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2 May 2019

Our Ref: NEW 17/107

The Secretary
Department of Planning & Environment
GPO Box 39
Sydney NSW 2001

Attention: Emma Butcher

Dear Madam

Major Project Approval No. MP09_0166 (Mod 3) Altitude Aspire, Fraser Drive and Parkes Lane, Terranora

In response to the letter from Tweed Shire Council dated 27 September 2018, we provide the following information:

1.0 CONDITIONS

Condition A2 – Staging

It is agreed that reference to 14 stages should be 15 stages and Lot 713 should read Lot 712. Subsequent to Council's RFI letter, further changes to the staging have been made to reduce the number of Stages to 14. The amended Subdivision Layout Plans (including Staging) are attached at **Annexure A**. Proposed amended Condition A2 is as follows:

Proposed Amended Condition A2 - Staging

The project is to be constructed in **fourteen (14) stages**, generally in accordance with the 'Plan Showing Existing topography and Proposed Subdivision Layout' dated **13 March 2019**, prepared by B & P Surveys Revision **O** (Drawing No 18779B), incorporating the lots as follows:

1) Stage 1 comprises 43 residential lots 101 -146 inclusive, dedication of land for a Sewage Pump Station to Council, and a drainage reserve and residue Lot 144 and construction of roads and infrastructure;
2) Stage 2 comprises 28 residential lots 201 - 228 inclusive, incorporating roads and infrastructure;
3) Stage 3 comprises 24 residential lots 301 – 324 inclusive, incorporating roads and infrastructure;
4) Stage 4A comprises 27 residential lots 401 – 427 inclusive, incorporating roads and infrastructure;
   Stage 4B comprises 26 residential lots 428 – 454 inclusive, public reserve on Lot 454 and incorporating roads and infrastructure;
5) Stage 5 comprises 21 residential lots 501 – 521 inclusive, incorporating roads and infrastructure;
6) Stage 6A comprises 9 residential lots 601 – 609 inclusive, incorporating roads and infrastructure;
   Stage 6B comprises a drainage reserve on Lot 610 and incorporating roads and infrastructure;

7) Stage 7A comprises 10 residential lots 701 – 710 inclusive, 1 medium density residential lot 701, incorporating roads and infrastructure;
Stage 7B comprises 2 medium density residential lots 711 and 712, public reserve on **Lot 713** and incorporating roads and infrastructure;
8) Stage 8A comprises 14 residential lots 801 – 814 and incorporating roads and infrastructure;
Stage 8B comprises 5 residential lots 815 – 820 inclusive of public reserve on Lot 819 and incorporating roads and infrastructure;
9) Stage 9 comprises 18 residential lots 901 – 918 inclusive, and incorporating roads and infrastructure; and
10) Stage 10 comprises 9 residential lots 1001 – 1009 inclusive, 2 medium density residential lots 1008 and 1009 and incorporating roads and infrastructure;
11) Stage 11 comprises 20 residential lots 1101 – 1120 inclusive and incorporating roads and infrastructure.

Subject to any conditions of approval, staging of allotment and/or road construction may vary in sequence and timing. Essential infrastructure associated with and including, but not limited to, roads, roundabouts, bus routes, footpaths, parks, services, landscaping and environmental management, shall be constructed as specified in the staging listed above or as otherwise provided in these conditions and the proponent's Statement of Commitments.

Any revised staging plan that varies the stage boundaries or components listed in (1) – (11) inclusive, shall be submitted for the approval of the Secretary, prior to the issuing of a Construction Certificate for subdivision works."

Condition A3 – Project in Accordance with Plans

The following responses are provided to the dot points in the Tweed Shire Council Submission.

Dot Point 1 – see response from Meinhardt Urban Pty Ltd dated 27 March 2019 attached at **Annexure B**.

Dot Point 2 – see response from Meinhardt Urban Pty Ltd dated 27 March 2019 attached at **Annexure B**.

Dot Point 3 – Council's comments on Condition A3 are reproduced as follows:

"SK3617: the inclusion of this plan is not supported.

This plan depicts retaining walls being constructed along property boundaries, which conflicts with the requirements of Condition B18.

It is further noted that this plan was not part of the original approval, but was however alternatively referenced in Condition A10 to disapprove retaining walls in the eastern portion of the development site. In the absence of any mention of lots in the western portion of the development site within Condition A10 to alternatively allow retaining walls along boundaries, the terms of Condition B18 are considered to take priority."

On 14 February 2019 Council advised the Department by email as follows:

"In responding to your email, please note the applicant has been copied in, due to prior direct consultations with Tweed Shire Council (TSC).

The issues regarding retaining walls, both as specifically relevant to this Development Approval and generally across the 'Area E' release area, have been reviewed by TSC. The following points are brought to your attention, for consideration while assessing the 'MOD 3' application:

- *TSC concurs with DAC that the terms of the written Consent Conditions prevail over plans (as already previously stated by TSC). The inconsistencies between Conditions A10 and B18, and plans SK 3617(G) and SK 3642(C) are therefore recommended to be resolved as part of this 'MOD 3' application. See hereunder for formal recommendations.*
- *TSC accepts that DPE's intention was to only exclude retaining walls from the eastern half of the development site. Condition A10 requires amendment accordingly.*
- *In this regard, prior TSC comments regarding plan SK 3617 per letter dated 27.9.2018 are to be amended. See formal recommendations hereunder.*
- *The terms of Condition B18 effectively allow for retaining walls of up to 1.2m (and 1.5m in certain circumstances) in height, by directly nominating TSC Development Design Specification D6. This over-rides the 1m +/- retaining wall height otherwise nominated in TSC DCP A1 and B24.*
- *In recognition of the two preceding points, it must be noted TSC have effectively accepted a variation to:*
  - *TSC DCP B24 Section 4.2: Objectives, as well as Control 1 - as referencing DCP A1 Part A Section 2.1: Topography, cut and fill - Principles and Objectives; as well as Control 1: +/- 1m cut/fill.*
  - *Landforming objectives of DCP A5.*
  - *Site regrading principles of TSC Development Design Specification D6.*

  Future applications for other development sites within the 'Area E' release area that seek to apply the same variation will not necessarily be endorsed by TSC.
- *The above-mentioned retaining wall height variation is only applicable under this consent, for subdivision-level retaining walls, and does not carry over to future individual dwelling construction DA's throughout the 'Altitude Aspire' development site.*
- *The following revised comments and recommendations are considered necessary to rectify the inconsistencies between Consent Conditions and approved plans, avoid possible misinterpretation and ambiguity, and generally provide improved clarity.*

<u>Recommendations</u>

a. *TSC withdraws its objection to the inclusion of plan **SK 3617**, as referenced in TSC letter of 27.9.2018, page 2, dot point 3 – subject to the following amendments being undertaken to the plan:*
   i. *Alter 'Detail D' to nominate a boundary offset of 0.9m, as well as relocating the swale drain to be within the higher-level lot.*
   ii. *Another 'Detail' diagram would be beneficial to depict the 3 locations where a RW on the boundary is supported – being Lots 812, 918 and 1001. This would then correlate with the recommended amendment of Condition B18 and provide further clarity.*
   iii. *Note re: 'Detail E' that the 1m wide crushed rock surfacing is not supported by Council. See separate correspondence trail regarding the Bushfire Hazard Assessment.*
   iv. *ALSO: 'Detail A' to be amended. As a consequence of recent perimeter boundary ground level mis-alignments along the southern boundary, including enhanced localised survey information, a retaining wall is now proposed for part of the common boundary with No's 8 – 16 Parkes Lane. To formally acknowledge this, indicative detail should be depicted.*

A copy of plan SK 3617 (G) is attached with amendments in red thereon, to depict and aid in clarifying the above-referenced amendments.

b. *Also amend plan **SK 3642 (C)** (earthworks cross-sections) for improved correlation with plan SK 3617. 'Sections' 13 and 14 on this plan depict a batter at the rear of Lot 701, which is now to be a retaining wall. While this plan amendment is not considered essential, it would nevertheless be beneficial.*

   A copy of plan SK 3642 (C) is attached with amendments in red thereon, to depict and aid in clarifying the recommended amendments.

c. *Amend the following Consent Conditions (as shown in red):*

   A10 Limits of Approval
   This approval does not approve the construction of any dwellings, medium density developments. Separate approvals must be obtained, if required by the EP&A Act.

   *This approval also does not approve the construction of the proposed retaining walls proposed to create terraced lots in the eastern portion of the site bounded by Proposed Road No 8 to the north, Road 5 to the east, Road 1 and a small section of Road 2 in the south and Road 8 to the west, including any inter-allotment retaining walls to create terraced lots, as outlined on the 'Retaining Wall Layout Plan' **Revision H** prepared by Bradlees Civil Consulting dated **26 March 2019**.*

   B18 Retaining Walls
   Subject to other conditions of this approval, all retaining walls and batters shall be designed in accordance with Tweed Shire Council's Development Design Specification D6 - Site Regrading. Permissible retaining wall and batter heights are specified in Table D6.1. Boundary retaining walls and batters shall be constructed with a minimum boundary setback of 0.9m in accordance with clause D6.05.6(c) of Development Design Specification D6 - Site Regrading.
   The only locations where a setback variation is permitted are Lot 701 and the road frontage boundaries of Lots 812, 918 and 1001."

The proponent agrees with the amended Conditions A10 and B18 as recommended by Council, subject to amending Condition A10 to refer to the latest Retaining Wall Layout Plan (Rev H, 26 March 2019).

Dot Point 4 – Noted.

Dot Point 5 – Noted.

Dot Point 6 – Noted.

The issues above can be addressed by amending Condition A3 as follows:

Proposed Amended Condition A3 – Project in Accordance with Plans

The project will be undertaken in accordance with the following documents:

a) Environmental Assessment prepared by Darryl Anderson Consulting Pty Ltd dated December 2010;
b) Preferred Project Report prepared by Darryl Anderson Consulting Pty Ltd dated April 2013;

c) Addendum to the PPR prepared by Darryl Anderson Consulting Pty Ltd dated October 2013;
d) Modification Report – Major Project Approval No. 09_0166 Proposed Residential Subdivision, "Altitude Aspire" Fraser Drive, Terranora, prepared by Darryl Anderson Consulting Pty Ltd and dated February 2015 (MOD 1); and
e) Modification Report – Major Project Approval No. 09_0166 Proposed Residential Subdivision, "Altitude Aspire" Fraser Drive, Terranora, prepared by Darryl Anderson Consulting Pty Ltd and dated September 2015 (MOD 2).
f) Modification Report – Major Project Approval No. 09_0166 Proposed Residential Subdivision, "Altitude Aspire" Fraser Drive, Terranora, prepared by DAC Planning Pty Ltd and dated February 2018 (MOD 3).
g) Response to Submissions Report MP09_0166 MOD3 prepared by DAC Planning Pty Ltd and dated July 2018.

and the following drawings, except where varied by the conditions of this approval:

Subdivision Layout Plans prepared by B & P Surveys, Reference No T15263			
Drawing No.	**Revision**	**Name of Plan**	**Date**
18779B	**O**	Plan Showing Existing Property Descriptions and Tweed Local Environmental Plan 2000 & 2014 - Zonings (Sheet 1)	**13 March 2019**
18779B	**O**	Plan Showing Existing Topography & Proposed Subdivision Layout (Sheet 2)	**13 March 2019**
18779B	**O**	Plan Showing Proposed Subdivision Layout & Design Contours (Sheet 3)	**13 March 2019**
18779B	**O**	Plan Showing Proposed Subdivision Layout & Design Contours (Sheet 4)	**13 March 2019**
18779B	**O**	Plan Showing Proposed Subdivision Layout & Design Contours (Sheet 5)	**13 March 2019**
18779B	**O**	Plan Showing Proposed Subdivision Layout & Design Contours (Sheet 6)	**13 March 2019**
18779B	**O**	Plan Showing Proposed Subdivision Layout & Design Contours (Sheet 7)	**13 March 2019**
18779B	**O**	Plan Showing Proposed Subdivision Layout & Design Contours (Sheet 8)	**13 March 2019**
18779B	I	Locality/Context Plan	10 July 2013

Engineering Drawings prepared by Bradlees Civil Consulting/Meinhardt Urban Pty Ltd, Project No 09-374			
Drawing No.	**Revision**	**Name of Plan**	**Date**
SK3628	E	Road Hierarchy Plan	3 July 2013
SK3586 - SK3616 (inclusive)	B	Road Plans – road longitudinal, long and cross sections	7 January 2013
SK3963, SK3965, SK3966, SK3967	A	Road Plans – road longitudinal, long and cross sections	7 January 2013
SK3562	E	Ultimate Earthworks Phasing Plan	4 July 2013
SK2604	F	Cut/Fill Plan (Sheet 1)	4 July 2013
SK2605	F	Cut/Fill Plan (Sheet 2)	4 July 2013
SK3507	D	Earthworks Layout (Sheet 1)	15 May 2013
SK3508	D	Earthworks Layout (Sheet 2)	15 May 2013

Engineering Drawings prepared by Bradlees Civil Consulting/Meinhardt Urban Pty Ltd, Project No 09-374			
Drawing No.	**Revision**	**Name of Plan**	**Date**
SK3527	D	Earthworks Layout (Sheet 3)	9 April 2013
SK3528	D	Earthworks Layout (Sheet 4)	9 April 2013
SK3529	C	Earthworks Layout (Sheet 5)	27 Feb 2013
SK3635	D	Earthworks Sections Layout	16 May 2013
SK3636	B	Earthworks Cross Sections (Sheet 1)	7 January 2013
SK3637	B	Earthworks Cross Sections (Sheet 2)	7 January 2013
SK3638	C	Earthworks Cross Sections (Sheet 3)	21 May 2013
SK3639	C	Earthworks Cross Sections (Sheet 4)	16 May 2013
SK3640	C	Earthworks Cross Sections (Sheet 5)	9 April 2013
SK3641	C	Earthworks Cross Sections (Sheet 6)	9 April 2013
SK3642	C	Earthworks Cross Sections (Sheet 7)	9 April 2013
SK3643	C	Earthworks Cross Sections (Sheet 8)	9 April 2013
SK4032	A	Existing Boundary Tie In	15 March 2013
SK3626	C	Water Quality Treatment Areas	25 Feb 2013
~~SK3618~~	~~D~~	~~Central Open Drain Swale Plan~~	~~9 April 2013~~
~~SK4038~~	~~B~~	~~Central Open Drain Swale Bund~~	~~17 April 2013~~
~~SK3619~~	~~B~~	~~Central Open Drain Swale Long Section~~	~~25 Feb 2013~~
~~SK3620~~	~~C~~	~~Central Open Drain Swale Cross Sections (Sheet 1)~~	~~25 Feb 2013~~
~~SK3621~~	~~C~~	~~Central Open Drain Swale Cross Sections (Sheet 2)~~	~~25 Feb 2013~~
~~SK3622~~	~~C~~	~~Central Open Drain Swale Cross Sections (Sheet 3)~~	~~25 Feb 2013~~
~~SK3623~~	~~C~~	~~Central Open Drain Swale Cross Sections (Sheet 4)~~	~~25 Feb 2013~~
~~SK3624~~	~~C~~	~~Central Open Drain Swale Cross Sections (Sheet 5)~~	~~25 Feb 2013~~
~~SK3625~~	~~C~~	~~Central Open Drain Swale Cross Sections (Sheet 6)~~	~~25 Feb 2013~~
SK6596	**D**	**Proposed Staging Updates**	**26 March 2019**
SK6622	**C**	**Areas of Proposed Changes for Consent Modification 3**	**26 March 2019**
SK4554	**F**	**Road Names Plan**	**6 July 2018**
SK6460	**B**	**Extent of Mawsons Peak Blvd - Townsend Crescent Roundabout Works**	**6 July 2018**
SK3618/1	**H**	**Central Open Drain Swale Plan – Sheet 1 of 3**	**26 March 2019**
SK3618/2	**H**	**Central Open Drain Swale Plan – Sheet 1 of 3**	**26 March 2019**
SK3618/3	**H**	**Central Open Drain Swale Plan – Sheet 1 of 3**	**26 March 2019**
SK3619	**E**	**Central Open Drain Swale Long Section**	**26 March 2019**
SK3620	**F**	**Central Open Drain Swale Cross Sections Sheet 1 of 6**	**26 March 2019**
SK3621	**F**	**Central Open Drain Swale Cross Sections Sheet 2 of 6**	**26 March 2019**
SK3622	**F**	**Central Open Drain Swale Cross Sections Sheet 3 of 6**	**26 March 2019**
SK3623	**F**	**Central Open Drain Swale Cross Sections Sheet 4 of 6**	**26 March 2019**

Engineering Drawings prepared by Bradlees Civil Consulting/Meinhardt Urban Pty Ltd, Project No 09-374			
Drawing No.	**Revision**	**Name of Plan**	**Date**
SK3624	**F**	**Central Open Drain Swale Cross Sections Sheet 5 of 6**	**26 March 2019**
SK3625	**F**	**Central Open Drain Swale Cross Sections Sheet 6 of 6**	**26 March 2019**
SK3626	**F**	**Water Quality Treatment Areas**	**26 March 2019**
SK3487	**F**	**Box Culvert Sections**	**6 February 2019**
SK4038	**E**	**Central Open Drain Swale Bund**	**26 March 2019**
SK6524	**D**	**West Boundary Earthworks Extent**	**23 January 2019**
SK6525	**C**	**West Boundary Roads Cross Sections Extent Sheet 1 of 4**	**6 July 2018**
SK6526	**C**	**West Boundary Roads Cross Sections Extent Sheet 2 of 4**	**6 July 2018**
SK6527	**B**	**West Boundary Roads Cross Sections Extent Sheet 3 of 4**	**6 July 2018**
SK6528	**C**	**West Boundary Roads Cross Sections Extent Sheet 4 of 4**	**26 March 2019**
SK3617	**H**	**Retaining Wall Layout**	**26 March 2019**
SK3591	**C**	**Road 2 (Market Parade) Cross Sections Sheet 1 of 5**	**24 July 2018**
SK3592	**C**	**Road 2 (Market Parade) Cross Sections Sheet 2 of 5**	**24 July 2018**
SK3593	**C**	**Road 2 (Market Parade) Cross Sections Sheet 3 of 5**	**24 July 2018**
SK3594	**C**	**Road 2 (Market Parade) Cross Sections Sheet 4 of 5**	**24 July 2018**
SK3609	**C**	**Road 10 (Mawsons Peak Blvd & Parkes Lane) Longitudinal Section**	**24 July 2018**
SK3610	**C**	**Road 10 (Mawsons Peak Blvd) Cross Sections Sheet 1 of 2**	**24 July 2018**
SK3611	**C**	**Road 10 (Mawsons Peak Blvd & Parkes Lane) Cross Sections - Sheet 2 of 2**	**24 July 2018**
SK3631	C	Stormwater Layout (Sheet 1)	16 May 2013
SK3632	D	Stormwater Layout (Sheet 2)	16 May 2013
~~SK3487~~	~~C~~	~~Bebo Culvert Sections~~	~~9 April 2013~~
SK3633	B	Water Layout (Sheet 1)	7 January 2013
SK3634	C	Water Layout (Sheet 2)	9 April 2013
SK3629	C	Sewer Layout (Sheet 1)	16 May 2013
SK3630	D	Sewer Layout (Sheet 2)	16 May 2013
SK3647	C	Stages 1,2 and 3 Services (Sheet 1)	16 May 2013
SK3648	D	Stages 1,2 and 3 Services (Sheet 2)	16 May 2013
SK6978	**A**	**Lot 610 Sewer Reticulation Plan and Trunk Sewer Long Section**	**26 March 2019**

Landscape Drawings prepared by Form Landscape Architects, Project No 100906, DA09 dated ~~12 August 2013~~ 11 February 2015			
Drawing No.	**Revision**	**Name of Plan**	**Date**
Figure 1	-	Landscape Master Plan	~~11 February 2015~~ **1 May 2019**
Figure 2	-	Landscape Structure	~~11 February 2015~~ **1 May 2019**
Figure 3	-	Circulation Network	~~11 February 2015~~ **1 May 2019**
Figure 4	**-**	**Casual Open Space Compliance Areas**	**1 May 2019**
-	-	Fence Types **and Balustrades**	~~11 February 2015~~ **1 May 2019**
-	**-**	**Fence Types**	**1 May 2019**
-	-	Community Park Node	~~11 February 2015~~ **1 May 2019**
-	-	Landscape Sections **1 – 3 (2 sheets)** ~~and 12 - 15 inclusive~~	~~11 February 2015~~ **1 May 2019**
~~-~~	~~-~~	~~**Community Park Node**~~	~~**11 February 2015**~~
-	-	~~Drainage Corridor and Wetlands~~ Central Drainage Reserve	~~11 February 2015~~ **1 May 2019**
-	**-**	**Landscape Sections 4 – 10 (4 sheets)**	**1 May 2019**
-	-	Pocket Park 1	~~11 February 2015~~ **1 May 2019**
-	-	Pocket Park 2	~~11 February 2015~~ **1 May 2019**
-	-	Fraser Drive Entry	~~11 February 2015~~ **1 May 2019**
-	**-**	**Sections 11 – 12 (2 sheets)**	**1 May 2019**
-	-	Planting Palette **(2 sheets)**	~~11 February 2015~~ **1 May 2019**

A4 Project in Accordance with Documents

Dot Point 1 (Item 10) – see Bush Fire Hazard Assessment, Bushfire Certifiers, 26 June 2018 (amended Rev D, 30 April 2019) at **Annexure C**.

Dot Point 2 (Item 25) – see amended Biome Report, March 2019 at **Annexure B**.

Dot Point 3 – as indicated in Section 6.0, it is proposed to pay for credits under the Biodiversity Offsets Scheme rather than translocate the Macadamia Tetraphylla. Therefore, the Macadamia Tetraphylla Translocation Plan should not be included in the list of documents in this Condition. Proposed amended Condition A4 is as follows:

Proposed Amended Condition A4

The project will be undertaken in accordance with the following documents except where varied by the conditions of this approval:

(1) Environmental Assessment Report dated September 2010, as revised December 2010 prepared by Darryl Anderson Consulting Pty Ltd;
(2) Preferred Project Report/Response to Submissions prepared by Darryl Anderson Consulting Pty Ltd dated April 2013 and PPR Addendum dated August 2013 and October 2013;

(3) Cultural Heritage Assessment prepared by Everick Heritage Consultant Pty Ltd dated March 2012;

(4) Acoustic Report prepared by Sound matters ttm, Reference No 11GCA0048 R01 7 dated 8 April 2013;

(5) Stormwater Assessment and Management Plan prepared by Gilbert & Sutherland dated April 2013;

(6) Revised Ecological Assessment prepared by JWA Pty Ltd Ecological Consultants dated April 2013, Job No N09031/EA/2013/Rw7 and Addendum to the Ecological Assessment prepared by JWA Pty Ltd dated August 2013;

(7) Revised Vegetation Management and Rehabilitation Plan prepared by JWA Pty Ltd Ecological Consultants dated April 2013, Job No N09031/VMRP/2013/MJ1;

(8) Preferred Project Report (Revised) for MP 09_0166 for Altitude Aspire Terranora (Engineering) prepared by Bradlees Civil Consulting dated March 2013 (Job No 09-374 Altitude Aspire and Response to DOP Outstanding Issues in Addendum to PPR.

(9) Amended Biting Insect Management Plan prepared by HMC Environmental Consulting Pty Ltd dated April 2012, Report No 2012.045;

(10) Bushfire Assessment Report prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012 **and the Bush Fire Hazard Assessment prepared by Bushfire Certifiers dated 26 June 2018 (amended Rev D, 30 April 2019)**;

(11) Altitude Aspire Revised Transport Assessment prepared by Bitzios Consulting dated 8 April 2013, Version 002 Project No P1197;

(12) Acid Sulphate Soil Assessment and Management Plan prepared by Gilbert & Sutherland dated April 2012, Ref No 10849_ASS&MP;

(13) Hydrological and Hydraulic Assessment prepared by Gilbert & Sutherland dated April 2013 (Revision 2), Ref No 10849 HHA;

(14) Soil Contamination Assessment for 'Area E' Properties Terranora dated October 2003, prepared by Gilbert & Sutherland Pty Ltd;

(15) Sampling, Analysis and Quality Plan prepared by Gilbert & Sutherland dated October 2013 (Revision 3), Ref No 10849_SAQP_RZ1F.docx;

(16) Remediation Action Plan, prepared by Gilbert & Sutherland dated October 2013 (Revision 3), Ref No 10849_RAP_RZ1F.docx;

(17) Section B Site Audit Statement prepared by Marc Salmon dated 15 October 2013, Ref 14003 (Site Audit Statement – 0103 – 1301);

(18) Interim Site Audit Advice prepared by Marc Salmon dated 9 August 2013;

(19) Soil Preservation Management Plan prepared by Gilbert & Sutherland Pty Ltd dated April 2013 (Ref 10849_SPMP_RMF);

(20) Broad Geotechnical Engineering Assessment prepared by Morrison Geotechnic Pty Ltd dated November 2010; and

~~(21) Draft Community Management Statement dated July 2013.~~

(21) Modification Report – Major Project Approval No. 09_0166 Proposed Residential Subdivision, "Altitude Aspire" Fraser Drive, Terranora, prepared by Darryl Anderson Consulting Pty Ltd and dated February 2015. (MOD1)

(22) Modification Report – Major Project Approval No. 09_0166 Proposed Residential Subdivision, "Altitude Aspire" Fraser Drive, Terranora, prepared by DAC Planning Pty Ltd and dated September 2015. (MOD2)

(22)(1) Modification Report – Major Project Approval No. 09_0166 Proposed Residential Subdivision, "Altitude Aspire" Fraser Drive, Terranora, prepared by DAC Planning Pty Ltd and dated February 2018. (MOD3)

(22)(2) Response to Submissions Report, DAC Planning Pty Ltd, July 2018. Excluding the Macadamia Tetraphylla Translocation Plan, JWA Pty Ltd, November 2018. (MOD3)

(22)(3) Response to Tweed Shire Council RFI Letter dated 27 September 2018, DAC Planning Pty Ltd, 1 May 2019. (MOD3)

Condition B22(i)

Council refers to Condition B22(i), however this condition does not exist. It is assumed that Council means Condition 22(1)(j), which requires the Construction Environmental Management Plan to include details of the Aboriginal Cultural Heritage Program.

The Response to Submissions Report (DAC Planning Pty Ltd) July 2018, includes, at Appendix 11, an Aboriginal Cultural Heritage Report prepared by Everick Heritage Consultants, dated July 2018. The Report contains six recommendations, including Recommendation #2 requiring cultural heritage induction.

It is not considered necessary to call up all of the recommendations as a condition of consent. Rather, it is proposed that Condition B22(1)(j) be amended to call up the Report. Proposed amended Condition B22(j) is as follows:

Proposed Amended Condition B22 - Construction Environmental Management Plan

1) Prior to the commencement of construction works for each stage of the project a Construction Environmental Management Plan (CEMP) shall be prepared that covers the area of works. The CEMP shall be consistent with the Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004). The CEMP shall include details sufficient to understand and avoid, mitigate and remedy all potential environmental impacts of the project during construction. The CEMP shall include, but not be limited to:
   a) a description of all relevant activities to be undertaken on the site during construction (including an indicative timeline);
   b) a description of relevant environmental management objectives for the site;
   c) a detailed construction management strategy for each sequence / stage of the bulk earthworks;
   d) details of measures to be installed to separate construction areas from publicly accessible areas;
   e) statutory and other obligations that the Proponent is required to fulfil during construction including all relevant approvals, licences and consultations;
   f) a description of the roles and responsibilities for all relevant employees involved in construction
   g) hours of work (including standard hours of work for the Environmental Officer);
   h) a 24-hour contact telephone number shall be provided to all adjoining owners and occupants. Note: the nominated telephone number may contain provision for a voice message service outside of normal working hours.
   i) Measures to be implemented during bulk earthworks operations to ensure the existing 600mm trunk water main is protected
   j) Details of the Aboriginal Cultural Heritage Program for personnel and contractors (the program should be developed and implemented in collaboration with the local Aboriginal community). **The relevant recommendations contained in the Aboriginal Cultural Heritage Report prepared by Everick Heritage Consultants Pty Ltd dated July 2018, should be addressed in the CEMP.**
   k) A subset of the following management plans:
      (i) traffic and pedestrian management (see condition B24);
      (ii) noise and vibration management (see conditionB25);
      (iii) construction waste management (including the proposed method and location of excess spoil from bulk earthworks) (see conditionB23);
      (iv) erosion and sediment control for the entire site (see condition B26);
      (v) dust management;
   l) Note: other conditions in this approval may specify relevant objectives or requirements for or in addition to any of the matters listed directly above.

2) Bulk earthworks are limited to one sequence area at a time, with the maximum exposed disturbed area (that has not been permanently vegetated) not exceeding a maximum of 5 hectares, at any time to reduce exposed areas.
3) The CEMP shall be submitted for the approval of the certifying authority no later than one month prior to the commencement of construction, or within such period otherwise agreed by the ~~Director- General~~ Secretary. Notwithstanding, where construction work is to be undertaken in stages, the Proponent may, subject to the agreement of the ~~Director-General~~ Secretary, stage the submission of the CEMP consistent with the staging of activities relating to that work. The Proponent shall also forward copy of the CEMP to the ~~Director- General~~ Secretary and Council for information. Construction shall not commence until written approval has been received from the certifying authority.

Condition B39 – Roads

Council's request is agreed to. The proposed amended Condition B39 is as follows:

Proposed Amended Condition B39 – Roads

1) Kerb and gutter, stormwater drainage, full road width pavement including traffic facilities (roundabouts, median islands etc.) and paved footpaths shall be constructed along the full length of the new roads.
2) All roads shall be designed in accordance with the Council's Development Design Specification D1 Road Design. Final road design plans shall be prepared by a qualified practising Civil Engineer and submitted to the Certifying Authority prior to the issue of a Construction Certificate for below ground works for each stage of the project.
3) All roundabouts are to comply with the requirements of Austroads Part 4B, which will need to be demonstrated with the relevant Construction Certificate Application.

Condition B49 – Bushfire Management

Council's concerns are noted. It is proposed to include in this condition the amended Bush Fire Hazard Assessment at **Annexure C**. The proposed amended Condition B49 is as follows:

Proposed Amended Condition B49 – Bushfire Management

The site shall be managed in accordance with the Bushfire Assessment Report prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012 **and the Bush Fire Hazard Assessment** prepared by **Bushfire Certifiers dated 26 June 2018 (amended Rev D, 30 April 2019)**. The entire site, including reserves on Lots **454**, 712 and 610, and excluding **Lot 146 DP 1233026**, shall be managed as an inner protection area (IPA) as outlined within Appendix 2 and 5 of Planning for Bushfire Protection (2006) and the NSW Rural Fire Service document 'Standards for Asset Protection Zones'.

Proposed Condition B51 – Treatment of Batters in Lot 610 Abutting Lot 316

Appropriate treatment of the batter in Lot 610 abutting Lot 316 to achieve a low maintenance surface and compliant bushfire APZ requirements was agreed with Tweed Shire Council Officers on 29 March 2019.

It is therefore proposed to insert the following new condition, B51:

Proposed New Condition B51 – Treatment of Batters in Lot 610 Abutting Lot 316

The batter abutting Lot 316 shall be treated with "stone pitching" for a nominal width of 8m and suitable fencing shall be erected on the common boundary of Lot 316 and the proposed drainage reserve, in accordance with the requirements of the Bush Fire Hazard Assessment **prepared by Bushfire Certifiers dated 26 June 2018 (amended Rev D, 30 April 2019)**. Details to be submitted with the relevant Construction Certificate Application that incorporates the batter enhancement works (landscaping, etc.), for approval by the PCA. All works covered by this Condition shall be completed concurrently.

Council shall not be responsible for fencing of private land that abuts a Council Reserve.

Condition E13 – Creation of Easements

As requested by Council, we have revised Condition E13 and identified changes required as a result of changes to plans, lot numbers and staging. Condition E13 is proposed to be amended to address these issues.

In relation to Condition E13(e), it is acknowledged that Lot 811 has been replaced by Lot 1106 and that lot does not have a 9m kerb frontage. It is therefore proposed to retain and amend this condition to refer to Lot 1106.

In relation to Conditions E13(f) and (g), it is proposed to amend these conditions to call up the Amended Landscape Master Plan at **Annexure D**.

As indicated in the Response to Submissions Report, amendment of Condition E13(j) and (k) is not required as the conditions have been complied with when the Plan of Subdivision for Stage 1 was registered (DP1233026).

Council has also recommended an extra item be included in Condition E13 relating to the nominated boundary setback for Lot 701. Subsequently, following further discussions, Council Officers agreed to extend the depth of Lot 701 from 28.235m to 29.235m to achieve the required asset protection zone. Therefore there is no need to amend Condition E13 in relation to Lot 701.

Proposed amended Condition E13 is in the following terms:

Proposed Amended Condition E13 - Creation of Easements

The creation of easements for services, rights of carriageway and restrictions as to user (including restrictions associated with planning for bushfire) as may be applicable under Section 88B of the Conveyancing Act 1919 including (but not limited to) the following:

a) Easements for sewer, water supply and drainage over ALL public services/infrastructure on private property.
b) Positive Covenant over the subject land (as applicable) to ensure that the required provisions of the "Planning for Bushfire Protection 2006 " Guidelines and the General Terms of Approval of the Consent as imposed under Section 100B of the Rural Fires Act 1997 are enforced in perpetuity.
c) Extinguishment of superfluous Right of Carriageways that were previously created to provide temporary turning areas for refuse vehicles and the general public, but are now no longer required.
d) A Restriction As To User requiring the provision of a minimum capacity 5kL rainwater tank for all single dwelling allotments, in accordance with the requirements of Council.

e) A Restriction As To User over **Lot 1106** requiring the provision and construction of a designated off-street parking space, in conjunction with the construction of any dwelling on the site.

f) A Restriction as to user requiring a timber screen fence with wire mesh unit to provide 'green walls' along the rear of lots adjoining Fraser Drive with planting in Council's road reserve as provided in the Landscape Masterplan prepared by Form Landscape Architects dated **1 May 2019**.

g) A Restriction as to user requiring fencing along the rear of medium density lot 701 adjoining public open space and drainage reserve areas to be a an aluminium and timber (open form) fence with screen planting and adjoining cycle path as provided in the Landscape Masterplan prepared by Form Landscape Architects dated **1 May 2019**.

h) A Restriction as to user requiring the future homes on lots to be responsive to the slope of the block. The restriction should specifically list all 251 residential lots and detail what slope category the allotments fall within (having regard to the revised Structural Systems Plan prepared by Local Office Architecture Version SK.0002 and dated 29 June 2018 Issue I). Each lot will be burdened to construct a house typology based on the below indicative Structural System dependant on slope.

i) The keeping of cats (with the exception of assistance animals, as defined under the Commonwealth Disability Discrimination Act 1992) within the site is prohibited.

j) The following Restriction on Title is to be imposed on all residential lots created that are adjacent to Fraser Drive: 'Future dwellings on noise affected lots identified in the Acoustic Report (Lots 122- 142 and Lots 201-205 and Lots 301-304 and Lot 324) prepared by TTM (ttm ref: 11GCA0048 RO1_7) dated April 2013 are to be designed in accordance with the procedures of Australian Standard AS3671:1998 'Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction' to achieve the internal sound levels outlined in SEPP (Infrastructure) 2007 - Regulation 102 which are reproduced in Section 4.2 of the TTM report. Purchasers of noise affected lots will be responsible for obtaining an Acoustic Assessment from an Acoustic Consultant and shall construct their dwellings in accordance with the recommendations contained in the assessment report.'

k) A 5 metre wide 'Restriction on Use' to be imposed on all lots abutting Fraser Drive (except lots 139 and 140) excluding any buildings within the rear 5 metres of the lots, ensuring a 5 metre wide landscape buffer is achieved along the rear of the proposed lots; and

l) Creation of an appropriate easement over the existing sewer rising main that currently traverses the northern portion of the site.

m) A restriction as to user for each lot that has the benefit of a retaining wall that prevents any cut or fill greater than 0.3m in vertical height within a zone adjacent to the wall that is equal to the height of the wall. Each lot burdened and or benefited by a Type 1 wall as defined in AS4678- 2002 Earth Retaining Structures, shall contain a restriction to user advising the landowner of the need to maintain the wall in accordance with that standard. The Council is to be nominated as the authority empowered to release, vary or modify the restrictions.

n) Where retaining walls are proposed to be parallel to the sewer and stormwater infrastructure, easements will be required to increase by a 1m width. Proposed landscaping in the drainage reserve/park area such as retaining, rock walls and large tree plantings shall not be located over water or sewer easements.

Pursuant to Section 88BA of the Conveyancing Act 1919 (as amended) the Instrument creating the right of carriageway/easement to drain water shall make provision for maintenance of the right of carriageway / easement by the owners from time to time of the land benefited and burdened and are to share costs equally or proportionally on an equitable basis.

Any Section 88B Instrument creating restrictions as to user, rights of carriageway or easements which benefit Council shall contain a provision enabling such restrictions, easements or rights of way to be revoked, varied or modified only with the consent of Council."

Condition B10 – Changes to Road 9

It is agreed that Condition B10 can be deleted as the amended plan deletes the road connection. The Department is therefore requested to delete Condition B10.

Condition B15 – Phasing of Bulk Earthworks

Council requests that staging and plan references are checked.

Condition B15 is in the following terms:

*"**B15 Phasing of Bulk Earthworks***

The phasing of bulk earthworks as depicted on the 'Ultimate Earthworks Phasing Plan' (Bradlees Consulting Drawing Number SK 3562 Revision E) shall be amended to include in Phase 1, as a minimum, the works in Stage 5 necessary to form the road extension of Market Parade (Road 2), in order for these road works to be undertaken as part of Stage 4 civil works. This must be reflected on the Construction Certificate for the relevant stage(s) of the subdivision."

The project Consulting Engineers (Meinhardt) advise as follows:

"Our CC Approved drawings (CC 15/0063 dated 18/12/2015) for the Phase 1 Bulk earthworks included the additional works referred to in Condition B 15 and earthworks have subsequently been completed."

Condition B35 – Extension of Market Parade

Council requests that staging references are checked.

Condition B15 is in the following terms:

*"**B35 Extension of Market Parade***

Construction of the extension of Market Parade (Road 2) shall occur no later than the Stage 4 civil works. Details are to be provided prior to the issue of the relevant Construction Certificate."

The project Consulting Engineers (Meinhardt) advise as follows:

"With regard to B35, our current CC Application for Stage 4 (b) includes the road extension referred to for Market Parade."

Condition B38 – Corner Truncations in the local street network

It is agreed that Condition B38 can be deleted as the amended plans show truncations rather than 'rounded corners'. The Department is therefore requested to delete Condition B38.

Condition B46 – Detailed Landscaping Plan

It is agreed that Condition B46 should be amended to refer to the current lot numbers. Proposed amended Condition B46 is as follows:

1) A detailed landscape plan prepared by a qualified landscape architect must be submitted for all Public Reserves and roads to be dedicated to Council, including but not limited to areas of casual open space, structured open space, cycleways, pedestrian walkways and streetscapes.
2) Such a plan must be approved by the Manager, Recreation Services, Tweed Shire Council prior to the issue of the Construction Certificate for each relevant stage and include embellishments such as listed in Councils Subdivision Manual (Section A5 of the Tweed Development Control Plan) and Development Design Specification (D14) and related Standard Drawings and include grassing, landscaping, seating, park activation areas, playground equipment and shade cover. The plans must provide slope information, indicate all underground services and indicate any implications or constraints at or beyond the boundary that will affect ongoing management of the public land.
3) The plans must also specifically address the following issues/requirements:
    a) An 'informal youth recreation space" as defined by the Tweed Youth Strategy and Action Plan", to be incorporated into the Neighbourhood Park design for Lot 712, in consultation with Council's Recreation Services Unit.;
    b) The public open space area on **Lot 454** is to be linked through design with the adjoining public land, and must address the vision and objectives of the Area E Urban Release Development Code: Section 2.7 Design Principle 5: Open Space;
    c) The final landscape design for Lot 610 **(proposed drainage reserve)** must consider the following to the satisfaction of the Council:-
        - Design and construction of the embellishments are to minimise maintenance costs (construction materials should include recycled plastic wherever possible, and any timber that is unavoidable is to be painted rather than stained).
        - Safety and security of the turf area and shelter shed (being remote from the street) is to be maximised through the landscape design; and
    d) The final landscape plan for the public open space area at Lot 819 is to ensure that all turf areas that require mowing do not exceed a slope of 1.5 or 20%. The plan will also contain cross sections of the park that show the view lines over the surrounding houses.
    e) The final landscape plan must identify the location of all water supply and sewerage discharge points within each public open space reserve.
    f) The final landscape plan must ensure that there are no signage walls or stone walls within the Fraser Drive road reserve.

Condition E6 – Section 94 Contributions – Heavy Haulage

It is agreed that this condition should be deleted for the reasons identified by Council. The Department is therefore requested to delete Condition E6.

Condition E14 – Bushfire Certification

Condition E14 is proposed to be amended to refer to the revised Bush Fire Hazard Assessment at **Annexure C**.

The proposed amended Condition E14 is as follows:

> **E14 Bushfire Certification**
> Prior to the issue of any Subdivision Certificate, certification from a Fire Protection Association Australia (FPA Australia) accredited Bushfire Planning And Design (BPAD) certified practitioner, must be submitted to the Certifying Authority, confirming that the works have been undertaken in accordance with the Bushfire Assessment Report prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012, **the Report prepared by Bushfire Certifiers dated 26th June 2018 (amended 30th April 2019)** and the conditions of this approval.

Condition E30 – Maintenance of Streetscapes and Casual Open Space

Condition E30 is in the following terms:

> *"**E30 Maintenance of Streetscapes and Casual Open Space***
>
> *The developer is to undertake care and maintenance operations on all streetscapes, casual open space and structured open space for a minimum of 24 months after the Subdivision is registered with the Land Titles Office. This is the establishment period for new plantings. Such maintenance will include all soft landscaping, particularly mowing and weed control. Any power and water consumption costs during this period must also be met by the developer**."***

Condition E32 – Landscape Bond

Condition E32 is in the following terms:

> *"**E32 Landscape Bond***
>
> *A bond to ensure acceptable plant establishment and landscaping performance at time of handover to Council shall be lodged by the proponent prior to the issue of any Subdivision Certificate. The bond shall be held by Council for a minimum period of 12 months from the date of issue of the Subdivision Certificate (or longer if required by the approved Landscaping Plan) and may be utilised by Council during this period to undertake essential plant establishment or related plant care works, should noncompliance occur. Any balance remaining at the end of the 12 months establishment period will be refunded.*
>
> *The amount of the bond shall be 20% of the estimated cost of the landscaping or $3000 whichever is the greater."*

On 27 February 2019 Tweed Shire Council's Open Space Officer advised that Council supports a change to the landscape maintenance period from 24 months to 12 months. This will mean that both Conditions E30 and E32 refer to a 12 month maintenance period.

Council's Development Engineer advised on 27 March 2019 that the inconsistency between Conditions E30 and E32 should be rectified as part of the current MOD3 to make the maintenance period for streetscapes and public reserves 12 months.

Having regard to the above, there is no need to amend Condition E32 however the Department is requested to amend Condition E30 as follows:

Proposed Amended Condition E30 Maintenance of Streetscapes and Casual Open Space

The developer is to undertake care and maintenance operations on all streetscapes, casual open space and structured open space for a minimum of **12** months after the Subdivision is registered with the Land Titles Office. This is the establishment period for new plantings. Such maintenance will include all soft landscaping, particularly mowing and weed control. Any power and water consumption costs during this period must also be met by the developer.

2.0 ENGINEERING SUBMISSION AND AMENDED ENGINEERING PLANS BY MEINHARDT URBAN

See response from Meinhardt Urban Pty Ltd at **Annexure B**.

3.0 BIORETENTION BASIN AND DRAINAGE RESERVE DESIGN

See response from Meinhardt Urban Pty Ltd at **Annexure B**.

4.0 LANDSCAPE MASTER PLAN AND COVER LETTER

See amended Landscape Plans at **Annexure D**.

5.0 BUSHFIRE HAZARD ASSESSMENT – LOT 610

See amended Bushfire Report at **Annexure C**.

6.0 MACADAMIA TETRAPHYLLA TRANSLOCATION PLAN, REVISED VEGETATION MANAGEMENT AND REHABILITATION PLAN AND REVISED ECOLOGICAL ASSESSMENT

The revised Vegetation Management Rehabilitation Plan (JWA, as amended 18 April 2019) is attached at **Annexure E**.

The revised Ecologic Assessment (Burchills, November 2018) is attached at **Annexure F**.

JWA response to OEH and Tweed Shire Council dated 13 December 2018 including BDAR at **Annexure G**.

Rather than translocate the Tetraphylla plants, it is proposed to pay for credits under the Biodiversity Offset Scheme. A Biodiversity Development Assessment Report (JWA Pty Ltd, December 2018) is attached at **Annexure G**.

7.0 OTHER MATTERS REQUIRING ATTENTION

Tweed Shire Council identified the following matters requiring attention:

- Updated Sewer Layout Plan shall be provided where sewerage infrastructure is proposed to be relocated as a result of retaining walls.

- Where the proposed stormwater drainage infrastructure is proposed in the same location as the future sewer trunk main to the west of the sewer pump station, further information shall be provided to demonstrate that it shall not impact the sewerage infrastructure. Stormwater drainage infrastructure such as bunds and filtration systems shall not be constructed within the 5m sewer trunk easement.

It is considered that both matters can be addressed by imposing appropriate conditions in Part B of the Approval (Prior to the Issue of a Construction Certificate), in the following terms: Insert a new Condition B8(j) as follows:

(j) Updated Sewer Layout Plan shall be submitted and approved by Tweed Shire Council where sewerage infrastructure is proposed to be relocated as a result of retaining walls.

Insert a new Condition B8(k) as follows:

(k) Where the proposed stormwater drainage infrastructure is proposed in the same location as the future sewer trunk main to the west of the sewer pump station, detailed plans shall be submitted and approved by Tweed Shire Council demonstrating that it shall not impact the sewerage infrastructure. Stormwater drainage infrastructure such as bunds and filtration systems shall not be constructed within the 5m sewer trunk easement.

8.0 OTHER CONDITIONS REQUIRED

Council has identified the following additional requirements:

- Where retaining walls are proposed to be parallel to the sewer and stormwater infrastructure, easements will be required to increase by a 1m width. Proposed landscaping in the drainage reserve/park area such as retaining, rock walls and large tree plantings shall not be located over water or sewer easements.

It is considered that this matter can be addressed by including a new Condition E13(n) as follows:

(n) Where retaining walls are proposed to be parallel to the sewer and stormwater infrastructure, easements will be required to increase by a 1m width. Proposed landscaping in the drainage reserve/park area such as retaining, rock walls and large tree plantings shall not be located over water or sewer easements

9.0 OEH SUBMISSION DATED 24 AUGUST 2018

Issue 1 – Ecological Assessment

As suggested by OEH, a Biodiversity Development Assessment Report (BDAR) has been prepared by JWA Ecological Consultants Pty Ltd dated November 2018. A copy of the Report is attached at **Annexure E**. in summary, the Report concludes that:

Issue 2 – Aboriginal Cultural Heritage Report

An Aboriginal Cultural Heritage Assessment Report for the Altitude Aspire Western Earthworks (Everick, November 2018) is attached at **Annexure H**.

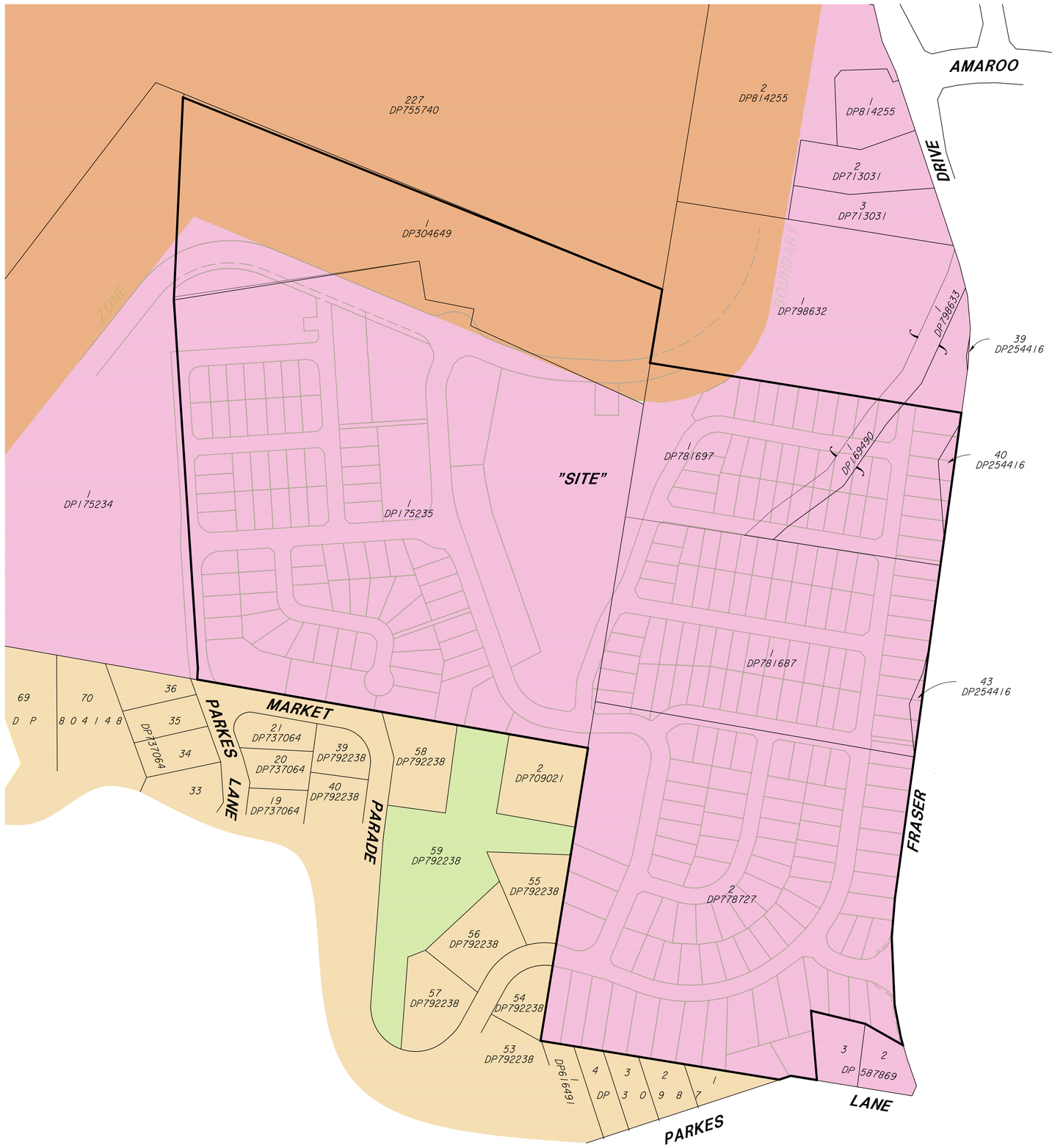
We trust that the above information adequately responds to all issues but please do not hesitate to contact Darryl Anderson should you require any further information in relation to this matter.

Yours faithfully
DAC Planning Pty Ltd

Darryl Anderson
Director

Encl.

ANNEXURE A

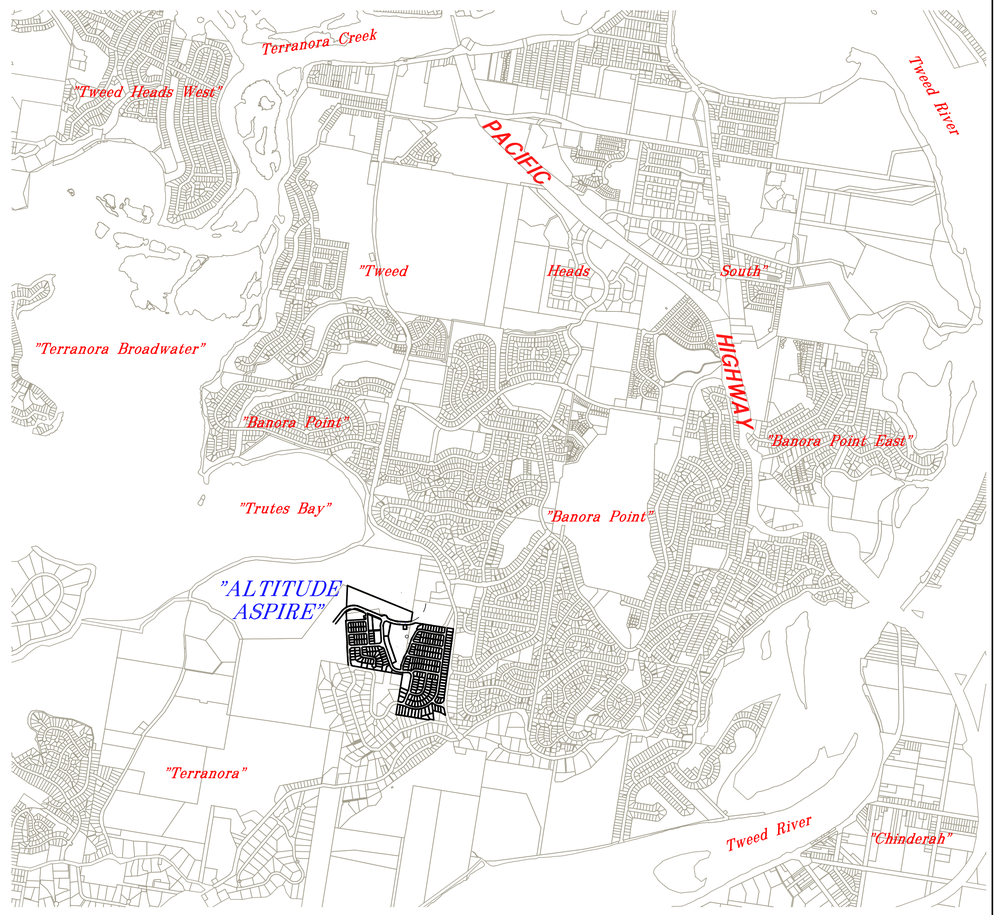


M.G.A.

N

LOCATION PLAN

SCALE 1:20000 AT A1
1:40000 AT A3



ALTITUDE ASPIRE

PLAN SHOWING EXISTING PROPERTY DESCRIPTIONS & TWEED LOCAL ENVIRONMENTAL PLAN 2000 & 2014 - ZONINGS

- TLEP2014 ZONE R5 LARGE LOT RESIDENTIAL
- TLEP2014 ZONE R1 GENERAL RESIDENTIAL
- TLEP2000 ZONE 6(a) OPEN SPACE
- TLEP2000 ZONE 7(a) ENVIRONMENTAL PROTECTION (WETLANDS AND LITTORAL RAINFORESTS)

0m 20 40 60 80 100 120 140 160 180 200
Scale in Metres - 1:2000 AT A1

Revision	Chk
Rev.O 13-3-19 Lot 701/610 & 713 amended	BDR
Rev.N 15-5-18 Stages 8A&8B added Stage 12 removed	BDR
Rev.M 14-2-18 Stage 6 amended/split	BDR
Rev.L 29-1-18 Staging amended/Lot numbers amended	BDR
Rev.K 8-11-17 Lots 707-712,801,802,811,812 Amended Pump Stn Added	BDR
Rev.J 15-9-17 Lots 807,823,832,840,912,918 Amended	BDR
Rev.H 14-9-15 Entry Road and Lots Amended/Lot 501	BDR
Rev.G 12-2-15 Zonings updated	BDR
Rev.F 3-2-15 Res.Lot removed, Entry Lots amended	BDR
Rev.E 12-6-14 Truncations / Lots 815-817 & 832	BDR
Rev.D 18-7-13 Layout amended	BDR

Associate Consultant:
BRADLEES CONSULTING ENGINEERS

IMPORTANT NOTES :

THE ZONE INFORMATION SHOWN HEREON HAS BEEN COMPILED FROM TWEED SHIRE COUNCIL ZONE MAP NO.14

PROPOSED STAGING

STAGE 1 LOTS 101 - 146 (INCLUDES DRAINAGE RESERVE & PUMP STATION LOT) NOTE-LOT 144 IS STAGE 1 RESIDUE LOT
STAGE 2 LOTS 201 - 228 STAGE 3 LOTS 301 - 324
STAGE 4A LOTS 401 - 427
STAGE 4B LOTS 428 - 454 (INCLUDES 1 PUBLIC RESERVE)
STAGE 5 LOTS 501 - 521
STAGE 6A LOTS 601 - 609 STAGE 6B LOT 610 (DRAINAGE RESERVE)
STAGE 7A LOTS 701 - 710 (INCLUDES 1 MEDIUM DENSITY SITE)
STAGE 7B LOTS 711 - 713 (INCLUDES 2 MEDIUM DENSITY SITES, & 1 PUBLIC RESERVE)
STAGE 8A LOTS 801 - 814 STAGE 8B LOTS 815-820 (INCLUDES 1 PUBLIC RESERVE) STAGE 9 LOTS 901 - 918
STAGE 10 LOTS 1001-1009 (INCLUDES 2 MEDIUM DENSITY LOTS)
STAGE 11 LOTS 1101-1120
TOTALS - 251 RESIDENTIAL LOTS 5 MEDIUM DENSITY LOTS
3 PUBLIC RESERVES 2 DRAINAGE RESERVES

PROPOSED SUBDIVISION

LOT 1 IN DP304649, LOT 1 IN DP175235,
LOT 2 IN DP778727, LOT 1 IN DP781687,
LOT 1 IN DP781697, LOT 1 IN DP169490,
LOTS 40 & 43 IN DP254416
FOR NEWLAND DEVELOPERS PTY LTD

Parish of TERRANORA County of ROUS

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SCALE	Level DATUM	F.Bk	L.Bk	Drawn BDR/RXP	Chk'd BDR
1:2000 AT A1 1:4000 AT A3	-	-	-		

REF. No. T15263 | DATE 19-1-2012 | DRAWING No./Size 18779 B | Sheet 1 | Of 8 | Rev. 0

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Offices Also At : Nerang Ph.(07)55960370 Tweed Heads Ph.(07)55536311
A QUALITY ASSURED COMPANY

PLAN SHOWING EXISTING TOPOGRAPHY & PROPOSED SUBDIVISION LAYOUT

M.G.A.

AMAROO DRIVE

227 DP755740

2 DP 814255

1 DP 814255

2 DP713031

3 DP713031

DRIVE

PARKWAY

BOUNDARY

1 DP798632

DP798633

39 DP254416

ZONE

FUTURE

STAGE 1

STAGE 1

BROADWATER

STAGE 10

STAGE 7B

STAGE 9

1 DP175234

STAGE 8A

STAGE 8B

STAGE 11

STAGE 7A

STAGE 6B

STAGE 3

STAGE 2

STAGE 1

STAGE 6A

STAGE 4A

STAGE 4B

STAGE 5

69 D P 804148

70

36 DP737064

35 DP737064

34 DP737064

33 DP737064

MARKET

PARKES LANE

21 DP737064

20 DP737064

19 DP737064

39 DP792238

40 DP792238

58 DP792238

PARADE

2 DP709021

59 DP792238

55 DP792238

56 DP792238

57 DP792238

54 DP792238

53 DP792238

DP816491

4 3 2 1 DP 309871

3 2 DP 587869

FRASER

PARKES LANE

0m 20 40 60 80 100 120 140 160 180 200

Scale in Metres - 1:2000 AT A1

Revision	Chk
Rev.O 13-3-19 Lot 701/610 & 713 amended	BDR
Rev.N 15-5-18 Stages 8A&8B added Stage 12 removed	BDR
Rev.M 14-2-18 Stage 6 amended/split	BDR
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Rev.G 12-2-15 Zonings updated	BDR
Rev.F 3-2-15 Res.Lot removed, Entry Lots amended	BDR
Rev.E 12-6-14 Truncations / Lots 815-817 & 832	BDR
Rev.D 18-7-13 Layout amended	BDR

Associate Consultant:
BRADLEES CONSULTING ENGINEERS

IMPORTANT NOTES :

THE EXISTING TOPOGRAPHY SHOWN HEREON IS PER INFORMATION RECEIVED FROM BRADLEES CONSULTING ENGINEERS.

THE PROPOSED BOUNDARIES AS SHOWN HEREON ARE PRELIMINARY ONLY AND ARE SUBJECT TO FINAL DESIGN, LOCAL AUTHORITY APPROVAL AND REGISTRATION IN THE DEPARTMENT OF LANDS.

PROPOSED STAGING

STAGE 1 LOTS 101 - 146 (INCLUDES DRAINAGE RESERVE & PUMP STATION LOT) NOTE-LOT 144 IS STAGE 1 RESIDUE LOT
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STAGE 11 LOTS 1101-1120

TOTALS - 251 RESIDENTIAL LOTS 5 MEDIUM DENSITY LOTS
3 PUBLIC RESERVES 2 DRAINAGE RESERVES

PROPOSED SUBDIVISION

LOT 1 IN DP304649, LOT 1 IN DP175235,
LOT 2 IN DP778727, LOT 1 IN DP781687,
LOT 1 IN DP781697, LOT 1 IN DP169490,
LOTS 40 & 43 IN DP254416
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A QUALITY ASSURED COMPANY

SCALE	Level DATUM	F.Bk	L.Bk	Drawn BDR/RXP	REF. No.	DATE	DRAWING No./Size	Sheet	Of	Rev.
1:2000 AT A1 1:4000 AT A3	-	-	-	Chk'd BDR	T15263	19-1-2012	18779 B	2	8	0

ALTITUDE ASPIRE

59
DP792238
PUBLIC RESERVE

55
DP792238

54
DP792238

53
DP792238

1
DP616491

4 3 2 1
D P 3 0 9 8 7

MARKET PARADE

ROAD 2

ROAD 4

ROAD 1

ROAD 3

DRIVE

PARKES LANE

FRASER

17 WIDE

14·5 WIDE

STAGE 4B

STAGE 4A

STAGE 1

STAGE 5

442 1242m² D
441 1228m² D
440 1261m² D
439 789.8m²
438 683.7m²
437 666.9m²
436 664.8m²
435 664.8m²
434 667.1m²
433 694.9m²
432 726.0m²
431 695.4m²
447 653.7m²
448 685.6m²
449 760.3m²
450 688.8m²
405 561.3m²
404 687.4m²
403 681.3m²
402 674.8m²
401 653.7m²
133 772.0m²
134 772.8m²
135 787.6m²
136 880.8m²
137 577.9m²
138 612.1m²
139 657.5m²
514 764.3m²
515 679.2m²
516 675.6m²
517 680.9m²
518 672.0m²
519 656.9m²
520 656.2m²
521 649.6m²
513 1204m² D
512 1217m² D
511 1214m² D
510 1299m² D
509 1215m² D
508 1223m² D
507 1256m² D
506 1216m² D
505 1318m² D
504 1367m² D
503 1482m² D
502 1203m² D
501 1205m² D
143 839.7m²
142 728.2m²
141 682.6m²
140 1045m² D

PROPOSED EASEMENT FOR ENTRY STATEMENT

PROPOSED EASEMENT FOR ENTRY STATEMENT

M.G.A.

ALTITUDE ASPIRE

PLAN SHOWING
PROPOSED SUBDIVISION LAYOUT
& DESIGN CONTOURS

0m 10 20 30 40 50
Scale in Metres - 1:500 AT A1

8
7 5
6 4
3

Revision	Chk
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Rev.J 15-9-17 Lots 802, 823, 832, 840, 912, 918 Amended	BDR
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Associate Consultant:
BRADLEES CONSULTING ENGINEERS

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LOT 1 IN DP781697, LOT 1 IN DP169490,
LOTS 40 & 43 IN DP254416
FOR NEWLAND DEVELOPERS PTY LTD

Parish of TERRANORA County of ROUS

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Tweed Heads Ph.(07)55363611
A QUALITY ASSURED COMPANY

M.G.A.

ROAD 8 | ROAD 6 | ROAD 5 | ROAD 4 | ROAD 2 | ROAD 1 | DRIVE | FRASER

STAGE 6A | STAGE 6B | STAGE 1 | STAGE 4A | STAGE 4B

610 (3.324ha) 3.422ha PROPOSED DRAINAGE RESERVE

606 547.7m² | 607 693.6m² | 608 583.7m² | 609 (985m²) | 601 842.1m² | 602 724.6m² | 603 657.5m² | 604 535.1m² | 605 529.5m²

111 596.1m² | 112 661.1m² | 113 551.3m² | 114 661.5m² | 115 551.3m² | 116 661.5m² | 117 661.5m² | 118 661.5m² | 119 661.5m² | 120 661.5m² | 121 745.9m²

107 527.0m² | 108 525.7m² | 109 539.3m² | 110 568.5m² | 101 639.8m² | 102 534.5m² | 103 639.7m² | 104 637.9m² | 105 636.0m² | 106 634.1m²

205 728.2m² | 122 728.8m² | 123 729.3m² | 124 729.9m² | 125 730.4m² | 126 731.0m² | 127 731.6m² | 128 773.0m² | 129 809.0m² | 130 770.0m² | 131 770.7m² | 132 771.3m² | 133 772.0m²

417 680.7m² | 418 548.7m² | 419 533.8m² | 420 547.5m² | 421 547.5m² | 422 657.0m² | 423 657.0m² | 424 657.0m² | 425 657.0m² | 426 547.5m² | 427 700.6m²

416 754.6m² | 415 587.2m² | 414 551.0m² | 413 636.2m² | 412 620.8m² | 411 564.5m² | 410 538.7m² | 409 609.4m² | 408 658.5m² | 407 540.7m² | 406 645.0m² | 405 561.3m²

443 737.9m² | 444 638.6m² | 445 643.8m² | 446 640.7m² | 447 653.7m² | 453 707.4m² | 452 766.1m² | 451 740.4m² | 450 688.8m² | 428 663.5m² | 429 670.8m² | 430 611.5m² | 431 695.4m²

454 6030m² PROPOSED PUBLIC RESERVE

PROPOSED PATHWAY

2 DP709021 TSC OWNED PROPERTY CLASSIFIED AS "OPERATIONAL LAND"

59 DP792238 PUBLIC RESERVE

EASEMENT FOR WATER SUPPLY (G79367) OVER WHOLE OF LOT

EASEMENT FOR WATER SUPPLY (G227070) OVER WHOLE OF LOT

Scale in Metres - 1:500 AT A1

ALTITUDE ASPIRE

PLAN SHOWING PROPOSED SUBDIVISION LAYOUT & DESIGN CONTOURS

8 | 7 5 | 6 4 | 3

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STAGE 1

146
4.29ha

PROPOSED DRAINAGE RESERVE

PARKWAY

ZONE BOUNDARY

FUTURE BROADWATER

STAGE 1

SEWER PUMP STATION
STAGE 1

DP798632

DP798633

39
DP254416

610
(3.324ha)
3.422ha

PROPOSED DRAINAGE RESERVE

STAGE 6B

316 1017m² D
317 669.3m²
318 630.1m²
319 676.4m²
320 682.7m²
321 686.7m²
322 679.6m²
323 671.2m²
324 695.1m²

301 916.5m² D
302 900.2m² D
303 732.9m²
304 731.8m²
201 730.7m²
202 729.6m²
203 728.5m²
204 727.8m²
205 728.2m²

ROAD 8
14·5 WIDE
STAGE 3

314 551.8m²
313 569.2m²
312 580.7m²
311 517.5m²
310 513.8m²
309 611.8m²
308 511.5m²
307 622.4m²
306 525.9m²
305 626.3m²

315 523.2m²
219 595.7m²
218 703.8m²
220 660.8m²
221 661.5m²
222 551.3m²
223 551.3m²
224 661.5m²
225 551.3m²
226 661.5m²
227 551.3m²
228 686.9m²

ROAD 1
14·5 WIDE

ROAD 7
14·5 WIDE
STAGE 2

216 534.6m²
217 484.3m²
215 559.3m²
214 514.1m²
213 618.1m²
212 516.0m²
211 620.3m²
210 621.5m²
209 622.7m²
208 623.9m²
207 625.1m²
206 670.9m²

609 489.8m²
608
112
113

STAGE 6A

14·5 WIDE

DRIVE

FRASER

8
7 5
6 4
3

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ALTITUDE ASPIRE

PLAN SHOWING PROPOSED SUBDIVISION LAYOUT & DESIGN CONTOURS

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M.G.A.

LANE 17 WIDE

PARKES

STAGE 8A

STAGE 8B

STAGE 11

STAGE 7A

STAGE 6B

ROAD 2

ROAD 9

PROPOSED PATHWAY

816 640.2m²
817 640.2m²
818 640.2m²
819 2704m² PROPOSED PUBLIC RESERVE
820 1209m² D
1120 635.4m²
1119 578.9m²
1118 781.6m²
1117 788.7m²
1116 661.2m²
1115 573.8m²
1114 573.8m²
1113 627.0m²
1112 1237m² D
1102 670.4m²
1103 487.9m²
1104 529.7m²
1105 622.2m²
1106 870.6m² VP
1107 688.3m²
1108 672.5m²
1109 807.0m²
1110 726.9m²
1111 1269m² D
708 576.5m²
707 573.9m²
706 601.6m²
705 614.9m²
704 685.2m²
703 1414m² D
702 1428m² D
701 5443m²
610 (3.324ha) 3.422ha PROPOSED DRAINAGE RESERVE

RIGHT OF WAY (B473665)

MARKET PARADE

1 DP175234
36 DP737064
35 DP737064
34 DP737064
33 DP737064
21 DP737064
39 DP792238
20 DP737064
40 DP792238
19 DP737064
58 DP792238
59 DP792238 PUBLIC RESERVE
2 DP709021 TSC OWNED PROPERTY CLASSIFIED AS "OPERATIONAL LAND"

EASEMENT FOR WATER SUPPLY (G79367) OVER WHOLE OF LOT

EASEMENT FOR WATER SUPPLY (G227070) OVER WHOLE OF LOT

(985m²)

0m 10 20 30 40 50
Scale in Metres - 1:500 AT A1

ALTITUDE ASPIRE

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M.G.A.

1

DP175234

1009

ROAD 12

14·5 WIDE

122·69

STAGE 10

1001 554.5m²
1002 502.1m²
1003 502.1m²
1004 580.5m²
1005 502.1m²
1006 502.6m²
1007 546.4m²

912 570.4m²
913 502.1m²
914 502.1m²
915 580.5m²
916 502.1m²
917 502.6m²
918 562.3m²

ROAD 12

STAGE 9

ROAD 11

911 593.4m²
908 550.9m²
907 550.4m²
906 550.4m²
905 550.4m²
904 597.8m²

910 561m²

909 561m²
808 563.0m²
809 562.5m²
810 562.5m²
811 562.5m²
812 613.3m²

807 592.2m²

ROAD 10

STAGE 8A

1008 2997m²

712 4202m²

PROPOSED PATHWAY 45·0

901 573.8m²
902 573.8m²
903 540.0m²
814 540.0m²
813 616.4m²

711 3716m²

STAGE 7B

ROAD 12

FUTURE BROADWATER PARKWAY

ZONE BOUNDARY

STAGE 1

PROPOSED DRAINAGE RESERVE 146 4.29ha

713 3701m²

PROPOSED PUBLIC RESERVE

610 (3.324ha) 3.422ha

PROPOSED DRAINAGE RESERVE

STAGE 6B

701 5443m²

710 625.6m²
709 574.8m²
708 576.5m²
707 573.9m²

STAGE 7A

LANE

PARKES

17 WIDE

815 595.8m²
806 643.7m²
816 640.2m²
1120 635.4m²
817 640.2m²
1119 578.9m²

STAGE 8B

ROAD 9

805 533.4m²
804 612.8m²
803 612.8m²
802 588.3m²
801 617.0m²
1101 497.3m²
1102 670.4m²
1103 487.9m²
1104 529.7m²
1105 622.2m²
1106 870.6m² VP

STAGE 11

18 WIDE

17 WIDE

Scale in Metres - 1:500 AT A1

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CONSULTING SURVEYORS
ACN 010177236
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A QUALITY ASSURED COMPANY

ALTITUDE ASPIRE

M.G.A.

0m 10 20 30 40 50

Scale in Metres - 1:500 AT A1

227
DP755740

EASEMENT FOR TRANSMISSION LINE 15 WIDE AND VARIABLE WIDTH (DP642269)

STAGE 1

PROPOSED DRAINAGE RESERVE

146
4.29ha

ZONE

FUTURE

ARC82·905

PROPOSED LANDSCAPE BUFFER

BROADWATER

51·425

1
DP175234

1009
7535m²

17·535

ROAD 13

13 WIDE

12·43

11·87

12·43

7·22

4·245

STAGE 1

BOUNDARY

33·225

67·89

STAGE 10

122·69

14·5 WIDE

ROAD 12

712

PARKWAY

1008
2997m²

99·83

33·255

STAGE 7B

12·8

6·535

7·81

6·325

7·17

6·225

15·845

ARC11·38

713

49·625

7·87

5·28 7·8 15·57 15·57 18·0 15·57 15·585 7·55 5·28 5·28 5·28

Rev.	Description	By
O	13-3-19 Lot 701/610 & 713 amended	BDR
N	15-5-18 Stages 8A&8B added Stage 12 removed	BDR
M	14-2-18 Stage 6 amended/split	BDR
L	29-1-18 Staging amended/Lot numbers amended	BDR
K	8-11-17 Lots 707-712, 801, 802, 811, 812 Amended Pump Sta Added	BDR
J	15-9-17 Lots 802, 823, 832, 840, 912, 918 Amended	BDR
H	14-9-15 Entry Road and Lots Amended/Lot 501	BDR
G	12-2-15 Zonings updated	BDR
F	3-2-15 Res.Lot removed, Entry Lots amended	BDR
E	12-6-14 Truncations / Lots 815-817 & 832	BDR
D	18-7-13 Layout amended	BDR
Revision		Chk

Associate Consultant:
BRADLEES CONSULTING ENGINEERS

8
7 5
6 4
3

ALTITUDE
ASPIRE

PLAN SHOWING
PROPOSED SUBDIVISION LAYOUT
& DESIGN CONTOURS

IMPORTANT NOTES :

THE PROPOSED BOUNDARIES AS SHOWN HEREON ARE PRELIMINARY ONLY AND ARE SUBJECT TO FINAL DESIGN, LOCAL AUTHORITY APPROVAL AND REGISTRATION IN THE DEPARTMENT OF LANDS.

DESIGN CONTOURS SHOWN HEREON ARE PER INFORMATION SUPPLIED BY BRADLEES CONSULTING ENGINEERS.

D - DENOTES POTENTIAL DUPLEX LOT

VP - DENOTES PROPOSED RESTRICTION ON USE OVER THE LOT, REQUIRING ONE OFFSTREET CARPARK IS TO BE PROVIDED.

