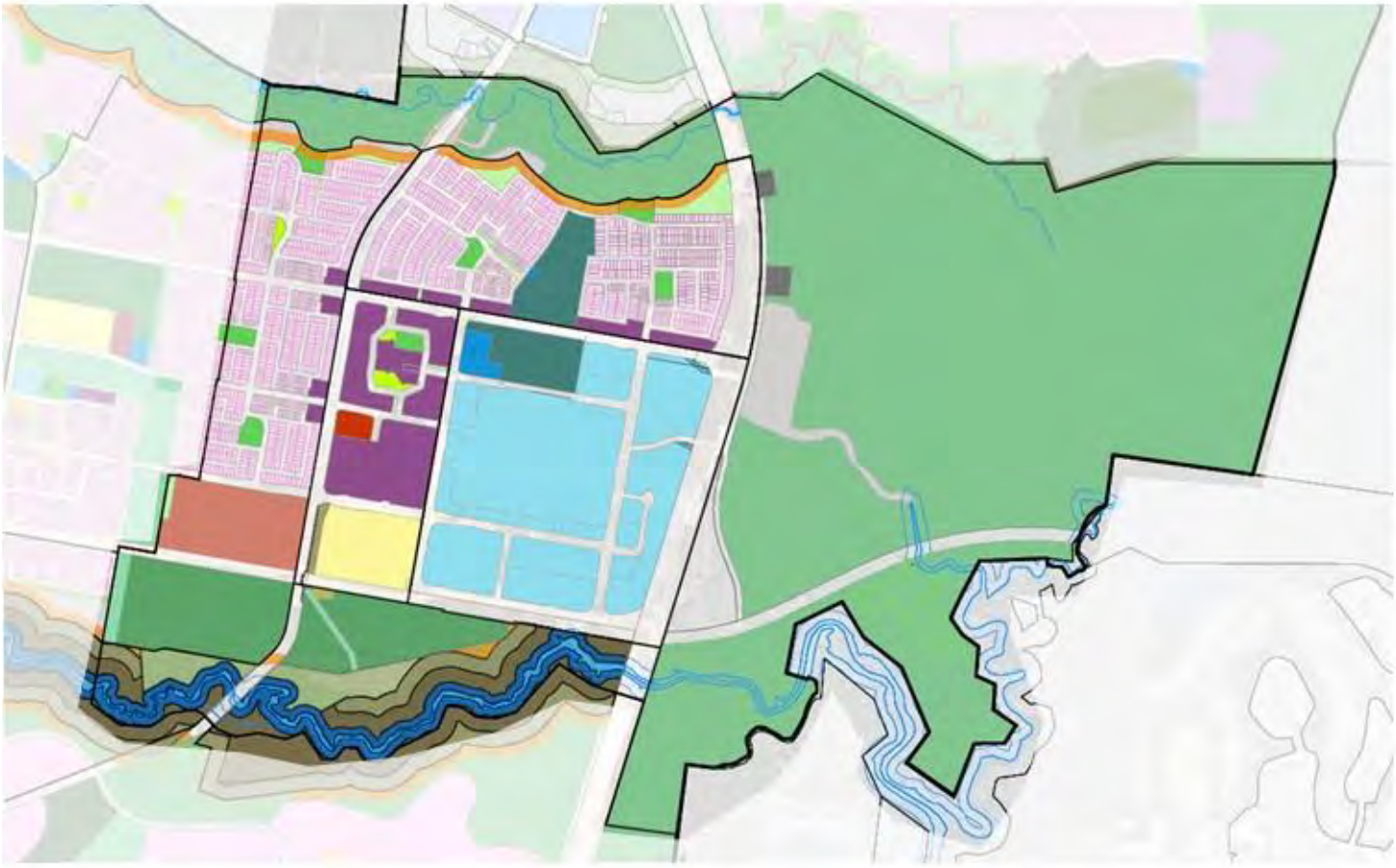


Figure 2 Aura Precincts 6 - 10 & 16 Development

2 Site Characteristics

The description of the site presented here relates to elements that the affect stormwater quality management strategy for Precincts 6 - 10 & 16. More thorough site descriptions of soils, geology, climate, vegetation and habitats are not replicated as these are covered in other reports relating to the site.

2.1 Topography and drainage

The site slopes generally from west to east with small parts of the site shedding flows both north and south into the reaches of Bells Creek. With such a large site with mild grades, there is some flexibility to direct runoff to different areas where it suits the overall stormwater management approach.

Existing elevations of the proposed development pad range from approximately 10m AHD in the west to 3m AHD on the eastern edge of the area. Bells Creek North and Bells Creek South have invert levels of approximately 4m & 1.0m AHD respectively at the eastern edge of the development area.

The development pad will need to be raised above predicted flood levels along Bells Creek and this offers some flexibility in shaping the area to direct stormwater flows to where there are suitable areas for treatment. This is discussed further in Section 4.1.

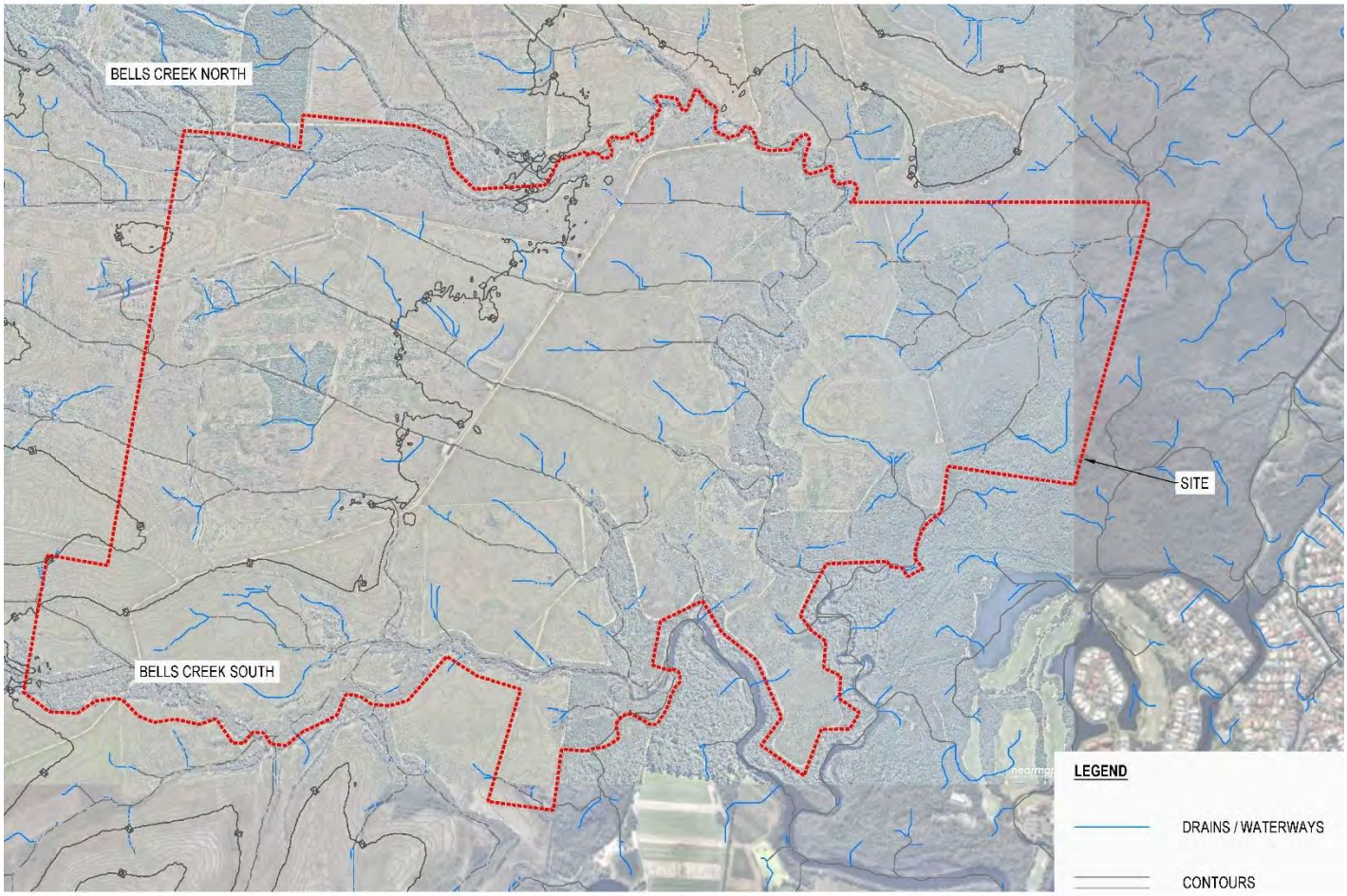


Figure 3 Existing landuse, topography and drainage

2.2 Bells Creek North and South

Bells Creek North and Bells Creek South (tributaries of Bells Creek) have been modified previous but have regrown to healthy waterways that support a range of wetland and riparian flora (see photo below). The condition of the creeks, including water quality, has been extensively monitored and presented in other reports and is not covered here.



The total catchment of Bells Creek including the Aura development is 4630ha (Figure 4). Precinct 6-10 & 16 form 642ha of this catchment with the actual residential, commercial and parkland urban footprint being ~260ha (5.6% of the catchment).

Protection of Bells Creek and the downstream Pumicestone Passage are a critical component of the Aura development and stormwater runoff from the whole area is required to meet a general "no worsening" water quality condition in Pumicestone Passage. This is discussed further with regard to the stormwater treatment objectives (Section 3).