PROPOSED STAGING

STAGE 1 LOTS 101 - 146 (INCLUDES DRAINAGE RESERVE & PUMP STATION LOT) NOTE-LOT 144 IS STAGE 1 RESIDUE LOT
STAGE 2 LOTS 201 - 228 STAGE 3 LOTS 301 - 324
STAGE 4A LOTS 401 - 427
STAGE 4B LOTS 428 - 454 (INCLUDES 1 PUBLIC RESERVE)
STAGE 5 LOTS 501 - 521
STAGE 6A LOTS 601 - 609 STAGE 6B LOT 610 (DRAINAGE RESERVE)
STAGE 7A LOTS 701 - 710 (INCLUDES 1 MEDIUM DENSITY SITE)
STAGE 7B LOTS 711 - 713 (INCLUDES 2 MEDIUM DENSITY SITES, & 1 PUBLIC RESERVE)
STAGE 8A LOTS 801 - 814 STAGE 8B LOTS 815-820 (INCLUDES 1 PUBLIC RESERVE) STAGE 9 LOTS 901 - 918
STAGE 10 LOTS 1001-1009 (INCLUDES 2 MEDIUM DENSITY LOTS)
STAGE 11 LOTS 1101-1120

TOTALS - 251 RESIDENTIAL LOTS 5 MEDIUM DENSITY LOTS
3 PUBLIC RESERVES 2 DRAINAGE RESERVES

PROPOSED SUBDIVISION

LOT 1 IN DP304649, LOT 1 IN DP175235,
LOT 2 IN DP778727, LOT 1 IN DP781687,
LOT 1 IN DP781697, LOT 1 IN DP169490,
LOTS 40 & 43 IN DP254416
FOR NEWLAND DEVELOPERS PTY LTD

Parish of TERRANORA County of ROUS

P:\TWEED\15263\projects\187798-0.pro

SCALE	Level DATUM	F.Bk	L.Bk	Drawn BDR/RXP	Chk'd BDR	REF. No.	DATE	DRAWING No./Size	Sheet	Of	Rev.
1:500 AT A1 1:1000 AT A3	-	-	-			T15263	19·1·2012	18779 B	8	8	0

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ANNEXURE B

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Web www.meinhardt.com.au
Web www.meinhardtgroup.com

Our Ref: 09-374 GC:BL
Your Ref: DA09/0701.03 LN 35979

27 March 2019

The CEO
Tweed Shire Council
PO Box 816
MURWILLUMBAH NSW 2484

ALTITUDE ASPIRE
Development Application DA09/0701.03 – amendment to Development Consent Application DA09/0701
Response to Council Letter 27th September 2018

We refer to Council's letter dated 27th September 2018, addressed to NSW Department of E-Planning and Environment regarding comments and responses associated with the above.

We provide further responses to such comments in Council's letter 27th September 2018, using the same referencing headings as Councils letter, as follows:

(i) Schedule 1 and Specific Consent Conditions

- A3 (Dot point 1), amended plans SK3591 to 3594 and SK3609 to3611 are current drawings relevant to Market Parade and Parkes Lane. Please discard any other drawings. Refer to attachment A for a complete list of sketch drawings
- A3 (dot point 2), amended sketch plan SK3626, revision F is the current version of that plan. All other references are to be discarded. Please refer to attachment A for a complete list of sketch drawings.
- A3 (Dot point 3) Sketch plan SK3617 revision H is attached and has been amended to accord with Council email dated 14th February 2109, Denise Galle to Emma Butcher DEP. Please refer to attachment A for a complete list of Sketch drawings.

(ii) Engineering Submission and amended engineering plans by Meinhardt Urban

Central Drainage Corridor Re-design

(e) **Maintenance Access for the Main Drainage channel**
Councils comments are noted, and both engineering and BIOME Drainage Report have been amended to include "reno mattresses" to enable Council requirements for accessibility to be satisfied.
Refer attachment A for sketch drawings.

Dual Use Access
Councils comments in relation to maintenance vehicles and public pedestrian access are noted. Engineering drawings have been amended, following discussions with Council Officers to clarify their requirements to satisfactorily address this issue, given that in some circumstances, separation of maintenance vehicle access and public pedestrian access is unavoidable.
The concrete footpath that links the main central path with the maintenance track for Basin B has been deleted, as requested in Councils letter.

Refer attachment A for sketch drawings.

(o) Market Parade Culvert Headwall
In relation to Council comments associated with 'visual enhancement' for the above, please find attached sketch SK3487 rev E, dated 6th February 2019 together with FORM landscape Architects – landscape sections dated 14th February 2019. Refer Attachment C Council should note the culvert headwalls will be constructed using rock filled gabion baskets. Hopefully Council will view the rock filled gabion baskets, as depicted on the attached drawings as satisfying their criteria for 'soft façade', 'decorative finish' and 'graffiti proof'.
Refer to attachment A for sketch drawings.

Bio-retention Basin and drainage Reserve Design Report by BIOME – July 2018
BIOME has provided responses to Council comments as shown in their Summary table Dropbox attached, together with their amended hydraulic report, "Bio-retention Basin and Drainage Reserve Design Report", Version 4, Project No. BC-16099, dated March 2019. Refer attachment B.

Landscape Master Plan (26.7.2018) and covering letter by FORM (19.7.2018)
Refer FORM Landscape response to RFI issues together with their suite of amended drawings which are submitted as a separate package.

Bushfire Hazard Assessment Lot 610 Drainage Reserve
Refer to amended Bushfire Management Plan, prepared by Peter Thornton – BCA Check Pty Ltd, Bushfire Certifiers, which is submitted as a separate package.

Macadamia Tetraphylla Translocation Plan – July 2018 and Revised Ecological Assessment July 2018.
Refer to JWA Translocation Plan. However, we note that Meinhardt cut/fill sketch drawing SK6524 Revision D, shows all individual plants referred to in the JWA Translocation plan.

Other Matters requiring attention: -

- We note Council's request for Updated Sewer Layout plans, where sewerage infrastructure is proposed to be relocated as a result of retaining walls.
  Please be advised that the only location where sewerage infrastructure is to be relocated as a consequence of the above is in the vicinity of lot 701 in Central Drainage reserve. Accordingly, our sketch drawing SK6978 Revision A shows amended sewer alignments.
- In relation to Councils request to demonstrate proposed stormwater west of the existing sewer pumping station does not impact the sewerage infrastructure, we again refer to our sketch drawing SK6978 Revision A, showing sewerage infrastructure west of the pumping station together with the trunk sewer longitudinal section. The long section demonstrates clearly that the trunk sewer does not clash with any proposed stormwater. The trunk sewer passes under the major cross drainage culverts in Broadwater Parkway with approximately 700-800mm clearance and approximately 500mm clearance to proposed 600mm diameter stormwater pipes at approximate drainage 100.

Other Conditions Required as Part of Proposed Modification include:

- We note Councils comments, in relation to the provision of wider easements where retaining walls are proposed to be parallel to the sewer and stormwater infrastructure.

- Further, we also note Council's criteria that rock retaining walls and large tree plantings shall not be located over water or sewer easements.
  In relation to these matters, we suggest that such detail be the subject of scrutiny at the time of lodging detail CC Construction drawings.

We trust you will find the RFI response, in relation to engineering (Meinhardt) related matters satisfactory.

Yours faithfully
MEINHARDT



Brian Lees
Project Director

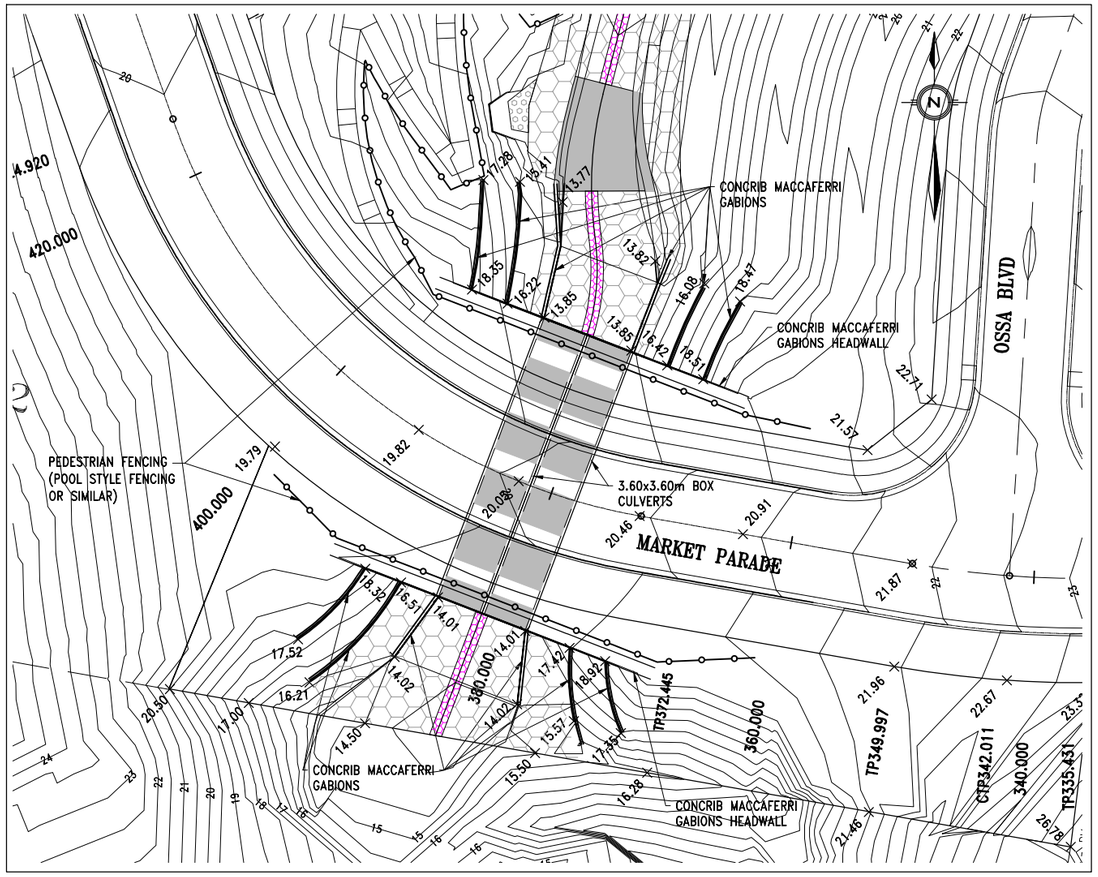
ATTACHMENT A

Meinhardt Urban Drawings List

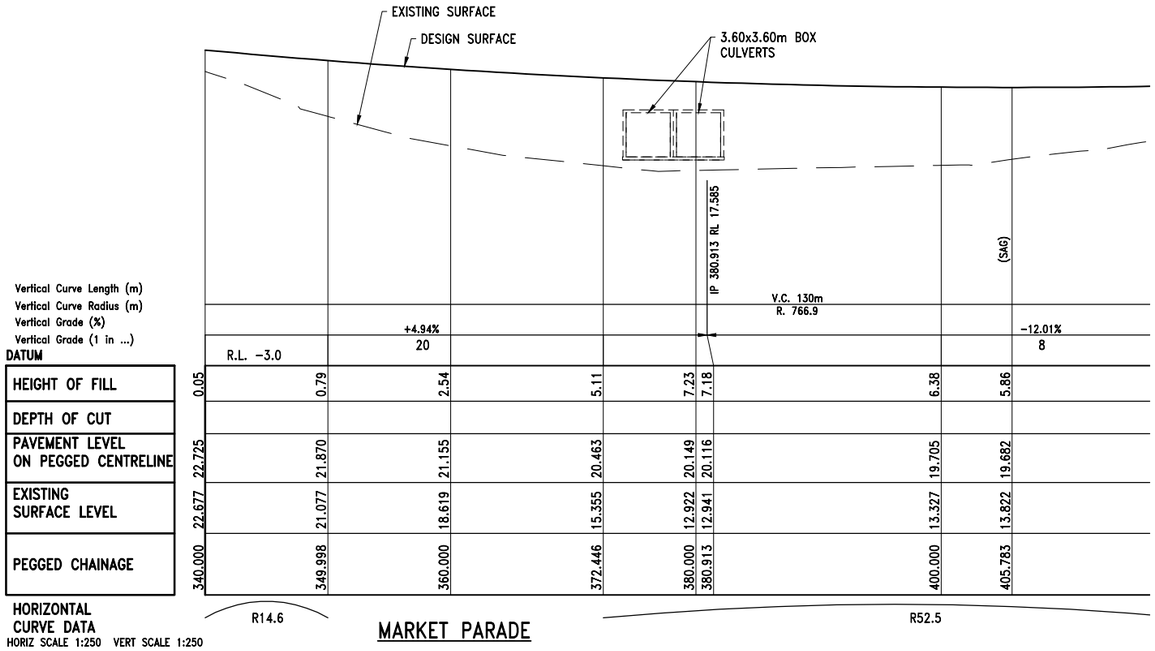
ATTACHMENT A

Meinhardt Urban Drawings List

DRAWING No.	REVISION	DRAWING TITLE
SK3487	F	BOX CULVERT SECTIONS
SK3591	C	ROAD 2 (MARKET PARADE) CROSS SECTIONS - SHEET 1 OF 5
SK3592	C	ROAD 2 (MARKET PARADE) CROSS SECTIONS - SHEET 2 OF 5
SK3593	C	ROAD 2 (MARKET PARADE) CROSS SECTIONS - SHEET 3 OF 5
SK3594	C	ROAD 2 (MARKET PARADE) CROSS SECTIONS - SHEET 4 OF 5
SK3609	C	ROAD 10 (MAWSONS PEAK BLVD & PARKES LANE) LONGITUDINAL SECTION
SK3610	C	ROAD 10 (MAWSONS PEAK BLVD & PARKES LANE) CROSS SECTIONS - SHEET 1 OF 2
SK3611	C	ROAD 10 (MAWSONS PEAK BLVD & PARKES LANE) CROSS SECTIONS - SHEET 2 OF 2
SK3617	H	RETAINING WALL LAYOUT
SK3618/1	H	CENTRAL OPEN DRAIN SWALE PLAN - SHEET 1 OF 3
SK3618/2	H	CENTRAL OPEN DRAIN SWALE PLAN - SHEET 2 OF 3
SK3618/3	H	CENTRAL OPEN DRAIN SWALE PLAN - SHEET 3 OF 3
SK3619	E	CENTRAL OPEN DRAIN SWALE LONG SECTION
SK3620	F	CENTRAL OPEN DRAIN SWALE CROSS SECTIONS - SHEET 1 OF 6
SK3621	F	CENTRAL OPEN DRAIN SWALE CROSS SECTIONS - SHEET 2 OF 6
SK3622	F	CENTRAL OPEN DRAIN SWALE CROSS SECTIONS - SHEET 3 OF 6
SK3623	F	CENTRAL OPEN DRAIN SWALE CROSS SECTIONS - SHEET 4 OF 6
SK3624	F	CENTRAL OPEN DRAIN SWALE CROSS SECTIONS - SHEET 5 OF 6
SK3625	F	CENTRAL OPEN DRAIN SWALE CROSS SECTIONS - SHEET 6 OF 6
SK3626	F	WATER QUALITY TREATMENT AREAS
SK4038	E	CENTRAL OPEN SWALE DRAIN BUND
SK4554	F	ROAD NAMES PLAN
SK6524	D	WEST BOUNDARY EARTHWORKS EXTENT
SK6525	C	WEST BOUNDARY ROADS CROSS SECTIONS EXTENT - SHEET 1 OF 4
SK6526	C	WEST BOUNDARY ROADS CROSS SECTIONS EXTENT - SHEET 2 OF 4
SK6527	B	WEST BOUNDARY ROADS CROSS SECTIONS EXTENT - SHEET 2 OF 4
SK6528	C	WEST BOUNDARY ROADS CROSS SECTIONS EXTENT - SHEET 4 OF 4
SK6460	B	EXTENT OF MAWSONS PEAK BLVD-TOWNSEND CRESCENT ROUNDABOUT WORKS
SK6596	D	PROPOSED STAGING UPDATES
SK6622	C	AREAS OF PROPOSED CHANGES FOR CONSENT MODIFICATION 3
SK6978	A	LOT 610 SEWER RETICULATION PLAN AND TRUNK SEWER LONG. SECTION



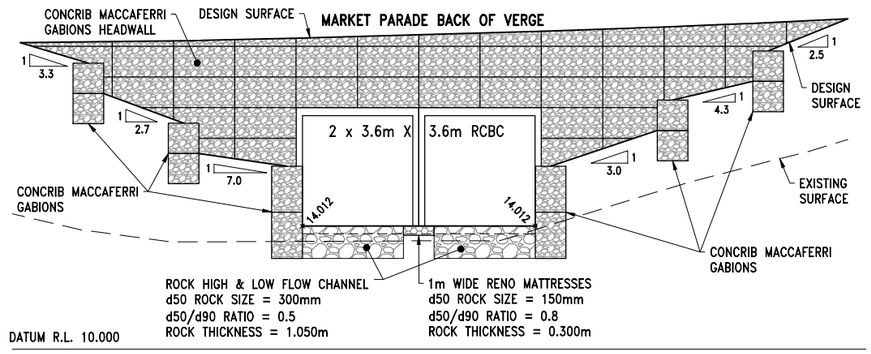
BOX CULVERT SECTIONS LAYOUT
SCALE 1:250



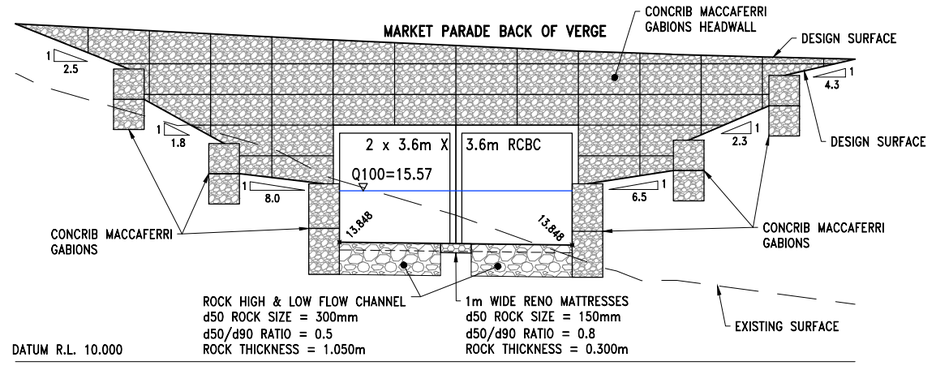
Vertical Curve Length (m)								
Vertical Curve Radius (m)								
Vertical Grade (%)						+4.94%		-12.01%
Vertical Grade (1 in ...)						20		8
DATUM								
HEIGHT OF FILL	0.05	0.79	2.54	5.11	7.23 / 7.18	6.38	5.86	
DEPTH OF CUT								
PAVEMENT LEVEL ON PEGGED CENTRELINE	22.725	21.870	21.155	20.463	20.149 / 20.116	19.705	19.682	
EXISTING SURFACE LEVEL	22.677	21.077	18.619	15.355	12.922 / 12.941	13.327	13.822	
PEGGED CHAINAGE	340.000	349.998	360.000	372.446	380.000 / 380.913	400.000	405.783	
HORIZONTAL CURVE DATA								

HORIZ SCALE 1:250 VERT SCALE 1:250

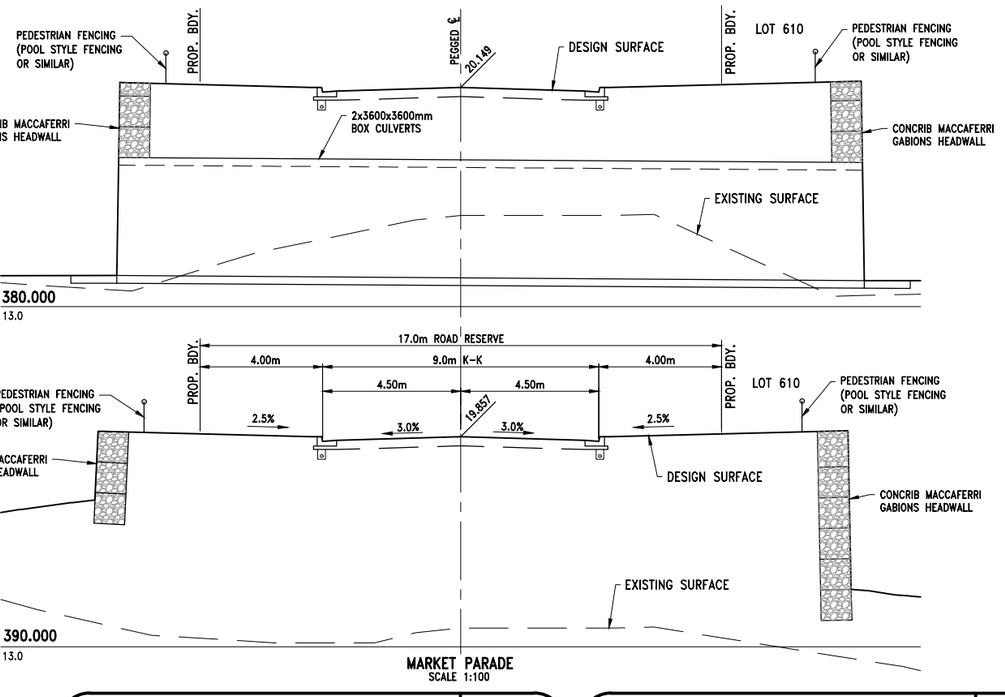
MARKET PARADE



MARKET PARADE CULVERT UPSTREAM WALL
SCALE 1:100



MARKET PARADE CULVERT DOWNSTREAM WALL
SCALE 1:100



MARKET PARADE
SCALE 1:100

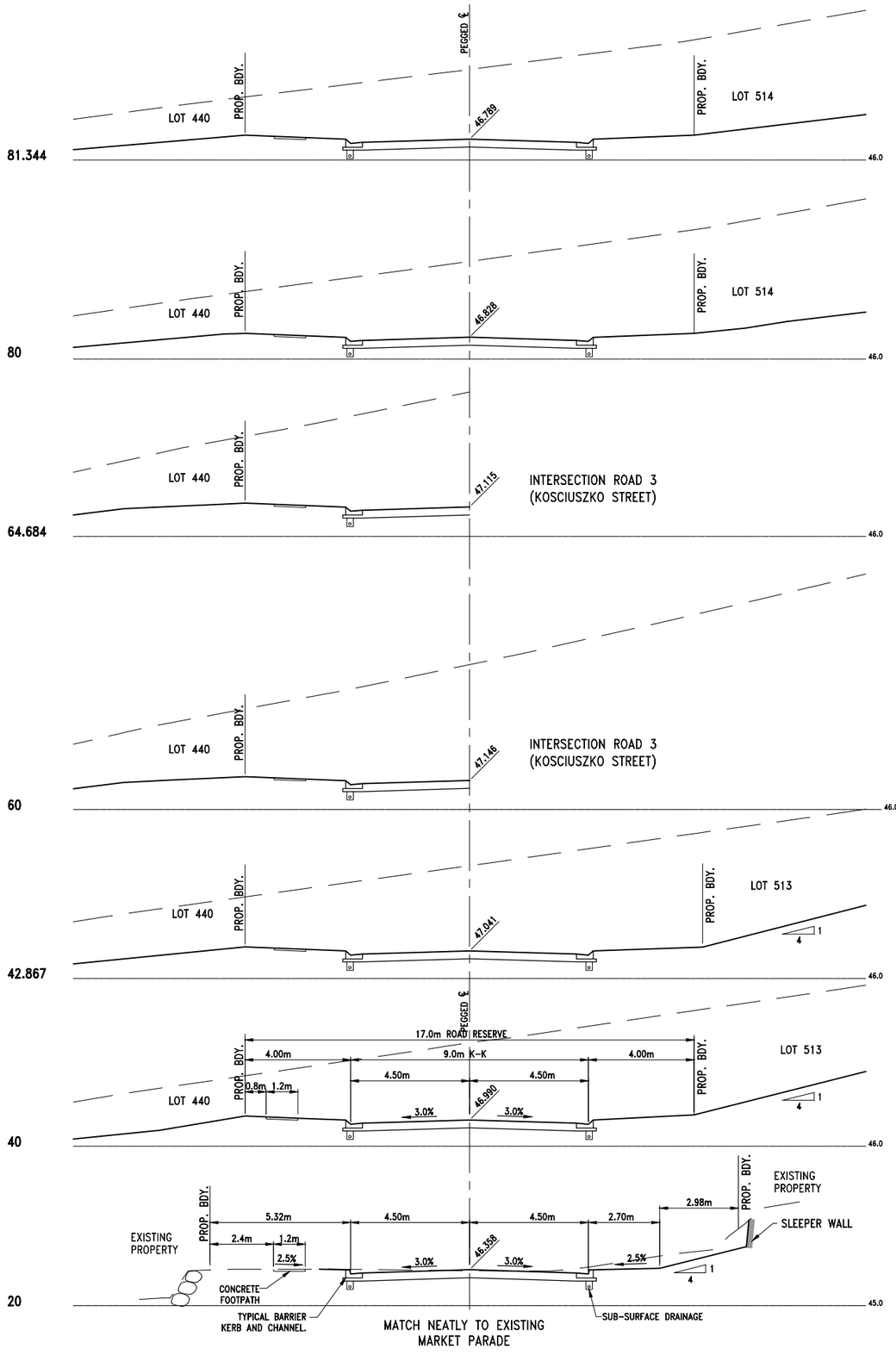
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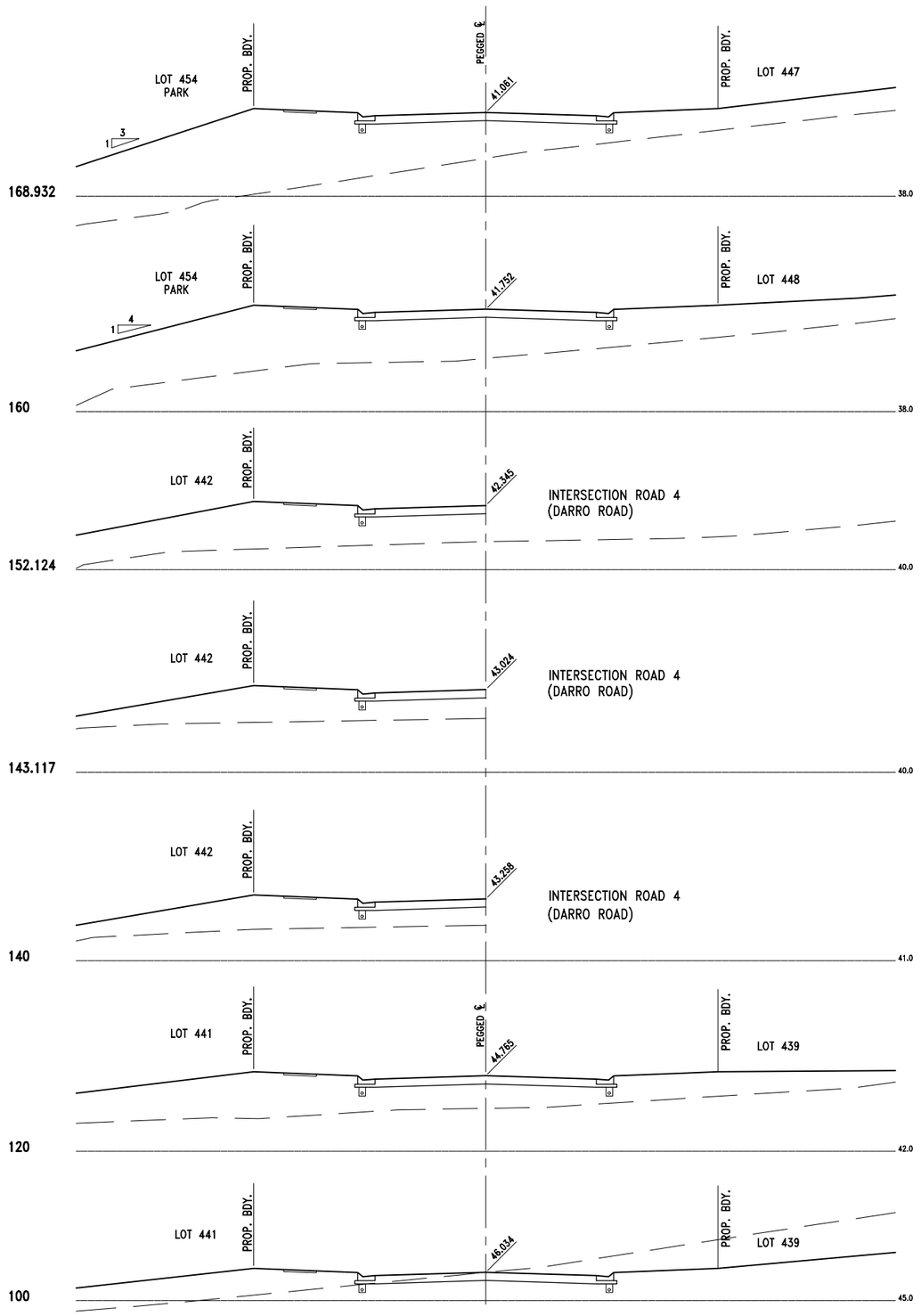
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NEWLAND DEVELOPERS PTY LTD	09-374 06-02-2019
ALTITUDE ASPIRE BOX CULVERT SECTIONS	SK 3487 REVISION F

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Bradlees Civil Consulting

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REGN. NO. 253

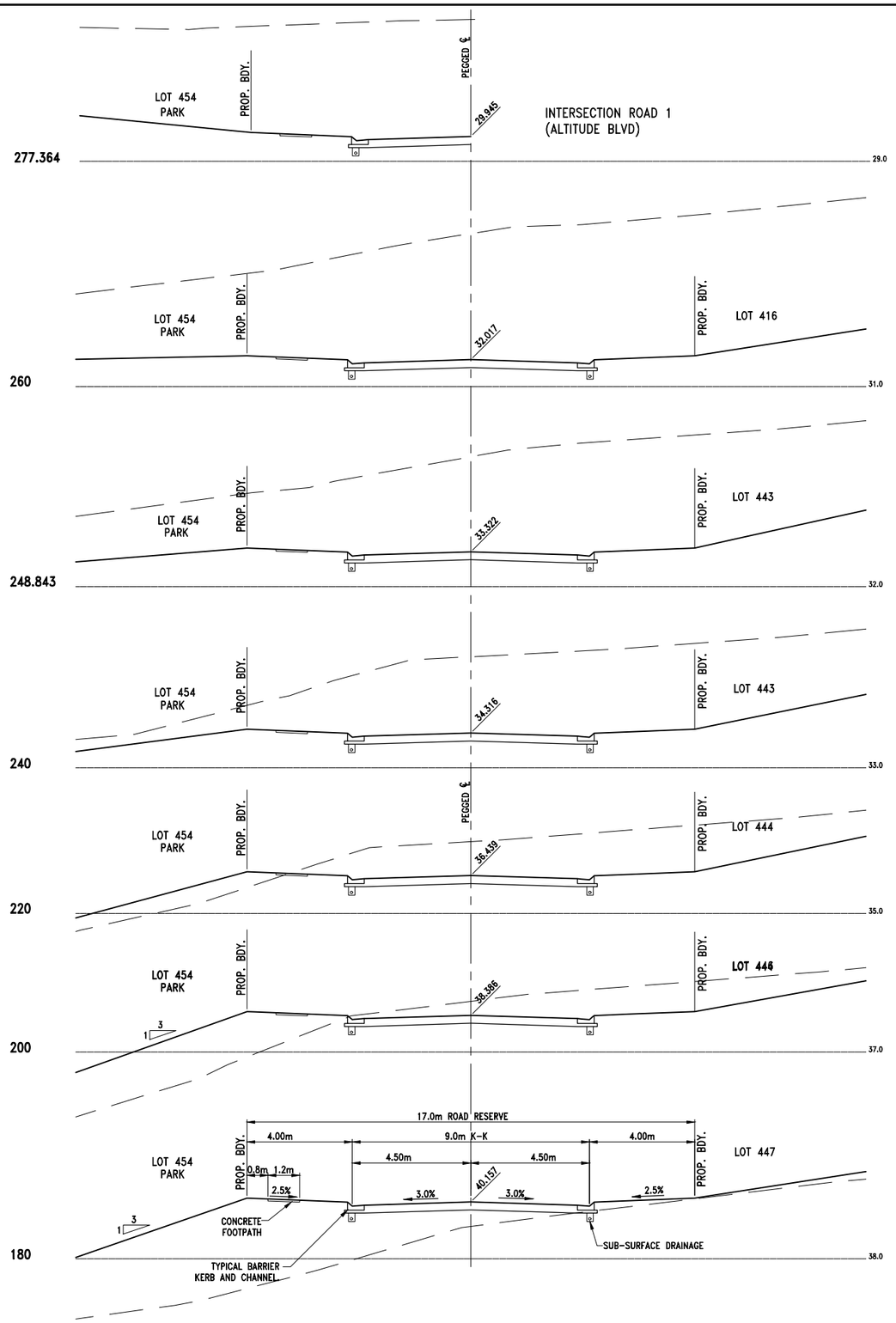


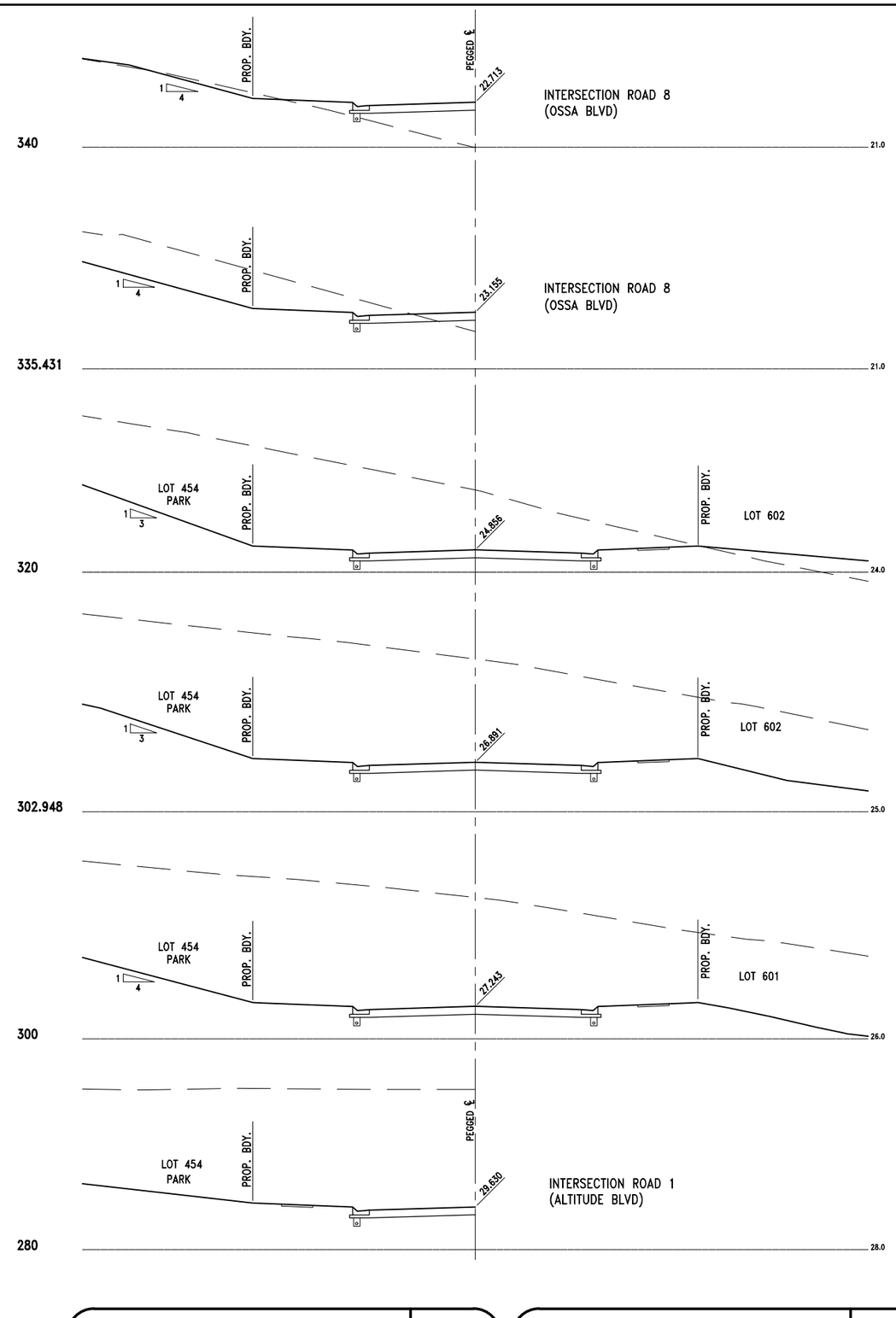


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NEWLAND DEVELOPERS PTY LTD	09-374 24-07-2018
TERRANORA PRECINCT 1 ROAD 2 (MARKET PARADE) CROSS SECTIONS – SHEET 1 OF 5	SK 3591 REVISION C

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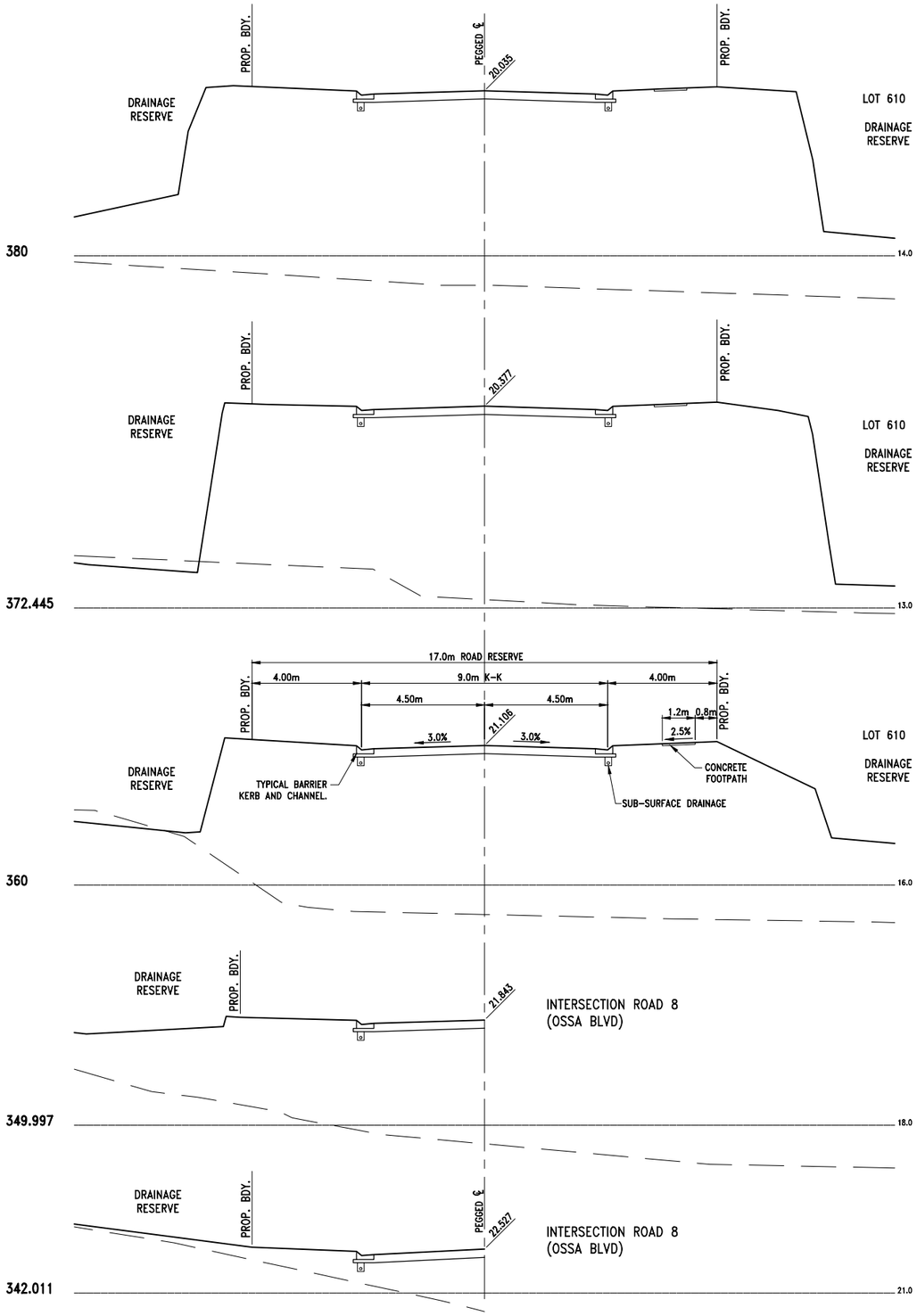


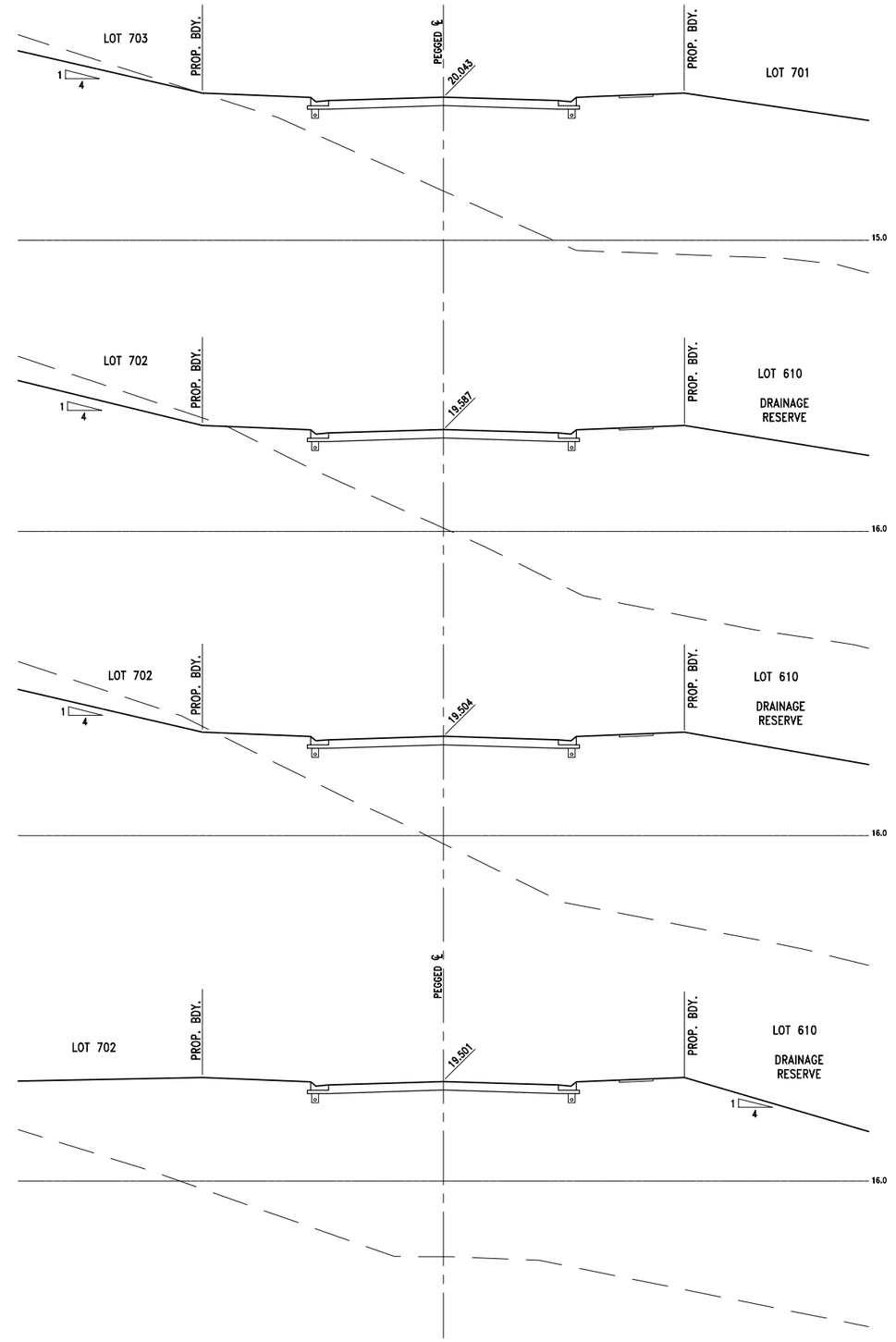


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NEWLAND DEVELOPERS PTY LTD	09-374 24-07-2018
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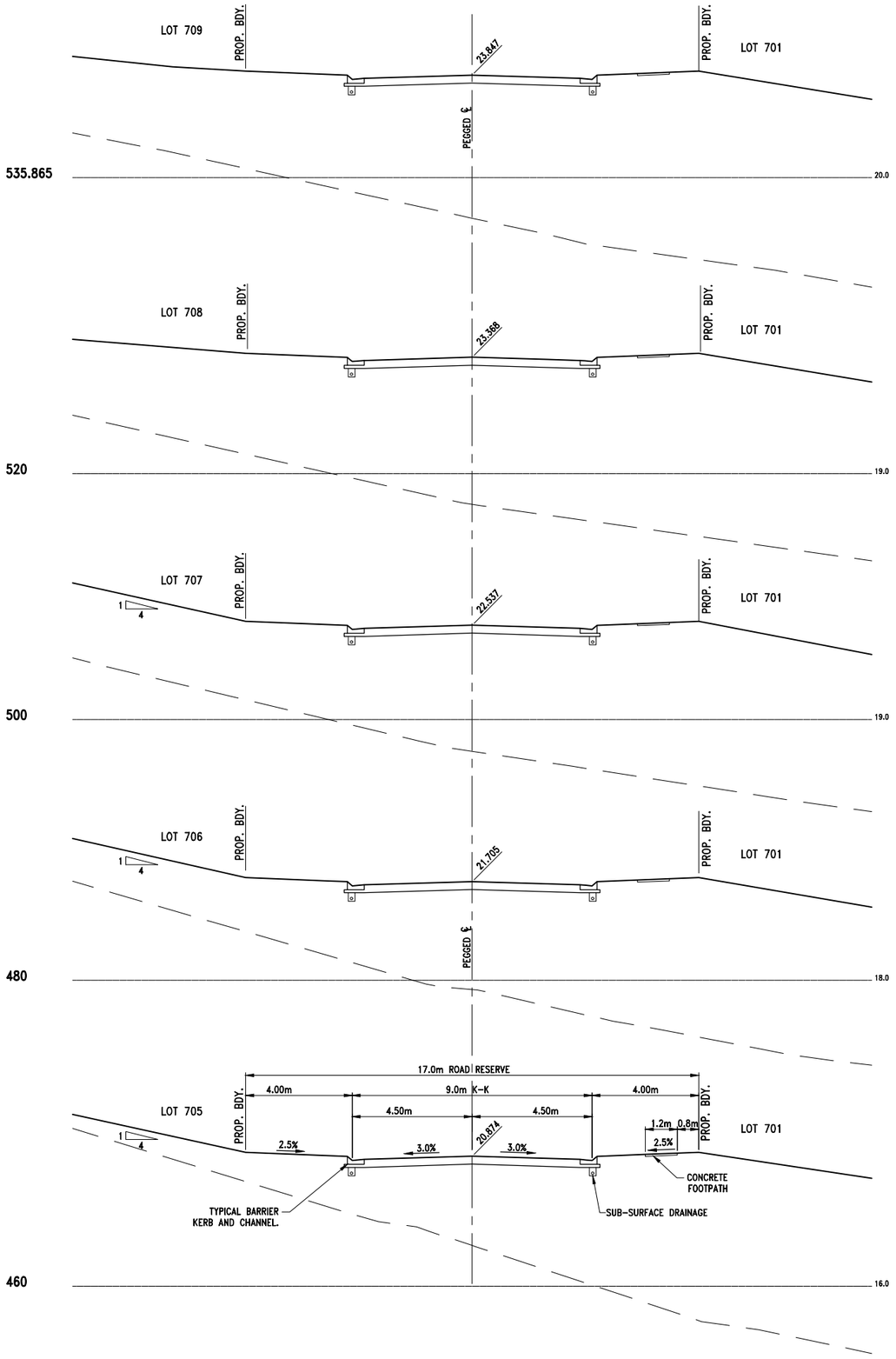
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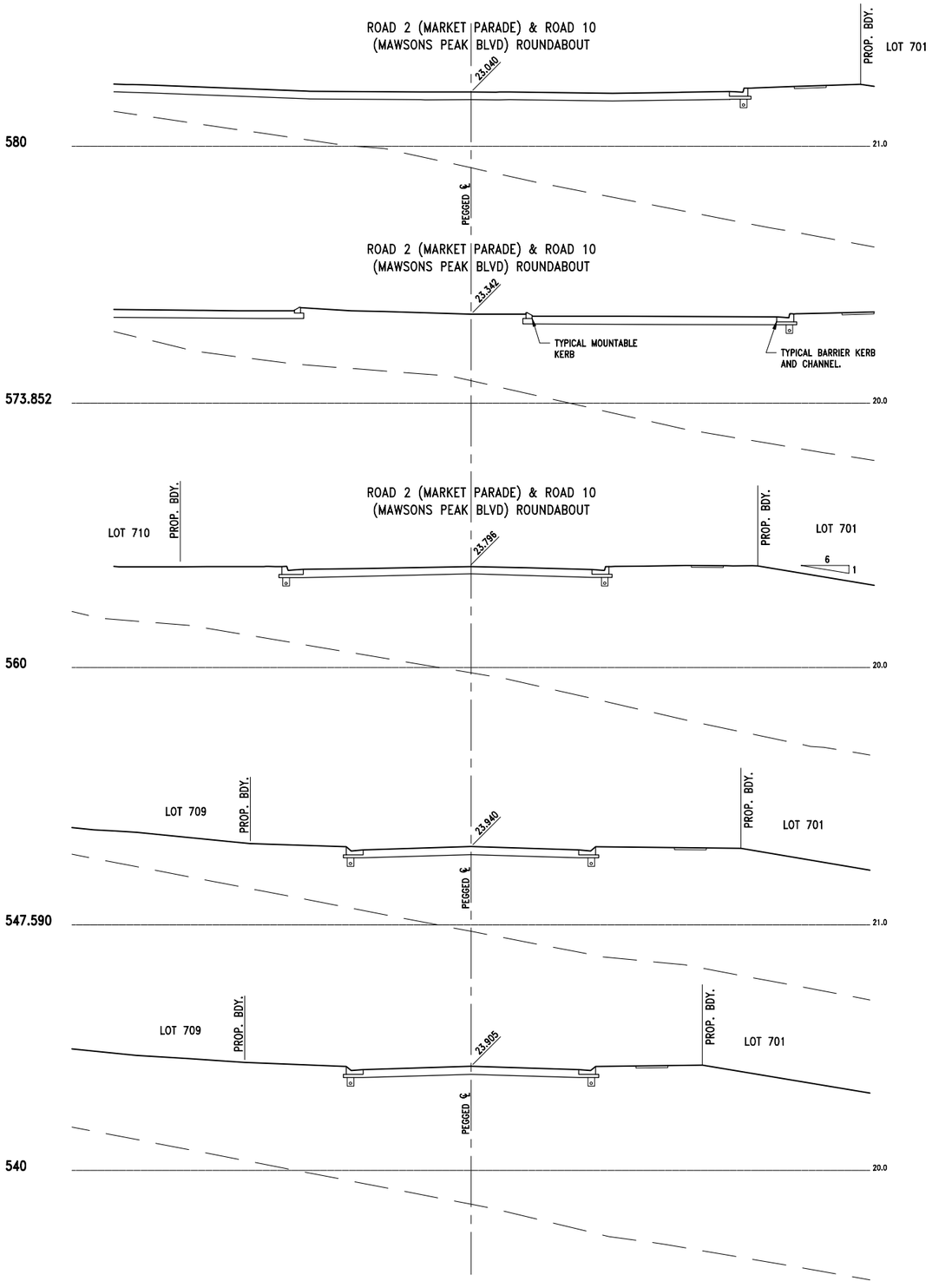
NEWLAND DEVELOPERS PTY LTD	09–374 24–07–2018
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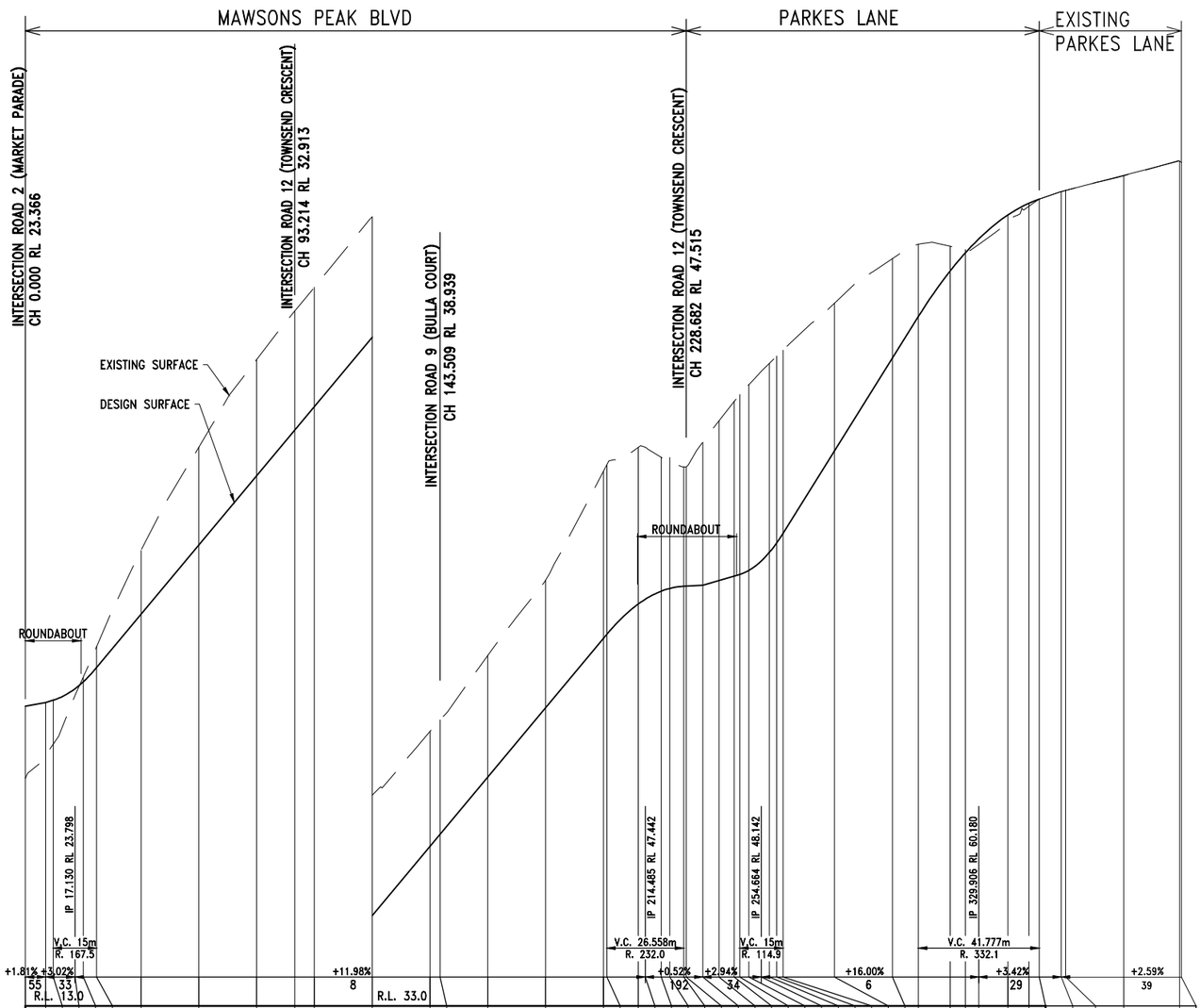


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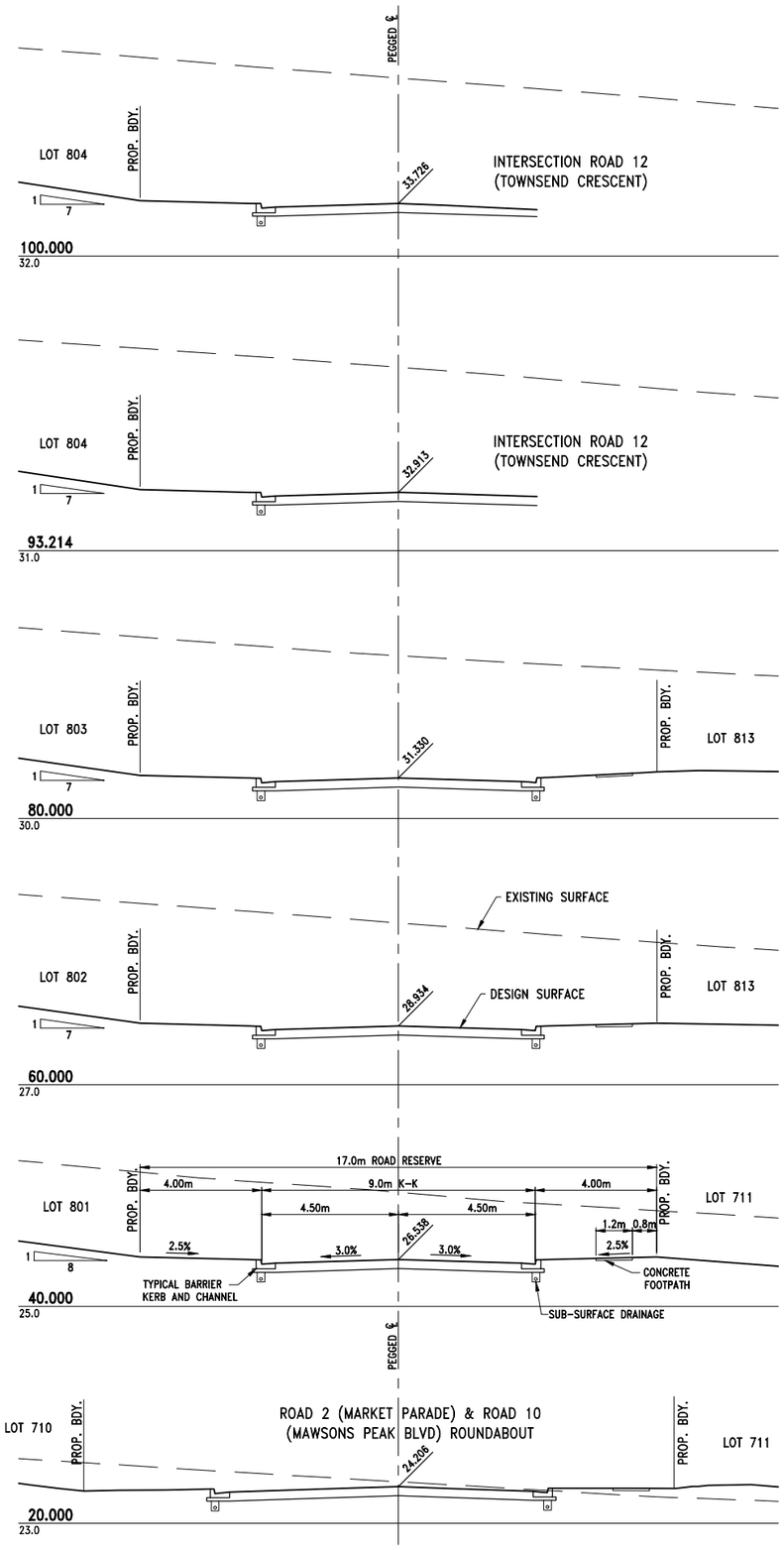
NEWLAND DEVELOPERS PTY LTD	09-374 24-07-2018
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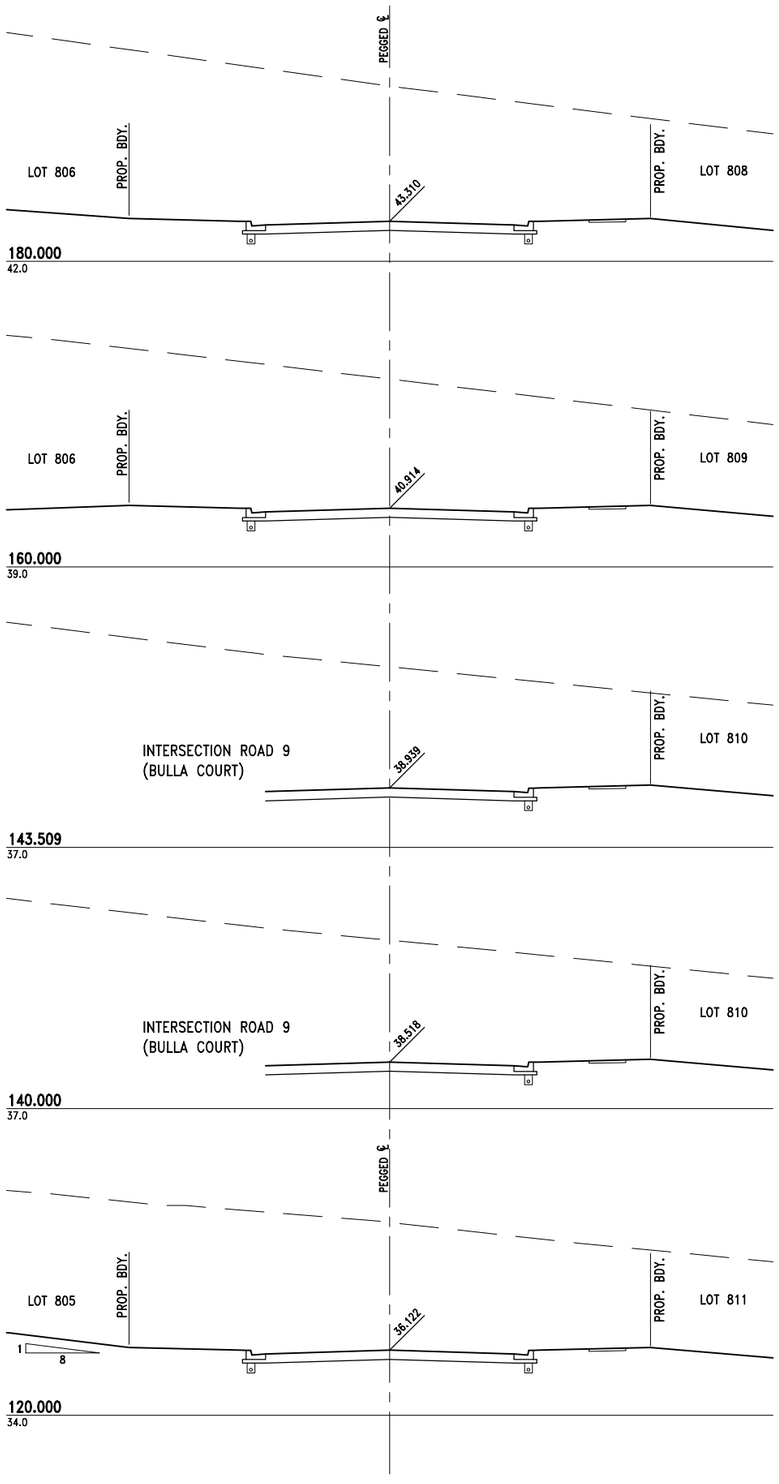
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Bradlees Civil Consulting

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QUALITY ASSURED COMPANY
AS/NZS ISO 9001:2008
REGN. NO. 233


MAWSONS PEAK BLVD
PARKES LANE
EXISTING PARKES LANE
INTERSECTION ROAD 2 (MARKET PARADE) CH 0.000 RL 23.366
INTERSECTION ROAD 12 (TOWNSEND CRESCENT) CH 93.214 RL 32.913
INTERSECTION ROAD 9 (BULLA COURT) CH 143.509 RL 38.939
INTERSECTION ROAD 12 (TOWNSEND CRESCENT) CH 228.682 RL 47.515
EXISTING SURFACE
DESIGN SURFACE
ROUNDABOUT
ROUNDABOUT
IP 17.130 RL 23.798
IP 214.485 RL 47.442
IP 254.664 RL 48.142
IP 329.906 RL 60.180
V.C. 15m R. 167.5
V.C. 26.558m R. 232.0
V.C. 15m R. 114.9
V.C. 41.777m R. 332.1
+1.81%
+3.02%
+11.98%
+0.52%
+2.94%
+16.00%
+3.42%
+2.59%
55
33
8
192
34
6
29
39
R.L. 13.0
R.L. 33.0

| | | |

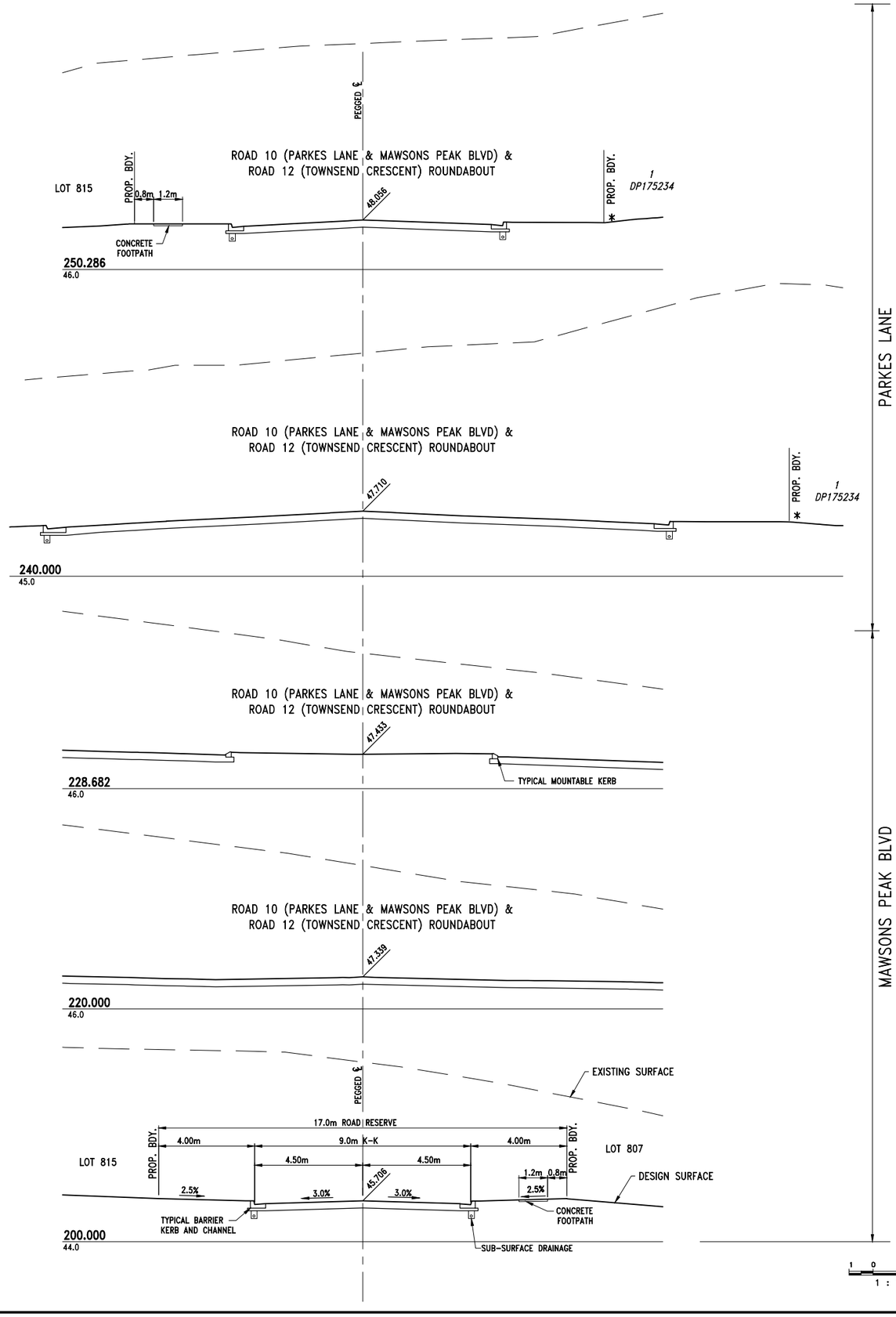




1 0 1 2 3 4 5m
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NEWLAND DEVELOPERS PTY LTD	09-374 24-07-2018
TERRANORA PRECINCT 1 ROAD 10 (MAWSONS PEAK BLVD) CROSS SECTIONS - SHEET 1 OF 2	SK 3610 REVISION C

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REGN. NO. 233



* REFER TO SKETCHES SK6524 TO SK6528 FOR EARTHWORKS LIMITS.

NEWLAND DEVELOPERS PTY LTD	09-374 24-07-2018
TERRANORA PRECINCT 1 ROAD 10 (MAWSONS PEAK BLVD & PARKES LANE) CROSS SECTIONS – SHEET 2 OF 2	SK 3611 REVISION C

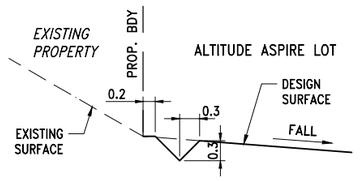
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LEGEND

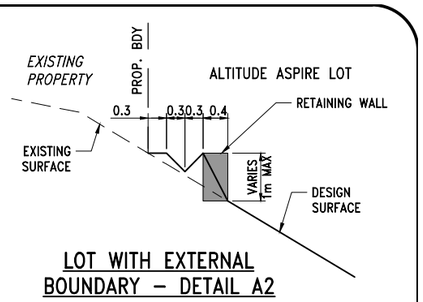
- 15 — FINISHED SURFACE CONTOURS
- LIMITS OF EARTHWORKS
- WALL 1.5m HIGH (MAX)
- WALL 1m HIGH (MAX)

NTS



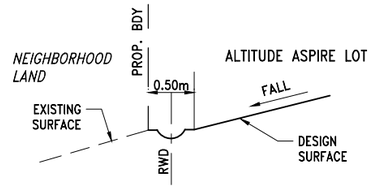
LOT WITH EXTERNAL BOUNDARY – DETAIL A1

SCALE: NTS



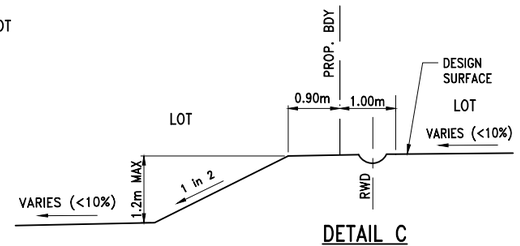
LOT WITH EXTERNAL BOUNDARY – DETAIL A2

SCALE: NTS



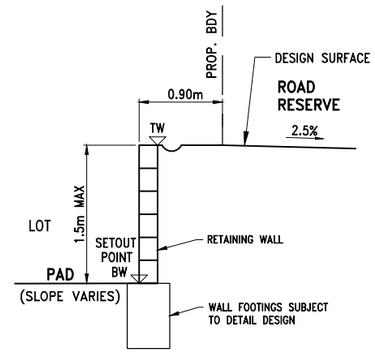
LOT WITH EXTERNAL BOUNDARY – DETAIL B

SCALE: NTS



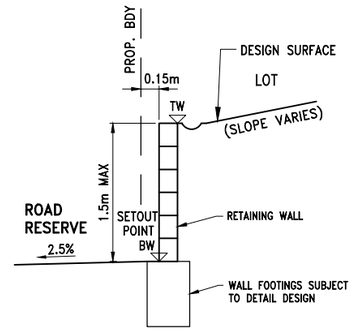
DETAIL C

SCALE: NTS



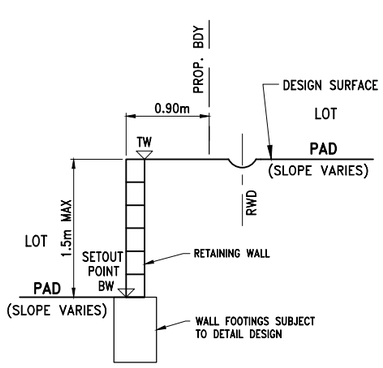
TYPICAL SIDE BOUNDARY DETAIL G

SCALE: NTS



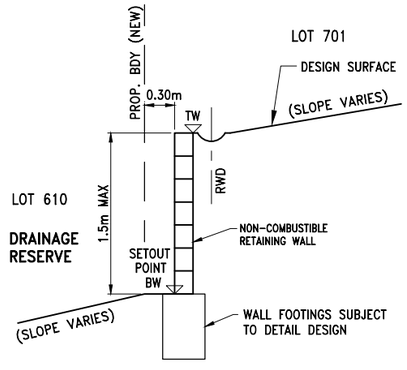
TYPICAL SIDE & ROAD RESERVE BOUNDARY – DETAIL F

SCALE: NTS



TYPICAL SIDE BOUNDARY DETAIL D

SCALE: NTS



TYPICAL SIDE & REAR BOUNDARY LOT 701 – DETAIL E

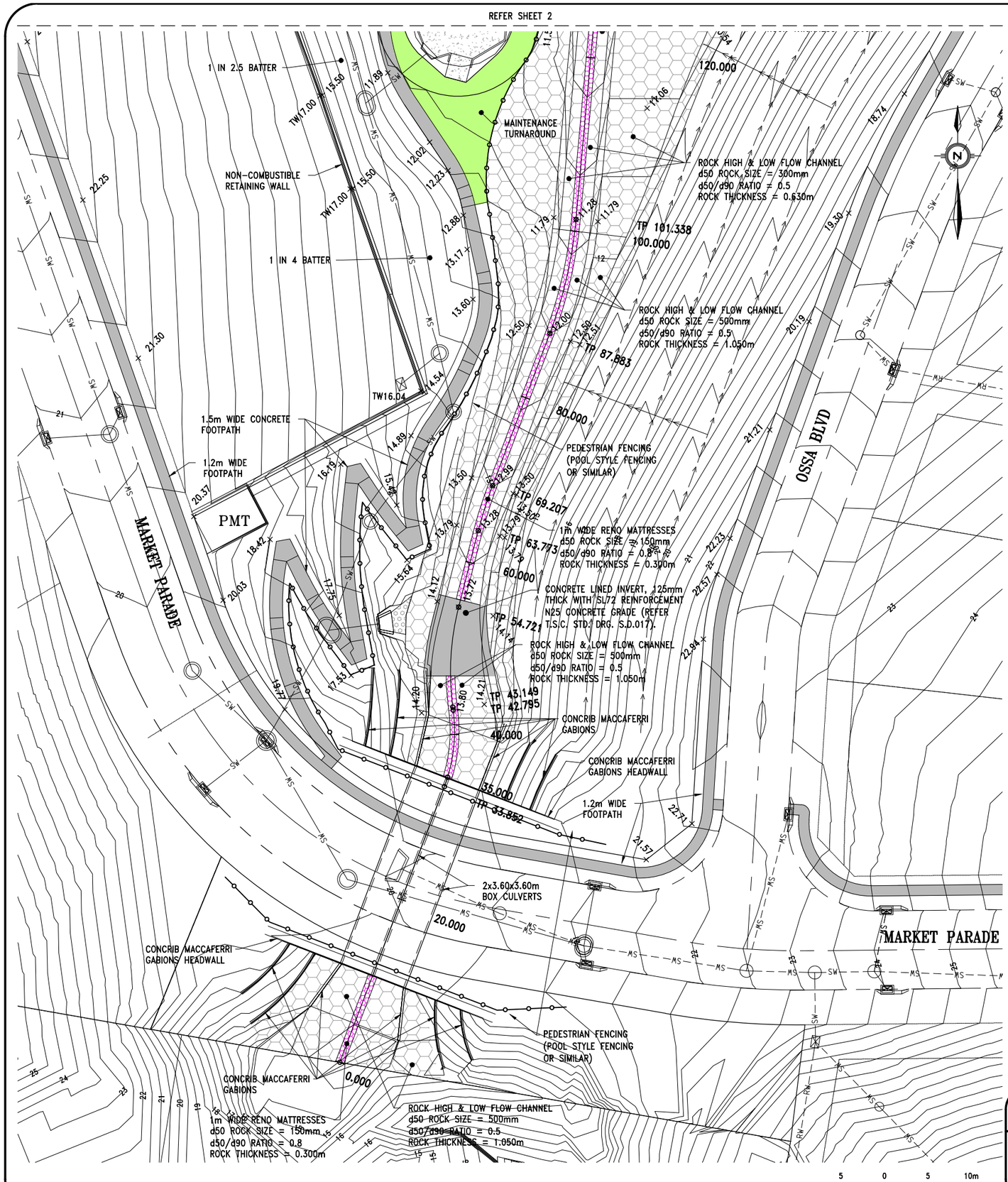
SCALE: NTS

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 RETAINING WALL LAYOUT	SK 3617 REVISION H

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NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE PLAN SHEET 1 OF 3	SK3618/1 REVISION H

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REFER SHEET 3

610

PROPOSED DRAINAGE RESERVE

ROCK LOW FLOW CHANNEL
d50 ROCK SIZE = 300mm
d50/d90 RATIO = 0.5
ROCK THICKNESS = 0.630m

1m WIDE RENO MATTRESSES
d50 ROCK SIZE = 150mm
d50/d90 RATIO = 0.8
ROCK THICKNESS = 0.300m

ROCK PROTECTION. 400mm DIA NOMINAL ROCK SIZE.

ROCK WEIR, BUND, SPILLWAY AND LEVEL SPREADER
d50 ROCK SIZE = 300mm
d50/d90 RATIO = 0.5
ROCK THICKNESS = 0.630m

MAINTENANCE TURNAROUND

COMBINED 3.0m WIDE ACCESS TRACK AND 1.5m WIDE, 150mm DEPTH WITH SL72 REINFORCEMENT N25 CONCRETE FOOTPATH (REFER TSC. STD. DRG. S.D.013). BALANCE OF ACCESS TRACK SURFACE TO BE GRASS-CEL POROUS TURF.

1.5m WIDE CONCRETE FOOTPATH

ROCK PROTECTION. 200mm DIA NOMINAL ROCK SIZE.

PEDESTRIAN FENCING (POOL STYLE FENCING OR SIMILAR)

1 IN 3 BATTER

1 IN 2.5 BATTER

1 IN 2 BATTER

BATTER/BERM DRAINAGE

3m WIDE ACCESS TRACK RL 11.50

3m WIDE ACCESS TRACK AND FOOTPATH RL 12.00

NON-COMBUSTIBLE RETAINING WALL

SEDIMENT FOREBAY 2A

SEDIMENT FOREBAY 1A

BASIN A
RL=11.10
AREA=1250m²

BUND RL 9.00

3x2.1x0.9m BOX CULVERTS

GRASS-CEL POROUS TURF SURFACE

BOARDWALK AS PER LANDSCAPE ARCHITECT DRAWINGS.

1 IN 3.2 BATTER

BASIN A GROUTED ROCK WEIR AND SPILLWAY.
150mm DIA NOMINAL ROCK SIZE.

VEGETATION HIGH FLOW CHANNEL

ROCK LOW FLOW CHANNEL
d50 ROCK SIZE = 300mm
d50/d90 RATIO = 0.5
ROCK THICKNESS = 0.630m

1m WIDE RENO MATTRESSES
d50 ROCK SIZE = 150mm
d50/d90 RATIO = 0.8
ROCK THICKNESS = 0.300m

ROCK HIGH & LOW FLOW CHANNEL
d50 ROCK SIZE = 300mm
d50/d90 RATIO = 0.5
ROCK THICKNESS = 0.630m

BUND RL9.30
SHELTER RL9.50

WEIR RL8.48

1.5m WIDE BOARDWALK AS PER LANDSCAPE ARCHITECT DRAWINGS.

OSSA BLVD

MARKET PARADE

701

TP 222.188
220.000
TP 189.709
TP 189.055
180.000
TP 166.704
TP 163.711
160.000
140.000
TP 139.150
TP 138.760
130.000
200.000

REFER SHEET 1

5 0 5 10m
1 : 250 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE PLAN SHEET 2 OF 3	SK3618/2 REVISION H

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146

PROPOSED DRAINAGE RESERVE

EXISTING TEMPORARY 7 x ø1050 CULVERT TO BE REMOVED DURING CONSTRUCTION OF BROADWATER PARKWAY EARTHWORKS AND NEW 6x1.5x1.2m BOX CULVERTS. TIMING OF THESE WORKS SUBJECT TO AGREEMENT WITH TWEED SHIRE COUNCIL.

FUTURE 6x1.5x1.2m BOX CULVERTS

BROADWATER PARKWAY (FUTURE)

PEDESTRIAN FENCING (POOL STYLE FENCING OR SIMILAR)

1.5m WIDE CONCRETE FOOTPATH

713
PROPOSED PUBLIC RESERVE

COMBINED 3m WIDE ACCESS TRACK AND 1.5m WIDE CONCRETE FOOTPATH

1.5m WIDE CONCRETE FOOTPATH

1 IN 4 BATTER

3m WIDE BUND & ACCESS TRACK RL3.90

GRASS-CEL POROUS TURF SURFACE

1 IN 2 BATTER

MAINTENANCE TURNAROUND

SEDIMENT FOREBAY 1C

BASIN C
RL=2.90
AREA=798m²

3m WIDE BUND RL3.30

SEDIMENT FOREBAY 2C

BASIN C GROUTED ROCK WEIR AND SPILLWAY. 150mm DIA NOMINAL ROCK SIZE.

1m WIDE RENO MATTRESSES
d50 ROCK SIZE = 150mm
d50/d90 RATIO = 0.8
ROCK THICKNESS = 0.300m

VEGETATION HIGH FLOW CHANNEL

ROCK LOW FLOW CHANNEL
d50 ROCK SIZE = 300mm
d50/d90 RATIO = 0.5
ROCK THICKNESS = 0.630m

610
PROPOSED ~~DRAINAGE~~ RESERVE

TP 327.133
332.931
320.000
TP 317.409
TP 311.189
300.000
TP 299.569
280.000
TP 278.559
TP 266.057
TP 263.425
260.000
TP 245.008
240.000
TP 238.959

145
EXISTING SEWER PUMP STATION

1 IN 2 BATTER

ROCK PROTECTION, 200mm DIA NOMINAL ROCK SIZE.

BASIN B GROUTED ROCK WEIR AND SPILLWAY. 150mm DIA NOMINAL ROCK SIZE.

1 IN 2 BATTER

3m WIDE ACCESS TRACK

MAINTENANCE TURNAROUND

3m WIDE BUND RL5.47

BASIN B
RL=4.88
AREA=830m²

SEDIMENT FOREBAY 2B

GRASS-CEL POROUS TURF SURFACE

SEDIMENT FOREBAY 3B

SEDIMENT FOREBAY 1B

3m WIDE BUND & ACCESS TRACK RL6.10

GROUTED ROCK PITCHING. REFER LANDSCAPE ARCHITECT DRAWINGS FOR DETAILS.

BASIN C GROUTED ROCK WEIR AND SPILLWAY. 150mm DIA NOMINAL ROCK SIZE.

OSSA BLVD

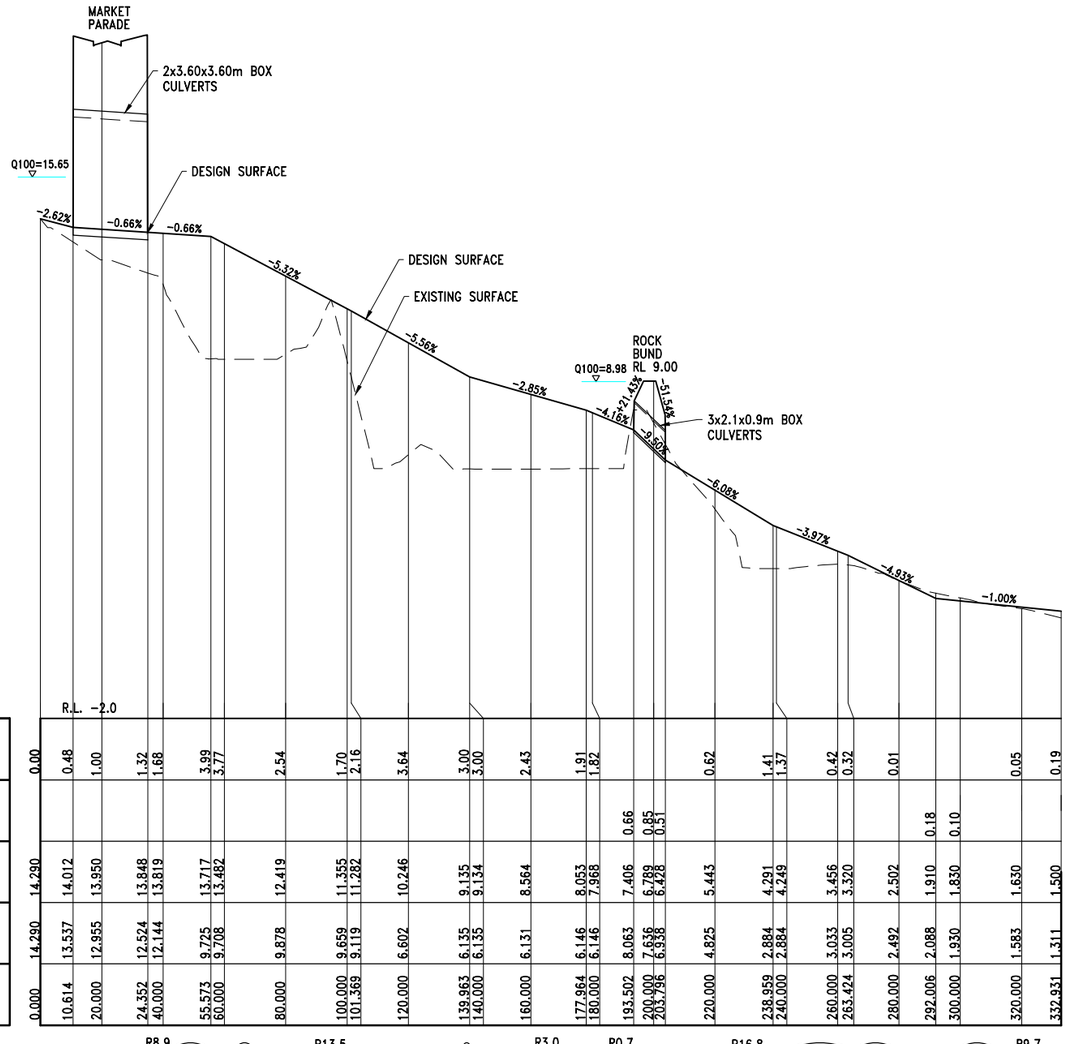
316

REFER SHEET 2

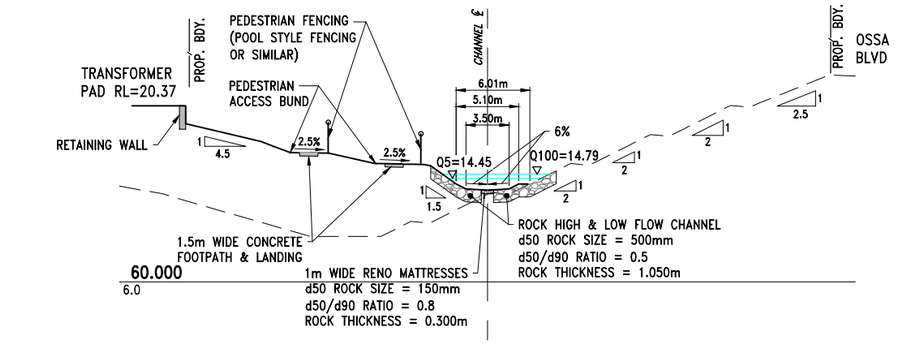
5 0 5 10m
1 : 250 (FULL SIZE A1)

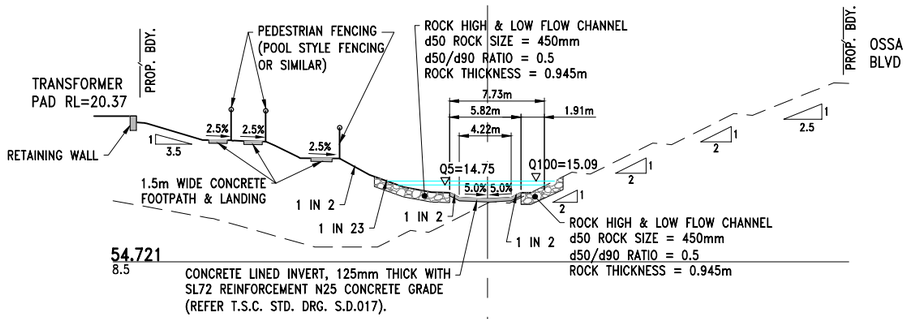
NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE PLAN SHEET 3 OF 3	SK3618/3 REVISION H

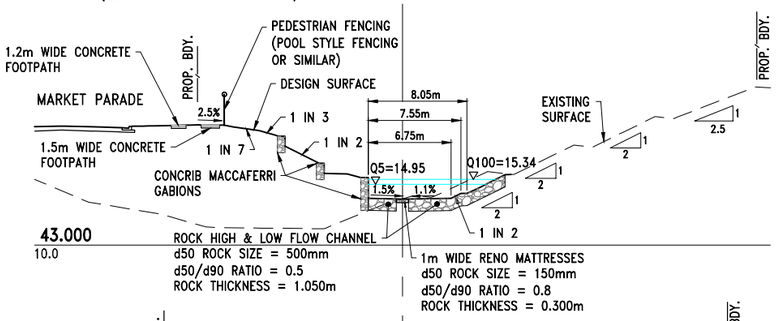
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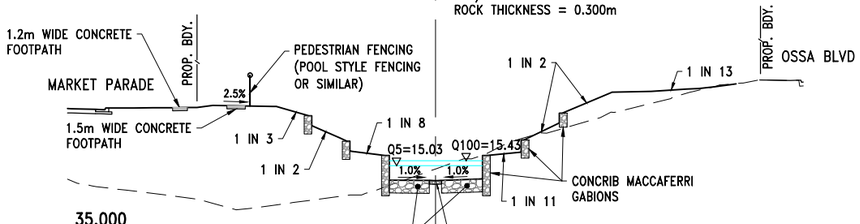

MARKET PARADE
2x3.60x3.60m BOX CULVERTS
Q100=15.65
DESIGN SURFACE
-2.62%
-0.66%
-0.66%
-5.32%
DESIGN SURFACE
EXISTING SURFACE
-5.56%
-2.85%
ROCK BUND RL 9.00
Q100=8.98
-21.43%
-4.16%
-51.54%
-9.50%
3x2.1x0.9m BOX CULVERTS
-6.08%
-3.97%
-4.83%
-1.00%

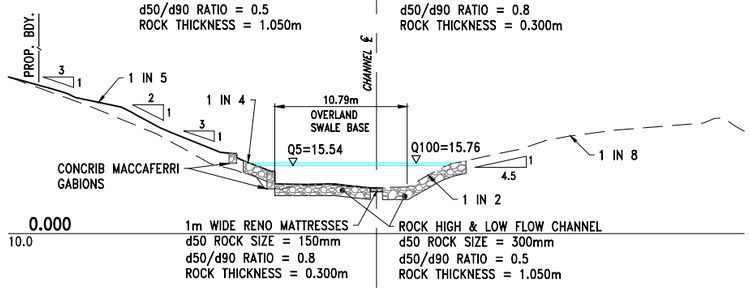
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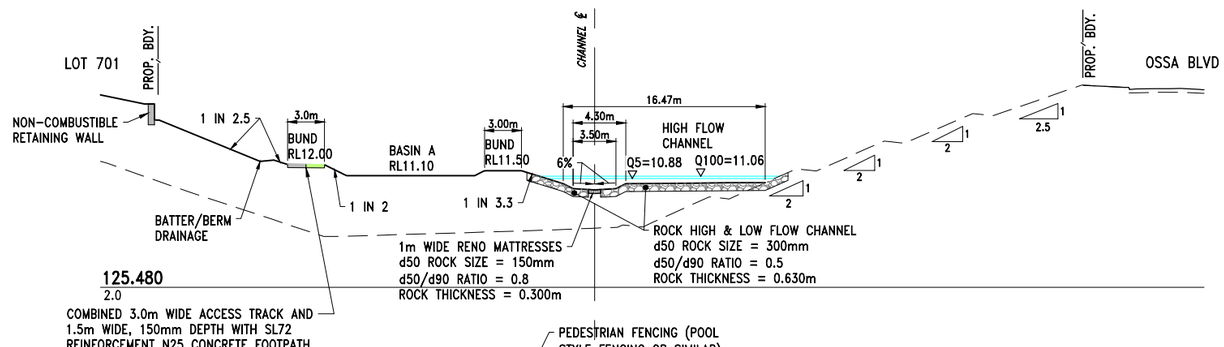


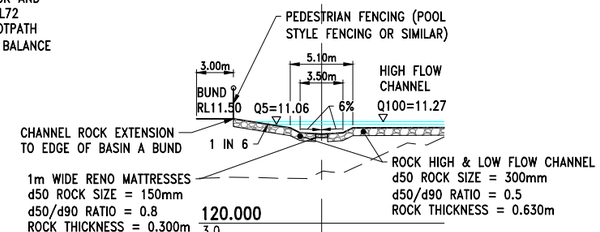


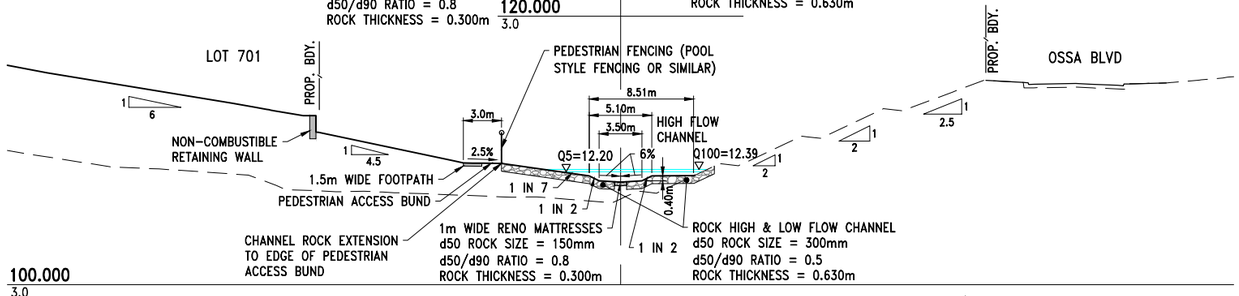


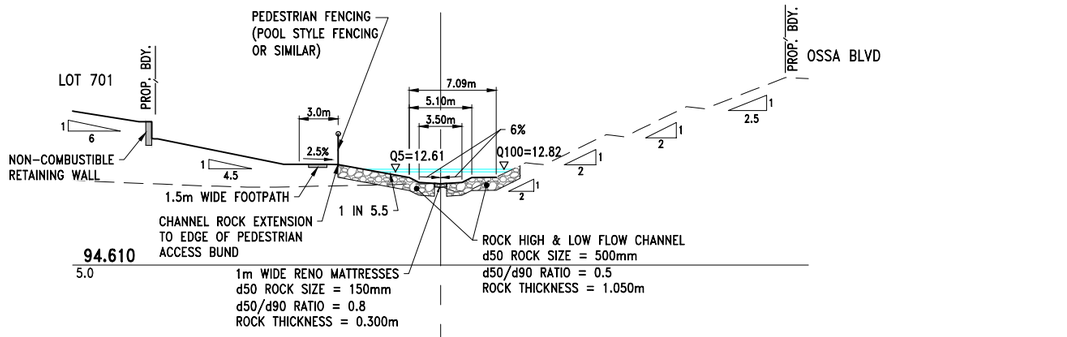


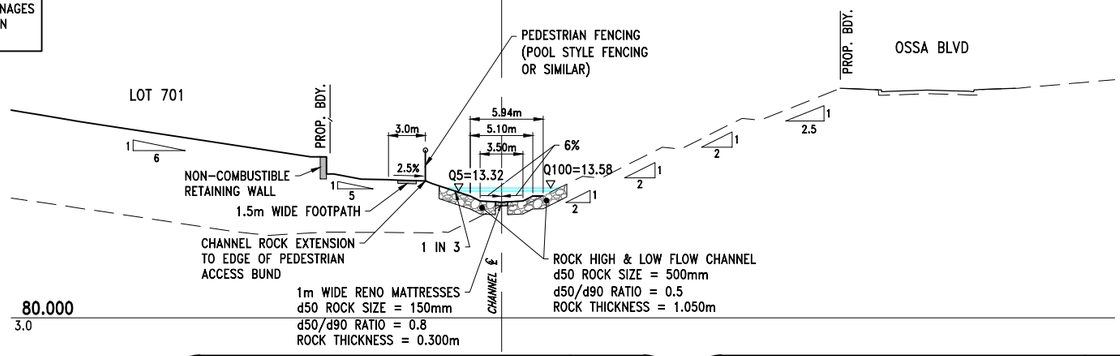












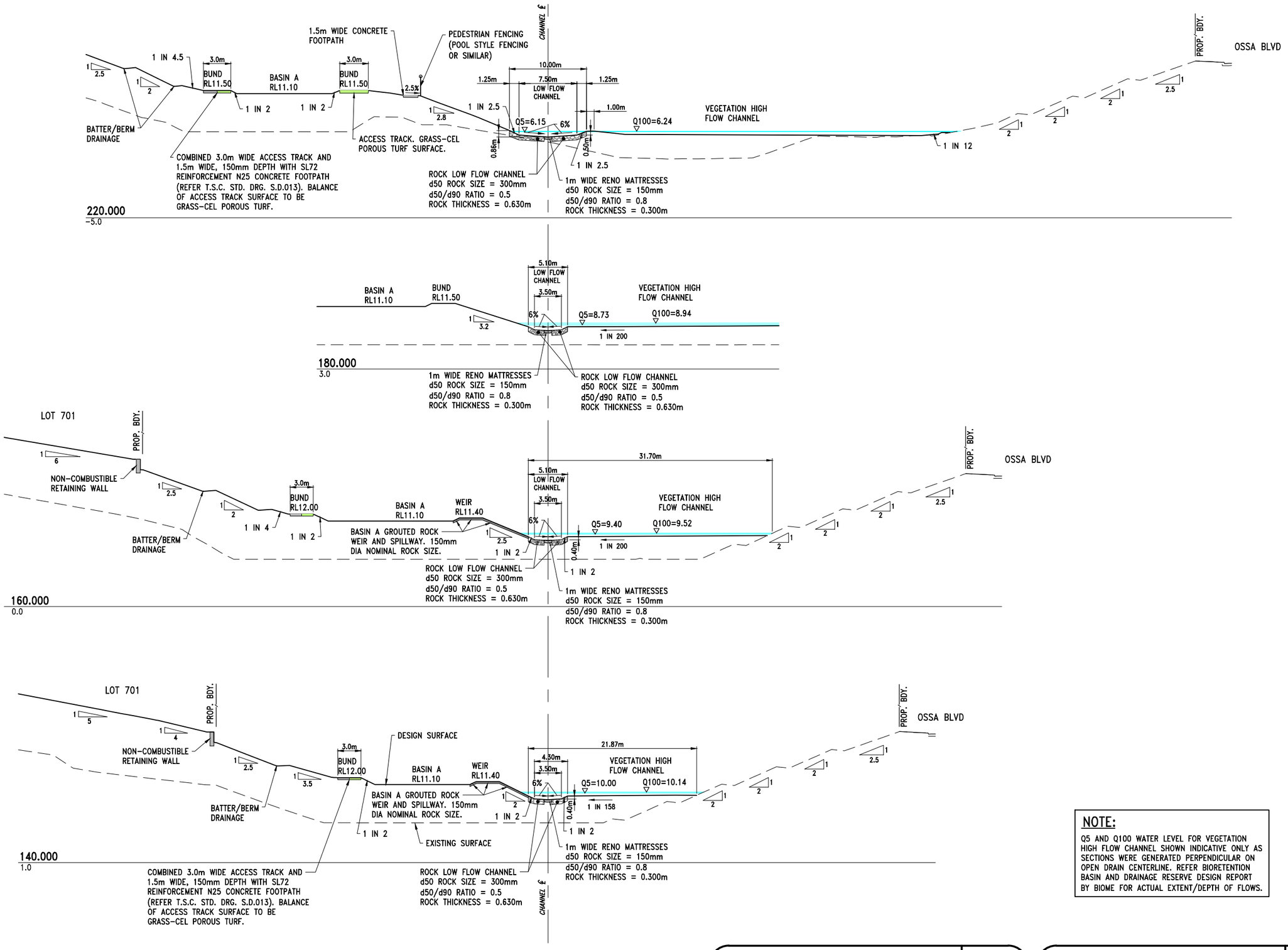
NOTE:

CHANNEL ROCK (AS SPECIFIED) EXTENSION TO BE 300mm ABOVE Q100 WATER LEVEL FOR HIGH & LOW FLOW CHANNEL CHAINAGES 0-10.614 AND 35-130, UNLESS SHOWN OTHERWISE.

5 0 5 10m
1 : 250 (FULL SIZE)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE CROSS SECTIONS SHEET 1 OF 6	SK3620 REVISION F

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NOTE:

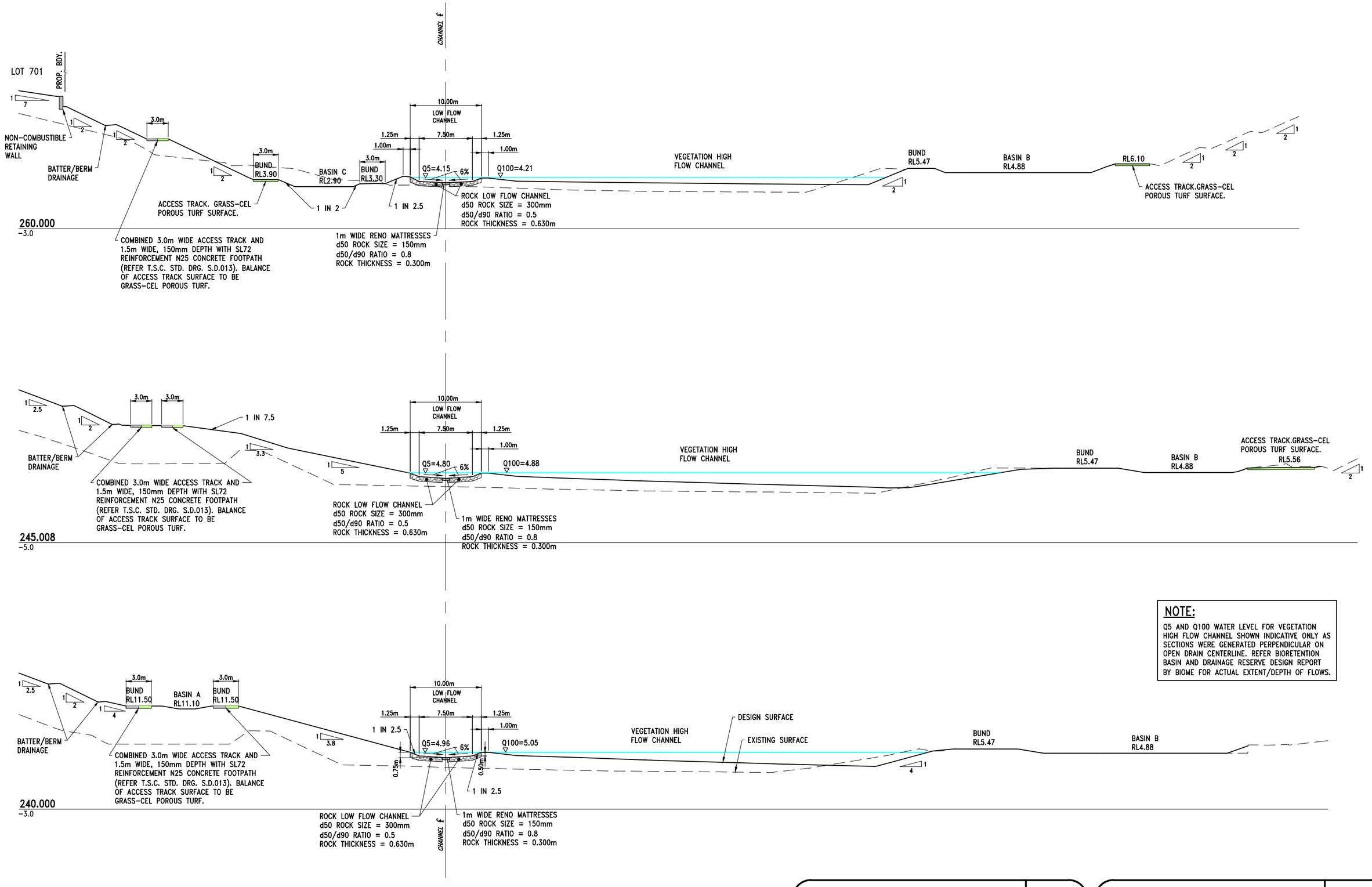
Q5 AND Q100 WATER LEVEL FOR VEGETATION HIGH FLOW CHANNEL SHOWN INDICATIVE ONLY AS SECTIONS WERE GENERATED PERPENDICULAR ON OPEN DRAIN CENTERLINE. REFER BIORETENTION BASIN AND DRAINAGE RESERVE DESIGN REPORT BY BIOME FOR ACTUAL EXTENT/DEPTH OF FLOWS.

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE CROSS SECTIONS SHEET 2 OF 6	SK3621 REVISION F

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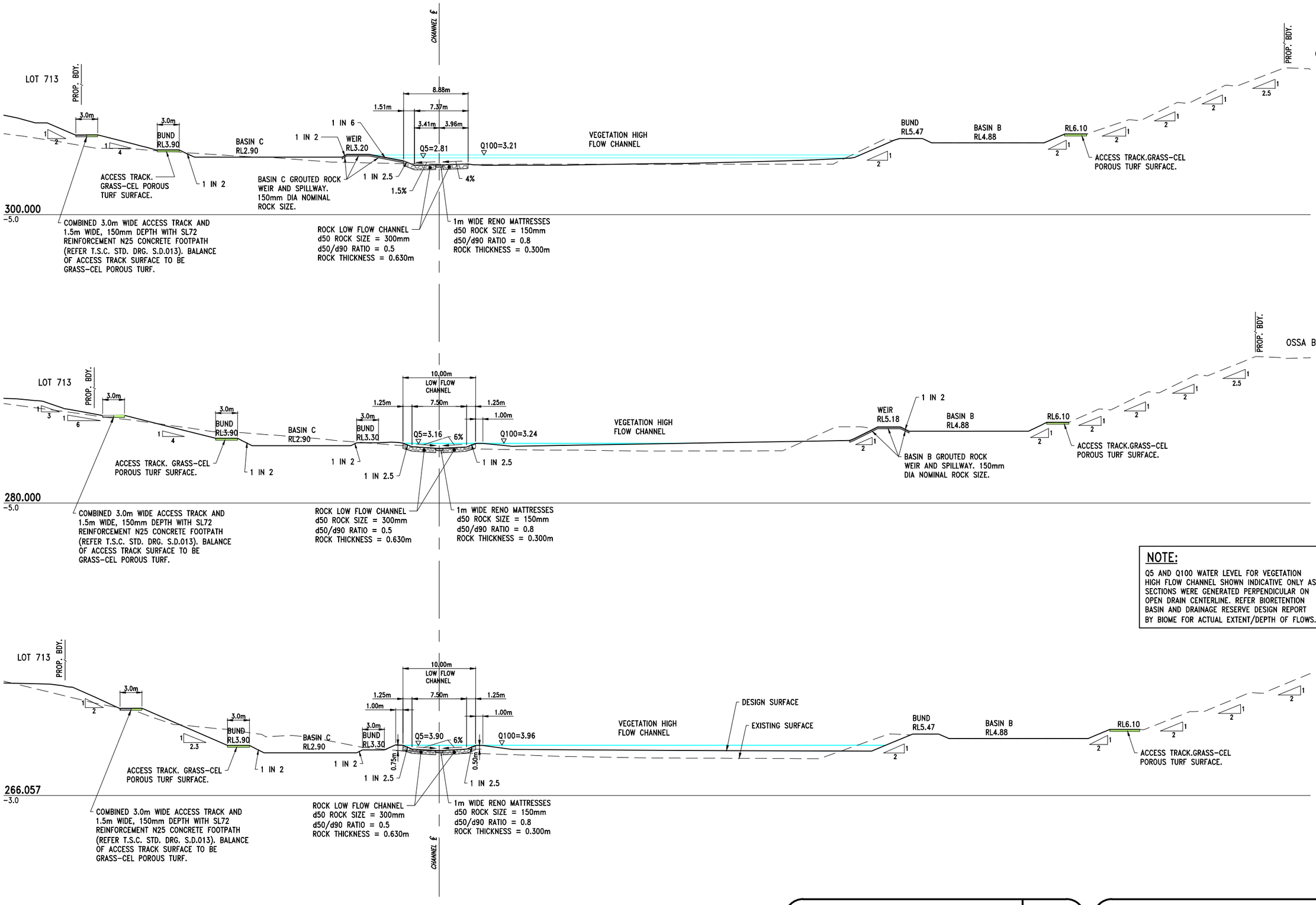
NOTE:

Q5 AND Q100 WATER LEVEL FOR VEGETATION HIGH FLOW CHANNEL SHOWN INDICATIVE ONLY AS SECTIONS WERE GENERATED PERPENDICULAR ON OPEN DRAIN CENTERLINE. REFER BIORETENTION BASIN AND DRAINAGE RESERVE DESIGN REPORT BY BIOME FOR ACTUAL EXTENT/DEPTH OF FLOWS.

5 0 5 10m
1 : 250 (FULL SIZE)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE CROSS SECTIONS SHEET 3 OF 6	SK3622 REVISION F

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NOTE:

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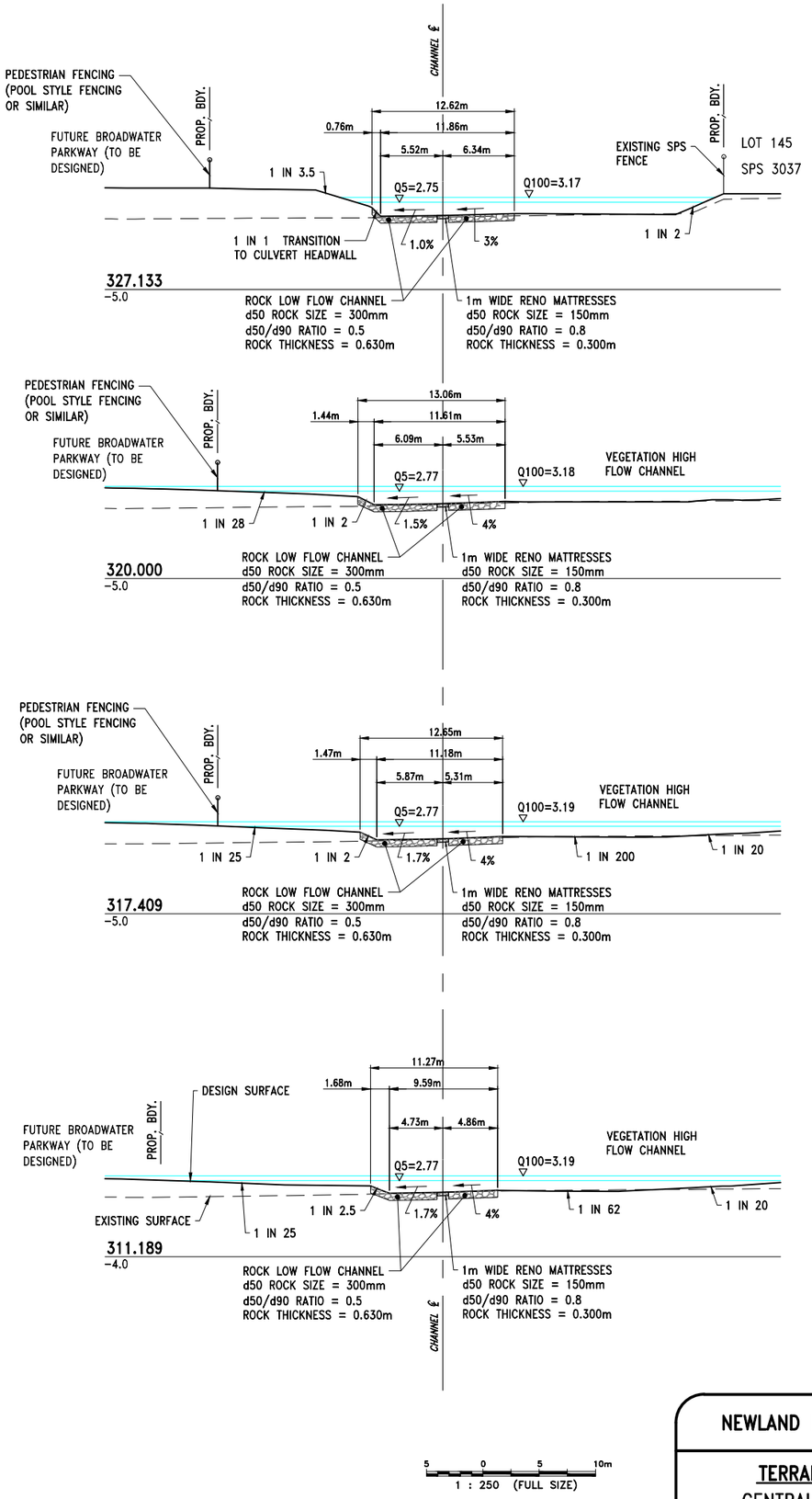
5 0 5 10m
1 : 250 (FULL SIZE)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE CROSS SECTIONS SHEET 4 OF 6	SK3623 REVISION F

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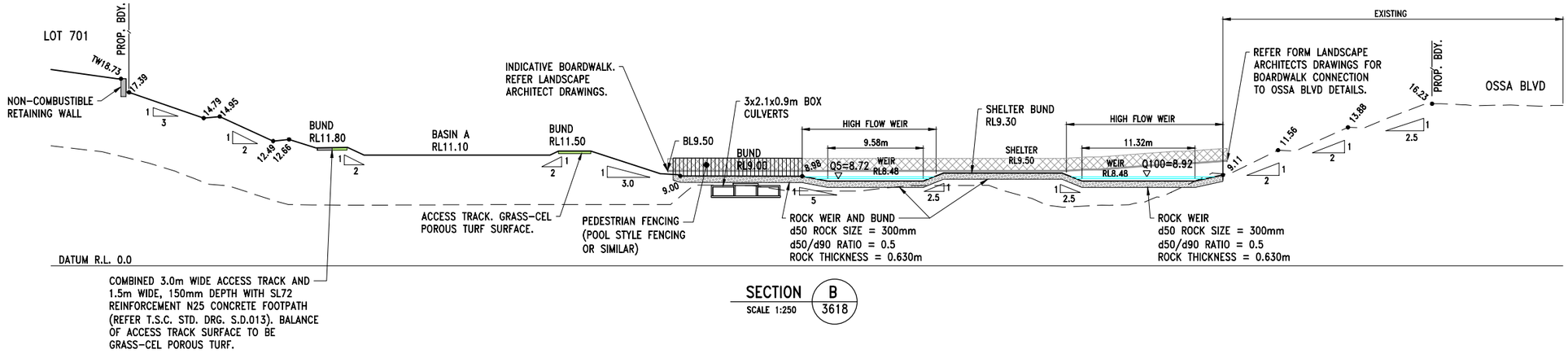
NOTE:

Q5 AND Q100 WATER LEVEL FOR VEGETATION HIGH FLOW CHANNEL SHOWN INDICATIVE ONLY AS SECTIONS WERE GENERATED PERPENDICULAR ON OPEN DRAIN CENTERLINE. REFER BIORETENTION BASIN AND DRAINAGE RESERVE DESIGN REPORT BY BIOME FOR ACTUAL EXTENT/DEPTH OF FLOWS.

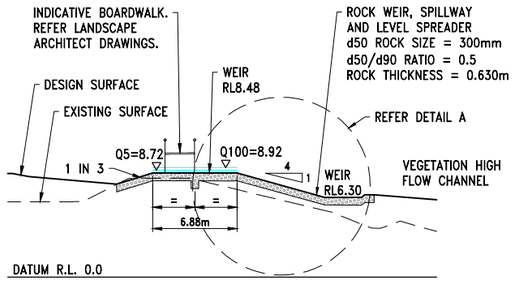
NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE CROSS SECTIONS SHEET 5 OF 6	SK3624 REVISION F

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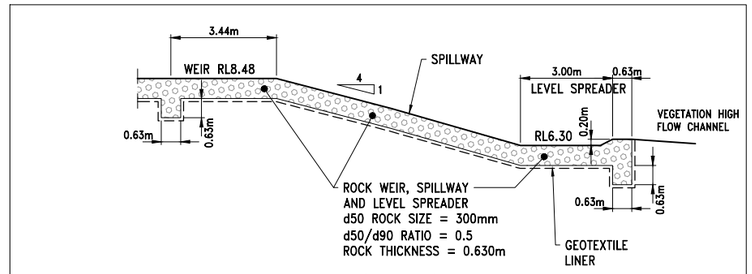
IAS-ANZ
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SECTION B
SCALE 1:250
3618



SECTION A
SCALE 1:250
3618



DETAIL A
TYPICAL ROCK PROTECTION TO WEIR, SPILLWAY AND LEVEL SPREADER
SCALE 1:100

5 0 5 10m
1 : 250 (FULL SIZE)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE CROSS SECTIONS SHEET 6 OF 6	SK3625 REVISION F

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BASIN B
BASIN RL4.88
AREA=830m2

BASIN C
BASIN RL2.90
AREA=798m2

BASIN A
BASIN RL11.10
AREA=1250m2

OSSA BLVD

BROADWATER PARKWAY

MARKET PARADE

MARKET PARADE

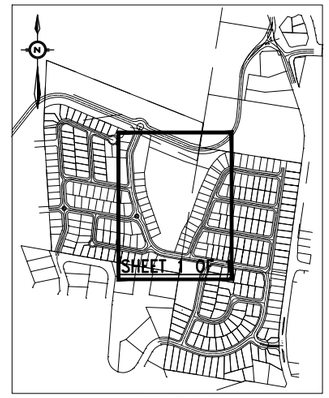
VEGETATION HIGH
FLOW CHANNEL

VEGETATION HIGH
FLOW CHANNEL

ROCK LOW FLOW CHANNEL

ROCK HIGH & LOW FLOW CHANNEL

OVERLAND
SWALE



KEY PLAN
NOT TO SCALE

LEGEND

12 — FINISHED SURFACE CONTOURS

NOMINAL KERB LINE

SCALE
5 0 5 10 15 20 25m
1 : 500 (FULL SIZE)

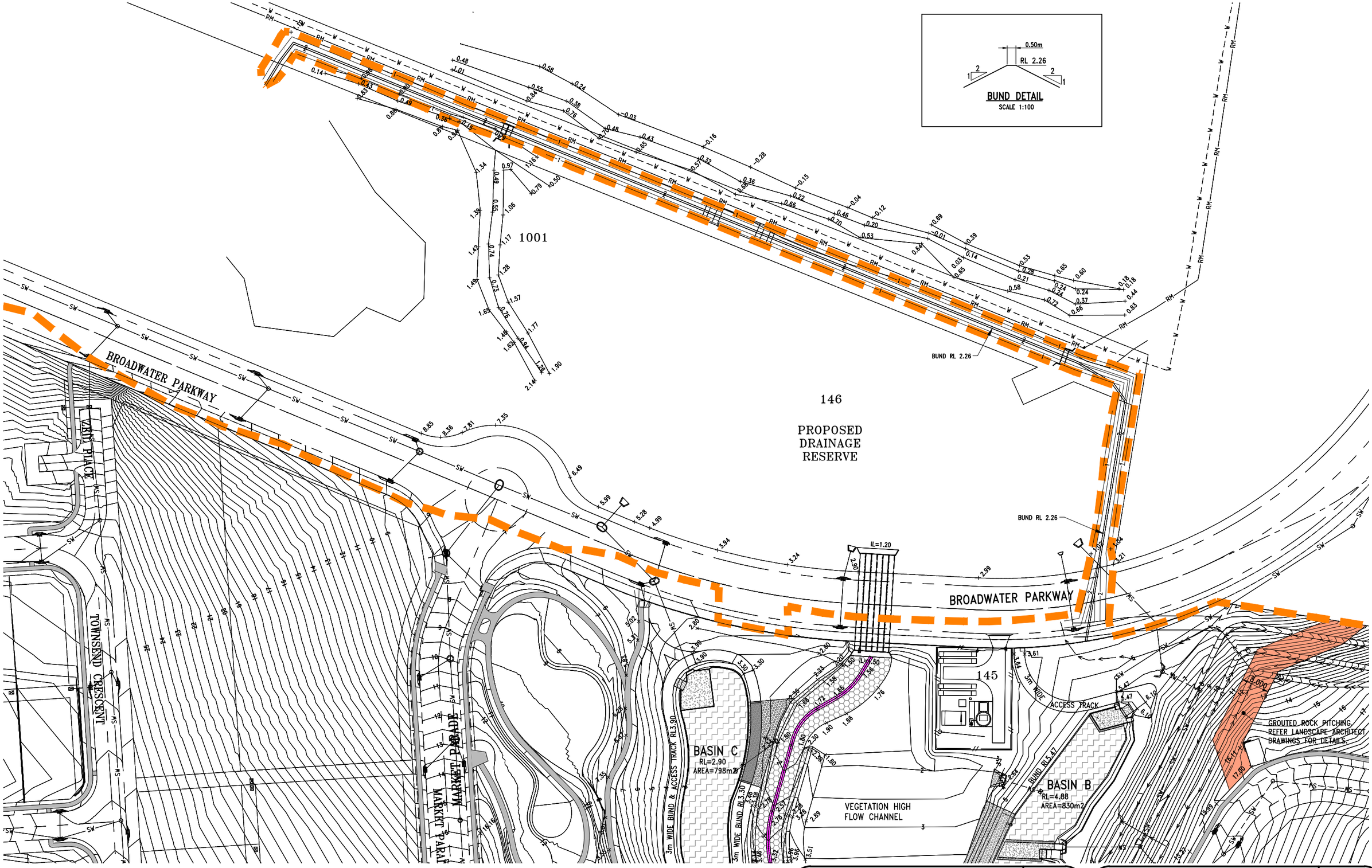
NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 WATER QUALITY TREATMENT AREAS	SK3626 REVISION F

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5 0 5 10 15 20 25m
1 : 500 (FULL SIZE)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE BUND	SK 4038 REVISION E

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PLAN LAYOUT
SCALE NTS

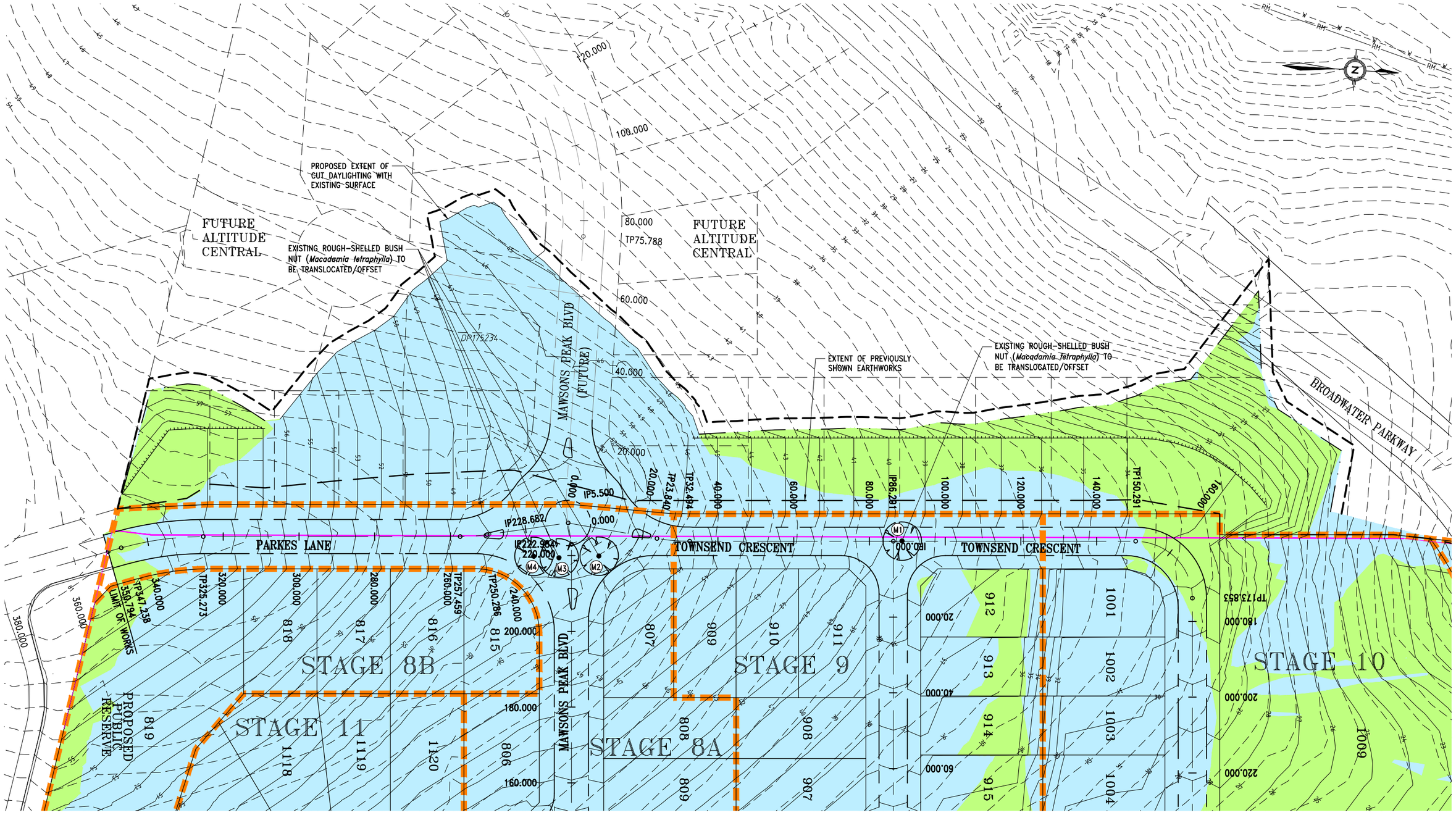
NEWLAND DEVELOPERS PTY LTD	09–374 06–07–2018
TERRANORA PRECINCT 1 ROAD NAMES PLAN	SK4554 REVISION F

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REGN. NO. 253



LAYOUT PLAN

SCALE 1:500

LEGEND

- EXISTING SURFACE CONTOURS (10)
- FINISHED SURFACE CONTOURS (12)
- NOMINAL KERB LINE
- EXISTING PARCEL BOUNDARY
- PROPOSED BATTER TOP
- PROPOSED BATTER TOE
- STAGE BOUNDARY
- LIMIT OF WORKS
- EXTENT OF PREVIOUSLY SHOWN EARTHWORKS
- CUT AREAS
- FILL AREAS

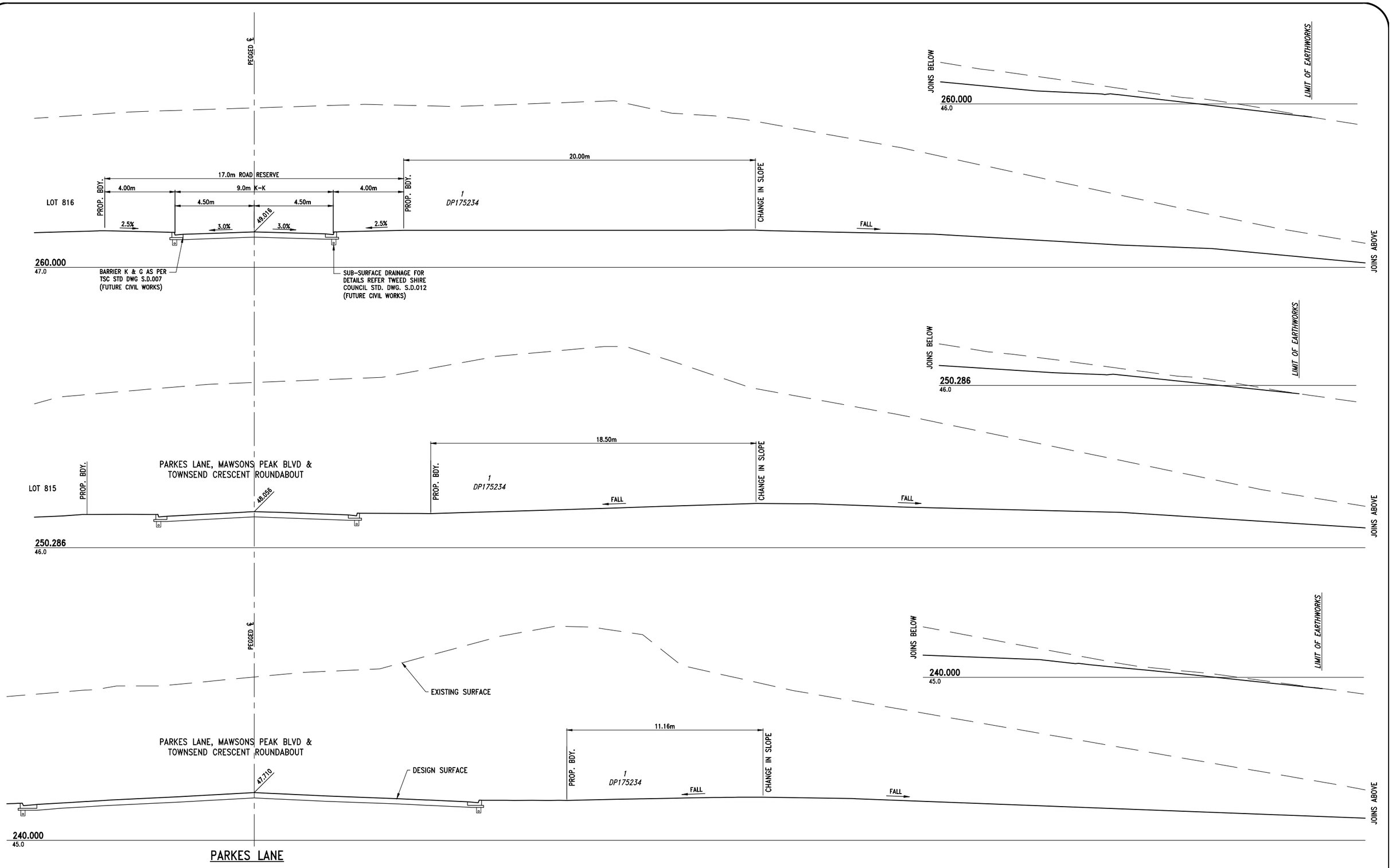
EXISTING ROUGH-SHELLED BUSH NUT (*Macadamia tetraphylla*) TO BE TRANSLOCATED/OFFSET
EXISTING COORDINATES

PLANT	EASTING	NORTHING
M1	550994.612	6877536.495
M2	551003.788	6877456.861
M3	551004.944	6877446.361
M4	551004.973	6877439.677

5 0 5 10 15 20 25m
1 : 500 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 23-01-2019
TERRANORA PRECINCT 1 WEST BOUNDARY EARTHWORKS EXTENT	SK 6524 REVISION D

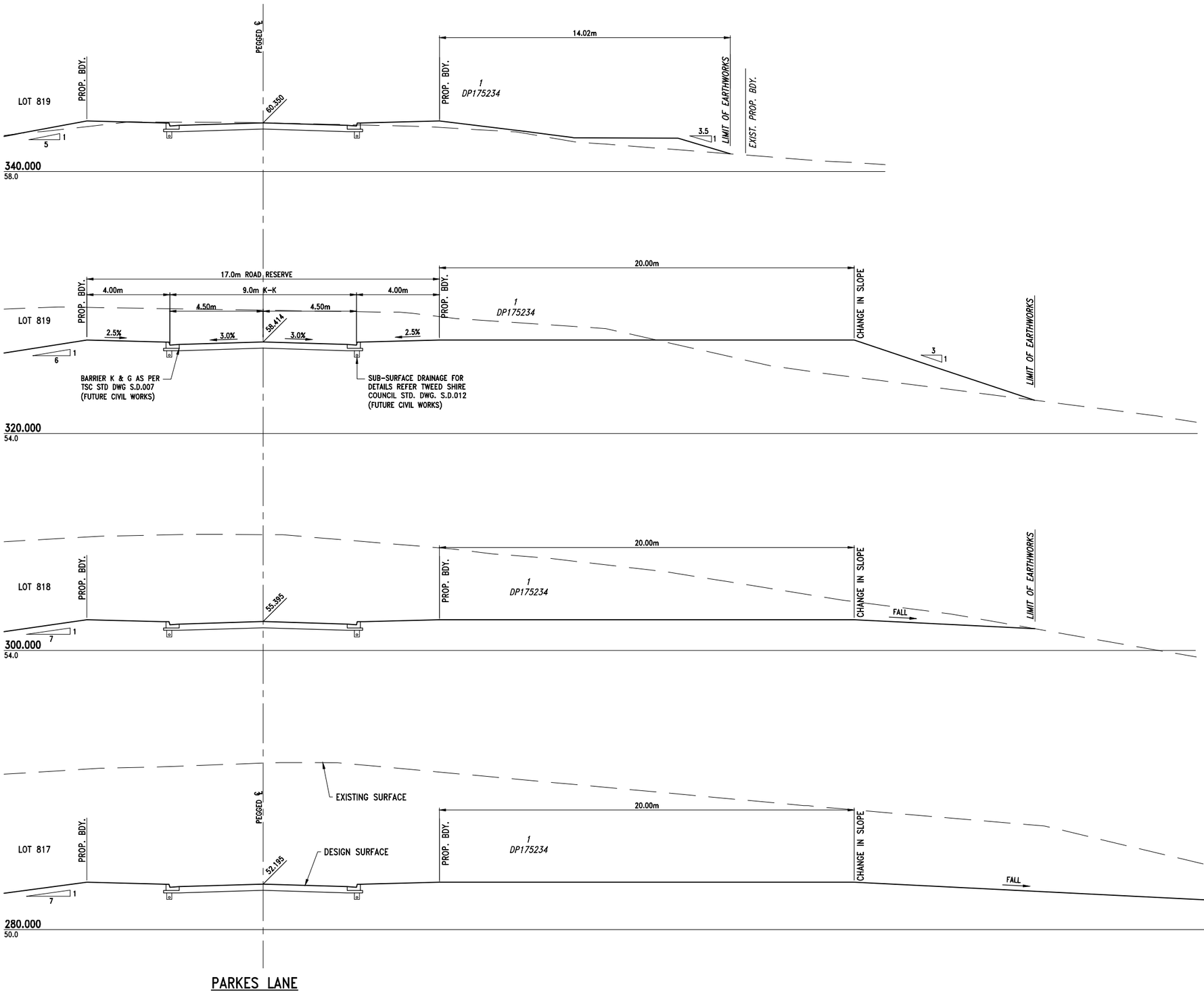
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1 0 1 2 3 4 5m
1 : 100 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09–374 06–07–2018
TERRANORA PRECINCT 1 WEST BOUNDARY ROADS CROSS SECTIONS EXTENT – SHEET 1 OF 4	SK 6525 REVISION C

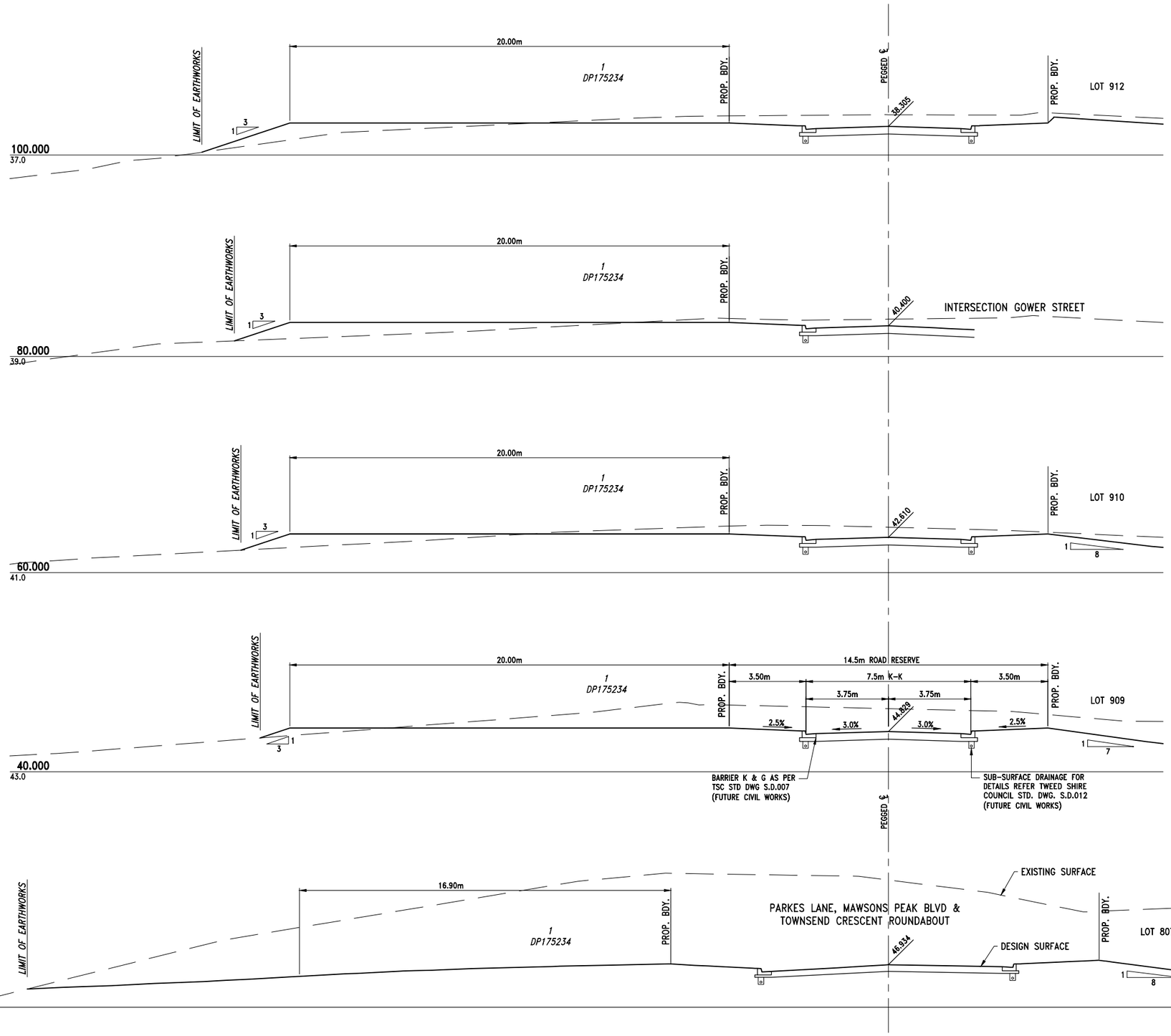
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1 0 1 2 3 4 5m
1 : 100 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 06-07-2018
TERRANORA PRECINCT 1 WEST BOUNDARY ROADS CROSS SECTIONS EXTENT – SHEET 2 OF 4	SK 6526 REVISION C

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TOWNSEND CRESCENT

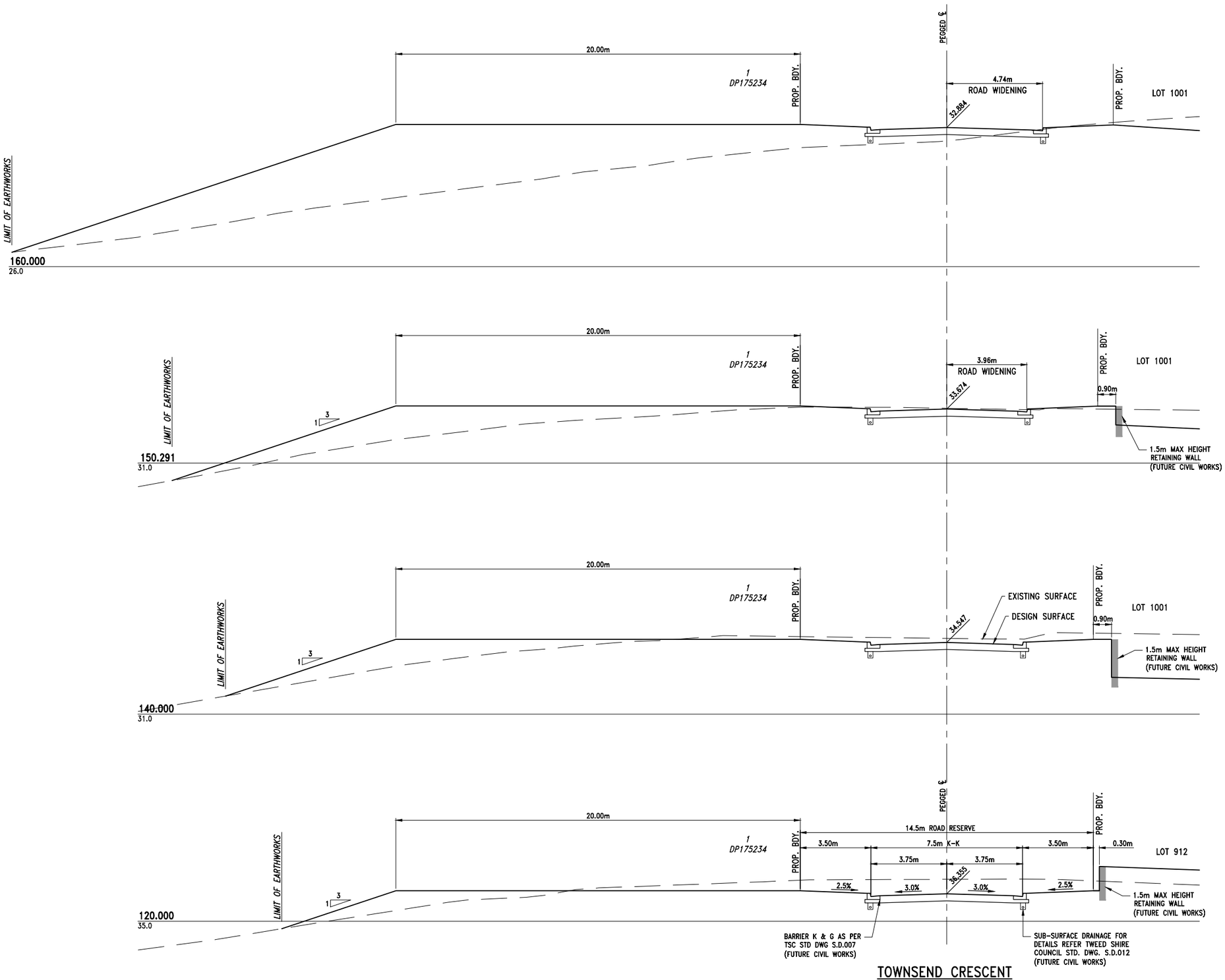
1 0 1 2 3 4 5m
1 : 100 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 06-07-2018
TERRANORA PRECINCT 1 WEST BOUNDARY ROADS CROSS SECTIONS EXTENT – SHEET 3 OF 4	SK 6527 REVISION B

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REGN. NO. 253



TOWNSEND CRESCENT

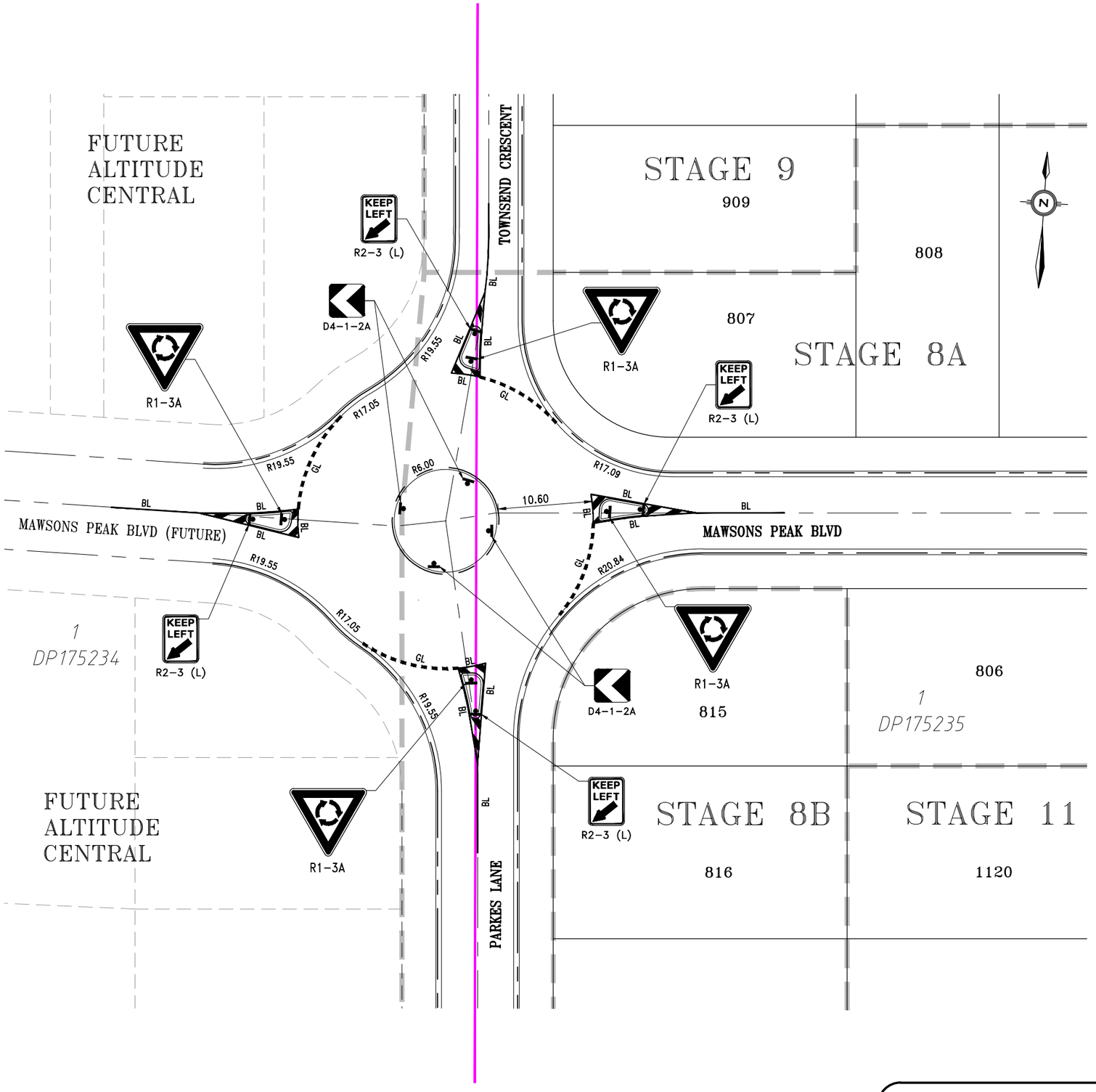
1 0 1 2 3 4 5m
1 : 100 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 WEST BOUNDARY ROADS CROSS SECTIONS EXTENT – SHEET 4 OF 4	SK 6528 REVISION C

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REGN. NO. 233



LAYOUT PLAN
SCALE 1:250

5 0 5 10m
1 : 250 (FULL SIZE)

PAVEMENT-MARKING LEGEND :

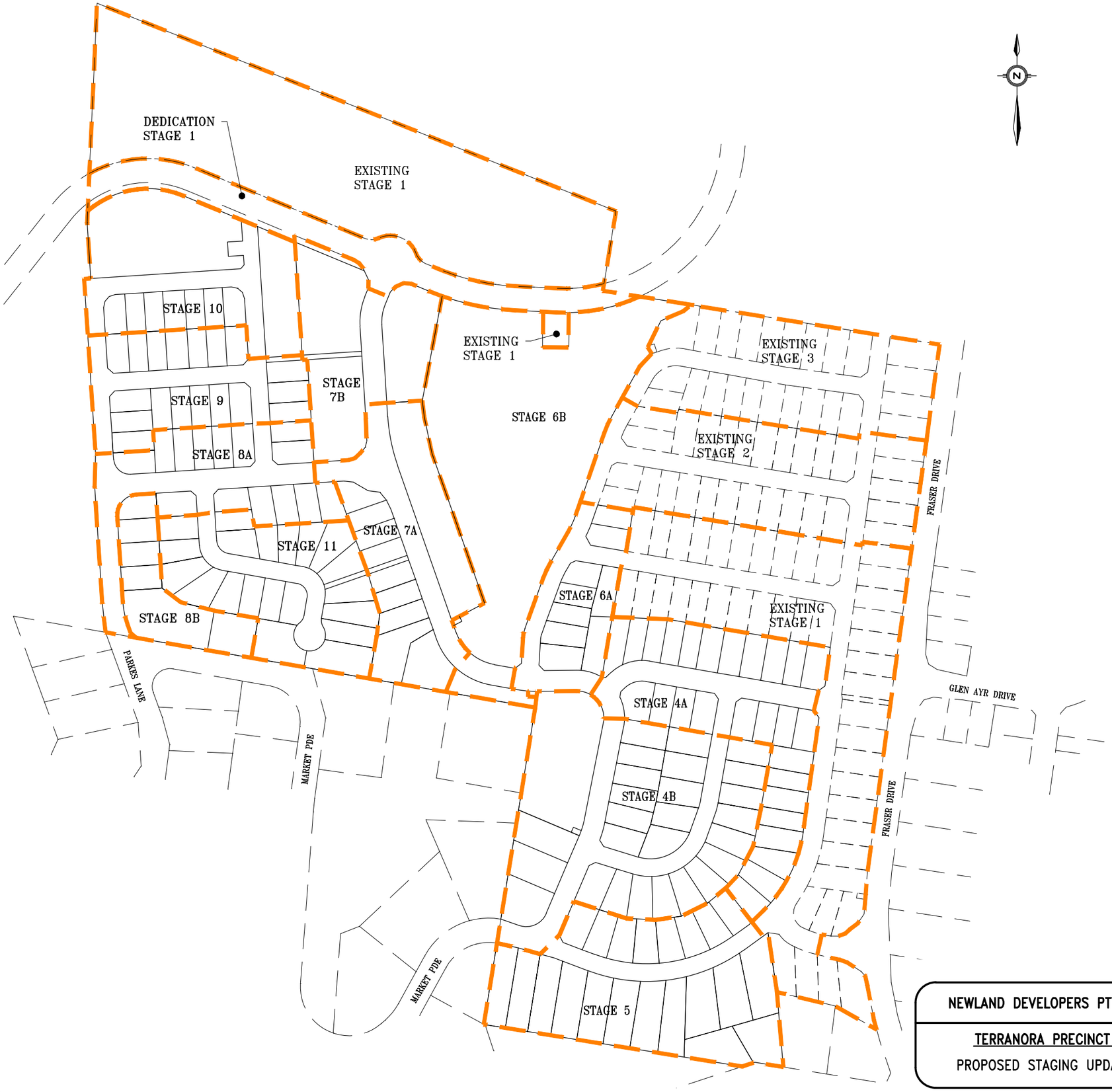
CODE	LINE TYPE	LINE LENGTH	GAP	WIDTH
LL	DIVIDING LINES (TWO LANE ROADS)	3.0m	9.0m	100mm
EL	DIVIDING LINES/EDGE LINES	–	–	100mm
BL	BARRIER LINES (SINGLE)	–	–	100mm
CL	CONTINUITY LINES	1.0m	3.0m	120mm
TL	TURN LINES	0.6m	0.6m	100mm
SL	STOP LINES	–	–	300mm
GL	GIVE WAY LINES	0.6m	0.6m	300mm
BLO	BARRIER LINES (ONE DIRECTION)	– 3.0m	– 9.0m	100mm
BLB	BARRIER LINES (BOTH DIRECTIONS)	– –	– –	100mm
LLS	LANE LINES (SPECIAL)	3.0m	9.0m	100mm
BS	BUS STOP (YELLOW)	0.6m	0.3m	100mm

LEGEND

12 FINISHED SURFACE CONTOURS
NOMINAL KERB LINE
EXISTING PARCEL BOUNDARY

NEWLAND DEVELOPERS PTY LTD	09-374 06-07-2018
TERRANORA PRECINCT 1 EXTENT OF MAWSONS PEAK BLVD – TOWNSEND CRESCENT ROUNDABOUT WORKS	SK 6460 REVISION B

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LEGEND

STAGE BOUNDARY

NEWLAND DEVELOPERS PTY LTD	09–374 26–03–2019
TERRANORA PRECINCT 1 PROPOSED STAGING UPDATES	SK6596 REVISION D

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REGN. NO. 253



LAYOUT PLAN

SCALE 1:2000

20 0 20 40 60 80 100m

1 : 2000 (FULL SIZE A1)

LEGEND

STAGE BOUNDARY

AREAS OF PROPOSED CHANGES FOR CONSENT MODIFICATION 3

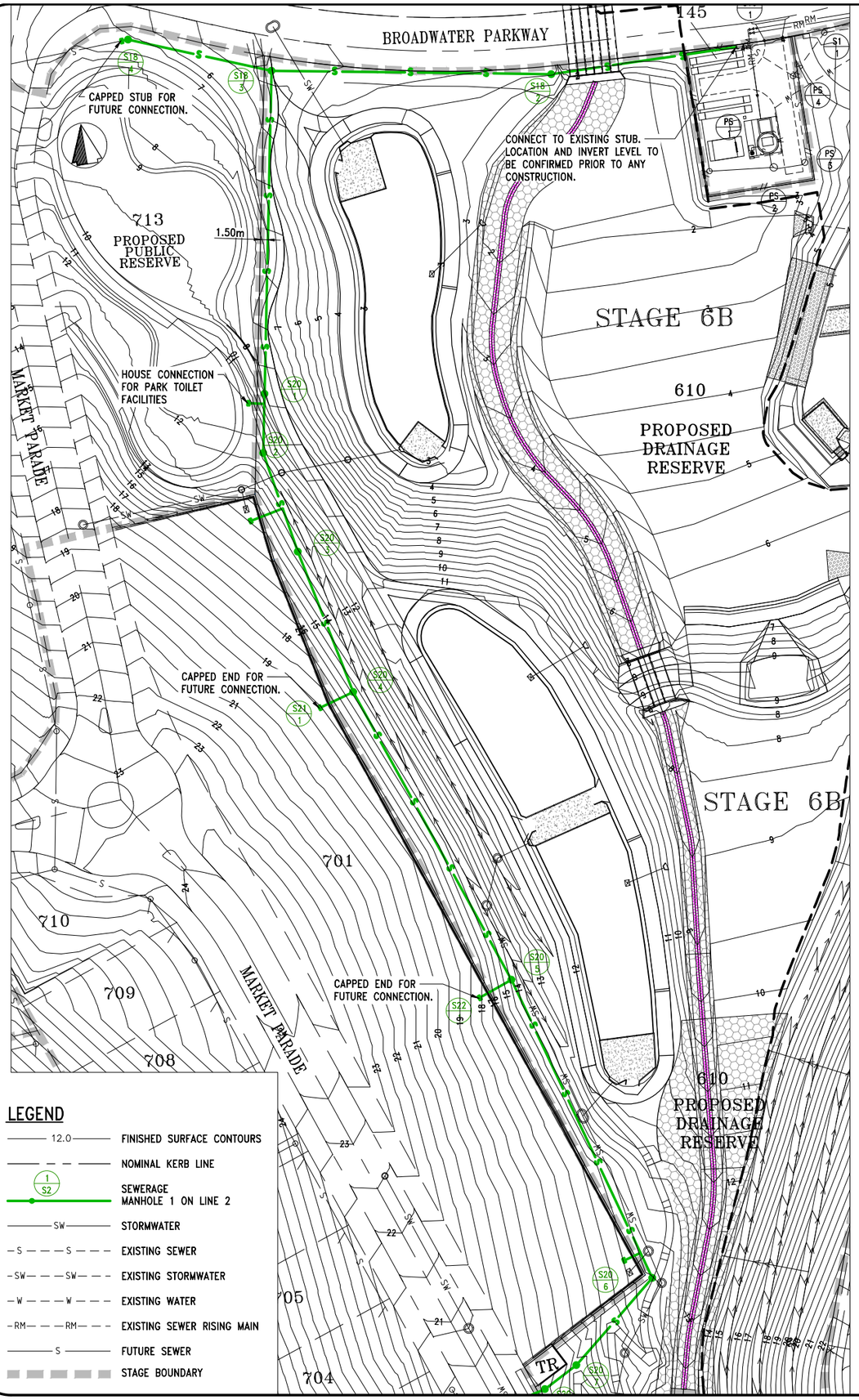
NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 AREAS OF PROPOSED CHANGES FOR CONSENT MODIFICATION 3	SK 6622 REVISION C

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LEGEND

- 12.0 — FINISHED SURFACE CONTOURS
- NOMINAL KERB LINE
- 1/S2 — SEWERAGE MANHOLE 1 ON LINE 2
- SW — STORMWATER
- S — EXISTING SEWER
- SW — EXISTING STORMWATER
- W — EXISTING WATER
- RM — EXISTING SEWER RISING MAIN
- S — FUTURE SEWER
- STAGE BOUNDARY

STRUCTURE No.	
COVER	–
TYPE	EXMH
DROP	–

PROVIDE CONCRETE BULKHEADS AND TRENCHSTOPS AS PER TSC STD. DRG. S.D.276. ALL SEWER TRENCH DRAINAGE SYSTEMS AS PER WSA02-2002 SEW-1206 AND 1207.