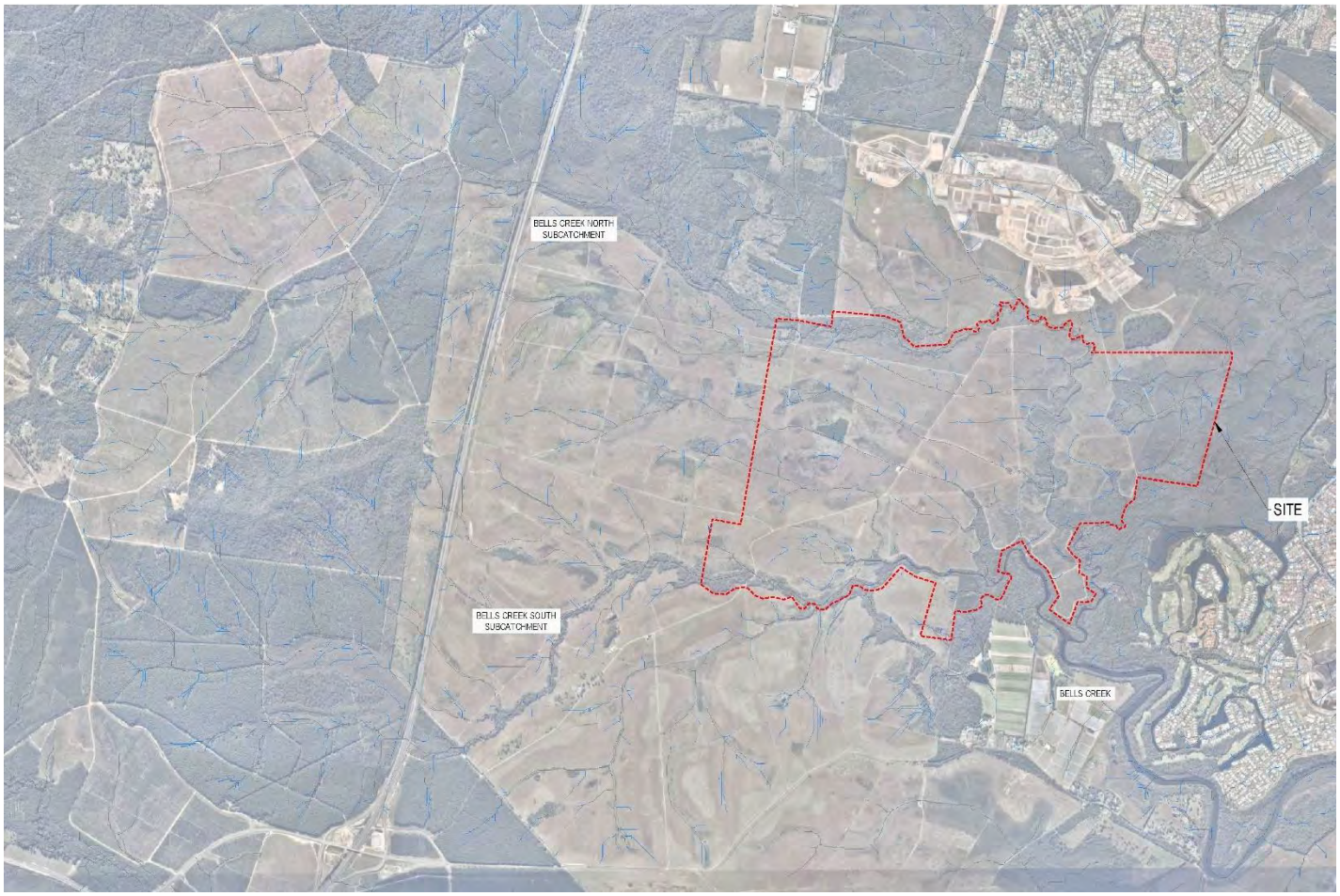


Figure 4 Bells Creek Catchment

2.3 Frog Habitat

Frog habitat has been identified across the Aura development for the following frogs which have federal or state significance:

- Wallum Sedgefrog
- Wallum Froglet
- Wallum Rocket Frog.

Management of the Wallum Sedgefrog is to occur in accordance with the approved *Caloundra South Wallum Sedge Frog Management Plan*. Some Sedgefrog habitat areas within the development footprint will be removed and compensatory Sedgefrog habitat areas recreated within the Aura development site (typically within frog zones and buffers as per Section 2.4).

The Wallum Froglet and Wallum Rocket Frog will be managed in accordance with the *Caloundra South Acid Frog Management Plan*, the requirements of which are very similar to the Wallum Sedgefrog outlined above.

2.4 Waterway and Frog Buffers

To preserve and enhance the riparian function of Bells Creek and meet the requirements of the *Caloundra South Wallum Sedge Frog Management Plan* and *Caloundra South Acid Frog Management Plan*, the development edges in Precincts 6 -10 are required to incorporate the following:

- 25m wide riparian buffers from top of waterway banks (for preservation and rehabilitation of riparian vegetation)
- 50m width Frog Zone (for creation of Wallum Frog habitat)
- 50m Frog Buffer (buffer to the Frog Zone and additional space for creation of Wallum Frog Habitat).

The Frog Buffer can incorporate some stormwater management as per *Caloundra South Wallum Sedge Frog Management Plan* and details of permitted encroachment into the frog buffer is described in Section 5.2.4.

3 Stormwater Treatment Objectives

There are several fundamental drivers for managing stormwater quality from Aura.

The adjacent sections of Pumicestone Passage which receive runoff from the site have been defined as having High Ecological Value (HEV) status in the *Environmental Protection Policy (EPP) – Water* (2009). Water quality objectives that accompany HEV status are of the nature of 'no worsening', but more specifically are quantified as maintaining existing water quality (20th, 50th and 80th percentiles) in the receiving waterway (Department of Environment and Heritage Protection).

Pumicestone Passage and the estuarine sections of Bells Creek have also been defined as having Ramsar wetland status. The associated significance criteria which accompany this designation include:

- Areas of the wetland being destroyed or substantially modified
- A substantial and measurable change in the hydrological regime of the wetland (e.g. volume, timing, duration and frequency of surface and groundwater flows)
- The habitat or lifecycle of native species being seriously affected
- A substantial and measurable change in the water quality of the wetland that may adversely impact on biodiversity, ecological integrity, social amenity or human health
- An invasive species that is harmful to the ecological character of the wetland becoming established, or an existing invasive species spreading.

With such significant high value environmental areas downstream of Aura, considerable investigation and planning has gone into protecting these areas from the impacts of urbanisation as outlined in a range of previous reports (not reproduced here). These reports have attempted to establish load base stormwater quality design objectives which will ensure the 'no worsening' receiving water quality requirement is achieved.

Objectives that are applied to developed portion of Precincts 6-10 and 16 (~260ha) are based on the catchment and waterway modelling completed for the Bells Creek catchment and Aura development site presented in *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019). The stormwater load based reduction targets are presented in Table 1. These exceed *State Planning Policy* requirements, reflecting the significance of the receiving waters.

The remainder of Precinct 6 - 10 and 16 (376ha) will be EPZ and waterway corridors and do not require stormwater treatment. These areas will be revegetated thus providing a flow and water quality benefit to Bells Creek and Pumicestone Passage. This benefit has not been included in the achievement of the objectives, which apply to the urban footprint (~260ha) only.

Table 1: Stormwater quality design objectives

Pollutant	Objective - Minimum reduction in mean annual load from unmitigated development
Total Suspended Solids	95%
Total Phosphorus	89%
Total Nitrogen	68%
Gross Pollutants	90%

4 Stormwater Quality Management Strategy

This section provides an overview of the stormwater strategy and describes the treatment systems proposed for Precincts 6-10 and 16.

4.1 Design Principles

To develop a robust stormwater treatment strategy, a number of principles were applied for managing stormwater quality. These include:

1. Flexibility – The stormwater treatment strategy will have flexibility and redundancy to allow adjustment in response to site constraints and issues identified as part of future design. This allows the design to be modified during detailed design if an unforeseen constraint is identified.
2. Avoid double treating – As much as practically possible, stormwater that has been "treated" in a wetland or bioretention system should not flow into a downstream treatment, but rather be discharged to the receiving waterway.
3. Identify End of Pipe Treatment opportunities first – Explore all "end-of-pipe" treatment systems initially. In the context of Precinct 6-10 and 16, treatment systems are located around the perimeter of the development and need to work within the constraints of areas for frog habitat and operate with existing Bells Creek (North & South) levels. This approach reduces the number of treatment devices needing maintenance, increases opportunities for adaptive management and consolidates locations where treated water could be harvested.
4. Tanks - Rainwater tanks (plumbed to toilets, cold laundry and outdoor supply) are to be adopted for most residential properties and all commercial, community and school properties.
5. At-source treatments – At source and streetscape systems are not required to stormwater treatment objectives but may be applied to the residential precincts at the discretion of Stockland.
6. Frogs – Ensure the requirements of the *Caloundra South Wallum Sedge Frog Management Plan* and *Caloundra South Acid Frog Management Plan* are achieved.
7. Match catchments, earthworks and drainage to Precinct Scale Treatment – Consideration of slopes within the development area to direct surface runoff to areas with sufficient capacity to provide downstream treatment was undertaken. This involved revising the earthworks, catchments and drainage to match catchment areas with the precinct scale treatment measures. It also required careful considering of earthworks and drainage levels to account for operational hydraulic level requirements.

4.2 Stormwater Treatment Strategy

The stormwater treatment strategy for Precinct 6 – 10 & 16 is presented in a number of formats below:

- Figure 5 shows the conceptual treatment train flow diagram
- Figure 6 provides the location and size of the various treatment systems on the development layout.
- Table 2 presents catchment and treatment conceptual details.

The strategy adopts the same suite of treatment measures as previous stormwater strategies for Aura (i.e. predominantly bioretention and wetland systems in various forms). In this instance, the treatment measures have been applied using the principles presented in Section 4.1 resulting in a strategy that responds to the constraints of the site carefully while providing flexibility to achieve the stormwater quality objectives.

The stormwater treatment strategy includes:

1. **Tanks** are included in the strategy and will provide a water conservation function. The tanks are to be placed on residential, commercial, community and school lots and plumbed for toilets and outdoor uses. These also contribute to Aura's water conservation initiatives.
2. **Gross pollutant traps** on lots for landuses which generate high volumes of litter (i.e. commercial, industrial, school, community facilities, child care and sporting ovals)
3. **End-of-line treatment systems** (i.e. combined sediment basins, wetlands and bioretention systems) have been sized to achieve the stormwater quality objectives in combination with upstream treatments. Based on concept layouts there is suitable space having given consideration to other land requirements (e.g. frog zones).
4. **Swales / Vegetation Channels** will collect and convey flows from the end-of-line treatment systems and convey to Bells Creek. The waterway will provide additional treatment of moderate to high flows.

Note the sizes nominated in Table 2 for treatment areas are the wet areas of sediment basins, wetlands (i.e. normal water level) and the filter area surfaces of bioretention basins. They do not include land for required batters, access tracks etc. Total land requirements have been considered carefully when developing the concept layouts and development layout for Precincts 6-10 and 16. Conceptual designs for each of the end of line stormwater treatment systems is provided in Appendix A.