HOUSE CONNECTION CHAINAGE/TYPE IL/DEPTH

EXISTING MANHOLE

LEGEND:

SEWER STRUCTURE LIDS TYPES

B	DUCTILE IRON NON-TRAFFICABLE LID
D	DUCTILE IRON TRAFFICABLE LID

SEWER STRUCTURE TYPES

G	TYPE "G" 1100mm DIA. MAINTENANCE HOLE IN ACCORDANCE WITH AS 4198
H	TYPE "H" 1200mm DIA. MAINTENANCE HOLE IN ACCORDANCE WITH AS 4198
F	TYPE "F" 1500mm DIA. MAINTENANCE HOLE IN ACCORDANCE WITH AS 4198
TMS	TERMINAL MAINTENANCE SHAFT IN ACCORDANCE WITH WSA STD DRG SEW-1316

SEWER STRUCTURE DROPS

A	STRAIGHT THROUGH SEWER TYPE 'A' 30mm – 150mm
D	EXTERNAL BACKDROP TYPE 'D' >460mm

SEWER PROPERTY CONNECTION TYPES

A	150 – 300mm SLOPED H.C. BRANCH TYPE 'A'
B	300 – 800mm SLOPED H.C. BRANCH TYPE 'B'
C1	> 800mm VERTICAL H.C. BRANCH TYPE 'C1'

FOR ALL H.C. DETAILS REFER T.S.C. STD DWG SD-250 & SD-251

	S18 1	S18 2	S18 3	S18 4	S18 5
COVER	–	B	D	B	B
TYPE	EXMH	H	H	H	H
DROP	–	A	A	A	A

FUTURE

(FUTURE)

6 X 1500 x 1200 RCBC I.L.1.50 CL0.73 (FUTURE CULVERTS UNDER BROADWATER PARKWAY)

2 x 600ø P_SWD I.L.3.07 CL0.48

DESIGN SURFACE

LINE S20 I.L. 3.72

CAPPED STUB FOR FUTURE CONNECTION

1.500m

CONNECT TO EXISTING STUB

		S18 1	S18 2	S18 3	S18 4	S18 5
TRENCHSTOPS/BULKHEADS						
DATUM		R.L. –4.0				
PROPERTY DESCRIPTION			PARK			ROAD
EMBEDMENT TYPE			TYPE 3			
DIAMETER & CLASS			375ø U.P.V.C. CL12			
GRADE			1 IN 100 (1.00%)	1 IN 30 (3.33%)	1 IN 30 (3.33%)	1 IN 30 (3.33%)
LENGTH			39.17	55.85	29.26	36.19
DEPTH TO INVERT		4.04	3.11	2.50	3.31	3.45
		3.99	3.09	2.48	3.29	
INVERT LEVEL		0.02	0.46	2.34	3.34	4.57
		0.07	0.48	2.36	3.36	
SURFACE LEVEL		4.06	3.57	4.84	6.65	8.01
CHAINAGE		11.14	50.31	106.16	135.42	171.60
STRUCTURE LOCATION		E551371.403 N6877591.762	E551332.237 N6877592.553	E551277.272 N6877602.436	E551250.091 N6877613.255	E551213.928 N6877611.897

5 0 5 10 15 20 25m
1 : 500 HORIZ.
1 0 1 2 3 4 5m
1 : 100 VERT.
(FULL SIZE)

LINE S18

SCALE H 1:500 V 1:100

SEWER RETICULATION PLAN

5 0 5 10 15 20 25m
1 : 500 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 26-03-2019
TERRANORA PRECINCT 1 LOT 610 SEWER RETICULATION PLAN AND TRUNK SEWER LONG. SECTION	SK 6978 REVISION A

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ATTACHMENT B

1. BIOME Summary table

2. BIOME, bioretention Basin and Drainage Reserve Design Report, version 4 Project No. BC – 16099, March 2019. Dropbox link.

Bioretention Basin and Drainage Reserve Design Report by Biome – July 2018		
Maintainability of Rock Lined Channel		
	In order to address concerns relating to future safe access for maintenance activities within the central rock lined channel an alternative design has been proposed. This design incorporates a 1 m wide central reno mattresses running down the length of the channel. It is proposed that the reno mattress be filled with d50 150 mm rock with a d50/d90 ratio of 0.8. This central strip will allow safe access up and down the channel for maintenance safe using knapsack spraying units. It is understood that these units have a maximum reach of up to 4 m. The revised design has been tested in the 2D hydraulic model TUFLOW and velocities within the central drainage channel have only increased slightly given the minimal width of the reduced Manning's roughness. The revised design and associated modelling results have been included within the amended Stormwater Design Report Version 4 dated January 2019.	MH to provide BIOME with new DTM for revised model run. DONE BIOME to provide MH with new water levels for all cross sections. DONE
Reintroduction of a fourth bioretention basin: Basin D		
	As suggest by Council Basin D has now been deleted. The upstream portion of the Broadwater Parkway catchment has now been directed into Basin B. MUSIC modelling has been rerun and the results demonstrate that a small increase in the filter surface area will be necessary along with an increase in the southern inlet forebay. The filter has been increased by 10 m^2 and the forebay increased by 7 m^2. The revised designs and MUSIC modelling have been included within the amended Stormwater Design Report Version 4 dated January 2019.	MH to provide BIOME with flows from new pipe into basin to size sediment forebay. DONE MH to amend base for BIOME to amend. DONE

Further Information		
Item 4.1 – dot point 6	The central culverts have been designed to limit flow over the larger central drainage areas downstream of the central bund. The culverts act to restrict flow and engage the high flow weir on events of greater than the 1 year ARI. During the 1 year ARI the culvert does not flow at capacity. Flow is governed by the head over the pipe which is influenced by the central weir RL. The weir is at RL 8.48 m AHD and the obvert of the culverts at RL 8.56 m AHD. The water level at the inlet of the culverts during the 1 year ARI is predicted to be RL 8.48 m AHD and RL 8.96 m AHD during the 100 year ARI. The difference in the upstream head is therefore 480 mm. The increase in driving head effectively increases peak velocity and therefore flow. The peak flow in the culverts is predicted to be 6.50 m^3/s during the 1 year ARI and 12.61 m^3/s during the 100 year ARI.	BIOME to finalise. DONE
Table 4.2	The reduction in catchment area is primarily due to the removal of part of Broadwater Parkway from the MUSIC model. This area was to be treated via grassed swales in the Version 2 report however when Basin D was added this area was removed from the model. A revised MUSIC catchment plan has been developed for Version 4 of the report which reduces the treated catchment of Broadwater Parkway further. This has been done so as to remove Basin D and treat the greatest extent possible of Broadway Parkway.	No action
Q100 d.V	The stormwater and landscape plans have been amended to ensure consistency of reports.	Landscape Plans need to be amended DONE
Q100 PFD Plot	Basin D has now been removed at Council's request. Please note that the level of the SPS within the TUFLOW model was based on the ultimate design levels of the SPS which are RL 3.5 m AHD. It appears that Council are referring to current bulk earthworks level which are	DONE

	RL 3.15 m AHD. The final design incorporates some minor additional earthwork and a concrete slab to raise the SPS site the finished RL of 3.5 m AHD.	
Broadwater Parkway Culverts	The report and modelling that has been prepared has relied upon a culvert design under Broadwater Parkway the includes 6 x 1500 x 1200 RCBC as was included within the report by Gilbert and Sutherland. As such all modelling results in relation to flood depth and velocities test the hydraulic performance of these structures. Section 5.1.2 of the Version 3 report included the following paragraph: *In addition to the DTM, drainage culverts under Broadwater Parkway were added as 1D elements into the TUFLOW model. These culverts are modelled as 6 x 1500 x 1200 RCBC in accordance with the Hydrologic and Hydraulic Assessment (April 2013) by Gilbert & Sutherland.* In addition within Section 5.2.5 of the Version 3 report the following paragraph was included; *Additionally a scenario with a regional Q100 tailwater has been analysed to test the immunity of Broadwater Parkway. The model was modified to include a tailwater level of RL 2.90 m downstream of Broadwater Parkway. This high tailwater level increases the peak Q100 flood level upstream of Broadwater Parkway to approximately RL 3.60 m AHD. The proposed sag level on Broadwater Parkway is 3.75 m AHD, therefore the road surface is still flood free during the regional Q100 tailwater scenario.* The modelling result clearly indicate that the 6 x 1500 x 1200 RCBC have the ability to convey the peak 100 year ARI flows under Broadwater Parkway with no overtopping during both a low and high tailwater condition.	DONE
Plots	When producing the amended plots for Version 3 of the report a different zoom was used which unintentionally excluded the area upstream of the Market Parade culverts. The zoom has now been amended to include this area with the Version 4 report. We apologise for any inconvenience this may have caused.	DONE
Difference in water level	The relatively small difference in water surface between 5 year ARI and the 100 year ARI the can be attributed to: • an increase in the hydraulic radius between each event; and • an increase in velocity. For example at Cross Section 100 the peak inflow in the 5 year ARI is 10.8 m3/s and in the 100 year ARI 18.7	DONE

	m3/s. This is an increase of approximately 7.9 m^3/s. The water level difference at this location is 150 mm. Using: Q = VA Q = 7.9 m3/s V = 3.4 m/s in the 100 year ARI. A = L x H L = 16 m H = 150 mm Therefore = 3.4 X 16 x 0.15 = 8.16 m^3/s	

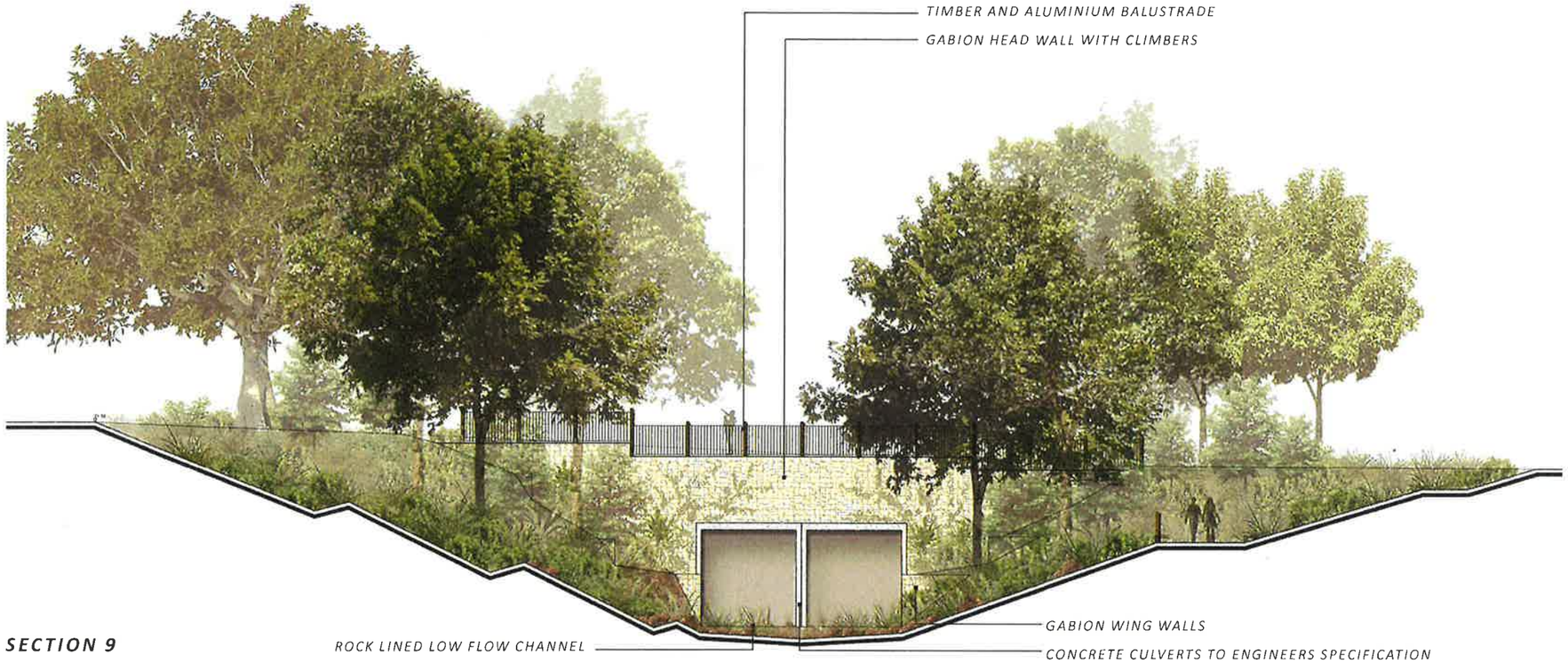
ATTACHMENT B

2. BIOME, bioretention Basin and Drainage Reserve Design Report, version 4 Project No. BC – 16099, March 2019. Dropbox link below. Please open in ADOBE.

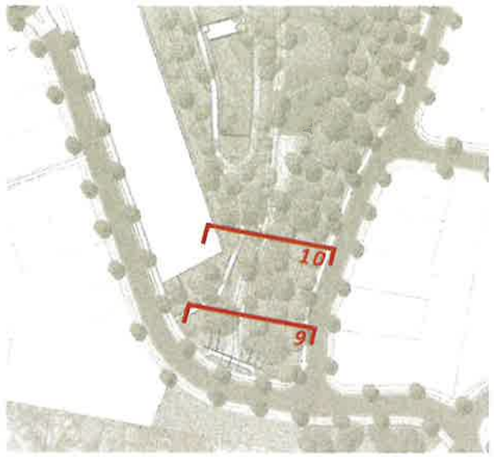
   https://www.dropbox.com/sh/0hx3lquya2tk0zb/AACCCKLF9SMWRFe_kSQrc_WLa?dl=0

ATTACHMENT C

1. FORM Landscape drawings (related to Market Parade culverts)
2. Landscape Sections, p15, Sections 7 & 8
3. Landscape Sections, p16, Sections 9 & 10
4. Bradlees Box Culvert Sections SK Revision E, 6-02-2019



SECTION 9





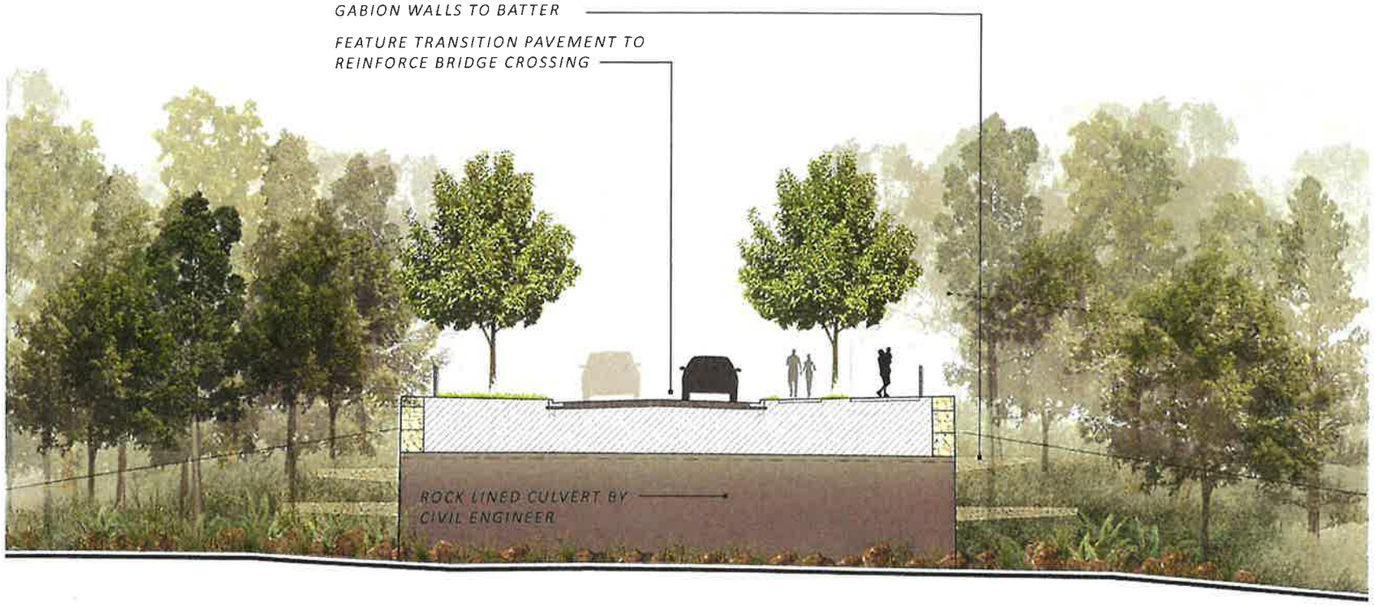
SECTION 10

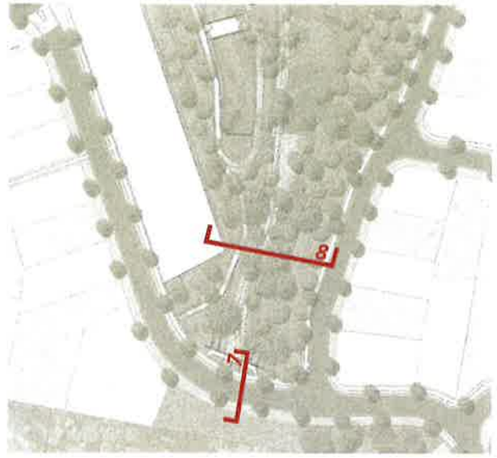


LANDSCAPE SECTIONS

100906 | 14 FEB 19 | DA16 | SCALE 1:200 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**





SECTION 7

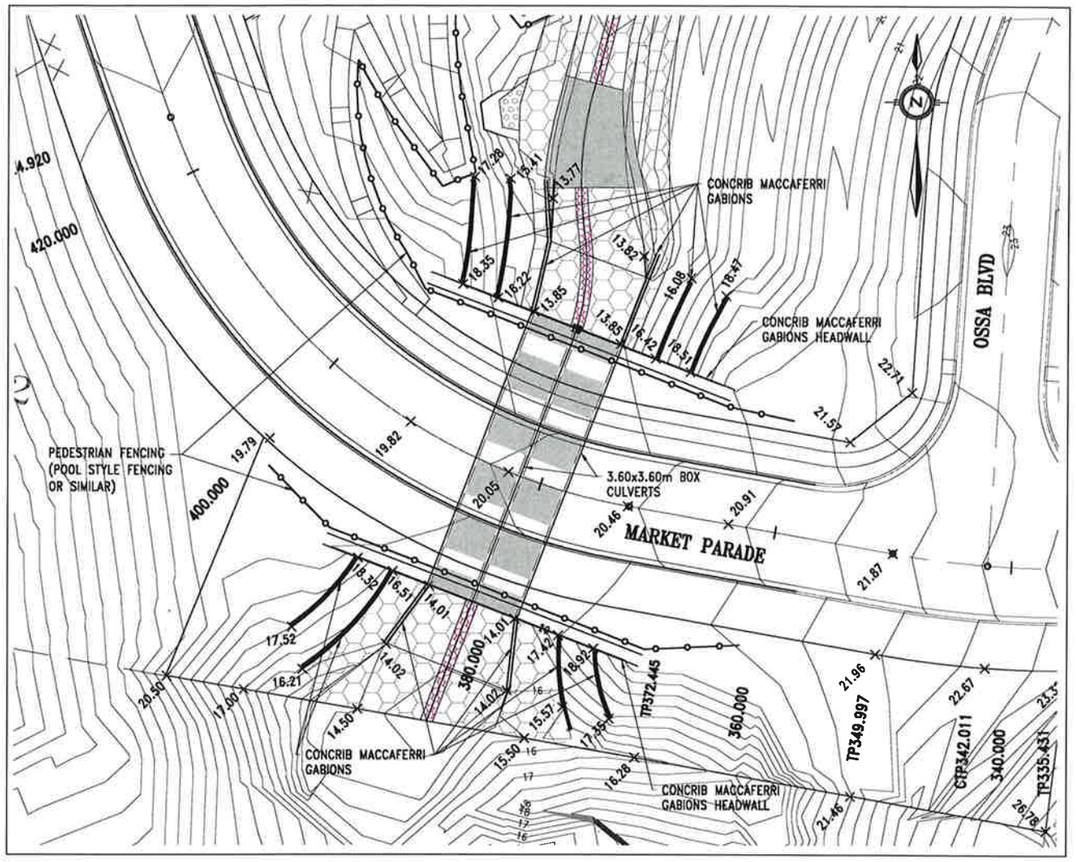


SECTION 8

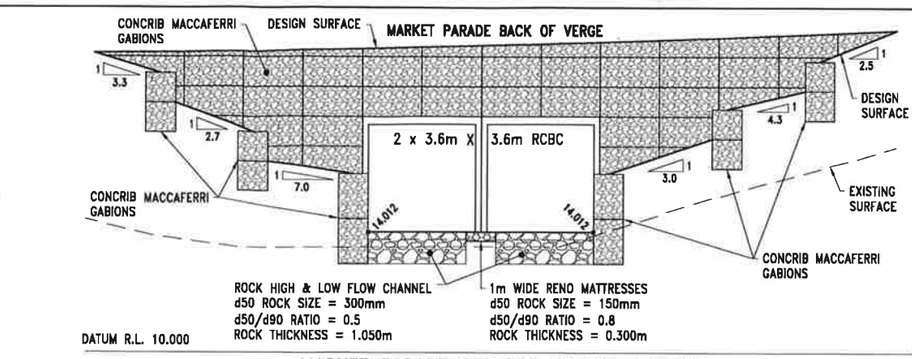
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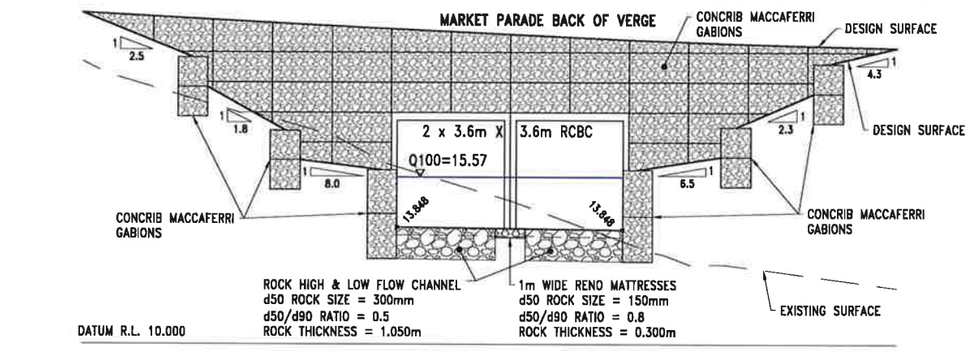
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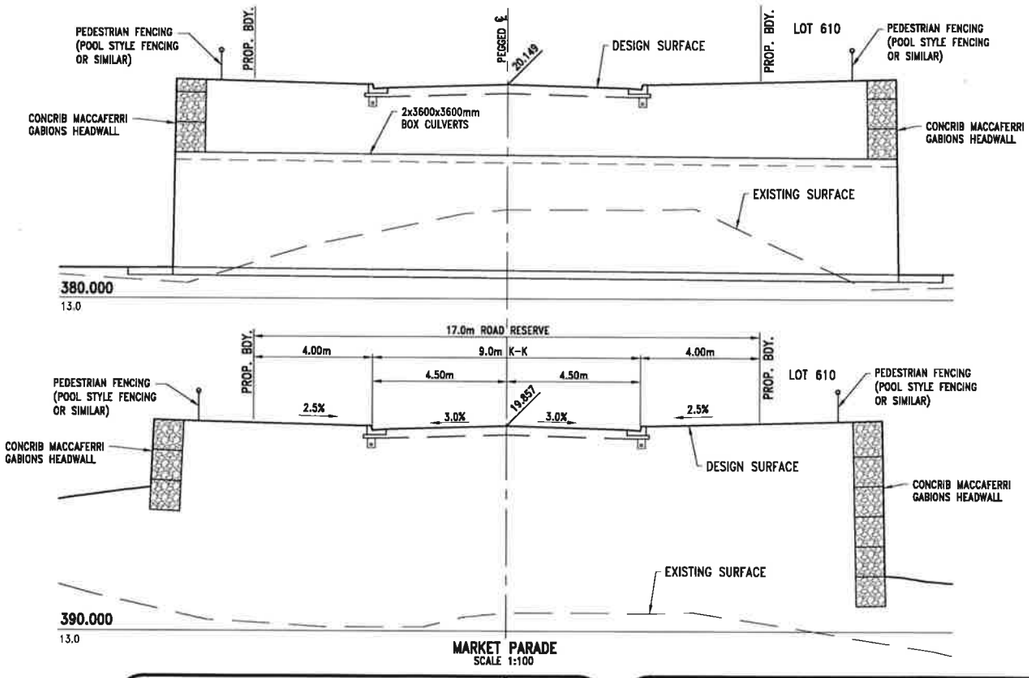
BOX CULVERT SECTIONS LAYOUT
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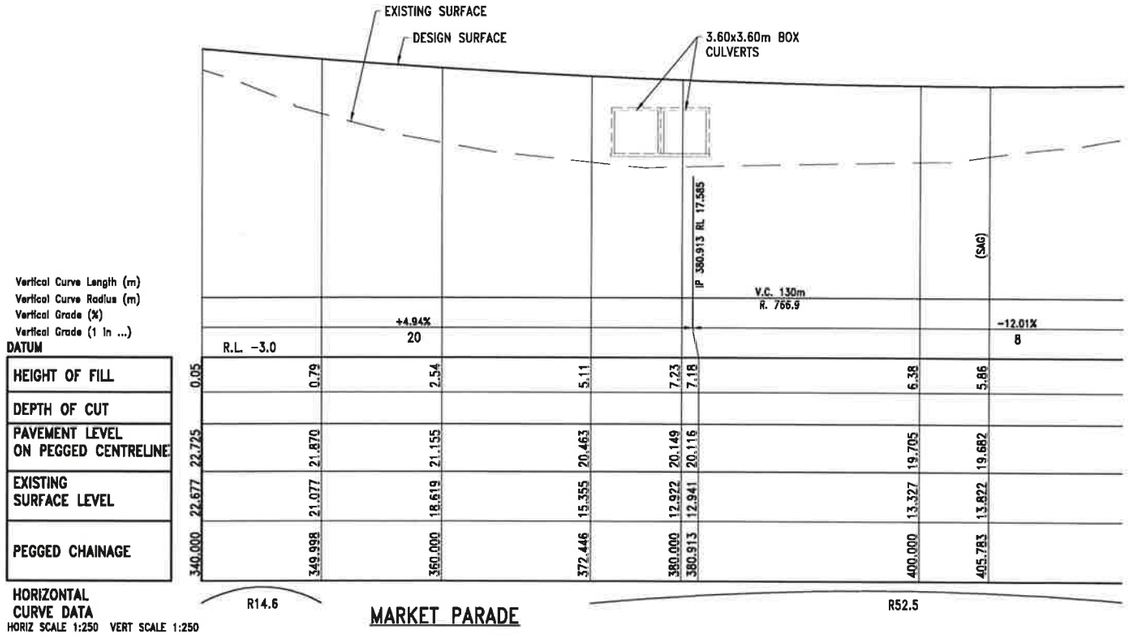
MARKET PARADE CULVERT UPSTREAM WALL
SCALE 1:100



MARKET PARADE CULVERT DOWNSTREAM WALL
SCALE 1:100



MARKET PARADE
SCALE 1:100



1 0 1 2 3 4 5m
1 : 100 (FULL SIZE A1)

5 0 5 10m
1 : 250 (FULL SIZE A1)

NEWLAND DEVELOPERS PTY LTD	09-374 06-02-2019	
ALTITUDE ASPIRE BOX CULVERT SECTIONS	SK 3487 REVISION E	

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BIOME
WATER AND ENVIRONMENTAL CONSULTING

Bioretention Basin and Drainage Reserve Design Report

Altitude Aspire,
Terranora

for

Newland Developers Pty Ltd

Version 4

Project No: BC-16099

March 2019

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Dated: March 2019

Distribution:

	Revision	Digital .PDF
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Version 3		1 x Bradlees 1 x Newland Developers Pty :Ltd 1 x BIOME Consulting
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Executive Summary

This Bioretention Basin and Drainage Reserve Design Report (Version 4), has been prepared on behalf of Newland Developers Pty Ltd to support revised designs of the bioretention basins and central drainage channel conveyance within the Altitude Aspire residential development at 37 Fraser Drive, Terranora (the subject site).

Versions 1 and 2 of this report were submitted to Council for consideration and whilst the revised designs presented for the bioretention basins and central drainage channel conveyance were conceptually supported, additional detail was requested. Version 3 of the report included the requested additional detail.

Version 4 of this report has been prepared to respond to items raised by Council within letter dated July 2018. The most significant amendment has been the removal of Bioretention D, which was designed to treat flows from Catchment D. Flow will now be directed to Basin B for treatment.

It is noted that two (2) reports, including a *Stormwater Assessment & Management Plan* and *Hydrologic & Hydraulic Assessment Report*, by Gilbert and Sutherland (dated April 2013) have been previously completed and approved by Council. These reports detail designs and sizing of the stormwater treatment measures (bioretention basins) and also provide a hydraulic assessment of the previous central drainage channel conveyance channel.

The purpose of this report is to:

- provide revised (up to date) *MUSICv6* modelling and a greater level of detail for the bio-retention basin to be located within the central drainage area; and
- to detail an alternative configuration for the central drainage reserve and conveyance channel, aimed at limiting peak velocities and depths so as to improve safety and ongoing maintenance requirements.

It has been demonstrated via *MUSICv6* modelling, that the proposed revised bioretention basin configurations and stormwater treatment train will achieve pollutant removal efficiencies of 80%, 60%, 45% and 90% for TSS, TP, TN and gross pollutants respectively.

In addition it has been demonstrated that peak water depths and velocities within the central drainage reserve can be greatly reduced, from the previous design, whilst maintaining the overall capacity of the flowpath to convey upstream flows. Maximum d.V product has been reduced from over 6 m^2/s to below 3.5 m^2/s.

Whilst this represents an improvement in safety, urban waterways and stormwater drainage systems with d.V products of greater than 0.6 m^2/s remain a safety risk (Table 12.1.12 of QUDM). It will therefore be necessary to restrict access and discourage a person/child from entering areas with an expected d.V product of greater than 0.6 m^2/s with the provision of fencing and dense planting to restrict/limit public/pedestrian access.

Where flows are concentrated and flow velocities are expected to be higher, appropriate scour protection has been incorporated into the revised design to protect against scour.

This report has been reviewed by a Registered Professional Engineer of Queensland (RPEQ), and certification has been provided that if the design parameters set out in this report are included within the development, stormwater pollutant load reductions in accordance with best practice should be achieved and the safety (peak flow, depths and d.V product) characteristics of the central drainage reserve improved from the previous design solution.

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Appendix A – Bradlees Channel Design (based on previous concept)
Appendix B – Operational Control Plan Drawing Set
Appendix C – Bioretention Design Checklist
Appendix D – Central Drainage Assessment Plots

1 Introduction

This *Bioretention Basin and Drainage Reserve Design Report* (Version 4), has been prepared on behalf of Newland Developers Pty Ltd to support revised designs of the bioretention basins and central drainage conveyance channel within the Altitude Aspire residential development at 37 Fraser Drive, Terranora (the subject site).

Versions 1 and 2 of this report were submitted to Council for consideration and whilst the revised designs presented for the bioretention basins and central drainage channel conveyance were conceptually supported, additional detail was requested. Version 3 of the report included the requested additional detail.

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It is noted that two (2) reports, including a *Stormwater Assessment & Management Plan* and *Hydrologic & Hydraulic Assessment Report*, by Gilbert and Sutherland (dated April 2013) have been previously completed and approved by Council. These reports detail designs and sizing of the stormwater treatment measures (bioretention basins), and also provide a hydraulic assessment of the approved central drainage channel conveyance channel.

The purpose of this report is to:

- provide revised (up to date) *MUSICv6* modelling and a greater level of design for the bio-retention basins to be located within the central drainage area; and
- to detail an alternative configuration for the central drainage reserve and conveyance channel, aimed at limiting peak velocities and depths so as to improve safety and ongoing maintenance requirements.

1.1 Objectives

The objective of this report is to present an optimised design of the stormwater treatment measures and central drainage channel, supported by current modelling software and industry best practice management measures.

1.1.1 Operational Phase Objectives

The overarching objective for stormwater quality management during the operational phase of the development is to ensure that development does not cause an unacceptable impact or nuisance which could result in actionable damage to downstream properties and receiving environments. The following objectives are to be achieved.

Operational Phase Objective (Quality)	Stormwater discharged from the site achieves the specified load based reduction targets in accordance with the Tweed Shire Council Water Quality Objectives (as described in Table D7.07-WQO of the Development Design Specification D7 – Stormwater Quality). For the development site relevant targets are TSS 80%, TP 60%, and TN 45%.
Operational Phase Objective (Quantity)	Central drainage conveyance capacity is not compromised and peak velocities and depths are maintained so as to limit safety risks and minimise ongoing maintenance requirements.

2 Site Location

The site is located to the west of Fraser Drive, Terranora and covers an area of approximately 36 ha. The site location is displayed in Figure 2.1.



Figure 2.1 Site Location

2.1 Rainfall

Based on rainfall data obtained from the Bureau of Meteorology (BOM) from the Tweed Heads Golf Club rainfall station 58056, the mean annual rainfall expected for the site is 1,693 mm (Figure 2.2).

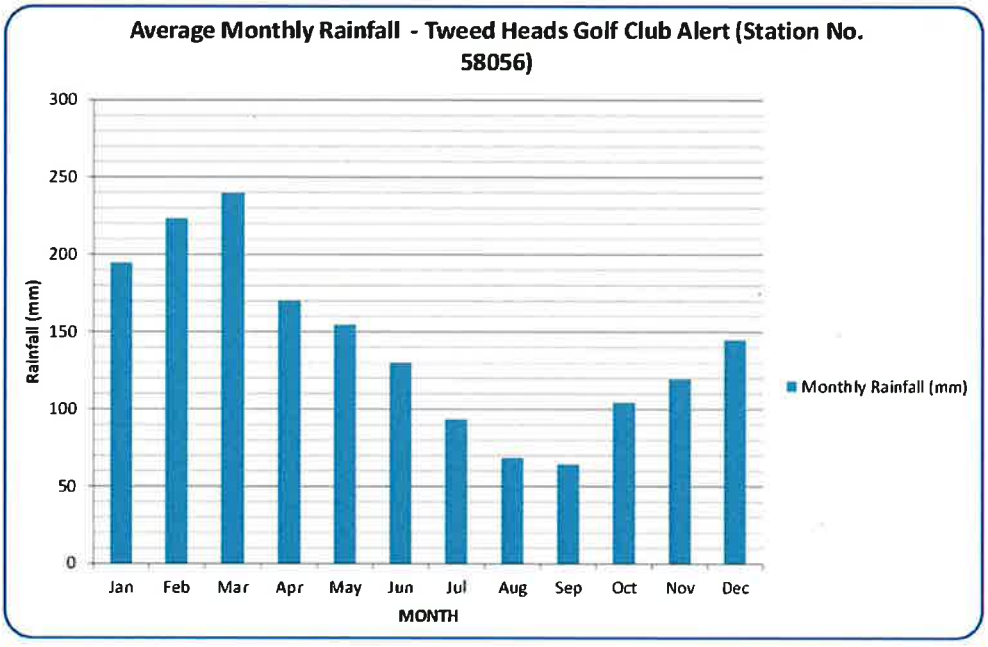


Figure 2.2 Monthly Rainfall Data

3 Previous Central Drainage Reserve Configuration

The site is being development as a 251 lot residential subdivision over several stages (Figure 3.1). As part of the approved development layout, a central drainage reserve has been included for the conveyance and treatment of stormwater from both the upstream and internal catchments.

The previous design of the central drainage corridor accommodates stormwater management features comprising of four (4) bioretention treatment basins and a constructed trapezoidal drainage channel to convey catchment flows through the site to the discharge point north of Broadwater Parkway. Stormwater detention is provided on the northern side of Broadwater Parkway via a low bund with hydraulic outlet controls.

This stormwater management concept was developed by Gilbert & Sutherland and detailed with their approved *Stormwater Assessment & Management Plan* (April 2013) and the *Hydrologic and Hydraulic Assessment* (April 2013).

The proposed stormwater management measures included;

- Rainwater tanks, with a 5kL storage capacity installed to capture roof runoff within each residential allotment;
- Four (4) Bioretention Basins;
- A central drainage channel for the conveyance of upstream and internal catchment flows; and
- A low bund on the downstream side of Broadwater Parkway for mitigation of peak discharge.

The previous central drainage configuration is presented within Figure 3.2 below.

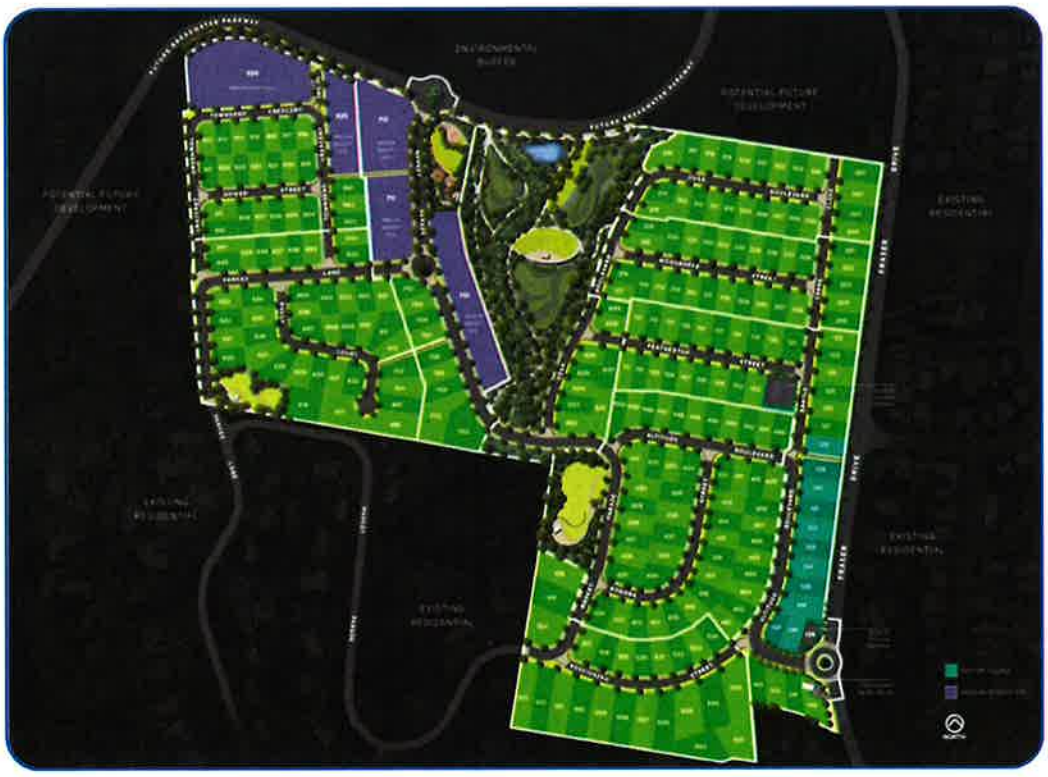


Figure 3.1 Development Layout

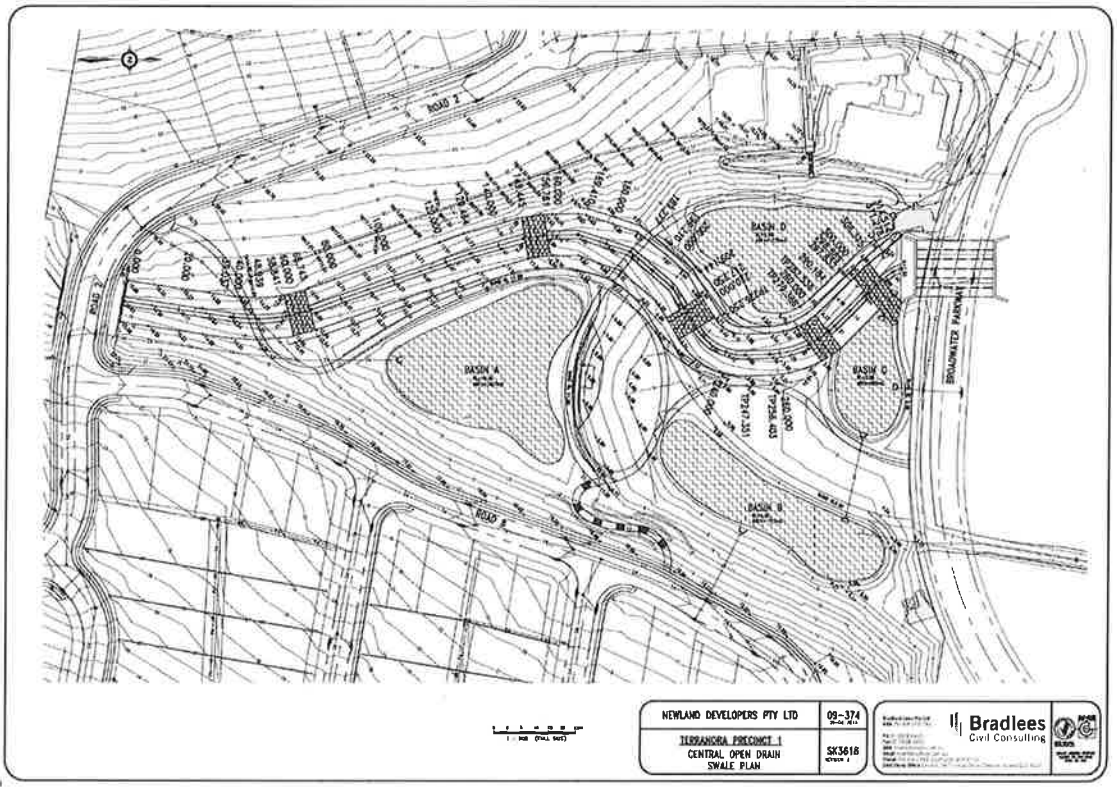


Figure 3.2 Previous Central Reserve Configuration

Since the original stormwater concept was prepared by Gilbert and Sutherland, there have been several MUSIC software updates and a number of parameter amendments. In general, these changes have resulted in smaller bioretention filter area requirements.

Undertaking revised *MUSICv6* modelling therefore provides the opportunity to optimise bioretention filter area requirements within the central drainage reserve and decrease construction and ongoing maintenance costs.

Hydraulic analysis of the previous central drainage channel design by Bradlees (Appendix A) was undertaken to assess the design requirements for the proposed constructed trapezoidal drainage channel. Whilst upstream and internal catchment conveyance through the central drainage reserve can be achieved, the resulting d.V product expected during the 0.01 AEP flood event are expected to be over 6 m^2/s. Modelling suggests that this d.V product would extend along the entire length of the channel and therefore in order to address safety concerns, fencing and appropriate warning signage would be required to restrict public access.

4 Revised Central Drainage Reserve Configuration

Given the opportunity to update and optimise the bioretention configurations and in an effort reduce the extent and scale of the current d.V product within central drainage reserve a revised central drainage reserve configuration has been proposed.

The following sections outline the design parameters for the alternative design solution.

4.1 Schematic Design Plan

Figure 4.1 presents a schematic design plan of the proposed alternative drainage and treatment system to be incorporated within the development. The Operational Control Plan Drawing Set within Appendix B contains design drawings which illustrate the layout and design requirements of each mitigation measures. Figures 4.2 to 4.4 provide a civil design drawing of the revised concept.

Whilst the alternative stormwater treatment train proposed within this report remains similar in principle to those stated within the approved Gilbert & Sutherland report, the following modifications have been proposed;

- Three (3) bioretention basins will be retained but reconfigured for the treatment of allotment and road surfaces;
- The central drainage channel will be replaced in part by a wide vegetated flow path to increase the width of flow, and therefore reduce flow depth and velocity;
- The upper 100 m of the new drainage path will be rock lined as the topography in this areas dictates that a relatively narrow flowpath will be required;
- This upper rocked channel will open out into a wide vegetated area of low flow depths and velocities;
- Approximately half way down the drainage channel, a pipe and weir arrangement will divert low flows into a low flow rock lined channel;
- The flow through these culverts during the 1 year ARI will be 6.50 m^3/s (approximately to the Q1 peak discharge) and 12.61 m^3/s during the 100 year ARI.
- High flows will discharge over two (2) central weirs into a wide (40 m) vegetated channel during storm events greater than Q1;
- Flows over the 40 m wide vegetated channel with have low depths and velocities; and
- The combined high and low flow channels discharge into the culverts under Broadwater Parkway.

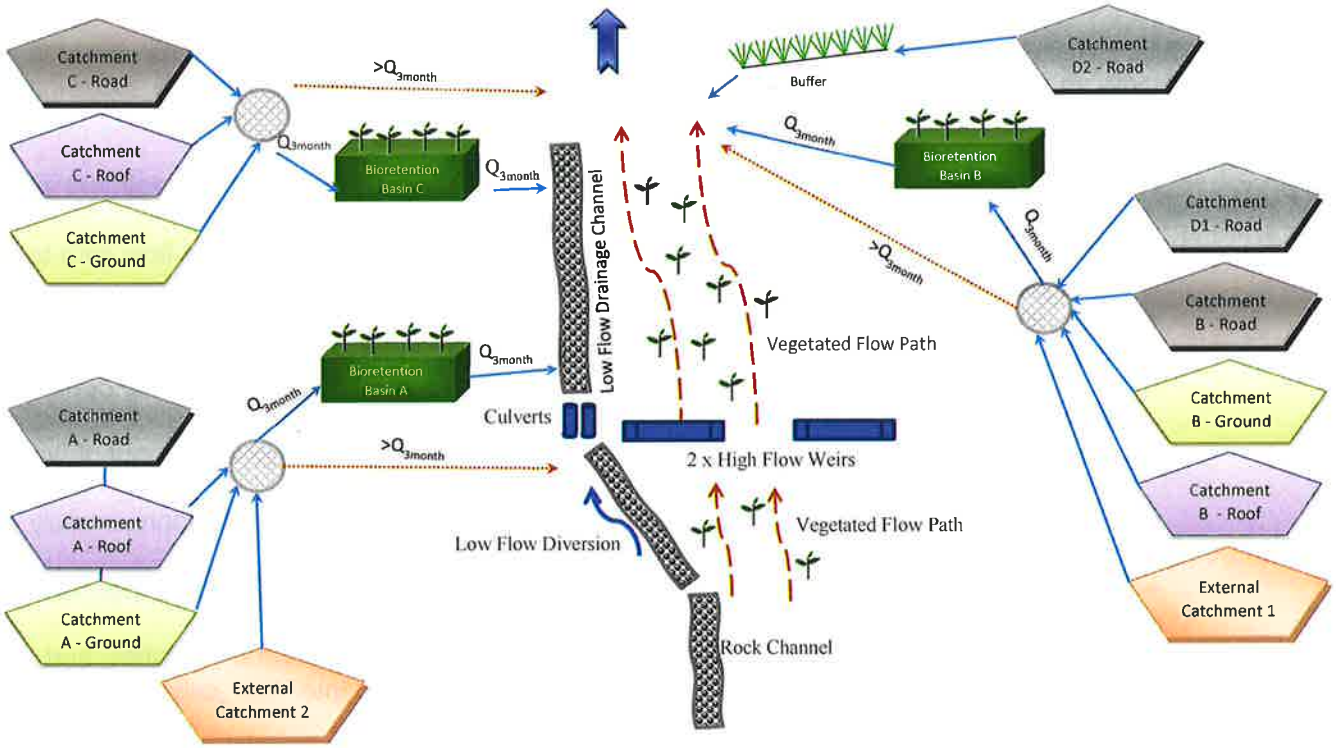


Figure 4.1 Schematic Stormwater Drainage and Treatment Concept

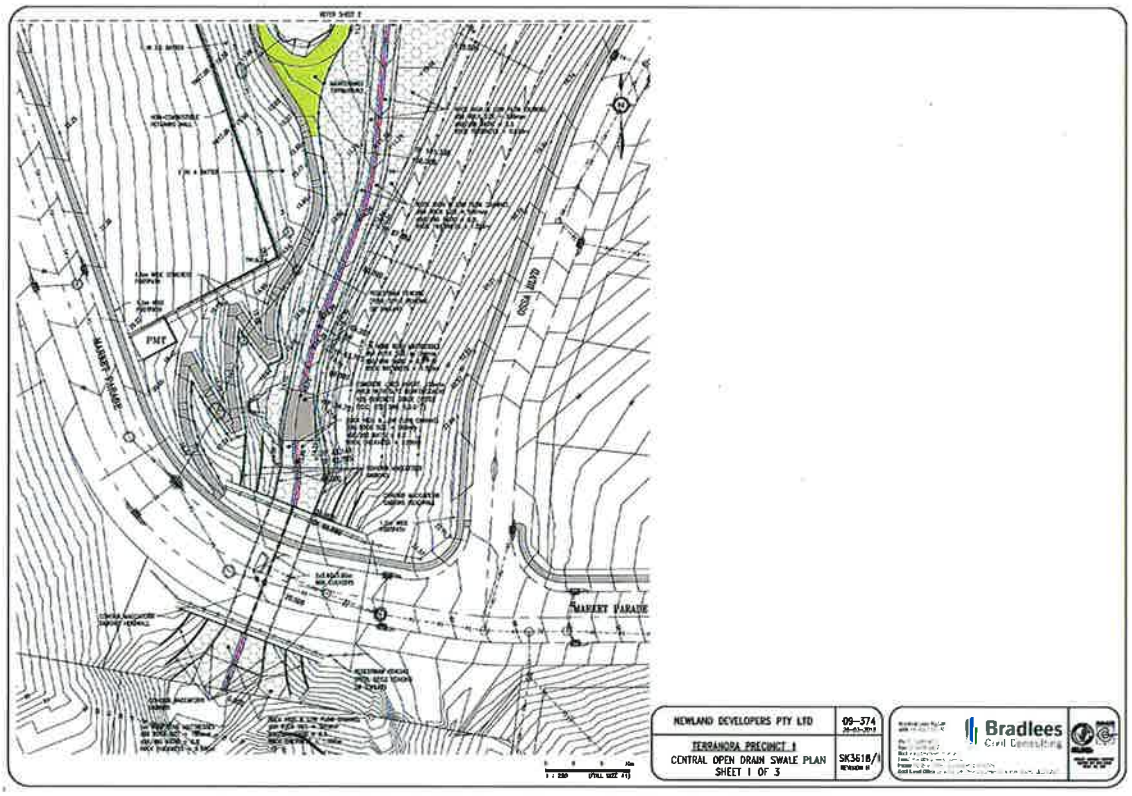


Figure 4.2 Revised Central Drainage Reserve Configuration (Bradlees) Sheet 1 of 3

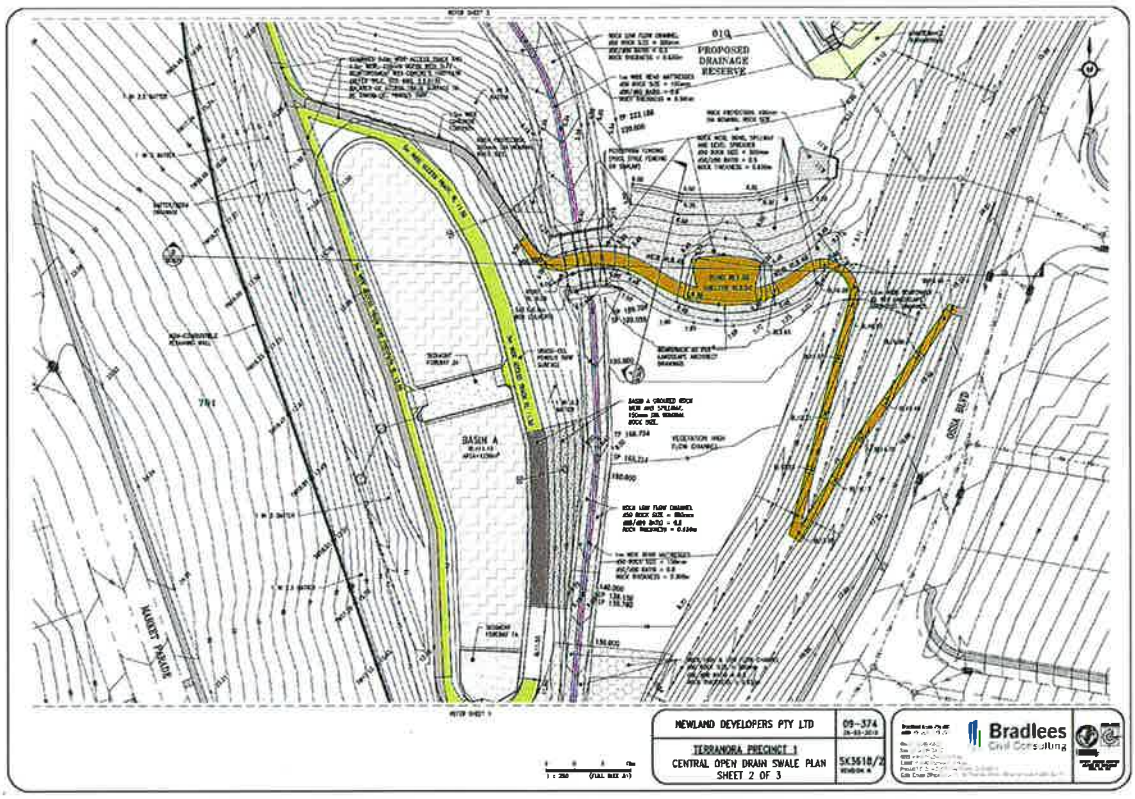


Figure 4.3 Revised Central Drainage Reserve Configuration (Bradlees) Sheet 2 of 3

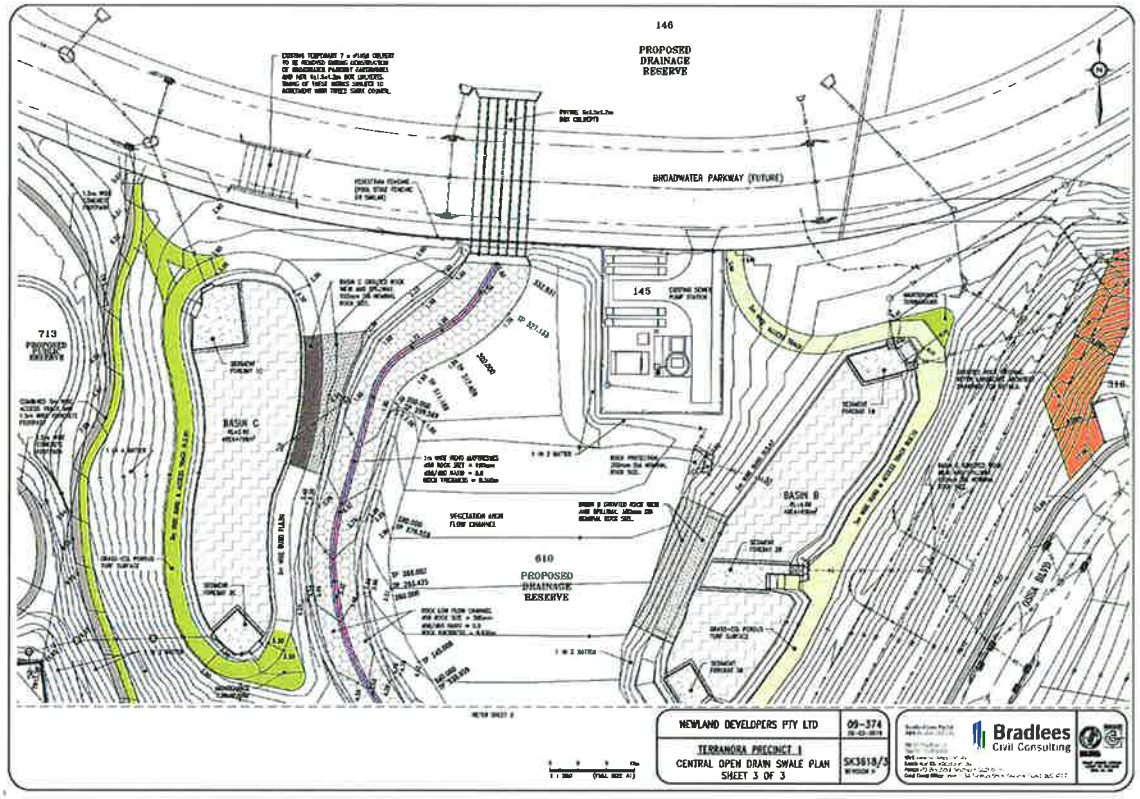


Figure 4.4 Revised Central Drainage Reserve Configuration (Bradlees) Sheet 3 of 3

4.2 Quality Control – Pollutant Reduction

In accordance with Tweed Shire Council Design Specifications, the site is required to meet minimum mean annual load based reductions of 80% for Suspended Sediment; 60% for Total Phosphorus, 45% for Total Nitrogen; and 90% for Gross Pollutants.

The Model for Urban Stormwater Improvement Conceptualisation (*MUSIC v6*) has been used to estimate the potential pollutant loads generated by the development and to re-size the proposed treatment measures. The following sections outline the parameters relied upon within the *MUSIC v6* modelling.

4.2.1 Rainfall and Evapotranspiration Data

The Tweed Standard Rainfall Dataset has been obtained from the Tweed Shire Council website and utilised for modelling purposes as required within DDS-D7 section D7.13. A summary of the Meteorological data utilised is included within Table 4.1 below.

Table 4.1 Meteorological and Rainfall Runoff Data Reporting

BOM Station No.	Murwillumbah (Bray Park) – Station No. 058158
Period	16/10/1973 to 30/06/1984 (10.5 years)
Time step	6 minute
Mean annual rainfall (mm)	1,697
Evapotranspiration	1,363

4.2.2 Developed Case - Catchment Parameters

The developed site has been considered as four (4) internal catchments based on the proposed layout and the developed earthworks. It is noted that there are two (2) external catchments which contribute flows to two (2) of the internal catchments and therefore need to be considered within the proposed stormwater treatment train. Each of the catchments has been modelled as an Urban Residential land use according to proposed land uses within the developed site. Each internal catchment has been split into roof, road and ground level source nodes in accordance with the proposed layout. It is noted that the larger unit allotments and external catchments have been modelled as 'lumped' residential catchments. Table 4.2 summarises the sub-catchment areas and Drawing DWG 210 – Appendix B presents the sub-catchment delineation. The pollutant export and runoff parameters for each sub catchment adopted is based on the data from the Water by Design *MUSIC v6* Modelling Guidelines (2010), as summarised in Table 4.3 and 4.4.

Table 4.2 *MUSIC v6* Sub-Catchment Areas

Catchment ID	Land Use	Area (ha)	Total Impervious (%)
Catchment A	Urban Residential - Road	2.481	60
	Urban Residential - Roof	3.763	100
	Urban Residential - Ground Level	4.584	20
	Urban Residential - Lumped	0.737	55
Catchment B	Urban Residential - Road	2.288	60
	Urban Residential - Roof	3.285	100
	Urban Residential - Ground Level	3.286	20

Catchment C	Urban Residential - Road	2.621	60
	Urban Residential - Roof	1.606	100
	Urban Residential - Ground Level	2.244	20
	Urban Residential - Lumped	2.151	55
External Catchment 1	Urban Residential - Lumped	1.189	55
External Catchment 2	Urban Residential - Lumped	1.048	55
Total (ha)	-	**31.28**	-

Table 4.3 Rainfall Runoff Parameters

Parameter	All Nodes
Landuse	Residential
Rainfall threshold (mm)	1
Soil storage capacity (mm)	500
Initial storage (% capacity)	10
Field capacity (mm)	200
Infiltration capacity coefficient a	211
Infiltration capacity exponent b	5.0
Initial depth (mm)	50
Daily recharge rate (%)	28
Daily baseflow rate (%)	27
Daily deep seepage rate (%)	0

Table 4.4 Pollutant Export Parameters

Flow Type	Surface Type	Total Suspended Solids (log mg/L)		Total Phosphorous (log mg/L)		Total Nitrogen (log mg/L)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
	Urban Residential						
Base Flow	Roof	N/A	N/A	N/A	N/A	N/A	N/A
	Road	1.00	0.34	-0.97	0.31	0.20	0.20
	Ground	1.00	0.34	-0.97	0.31	0.20	0.20
	LUMPED	1.00	0.34	-0.97	0.31	0.20	0.20
Storm Flow	Roof	1.30	0.39	-0.89	0.31	0.26	0.23
	Road	2.43	0.39	-0.30	0.31	0.26	0.23
	Ground	2.18	0.39	-0.47	0.31	0.26	0.23
	LUMPED	2.18	0.39	-0.47	0.32	0.26	0.23

4.2.3 Treatment Measures

In order to determine the design requirements for the necessary stormwater treatment measures, key "Treatment Nodes" were added to the *MUSICv6* model. The following sections outline the modelling parameters relied upon for each "Treatment Node".

Bioretention

It is proposed that bioretention measures be incorporated into the development layout to provide the necessary load based reductions. Bioretention systems operate by capturing water and retaining water in an extended ponding area (no more than 400 mm deep for a maximum of four (4) days to prevent anaerobic conditions, plant death and insect breeding),

before filtering through a soil media. The devices remove pollutants via the following physical processes:

- Sedimentation in the extended detention storage;
- Filtration by filter media;
- Nutrient uptake by biofilms;
- Nutrient adsorption and pollutant decomposition by soil bacteria; and
- Adsorption of metals and nutrients by filter particles (Somes & Crosby, 2007).

In accordance with Water by Design Guidelines, Table 4.5 summarises the treatment node parameters used in the *MUSIC v6* modelling whilst Figure 4.5 provides typical design parameters for the proposed bioretention devices. A bioretention Design Checklist in accordance with the Water by Design Bioretention Technical Design Guidelines has been completed and is included within Appendix C.

Table 4.5 Bioretention Parameters

Catchment ID	Bioretention A	Bioretention B	Bioretention C
Surface area (m^2)	1,500	1,024	880
Has the filter area been calculated appropriately?	Yes	Yes	Yes
Extended detention depth (m)	0.3	0.3	0.3
Filter area (m^2)	1,250	830	798
Unlined filter media perimeter (m)	0.01	0.01	0.01
Saturated hydraulic conductivity (mm/hour).	200	200	200
Filter depth (m)	0.5	0.4	0.5
TN content of filter media (mg/kg)	400*	400*	400*
Proportion of organic material in filter (%)	< 5	< 5	< 5
Orthophosphate content of filter media (mg/kg)	30*	30*	30*
Is the base lined? (Y/N)	Yes	Yes	Yes
Effectiveness of plant TN removal	Effective	Effective	Effective
Overflow weir width (m)	Surface Area/10	Surface Area/10	Surface Area/10
Exfiltration rate (mm/hr)	0.00	0.00	0.00
If an exfiltration rate has been used, have node water balance losses been used in calculation of treatment train effectiveness?	N/A	N/A	N/A
If exfiltration rate has been used, is the exfiltration rate justified?	N/A	N/A	N/A
Underdrain present?	Yes	Yes	Yes
Submerged zone with carbon present?	No	No	No
Depth of submerged zone (m)	N/A	N/A	N/A
Confirmation that K and C* remain default?	Yes	Yes	Yes

*As per Healthy Land and Water Recommendations for MUSICv6 modelling

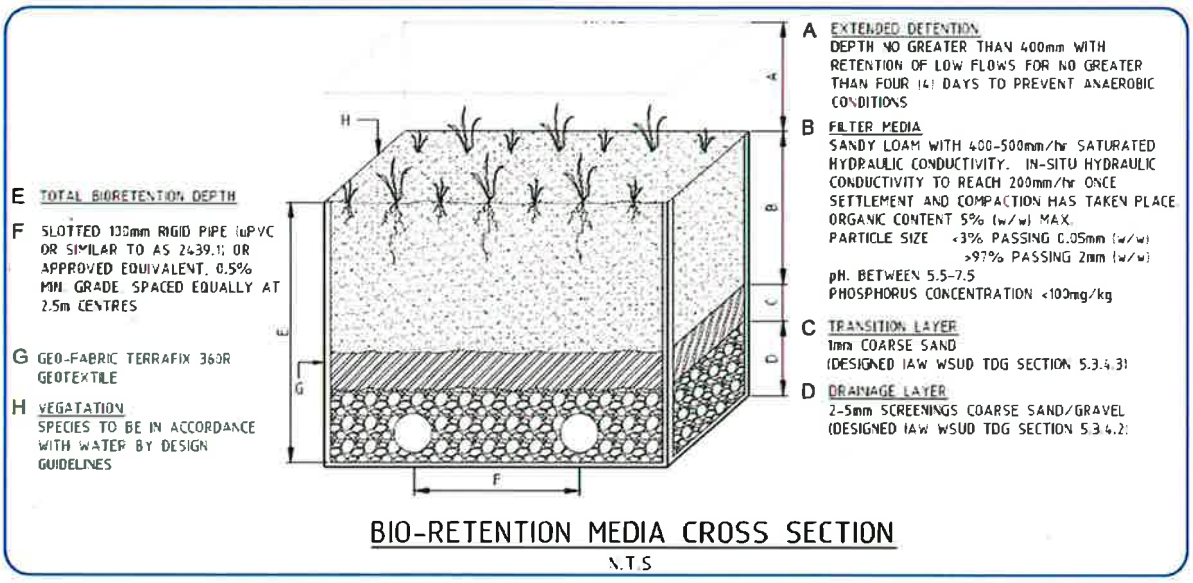


Figure 4.5 Bioretention specifications

Coarse Sediment Forebay

For the contributing catchments to the bioretention measures with and area greater than 2 ha, a coarse sediment forebay will be installed at each piped discharge point into the bioretention basins. Each forebay will limit sediment accumulation over the bioretention filter surface and reduce the potential for clogging. This will also help to reduce the frequency of maintenance required for the bioretention systems. For the larger basins, Basins A and B, the forebays have been shaped so as to allow formation of two (2) smaller filter cells. This will assist in constructability, limit the length of underdrainage, and in addition reduce the risk of uneven distribution of stormwater over the filter surface. Table 4.6 provides a summary of the sediment forebay calculations and requirements. The sediment forebays have been excluded from the *MUSIC v6* modelling.

Table 4.6 Sediment Forebay Parameters

Basin ID	Forebay I.D	Contributing Catchment Area (ha)	Q_{3month} Inflow Rate (m^3s)	Settling Velocity (m/s)	Area (m^2)	Depth (m)	Capture Efficiency (%)
Basin A	1A	5.78	0.718	0.1	82.5	0.2	80
	2A	5.78	0.718	0.1	82.5	0.2	80
Basin B	1B	0.6	0.281	0.1	40	0.2	80
	2B	2.4	0.397	0.1	46	0.2	80
	3B	6.0	0.34	0.1	40	0.2	80
Basin C	1C	6.3	0.72	0.1	83	0.2	80
	2C	2.6	0.325	0.1	38	0.2	80

4.2.4 Bioretention Basin Staged Construction and Establishment

In accordance with the Water by Design Construction and Establishment Guidelines: Swales Bioretention Systems and Wetlands (C & E Guidelines), inflow of sediment-laden runoff during the building stage is a major risk to the successful and long-term functioning of bioretention systems.

During the building phase of developments, sediment can seal the surface of the filter media, move into and clog the filter media and accumulate in the under-drainage. Within the C & E

Guidelines, there are four (4) options recommended to overcome the challenges associated with delivering bioretention systems. These generally include the following options:

- Option 1: Surface Protection
- Option 2: Bypass flows and early establishment of vegetation;
- Option 3: Sediment basin and bioretention function; and
- Option 4: Leave as sediment basin.

It is recommended that Option 4 method to leave the basin as a sediment basin during the construction phase of the proposed development be implemented. This method will generally include the following:

- Earthworks and bulking out of basin;
- Install the hydraulic structures;
- Allow system to operate as a sediment basin (Type D as determined in Section 5.3.4) during the building phase; and
- When 80-90% of building in the catchment is complete, the bioretention system can be cleaned and profiled, the under-drainage and bioretention media installed, and the vegetation planted and established.

For details of the procedure and order of construction for Option 4 method please refer to Section 3.10 (Steps 1-41) of the C& E Guidelines.

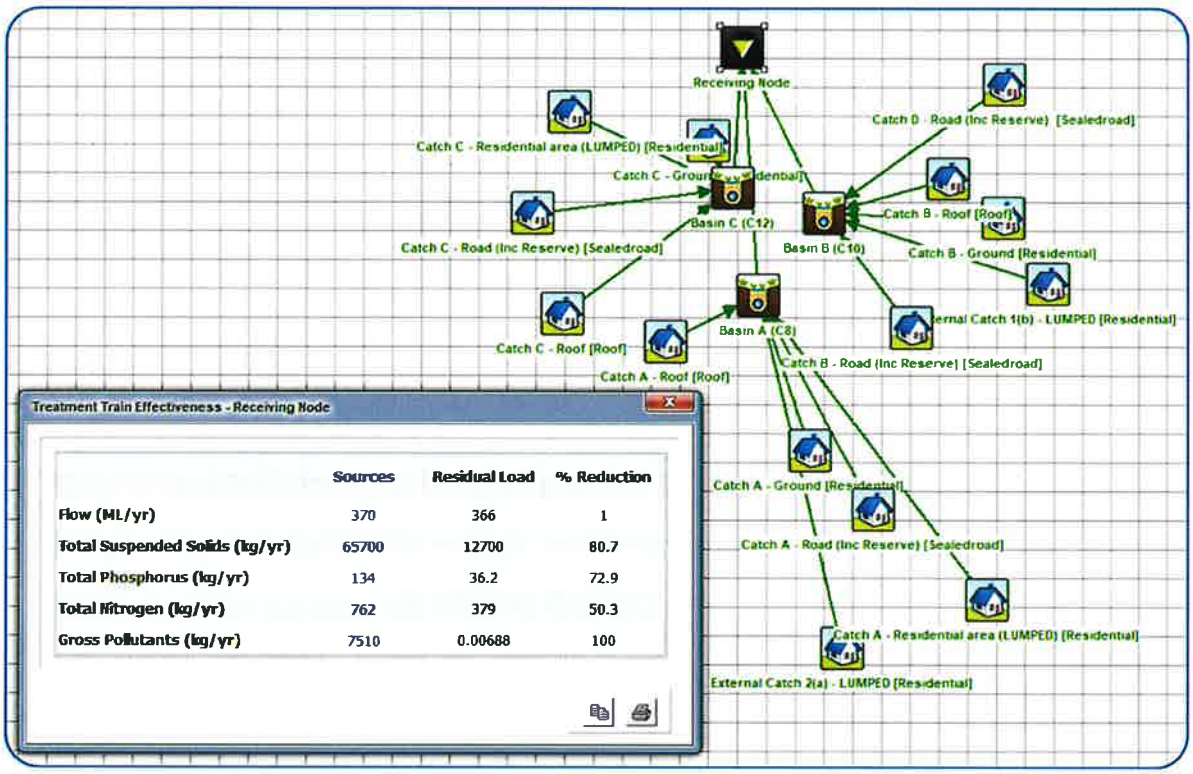
4.2.5 Modelling Results

Results of the *MUSICv6* modelling for the treatment train effectiveness are summarised in Table 4.7. The results indicate the 80%, 60%, 45% and 90% reduction target for TSS, TP, TN and gross pollutants respectively are achieved for the rainfall data set simulated. A screen capture of the *MUSICv6* modelling results is included as Figure 4.6.

Table 4.7 Treatment Train Effectiveness

Catchment ID	Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction (kg/yr)	Reduction Achieved (%)	Water Quality Objective (%)
TOTAL	TSS	65,700	12,700	53,000	**80.7**	80.0
	TP	134	36.2	97.8	**72.9**	60.0
	TN	762	379	383	**50.3**	45.0

NOTE: All simulations have been run with pollutant export estimation set to "stochastic generation".



	Sources	Residual Load	% Reduction
Flow (ML/yr)	370	366	1
Total Suspended Solids (kg/yr)	65700	12700	80.7
Total Phosphorus (kg/yr)	134	36.2	72.9
Total Nitrogen (kg/yr)	762	379	50.3
Gross Pollutants (kg/yr)	7510	0.00688	100

Figure 4.6 Screen Capture of MUSIC Modelling Results

5 Hydraulic Assessment - *TUFLOW*

The 1D - 2D hydrodynamic flood model TUFLOW has been utilised to route stormwater through the central drainage channel of the site in an effort to:

- confirm the capacity of the drainage path;
- determine post-development depths within the drainage path; and
- quantify post-development velocities to ensure adequate surface scour protection.

5.1.1 Modelling Procedure

To simulate the peak flow behaviour within the catchment and quantify peak flood depths, discharges, and flow velocities, hydraulic modelling using the 1D/2D hydrodynamic model TUFLOW was undertaken. This involved the insertion of inflow hydrographs into the model upstream of the site. The hydrographs were taken from the previously approved *Hydrologic and Hydraulic Assessment (April 2013)* by Gilbert & Sutherland. Table 5.1 presents the peak inflow at each location for the full range of AEP's and the locations are depicted in Figure 5.1.

Table 5.1 Peak Model Inflows

Inflow Location	0.632 (1 yr ARI) (m^3/s)	0.393 (2 yr ARI) (m^3/s)	0.181 (5 yr ARI) (m^3/s)	0.095 (10 yr ARI) (m^3/s)	0.049 (20 yr ARI) (m^3/s)	0.02 (50 yr ARI) (m^3/s)	0.01 (100 yr ARI) (m^3/s)
A	4	5.5	7.7	9	11	12.4	14.1
B	1.8	2.4	3.1	3.6	4.2	4.4	4.9
C	0.7	0.9	1.2	1.3	1.5	1.5	1.6
D	0.03	0.1	0.2	0.2	0.3	0.4	0.5
E	0.03	0.1	0.2	0.2	0.3	0.3	0.3
F	0.04	0.1	0.1	0.2	0.2	0.2	0.2
G	2.2	2.4	3.1	3.5	4.2	4.4	4.9
H	1.5	2.1	2.9	3.4	4	4.4	4.9

5.1.2 Digital Terrain Model (DTM)

The modelling scenario has relied upon the civil design DTM provided by Bradlees. The upper section of the channel is rock lined, which spreads to a rock lined low flow channel which winds down to the diversion weir. Approximately half way down the channel there is a diversion weir and a set of central culverts which direct flows below the 1 year ARI into a low flow rock lined channel along the western side of the lower flowpath. The culverts have been sized to ensure that the main weir does not engage on any storm events less than 1 year ARI. This is to ensure that the large vegetated area downstream of the weir is not inundated in frequent flow events. 2D modelling indicates that flows over the central weir will only occur on events of greater than the 1 year ARI. The length of the drain incorporates a 1 m wide reno mattress to allow for maintenance access.

The low flow culverts consist of 3 x 2100 x 900 RCBC and a grade of 9.5%. The flow through the culverts during the 1 year ARI is predicted to be 6.50 m^3/s and 12.61 m^3/s during the 100 year ARI. Modelling indicates that these culverts will have a peak velocity of 3.7 m/s during the 100 year ARI event. QUDM allows for a peak velocity of 5 to 6 m/s.

In addition to the DTM, drainage culverts under Broadwater Parkway were added as 1D elements into the *TUFLOW* model. These culverts are modelled as 6 x 1500 x 1200 RCBC in accordance with the *Hydrologic and Hydraulic Assessment (April 2013)* by Gilbert & Sutherland.

5.1.3 Downstream Boundary Condition

The downstream boundary of the model has been applied downstream of Broadwater Parkway as a free draining outlet. This arrangement is considered appropriate as the culverts under Broadwater Parkway act as a flow restriction.

An additionally scenario with a regional Q100 tailwater has been analysed as part of a sensitivity analysis to test the immunity of Broadwater Parkway. The model was modified to include a tailwater level of RL 2.90 m downstream of Broadwater Parkway.

5.1.4 Manning's Coefficient

Based on recommendations from; *Chow. V. T, (1959) Open Channel Hydraulics*, *Tweed Shire Council Development Design Specification D5 (V1.4)*, the following Manning Coefficients were applied:

- Lower rock lined channel: 0.080
- Vegetated channel: 0.060
- Upper rock lined channel: 0.090
- Mid rock lined channel 0.080
- Reno mattress 0.035
- High Flow Weir (top): 0.090
- High Flow Weir (downstream face): 0.140

Figure 5.2 below presents the extent of each surface type.

The manning's n value for the vegetated portion of the drain has been selected to represent a dense cover of grass species with limited canopy trees. This will provide Council with a low maintenance asset and restrict uncontrolled pedestrian access. The landscape intent prepared by Form Landscape Architects envisages endemic grass and sedge species such *Lomandra spp*. A minimum cover of approximately 70% with a typical vegetation height of 1.0 m has been relied upon.

As per Chow (1959) a manning's value of 0.06 has therefore been appropriate for floodplains with light brush and trees, with upper and lower limits of 0.08 and 0.04 respectively. The results presented within further sections of this report rely on a typical manning's n value 0.06.

5.1.5 Hydraulic Model Simulation

Simulation of the adopted design storm events was undertaken based on:

- Applying the inflow hydrographs within the *TUFLOW* model; and
- Applying the appropriate downstream boundary condition to the hydraulic model.

Key model outputs describing flood behaviour include peak water levels, flows and velocities. Results of the hydraulic analysis have been presented in the following sections for the design scenarios.

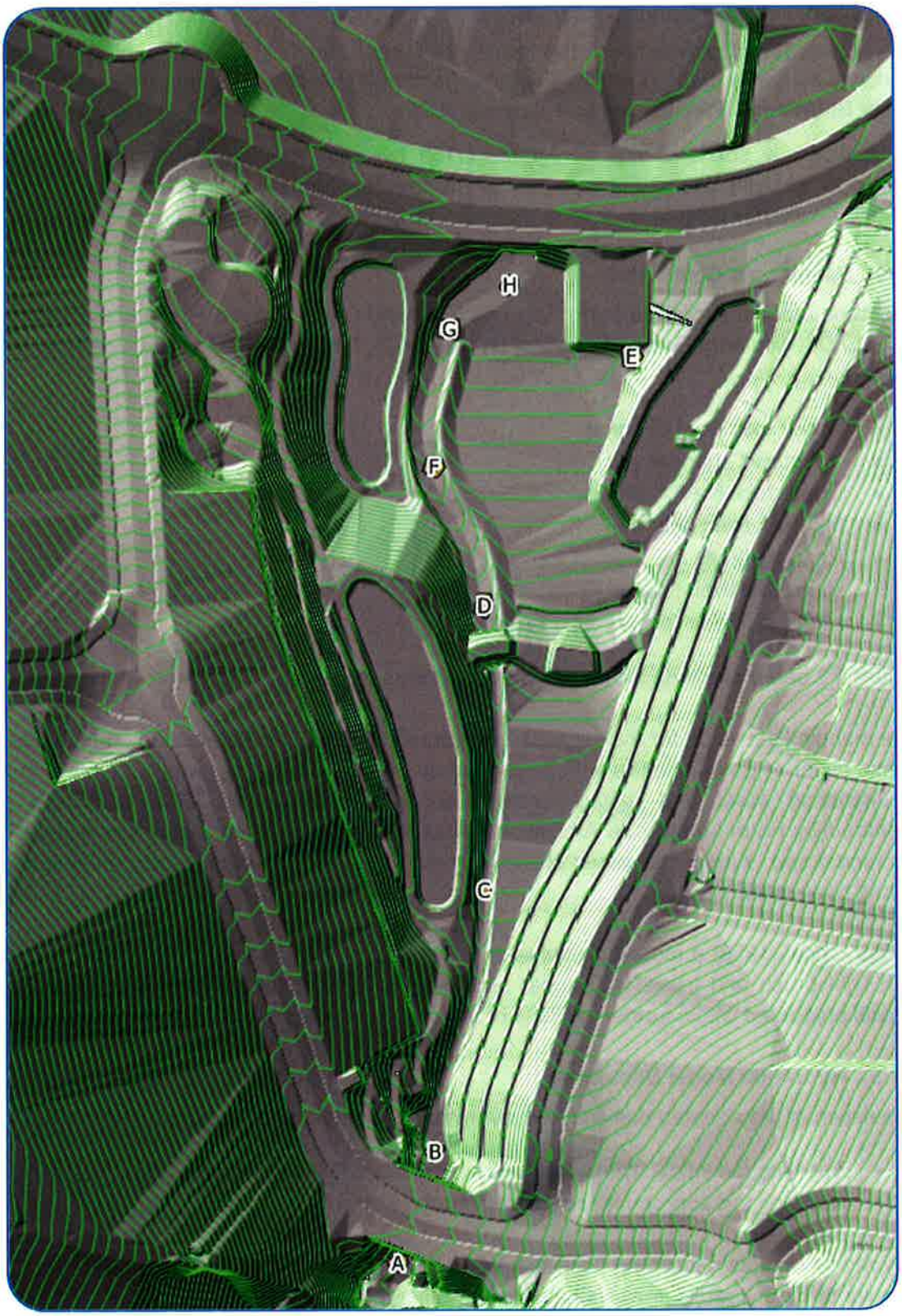


Figure 5.1 TUFLOW Model Inflow Locations

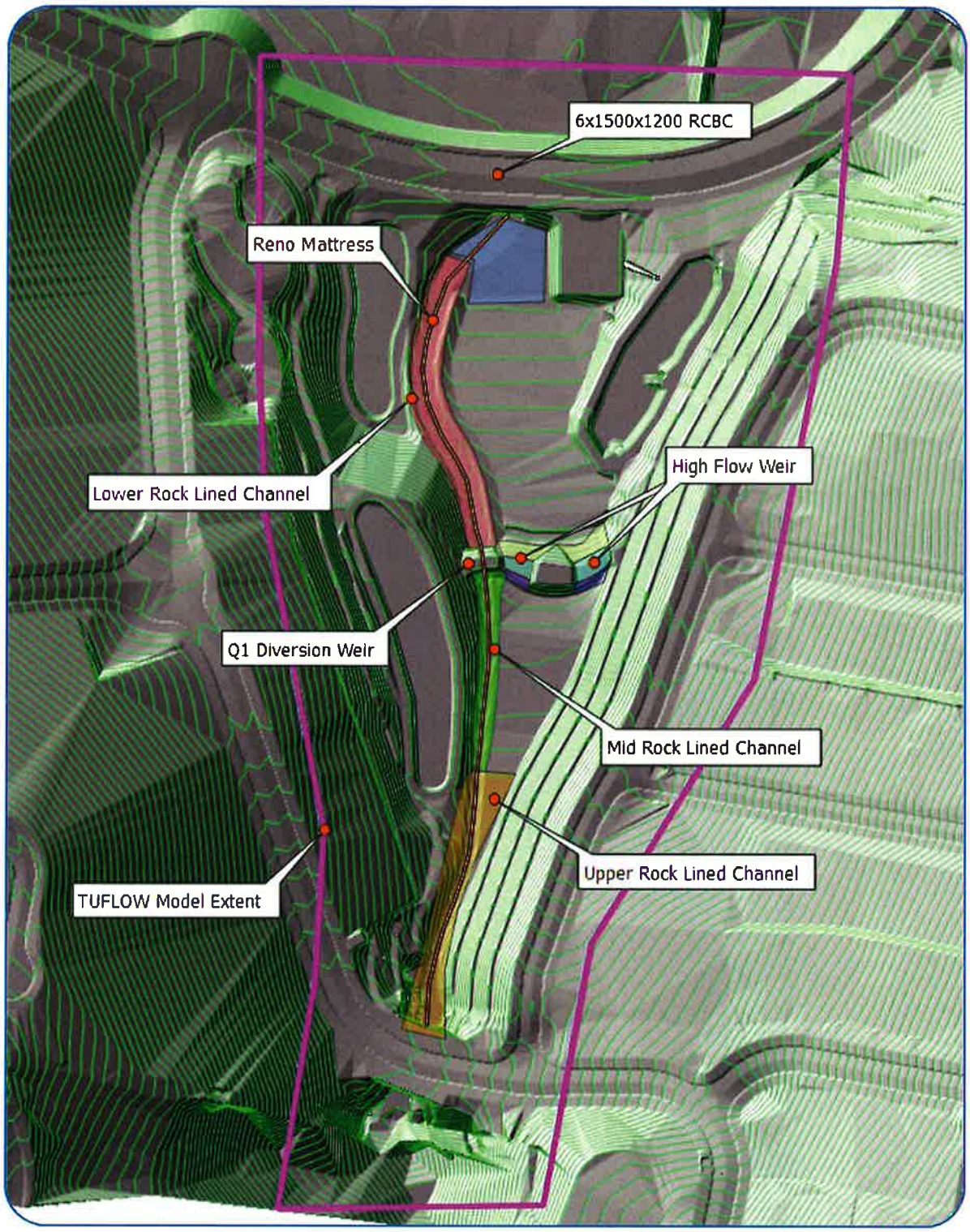


Figure 5.2 TUFLOW Model Layout

5.2 Modelling Results

The following sections provide a summary of the 2D modelling results for modified drainage channel. Result plots for all modelling events have been included within Appendix D.

5.2.1 Peak Flood Depths

Flood depths estimated by TUFLOW for the 100 year ARI (Figure 5.3) and 1 year ARI (Figure 5.4) storms are presented below. Peak water depths occur at the following locations during the 100 year ARI:

- Outlet of Market Parade culverts - 1.72 m deep;
- Behind the central culverts - 1.55 m deep; and
- Upstream of Broadwater Parkway - 1.66 m.

Depths within the vegetated flow areas are below 0.60 m in a for the 100 year storm.

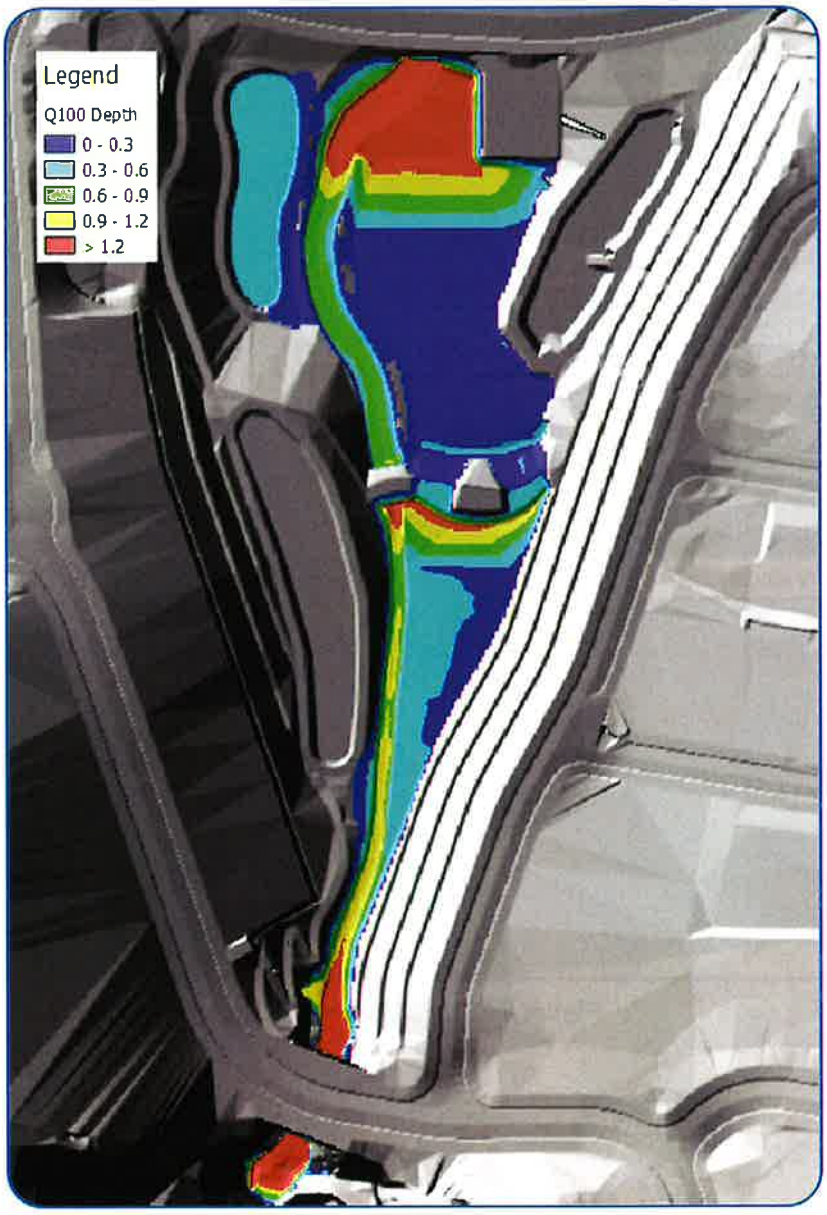


Figure 5.3 100 year ARI Peak Flood Depth



Figure 5.4 1 year ARI Peak Flood Depth

5.2.3 Peak Velocity

The expected peak discharge through the drainage channel, based on the 100 year ARI TUFLOW modelling, are shown below in Figure 5.5. Velocities within the upper rock lined channel are approximately 3.5 m/s, while the lower rock lined channel is approximately 3.1 m/s. Velocity over the high flow weir peaks at 1.9 m/s on the downstream slope, with 0.85 m/s expected over the crest.

Velocities within the upper vegetated channel are expected to peak at 1.7 m/s, with velocities in the lower vegetated section generally around 1.4 m/s. In accordance with Table 9.5.2 of QUDM and the design slope for these areas (upper vegetated channel 2.9% and lower vegetated channel 6%), these velocities are not expected to cause scour, provided 70% vegetation cover is maintained.

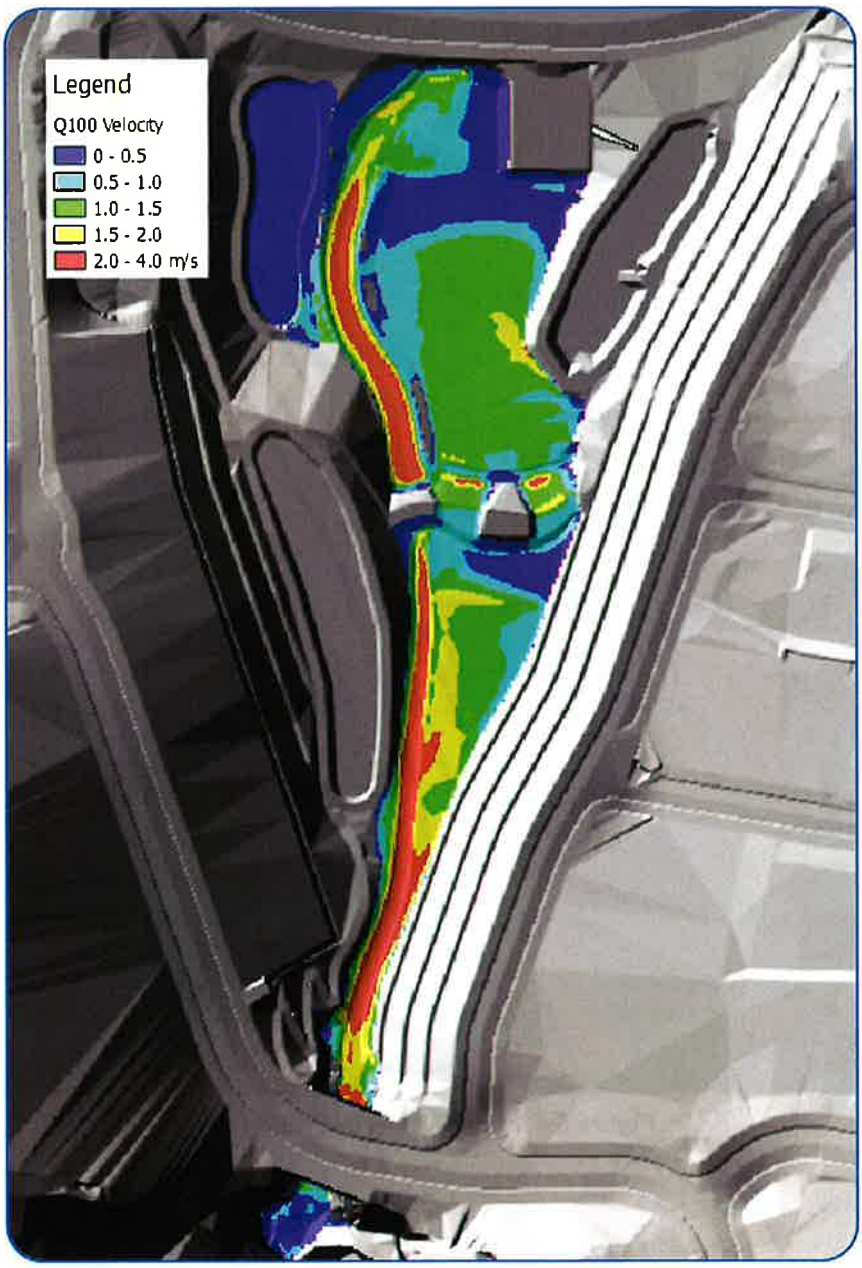


Figure 5.5 100 year ARI Velocity Plot

5.2.4 Depth x Velocity

The d.V product is generally below 0.4 m^2/s over the majority of the vegetated area downstream of the weir. Flow over the crest of the weir is also below 0.4 m^2/s. Areas where the d.V product is predicted to be above 0.6 m^2/s is generally restricted to rock lined high flow areas within defined conveyance channels. The maximum d.V product during the 100 year ARI is expected to be below 3.5 m^2/s and will occur directly downstream of Market Parade.

The magnitude of the predicted d.V product within the high flow channel has been substantially reduced from that previously reported for central drainage reserve configuration. Maximum d.V produced has been reduced from over 6 m^2/s to below 4.0 m^2/s.

Whilst this represents an improvement in safety, urban waterways and stormwater drainage systems with d.V products of greater than 0.6 m^2/s remain a safety risk (Table 12.1.12 of QUDM). It will therefore be necessary to restrict access and discourage a person/child from entering areas with an expected d.V product of greater than 0.6 m^2/s with the provision of fencing and dense planting to restrict/limit public/pedestrian access in the locations indicated on Figure 5.6.

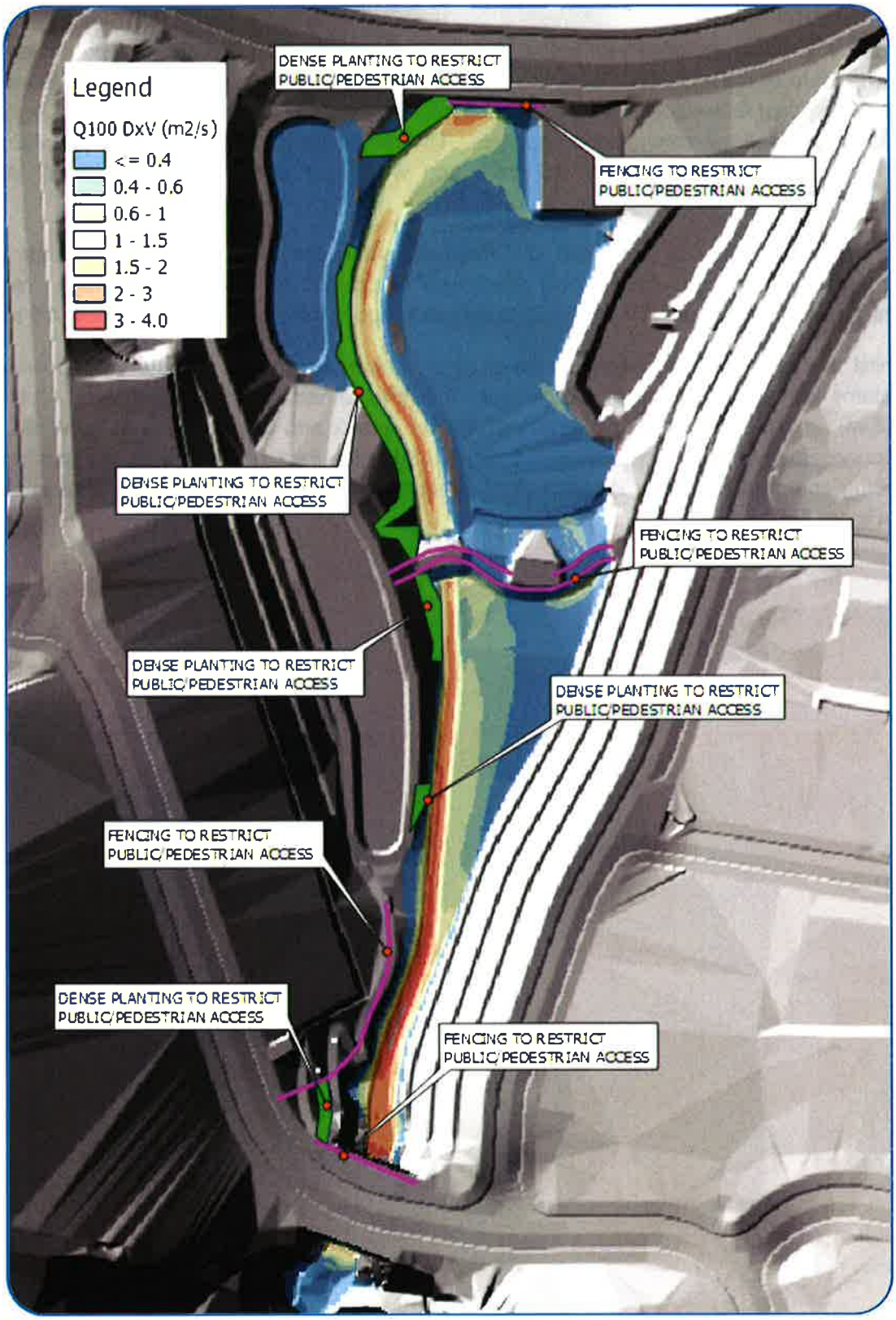


Figure 5.6 100 year ARI d.V Product Plot

5.2.5 Sensitivity Analysis

A sensitivity analysis has been undertaken to analyse:

- potential changes in the Manning's n values within the central conveyance channel; and
- the impacts of a regional 100 year ARI tailwater.

Manning's Variations

As a sensitivity analysis, the upper and lower Manning's n values of 0.04 and 0.08 have been tested within the main conveyance channels to simulate either poor grass establishment or a denser outcome. This sensitivity analysis predicted an increase in typical velocities by 20–30% when the lower manning's n value of 0.04 was applied, with peaks in the order of 1.9 m/s. Based on the design slope of 6% and in accordance with QUDM, a velocity of this magnitude could result in scour. The sensitivity analysis suggests that this would only occur on ARI events greater than that 20 year event. Maintenance of a minimum vegetation cover of 70% will be required within the open conveyance areas.

When the upper manning's n value of 0.08 is used, velocities reduce to below 1.2 m/s and flow depth increases by approximately 40 mm. This increased depth is contained within the design of the conveyance areas.

Regional Tailwater

Additionally a scenario with a regional Q100 tailwater has been analysed to test the immunity of Broadwater Parkway. The model was modified to include a tailwater level of RL 2.90 m downstream of Broadwater Parkway. This high tailwater level increases the peak Q100 flood level upstream of Broadwater Parkway to approximately RL 3.60 m AHD. The proposed sag level on Broadwater Parkway is 3.75 m AHD, therefore the road surface is still flood free during the regional Q100 tailwater scenario.

6 Conclusions

This *Bioretention Basin and Drainage Reserve Design Report* (Version 4), has been prepared on behalf of Newland Developers Pty Ltd to support revised designs of the bioretention basins and central drainage channel conveyance within the Altitude Aspire residential development at 37 Fraser Drive, Terranora (the subject site).

The revised stormwater treatment *MUSICv6* modelling has been undertaken on the proposed revised bioretention basin configurations and stormwater treatment train and it has been shown that it will achieve pollutant removal efficiencies of 80%, 60%, 45% and 90% for TSS, TP, TN and gross pollutants respectively.

This report also demonstrates that peak water depths and velocities within the central drainage reserve can be greatly reduced from the previous design, whilst maintaining the overall capacity of the flowpath to convey upstream flows. Maximum d.V product has been reduced from over 6 m^2/s to below 3.5 m^2/s.

Whilst this represents an improvement in safety, urban waterways and stormwater drainage systems with d.V products of greater than 0.6 m^2/s remain a safety risk (Table 12.1.12 of QUDM). It will therefore be necessary to restrict access and discourage a person/child from entering areas with an expected d.V product of greater than 0.6 m^2/s with the provision of fencing and dense planting to restrict/limit public/pedestrian access.

This report has been reviewed by a Registered Professional Engineer of Queensland (RPEQ), and certification has been provided that if the design parameters set out in this report are included within the development, stormwater pollutant load reductions in accordance with best practice should be achieved and the safety (peak flow, depths and d.V product) characteristics of the central drainage reserve improved from the previous design solution.

7 RPEQ Certification

I am aware that Council may rely upon the contents and findings of this assessment for the purposes of development assessment. In my opinion, the Council can rely upon the information contained within the report and there are no reservations or qualifications in respect to the information other than set out in the report.

I confirm that if the design parameters set out in this report are included within the development stormwater pollutant load reductions in accordance with best practice should be achieved.

..... 28.03.19

Brad Comley **RPEQ 17706** **DATE**

8 References

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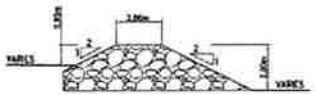
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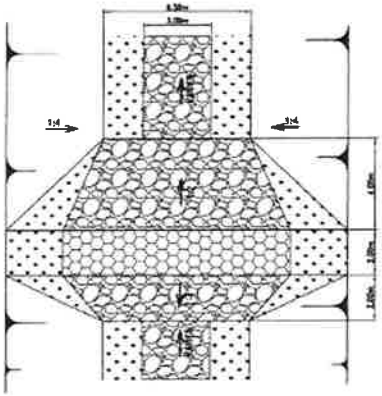
Appendix A

Bradlees Channel Design

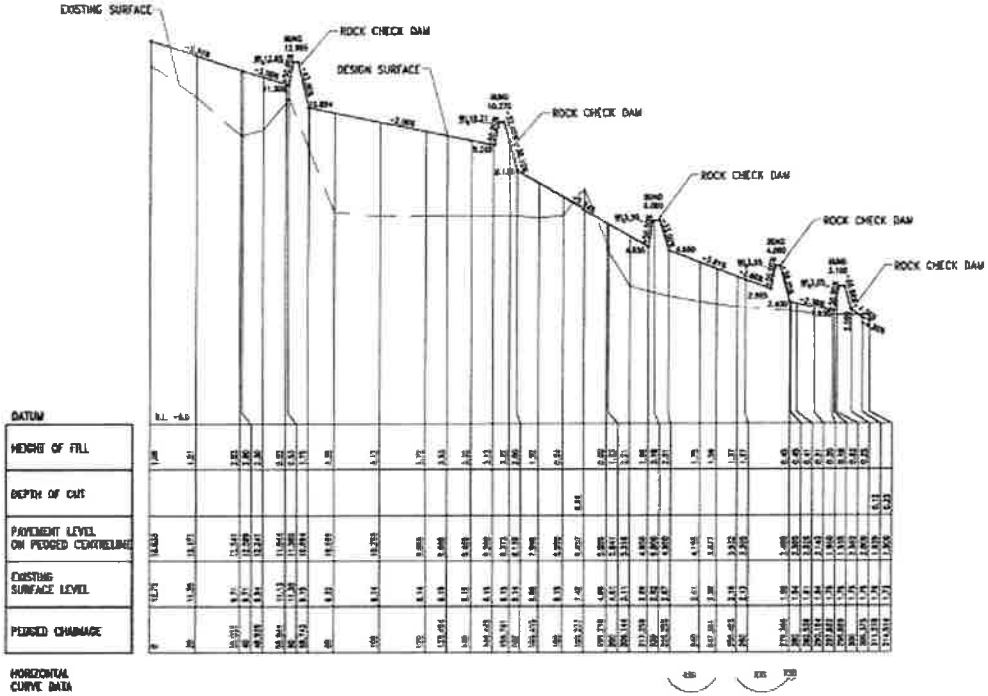
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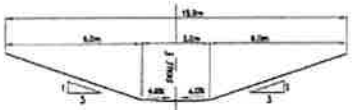


ROCK CHECK DAM DETAIL



DROP STRUCTURE - PLAN





TYPICAL SWALE DETAIL

NEWLAND DEVELOPERS PTY LTD	09-374	Bradlees Civil Consulting
TERRANORA PRECINCT 1 CENTRAL OPEN DRAIN SWALE LONG SECTION	SK3619 REVISION 1	

Appendix B

Operational Control Plan Drawing Set

VERSION: E
DATE : 28 03 19

OPERATIONAL CONTROL PLAN DRAWING SET

Altitude Aspire Terranora
Terranora Road, Terranora

for

Newland Developers Pty Ltd

Project No: BC-16099

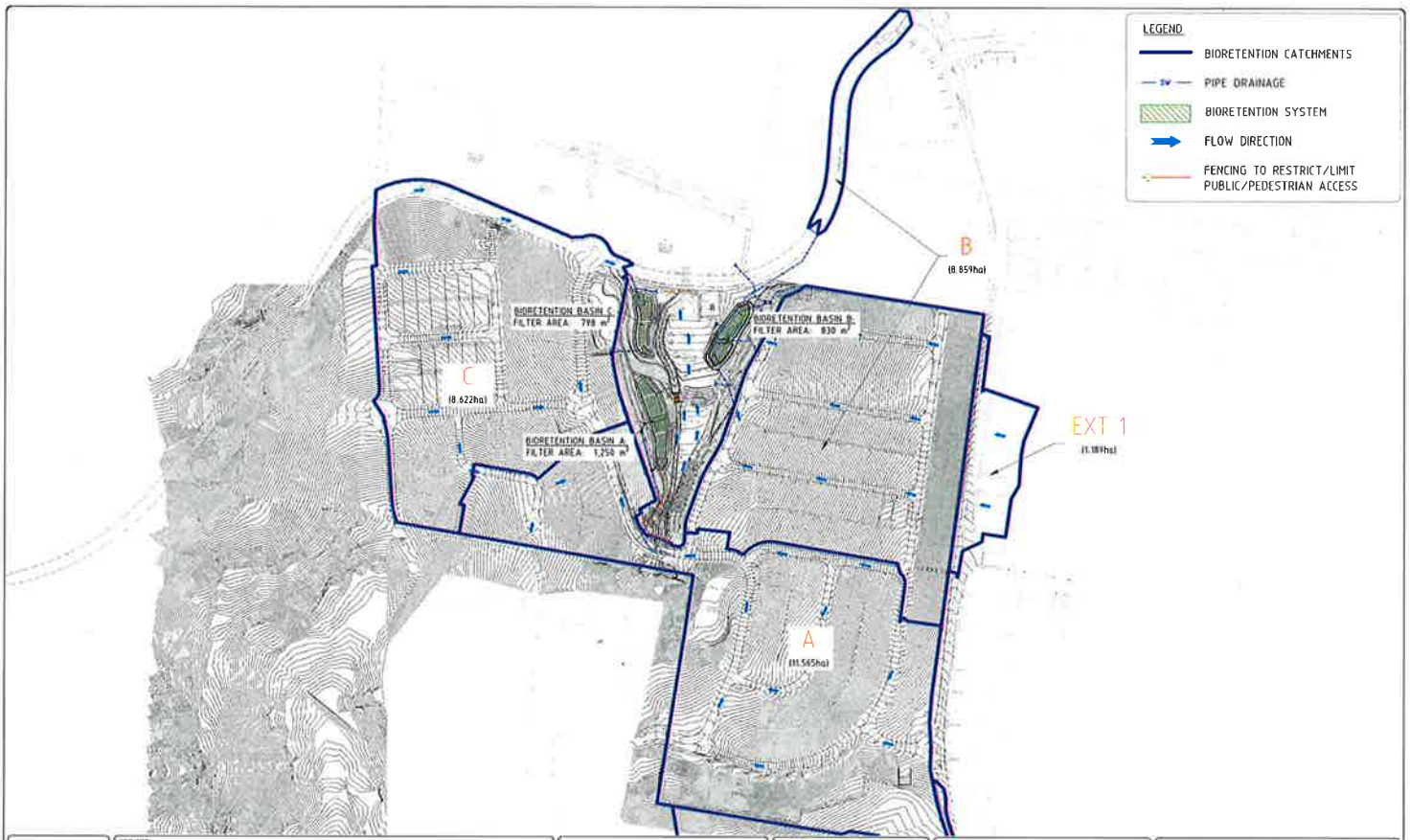
March 2019



Site Location

SCHEDULE OF DRAWINGS	
Drawing No	Drawing Title
DWG 000	LOCALITY AND DRAWING INDEX PLAN
DWG 200	BIORETENTION CATCHMENT PLAN
DWG 210	MUSIC CATCHMENT PLAN
DWG 300	OPERATIONAL CONTROL PLAN - OVERALL
DWG 301	OPERATIONAL CONTROL PLAN - CENTRAL CONVEYANCE - LONG SECTION
DWG 302	OPERATIONAL CONTROL PLAN - CENTRAL CONVEYANCE - CROSS SECTION SHEET 1 OF 2
DWG 303	OPERATIONAL CONTROL PLAN - CENTRAL CONVEYANCE - CROSS SECTION SHEET 2 OF 2
DWG 304	OPERATIONAL CONTROL PLAN - BASIN A - LAYOUT AND DETAILS
DWG 305	OPERATIONAL CONTROL PLAN - BASIN A - SEDIMENT FOREBAY DETAILS
DWG 306	OPERATIONAL CONTROL PLAN - BASIN B - LAYOUT AND DETAILS
DWG 307	OPERATIONAL CONTROL PLAN - BASIN B - SEDIMENT FOREBAY DETAILS
DWG 308	OPERATIONAL CONTROL PLAN - BASIN C - LAYOUT AND DETAILS
DWG 309	OPERATIONAL CONTROL PLAN - BASIN C - SEDIMENT FOREBAY DETAILS
DWG 310	OPERATIONAL CONTROL PLAN - STANDARD DETAILS

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ABN 86 166 087 476



DATE
28.03.19

PROJECT No
BC16099

DRAWING No.
DWG-200

REVISION No
E

PROJECT
ALTITUDE ASPIRE TERRANORA

DRAWING TITLE
BIORETENTION CATCHMENT PLAN

CLIENT
NEWLAND DEVELOPERS PTY LTD

ADDRESS
TERRANORA ROAD, TERRANORA

DRAFTED BY	DESIGNED BY	CHECKED BY	PAPER SIZE	SCALE
TP/HN	BC	BC	A3	1:4000

APPROVED FOR AND ON BEHALF OF BIOME CONSULTING PTY LTD
ACN 166 087 476
RPEQ No

VER	DESCRIPTION	APPR	DATE
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B	COUNCIL COMMENTS		18.03.18
C	MOD 3 AMENDMENTS		02.07.18
D	COUNCIL MOD3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

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ORIGINAL SCALE BEFORE REDUCTION
40 0 40 80 120 160 200
1 : 4000 (FULL SIZE) (metres)

CERTIFIED BY

N



DATE
28.03.19

PROJECT No
BC16099

DRAWING No
DWG-210

REVISION No
E

PROJECT
ALTITUDE ASPIRE TERRANORA

DRAWING TITLE
MUSIC CATCHMENT PLAN

CLIENT
NEWLAND DEVELOPERS PTY LTD

ADDRESS
TERRANORA ROAD, TERRANORA

DRAFTED BY	DESIGNED BY	CHECKED BY	PAPER SIZE	SCALE
TP/KP	BC	BC	A3	1:1000

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VER	DESCRIPTION	APPR	DATE
A	ORIGINAL ISSUE		21.11.17
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D	COUNCIL MOD3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

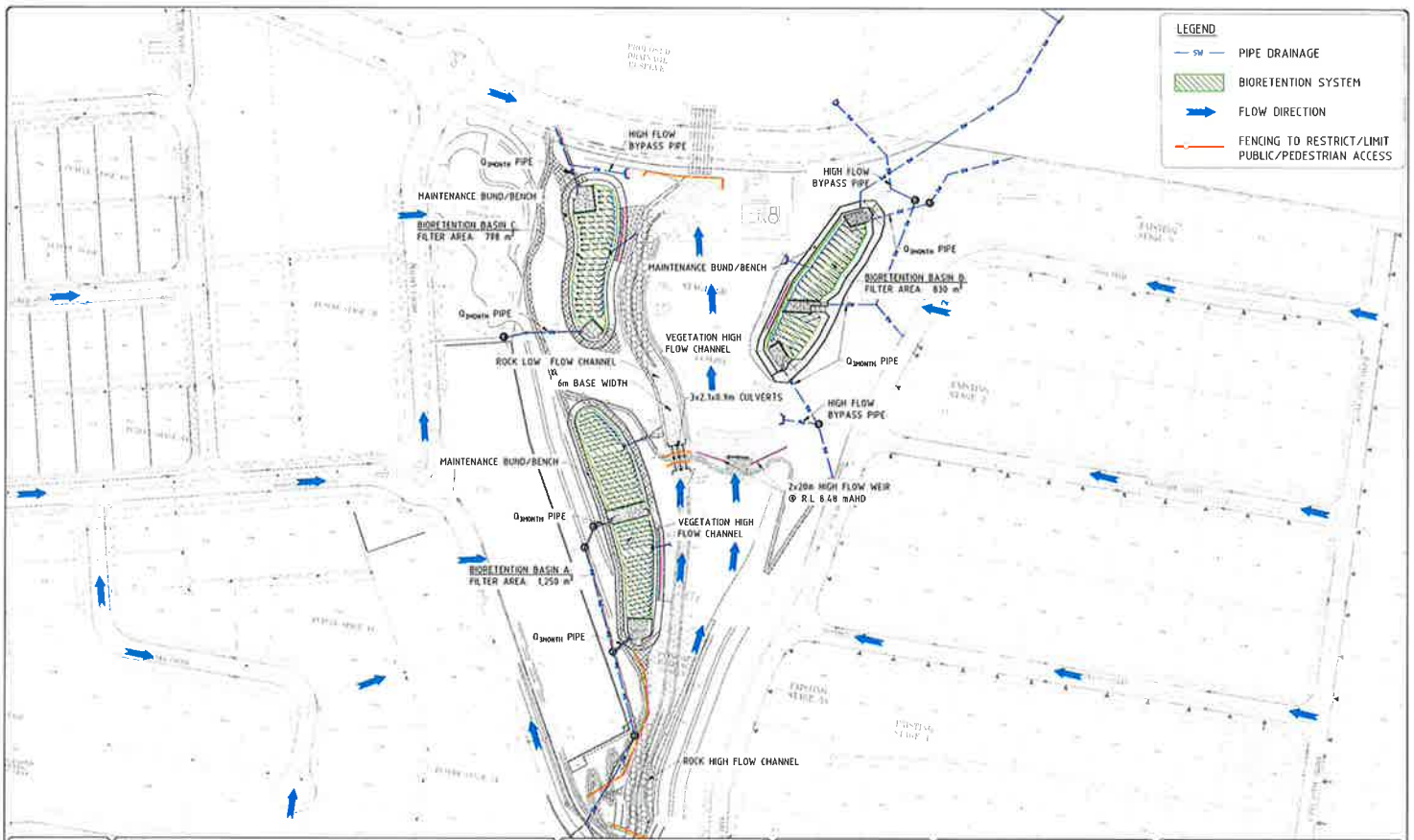
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ORIGINAL SCALE BEFORE REDUCTION
50 0 50 100 150 200 250
1 : 5000 (FULL SIZE) (metres)

CERTIFIED BY

N



DATE
28.03.19

PROJECT No.
BC16099

DRAWING No.
DWG-300

REVISION No.
E

PROJECT
ALTITUDE ASPIRE TERRANORA

DRAWING TITLE
OPERATIONAL CONTROL PLAN - OVERALL

CLIENT
NEWLAND DEVELOPERS PTY LTD

ADDRESS
TERRANORA ROAD, TERRANORA

DRAFTED BY	DESIGNED BY	CHECKED BY	PAPER SIZE	SCALE
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VER	DESCRIPTION	APPR	DATE
A	ORIGINAL ISSUE		22.11.17
B	COUNCIL COMMENTS		19.03.18
C	MOD DAM DOMAINS		23.07.18
D	COUNCIL MOD3 COMMENTS		21.01.19
E	FURTHER COUNCIL COMMENTS		28.03.19

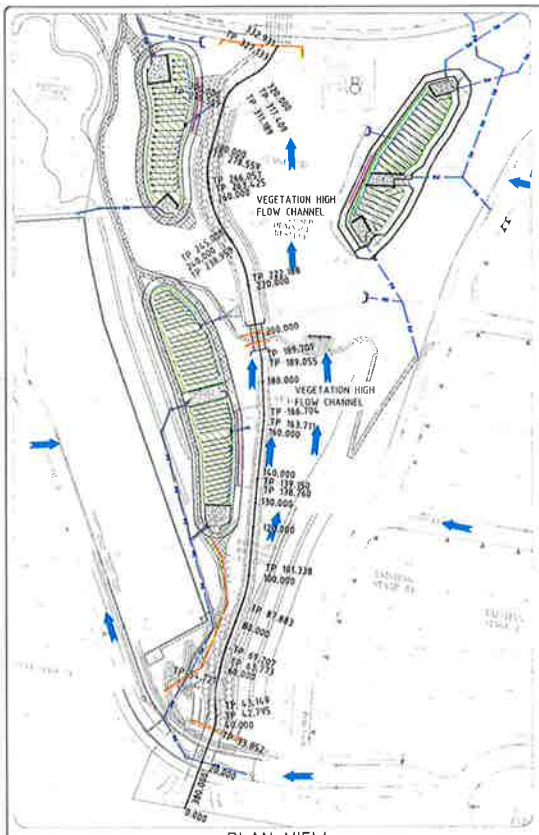
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ORIGINAL SCALE BEFORE REDUCTION
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1 : 1500 (FULL SIZE) (metres)

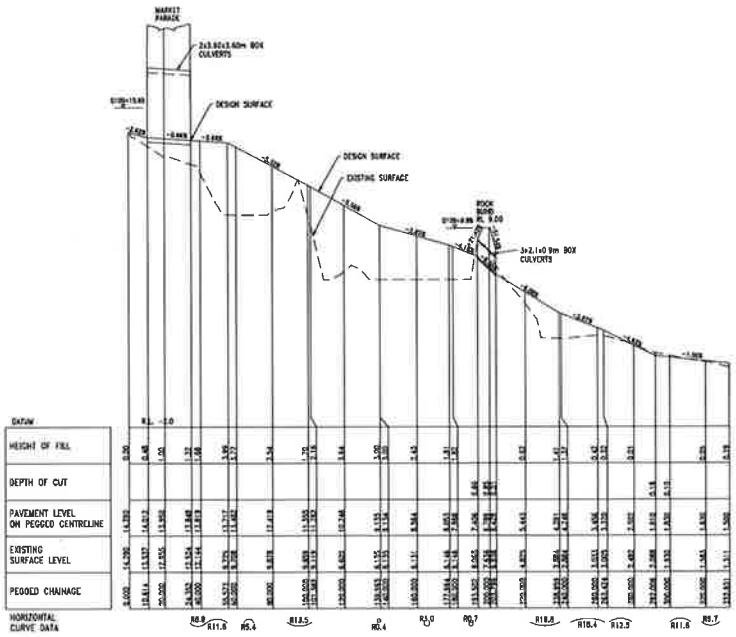
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N



PLAN VIEW

N.T.S



CENTRAL CONVEYANCE LONG SECTION

VERTICAL SCALE 2 0 2 4 6 8 10 (200 (metres)

HORIZONTAL SCALE 20 0 20 40 60 80 100 (2000 (metres)

(FULL SIZE)

DATE	28.03.19
PROJECT No	BC16099
DRAWING No	DWG-301
REVISION No	E

PROJECT: ALTITUDE ASPIRE TERRANORA

DRAWING TITLE: OPERATIONAL CONTROL PLAN - CENTRAL CONVEYANCE LONG SECTION

CLIENT: NEWLAND DEVELOPERS PTY LTD

ADDRESS: TERRANORA ROAD, TERRANORA

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A	ORIGINAL ISSUE		01.11.17
B	COUNCIL COMMENTS		18.05.18
C	WQ13 AMENDMENTS		02.07.18
D	COUNCIL MQ05 COMMENTS		20.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

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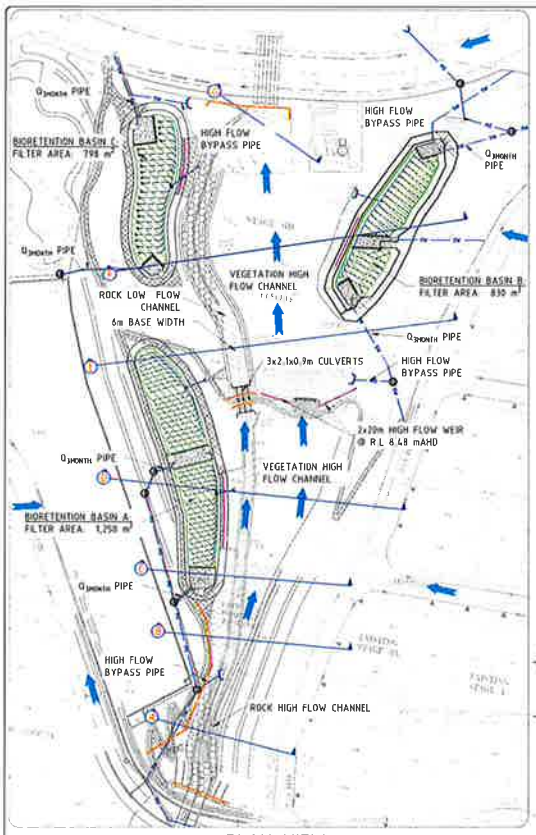
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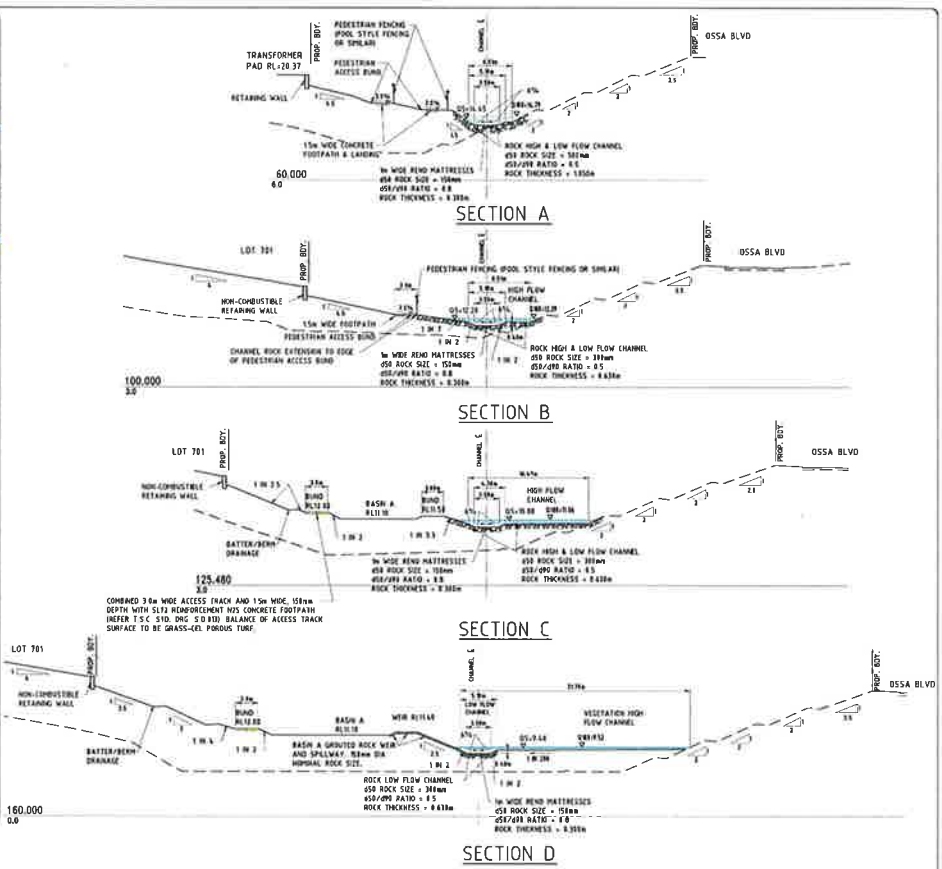
ORIGINAL SCALE BEFORE REDUCTION

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PLAN VIEW
N.T.S



DATE	29.03.19
PROJECT No	BC16099
DRAWING No	DWG-302
REVISION No	E

PROJECT: ALTITUDE ASPIRE TERRANORA

DRAWING TITLE: OPERATIONAL CONTROL PLAN - CENTRAL CONVEYANCE
CROSS SECTION SHEET 1 OF 2

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ADDRESS: TERRANORA ROAD, TERRANORA

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C	WQO 3 AMENDMENTS		02.07.18
D	COUNCIL WQO3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		29.03.19

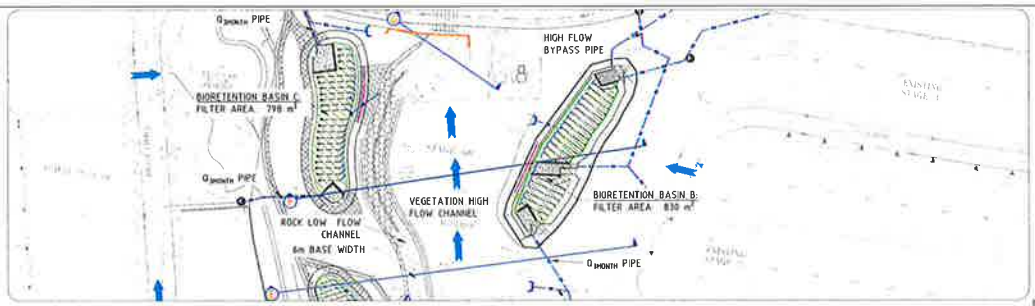
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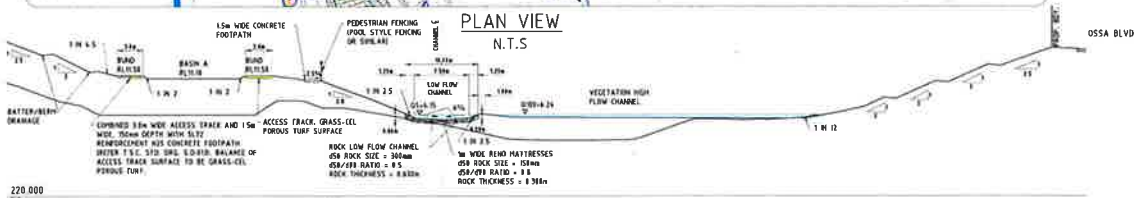
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CERTIFIED BY

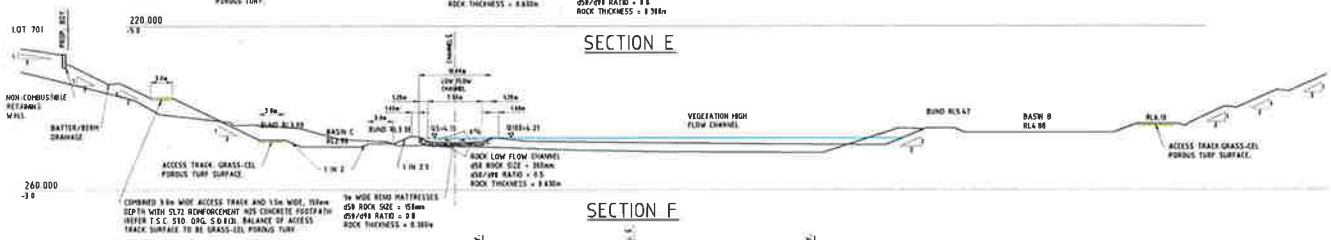
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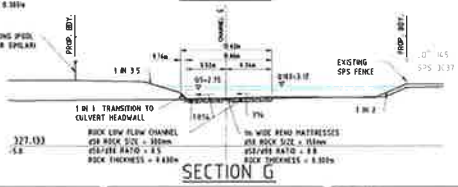
PLAN VIEW
N.T.S



SECTION E



SECTION F



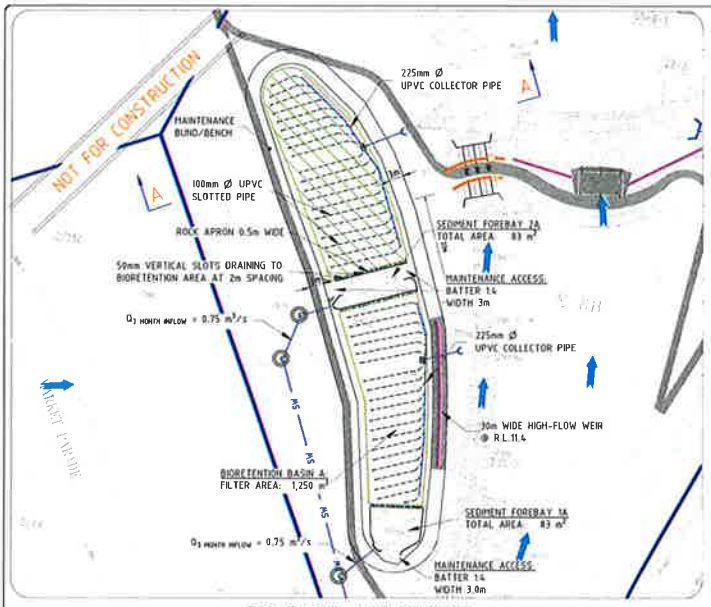
SECTION G

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PROJECT No	DRAWING TITLE	VER / DESCRIPTION / APPR / DATE	
BC16099	OPERATIONAL CONTROL PLAN - CENTRAL CONVEYANCE CROSS SECTION SHEET 2 OF 2	A ORIGINAL ISSUE 21.11.17	
DRAWING No	CLIENT	B COUNCIL COMMENTS 16.05.18	
DWG-303	NEWLAND DEVELOPERS PTY LTD	C MOD 3 AMENDMENTS 22.07.18	
REVISION No	ADDRESS	D COUNCIL MOD3 COMMENTS 25.07.18	
E	TERRANORA ROAD, TERRANORA	E FURTHER COUNCIL COMMENTS 28.03.19	
DRAFTED BY TP/MN	DESIGNED BY BC	CHECKED BY BC	PAPER SIZE A3
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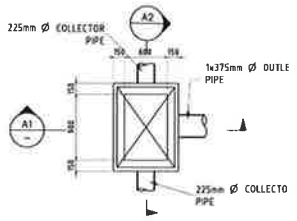
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ORIGINAL SCALE BEFORE REDUCTION
12 0 12 24 36 48 60
1 : 1200 (FULL SIZE) (metres)
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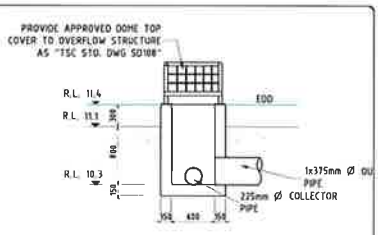
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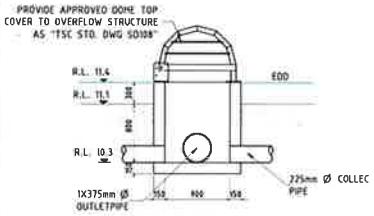
BIO BASIN A PLAN VIEW
N.T.S



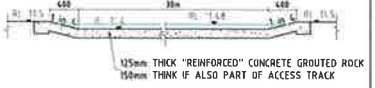
BASIN A OVERFLOW STRUCTURE PLAN
N.T.S



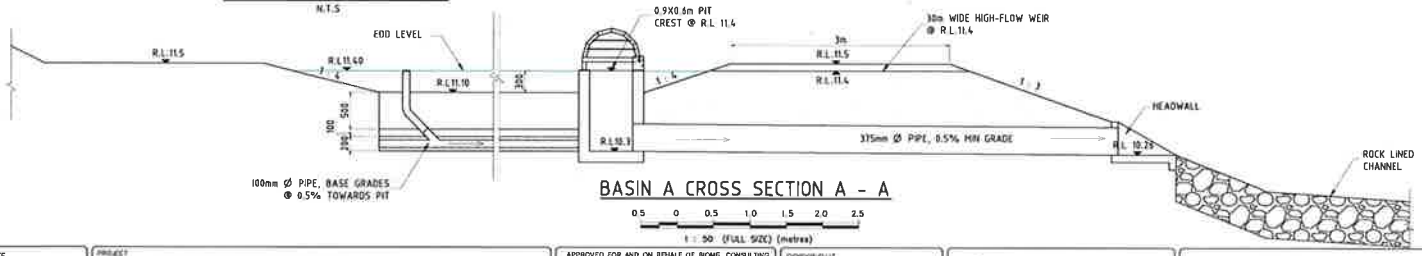
SECTION A1 - A1
N.T.S



SECTION A2 - A2
N.T.S



WEIR DETAILS
N.T.S



BASIN A CROSS SECTION A - A

0.5 0 0.5 1.0 1.5 2.0 2.5
1 : 50 (FULL SIZE) (metres)

DATE 28.03.19
PROJECT No. BC16099
DRAWING No. DWG-304
REVISION No E

PROJECT: ALTITUDE ASPIRE TERRANORA
DRAWING TITLE: OPERATIONAL CONTROL PLAN – BASIN A – LAYOUT AND DETAILS
CLIENT: NEWLAND DEVELOPERS PTY LTD
ADDRESS: TERRANORA ROAD, TERRANORA

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VER	DESCRIPTION	APPR	DATE
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C	WQO 3 AMENDMENTS		02.07.18
D	COUNCIL WQO3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		28.03.18

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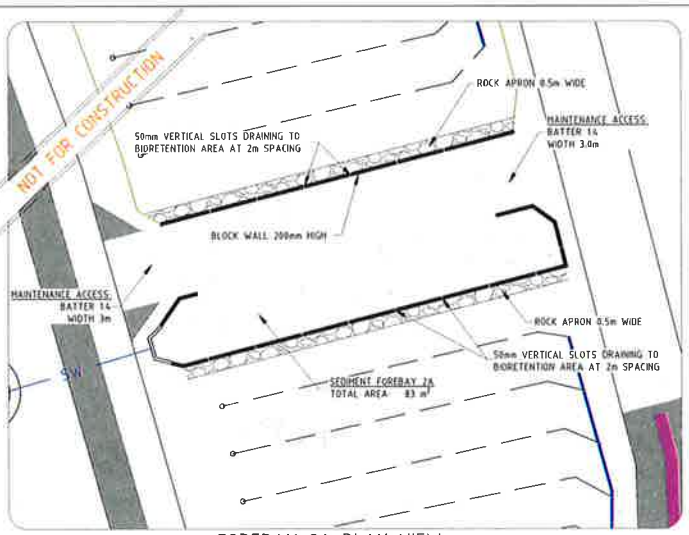
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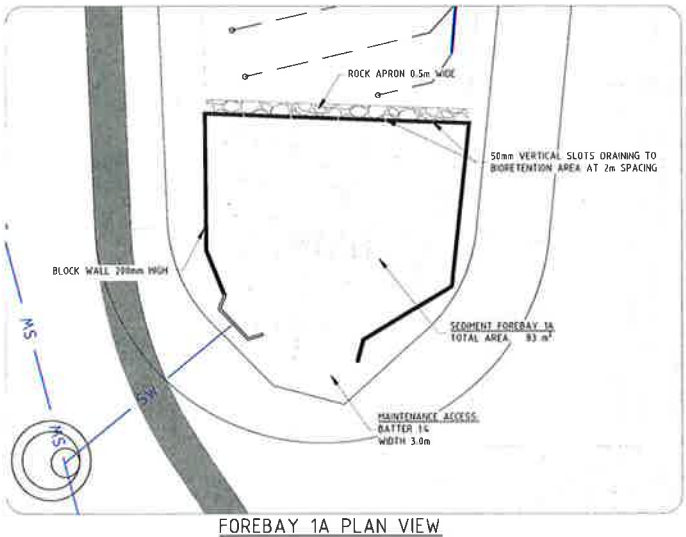
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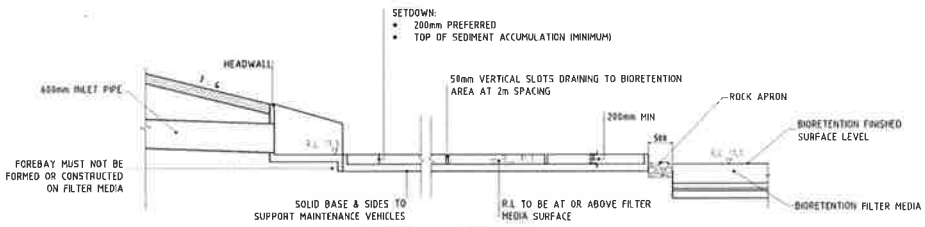
FOREBAY 2A PLAN VIEW

N.T.S



FOREBAY 1A PLAN VIEW

N.T.S



FOREBAY DETAILS

1 0.5 0 0.5 1 1.5 2 2.5 3 3.5 4

1 : 75 (FULL SIZE) (metres)

DATE
28.03.19

PROJECT No
BC16099

DRAWING No
DWG-305

REVISION No
E

PROJECT
ALTITUDE ASPIRE TERRANORA

DRAWING TITLE
OPERATIONAL CONTROL PLAN – BASIN A – SEDIMENT FOREBAY DETAILS

CLIENT
NEWLAND DEVELOPERS PTY LTD

ADDRESS
TERRANORA ROAD, TERRANORA

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VER	DESCRIPTION	APPR	DATE
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B	COUNCIL COMMENTS		18.05.18
C	MOD 3 AMENDMENTS		02.07.18
D	COUNCIL MOD3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

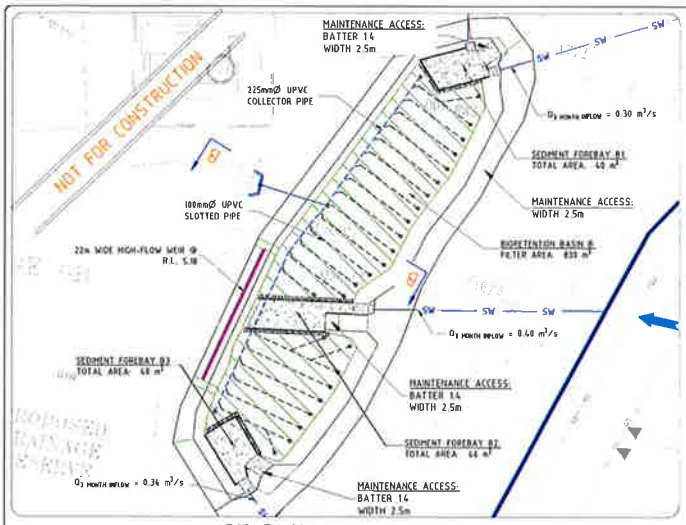
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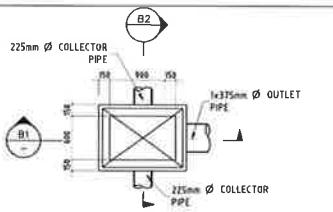
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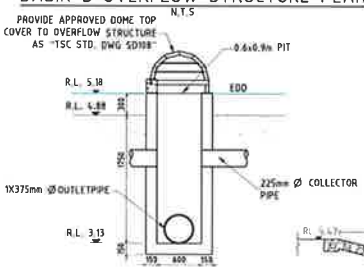
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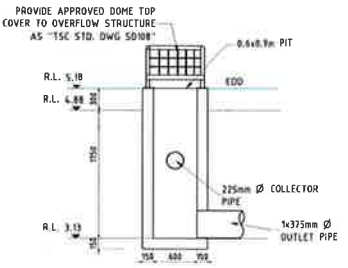


BIO BASIN B PLAN VIEW
N.T.S

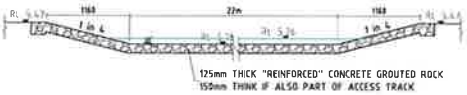


BASIN B OVERFLOW STRUCTURE PLAN
N.T.S



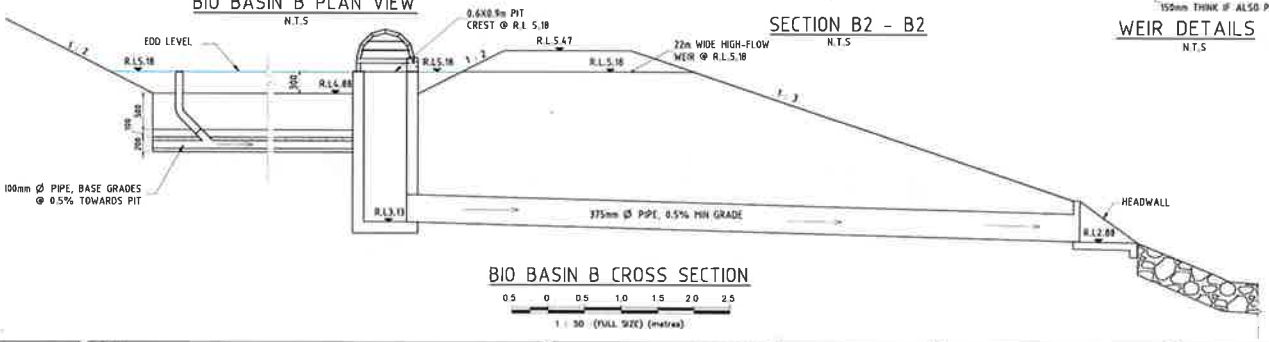


SECTION B1 - B1
N.T.S



WEIR DETAILS
N.T.S

SECTION B2 - B2
N.T.S



BIO BASIN B CROSS SECTION
0.5 0 0.5 1.0 1.5 2.0 2.5
1 : 50 (FULL SIZE) (metres)

DATE 28.03.19
PROJECT No BC16099
DRAWING No DWG-306
REVISION No E

PROJECT: ALTITUDE ASPIRE TERRANORA
DRAWING TITLE: OPERATIONAL CONTROL PLAN – BASIN B – LAYOUT AND DETAILS
CLIENT: NEWLAND DEVELOPERS PTY LTD
ADDRESS: TERRANORA ROAD, TERRANORA

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A	ORIGINAL ISSUE		23.11.17
B	COUNCIL COMMENTS		19.05.18
C	WQO 3 AMENDMENTS		02.07.18
D	COUNCIL WQO3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

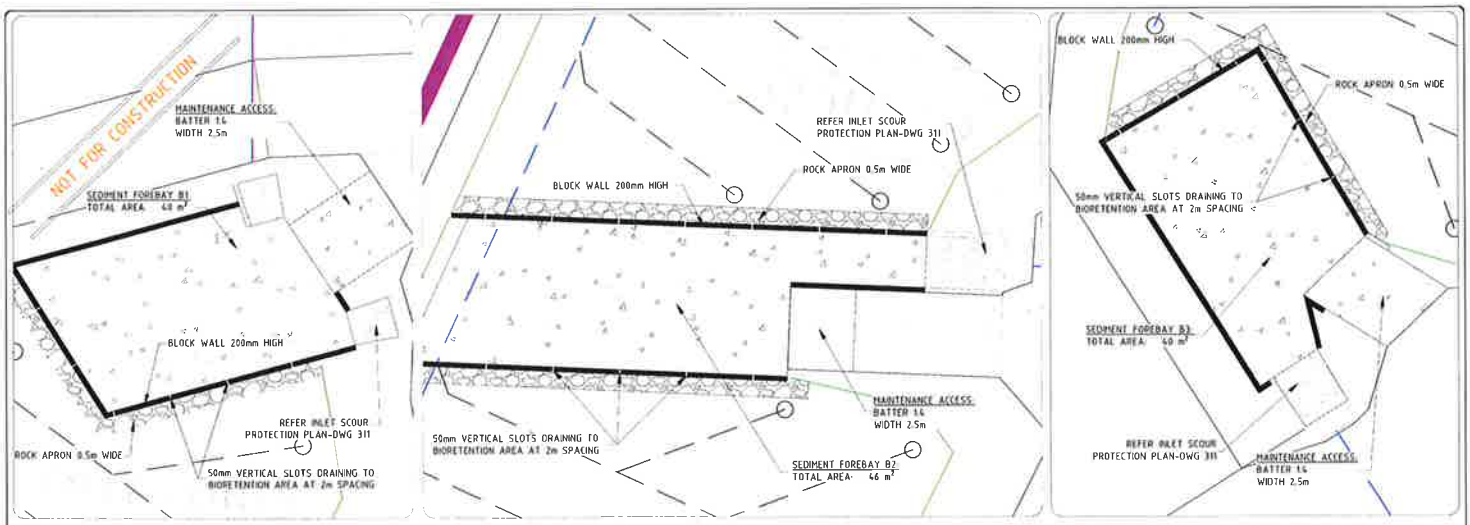
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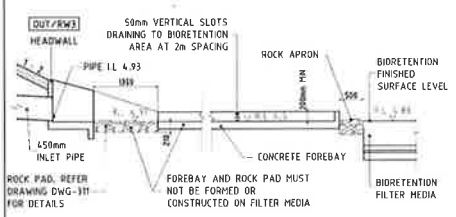
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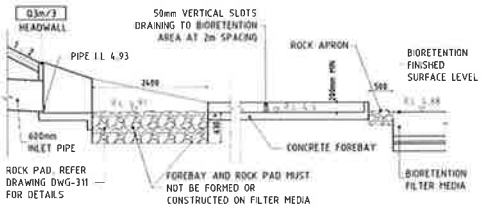