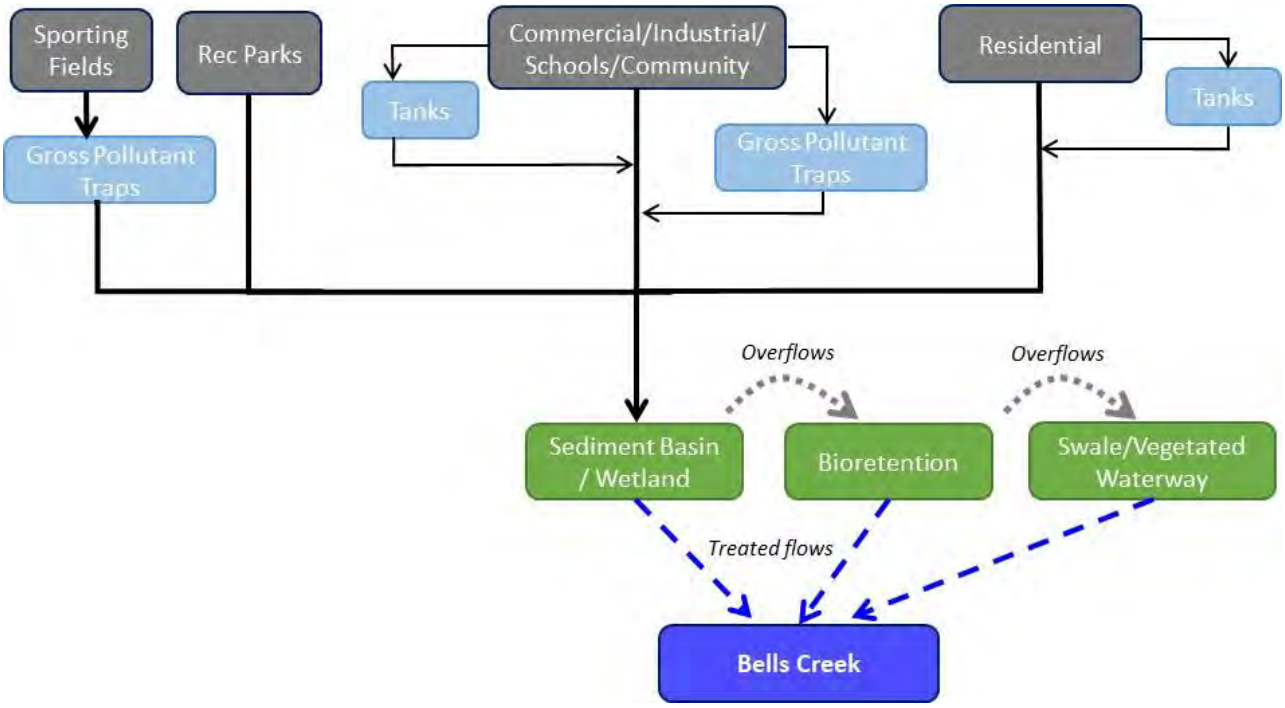


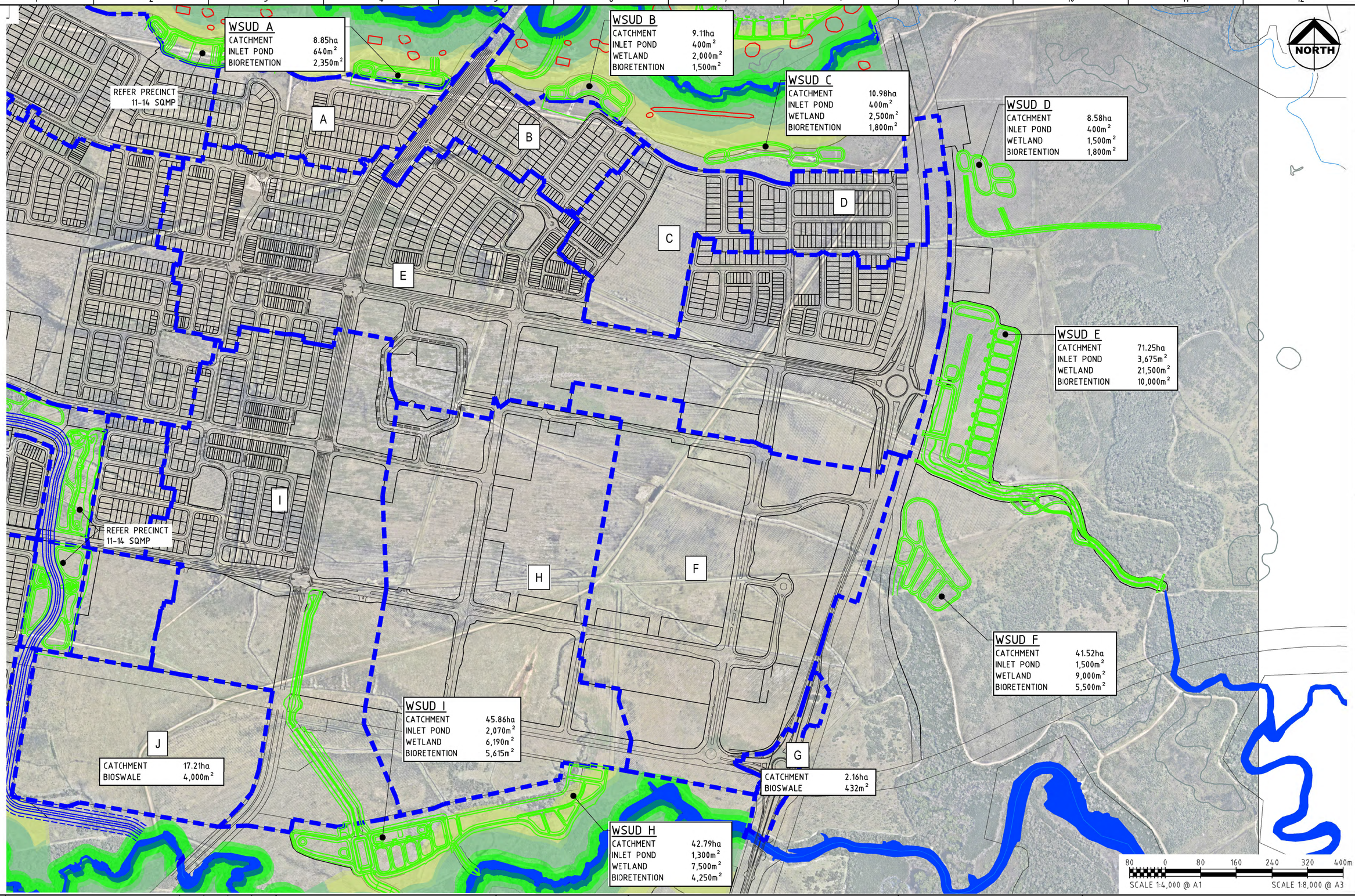
Figure 5 Stormwater treatment train flow diagram

Table 2 Stormwater catchment and treatment areas

Catchment ID	Area	Inlet Pond		Wetland	Bioretention
	(ha)	Volume (m3)	Area (m2)	(m2)	(m2)
A	8.85	960	640		2350
B	9.11	400	400	2000	1500
C	10.98	400	400	2500	1800
D	8.58	400	400	1500	1800
E	71.25	5512.5	3675	21500	10000
F	41.52	2250	1500	9000	5500
G	2.16				432
H	42.79	1950	1300	7500	4250
I	45.86	3105	2070	6190	5615
J	17.21				4000
Total	**258.3**	**14977.5**	**10385**	**50190**	**37247**

* For large inlet pond (>500m3), underwater batters have little influence of volume so area = volume / 1.5m depth. For smaller inlet ponds (<500m3), area approximately = volumes (average 1m depth).

Note: All areas, volumes and levels subject to change as part of detailed design.



REVISION	DESCRIPTION	DRAFTED BY	INITS	DATE	CHECKED BY	INITS	DATE
E	UPDATED LAYOUT		SBY	05.11.22	SL	SL	05.11.22
D	UPDATED CATCHMENT		SBY	24.06.22	SL	SL	24.06.22
C	UPDATED LAYOUT		SBY	01.12.21	SL	SL	01.12.21
B	UPDATED LAYOUT		SBY	18.06.18	SL	SL	18.06.18

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DRAWING No	FIGURE 6
REVISION	E

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4.3 Treatment Measures

The table below briefly describes the stormwater treatments measures adopted for Precinct 6 – 10 and 16.

Table 3 Summary of Stormwater Treatment Measures

Measure	Description
Rainwater Tanks	As part of Stockland's water conservation policy and to reduce the volumes of stormwater requiring treatment, rainwater tanks are proposed for residential, commercial, industrial, community and school land uses. Water from the tanks is to be plumbed for toilet, cold laundry tap, outdoor uses and suitable non-potable demands. While the tanks serve an important water conservation role they also act to reduce the volume of stormwater (and associated pollutants) from reaching downstream waterways. Section 5.1 outlines the proposed tank implementation for Precincts 6-10.
Gross Pollutant Traps (Commercial Lots only)	Commercial, industrial, school, child care, community and sporting parks are a significant source of litter and sometimes sediment at ground level. Runoff from the ground level area on these landuses will pass through gross pollutant traps prior to discharging from the lot. The GPTs will focus on litter and coarse sediment. The GPTs will be owned and managed by the lot owners other than for sporting parks where the GPTs will be owned and managed by Council. No specific oil management is required for most lots because the risk of oil is very low and suitable treatment of oil will be provided in the end-of-line wetland and bioretention systems. However, the design of high risk landuses such as service stations and car wash sites must occur in accordance with Council and State Government policy. Structural separation (installation of bunds and rooves/canopies) of high pollutant generating operations, such has fuel bowsers and car wash areas on the lot, must be adopted to effectively exclude these areas from stormwater runoff. GPTs have not be included in the MUSIC model as the focus of these in Precincts 6-10 is litter and coarse sediment.
Constructed Wetlands	Constructed wetlands are proposed to manage stormwater from the larger catchments in Precincts 6-10. The wetlands will receive flows from the drainage network hold water for treatment for approximately 2 days with overflows being transferred to adjacent bioretention basins. Constructed wetland systems are shallow extensively vegetated water bodies that use enhanced sedimentation, fine filtration and pollutant uptake processes to remove pollutants from stormwater. Water levels rise during rainfall events (by up to 350mm) and outlets are configured to slowly release flows, typically over two to three days, back to dry weather water levels. Wetlands consist of an inlet zone (sediment basin to remove coarse sediments), a macrophyte zone (a shallow heavily vegetated area to remove fine particulates and facilitate the uptake of soluble pollutants) and a high flow bypass (to protect the macrophyte zone). The proposed operation of the wetlands and interaction with the subsequent bioretention basins is described in Section 5.2. Treated flows from the wetlands will be discharged to either Bells Creek North or South. Overflows from the wetland will enter bioretention basins located immediately around the wetland perimeter to receive further treatment. During large events, overflows from the inlet pond will drain via overflow swales. The wetlands will all be designed in accordance with *the WSUD Technical Design Guidelines for SEQ* (Water by Design).
Bioretention Basins	Bioretention basins are proposed to receive stormwater that overflows from the wetlands as part of the end-of-line treatment systems. There are a number of advantages in considering the

Measure	Description
	bioretention systems in this manner: • bioretention systems accept untreated stormwater thus avoiding double treating stormwater • bioretention systems do not receive regular "trickle' flows (that can cause algal growth and block their surface) • minimises the hydraulic head required to operate the wetland and bioretention treatment combination and minimises the level the development pad is required to be lifted to enable free draining treatment systems • by combining the active storages of the wetlands and bioretention, much more water can be treated through the bioretention because of the relatively large areas of the wetlands and the faster treatment rates of bioretention. In this way, less water overflows the overall treatment systems. Treated flow that collects in the underdrainage pipes will combine with treated water from the wetlands and discharge into Bells Creek North or the waterway leading to Bells Creek South. Design of the bioretention systems will occur in accordance with *Bioretention Technical Design Guideline* (Water by Design).
Overflow Swales	Overflows from the wetland and bioretention systems will be directed to wide shallow vegetated areas that will convey flows to Bells Creek. The areas will act to filter the overflows and slow flows down before entering Bells Creek. The systems will essentially act like occasional flowing wide swales.

In addition to the above stormwater treatment measures, the EPZ and waterway corridors will be allowed to revegetate and also be actively rehabilitated in accordance with approved restoration plans. This will result in the cleared pastured areas of the site to become vegetated thus reducing runoff volumes and associated pollutant loads from those areas flowing into Bells Creek and Pumicestone Passage. This benefit has not been included in the MUSIC modelling for Precinct 6-10 and 16.

5 Design Principles

5.1 Rainwater Tanks

Rainwater tanks are an important part of Stockland's water conservation and stormwater management strategy for Aura. Table 4

summaries the proposed tank approach for Precincts 6-10 which is consistent with the tank approach outlined in *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019). These have been written into the Plan of Development for Precincts 6-10 and 16 to ensure compliance with this Stormwater Quality Management Plan.

Table 4: Rainwater tank approach for Precincts 6-10 & 16

Landuse	Roof Area	Tank size (minimum)	Tank Connections / Fixtures / Uses
Residential - Detached/attached dwellings (Lot >300m²)	50% roof area must connect / drain to tank	5kL per dwelling	Tanks must be connected to and supply water to all of the following: • Toilets (all toilets) • Laundry cold (all cold taps in laundry) • Outdoor taps (all outdoor taps)
Residential - Detached/attached dwellings (Lot = 225-300m²)	50% roof must connect / drain to tank	3kL per dwelling	Tanks must be connected to and supply water to all of the following: • Toilets (all toilets) • Laundry cold (all taps in laundry) • Outdoor taps (all outdoor taps)
Residential - Detached/attached dwellings (Lot <225m²)	No tanks		
Residential - Medium density dwellings	75% roof must connect / drain to tank If multiple buildings then 50% of total roof area must connect / drain to tank	1kL per dwelling	Tanks must be connected to and supply water to all of the following: • Toilets (all toilets) • Laundry cold (all taps in laundry) • Outdoor taps (all outdoor taps)
All non-residential uses including but not limited to: • Commercial • Retail • Industrial • School • Community	50% roof must connect / drain to tank If multiple buildings then 50% of total roof area must connect / drain to tank	1KL per toilet or urinal or 25kL/ha Minimum 5 KL size	Tanks must be connected to and supply water to all non-potable uses and fixtures including but not limited to: • Toilets (all toilets) • Urinals (all urinals) • Laundry cold (all taps in laundry) • Outdoor taps (all outdoor taps)

5.2 Wetland and Bioretention System Concept Designs

Concept designs for the end-of-line treatment systems (i.e. constructed wetlands, bioretention basins and overflow swales) involved a number of steps:

1. Resolving the function of the treatment systems (i.e. how they interact hydraulically to maximize treatment performance)
2. Identifying available space for treatment adjacent to Bells Creek North and accommodating the required buffers and finding sufficient space within the proposed waterway flowing to the south
3. Ensuring there is sufficient space for the contributing catchments
4. Completing MUSIC modelling to confirm treatment performance
5. Completing survey of creek levels (top of bank and standing water level)
6. Defining operating levels in the wetlands and bioretention systems (using discharge levels into the creek)
7. Optimising the drainage levels and associated earthworks in the development.

The following sections summarise the considerations and findings of this process.

5.2.1 Treatment system operation

The operating principles of the wetland, bioretention and overflow swales are presented in Figure 7 and described below:

- **Inlet pond** - Flows from the development drainage enter the inlet pond where coarse sediment will settle out and flows will pass via a pit/pipe system to the wetland.
- **Wetland** - Flows will then enter the macrophyte zone of a wetland for treatment. The wetland will treat baseflows and small storm events with treated flows discharged to Bells Creek. Water levels rise during rainfall events 50mm before overtopping into the bioretention basin. Wetlands will typically have a 48-72hr notional detention time and a maximum depth of 350mm above normal water level (when bioretention is engaged as well).
- **Bioretention** – During rainfall events, the wetlands begin to fill and as water levels increase by more than 50-100mm they will overtop weirs into adjacent bioretention basins. As flow increases water ponds over the bioretention by up to 300mm. The ponded water is combined with that over the wetland. As a storm ends, water then flows through the bioretention media (the majority) and through the wetland outlet. Treated flows from the bioretention basins will be discharged to Bells Creek. Bioretention basins are divided into "cells" to provide management flexibility, promote better flow spreading and allow easier construction and maintenance.
- **Overflow swale** – The vast majority of stormwater will pass through the wetland and bioretention system to achieve the performance objectives listed in Section 3. Large storm events will overflow the wetland and bioretention basins and pass through an overflow swale which will be vegetated with native grasses and potentially melaleuca. The swale will promote sedimentation and filtration of sediment and particulate phosphorus and discharge large flow events to the creek.

The design of the treatment systems has undergone a conceptual design process to locate and size the systems in relation to the catchments and define design levels to ensure hydraulic function. Refer to Appendix A for the conceptual designs.

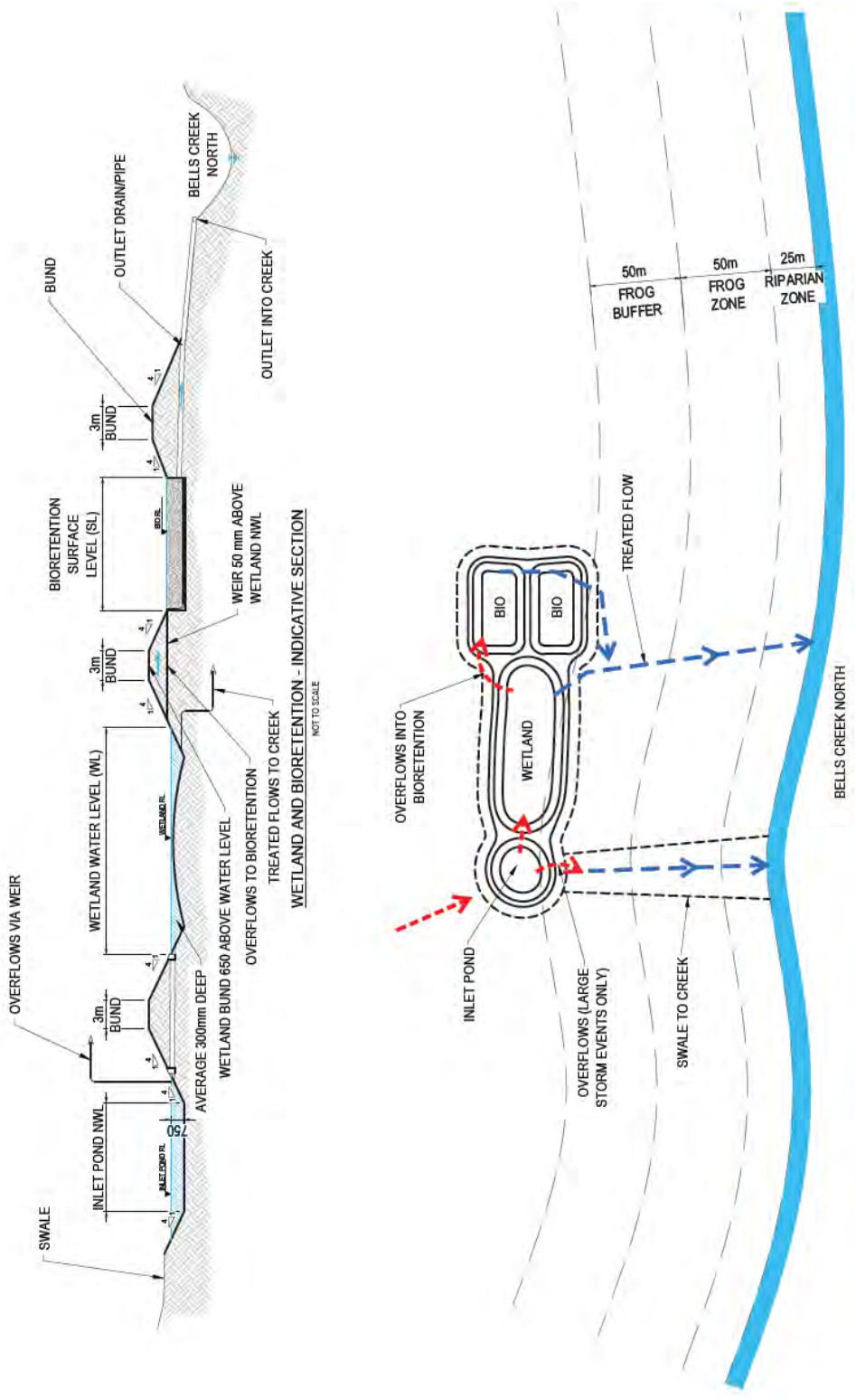


Figure 7 Function of the wetland and bioretention treatment systems

5.2.2 Operating Levels

A critical consideration of the end of pipe treatment systems is the operating levels and how the systems will discharge into adjacent creeks. Figure 7 provides a conceptual cross section through the wetlands and bioretention systems to illustrate how water will move through the systems and drain freely into the adjacent creek.

It shows there needs to be a minimum 1.0m (preferably 1.5m) between the outfall level at the creek to the pipe invert entering the wetlands. Survey of the creek standing water level and top of bank was completed as part of the conceptual design to define outfall levels, which have been set above the standing water and low flow levels in the creek.

5.2.3 Location and size

The end-of-line inlet ponds (sediment basins), wetlands and bioretention systems have been carefully located considering the constraints including:

- Existing Wallum Sedgefrog habitat (no stormwater management allowed)
- Riparian buffer of 25m (no stormwater management allowed)
- Frog zone of 50m (no stormwater management allowed)
- Frog buffer of 50m (stormwater management allowed) following appropriate criteria (Section 5.2.4)
- Existing vegetation
- Existing drainage
- Interaction with The Brook and surrounding development edges to ensure there is space for the treatment systems
- Flood immunity requirements
- Parkland, following appropriate criteria (Section 5.2.5)
- Suitable discharge points for treated stormwater.

Sufficient space for the treatment areas as well as batters and access tracks etc. have been provided.

5.2.4 Frog Buffer

Stormwater treatment systems are to be located in parts of the frog buffer ensuring the following criteria are met (developed in consultation with Australian Wetlands Consulting):

1. No more than 40% of the Frog Buffer can be used for stormwater management devices, including drainage channels. Stormwater management devices must be placed uniformly along the length of the Frog Buffer to ensure no restriction to the overall connectivity of Wallum Sedgefrog (WSF) habitat within the Frog Zone and Frog Buffer.
2. Where stormwater management is located within the Frog Buffer, an average minimum set back of 20m is required between all the edges of each stormwater management measure and the Frog Zone boundary. This set back distance does not apply to stormwater outlet drainage channels.

3. The stormwater management measures must be set back 30m from the create Frog Ponds within the Frog Zone and Frog Buffer. Drainage channels and swales from the stormwater management measures to the creek can be closer than 30m.
4. The final locations of the stormwater management devices will be determined during detailed design. The location will consider the proposed WSF breeding ponds, foraging habitat and overall habitat connectivity to ensure compliance with Key Performance Criteria 5, listed in Table 6.2a within the *Wallum Sedgefrog Management Plan* and Table 8.2a within the *Acid Frog Management Plan*.

5.2.5 Parklands

Stormwater treatment systems have been placed in parklands in accordance with the *Caloundra South – Local Government Infrastructure Agreement*:

- Land provided for stormwater treatment facilities for the park are to have a minimal impact on the park's functionality.
- Max. 5% of total park area for stormwater treatment
- Where possible, stormwater treatment facilities are to be integrated with planting areas and form part of the overall vegetated area.
- 30% of the parkland area can be below the 5yr ARI
- Max grade 1:4, 1:6 preferred for maintenance requirements.

5.2.6 End-of-line concept designs

Proposed sizes, shapes and configurations for wetland and bioretention systems were resolved by considering available areas for the treatment systems, catchments, required treatment areas and surveyed outfall levels.