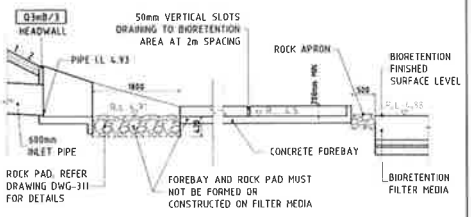
FOREBAY B1 PLAN VIEW
N.T.S

FOREBAY B2 PLAN VIEW
N.T.S

FOREBAY B3 PLAN VIEW
N.T.S







FOREBAY B1 DETAILS
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1 : 75 (FULL SIZE) (metres)

FOREBAY B2 DETAILS
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1 : 75 (FULL SIZE) (metres)

FOREBAY B3 DETAILS
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1 : 75 (FULL SIZE) (metres)

DATE 28.03.19
PROJECT No BC16099
DRAWING No DWG-307
REVISION No E

PROJECT: ALTITUDE ASPIRE TERRANORA
DRAWING TITLE: OPERATIONAL CONTROL PLAN – BASIN B – SEDIMENT FOREBAY DETAILS
CLIENT: NEWLAND DEVELOPERS PTY LTD
ADDRESS: TERRANORA ROAD, TERRANORA

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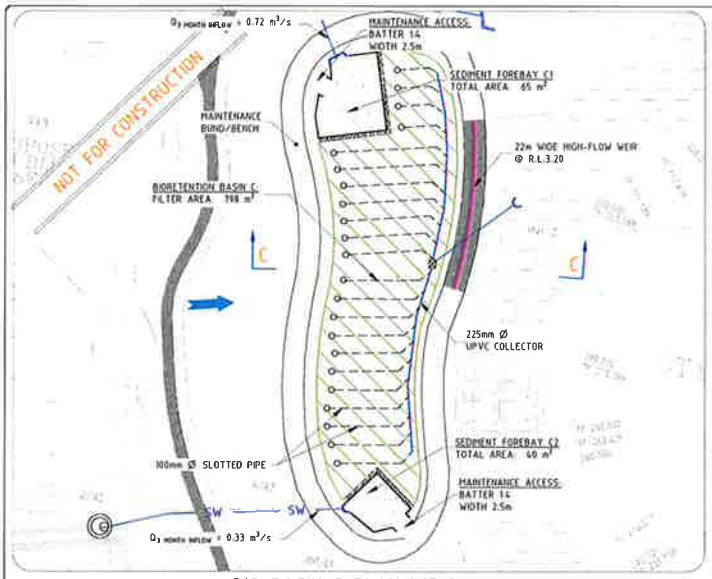
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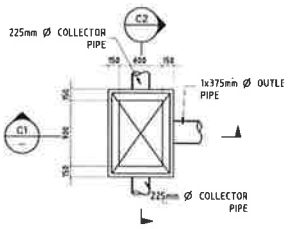
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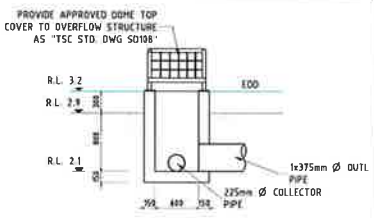
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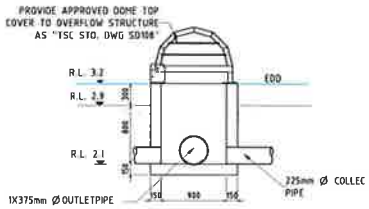
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N.T.S



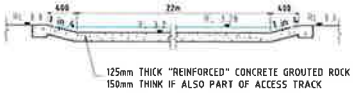
BASIN C OVERFLOW STRUCTURE PLAN
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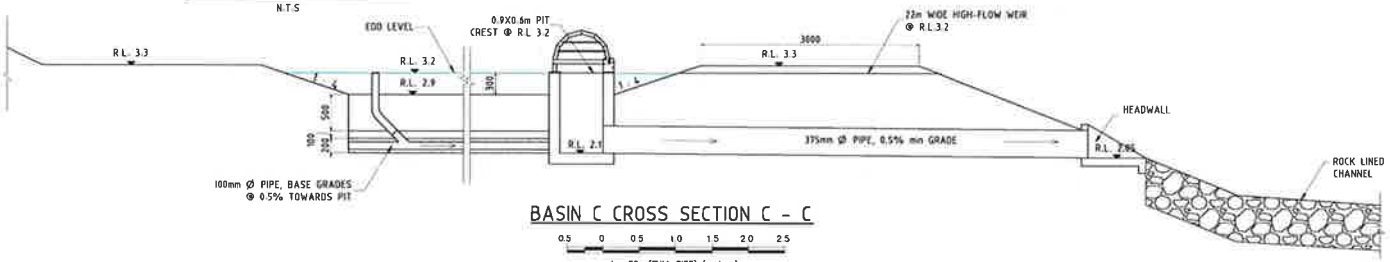
SECTION C1 - C1
N.T.S



SECTION C2 - C2
N.T.S



WEIR DETAILS
N.T.S



BASIN C CROSS SECTION C - C

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1 : 50 (FULL SIZE) (metres)

DATE	28.03.19
PROJECT No	BC16099
DRAWING No	DWG-308
REVISION No	E
PROJECT	ALTITUDE ASPIRE TERRANORA
DRAWING TITLE	OPERATIONAL CONTROL PLAN – BASIN C – LAYOUT AND DETAILS
CLIENT	NEWLAND DEVELOPERS PTY LTD
ADDRESS	TERRANORA ROAD, TERRANORA
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CHECKED BY: BC	PAPER SIZE: A3
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C	WQO 3 AMENDMENTS		03.07.18
D	COUNCIL WQO3 COMMENTS		23.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

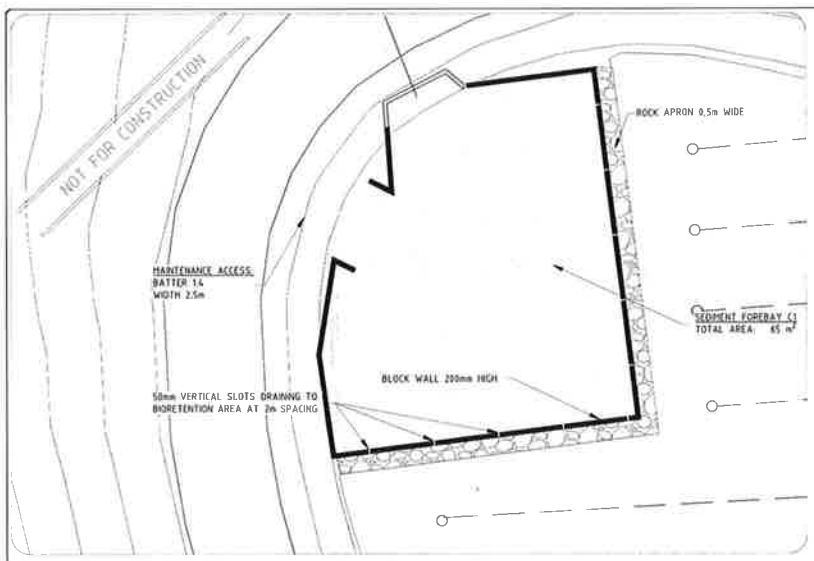
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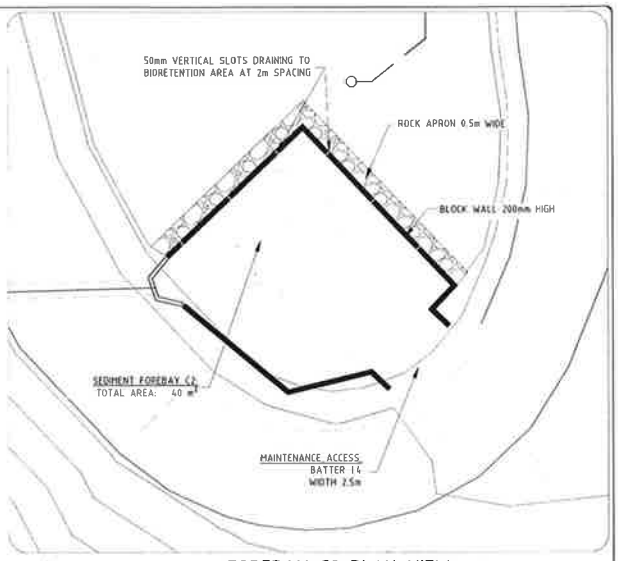
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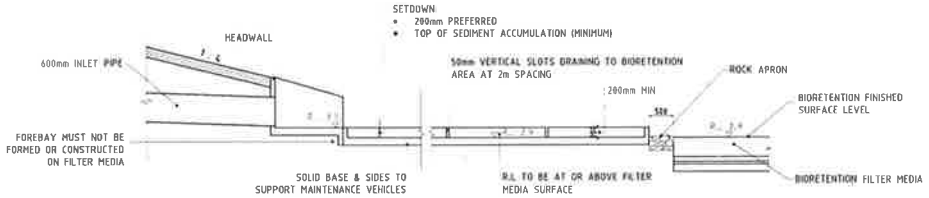
FOREBAY C1 PLAN VIEW

N.T.S



FOREBAY C2 PLAN VIEW

N.T.S



FOREBAY DETAILS

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1 : 75 (FULL SIZE) (metres)

DATE 28.03.19

PROJECT No BC16099

DRAWING No SMP-309

REVISION No E

PROJECT: ALTITUDE ASPIRE TERRANORA

DRAWING TITLE: OPERATIONAL CONTROL PLAN – BASIN C – SEDIMENT FOREBAY DETAILS

CLIENT: NEWLAND DEVELOPERS PTY LTD

ADDRESS: TERRANORA ROAD, TERRANORA

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C	MOD 3 AMENDMENTS		22.07.18
D	COUNCIL MOD3 COMMENTS		25.07.18
E	FURTHER COUNCIL COMMENTS		28.03.19

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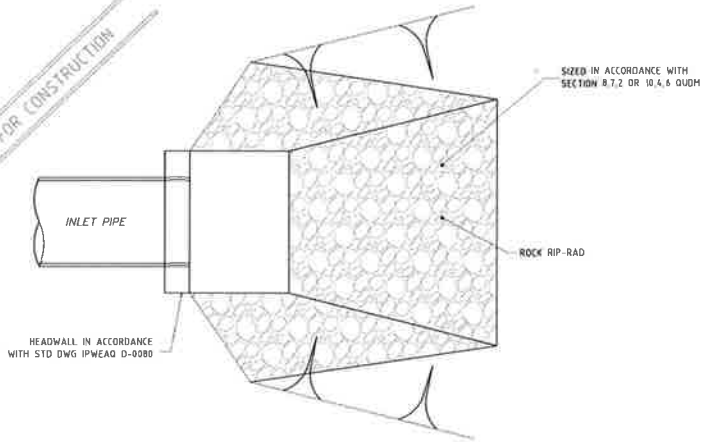
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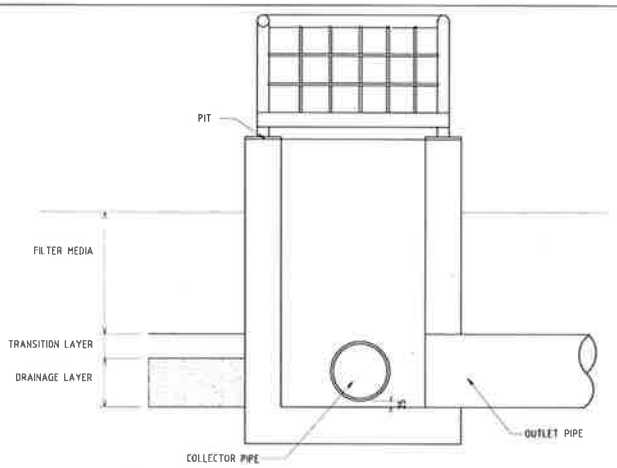
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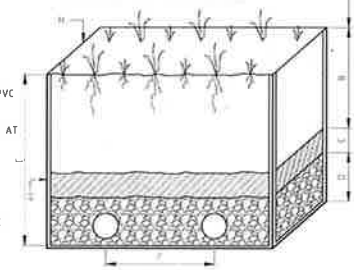
INLET SCOUR PROTECTION PLAN



UNDERDRAINAGE PIPE CONNECTION DETAILS

N.T.S

N.T.S



A **EXTENDED DETENTION**
DEPTH NO GREATER THAN 400mm WITH RETENTION OF LOW FLOWS FOR NO GREATER THAN FOUR (4) DAYS TO PREVENT ANAEROBIC CONDITIONS

B **FILTER MEDIA**
SANDY LOAM WITH 400-500mm/hr SATURATED HYDRAULIC CONDUCTIVITY, IN-SITU HYDRAULIC CONDUCTIVITY TO REACH 200mm/hr ONCE SETTLEMENT AND COMPACTION HAS TAKEN PLACE.
ORGANIC CONTENT 5% (w/w) MAX.
PARTICLE SIZE <3% PASSING 0.05mm (w/w)
>97% PASSING 2mm (w/w)
pH. BETWEEN 5.5-7.5
PHOSPHORUS CONCENTRATION <100mg/kg

C **TRANSITION LAYER**
1mm COARSE SAND
(DESIGNED IAW WSUD TDG SECTION 5.3.4.3)

D **DRAINAGE LAYER**
2-5mm SCREENINGS (COARSE SAND/GRAVEL
(DESIGNED IAW WSUD TDG SECTION 5.3.4.2)

E **TOTAL BIORETENTION DEPTH**

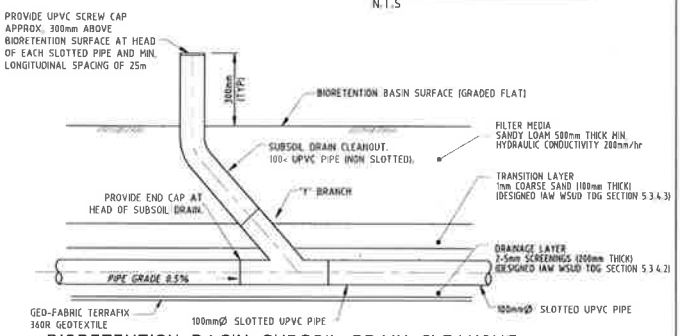
F SLOTTED 100mm RIGID PIPE (uPVC OR SIMILAR TO AS 2439.1) OR APPROVED EQUIVALENT, 0.5% MIN. GRADE, SPACED EQUALLY AT 2.5m CENTRES

G GEO-FABRIC TERRAFIX 360R GEOTEXTILE

H **VEGATATION**
SPECIES TO BE IN ACCORDANCE WITH WATER BY DESIGN GUIDELINES

BIO-RETENTION MEDIA CROSS SECTION

N.T.S



BIORETENTION BASIN SUBSOIL DRAIN CLEANOUT

N.T.S

DATE
28.03.19
PROJECT No.
BC16099
DRAWING No
DWG-310
REVISION No
E

PROJECT
ALTITUDE ASPIRE TERRANORA
DRAWING TITLE
OPERATIONAL CONTROL PLAN – STANDARD DETAILS
CLIENT
NEWLAND DEVELOPERS PTY LTD
ADDRESS
TERRANORA ROAD, TERRANORA

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C	MOD ENHANCEMENTS		03.07.18
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Appendix C

Bioretention Design Checklist

BIORETENTION DESIGN CHECKLIST

Item	Description	Detail		
		Basin A	Basin B	Basin C
1.Treatment				
a)	Catchment Area	11.57 ha	8.86 ha	8.62 ha
b)	Filter media area (excluding batters)	1,250 m^2	830 m^2	798 m^2
c)	Confirm water quality performance meets the design objectives	Yes		
d)	Confirm hydrological performance meets relevant frequent flow objectives	Yes	Yes	Yes
2. Design Inflows				
a)	Minor design storm entering system (ARI event)	Q_{3month}	Q_{3month}	Q_{3month}
b)	Minor storm peak flow rate – Total (m^3/s)	1.494	1.135	1.045
c)	Major design storm entering system (ARI event)	Major is Bypassed	Major is Bypassed	Major is Bypassed
d)	Major storm peak flow rate (m^3/s)	-	-	-
a)	Bioretention drainage profile type	Type 3	Type 3	Type 3
b)	Minimum drainage layer depth (mm)	200	200	200
c)	Maximum drainage layer depth (mm)	200	200	200
d)	Transition layer depth (mm)	100	100	100
e)	Saturated zone depth for Type 1 bioretention systems	N/A	N/A	N/A
f)	Filter media layer depth (mm)	500	500	500
g)	Extended detention depth (mm)	300	300	300
h)	Freeboard to top of embankment (mm)	100	100	100
i)	Maximum water level depth above extended detention for major storm event (mm)	100	100	100
j)	Total system profile depth (mm) [3(c)+3(d)+3(f)+3(g)+A3(i)	1200	1200	1200
k)	Layer type (i)Permeable (ii)Impermeable (iii)None to base	Permeable	Permeable	Permeable
l)	AASS/PASS assessed and appropriately managed	N/A	N/A	N/A
m)	Presence of dispersive soils and appropriately managed	N/A	N/A	N/A
4. Design Levels				
a)	Outlet invert level (m AHD)	10.26	2.88	2.05
b)	Overflow pit invert level (m AHD)	10.3	3.13	2.1
c)	Minimum drainage layer level (m AHD)	10.3	4.08	2.1
d)	Filter media surface level (m AHD)	11.1	4.88	2.9
e)	Overflow pit crest level (m AHD)	11.4	5.18	3.2
f)	Overflow weir level (m AHD)	11.4	5.18	3.2
g)	Maximum design water level (m AHD)	11.5	5.47	3.3
h)	Top of embankment/batter level (m AHD)	11.5	5.47	3.3
i)	Inlet/inflow invert level (m AHD)	11.3	4.91	3.1
j)	Total level difference [4(h)-(4(c)]	1.2 m	1.39 m	1.2 m
k)	Highest astronomical tide level	N/A	N/A	N/A
l)	Ground water level	N/A	N/A	N/A

BIORETENTION DESIGN CHECKLIST

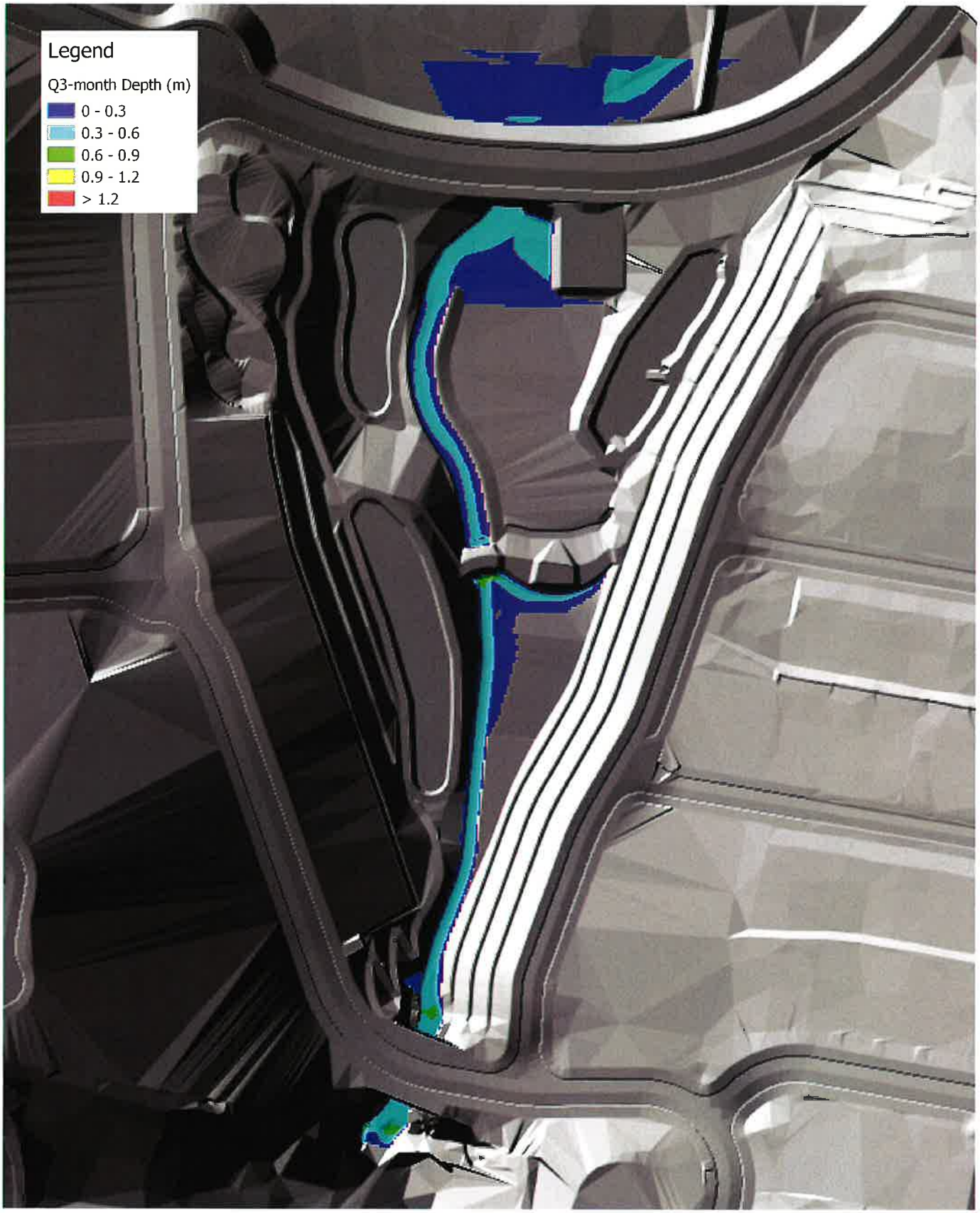
5. Layout				
a)	Maximum filter media length (m)	20	15	16
b)	Maximum filter media width (m)	33.5	38.5	30
c)	Maximum batter slope (V:H)	1:4	1:2	1:4
d)	Maximum wall height (m)	N/A	N/A	N/A
e)	Provision for services	N/A - Greenfield	N/A - Greenfield	N/A - Greenfield
f)	Maintenance access provided(Yes/No)	Yes	Yes	Yes
g)	Flood storage volume above extended detention (m^3)	N/A	N/A	N/A
6. Inlet Design				
a)	Inlet/inflow type (i)pipe (ii)channel (iii) sheet flow (iv)other	pipe	pipe	pipe
b)	Diversion/surcharge type	N/A	N/A	N/A
c)	Coarse sediment removal (i)forebay (ii)inlet pond (iii)swale (iv) other	2x Forebays	3x Forebays	2x Forebays
d)	Coarse sediment removal area - Total (m^2)	165	126	121
e)	Coarse sediment removal depth (m)	0.2	0.2	0.2
f)	Coarse sediment clean-out frequency (/year)	1	1	1
g)	Flow distribution	Yes	Yes	Yes
h)	Confirm scour protection at inflow locations	Yes	Yes	Yes
i)	Minor storm flow velocity over filter (m/s)	0.374	0.185	0.187
j)	Major storm flow velocity over filter (m/s)	0.374	0.185	0.187
7. Underdrainage (outlet design)				
a)	Filer media saturated hydraulic conductivity (mm/hr)	200	200	200
b)	Maximum filter infiltration capacity (m^3/s) – Cell 1	0.0215	0.0276	0.0316
	Cell 2	0.0235	0.0373	0.0317
	Cell 3	0.0297		
	Cell 4	0.0242		
c)	Underdrain capacity - Collector (m3/s) Cell 1	0.0375	0.0375	0.0375
	Cell 2	0.0375	0.0375	0.0375
	Cell 3	0.0375		
	Cell 4	0.0375		
8. Overflow design (outlet design)				
a)	Overflow pit type	Rectangular	Rectangular	Rectangular
b)	Overflow pit dimensions	2 x 900x600	900x600	900x600
c)	Overflow weir length (m)	30	22	22
d)	Overflow pit capacity (taking into account blockage factor) (m^3/s)	0.314	0.157	0.157
e)	Overflow pit plus overflow weir capacity (taking into account blockage factor) (m^3/s)	1.889	1.312	1.312
f)	Outlet pipe size (mm)	2x375	375	375
g)	Appropriate outlet scour protection provided	Yes	Yes	Yes

BIORETENTION DESIGN CHECKLIST

9. Vegetation Design				
a)	Planting style (i)small scale urban (ii)med-large scale urban (iii) bushland	med-large scale urban	med-large scale urban	med-large scale urban
b)	Trees and shrubs to be included (yes/no)	Shrubs	Shrubs	Shrubs
c)	Species diversity (number of species)	Six	Six	Six
d)	Species selection	Table 19 WUSD	Table 19 WUSD	Table 19 WUSD
e)	Planting density	Ground Covers 6 – 8 /m^2 Shrubs 1/ 2-20 m^2	Ground Covers 6 – 8 /m^2 Shrubs 1/ 2-20 m^2	Ground Covers 6 – 8 /m^2 Shrubs 1/ 2-20 m^2
f)	Mulch type and depth	Organic Friable 50-75 mm	Organic Friable 50-75 mm	Organic Friable 50-75 mm

Appendix D

Central Drainage Assessment Plots



DATE : 16.07.2018

PROJECT No. : BC-16099

DRAWING No. : DWG-701

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q3-MONTH DEPTH

CLIENT : NEWLAND DEVELOPERS PTY LTD

ADDRESS : ALTITUDE ASPIRE, TERRANORA

DRAFTED BY :	DESIGNED BY :	CHECKED BY :	PAPER SIZE :	SCALE :
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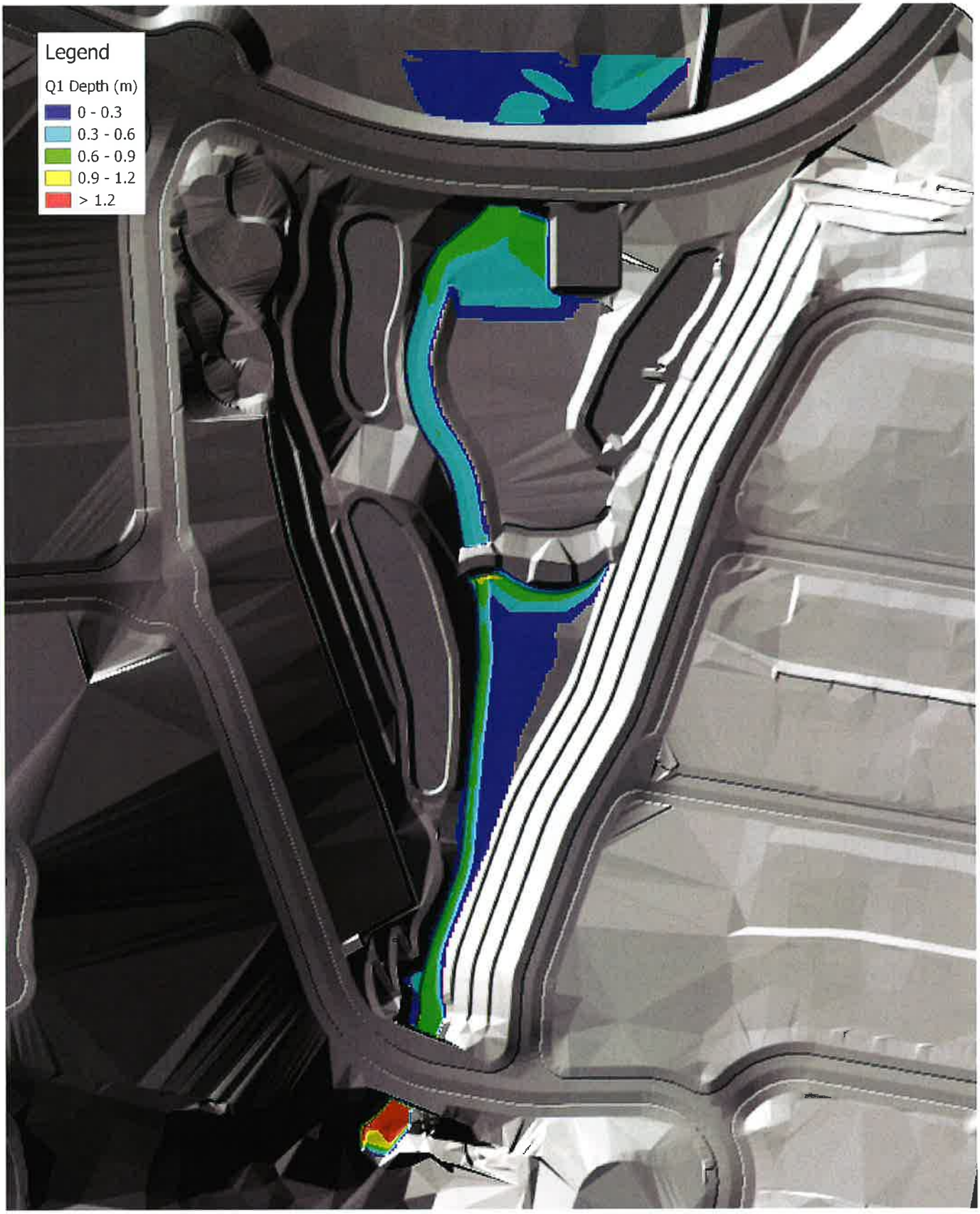
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DATE :
16.07.2018

PROJECT No. :
BC-16099

DRAWING No. :
DWG-702

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q1 DEPTH

CLIENT :
NEWLAND DEVELOPERS PTY LTD

ADDRESS :
ALTITUDE ASPIRE, TERRANORA

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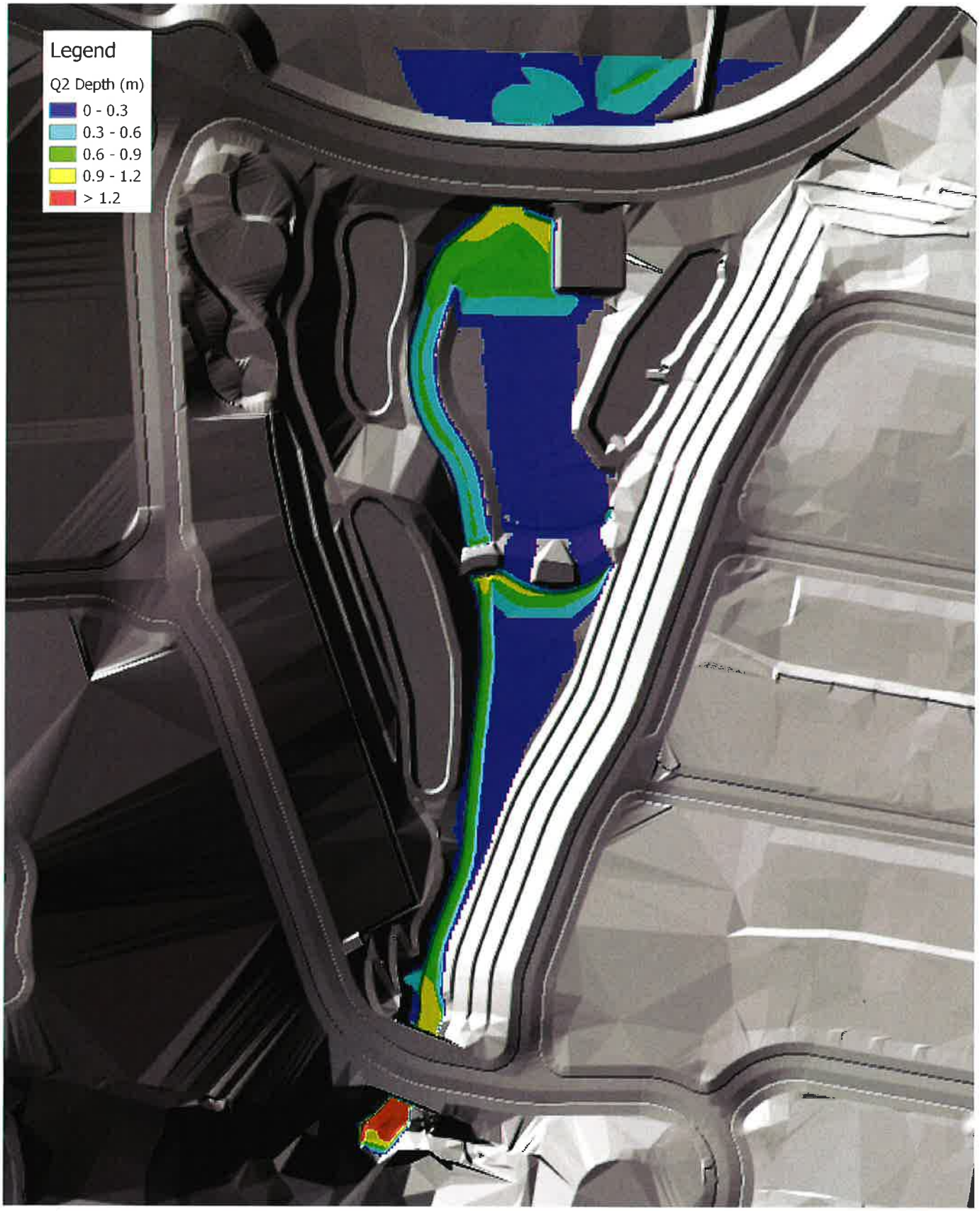
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ABN 86 166 087 476



DATE :
16.07.2018

PROJECT No. :
BC-16099

DRAWING No. :
DWG-703

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q2 DEPTH

CLIENT :
NEWLAND DEVELOPERS PTY LTD

ADDRESS :
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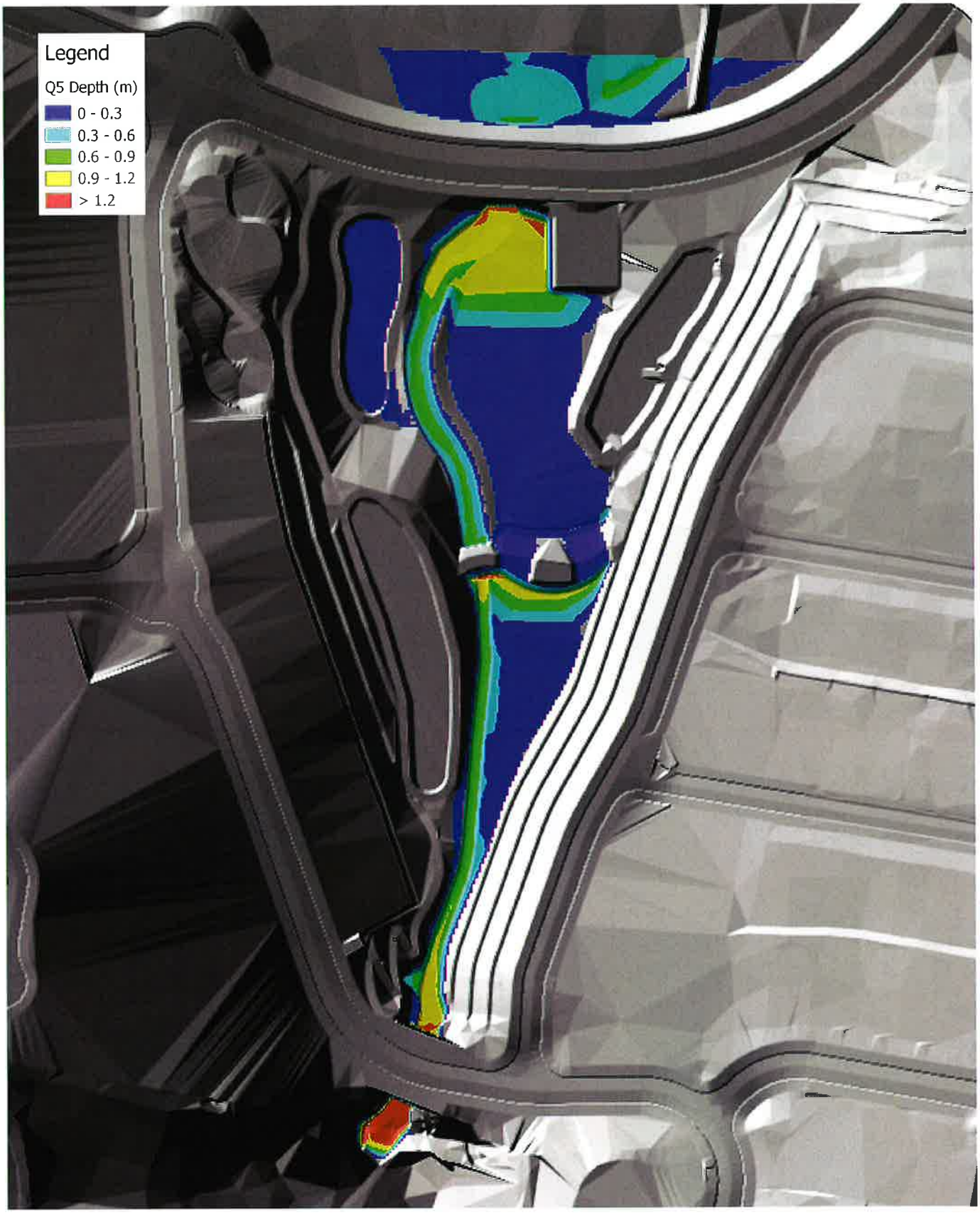
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PROJECT No. : BC-16099

DRAWING No. : DWG-704

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q5 DEPTH

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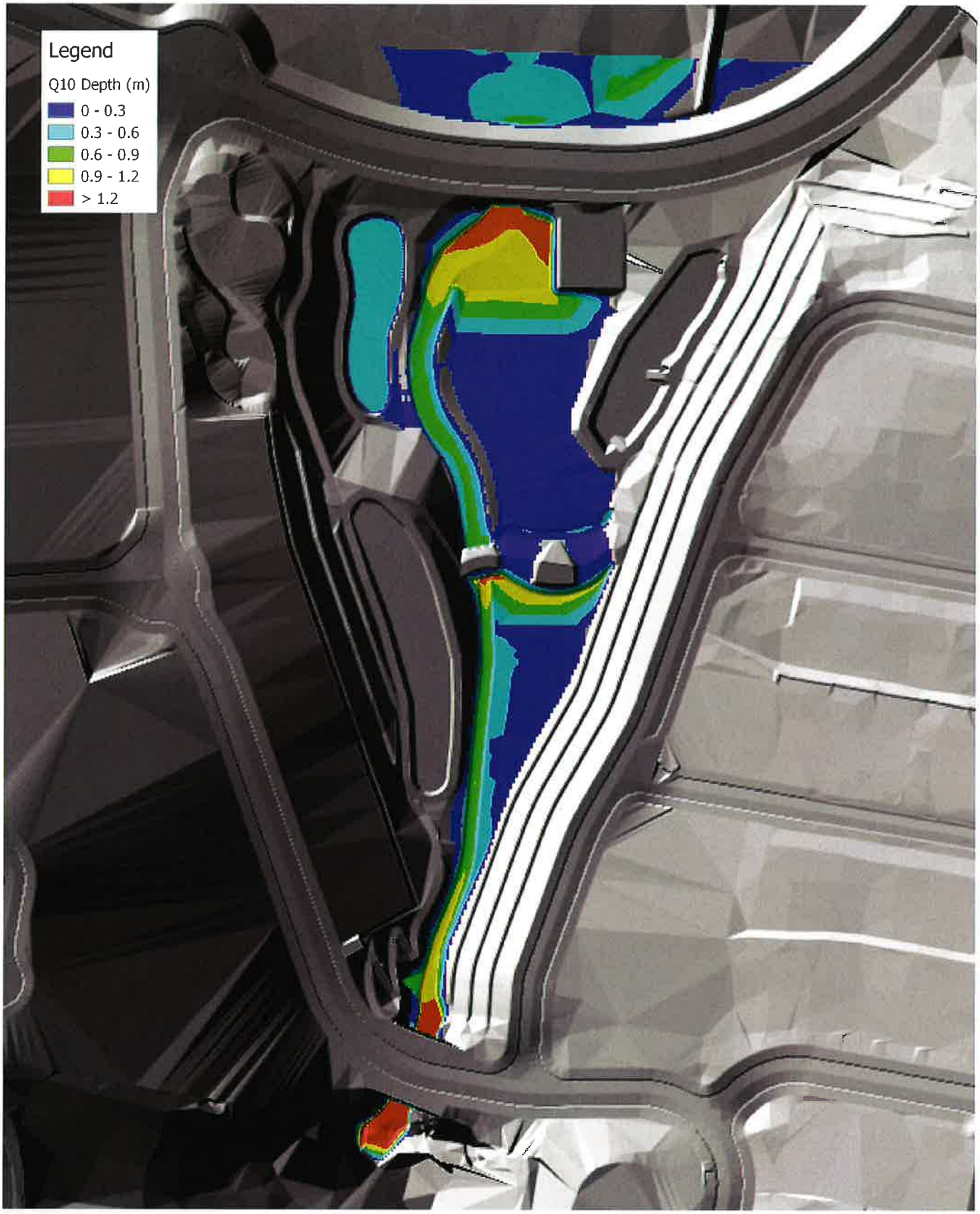
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-705

REVISION No. :
B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q10 DEPTH

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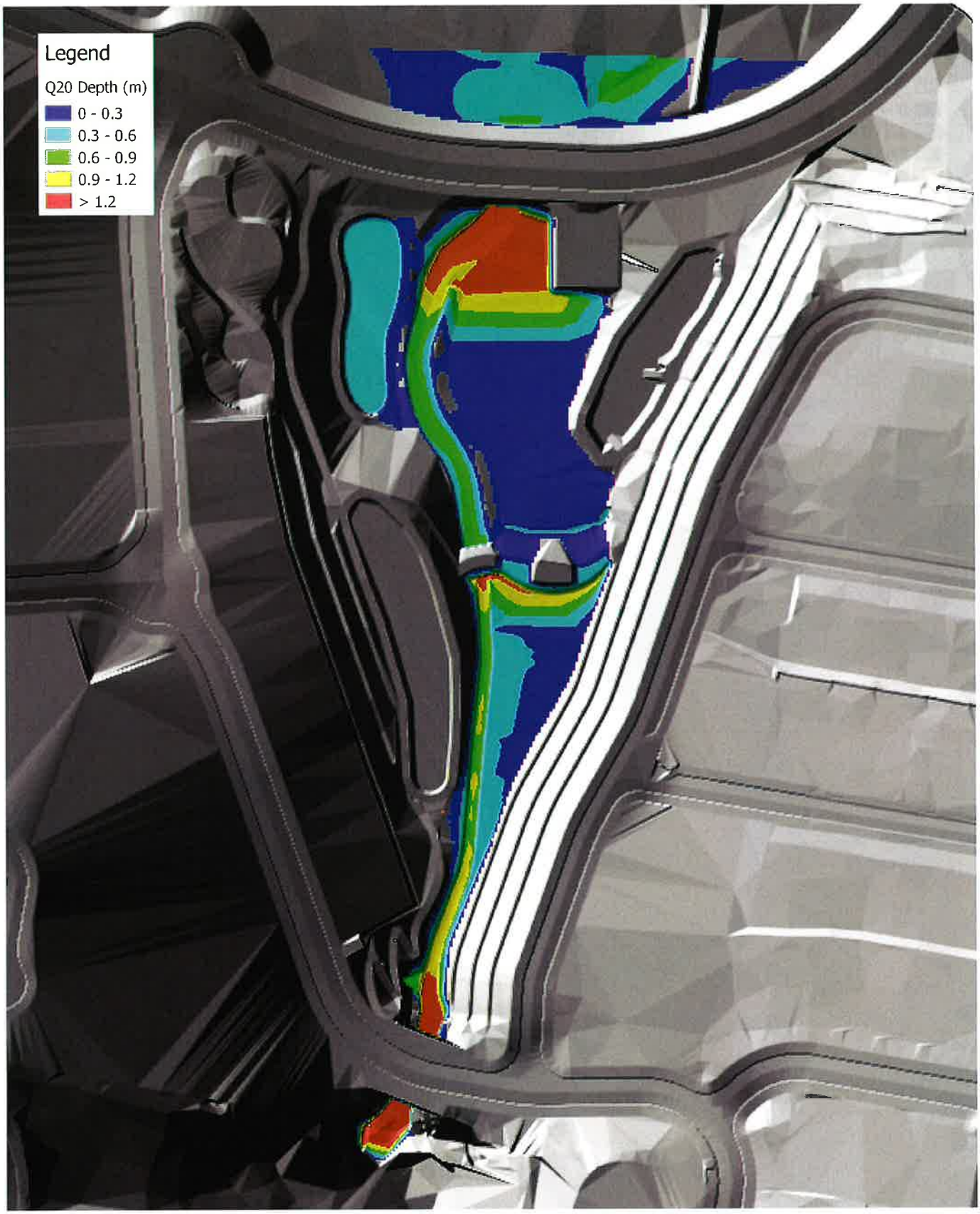
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-706

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q20 DEPTH

CLIENT :
NEWLAND DEVELOPERS PTY LTD

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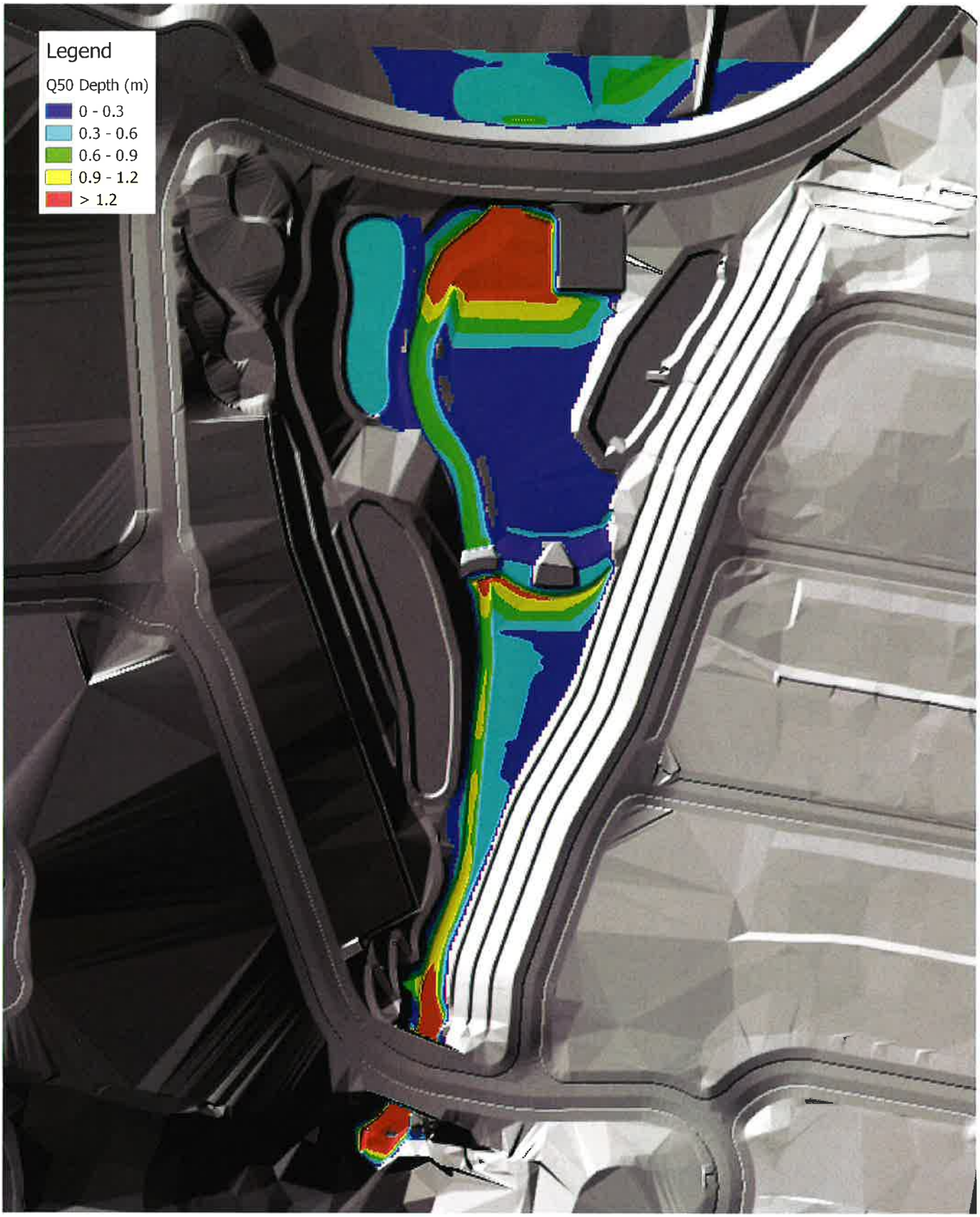
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DRAWING No. :
DWG-707

REVISION No. :
B

PROJECT :
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DRAWING TITLE :
Q50 DEPTH

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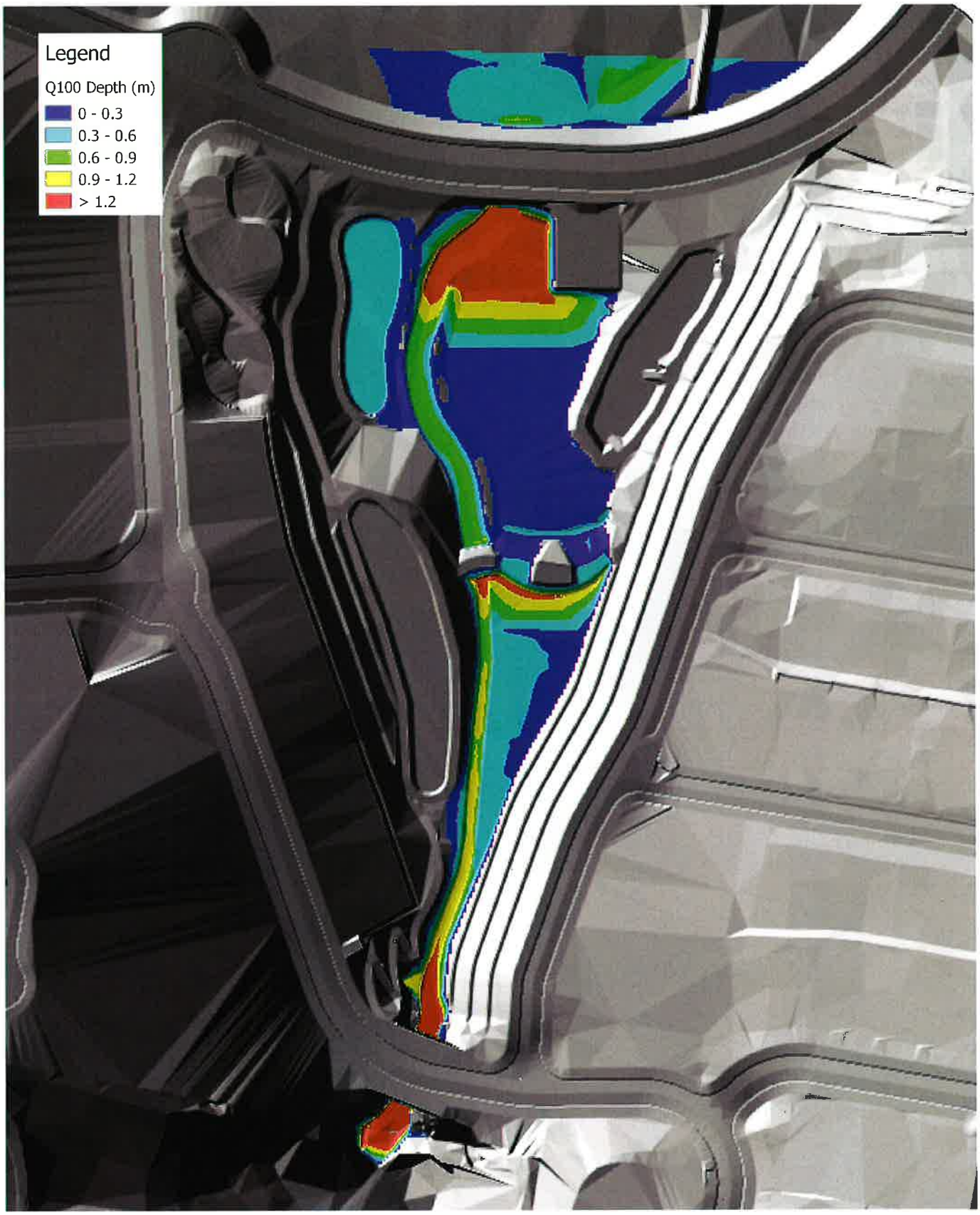
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PROJECT No. :
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DRAWING No. :
DWG-708

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q100 DEPTH

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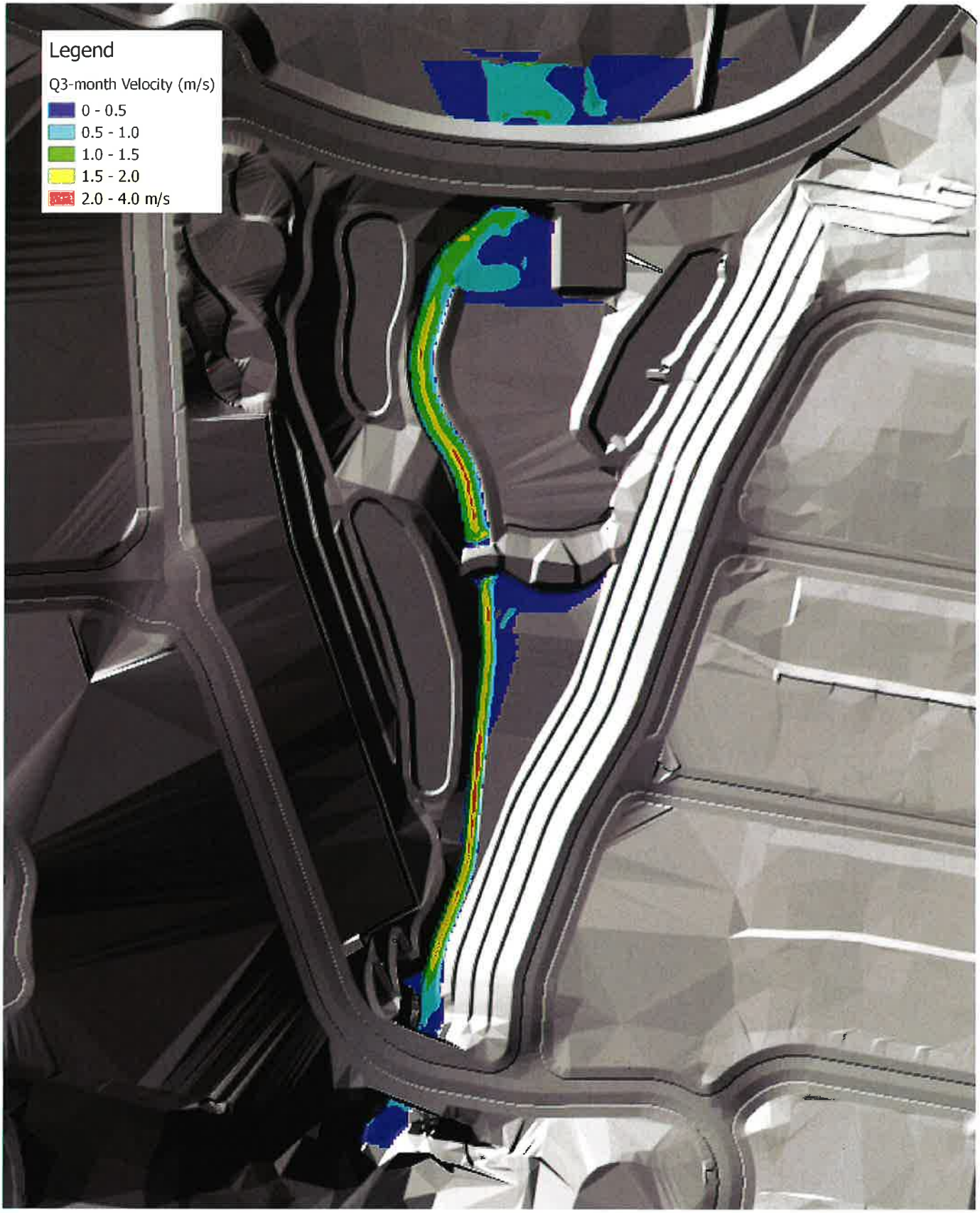
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-709

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q3-MONTH VELOCITY

CLIENT :
NEWLAND DEVELOPERS PTY LTD

ADDRESS :
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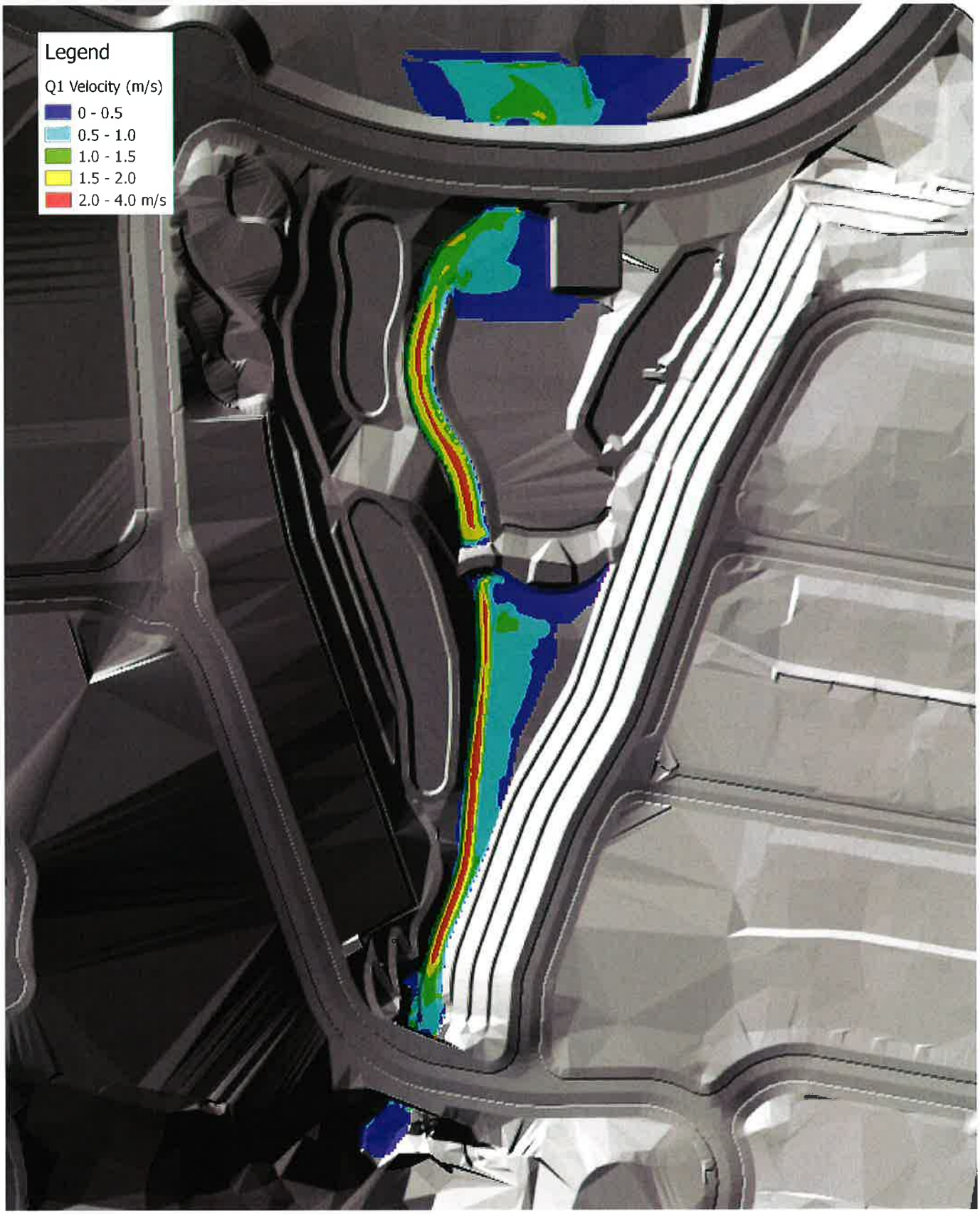
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-710

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q1 VELOCITY

CLIENT :
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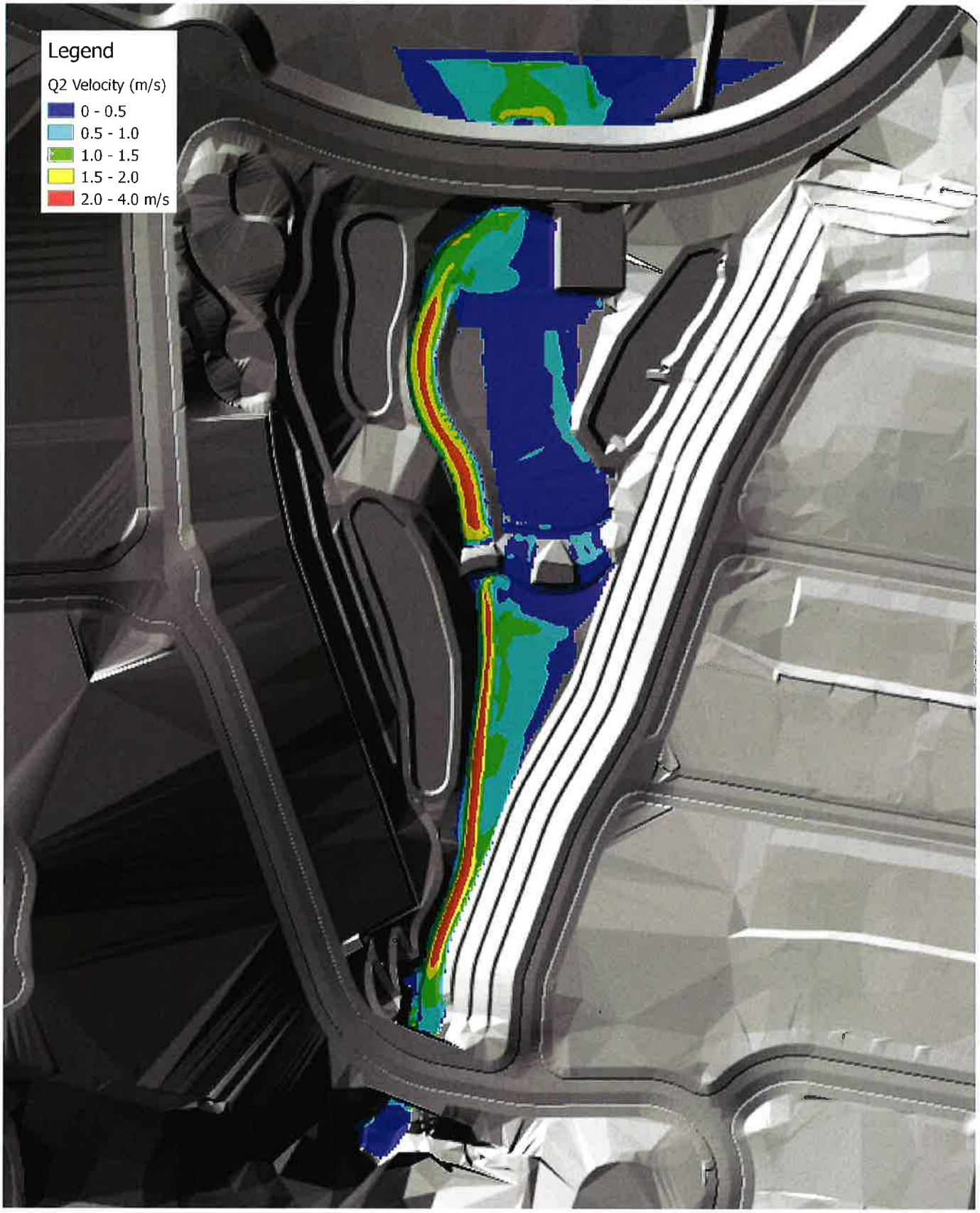
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DRAWING No. : DWG-711

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q2 VELOCITY

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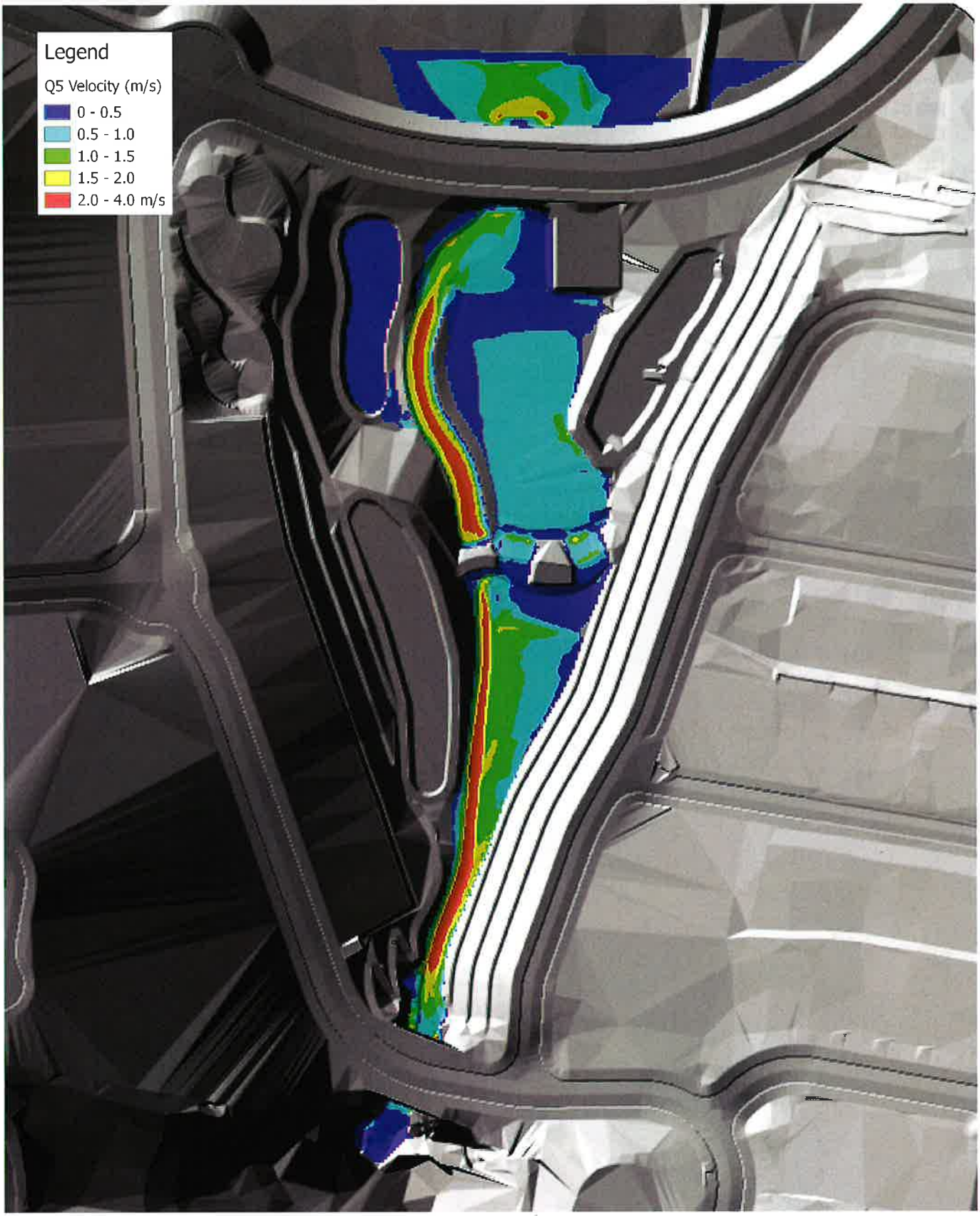
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PROJECT No. :
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DRAWING No. :
DWG-712

REVISION No. :
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PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q5 VELOCITY

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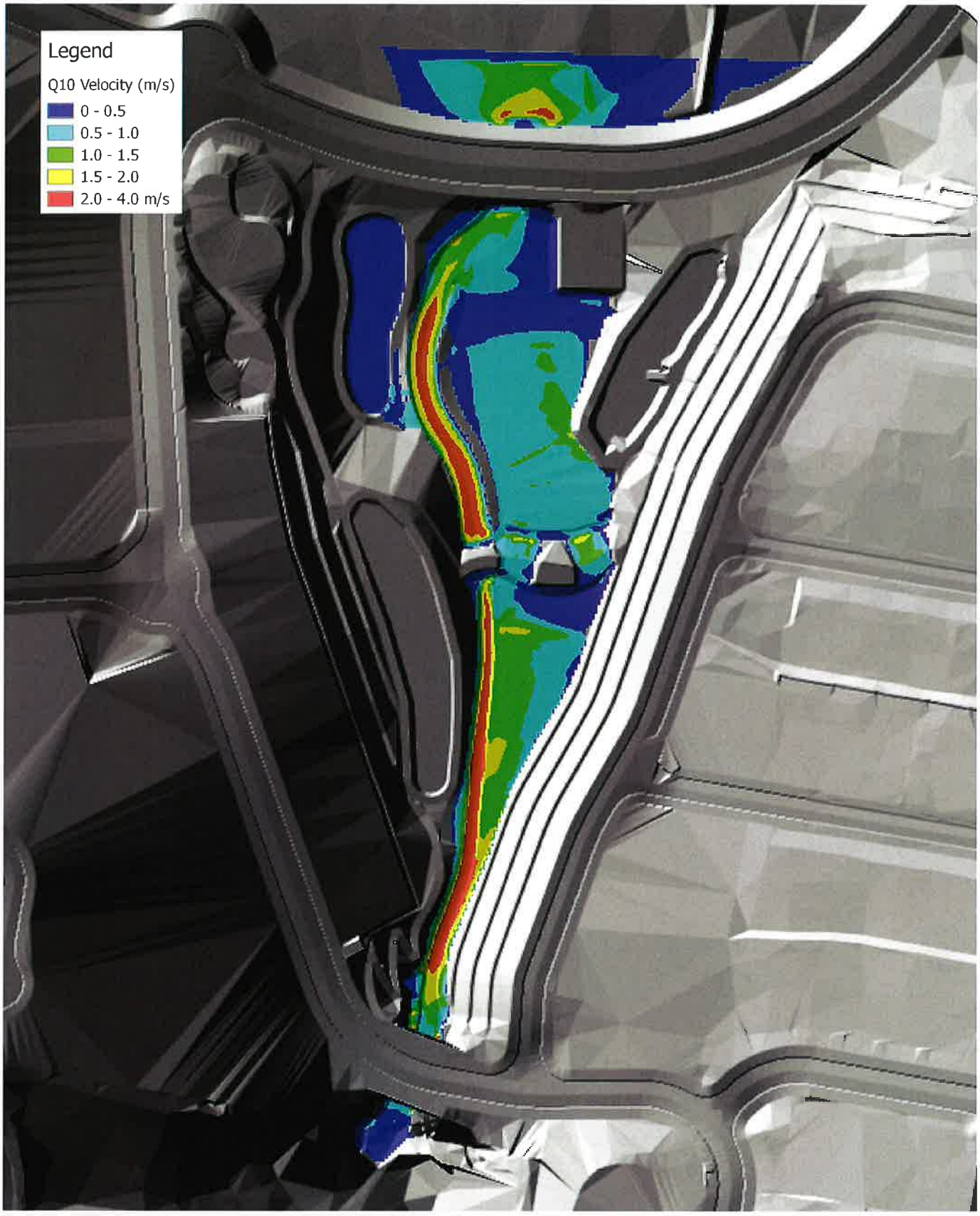
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DRAWING No. : DWG-713

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q10 VELOCITY

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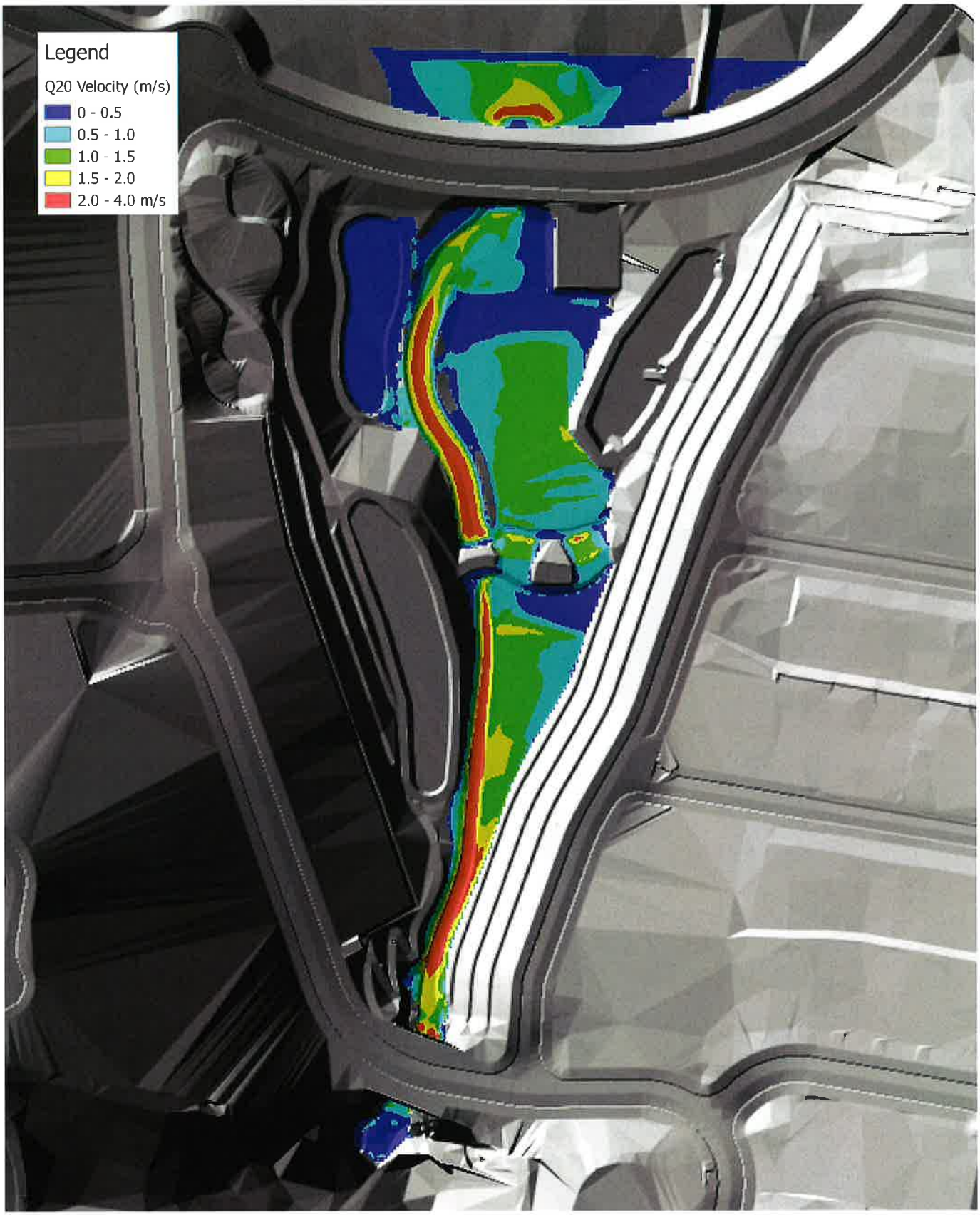
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-714

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

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Q20 VELOCITY

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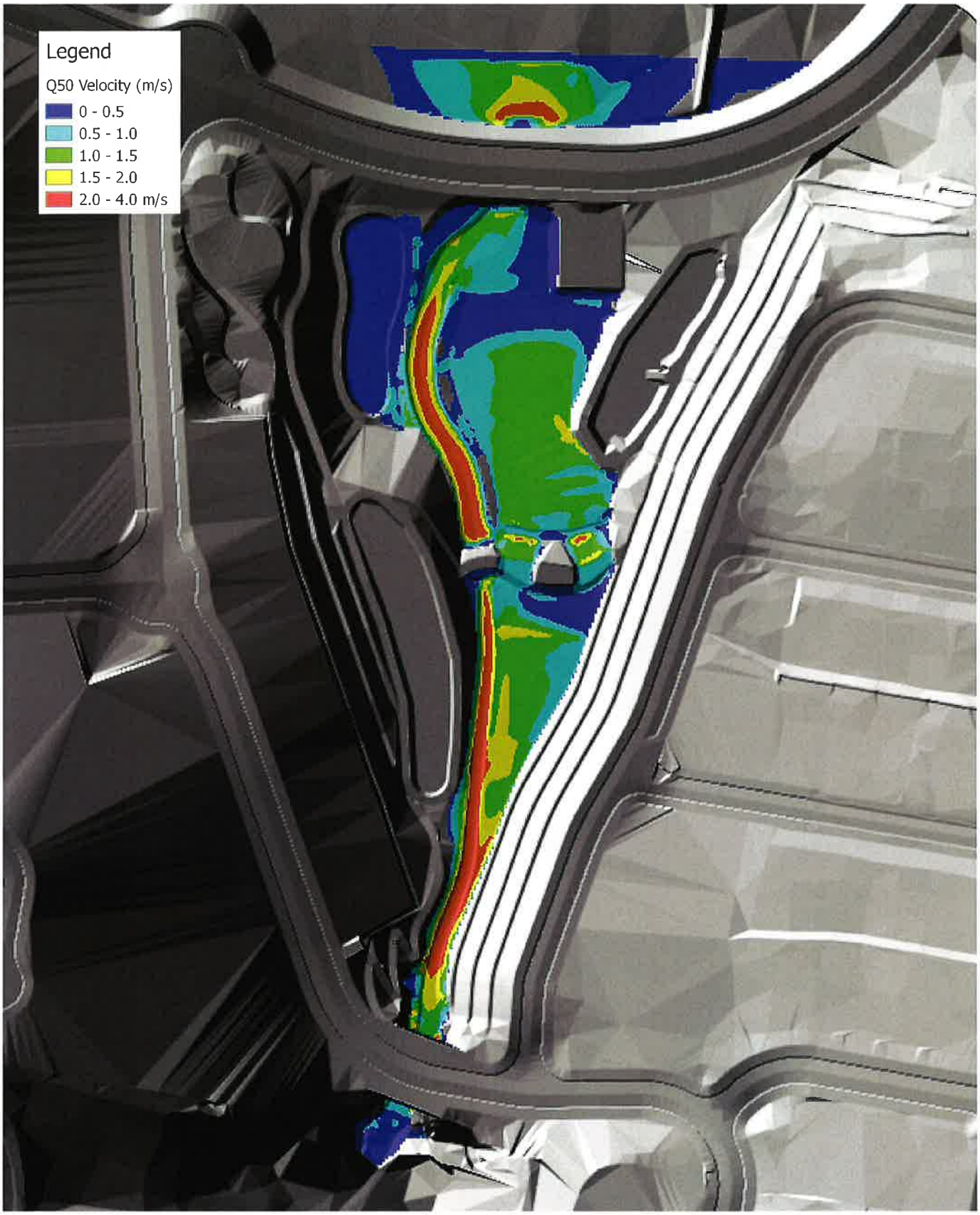
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-715

REVISION No. :
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PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q50 VELOCITY

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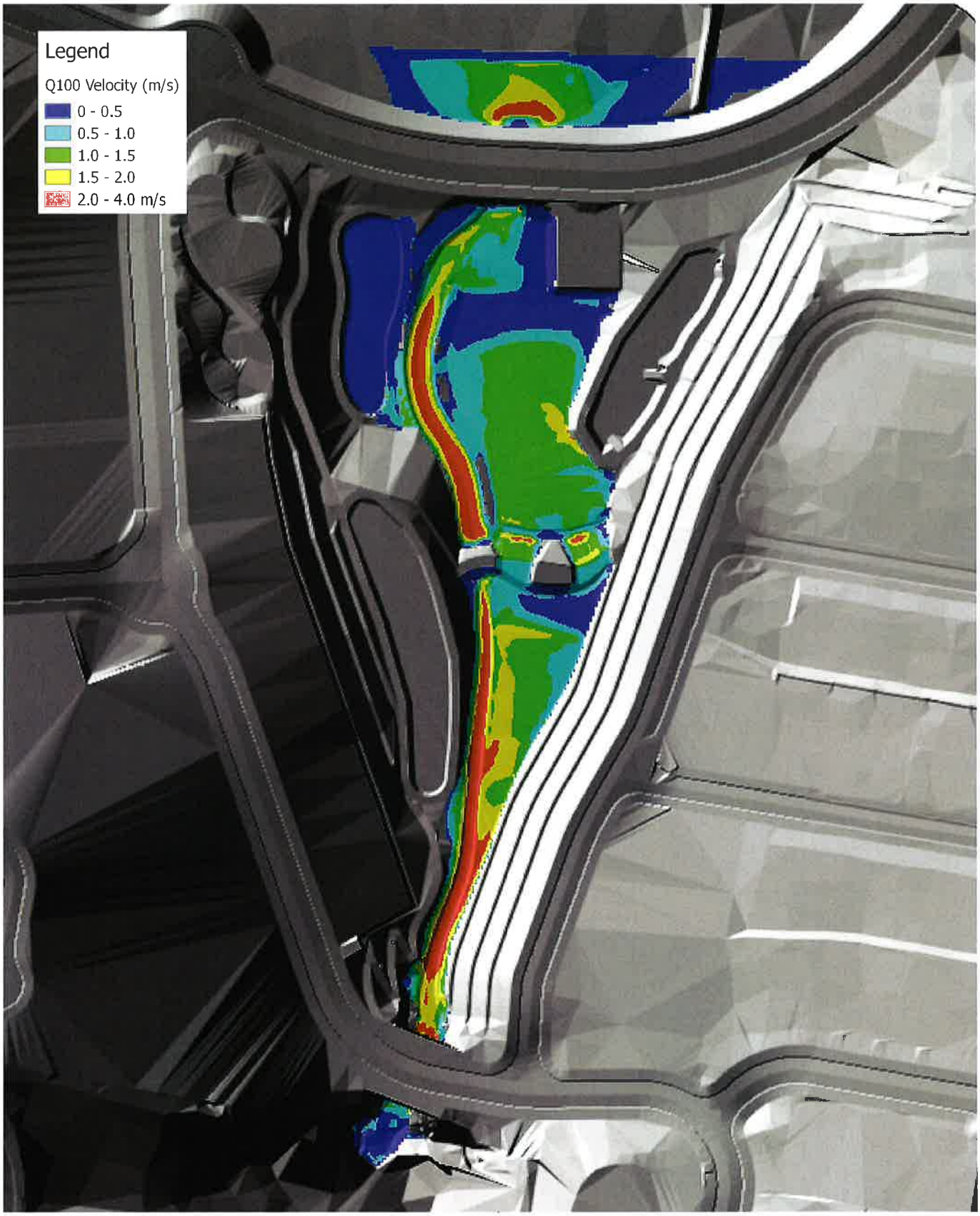
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DATE :
16.07.2018

PROJECT No. :
BC-16099

DRAWING No. :
DWG-716

REVISION No. :
B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q100 VELOCITY

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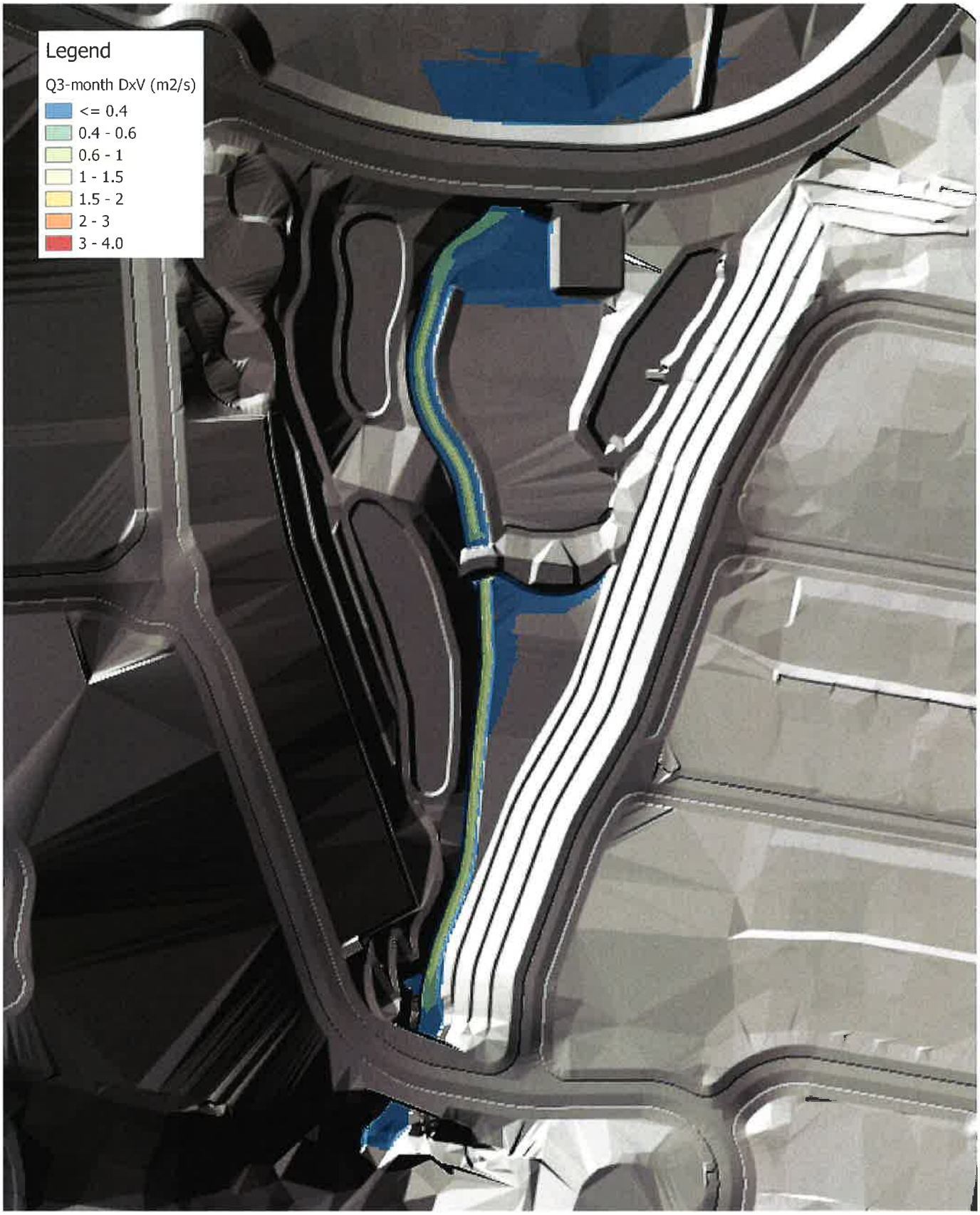
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PROJECT No. : BC-16099

DRAWING No. : DWG-717

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q3-MONTH DxV

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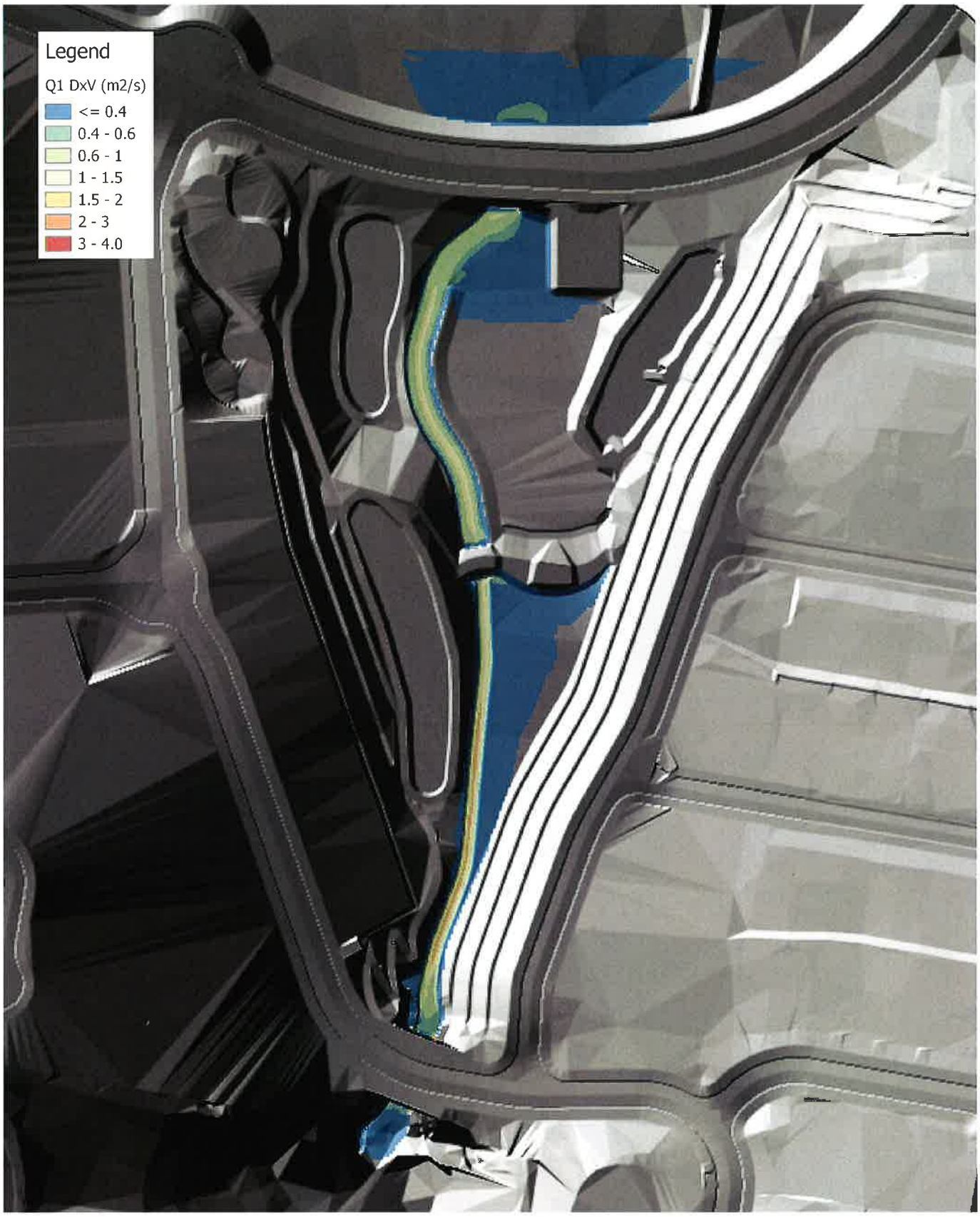
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PROJECT No. : BC-16099

DRAWING No. : DWG-718

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q1 DxV

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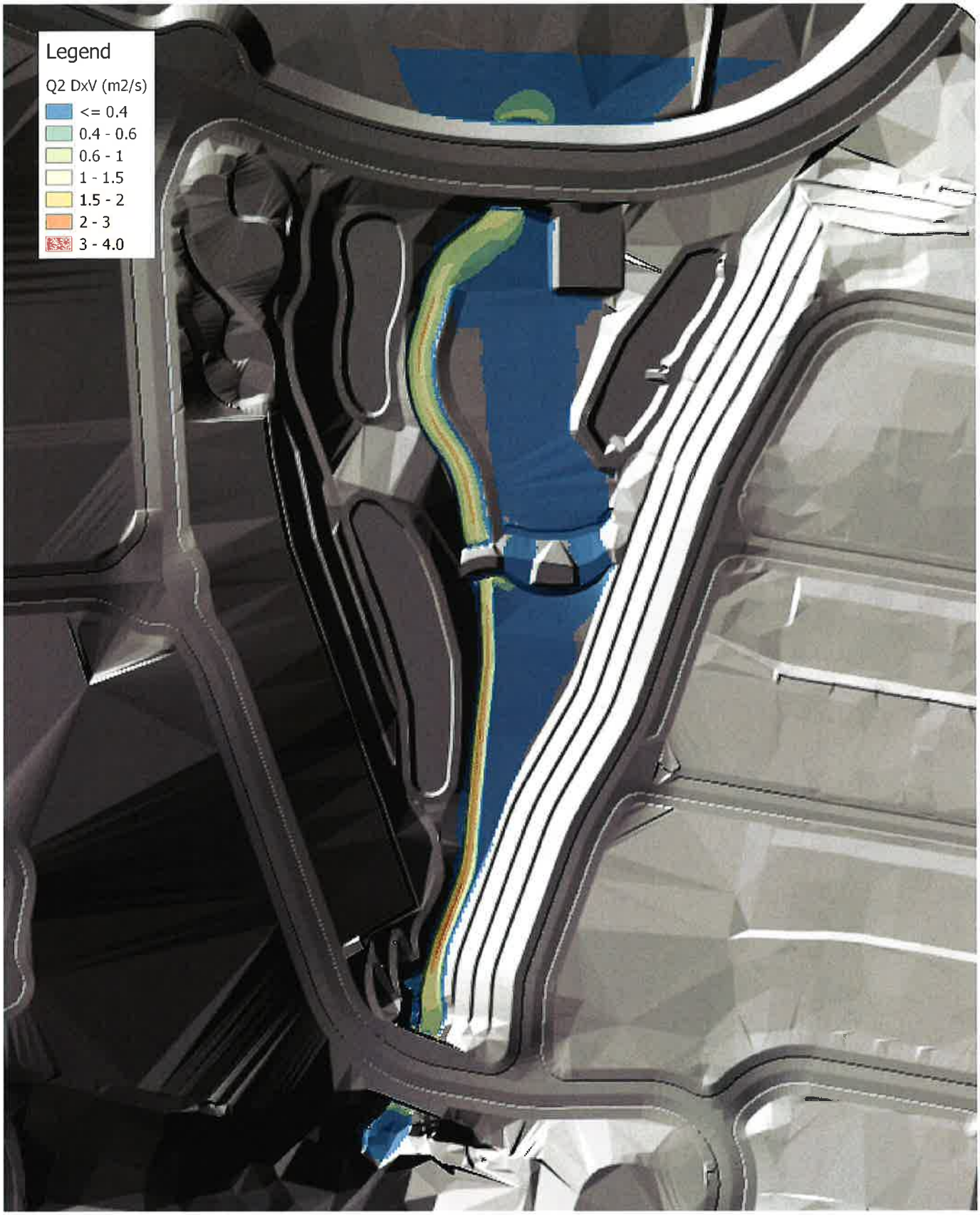
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DATE : 16.07.2018

PROJECT No. : BC-16099

DRAWING No. : DWG-719

REVISION No. : B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q2 DxV

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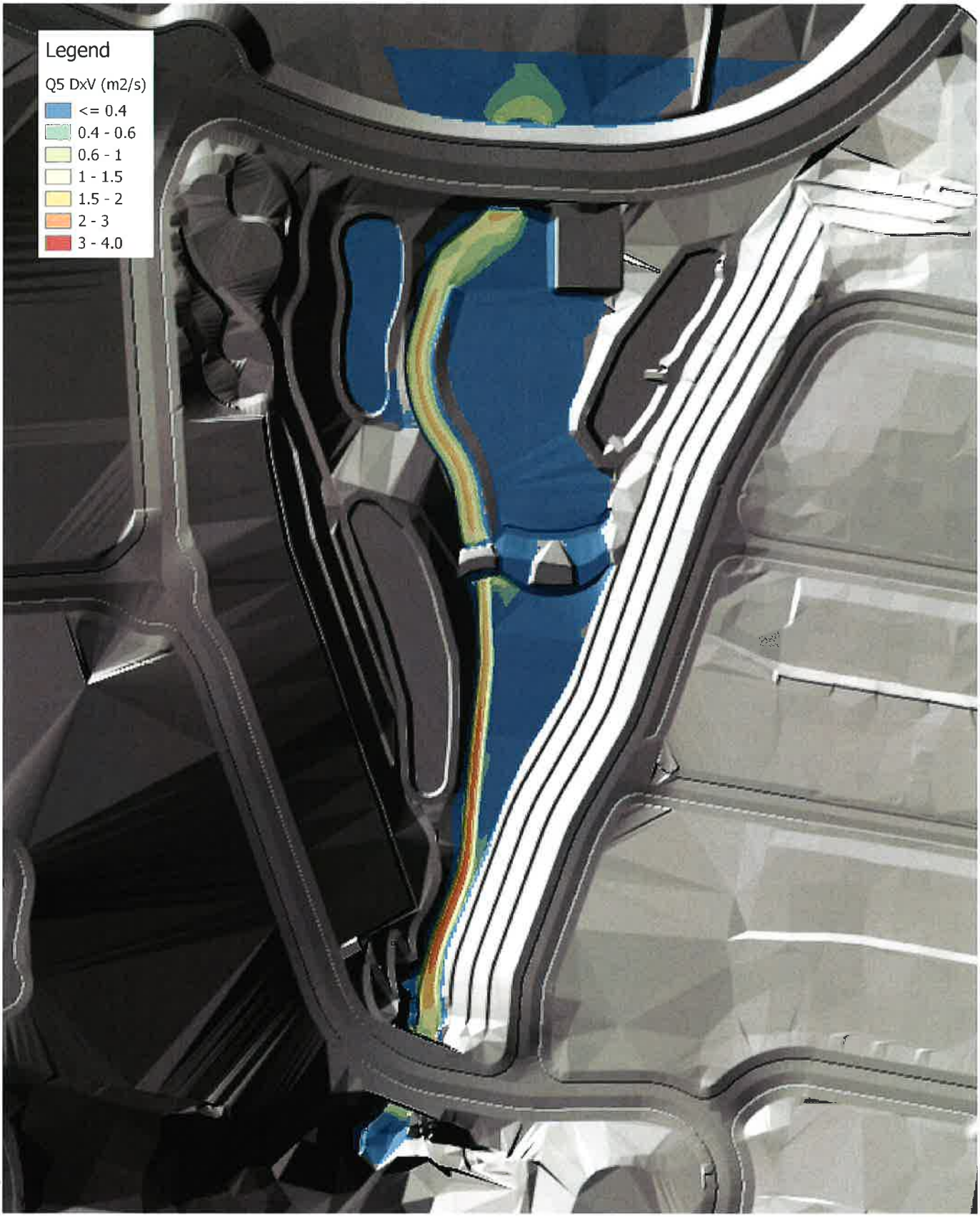
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-720

REVISION No. :
B

PROJECT : DRAINAGE ASSESSMENT

DRAWING TITLE : Q5 DxV

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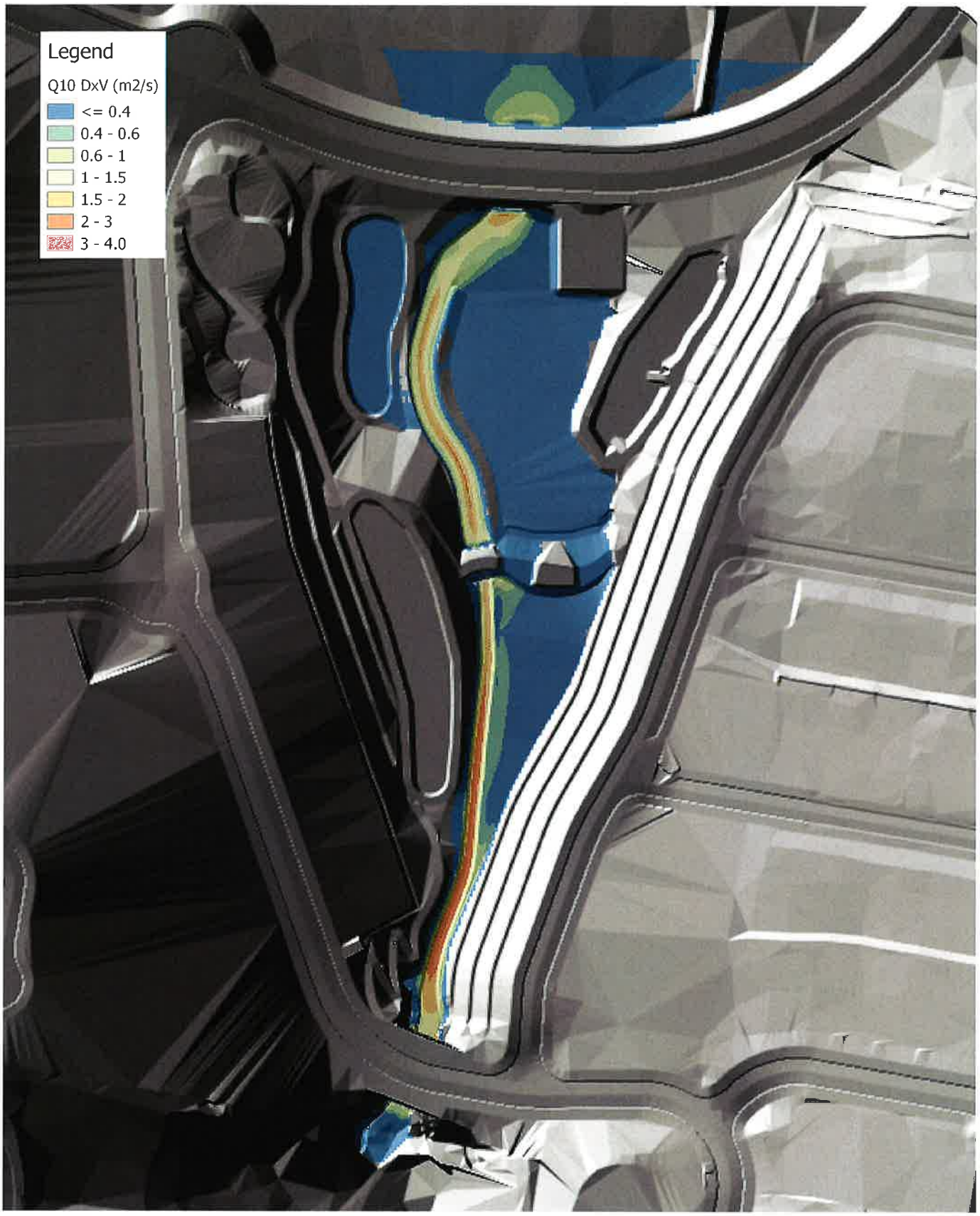
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DATE :
16.07.2018

PROJECT No. :
BC-16099

DRAWING No. :
DWG-721

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q10 DxV

CLIENT :
NEWLAND DEVELOPERS PTY LTD

ADDRESS :
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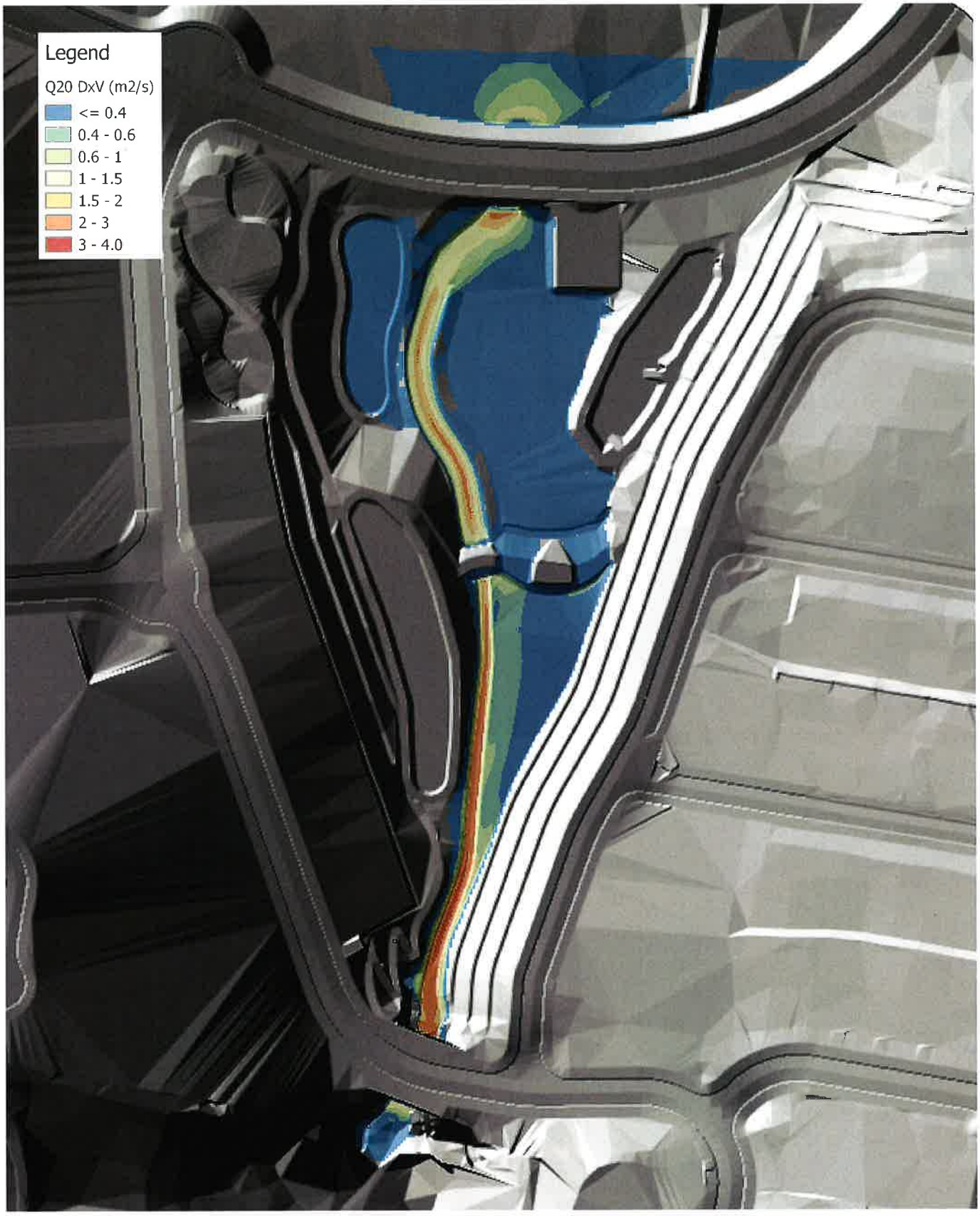
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DATE :
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-722

REVISION No. :
B

PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q20 DxV

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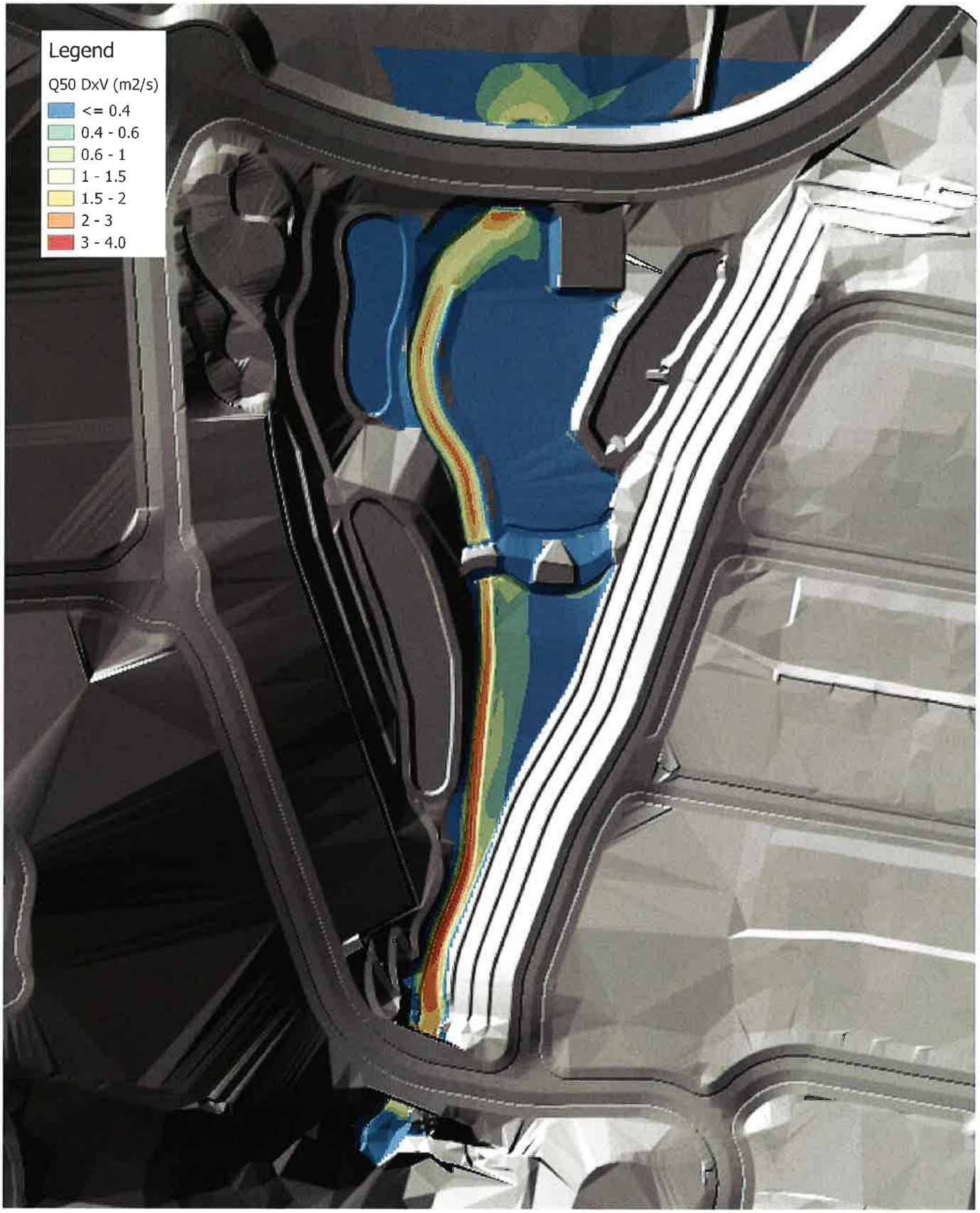
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-723

REVISION No. :
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PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q50 DxV

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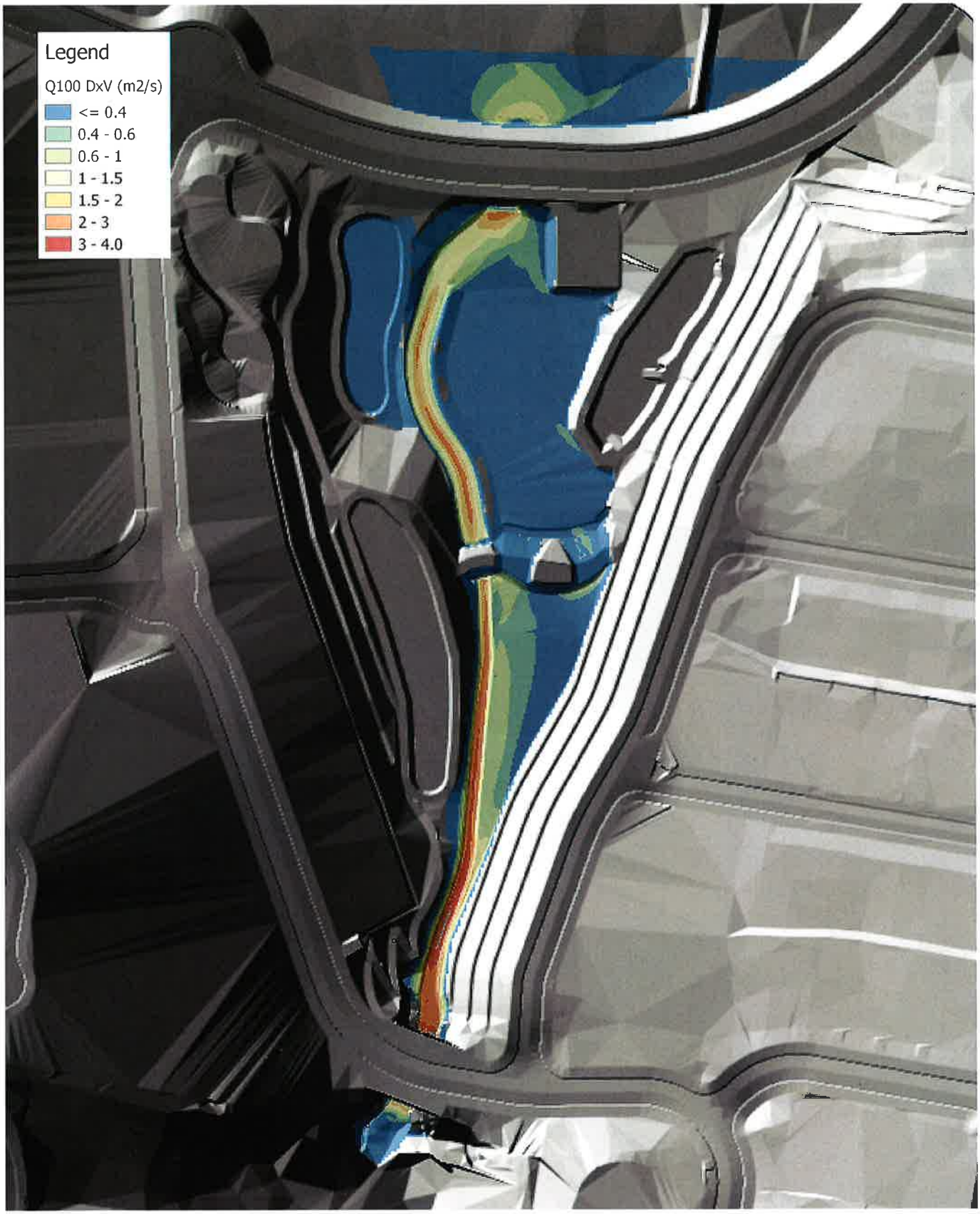
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PROJECT No. :
BC-16099

DRAWING No. :
DWG-724

REVISION No. :
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PROJECT :
DRAINAGE ASSESSMENT

DRAWING TITLE :
Q100 DxV

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ANNEXURE C

Bushfire Certifiers

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Lennox Head NSW 2478

info@bushfirecertifiers.com.au
www.bushfirecertifiers.com.au

ABN: 95 104 451 210
BCA Check Pty Ltd trading as Bushfire Certifiers

BUSH FIRE HAZARD ASSESSMENT LOT 610 DRAINAGE RESERVE

Lot 1 DP 304649, Lot 1 DP 175235, Lot 1 DP 781687, Lot 2 DP 778727, Lot 1 DP 781697, Lot 1 DP 169490, Lots 40 & 43 DP 254416 Fraser Drive, Terranora.

Altitude Aspire Estate

Prepared for: Newland

Prepared by:
Peter Thornton
BPAD-L3 ACCREDITED PRACTITIONER

Date: 26 June 2018 (amended)

Ref: 18/205

BCA Check Pty Ltd
t/as Bushfire Certifiers
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(PO Box 375 LENNOX HEAD NSW 2478)

ABN 95104451210
T: 02 66877461
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E: bcacheck@bigpond.com



Peter Thornton
Principal
BPAD-L3 Accredited Practitioner No. 14867
MFireSafeEng
Building Surveyor MAIBS

DOCUMENT CONTROL

Revision No.	Date	Description	Prepared	Checked	Authorised
A	26.06.2018	Final	Peter Thornton	SJT	Peter Thornton
B	03.12.2018	Amend Design Fire.4	Peter Thornton	SJT	Peter Thornton
C	23.04.2019	Amend Design Fires	Peter Thornton	SJT	Peter Thornton
D	30.04.2019	Amended – Typo	Peter Thornton	SJT	Peter Thornton

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1.0 EXECUTIVE SUMMARY

The purpose of this report is to address Tweed Shire Council's concern that the connective canopies and landscape areas exceeding 20% area of the reserve will not comply with the Bushfire Assessment Report prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012 and, in turn, the consent.

The subject residential subdivision development received conditional approval pursuant to S75J approval 09-0166 Modified MOD 2 dated 26th November 2015. NSW RFS provided a response to the bushfire assessment report for the landscaping with Lot 610 (see ***attached***). This report is an amendment to that report relating to proposed 09-0166 Modification No. 3 with the amendments to this report relating to Design Fires 2, 3 and 4. This amended report varies Design Fires 2 and 3 on the basis the 5m setback to the landscaping of Lot 610 will be wholly within the lot of Lot 701 and amendment to Design Fire 4 modelling the inclusion of an 8m wide grouted stone batter within Lot 610 and adjacent to the western boundary of Lot 316 as discussed with Tweed Shire Council.

The report provides four (4) design fires together with sensitivity studies to demonstrate the landscaping should not be considered as a significant bushfire hazard based on the landscaping recommendations. Should it be considered by NSW RFS to be an area of bushfire hazard, the report provides some methodologies to determine appropriate setbacks.

The report does not provide a completely new assessment of the development which has been approved and references the Bushfire Safe (Australia) Pty Ltd report dated March 2012 but is simply a study addressing the landscaping requirements of Tweed Shire Council for the open space Lot 610 and minor amendments to lot numbering. In turn, the report provides the following recommended amendments to existing bushfire conditions A4(10), B49 and E14 of approval s75J approval 09-0166 Modified MOD 2 dated 26th November 2015.

The report recommends the following amendments to the existing conditions A4 (10), B49 and E14.

A4 Project in Accordance with Documents
The project will be undertaken in accordance with the following documents except where varied by the conditions of this approval:

(10) *Bushfire Assessment Report* prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012 and the Report prepared by Bushfire Certifiers dated 26th June 2018 (amended 30th April 2019) addressing the amended central drainage corridor design identified as Lot 610 (MOD3);

B49 Bushfire Management
The site shall be managed in accordance with the *Bushfire Assessment Report* prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012 and the report prepared by Bushfire Certifiers dated 26th June 2018 (amended 30th April 2019) addressing the amended central drainage corridor design of Lot 610 (MOD3). The entire site shall be managed as an inner protection area (IPA) as outlined within

Appendix 2 and 5 of *Planning for Bushfire Protection (2006)* and the NSW Rural Fire Service document '*Standards for Asset Protection Zones*'. The central drainage corridor Lot 610 is to have an approved landscape plan prepared with the following requirements to be assessed and approved by Tweed Shire Council –

- All vegetation is to be high moisture rainforest species in accordance with Appendix 5 PBP2006.
- The near surface and elevated fuels are not to exceed a height of 300mm with species selection nominated on the plans.
- An 8m wide area within Lot 610 directly adjacent to the west boundary of Lot 316 is to be provided with a non-combustible surface treatment. It is noted this report does not rely on a specific setback for a dwelling on Lot 316.
- The rear boundary of Lot 701 is to extend 1m within Lot 610.
- A 1.2m high non-combustible fence is to be provided on top of the concrete block retaining wall along the entire east boundary of Lot 701.

E14 Bushfire Certification

Prior to the issue of any Subdivision Certificate, certification from a Fire Protection Association Australia (FPA Australia) accredited Bushfire Planning And Design (BPAD) certified practitioner, must be submitted to the Certifying Authority, confirming that the works have been undertaken in accordance with the Bushfire Assessment Report prepared by Bushfire Safe (Australia) Pty Ltd dated March 2012, the Report prepared by Bushfire Certifiers dated 26th June 2018 (amended 30th April 2019) *and the conditions of this approval.*

2.0 ASSET PROTECTION ZONES AND CONSTRUCTION STANDARDS

Asset Protection Zones are areas established and maintained to ensure that bushfire fuels are progressively reduced between the development and the bushfire hazard. The asset protection zone incorporates an Inner Protection Area (IPA) having reduced fuel loadings of approximately 3t/ha.

The future dwelling sites (building envelopes) relating to each design fire will have the following setbacks from the landscaping –

Design Fire 1 - Lots on the western interface of Stages 2, 3 and 6A will have minimum 6m building line with a 14.5m road reserve. In turn, the width of managed land between the future dwellings and the remnant rainforest will be 20.5m.

Design Fires 2 and 3 – Approved Lot 701 will have a 5m rear boundary setback from the boundary adjoining Lot 610 as shown in Figure 1.

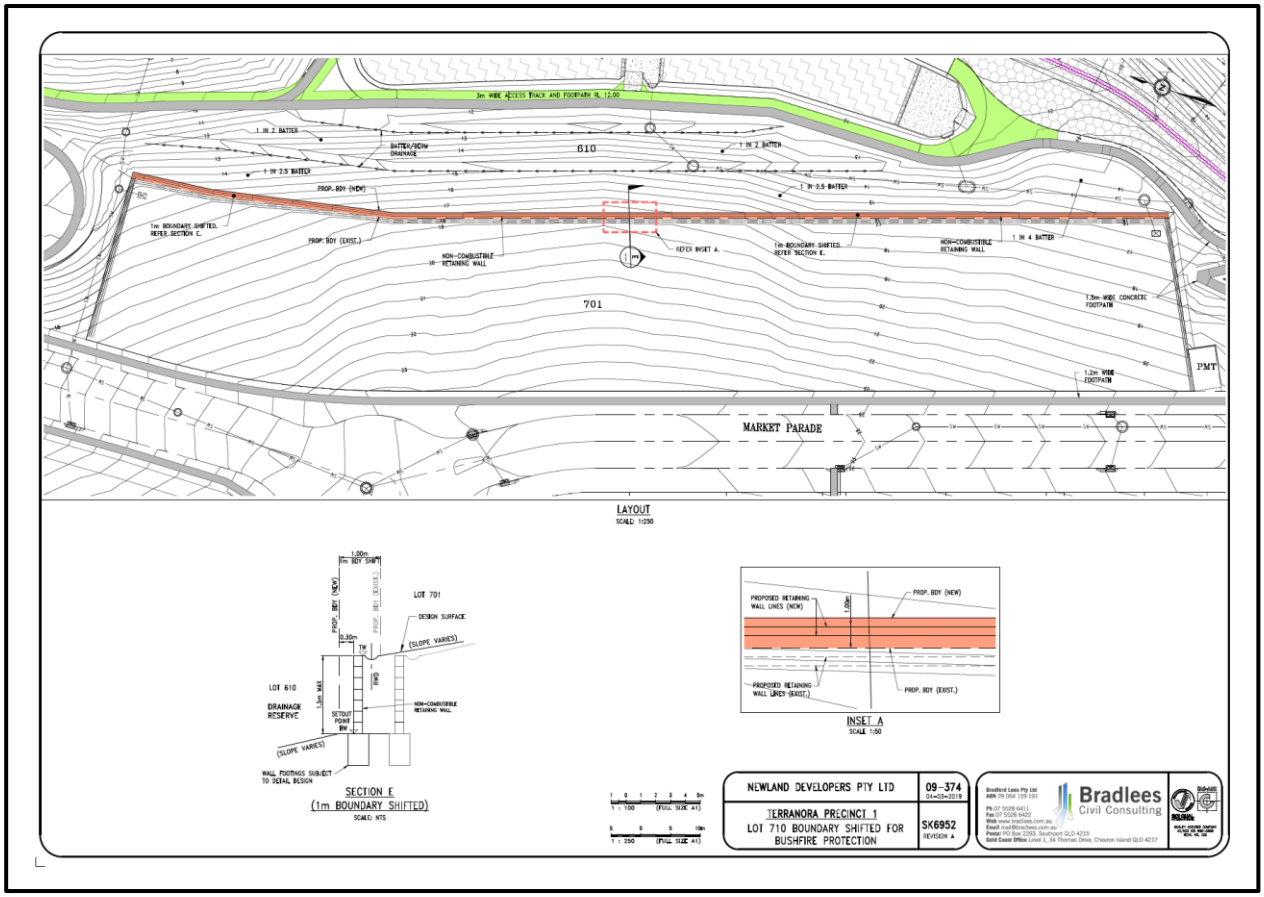


Figure 1: Lot 701 has the rear boundary relocated 1m to the east to accommodate a minimum 5m buffer from the rear boundary to a potential dwelling location as provided for in this study.

Design Fire 4 – Approved Lot 316 will have an 8m wide grouted rock area adjacent to the western boundary separating Lot 316 and reserve Lot 610 as shown in Figure 2. The grouted rock area will be included in the study and have a lower potential fuel level than an asset protection zone.

Design Fire 4 will include the 8m wide APZ in lieu of specifically calculating a building envelope set back on approved Lot 316 given this allotment has been sold and is in private ownership. Design Fire 4 will be provided without calculating the radiant heat reduction than may occur should a boundary fence be constructed.

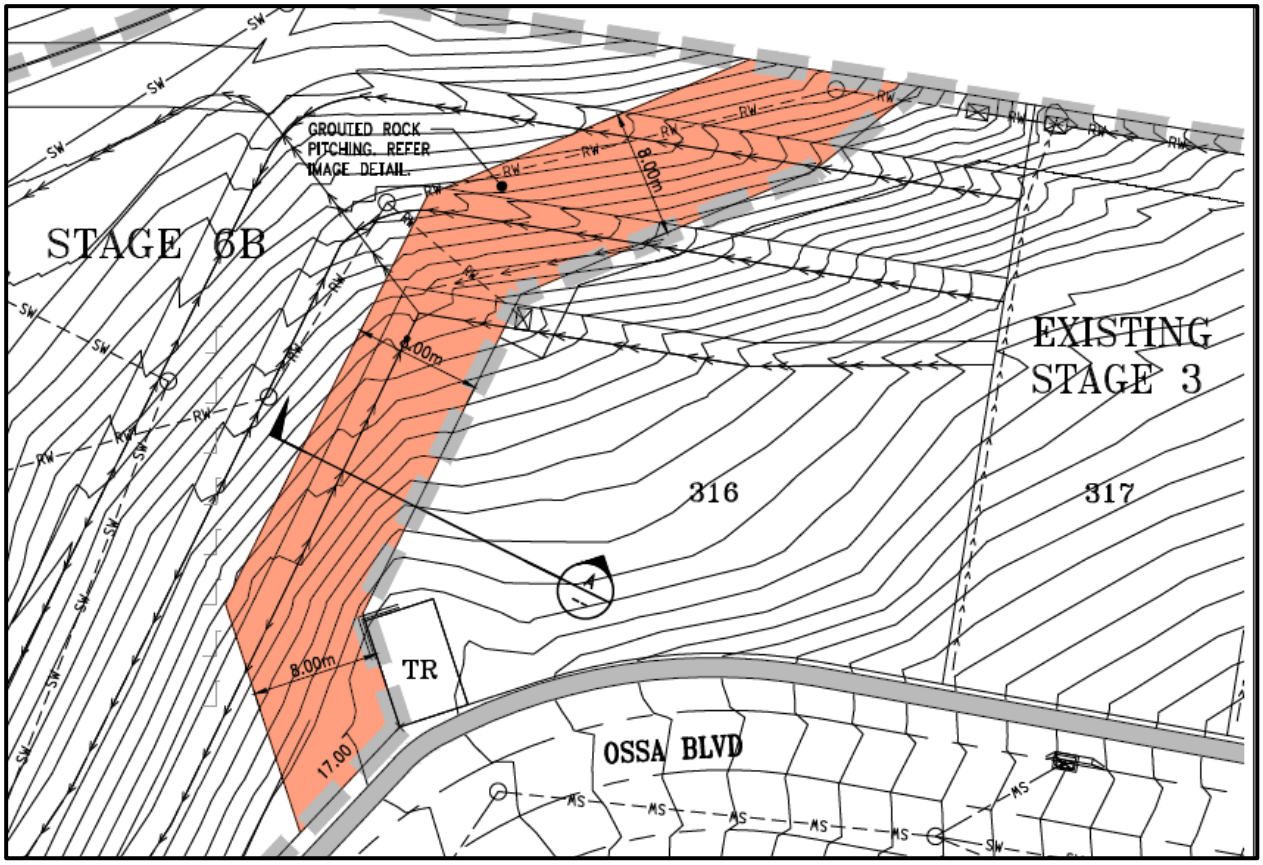


Figure 2: 8m wide hard surface area (grouted rock) will be fuel free for Design Fire 4.

3.0 CONSTRUCTION STANDARDS & ASSET PROTECTION ZONES – PERFORMANCE SOLUTION

The performance solution documents the findings of the bushfire assessment and study of fire behaviour consistent with NSW RFS policy for the future dwellings. This report is also prepared as the bushfire engineering brief and any comments from stakeholders may require the report to be amended. It is noted that this report is to be referred to the NSW RFS and can accompany an application for a Bush Fire Safety Authority.

APZ Acceptable Solution

''An APZ is provided in accordance with the relevant tables/figures in Appendix 2 of this document''

Given the shape and size of the hazard the performance solution demonstrates that the future dwellings will comply with the following performance criteria;

APZ Performance Criteria

''Radiant heat levels at any point on a proposed building will not exceed 29kW/m^2''

The distance for the asset protection zone shall be measured in accordance with Figure A2.1 of Planning for Bushfire Protection 2006 (see below) which is from the base of the vegetation (where surface fuels are maintained).

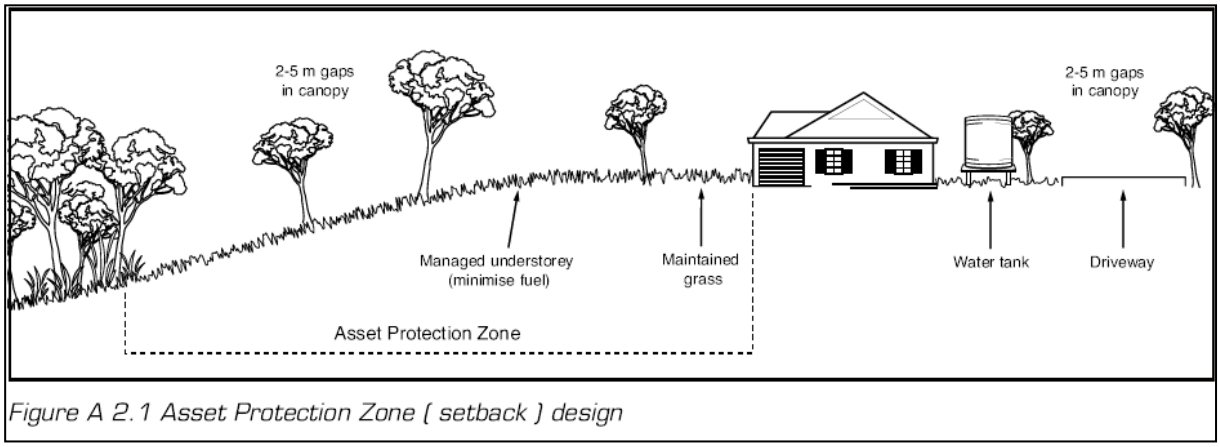


Figure 3: Figure A 2.1 Asset Protection Zone (setback) design

BCA METHODOLOGY

General

The building works need to comply with the performance requirement of P2.3.4 of the Building Code of Australia (BCA). Part 1.0.3 of the Housing Provisions identifies how you would satisfy the performance requirements and provides as follows:

(a) A Performance Solution must –

(i) comply with the Performance Requirements; or

(ii) be at least equivalent to the Deemed-to-Satisfy Provisions,

and be assessed according to one or more of the Assessment Methods.

(b) A Performance Solution will only comply with the NCC when the Assessment Methods used satisfactorily demonstrate compliance with the Performance Requirements.

This report will outline compliance by meeting the performance requirement pursuant to 1.0.3(a)(i) of the Housing Provisions of the BCA.

The assessment method for the performance solution is identified in Part 1.0.5 – Assessment Methods in the Housing Provisions of the Building Code of Australia 2016. The report will be assessed in accordance with Part 1.0.5(b)(ii) by using a qualitative and quantitative analysis consistent with Planning for Bushfire Protection 2006.

The methodology adopted in formulating the performance solution is based on that described in the *International Fire Engineering Guidelines 2005*, RFS Practice Note 03/06 and AS 3959-2009. The Guidelines provide guidance for the design of performance solutions for the BCA in order to establish an acceptable level of compliance with the relevant performance requirement.

In this regard the radiant heat flux established within the performance solution will identify the Bushfire Attack Level to be constructed in accordance with AS 3959-2009 and Addendum to Appendix 3 PBP2006. Ember protection is considered and will be addressed by complying AS 3959-2009 for the relevant Bushfire Attack Level (BAL).



Figure 4: Location of proposed design fires 1- 4.

3.1 DESIGN FIRE NO. 1

Undertake short fire run modelling. The following modelling uses the 26 degree downslope of the steepest batter in consideration of the short run given that it is direct. The bushfire behaviour given the short fire run is not likely to involve the canopy due to the high moisture content of the vegetation and low intensity of the forecast fire together with the lack of prominent mid strata.

The methodology will be as outlined in Method 2 of AS 3959-2009. The variations to the AS 3959-2009 Method 2 inputs will be outlined in the sections following, however they relate to;

- Fire front width reduction due to short fire run modelling.
- NSW RFS Community Resilience Sheet – Methodology for assessing bush fire risk for low risk vegetation and Appendix A Community Resilience Sheet 1/14.

Redundancies include;

- The performance solution assumes 100% rate of spread at fire initiation stage within the primary hazard however it is acknowledged that ember ignition will require a growth period that is not likely to reach 100% intensity over a short fire run.
- Flame emissivity is conservative, with 95% emitting power (as detailed in AS3959 (2009).
- Rate of spread assumes that the fire is moving at equilibrium rate of spread from the instant it starts. This is not possible with Cheney and Barry's (1969) forest growth model of R=Rss e-a/t being more appropriate, where R = rate of spread at time t, Rss = equilibrium rate of spread, t = time since ignition.

Fire initiation from the west and east (Lot 610) in the nominated study areas will have a direct fire run of approximately 25m at the widest point. The fire behaviour with this fire run from a point ignition is not likely to evolve into a fire with 100% intensity as prescribed by AS 3959-2009.

The fire will be in the initiation and growth stages of development. As shown in the Bushfire CRC illustration below the rate of spread will not be sufficient to fully involve the canopy and therefore the intensity and flame length is potentially overestimated by AS 3959-2009.

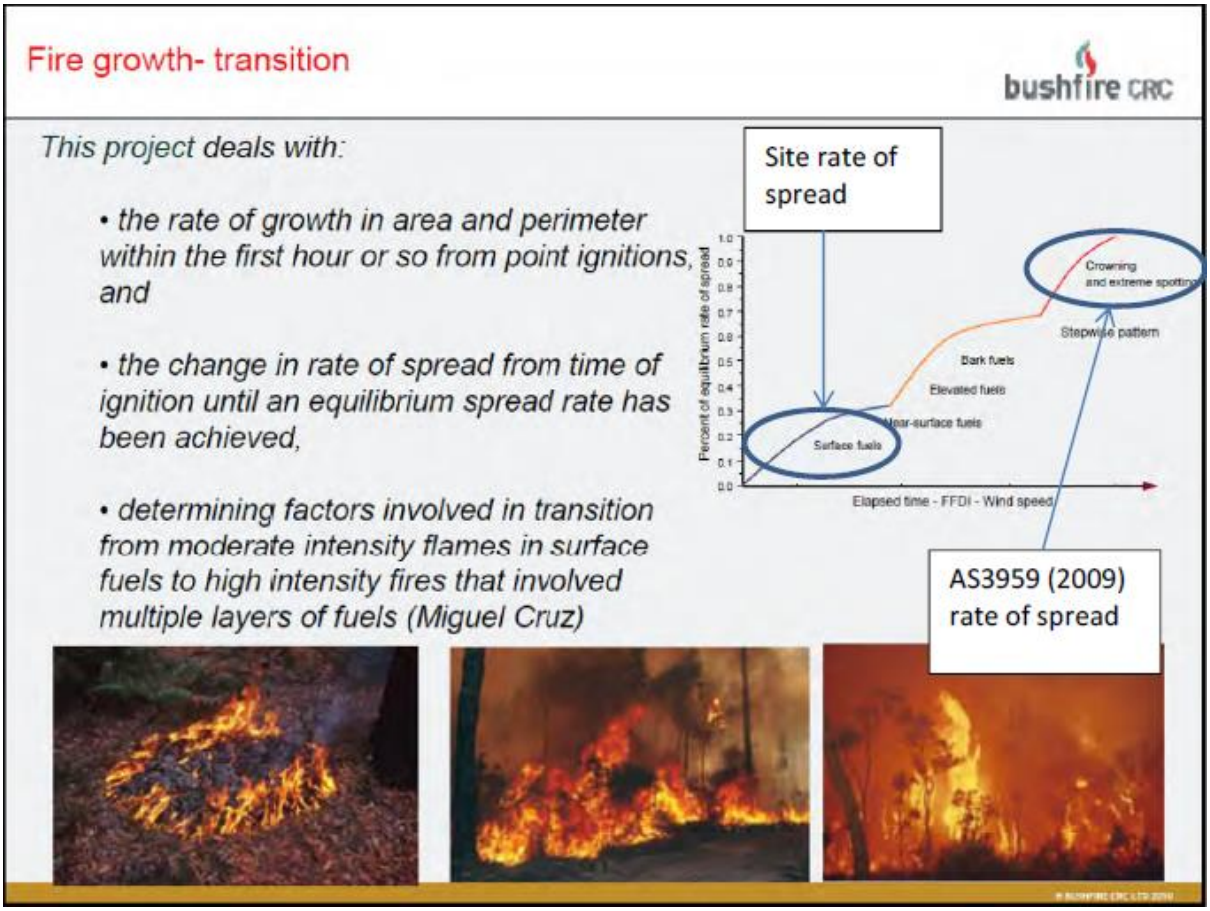


Figure 5: Bushfire CRC graph shows how short fire runs will not reach 100% intensity

The following quantification of the short fire run is provided to comply with the identified performance criteria having a setback from the hazard of a minimum 20.5m.

The fire scenario used to quantify the forecast fire front is from a single or multi-spot ignition source. The following model provides some variation to the intensity, rate of spread and flame length calculation adopted by AS 3959-2009.

The variations are used due to the fact that AS 3959-2009 has inputs for a fire in full equilibrium state of spread whereas the size and short fire run of the rainforest will promote fire behaviour in the initiation and growth stage in an accelerating phase rather than at 100% intensity at the vegetation/APZ interface.

The modelling is based on plants provided to this strata having a maximum height of 0.9m. Based on this recommendation it is appropriate to use the elevated height of 0.9m (Vesta) which is consistent with Appendix B of NSW RFS Community Resilience Sheet – Methodology for assessing bush fire risk for low risk vegetation.

Table 1: PBP2006 Inputs

	PLANNING FOR BUSHFIRE PROTECTION 2006 INPUT
Rainforest Surface Fuel Load	10 tonnes per hectare
Rainforest Overall Fuel Load	12 tonnes per hectare
Average Elevated Vegetation Height	0.9m
FDI	80
Flame Temperature	1090 kelvin

The methodology of Method 2 AS 3959-2009 is used as part of the performance solution with the following variations relating to fire front width and flame height being consistent with NSW RFS Community Resilience Sheet – Methodology for assessing bush fire risk.

1. Radiant heat shall be measured as a cylinder or elliptical shape rather than a flat panel. Alexander (1985) proposes the length to breadth ratio of 1.0 + 0.0012 W2.154 where W equals a theoretical wind speed of 30 km/h. In turn the calculation establishes that the length to breadth (Lb) ratio = 2.82.

2. AS3959 (2009) Rate of spread (metres per minute) = (0.0012 * FDI * Surface fuel load* (0.069*SLOPE)*1000)/60.
   ROS = (0.0012 * 80 * 10 * (0.069*26) * 1000)/60.

3. Alexander (1985) proposes a head fire spread ratio of = ((Lb+√(Lb^2)-1) / Lb-(Lb^2) -1)).

Head fire spread (Hfs) = 29.85 metres per hour.

4. Alexander (1985) proposes ellipse length by dividing the forward rate of spread (AS3959 (2009) calculation) with the Head Fire Spread.
   Ellipse length (El) = ROS/Hfs+ROS.

5. Total ellipse length (Tel) is calculated by multiplying Ellipse length by the time taken to travel the short fire run distance.
   Tel = El * (distance/ROS)

   Tel = 25.84 metres (which is longer than the bushland).

6. The ellipse breadth (Eb) is calculated by multiplying the actual fire run as it is shorter than the ellipse length by the length breadth ratio.

   Eb = 25.84/Lb

   Eb = 9.15 metres.

7. The flame width at the APZ interface for a fire burning directly from the remnant is forecast at 9.15m.

Inputs		
Fire Run Distance	25	metres
FDI	80	
Veg Slope	26	deg
Surface Fuel Load	10	tph
Overall Fuel Load	12	tph
Wind Speed	30	kph
Elevated Fuel Height	0.9	metres
Outputs		
ROS	5772.92	metres per hour
Length/Breadth Ratio	2.82	
Headfire/Backfire spread	29.85	metres per hour
Full Elipse Length	193.37	
Full Spread	5966.29	
Head Width	2113.10	
ROS	96.22	metres per minute
Duration to travel Fire Run	0.26	minutes
ROS	5.77	kph
Length/Breadth using ROS	2.82	kph
Headfire/Backfire spread ratio	29.85	
	99.44	metres per minute
Total Ellipse Length	25.84	metres
Head Width	9.15	metres

Site Street Address:	Fraser Drive, Terranora		
Assessor:	Peter Thornton; BCA Check Pty Ltd		
Local Government Area:	Byron	**Alpine Area:**	No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description:	Fire Growth Model -FDI 80		
Vegetation Information			
Vegetation Type:	Rainforest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	26 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10	**Overall Fuel Load(t/ha):**	12
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	20.5
Fire Inputs			
Veg./Flame Width(m):	9	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	6.47
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	35792
Radiant Heat(kW/m2):	9.82	**Flame Angle (degrees):**	46
Flame Length(m):	18	**Maximum View Factor:**	0.152
Rate Of Spread (km/h):	5.77	**Inner Protection Area(m):**	20
Transmissivity:	0.849	**Outer Protection Area(m):**	0

Figure 6: Design Fire No.1 Modelling for Short Fire Run FDI 80

CONCLUSION

The study found that Design Fire No. 1 with an FDI of 80 traversing for 25m with a distance to the building envelope of 20.5m will receive a radiant heat flux of 9.82kW/m^2 to the building envelope which will require construction to BAL 12.5 + Addendum to Appendix 3 PBP2006.

The following further sensitivity study has been undertaken to provide supporting evidence for the appropriateness of the above performance solution recommendation.

SENSITIVITY STUDY – Bushfire Initiation and Fire Growth Study

The acceptable solution of Planning for Bushfire Protection 2006 for a residential dwelling and the subsequent Addendum to Amendment 3 using AS 3959-2009 methodology is based on bushfire behaviour reaching a quasi-steady state and does not acknowledged the states prior to full equilibrium being –

- Fire initiation
- Fire growth in the acceleration phase to 100% equilibrium.

Numerous studies such as those by Cheney (1981) and McAlpine and Wakimoto (1991) have recognised the validity of the theoretical model established by Cheney and Barry (1969) in an endeavor to forecast the early stage growth from ignition to equilibrium rate of spread for a uniform fuel. The equation given by Cheney and Bary (1969) to forecast the fire growth of forest fires from a point source ignition to a quasi-steady state was as follows –

$$R = R_{ss}\, e^{-a/t}$$

Where

R = rate of spread at ''t'' (time)
R_{ss} = rate of equilibrium rate of spread.
t = the time elapsed since ignition.
a = acceleration constant.

The constant for acceleration is dependent of the expected time that a bushfire will take to reach a quasi-steady state. In this regard the expected growth of the fire needs to be understood based on either a slow, medium or fast growth fire. McAlpine and Wakimoto (1991) and Cheney and Gould (1995) identified that low intensity grassland reached 100% rate of spread (5 to 10 minutes) more quickly than high intensity fires where there where higher wind velocities and maximum rate of spread was reached in 12 to 45 minutes.

Grassland and woodland fires where the fine, cured fuels of grassland together with wind and slope were the primary catalyst for consideration of fast growth fires with a duration of 10m for an equilibrium rate of spread (Cheney and Gould 1995 and Chanler et al 1983).

Medium growth fires are relating to forest fires where fuels not as fine and available and wind below the canopy is decreased due to the dense canopy. A medium growth fire is generally forecast to take at least 25 -30 minutes to reach equilibrium rate of spread Slow growth fires can take 60 minutes or more to reach equilibrium rate of spread (Gould et al 2007 and Sullivan et al 2014).

A slow growth fire would generally occur where there is discontinuity of available fuel and where the canopy is very closed thereby reducing the impact of wind significantly at surface and elevated fuel levels.

FIRE GROWTH CATEGORY – FAST, MEDIUM OR SLOW

The determination of potential fire growth being fast, medium or slow is a primary consideration when determining the forecast acceleration rate of a bushfire. Consideration is given to the following factors in determining the likely fire growth category –

(a) Impact of wind i.e. fuel being fully exposed to wind or sheltered from the impact of wind etc.
(b) Fuel characteristics i.e. arrangement and moisture/curing rate of fuels etc.
(c) Fuel availability i.e. continuity of fuels (continuous, patchy, rocky etc) and availability (fuels continuous and on steep downslopes or on steep upslopes being less available).

Wind

Wind is fundamentally involved in the transfer of heat between fuels in the pre-ignition heating phase and flame transfer *(Nelson Jr et al 1988)*. The effect of wind increases the rate of spread of a fire by bending the flames toward the available fuel and thereby increasing the rate of combustion and promoting spotfires by blowing embers ahead of the fire front (*K Moon, TJ Duff and KG Tolhurst 2013*).

In low intensity fires e.g. where the fire run is not sufficient to support a high intensity fire then the fire will burn beneath the canopy and depending on the type of vegetation will be sheltered to a degree from wind.

The rainforest being the hazard that is subject to this assessment is typically very dense and due to this dense canopy and leaf density and size (i.e. not sclerophyll) it will cause significant decrease in wind velocity by absorbing a high proportion of the winds momentum. This will in turn decrease significantly any wind assists in relation to rate of spread thereby slowing the growth of the fire as supported by the following table (*Tolhurst 2010*) where the wind reduction factor by 5. Therefore, in relation to the consideration of wind, a forecast fire will be considered to be a slow growth fire.

Table 6 Tolhurst 2010 Wind reduction factor guide as contained within the Fire Behaviour calcs_Southern Australia spreadsheet.

Wind Reduction Factor	Vegetation Type
1	Herbfield
1.2	Grassland, sedgeland
1.5	Heathland, Mallee woodland
2	Tall shrubland (>1.5 m)
2.5	Eucalypt woodland (>6 m)
3	Open Eucalypt Forest (standard McArthur forest)
3.5	Shrubby open forest
4	Damp forest with shrubs, Karri
4.5	Wet eucalypt forest, Mature plantation
5	Rainforest

Fuel Characteristics

Finer fuels that are exposed to radiant heat and wind e.g. grassland will have a faster curing rate and less moisture thereby supporting high fire growth unlike rainforest fuels which are sheltered by a closed canopy to predominant wind and radiant heat resulting in a slower curing rate and higher moister content. Of all vegetation types, rainforest vegetation will have the slowest fire growth primarily due to these factors. Therefore, in relation to fuel characteristics the fire growth would be considered to be slow.

Fuel Availability

Although wind beneath the closed canopy will be significantly decreased and therefore reducing the assistance given to spread the flame to available fuel that will be located above the seat of the fire due to the steepness of the downslope, consideration has been given the fuel arrangement and the ability to spread fire.

A closed canopy rainforest bushfire having a closed canopy reducing the velocity and impact wind influence is considered to have the characteristics of a slow growth fire, almost the opposite to the fast growth grass and woodland fire. In turn, it is considered reasonable to assume for the purpose of this sensitivity study, the time to maximum rate of spread will be 60 minutes.

CALCULATIONS OF FORECAST FIRE GROWTH

On the basis that the slow growth fire will develop to 90% of its quasi-steady rate of spread (Van Wagner 1985) over the assumed 60 minutes then the acceleration constant of 6.32 will be applicable. In order to establish the time the fire will take to traverse the 25m fire run being the subject of the study the following integral equation is used –

$$S = R_{ss}\int_0^t e^{-a/t}dt$$

Where

S = Fire run

The time that the fire will take to traverse the 25m fire run based on the acceleration constant will be approximately 3min 59seconds. Using the outputs in the table within this study the maximum rate of spread for the study will be 5.77km/hr.

Therefore,

$$R = R_{ss}\, e^{-a/t}$$

$$R = R_{ss}\, e^{-a/t}$$

$$R = 5.77e^{-6.32/3.9}$$

Rate of spread at the APZ/hazard interface over 25m of rainforest vegetation at 26 degrees downslope will be 1.18km/hr.

Run Description:	Fire Growth study Design Fire 1		
Vegetation Information			
Vegetation Type:	Rainforest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	26 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10	**Overall Fuel Load(t/ha):**	12
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	20.5
Fire Inputs			
Veg./Flame Width(m):	9	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	2.76
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	7316
Radiant Heat(kW/m2):	2.44	**Flame Angle (degrees):**	75
Flame Length(m):	5.71	**Maximum View Factor:**	0.039
Rate Of Spread (km/h):	1.18	**Inner Protection Area(m):**	20
Transmissivity:	0.832	**Outer Protection Area(m):**	0

Figure 7: Fire growth modelling using the Short Fire Run Methodology Vesta Fuel Height input.

As established in Figure 7, modelling has included the reduced rate of spread of the fire growth calculation establishes a forecast radiant heat flux output of 2.44kW/m^2 with a 20.5m setback from the hazard.

In conclusion, the performance solution and sensitivity studies provide adequate supporting information to accompany an application for Bush Fire Safety Authority in relation to the landscape vegetation planting as provided in the following recommendations. All information is based on the legislation current at the time of reporting and studies known to be available at the time of reporting.

RECOMMENDATIONS

The following recommendations are made –

1. A landscape plan is to be prepared providing only rainforest species with near surface and elevated fuels not exceeding 0.9m in height to the southeast batter of Lot 610. The final landscaping plan as provided in this report has been assessed by Bushfire Certifiers as being

consistent with this study and is to be submitted to Tweed Shire Council for NSW RFS approval.

2. Rainforest overstorey and understorey is permitted to be a closed canopy. All plantings must be rainforest species.

3. The width of the rainforest (direct fire run to an approved dwelling site) is not to exceed 25m.

3.2 DESIGN FIRES NO. 2 AND NO. 3

Two design fires are provided given the length of the east boundary of approved Lot 701 to reflect two different fire run distances and slopes. The location of the design fires is shown in Figure 4 of this report. The bushfire behaviour given the short fire run is not likely to involve the canopy, due to the high moisture content of the vegetation and low intensity of the forecast fire together with the lack of prominent mid strata.