Conceptual designs for the systems are presented in Appendix A which provide size, shape, conceptual earthworks and levels for each proposed treatment measure. These are conceptual only but illustrate that the wetland and bioretention systems work in the space that's available and that they have suitable grade to ensure proper hydraulic function.

It is possible that during design development, the designs may 'evolve' in response to catchment changes or other constraints. There is sufficient redundancy and flexibility in the proposed designs to accommodate these changes. On the basis of these conceptual designs, there is a high level of certainty that the proposed treatment strategy is feasible and can be implemented without changing the development layout.

5.3 Streetscape bioretention

Biopods are an optional treatment system which may be adopted in some streets to enhance the stormwater treatment strategy. Where they are adopted, the biopods will be located within the residential streets, receive water flowing along kerns and be set down in the verges. They size of the system will vary depending on the catchment and available space and have 100-200mm ponding depths.

Stockland has extensive experience on other Precincts of Aura in delivering biopods in different locations. While the particular aspects of the biopods will differ between the locations the operating principles are all similar:

- Biopod filter media set back a minimum of 1.0m from the invert of kerb.
- Biopod filter media minimum width of 1.0m
- Batters of 1 in 2 or flatter
- Avoid safety fencing and pedestrian trip hazards
- No conflict with services sewer and water may pass under a biopod, with correct protection.
- Consider one-way cross-fall pavement for streets can be considered
- Locate biopods to avoid driveways and parking areas
- Moving pedestrian pathways and non-compatible services to the opposite verge from the biopod to create space where required.

There are many variations of biopod designs but the proposal for this precinct will be to create systems similar to other areas of Aura so that maintenance can be streamlined. An example biopod is provided in the photo below.



Photo: Example of biopod with one-way cross fall

6 Performance Assessment (MUSIC Modelling)

6.1 MUSIC Modelling Approach

MUSIC modelling was undertaken to quantitatively assess the performance of the proposed stormwater strategy. MUSIC version 6.3 was used for the assessment and the parameters have been established in accordance with the *MUSIC Modelling Guidelines* (Water by Design, 2010 and 2018 Draft).

6.1.1 Model structure

The Precincts 6 - 10 & 16 MUSIC model layout is shown in Figure 8. Details of the modelling assumptions, parameters and results are provided below.

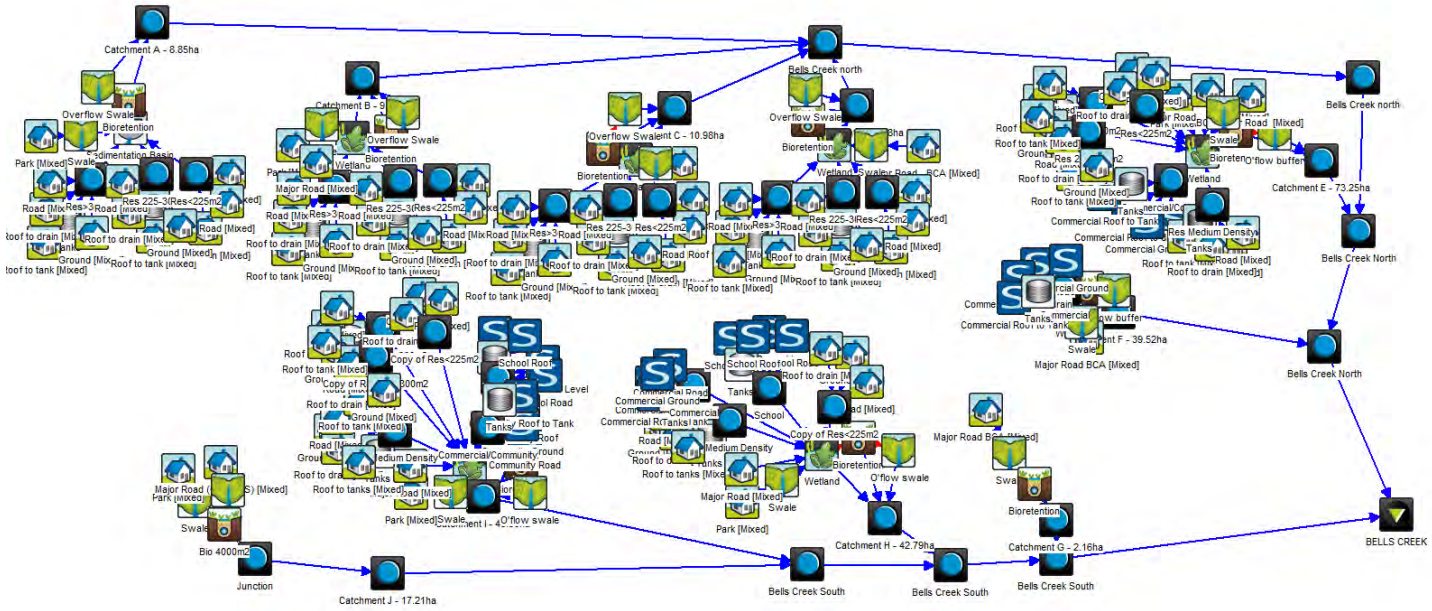


Figure 8 Precincts 6 - 10 & 16 MUSIC model layout

Table 5 provides a summary of the meteorological data on which the model is based.

Table 5 Meteorological and rainfall runoff data

Input	Data used in modelling
Rainfall station	40496 Caloundra (Updated)
Time step	6 minute
Modelling period	1997 – 2009
Mean annual rainfall	1,570 mm (for the period used)
Mean annual evapotranspiration	1,628 mm
Rainfall runoff parameters	Per SEQ MUSIC Guidelines
Pollutant export parameters	Per SEQ MUSIC Guidelines

6.1.2 Catchments

The stormwater catchments presented in Figure 6 were reviewed and the various landuses (residential, commercial or parkland) within these catchments were measured. Given rainwater tanks are adopted on the site, a split catchment modelling approach was adopted as per the *MUSIC Modelling Guidelines* (Water by Design, 2010 and 2018 Draft). Catchment characteristics for Catchments A – J are shown in Table 6.

The focus on the MUSIC modelling was the urban footprint (258ha) to assess compliance with the stormwater design objectives listed in Table 1.

Table 6 Catchment Landuse area details

Catchment ID	Residential >300m²	Residential 225-300m2	Residential <225m2	Residential Medium Density	Commercial / Community	School	Major Road/Rail	Park	Total
	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
A	6.06	0.57	0.71					1.50	**8.85**
B	5.45	0.52	0.64				1.60	0.90	**9.11**
C	4.03	0.38	0.47					6.10	**10.98**
D	5.84	0.55	0.69				1.50		**8.58**
E	31.80	3.01	3.74	9.90	8.90		10.60	3.30	**71.25**
F					36.72		2.80	2.00	**41.52**
G							2.16		**2.16**
H				8.50	22.99	4.10	2.50	4.70	**42.79**
I	14.59	1.38	1.72	13.46	0.50	3.90	5.50	4.81	**45.86**
J							2.21	15.00	**17.21**
Total	**67.78**	**6.41**	**7.97**	**31.86**	**69.11**	**8.00**	**28.87**	**38.31**	**258.31**

Catchment ID	Residential >300m2				Residential 225-300m2				Residential <225m2			Residential Medium Density				Commercial / Community				School				Major Road	Park	Total
	Roof to tank (ha)	Roof to drain (ha)	Road (ha)	Ground (ha)	Roof to tank (ha)	Roof to drain (ha)	Road (ha)	Ground (ha)	Roof to drain (ha)	Road (ha)	Ground (ha)	Roof to tank (ha)	Roof to drain (ha)	Road (ha)	Ground (ha)	Roof to tank (ha)	Roof to drain (ha)	Ground (ha)	Road/Parkng (ha)	Roof to tank (ha)	Roof to drain (ha)	Ground (ha)	Road/Parking (ha)	(ha)	(ha)	(ha)
A	1.061	1.061	1.516	2.426	0.107	0.107	0.143	0.215	0.278	0.178	0.257														1.500	**8.850**
B	0.954	0.954	1.363	2.181	0.097	0.097	0.129	0.193	0.250	0.160	0.231													1.600	0.900	**9.110**
C	0.705	0.705	1.007	1.610	0.071	0.071	0.095	0.143	0.185	0.118	0.170														6.100	**10.980**
	1.022	1.022	1.460	2.336	0.104	0.104	0.138	0.207	0.268	0.172	0.247													1.500		**8.580**
E	5.566	5.566	7.951	12.722	0.564	0.564	0.752	1.128	1.458	0.935	1.346	1.733	1.733	2.970	3.465	2.225	2.225	1.780	2.670					10.600	3.300	**71.250**
F																9.180	9.180	7.344	11.016					2.800	2.000	**41.520**
G																								2.160		**2.160**
H												1.488	1.488	2.550	2.975	5.748	5.748	4.598	6.897	0.820	0.410	2.255	0.615	2.500	4.700	**42.790**
I	2.554	2.554	3.649	5.838	0.259	0.259	0.345	0.517	0.669	0.429	0.618	2.356	2.356	4.038	4.711	0.125	0.125	0.100	0.150	0.780	0.390	2.145	0.585	5.500	4.810	**45.860**
J																								2.210	15.000	**17.210**
Total																										258.31

6.2 Treatment Systems

A summary of the treatment system sizes is shown in Table 2 and the characteristics of each treatment system are summarised below.

6.2.1 Rainwater Tanks

Rainwater tanks were modelled in accordance with *MUSIC Modelling Guidelines* (Water by Design) based on the sizes defined in Table 4.

In this case tanks were modelled conservatively at 80% of the volume to allow for main water topup storage in the tanks at the request of Economic Development Queensland and the peer reviewer. Advice from Stockland is that in many situations main water backup for the tanks is being provided valves which switch to main supply (i.e. Rainbank style systems) rather than topping up the tank. In this case there is no loss of storage in the tank for mains water topup.

Given this advice, we conclude the modelling approach of using 80% of the tank volume for storage is conservative.

6.2.2 GPTs

GPTs were not included in the MUSIC model.

6.2.3 Inlet Ponds / Sediment Basins

The inlet area was generally set at 0.25% of the catchment with a minimum of 300m^2. To derive the volume a notional depth of 1.5m in larger systems (>500m^2) and 1m for systems smaller (<500m^2) given the average depth in smaller systems is reduce to the surrounding underway batters.

6.2.4 Wetland systems

Wetlands were modelled in accordance with the *MUSIC Modelling Guidelines* (Water by Design) and the description provided in Section 5.2. An extended detention depth of 50mm was adopted with weir and bypass flows were directed to the bioretention basins. Treated pipe flows bypass the bioretention and discharge to the receiving waterways.

6.2.5 Bioretention systems

The end of line bioretention basins were modelled to only receive overflows from the wetlands with the adopted parameters in accordance with the *MUSIC Modelling Guidelines* (Water by Design). The only variation from the *MUSIC Modelling Guidelines* (Water by Design) is the bioretention media specifications Ortho-P of 20mg/kg and TN of 400mg/kg which have been justified previously by BMT WBM and previously accepted by EDQ reviewers.

The extended detention depth above the bioretention basins is configured to include the ponding depth above the wetlands once the wetlands spill into the bioretention basins. This is because the two systems will 'share' this ponded water and the bioretention basins will draw down much faster than the wetland systems, hence the vast majority of ponded water will filter through the bioretention media.

6.2.6 Overflow swale characteristics modelled

The swales that take untreated overflows from the bioretention systems have the following characteristics:

- Length = 50m (longer in some swales depending on concept design)
- 0.1-0.2% bed slope
- Base width = varies
- Top width = varies
- Depth = 500-800mm
- Vegetation height = 250mm
- Exfiltration = 0 mm/hour

Some small swales were also included in the MUSIC model downstream of the parkland nodes and the major road nodes to replicate the proposed drainage swale in these catchments.

6.3 Results

The results of the MUSIC modelling for the proposed Precincts 6 - 10 & 16 development are shown in Table 7. The results demonstrate that the proposed stormwater strategy achieves the stormwater quality load reduction objectives.

Table 7 MUSIC modelling results

Parameter	Unmitigated	Mitigated	% Removal
Flow (ML/yr)	2,820	2,490	11.5%
TSS (kg/yr)	540,000	24,600	95.4%
TP (kg/yr)	1,090	120	89.1%
TN (kg/yr)	6,750	2,150	68.2%
Gross Pollutants (kg/yr)	58,100	-	100%

7 Conclusion

This report provides an updated Stormwater Quality Management Plan for Precincts 6 - 10 & 16 following a thorough assessment of all constraints to stormwater treatment measures. This strategy builds on previous stormwater quality management proposals for the site.

The strategy takes advantage of available areas for stormwater treatment around the perimeter of the development prior to discharge into Bells Creek. The principles of the strategy focus on not treating already treated water and providing flexibility in the treatment train to adjust the design in response to constraints and other design requirements. The majority of the treatment occurs via end of line wetland and bioretention basin. The strategy relies rainwater tanks and but does not rely on at source or streetscape biopods which may be adopted by Stockland to further improve treatment (at Stockland's discretion). This proposed strategy provides flexibility in the overall achievement of the water quality objectives.

The treatment strategy meets the stormwater objectives for the Aura development, as defined in *Aura Development Stormwater Quality Management Plan* (DesignFlow & BMT, 2019), to ensure there are no adverse impacts on Bells Creek and Pumicestone Passage. This includes reducing annual pollutant loads by the required 95% for total suspended solids (TSS), 89% for total phosphorus (TP) and 68% for total nitrogen (TN).

8 References

Corrs Chambers McGrath (2015) *Caloundra South Infrastructure Agreement*

DesignFlow & BMT (2019) *Aura Development Stormwater Quality Management Plan*

Stockland (2017) *Caloundra South Wallum Sedge Frog Management Plan*

Stockland (2017) *Caloundra South Acid Frog Management Plan*

Water by Design (2009), *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*, SEQ Healthy Waterways Partnership. Brisbane, Queensland.

Water by Design (2006), *Water Sensitive Urban Design Technical Design Guidelines for South East Queensland Version 1.* Moreton Bay and Waterways Catchments Partnership. Brisbane, Queensland.

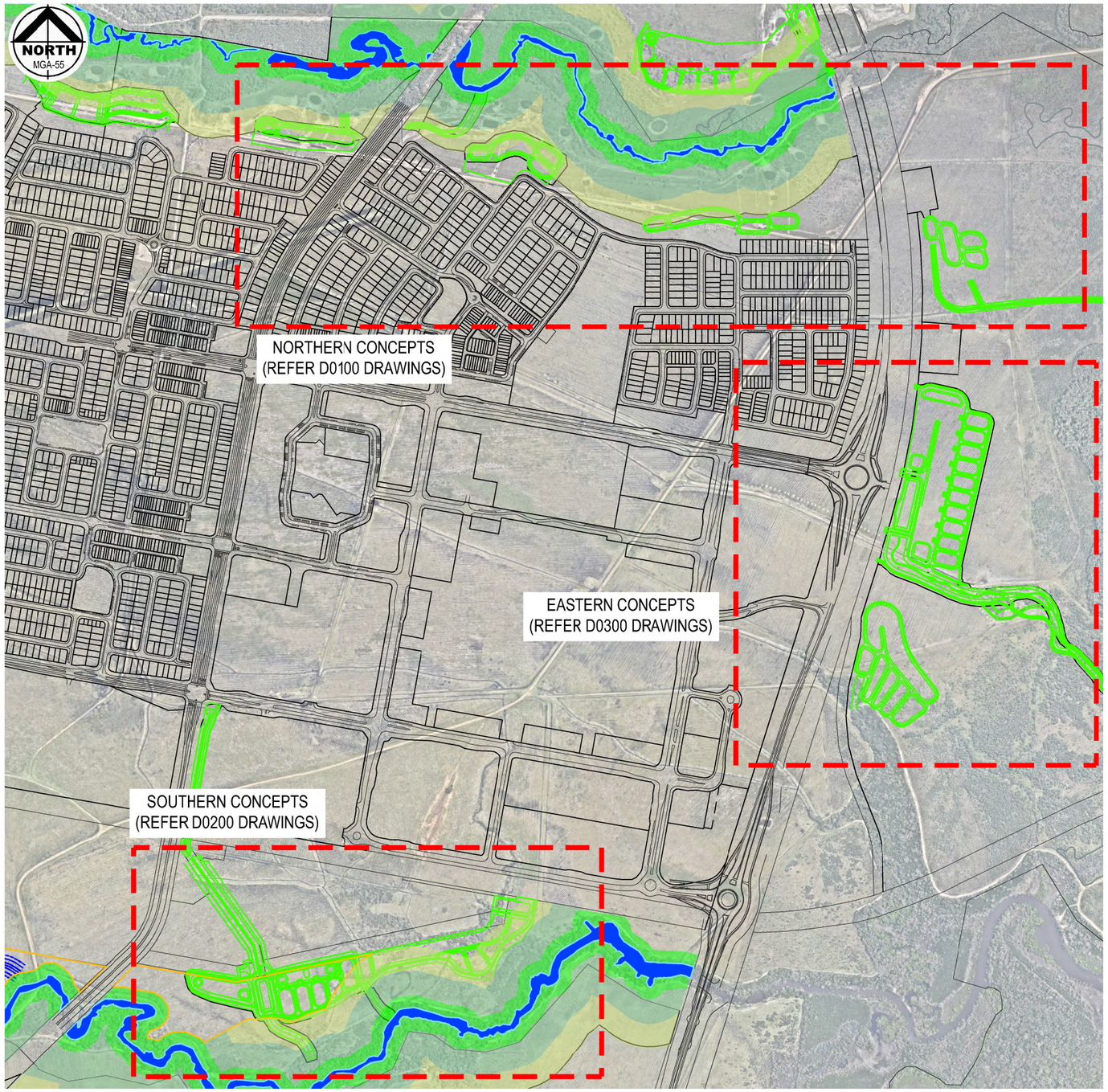
Water by Design (2014), *Bioretention Chapter Technical Design Guidelines for South East Queensland.*

Water by Design (2010/2018), *MUSIC Modelling Guidelines.* Water by Design - SEQ Healthy Waterways Partnership. Brisbane, Queensland.

Appendix A: Wetland and Bioretention System Concepts

DATE PLOTTED: 5 November 2022 5:49 AM BY : SIMON YOUNG

AURA PRECINCT 6-10 & 16 WSUD CONCEPTS



SITE LOCALITY MAP

NOT TO SCALE

DRAWING LIST

D0001	SITE LOCALITY MAP AND DRAWING LIST
D0002	CATCHMENT AND DRAINAGE
D0003	TREATMENT SYSTEM CONCEPT DETAILS (SECTIONS)
D0101	NORTHERN STORMWATER TREATMENT CONCEPT DESIGN
D0201	SOUTHERN STORMWATER TREATMENT CONCEPT DESIGN
D0301	EASTERN STORMWATER TREATMENT CONCEPT DESIGN

REVISION	DESCRIPTION	DRAFTED BY INITS	DRAFTED BY DATE	CHECKED BY INITS	CHECKED BY DATE
D	UPDATED LAYOUT	SBY	05.11.22	SL	05.11.22
C	UPDATED LAYOUT	SBY	01.12.21	SL	01.12.21
B	UPDATED LAYOUT	MLM	18.06.18	SL	18.06.18
A	PRELIMINARY ISSUE	MLM	10.06.16	SL	10.06.16

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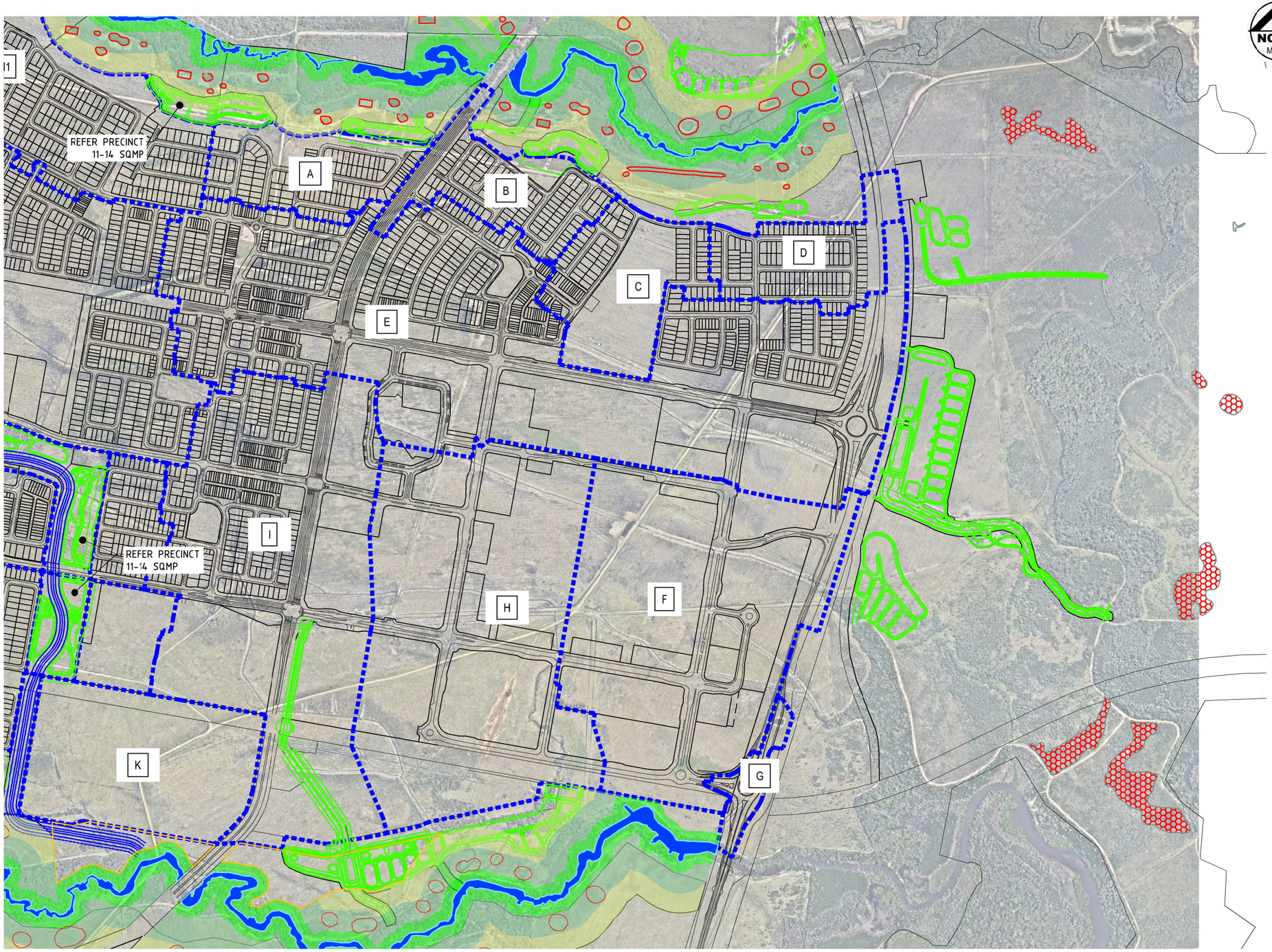
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PROJECT	AURA - PRECINCTS 6 - 10 & 16
DRAWING TITLE	SITE LOCALITY MAP AND DRAWING LIST
PROJECT No	4290
DRAWING No	D0001
REVISION	D

XREF: Air photo 01-12-21; Aura Master Catchments - DF; Aura Master WSUD - DF; x_droa_cad; BCA DATA 20-08-19; FrogHabitatMapping_20211029_LOCAL; 221104_P6-19 Overall Master Plan - Base
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NORTH
MGA-55

LEGEND

- DRAINAGE DIRECTION
- MAJOR CATCHMENTS
- STORMWATER TREATMENT
- WATERWAYS / DRAINS
- WALLUM SEDGEFROG HABITAT PROTECTED
- FROG PONDS

CATCHMENT AND DRAINAGE PLAN

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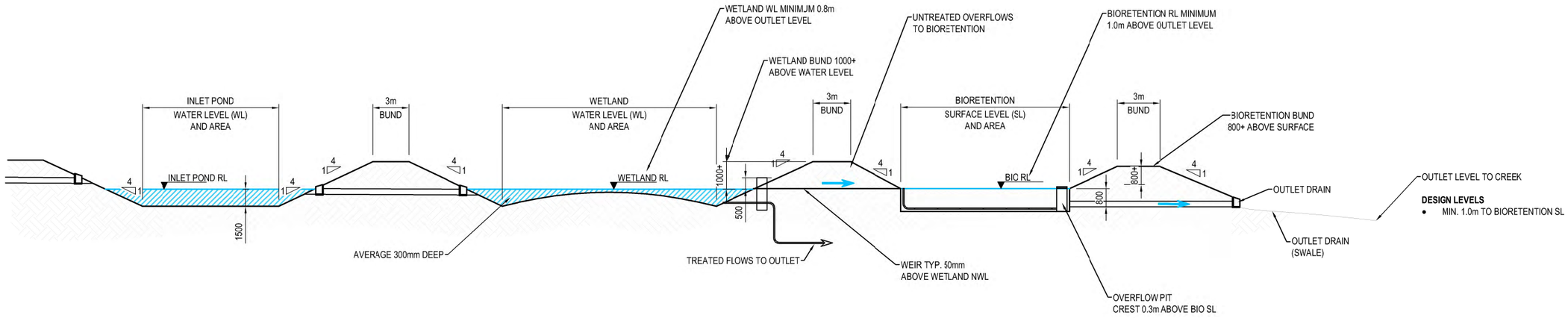
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DRAWING TITLE	CATCHMENT AND DRAINAGE
PROJECT No	4290
DRAWING No	D0002
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WETLAND AND BIORETENTION RL'S - INDICATIVE SECTION

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CATCHMENT AND TREATMENT TABLE

Catchment ID	Area	Inlet Pond			Wetland		Bioretention	
	(ha)	Volume (m3)	Area (m2)	m AHD	(m2)	m AHD	(m2)	m AHD
A	8.85	960	640	6.85			2350	6.85
B	9.11	400	400	6.10	2000	6.10	1500	6.10
C	10.98	400	400	5.15	2500	5.15	1800	5.15
D	8.58	400	400	3.7	1500	3.7	1800	3.7
E	73.25	5512.5	3675	2.65	21500	2.65	10000	2.65
F	39.52	2250	1500	2.2	9000	2.2	5500	2.2
G	2.16						432	
H	42.79	1800	1200	2.2	7500	2.2	4250	2.2
I	45.86	3105	2070	2.2	6190	2.2	5615	2.2
J	17.21						4000	
Total	258.3	14827.5	10285		50190		37247	

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E	UPDATED LAYOUT	MJM	05.11.22	SL	05.11.22
D	TABLE UPDATED	MJM	23.06.22	SL	23.06.22
C	UPDATED LAYOUT	SBY	01.12.21	SL	01.12.21
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PROJECT	AURA - PRECINCTS 6-10 & 16
DRAWING TITLE	TREATMENT SYSTEM CONCEPT DETAILS (SECTIONS)
PROJECT No	4290
DRAWING No	D0003
REVISION	D

XREF: Air photo 01-12-21; Aura Master Catchments - DF; Aura Master WSUD - DF; x_droa_cad; BCA DATA 20-08-19; FrogHabitatMapping_20211029_LOCAL; 221104_P6-19 Overall Master Plan - Base
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DATE PLOTTED: 6 November 2022 BY: SIMON YOUNG

NORTH
MGA-55

NOTES:

1. OUTLET LEVEL (OL) SET ABOVE STANDING WATER IN CREEK OR LOCAL LEVEL ON FLOOD PLAIN OR AT HIGHEST ASTRONOMICAL TIDE
2. BUND LEVELS SET AT OR ABOVE 1yr ARI LEVEL
3. STORMWATER TREATMENT SYSTEMS HAVE BEEN LOCATED TO CONSIDER FROG HABITAT, FROG ZONE AND FROG BUFFER IN ACCORDANCE WITH CALOUNDRA SOUTH WALLUM FROGLET MANAGEMENT PLAN
4. DEVELOPMENT DRAINAGE AND EARTHWORKS HAS BEEN CONFIGURED TO DRAIN INTO INLET POND ABOVE STANDING WATER LEVEL (PREFERABLY AT TOP OF EXTENDED DETENTION). REFER CONCEPTUAL EARTHWORKS DRAWINGS (CALIBRE)
5. LOCATION, SIZE, CONFIGURATION AND LEVELS TO BE REFINED AS PART OF OPERATIONAL WORKS DESIGN

INLET POND A
AREA = 640m²
RL = 6.85
BUND = 7.00
INFLOW/PIPE = RL6.85

BIORETENTION A
AREA = 2,350m²
RL = 6.85
BUND = 7.80

OL 5.75

WETLAND B
AREA = 2,000m²
RL = 6.10
BUND = 7.10

OL 5.10

OL 4.20

INLET POND B
AREA = 400m²
RL = 6.10
BUND = 7.10
INFLOW/PIPE = RL6.15

BIORETENTION BASINS B
AREA = 2 x 750m²
RL = 6.10
BUND = 7.10

WETLAND C
AREA = 2,500m²
RL = 5.15
BUND = 6.20

BIORETENTION BASINS D
AREA = 2 x 900m²
RL = 3.70
BUND = 4.70

INLET POND D
AREA = 400m²
RL = 3.70
BUND = 4.70
INFLOW/PIPE = RL3.75

INLET POND C
AREA = 400m²
RL = 5.15
BUND = 6.20
INFLOW/PIPE = RL5.20

BIORETENTION BASINS C
AREA = 2 x 900m²
RL = 5.15
BUND = 6.20

WETLAND D
AREA = 1,500m²
RL = 3.70
BUND = 4.70

OL 2.70

LEGEND:

- STORMWATER
- EXISTING FROG HABITAT
- FROG PONDS (CREATED)
- WATERWAY
- RIPARIAN BUFFER ZONE
- FROG ZONE
- FROG BUFFER

A3 SCALE 1:4000 0 80 160 240 320 400m

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B	UPDATED LAYOUT	MJM	18.06.18	SL	18.06.18
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PROJECT No	4290
DRAWING No	D0101
REVISION	D

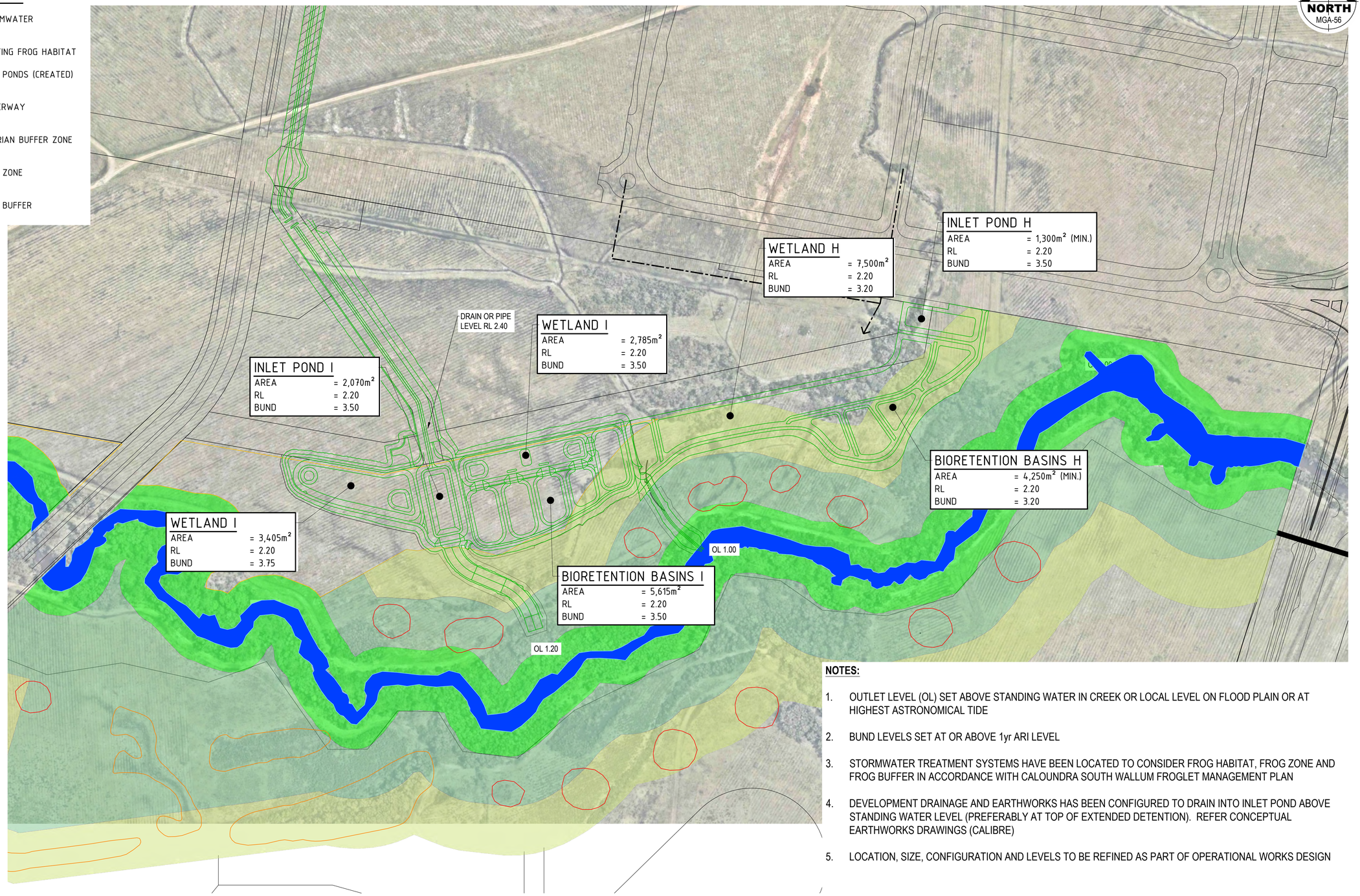
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LEGEND:

- STORMWATER
- EXISTING FROG HABITAT
- FROG PONDS (CREATED)
- WATERWAY
- RIPARIAN BUFFER ZONE
- FROG ZONE
- FROG BUFFER

NORTH
MGA-56



NOTES:

1. OUTLET LEVEL (OL) SET ABOVE STANDING WATER IN CREEK OR LOCAL LEVEL ON FLOOD PLAIN OR AT HIGHEST ASTRONOMICAL TIDE
2. BUND LEVELS SET AT OR ABOVE 1yr ARI LEVEL
3. STORMWATER TREATMENT SYSTEMS HAVE BEEN LOCATED TO CONSIDER FROG HABITAT, FROG ZONE AND FROG BUFFER IN ACCORDANCE WITH CALOUNDRA SOUTH WALLUM FROGLET MANAGEMENT PLAN
4. DEVELOPMENT DRAINAGE AND EARTHWORKS HAS BEEN CONFIGURED TO DRAIN INTO INLET POND ABOVE STANDING WATER LEVEL (PREFERABLY AT TOP OF EXTENDED DETENTION). REFER CONCEPTUAL EARTHWORKS DRAWINGS (CALIBRE)
5. LOCATION, SIZE, CONFIGURATION AND LEVELS TO BE REFINED AS PART OF OPERATIONAL WORKS DESIGN

A3 SCALE 1:4000 — 0 80 160 240 320 400m

REVISION	DESCRIPTION	DRAFTED BY	INITS	DATE	CHECKED BY	INITS	DATE
D	UPDATED LAYOUT		MJM	27.02.22		SL	27.02.22
C	UPDATED LAYOUT		SBY	01.12.21		SL	01.12.21
B	UPDATED LAYOUT		MJM	18.06.18		SL	18.06.18
A	PRELIMINARY ISSUE		MJM	10.06.16		SL	10.06.16

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CLIENT	STOCKLAND
DRAWN	MJM — DATE 27.02.22
DESIGNED	SL — DATE 27.02.22
SCALE	1:2000 — A1
PROJECT	AURA - PRECINCTS 6-10 & 16
DRAWING TITLE	SOUTHERN STORMWATER TREATMENT CONCEPT DESIGN
PROJECT No	4290
DRAWING No	D0201
REVISION	D

XREF: Aura Master WSUD - DF_MJM; AURA - P7:10; AURA GAGALBA - Master Plan; BCA DATA 20-08-19; FroghabiatMapping_20211029_LOCAL; Air photo 01-12-21; 124697-12-17 Emergency Services (Draft for Comment); FroghabiatMapping_20210831 Local Datum; SURF4344_DESIGN_210827; v2018; 124697 South
FILE: \\192.168.4.3\SHARED\PROJECTS\QLD ACTIVE\4344 AURA PRECINCT 11-15 @ SHAREPOINT\DRAFTING\INCOMING\INCOMING CAD\FROM SIMON YOUNG\4290_D0200_SOUTHERN_MJM.DWG

DATE PLOTTED: 5 November 2022 BY : SIMON YOUNG

NORTH
MGA-56

NOTES:

1. OUTLET LEVEL (OL) SET ABOVE STANDING WATER IN CREEK OR LOCAL LEVEL ON FLOOD PLAIN OR AT HIGHEST ASTRONOMICAL TIDE
2. BUND LEVELS SET AT OR ABOVE 1yr ARI LEVEL
3. STORMWATER TREATMENT SYSTEMS HAVE BEEN LOCATED TO CONSIDER FROG HABITAT, FROG ZONE AND FROG BUFFER IN ACCORDANCE WITH CALOUNDRA SOUTH WALLUM FROGLET MANAGEMENT PLAN
4. DEVELOPMENT DRAINAGE AND EARTHWORKS HAS BEEN CONFIGURED TO DRAIN INTO INLET POND ABOVE STANDING WATER LEVEL (PREFERABLY AT TOP OF EXTENDED DETENTION). REFER CONCEPTUAL EARTHWORKS DRAWINGS (CALIBRE)
5. LOCATION, SIZE, CONFIGURATION AND LEVELS TO BE REFINED AS PART OF OPERATIONAL WORKS DESIGN

WETLAND E
AREA = 21,500m²
RL = 2.65
BUND = 3.50

BIORETENTION BASINS E
AREA = 10 x 1000m²
RL = 2.65
BUND = 3.50

INLET POND E
AREA = 3,675m²
RL = 2.65
BUND = 3.70

INLET POND F
AREA = 1,500m²
RL = 2.20
BUND = 3.30

WETLAND F
AREA = 9,000m²
RL = 2.20
BUND = 3.20

BIORETENTION BASINS F
AREA = 5,500m²
RL = 2.20
BUND = 3.20

ENVIRONMENTAL PROTECTION ZONE (EPZ)

OL 1.00

OL 1.00 - 1.10

LEGEND:
- STORMWATER
- EXISTING FROG HABITAT
- FROG PONDS (CREATED)
- WATERWAY
- RIPARIAN BUFFER ZONE
- FROG ZONE
- FROG BUFFER

A3 SCALE 1:2000 0 40 80 120 160 200m

REVISION	DESCRIPTION	DRAFTED BY: INITS	DRAFTED BY: DATE	CHECKED BY: INITS	CHECKED BY: DATE
D	UPDATED LAYOUT	SBY	05.11.22	SL	05.11.22
C	UPDATED LAYOUT	SBY	01.12.21	SL	01.12.21
B	UPDATED LAYOUT	MJM	18.06.18	SL	18.06.18
A	PRELIMINARY ISSUE	MJM	10.06.16	SL	10.06.16

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CLIENT	STOCKLAND
PROJECT	AURA - PRECINCTS 6-10 & 16
DRAWN	MJM — DATE 05.11.22
DESIGNED	SL — DATE 05.11.22
DRAWING TITLE	EASTERN STORMWATER TREATMENT CONCEPT DESIGN
SCALE	1:1000 — A1
PROJECT No	4290
DRAWING No	D0301
REVISION	D

XREF: Aura Master WSUD - DF- x_dnoa_cad; BCA DATA 20-08-19; FrogHabitatMapping_20211029_LOCAL; Air photo 01-12-21; 221104_P6-19 Overall Master Plan - Base
FILE: C:\PROJECTS\DF - 4419 AURA STORMWATER MANAGEMENT\MASTERPLAN\ACAD\4290_D0300_EASTERN.DWG

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Appendix E – Construction Phase Water Quality Practices

1.1 Pollutants

The pollutants that would typically be generated during the construction of the proposed development are outlined in **Table 1**.

TABLE 1: TYPICAL CONSTRUCTION PHASE POLLUTANTS

Pollutant	Source
Litter	Paper, construction packaging, food packaging, cement bags, offcuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building
Hydrocarbons	Fuel and oil spills, leaks from construction equipment
Toxic Materials	Cement slurry, asphalt prime, solvents, cleaning agents, wash waters e.g. from tile works)
Ph Altering Substances	Acid sulphate soils, cement slurry

1.2 Potential Impacts

Construction activities can have a potential impact on water quality. Removal of vegetation, earthworks and changes to drainage patterns can result in erosion and sediment being washed into waterways. This can impact the physical-chemical parameters of the receiving water, the decline in the health of aquatic ecosystems, and overall aesthetics. The potential impacts on the development site's surrounding receiving waters will be minimised during the construction phase with typical measures outlined below. These measures should be adequately detailed on erosion and sediment control plans as part of the development's Operational Works application.

1.3 Performance Objectives

The amount of runoff traversing and discharging from the site while under construction should be kept to a minimum. This will restrict soil erosion and mobilisation of sediments and pollutants through and off the site. During the construction phase, stormwater runoff at discharge points shall comply with the objectives detailed in QLD SPP (July 2017).

1.4 Control Measures

The following are typical treatment measures that should be implemented before the commencement of any construction works. Detailed erosion and sediment control procedures shall be based on the erosion and sediment control plans lodged at the Operational Works phase.

1.5 Maintenance

Maintenance of erosion and control treatment measures (such as sediment fences) will be undertaken if it is observed that they have not been properly installed or the capacity of the measure falls below 75%.

1.6 Minimise Disturbance Area

Clearing of land is to be minimised to areas planned to be actively under construction in the near term (e.g. within the next 3-6 months).

1.7 Stabilise Disturbed Areas

Provide temporary stabilisation of disturbed soils whenever active construction is not occurring on a portion of the site. Provide permanent stabilisation during finish grade and landscape the site.

1.8 Protect Slopes and Channels

Safely convey runoff from the top of the slope and stabilise temporary and permanent channel crossings as quickly as possible and ensure that increases in runoff velocity caused by the project do not erode the channel.

1.9 Diversions of Upslope Runoff

Upslope runoff should be diverted away from areas of exposed soil to prevent the contamination of clean runoff. This may be achieved by installing tightly abutting sandbags, creating a 'sandbag perimeter bank' to divert flow.

1.10 Sediment Fences and Inlet Protection

Delineate site perimeter to prevent disturbing areas outside the project limits. Sediment fences should be installed around the perimeter of works to ensure contaminated runoff is filtered and sediment is trapped before leaving the site. Sandbags or geofabric should also be placed around/over existing stormwater inlets/grates throughout the site to filter any contaminated runoff before entering the existing piped stormwater network.

1.11 Retain Sediment

Retain sediment-laden waters from disturbed, active areas within the site.

1.12 Stabilised Vehicle Entry/Exit Point

A stabilised entry/exit point should be constructed to minimise the transport of sediment off-site. All vehicles entering and leaving the site must use this designated entry/exit point.

1.13 Stockpiles

Stockpile locations should be identified before the commencement of works. Ideally, they should be located in a flat area at least 15m from any water body or stormwater inlet. Sediment fences should be installed downslope of all erodible stockpiles, and upslope protection measures should be used (i.e. sandbags or sediment fence) to divert runoff in the event of rain. At the end of each working day, stockpiles should be covered with geofabric if rain or high winds are forecast.

1.14 Street Sweeping

Ensure that local roads are swept as required. This will minimise the potential for sediment tracked onto the road to be washed into the stormwater system. If there is a large quantity of sediment being tracked onto the surrounding streets, the stabilised entry/exit point may need to be raked or reinforced with rock treatment to provide more effective sediment removal for vehicles.

1.15 Erosion Control Matting and Permanent Stabilisation

Exposed areas onsite should be permanently stabilised (i.e. with turf) as the construction works progress. Erosion control matting or mulching should be used as a temporary measure to stabilise exposed areas before permanent stabilisation can be undertaken.

1.16 Monitoring

Monitoring and recording of the performance of the drainage control devices are to be undertaken in accordance with local government requirements. It is further recommended that the proposed construction works be undertaken during periods of dry weather to reduce the potential for sediment to be transported off-site during construction.