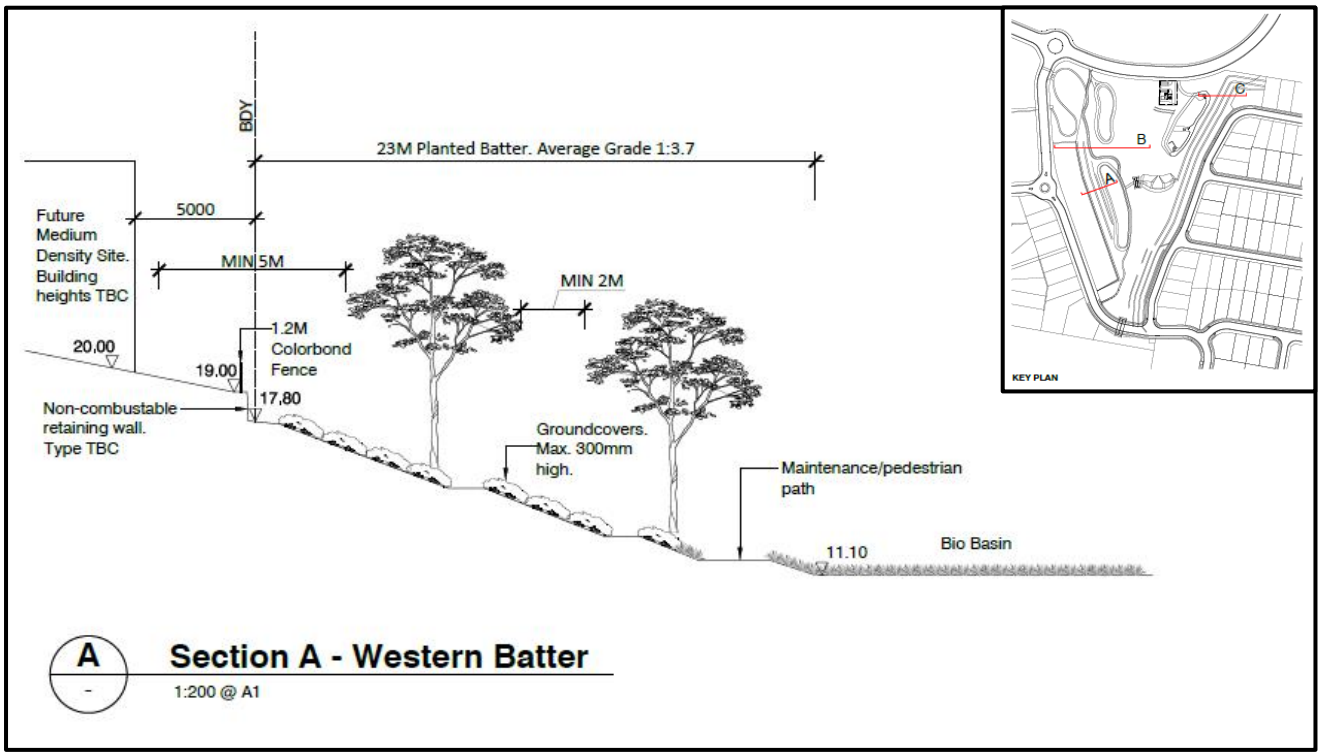


Figure 8: Section of Design Fire No. 2.

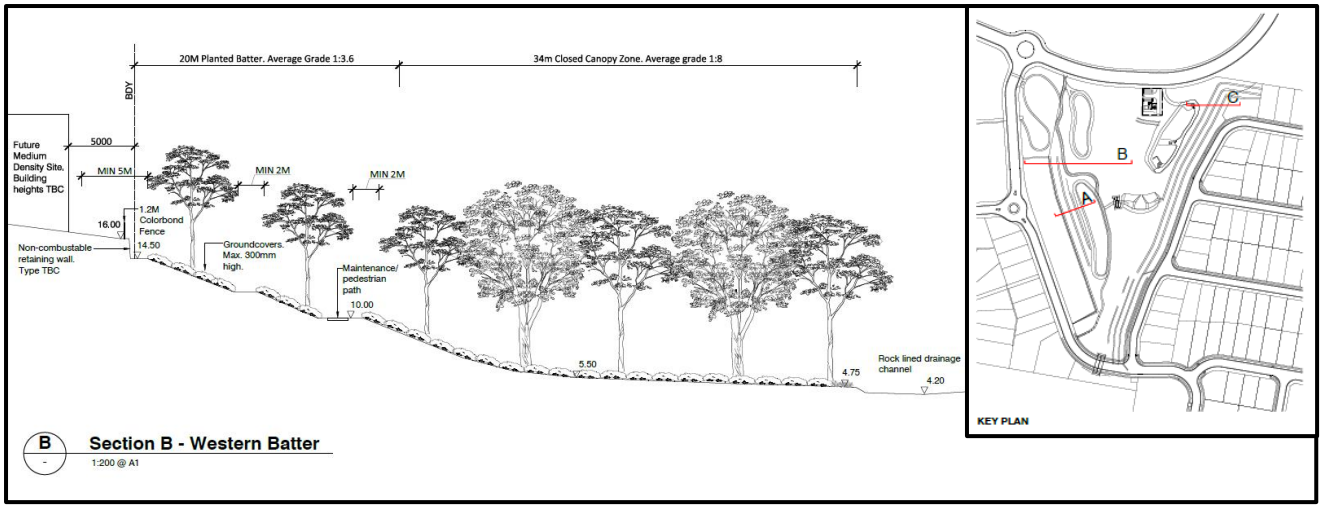


Figure 9: Section of Design Fire No. 3.

The methodology will be as outlined in Method 2 of AS 3959-2009. The variations to the AS 3959-2009 Method 2 inputs will be outlined in the sections following, however they relate to;

- Fire front width reduction due to short fire run modelling.
- NSW RFS Community Resilience Sheet – Methodology for assessing bush fire risk for low risk vegetation and Appendix A Community Resilience Sheet 1/14.

Redundancies include;

- The performance solution assumes 100% rate of spread at fire initiation stage within the primary hazard however it is acknowledged that ember ignition will require a growth period that is not likely to reach 100% intensity over a short fire run.
- Flame emissivity is conservative, with 95% emitting power (as detailed in AS3959 (2009).
- Rate of spread assumes that the fire is moving at equilibrium rate of spread from the instant it starts. This is not possible with Cheney and Barry's (1969) forest growth model of R=Rss e-a/t being more appropriate, where R = rate of spread at time t, Rss = equilibrium rate of spread, t = time since ignition.

Fire initiation from the east to west of part Lot 610 in the nominated study areas as shown in Figures 8 and 9 with each design fire having the inputs as identified in Table 2 and 3.

The fire behaviour with this fire run from a point ignition is not likely to evolve into a fire with 100% intensity as prescribed by AS 3959-2009.

The fire will be in the initiation and growth stages of development. As shown in the Bushfire CRC illustration below the rate of spread will not be sufficient to fully involve the canopy and therefore the intensity and flame length is potentially overestimated by AS 3959-2009.

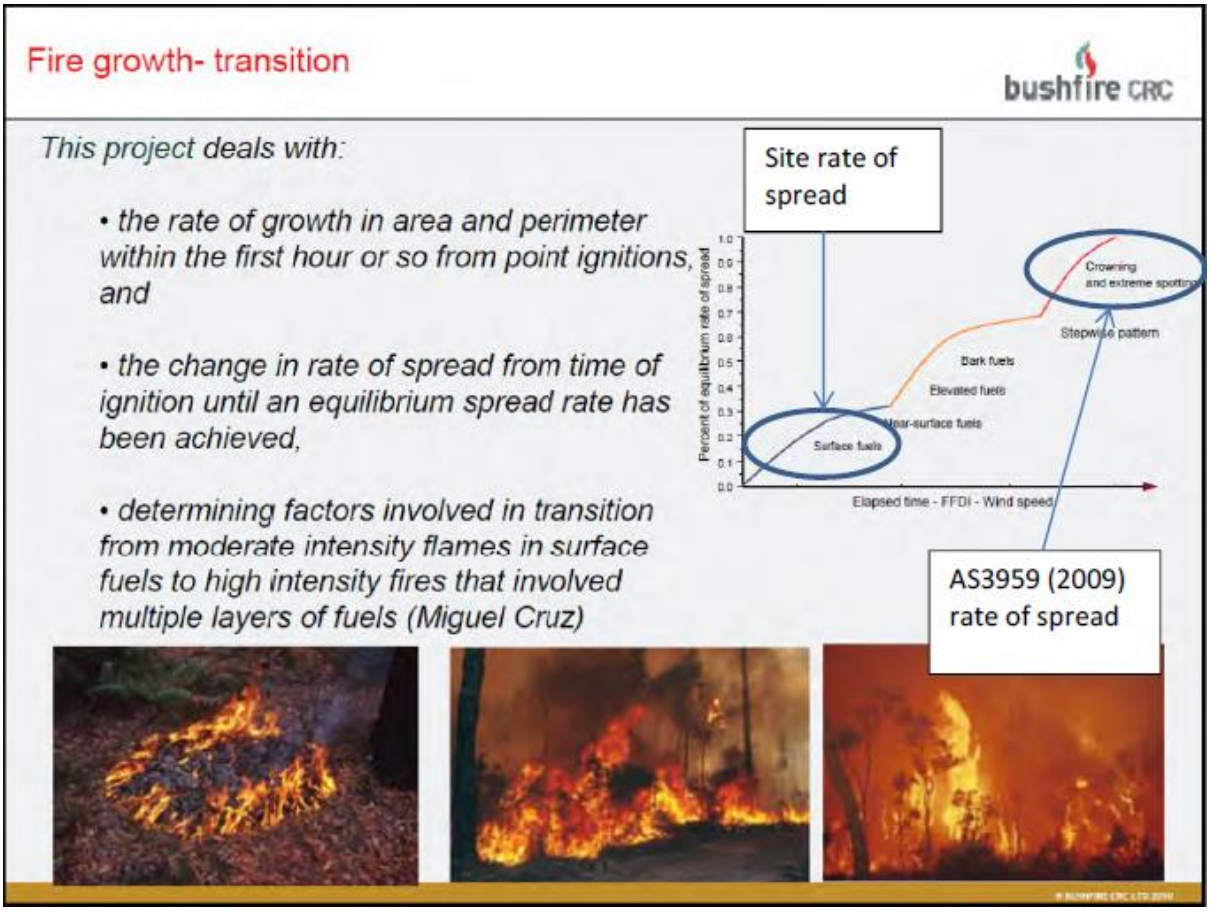


Figure 10: Bushfire CRC graph shows how short fire runs will not reach 100% intensity.

The fire scenario used to quantify the forecast fire front is from a single or multi-spot ignition source. The following model provides some variation to the intensity, rate of spread and flame length calculation adopted by AS 3959-2009.

The variations are used due to the fact that AS 3959-2009 has inputs for a fire in full equilibrium state of spread whereas the size and short fire run of the rainforest will promote fire behaviour in the initiation and growth stage in an accelerating phase rather than at 100% intensity at the vegetation/APZ interface.

The report will recommend a 300mm maximum elevated and near surface fuel height of 300mm. Based on this recommendation it is appropriate to use the elevated height of 0.3m (Vesta) which is consistent with Appendix B of NSW RFS Community Resilience Sheet – Methodology for assessing bush fire risk for low risk vegetation.

DESIGN FIRE No. 2

Table 2 – DESIGN FIRE INPUTS

DESIGN FIRE No. 2	PLANNING FOR BUSHFIRE PROTECTION 2006 INPUT
Rainforest Surface Fuel Load	8 tonnes per hectare (Appendix 2 PBP2006)
Fire Run Distance.	Approximately 20m
Setback from Vegetation	5m
Effective Slope (measured over the remnant)	17 degrees
Average Elevated Vegetation Height	0.3m
FDI	80
Flame Temperature	1090 kelvin

It is noted the slope is measured as the effective slope across the remnant given the short fire run and varying slope. The RLs provided have established the slope for the purpose of modelling to be 17 degrees downslope. The site slope has taken into account the 1.5m high retaining wall and the RL of the base of the wall to the likely RL of a future dwelling. The site slope is taken to be 17 degrees downslope based on the RLs.

The methodology of Method 2 AS 3959-2009 is used as part of the performance solution with the following variations relating to fire front width and flame height being consistent with NSW RFS Community Resilience Sheet – Methodology for assessing bush fire risk.

1. Radiant heat shall be measured as a cylinder or elliptical shape rather than a flat panel. Alexander (1985) proposes the length to breadth ratio of 1.0 + 0.0012 W2.154 where W equals a theoretical wind speed of 30 km/h. In turn the calculation establishes that the length to breadth (Lb) ratio = 2.82.

2. AS3959 (2009) Rate of spread (metres per minute) = (0.0012 * FDI * Surface fuel load* (0.069*SLOPE)*1000)/60.
   ROS = (0.0012 * 80 * 8 * (0.069*17) * 1000)/60.

3. Alexander (1985) proposes a head fire spread ratio of = ((Lb+√(Lb^2)-1) / Lb-(Lb^2) -1)).

   Head fire spread (Hfs) = 29.85 metres per hour.

4. Alexander (1985) proposes ellipse length by dividing the forward rate of spread (AS3959 (2009) calculation) with the Head Fire Spread.
   Ellipse length (El) = ROS/Hfs+ROS

5. Total ellipse length (Tel) is calculated by multiplying Ellipse length by the time taken to travel the short fire run distance.
   Tel = El * (distance/ROS)

   Tel = 20.67 metres (which is longer than the bushland)

6. The ellipse breadth (Eb) is calculated by multiplying the actual fire run as it is shorter than the ellipse length by the length breadth ratio.

   Eb = 20.67/Lb

   Eb = 7.32 metres.

7. The flame width at the APZ interface for a fire burning directly from the remnant is forecast at 7.32m.

Inputs

Fire Run Distance	20	metres
FDI	80	
Veg Slope	17	deg
Surface Fuel Load	8	tph
Overall Fuel Load	8	tph
Wind Speed	30	kph
Elevated Fuel Height	0.3	metres
Outputs		
ROS	2481.92	metres per hour
Length/Breadth Ratio	2.82	
Headfire/Backfire spread	29.85	metres per hour
Full Elipse Length	83.13	
Full Spread	2565.06	
Head Width	908.47	
ROS	41.37	metres per minute
Duration to travel Fire Run	0.48	minutes
ROS	2.48	kph
Length/Breadth using ROS	2.82	kph
Headfire/Backfire spread ratio	29.85	
	42.75	metres per minute
Total Ellipse Length	20.67	metres
Head Width	7.32	metres

Site Street Address:	Fraser Drive (Altitude Aspire Estate), Terranora		
Assessor:	Peter Thornton; BCA Check Pty Ltd		
Local Government Area:	Tweed	**Alpine Area:**	No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description:	Design Fire 2		
Vegetation Information			
Vegetation Type:	Rainforest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	17 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	8	**Overall Fuel Load(t/ha):**	8
Site Information			
Site Slope	17 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	default	**APZ/Separation(m):**	5
Fire Inputs			
Veg./Flame Width(m):	7.32	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80
Program Outputs			
		Peak Elevation of Receiver(m):	1.16
		Fire Intensity(kW/m):	10259
Radiant Heat(kW/m2):	32.86	**Flame Angle (degrees):**	54
Flame Length(m):	6.66	**Maximum View Factor:**	0.485
Rate Of Spread (km/h):	2.48	**Inner Protection Area(m):**	5
Transmissivity:	0.892	**Outer Protection Area(m):**	0

Figure 11: Design Fire No.2 Modelling for Short Fire Run FDI 80.

The acceptance criteria is not to exceed 29kW/m^2. The base modelling establishes a radiant heat flux of 32.86kW/m^2. In this regard a 1.2m high metal radiant heat shield (fence) along the rear boundary is modelled to ascertain the reduction in radiant heat.

Run Description:	Design Fire 2		
Vegetation Information			
Vegetation Type:	Rainforest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	17 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	0.561	Overall Fuel Load(t/ha):	0.561
Site Information			
Site Slope	17 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	default	APZ/Separation(m):	5
Fire Inputs			
Veg./Flame Width(m):	7.32	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	80
Program Outputs			
Category of Attack:	LOW	Peak Elevation of Receiver(m):	0
Level of Construction:	BAL 12.5	Fire Intensity(kW/m):	50
Radiant Heat(kW/m2):	5.35	Flame Angle (degrees):	97
Flame Length(m):	1.2	Maximum View Factor:	0.08
Rate Of Spread (km/h):	0.17	Inner Protection Area(m):	5
Transmissivity:	0.883	Outer Protection Area(m):	0

Figure 12: Modelling view factor - 1.2m non-combustible high radiant heat shield to rear boundary.

Run Description:	Design Fire 2		
Vegetation Information			
Vegetation Type:	Rainforest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	17 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	8	Overall Fuel Load(t/ha):	8
Site Information			
Site Slope	17 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	default	APZ/Separation(m):	5
Fire Inputs			
Veg./Flame Width(m):	7.32	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	80
Program Outputs			
		Peak Elevation of Receiver(m):	1.16
		Fire Intensity(kW/m):	10259
Radiant Heat(kW/m2):	27.45	Flame Angle (degrees):	54
Flame Length(m):	6.66	Maximum View Factor:	0.405
Rate Of Spread (km/h):	2.48	Inner Protection Area(m):	5
Transmissivity:	0.892	Outer Protection Area(m):	0

Figure 13: Final modelling of Design Fire 2 with a 1.2m high radiant heat shield. Flame length will reduce to 3.96m with the 1.2m high heat shield and 1.5m high retaining wall.

CONCLUSION

The study found that Design Fire No. 2 with an FDI of 80 traversing for 20m with a distance to the building envelope of 5m will receive a radiant heat flux of 27.45kW/m^2 to the building envelope which will require construction to BAL 29 + Addendum to Appendix 3 PBP2006 and a 1.2m high non-combustible radiant heat shield along the rear boundary. This design fire however is very conservative given it assumes 100% intensity from ignition and no growth phase.

In this regard it is considered reasonable to look at the sensitivity study for the purpose of providing a more realistic forecast for the fire behaviour when initiation and growth is taken into account.

The following further sensitivity study has been undertaken to provide supporting evidence in this regard.

SENSITIVITY STUDY – Bushfire Initiation and Fire Growth Study

The acceptable solution of Planning for Bushfire Protection 2006 for a residential dwelling and the subsequent Addendum to Amendment 3 using AS 3959-2009 methodology is based on bushfire behaviour reaching a quasi-steady state and does not acknowledged the states prior to full equilibrium being –

- Fire initiation
- Fire growth in the acceleration phase to 100% equilibrium.

Numerous studies such as those by Cheney (1981) and McAlpine and Wakimoto (1991) have recognised the validity of the theoretical model established by Cheney and Barry (1969) in an endeavor to forecast the early stage growth from ignition to equilibrium rate of spread for a uniform fuel. The equation given by Cheney and Bary (1969) to forecast the fire growth of forest fires from a point source ignition to a quasi-steady state was as follows –

$$R = R_{ss}\, e^{-a/t}$$

Where

R = rate of spread at ''t'' (time)
R_{ss} = rate of equilibrium rate of spread.
t = the time elapsed since ignition.
a = acceleration constant.

The constant for acceleration is dependent of the expected time that a bushfire will take to reach a quasi-steady state. In this regard the expected growth of the fire needs to be understood based on either a slow, medium or fast growth fire. McAlpine and Wakimoto (1991) and Cheney and Gould (1995) identified that low intensity grassland reached 100% rate of spread (5 to 10 minutes) more

quickly than high intensity fires where there where higher wind velocities and maximum rate of spread was reached in 12 to 45 minutes.

Grassland and woodland fires where the fine, cured fuels of grassland together with wind and slope were the primary catalyst for consideration of fast growth fires with a duration of 10m for an equilibrium rate of spread (Cheney and Gould 1995 and Chanler et al 1983).

Medium growth fires are relating to forest fires where fuels not as fine and available and wind below the canopy is decreased due to the dense canopy. A medium growth fire is generally forecast to take at least 25 - 30 minutes to reach equilibrium rate of spread Slow growth fires can take 60 minutes or more to reach equilibrium rate of spread (Gould et al 2007 and Sullivan et al 2014).

A slow growth fire would generally occur where there is discontinuity of available fuel and where the canopy is very closed thereby reducing the impact of wind significantly at surface and elevated fuel levels.

FIRE GROWTH CATEGORY – FAST, MEDIUM OR SLOW

The determination of potential fire growth being fast, medium or slow is a primary consideration when determining the forecast acceleration rate of a bushfire. Consideration is given to the following factors in determining the likely fire growth category –

(d) Impact of wind i.e. fuel being fully exposed to wind or sheltered from the impact of wind etc.
(e) Fuel characteristics i.e. arrangement and moisture/curing rate of fuels etc.
(f) Fuel availability i.e. continuity of fuels (continuous, patchy, rocky etc) and availability (fuels continuous and on steep downslopes or on steep upslopes being less available).

Wind

Wind is fundamentally involved in the transfer of heat between fuels in the pre-ignition heating phase and flame transfer *(Nelson Jr et al 1988)*. The effect of wind increases the rate of spread of a fire by bending the flames toward the available fuel and thereby increasing the rate of combustion and promoting spotfires by blowing embers ahead of the fire front (*K Moon, TJ Duff and KG Tolhurst 2013*).

In low intensity fires e.g. where the fire run is not sufficient to support a high intensity fire then the fire will burn beneath the canopy and depending on the type of vegetation will be sheltered to a degree from wind.

The rainforest being the hazard that is subject to this assessment is typically very dense and due to this dense canopy and leaf density and size (i.e. not sclerophyll) it will cause significant decrease in wind velocity by absorbing a high proportion of the winds momentum. This will in turn decrease significantly any wind assists in relation to rate of spread thereby slowing the growth of the fire as supported by the following table (*Tolhurst 2010*) where the wind reduction factor by 5. Therefore, in relation to the consideration of wind, a forecast fire will be considered to be a slow growth fire.

Table 6 Tolhurst 2010 Wind reduction factor guide as contained within the Fire Behaviour calcs_Southern Australia spreadsheet.

Wind Reduction Factor	Vegetation Type
1	Herbfield
1.2	Grassland, sedgeland
1.5	Heathland, Mallee woodland
2	Tall shrubland (>1.5 m)
2.5	Eucalypt woodland (>6 m)
3	Open Eucalypt Forest (standard McArthur forest)
3.5	Shrubby open forest
4	Damp forest with shrubs, Karri
4.5	Wet eucalypt forest, Mature plantation
5	Rainforest

Fuel Characteristics

Finer fuels that are exposed to radiant heat and wind e.g. grassland will have a faster curing rate and less moisture thereby supporting high fire growth unlike rainforest fuels which are sheltered by a closed canopy to predominant wind and radiant heat resulting in a slower curing rate and higher moister content. Of all vegetation types, rainforest vegetation will have the slowest fire growth primarily due to these factors. Therefore, in relation to fuel characteristics the fire growth would be considered to be slow.

Fuel Availability

Although wind beneath the closed canopy will be significantly decreased and therefore reducing the assistance given to spread the flame to available fuel that will be located above the seat of the fire due to the steepness of the downslope, consideration has been given the fuel arrangement and the ability to spread fire.

A closed canopy rainforest bushfire having a closed canopy reducing the velocity and impact wind influence is considered to have the characteristics of a slow growth fire, almost the opposite to the fast growth grass and woodland fire. In turn, it is considered reasonable to assume for the purpose of this sensitivity study, the time to maximum rate of spread will be 60 minutes.

CALCULATIONS OF FORECAST FIRE GROWTH

On the basis that the slow growth fire will develop to 90% of its quasi-steady rate of spread (Van Wagner 1985) over the assumed 60 minutes then the acceleration constant of 6.32 will be applicable. In order to establish the time the fire will take to traverse the 20m fire run being the subject of the study the following integral equation is used –

$$S = R_{ss}\int_0^t e^{-a/t}dt$$

Where

S = Fire run

The time that the fire will take to traverse the 20m fire run based on the acceleration constant will be approximately 4min 55seconds. Using the outputs in the table within this study the maximum rate of spread for the study will be 2.48km/hr.

Therefore,

$$R = R_{ss}\, e^{-a/t}$$

$$R = R_{ss}\, e^{-a/t}$$

$$R = 2.48e^{-6.32/4.92}$$

Rate of spread at the APZ/hazard interface over 20m of rainforest vegetation at 17 degrees downslope will be 0.6km/hr.

Run Description:	Fire Growth Study		
Vegetation Information			
Vegetation Type:	Rainforest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	17 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	8	**Overall Fuel Load(t/ha):**	8
Site Information			
Site Slope	17 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	5
Fire Inputs			
Veg./Flame Width(m):	7.32	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	0
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	2480
Radiant Heat(kW/m2):	10.89	**Flame Angle (degrees):**	86
Flame Length(m):	2.39	**Maximum View Factor:**	0.162
Rate Of Spread (km/h):	0.6	**Inner Protection Area(m):**	5
Transmissivity:	0.884	**Outer Protection Area(m):**	0

Figure 14: Fire growth modelling using the Short Fire Run Methodology Vesta Fuel Height input.

As established in Figure 14, modelling has included the reduced rate of spread of the fire growth calculation establishes a forecast radiant heat flux output of 10.89kW/m^2 with a 5m setback from the hazard and without the inclusion of a radiant heat shield.

In conclusion, the performance solution and sensitivity studies provide adequate supporting information to accompany an application for Bush Fire Safety Authority in relation to the landscape vegetation planting as provided in the following recommendations.

All information is based on the legislation current at the time of reporting and studies known to be available at the time of reporting.

DESIGN FIRE No. 3

The same methodology for Design Fire No. 3 is used as for Design Fire No. 2 with exception to the inputs of Table 3 being used for the design fire. In this regard the outline of the methodology will not be repeated in the report and can be assumed to be as previously outlined. The section of Design Fire No. 3 is provided in Figure 8.

Table 3 – DESIGN FIRE INPUTS

DESIGN FIRE No. 3	PLANNING FOR BUSHFIRE PROTECTION 2006 INPUT
Rainforest Surface Fuel Load	8 tonnes per hectare (Appendix 2 PBP2006)
Fire Run Distance.	Approximately 50m
Setback from Vegetation	5m
Effective Slope (measured over the remnant)	10 degrees
Average Elevated Vegetation Height	0.3m
FDI	80
Flame Temperature	1090 kelvin

The following table provides calculations to determine the fire front width will be 18.3m over the 50m fire run.

Inputs		
Fire Run Distance	50	metres
FDI	80	
Veg Slope	10	deg
Surface Fuel Load	8	tph
Overall Fuel Load	8	tph
Wind Speed	30	kph
Elevated Fuel Height	0.3	metres
Outputs		
ROS	1531.17	metres per hour
Length/Breadth Ratio	2.82	
Headfire/Backfire spread	29.85	metres per hour
Full Elipse Length	51.29	
Full Spread	1582.46	
Head Width	560.47	
ROS	25.52	metres per minute

Duration to travel Fire Run	1.96	minutes
ROS	1.53	kph
Length/Breadth using ROS	2.82	kph
Headfire/Backfire spread ratio	29.85	
	26.37	metres per minute
Total Ellipse Length	51.67	metres
Head Width	18.30	metres

Site Street Address: Fraser Drive (Altitude Aspire Estate), Terranora

Assessor: Peter Thornton; BCA Check Pty Ltd

Local Government Area: Tweed **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: Design Fire 3

Vegetation Information

Vegetation Type:	Rainforest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	10 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	8	**Overall Fuel Load(t/ha):**	8

Site Information

Site Slope	10 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	default	**APZ/Separation(m):**	5

Fire Inputs

Veg./Flame Width(m):	18.3	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80

Program Outputs

Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	1.32
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	6329
Radiant Heat(kW/m2):	28.7	**Flame Angle (degrees):**	70
Flame Length(m):	4.7	**Maximum View Factor:**	0.426
Rate Of Spread (km/h):	1.53	**Inner Protection Area(m):**	5
Transmissivity:	0.887	**Outer Protection Area(m):**	0

Figure 15: Modelling of design fire No. 3

As shown in the modelling in Figure 15 the design fire based which does not calculate fire growth and is considered to be very conservative, forecasts a radiant heat flux of 28.7kW/m^2 without modelling a fence. A sensitivity study of the fire growth being a more accurate assessment has not been undertaken for this design fire however can be completed on request. It is considered that this type of assessment may be prudent when an application for dwellings/units is being prepared and undertaken with a bushfire design brief.

3.3 DESIGN FIRE NO. 4

The same methodology for Design Fire No. 4 is used as for Design Fire No. 3 with exception to the inputs of Table 4 being used for the design fire. In this regard the outline of the methodology will not be repeated in the report and can be assumed to be as previously outlined.

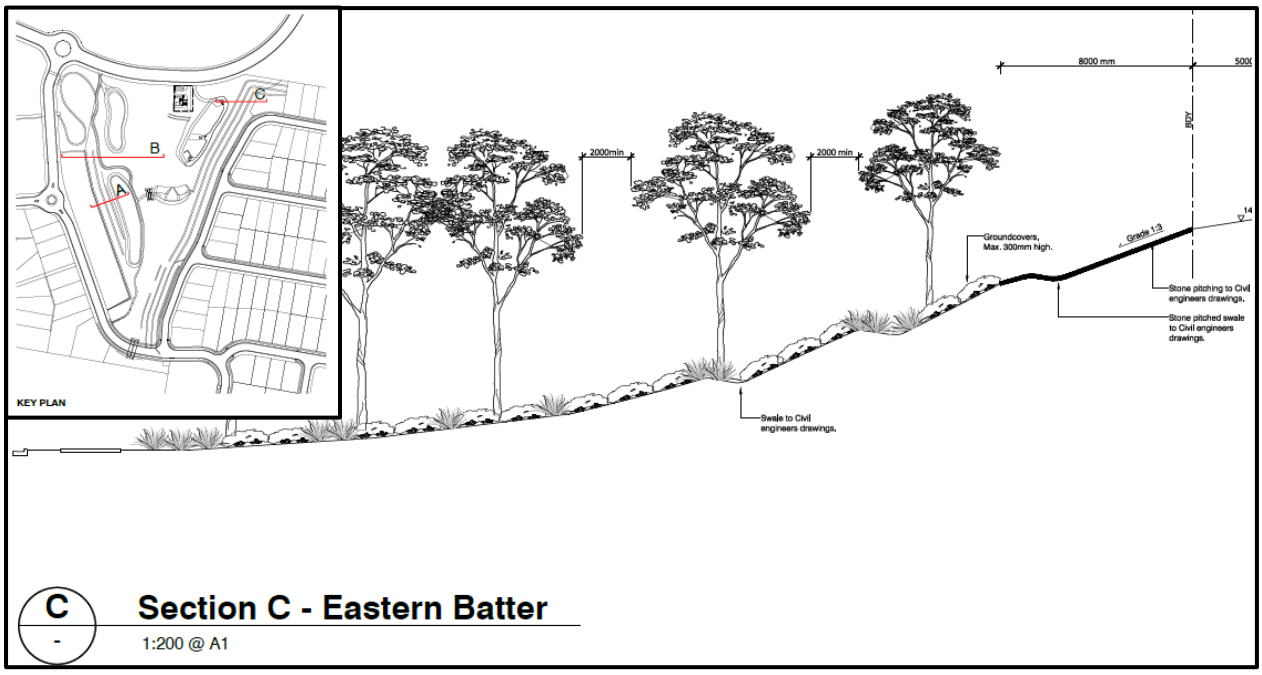


Figure 16: Section through Design Fire No. 4.

The fire run of rainforest near surface plants is shown at approximately 30m with the Relative Levels (RLs) being used to determine the slope over the remnant rainforest plantings. The slope has been calculated for the purpose of modelling as being 15 degrees downslope.

The Design Fire will not calculate a required setback off the western side boundary for a future dwelling on approved Lot 316 nor a calculation relating to any potential future boundary fence along this boundary. The design fire uses the NSW RFS short fire run methodology as a very conservative model given the methodology assumes the fire is at 100% intensity at the time of ignition and does not recognise a fire growth phase.

Design Fire 4 does include the 8m wide grouted stone batter located with the reserve Lot 610 and adjacent to the western boundary of Lot 316. The modelling is undertaken to demonstrate the west boundary of Lot 316 will not to receive more than 29kW/m^2 from a bushfire initiated within the landscape area of reserve Lot 610.

Table 4 – DESIGN FIRE INPUTS

DESIGN FIRE No. 4	PLANNING FOR BUSHFIRE PROTECTION 2006 INPUT
Rainforest Surface Fuel Load	8 tonnes per hectare (Appendix 2 PBP2006)
Fire Run Distance.	Approximately 22m
Setback from Vegetation	8m
Effective Slope (measured over the remnant)	15 degrees
Average Elevated Vegetation Height	0.3m
FDI	80
Flame Temperature	1090 kelvin

The following table provides calculations to determine the fire front width will be 8.05m over the 22m fire run.

Inputs		
Fire Run Distance	22	metres
FDI	80	
Veg Slope	15	deg
Surface Fuel Load	8	tph
Overall Fuel Load	8	tph
Wind Speed	30	kph
Elevated Fuel Height	0.3	metres
Outputs		
ROS	2162.00	metres per hour
Length/Breadth Ratio	2.82	
Headfire/Backfire spread	29.85	metres per hour
Full Elipse Length	72.42	This should be less than the fire run distance
Full Spread	2234.42	
Head Width	791.37	
ROS	36.03	metres per minute
Duration to travel Fire Run	0.61	minutes
ROS	2.16	kph
Length/Breadth using ROS	2.82	kph
Headfire/Backfire spread ratio	29.85	
	37.24	metres per minute
Total Ellipse Length	22.74	metres
Head Width	8.05	metres

Run Description:	Design Fire 4		
Vegetation Information			
Vegetation Type:	Rainforest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	15 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10	**Overall Fuel Load(t/ha):**	12
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	8
Fire Inputs			
Veg./Flame Width(m):	8	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	80
Program Outputs			
Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	2.71
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	16756
Radiant Heat(kW/m2):	19.32	**Flame Angle (degrees):**	50
Flame Length(m):	7.08	**Maximum View Factor:**	0.289
Rate Of Spread (km/h):	2.7	**Inner Protection Area(m):**	8
Transmissivity:	0.88	**Outer Protection Area(m):**	0

Figure 17: Modelling of landscaping to the west of Lot 316.

The modelling forecasts a radiant heat flux of 19.32kW/m^2 with the 8m width of the grouted stone batter within Lot 610 and adjacent to the west boundary of Lot 316. It is noted this modelling has a conservative methodology and a methodology for fire growth is considered to be more reflective of fire behaviour in this circumstance. This type of modelling can be provided upon requested for with a development application for a dwelling on Lot 316 to further reduce a Bushfire Attack Level (BAL) rating.

DISCLAIMER

This report was prepared for the purposes and exclusive use of the stated client to for NSW RFS consultation and referral to NSW RFS as part of a modification to a development application for the subdivision relating to the proposed development on the subject property and is not to be used for any other purpose or by any other person or Corporation. This report or the content within it is not to be used for the submission of a development application for proposed buildings. BCA Check Pty Ltd accepts no responsibility for any loss or damage suffered howsoever arising to any person or Corporation who may use or rely on this report in contravention of the terms of this clause.

As identified in Planning for Bushfire Protection 2006 and the Building Code of Australia the report is to provide recommendations to reduce the risk of ignition and does not guarantee the complete protection of the building in the event of bush fire or that the building will not be adversely impacted upon.

Reporting has been based on the relevant Council and Rural Fire Service Guidelines however recommendations or suggestions given in this report are based on our site investigation at the time of reporting. In some cases site conditions may change dramatically within a few years due to rapid vegetation re-growth and invading weed species.

REFERENCES

NSW Rural Fire Service and Planning NSW (2006), *Planning for bushfire protection, A guide for councils planners fire authorities developers and homeowners.* Rural Fire Service NSW Australia.
Standards Australia, (2009), AS3959 *Construction of buildings in bushfire prone areas,* Australian Standards, Sydney.

LEGISLATION

Environmental Planning and Assessment Act 1979 and Regulations 2000. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.
Rural Fires Act 1997. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service.
Rural Fires Regulation. *New South Wales.* Parliamentary Counsel's Office, NSW Government Information Service

ATTACHMENTS

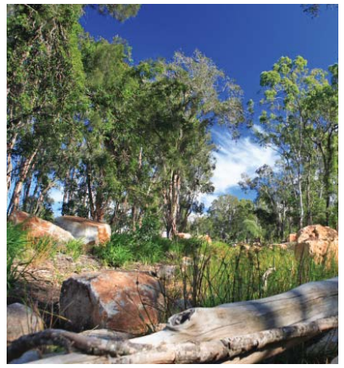
- **NSW Rural Fire Service letter correspondence, dated 10.01.2019**
- **Altitude Aspire Landscape Masterplan Stages 1-11**
- **Lot 316 Plan**
- **Lot 701 Plan**

ANNEXURE D

ALTITUDE ASPIRE TERRANORA
LANDSCAPE MASTERPLAN STAGES 1-11

NEWLAND DEVELOPERS PTY LTD





100906 | 01 MAY 19 | DA18
A 900 ANN ST, TRINITY LANE VIA CHURCH ST, FORTITUDE VALLEY Q 4006 T 07 3216 0606 F 07 3216 0608 W FORMLA.COM.AU
FORM LANDSCAPE ARCHITECTS

INTRODUCTION.

Form Landscape Architects have been engaged by Newland Developers Pty Ltd to prepare a Landscape Masterplan and Landscape Design Intent report for the Altitude Aspire residential subdivision located at Terranora in the Tweed Shire.

The original Landscape Master Plan dated 1 December 2010 has been amended to address the amended Subdivision Layout, the provisions of Tweed Development Control Plan 2008, Section B24 Area E Urban Release Development Code and issues raised by Tweed Shire Council, State Agencies and members of the public in their submissions lodged during the public exhibition stage.

- The landscape design philosophy for the project is encompassed in the following key statements:
- To generate an integrated built and landscape environment that embraces the surrounding endemic landscape character;
- To develop a landscape character that reinforces a unique and memorable landscape experience and identity;
- To provide a choice of passive and active recreational opportunities throughout the developments open spaces and parks;
- To compliment the built environment structure and its details;
- To integrate the water management landforms throughout the site into the landscape design to provide a seamless natural landscape aesthetic;
- To create an aesthetically pleasing, engaging, and safe environment for the resident population.

In order to explain how this design philosophy has been achieved the development can be described under the following key areas. The Entry Precinct, neighbourhood playground park, revegetated drainage corridor, and the residential streetscapes.

THE ENTRY PRECINCT.

The entry precinct is located centrally to the northern boundary of the site framed by an arbour of feature shade trees, a community recreation area to the east and wetlands to the north. The approach to the development entry along Broadwater Parkway from the east provides a strong visual connection into the revegetated drainage corridor with treatments to the road edge to give the perception of crossing a bridge over the reinstated dry creekline. From the west a tree lined boulevard will be provided flanked along the development boundary with a dense vegetation buffer on a steep bank. The experience on this approach will be predominantly natural with views promoted over the adjoining wetland and adjoining landscape.

At the roundabout to the site a series of stone gabion and precast concrete blade walls will frame the entry road into the site. The textures will be combined to create a balance between contemporary and natural elements. Elevated development signage will introduce the development branding and identity and a Hoop Pine boulevard will define the entrance reinforced by transitional pavement treatments.

NEIGHBOURHOOD PLAYGROUND PARK.

The proposed neighbourhood park is located on the eastern side of the development entry. The park grades away from the road and will be manipulated and contoured to provide a series of terraced pockets interconnected by a meandering accessible pathway. The design intent is that all grassed areas will not exceed 1:6 grade for ease of maintenance and where grades do exceed 1:6 garden beds will be installed with low maintenance native planting palettes. Views can be experienced from sections of the park and the elevated position has been embraced capturing the favourable climatic influences. The children's playground will endeavour to integrate elements of natural play in the form of climbing rocks, tree stumps, and mounding with structured formalised play elements and interactive sculpture. Picnic shelters will be located at the most elevated section of the park overlooking the playground and park to the distant north-eastern valley. A public toilet facility will also be provided.v

DRAINAGE CORRIDOR.

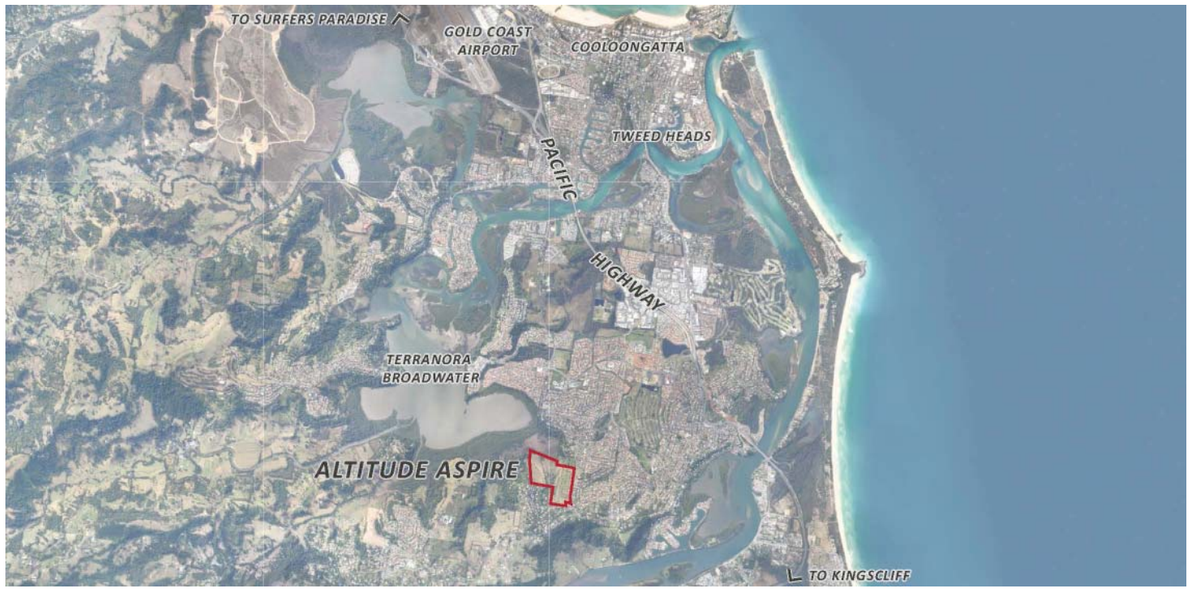
A major feature of the estate is the central drainage reserve that will be used for the conveyance and treatment of storm water from the southern boundary of the site to Broadwater Parkway to the north. The elements that provide these functions will be constructed in a way to take on a relatively natural form and revegetated to become a mix of shaded rainforest gully and open sedge grasslands, both of which will provide important habitat for local fauna.

Various viewing and passive recreational experiences are available throughout the reserve with pedestrian access weaving its way through regenerated closed rainforest and open sedge grasslands. The central low flow channel will be lined with site boulders and fringed by endemic species to provide a distinctive natural setting. A raised boardwalk will connect pedestrians across the central weir to a sheltered picnic and wildlife viewing area providing a focal point for the reserve. This raised boardwalk continues to the east providing ramp access to Ossa Road. Ramp access is also provided with a concrete path to the south of the drainage reserve connecting pedestrians to Market Parade.

All required maintenance paths and safety fencing will be integrated into the design in a way that it is complementary to the natural landscape character.

RESIDENTIAL STREETSCAPE.

Legibility of the street network throughout the site will be enhanced through a clear selection of street trees that will compliment the hierarchy of the streets. Trees will be selected from a palette of local endemic and native species and are intended to provide a long term series of shaded boulevards within the development. Trees will be located according to council guidelines and spaced according to the appropriate species selection. Transitional road treatments will be utilised at key intersections to enhance legibility and will consist of coloured exposed aggregate.





1 ENTRY PRECINCT
2 COMMUNITY PARK NODE
3 POCKET PARK
4 FLOODPLAIN GRASSLANDS
5 DRAINAGE CORRIDOR
6 FRASER DRIVE ENTRY
7 Q100

NOTE: STREET TREE LOCATIONS ARE FOR INDICATIVE PURPOSES ONLY.



Note : Tree locations are indicative only, review to occur at Construction Certificate Phase.

LANDSCAPE MASTERPLAN

100906 | 01 MAY 19 | DA18 | NORTH | SCALE 1:3000 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**

FIGURE 1 – LANDSCAPE MASTERPLAN

- BIO-RETENTION
- COMMUNITY PARK NODE
- POCKET PARKS
- LOW FLOW DRAINAGE CHANNEL
- MANAGED LANDSCAPE ZONE
- LANDSCAPE BUFFER
- ENTRY PRECINCTS
- Q100



LANDSCAPE STRUCTURE

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FIGURE 2 – LANDSCAPE STRUCTURE

- PARK PATHWAYS
- MAINTENANCE ACCESS PATHWAYS
- BUSH TRACK
- CONCRETE PATHWAYS
- BLUESTONE GABION RETAINING WALLS
- TRANSITIONAL ROAD TREATMENT
- MAJOR ROADS
- PRIMARY BOULEVARD
- SECONDARY SPINE ROAD
- TERTIARY STREETS



CIRCULATION NETWORK

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FIGURE 3 – CIRCULATION NETWORK

COMPLYING AREA

TOTAL PARK AREA



COMPLIANCE AREAS

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FIGURE 4 – CASUAL OPEN SPACE COMPLIANCE AREAS

1200 HIGH COLORBOND FIRE BUFFER FENCE

TIMBER SCREEN FEATURE FENCE

TIMBER PALING FENCE

SAFETY BALUSTRADE



FENCE TYPES & BALUSTRADES

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PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**



COLORBOND FENCE

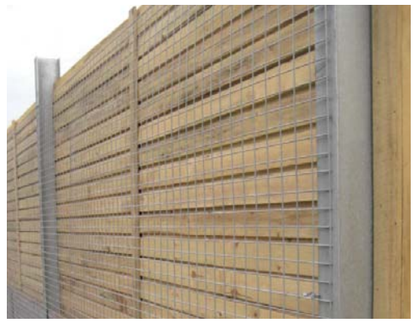
ITEM: COLORBOND STEEL FENCING

SUPPLIER: LOCAL APPROVED

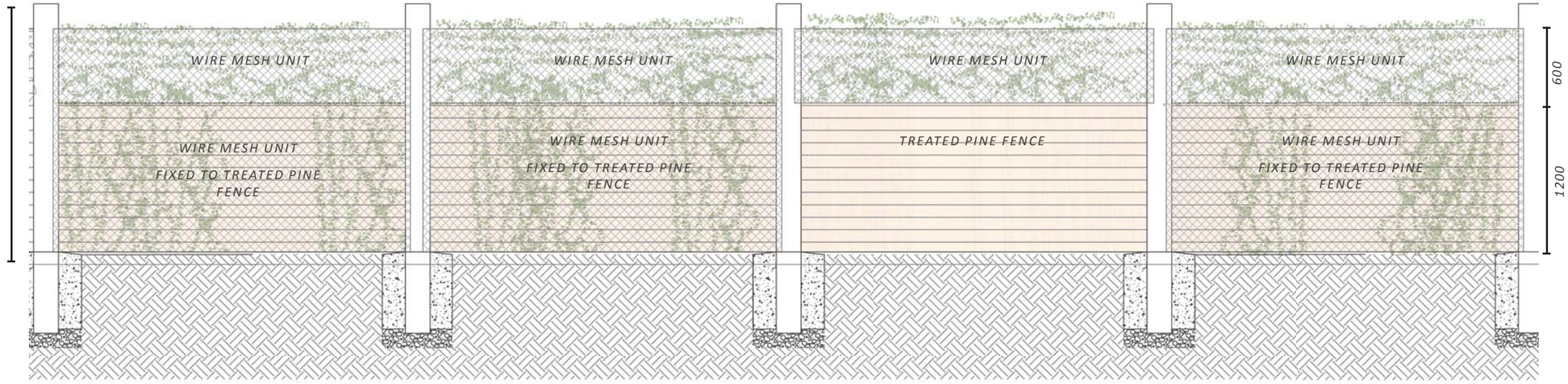
SIZE: 1200MM HIGH

TYPE/FINISH: WOODLAND GREY

DETAIL REF: REFER MANUFACTURER'S DETAIL (WWW.COLORBOND.COM)

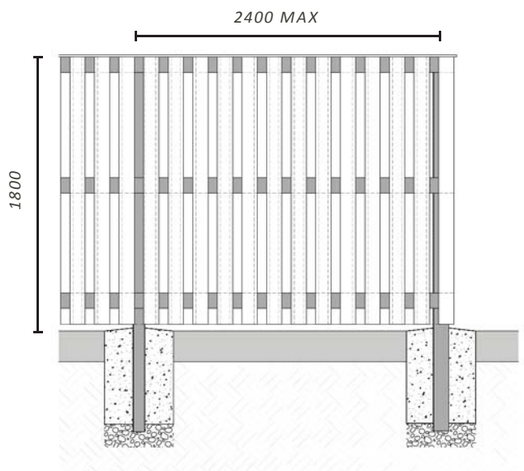


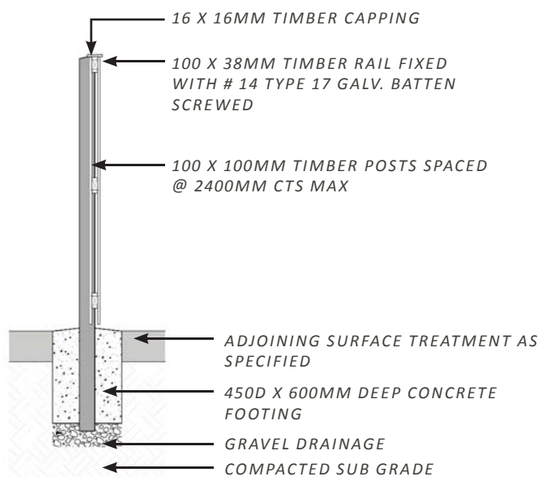
TIMBER SCREEN FENCE





TIMBER PALING FENCE





FENCE TYPES

















1 PICNIC SHELTERS AND BBQ AREA OVERLOOKING PARK
2 BOLLARDS TO PARK PERIMETER
3 VIEWS INTO PARK AND PLAYGROUND FROM ELEVATED FOOTPATH FOR IMPROVED CPTED
4 TOILET FACILITIES
5 1500 WIDE CONCRETE FOOTPATH
6 MAIN PARK ENTRY NODE
7 TERRACE SEATING OVERLOOKING KICK AND THROW PARK
8 INFORMAL ENTRY
9 VIEWS INTO OPEN PARK FROM STREET
10 TERRACE SEATING WALL OVERLOOKING COURT AND SKATE SPACE
11 LARGE CORNER SHADE TREES AS FEATURE OF ENTRY
12 SCULPTURAL SKATE / PARKOUR WALLS AND RAILS
13 TEEN PLAYGROUND
14 PATHWAY CONNECTION TO STORM WATER DRAINAGE RESERVE
15 RETAINING WALL TO ACHIEVE LEVEL AND USABLE PARK POCKETS
16 TODDLER / JUNIOR PLAYGROUND
17 400MM HIGH TERRACE WALLS BETWEEN LEVELS
18 JUNIOR PLAYGROUND
19 SHADE TREE PLANTING
20 HALF BASKETBALL COURT / HANDBALL
21 STREETSIDE CARPARKING ACCOMMODATED IN ROAD WIDTH

COMMUNITY PARK NODE

100906 | 01 MAY 19 | DA18 | NORTH | SCALE 1:500 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**





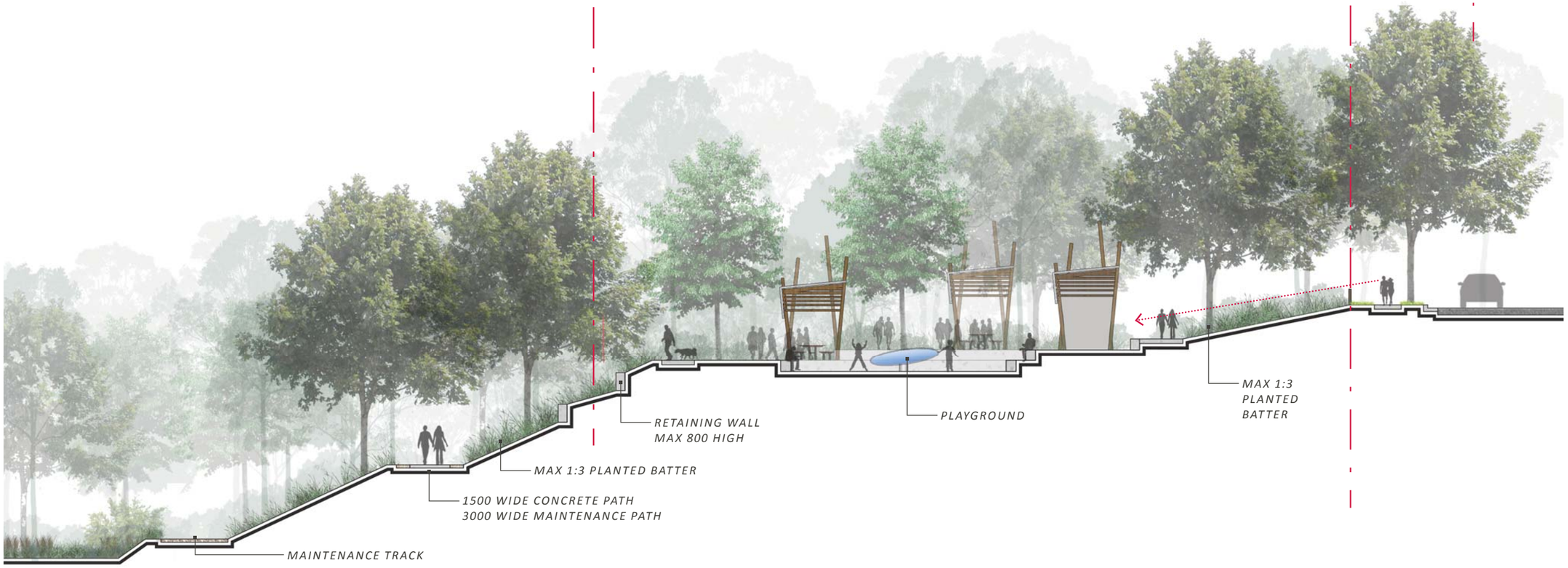
SECTION 1



SECTION 1 (cont.)



SECTION 2



SECTION 3

100906 | 01 MAY 19 | DA18 | SCALE 1:200 @ A3















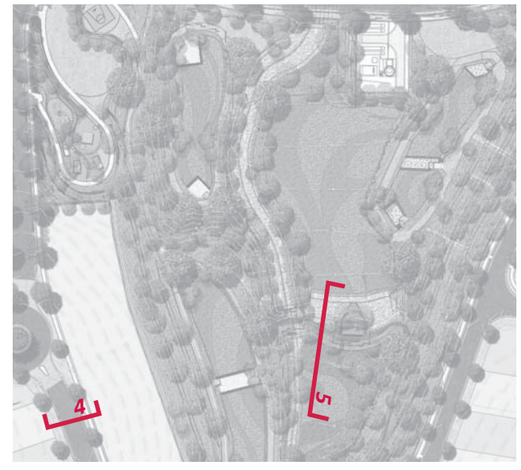
1. SHELTER AND DECK
2. RAISED BOARDWALK ACROSS CREEK
3. SEDGES AND MARGINAL PLANTING ZONE
4. DRAINAGE GULLY
5. PARK PEDESTRIAN PATH WITH RAMP LINKING TO MARKET PARADE
6. BIO RETENTION BASIN
7. GABION RETAINING WALLS
8. WATER BODY
9. Q100
10. RAISED BOARDWALK RAMP
11. 8M WIDE STONE PITCHING TO BATTER FOR STABILISED, LOW MAINTENANCE BUSHFIRE BUFFER

CENTRAL DRAINAGE RESERVE

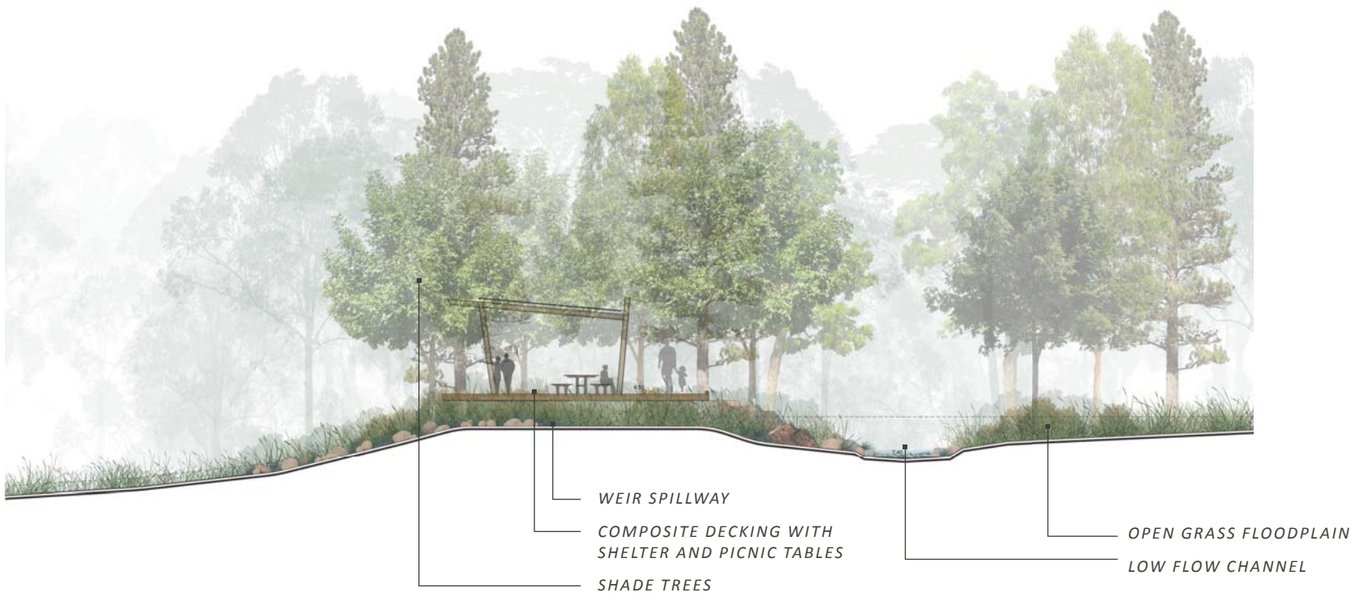
100906 | 01 MAY 19 | DA18 | NORTH | SCALE 1:1000 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**





SECTION 4



SECTION 5

LANDSCAPE SECTIONS

100906 | 01 MAY 19 | DA18 | SCALE 1:200 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**











SECTION 6

LANDSCAPE SECTIONS

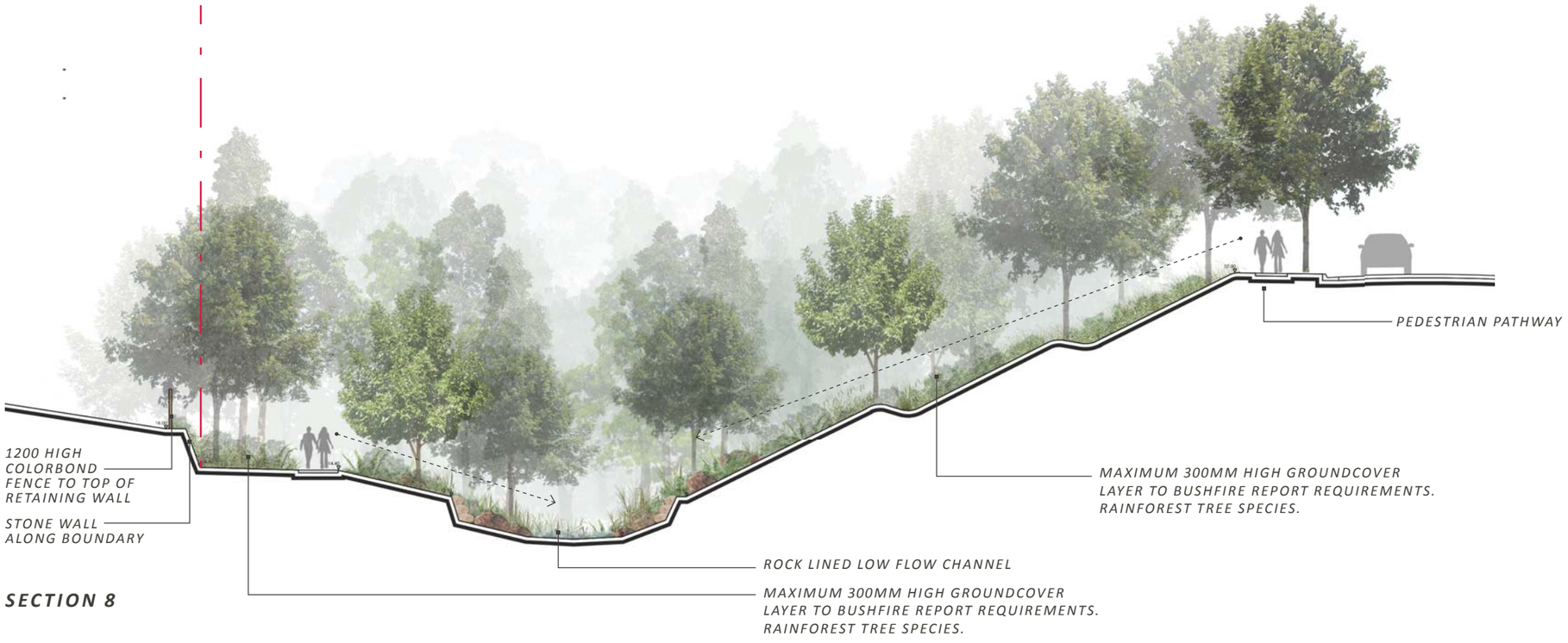
100906 | 01 MAY 19 | DA18 | SCALE 1:200 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**





SECTION 7



SECTION 8

LANDSCAPE SECTIONS

100906 | 01 MAY 19 | DA18 | SCALE 1:200 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**



SECTION 9





SECTION 10



LANDSCAPE SECTIONS

100906 | 01 MAY 19 | DA18 | SCALE 1:200 @ A3



Note : Tree locations are indicative only, review to occur at Construction Certificate Phase.















1. *PARK PATHWAY*
2. *KICK AND THROW GRASS AREA*
3. *PICNIC SHELTER*
4. *SANDSTONE TERRACE*
5. *SCREEN PLANTING TO BOUNDARY*

POCKET PARK 1

100906 | 01 MAY 19 | DA18 | NORTH | SCALE 1:500 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**

















1 PARK PATHWAY
2 BARBEQUE
3 TIMBER BOLLARDS AND LOCKRAIL TO PARK BOUNDARY
4 PICNIC SHELTER
5 SANDSTONE TERRACE
6 KICK AND THROW GRASS AREA
7 SCREEN PLANTING TO BOUNDARY

NEW TREES

EXISTING TREES

PROPOSED CONTOURS

POCKET PARK 2

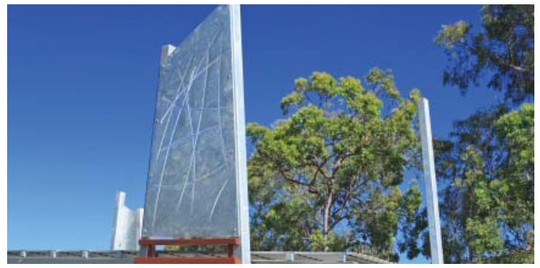
100906 | 01 MAY 19 | DA18 | NORTH | SCALE 1:500 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**



Note : Tree locations are indicative only, review to occur at Construction Certificate Phase.















1. *STREET TREES*
2. *TIMBER ACOUSTIC FENCE WITH SCREEN PLANTING*
3. *PATHWAY*
4. *SIGNAGE WALL*
5. *LOW LEVEL STONE WALL*
6. *BOULEVARD SHADE TREES*
7. *FEATURE ACCENT TREES*
8. *HIGH STONE ENTRY WALL/ACOUSTIC WALL*
9. *LOW PLANTING TO ROUNDABOUT*
10. *ELEVATED SIGNAGE BLADE*

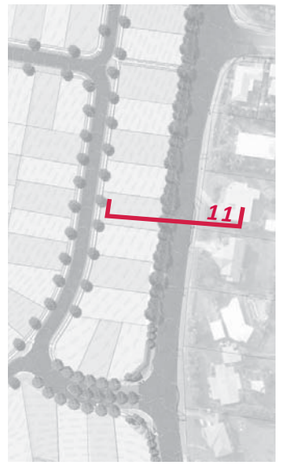
FRASER DRIVE ENTRY

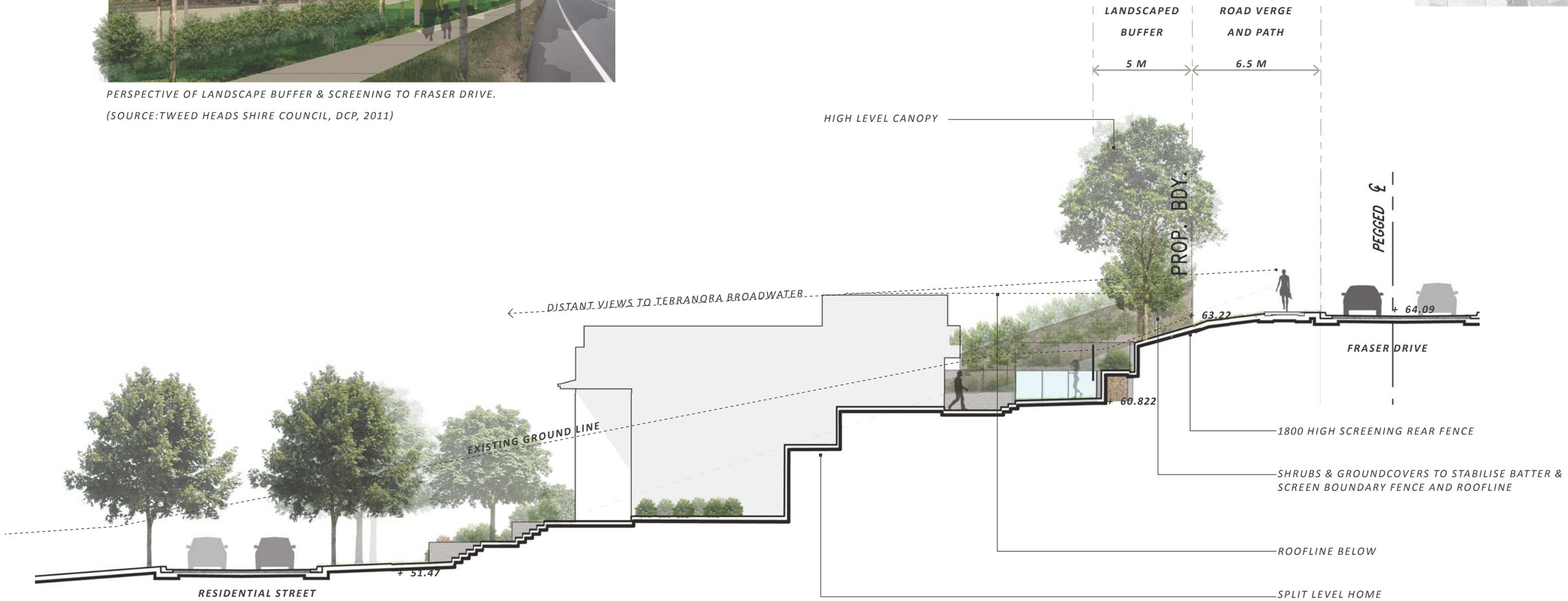
100906 | 01 MAY 19 | DA18 | NORTH | SCALE 1:500 @ A3

PROJECT **ALTITUDE ASPIRE | TERRANORA | PERMISSIBLE CHANGE** | CLIENT **NEWLAND DEVELOPERS PTY LTD**

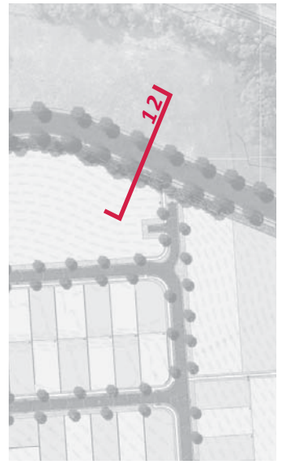


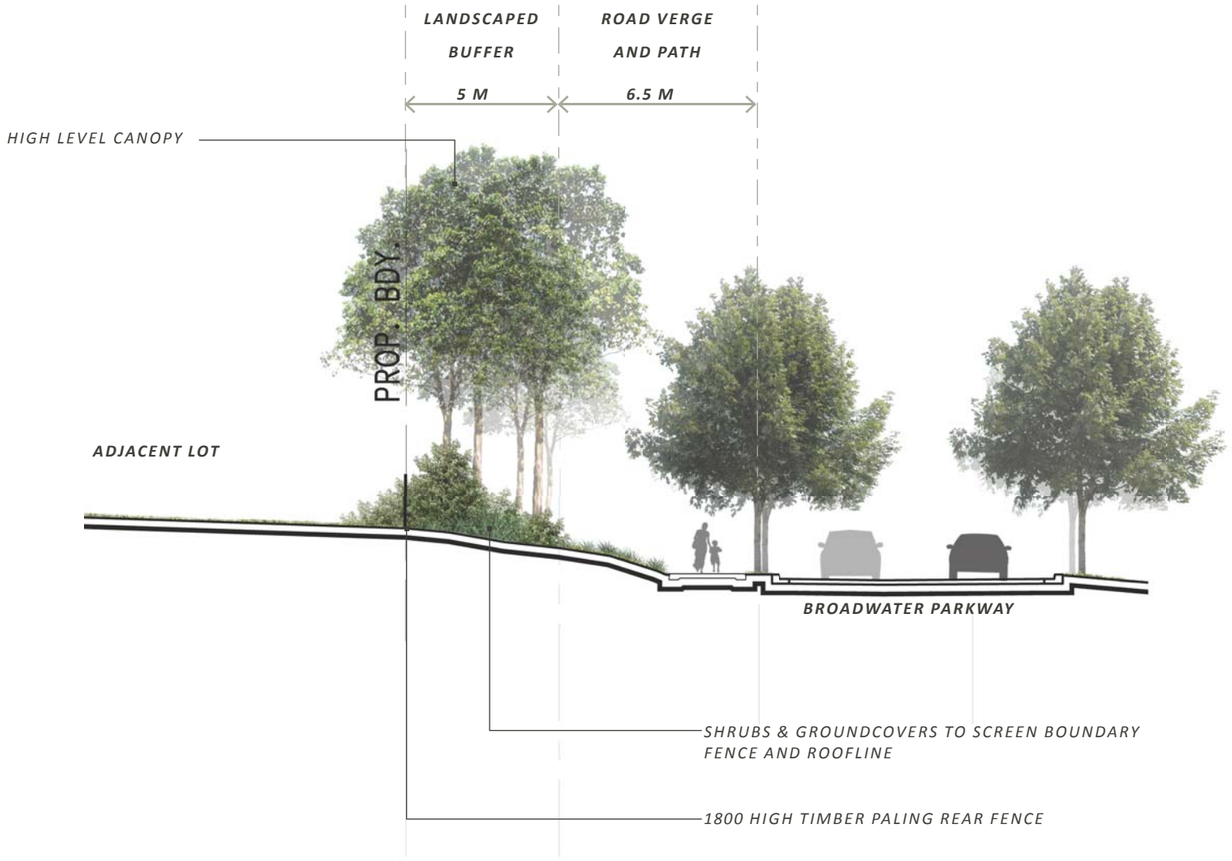
PERSPECTIVE OF LANDSCAPE BUFFER & SCREENING TO FRASER DRIVE.
(SOURCE:TWEED HEADS SHIRE COUNCIL, DCP, 2011)





SECTION 11


12


LANDSCAPED BUFFER
5 M
ROAD VERGE AND PATH
6.5 M
HIGH LEVEL CANOPY
PROP. BDY.
ADJACENT LOT
BROADWATER PARKWAY
SHRUBS & GROUNDCOVERS TO SCREEN BOUNDARY FENCE AND ROOFLINE
1800 HIGH TIMBER PALING REAR FENCE

SECTION 12

TREES

		STREETSCAPE	PLAYGROUND PARK	ENTRY	BIORETENTION	FEATURE POND	BUFFER	REVEGETATION	VEGETATED BANKS FOR BATTERS GREATER THAN 1:4
ACMENA SMITHII	LILLY PILLY	✓	✓						
ALLOCASUARINA LITTORALIS	BLACK SHE OAK				✓	✓	✓	✓	
ALPHITONIA EXCELSA	RED ASH					✓	✓	✓	
ARCHONTOPHOENIX CUNNINGHAMIA	BANGALOW PALM						✓	✓	
ATRACTOCARPUS BENTHAMIANA	NATIVE GARDENIA		✓	✓					
CALDCLUVIA PANICULOSA	SOFT CORKWOOD						✓	✓	
CASTANOSPERMUM AUSTRALE	BLACK BEAN						✓	✓	
CASUARINA GLAUCA	SWAMP OAK		✓	✓	✓	✓	✓		
COMMERSONIA BARTRAMIA	BROWN KURRAJONG		✓	✓					
CORYMBIA INTERMEDIA	PINK BLOODWOOD						✓	✓	
CRYPTOCARYA OBOVATA	PEPPERBERRY TREE							✓	✓
CRYPTOCARYA TRIPLINERVIS VAR PUBENS	THREE-VEINED LAUREL (HAIRY FORM)						✓		✓
CUPANIOPSIS NEWMANII	LONG LEAVED TUCKEROO						✓	✓	✓
CYATHEA LEICHHARDTIANA	PRICKLY TREE FERN		✓	✓			✓	✓	
ELAEOCARPUS GRANDIS	BLUE QUANDONG		✓	✓					
ELAEOCARPUS OBOVATUS	HARD QUANDONG		✓	✓					
ELAEOCARPUS RETICULATUS	BLUEBERRY ASH		✓				✓		✓
FICUS CORONATA	CREEK SANDPAPER FIG		✓						
FICUS MACROPHYLLA	MORETON BAY FIG		✓				✓	✓	
GLOCHIDION FERDINANDI	CHEESE TREE		✓				✓	✓	
JACKSONIA SCOPARIA	DOGWOOD						✓	✓	
JAGERA PSEUDORHUS	FOAMBARK						✓	✓	✓
JAGERA PSEUDORPHUS	JAGERA/ FOAMBARK						✓	✓	
LIVISTONA AUSTRALIS	CABBAGE PALM	✓	✓	✓	✓	✓	✓	✓	
LOPHOSTEMON CONFERTUS	BRUSH BOX	✓	✓			✓	✓	✓	
LOPHOSTEMON SUAVEOLENS	SWAMP MAHOGANY	✓	✓		✓	✓	✓	✓	
MACARANGA TANARIUS	MACARANGA		✓				✓	✓	✓
MELALEUCA QUINQUENERVIA	BROAD LEAVED PAPERBARK		✓	✓	✓	✓			
MELICOPE ELLERYANA	PINK EUODIA						✓	✓	✓
NOTOLAEA LONGIFOLIA	LARGE MOCK OLIVE						✓	✓	
OLEA PANICULATA	NATIVE OLIVE		✓			✓	✓	✓	
POLYSCIAS ELEGANS	CELERYWOOD			✓					
STREBLUS BRUNONIANUS	WHALEBONE TREE		✓						
SYZYGIUM OLEOSUM	BLUE LILLY PILLY		✓	✓					

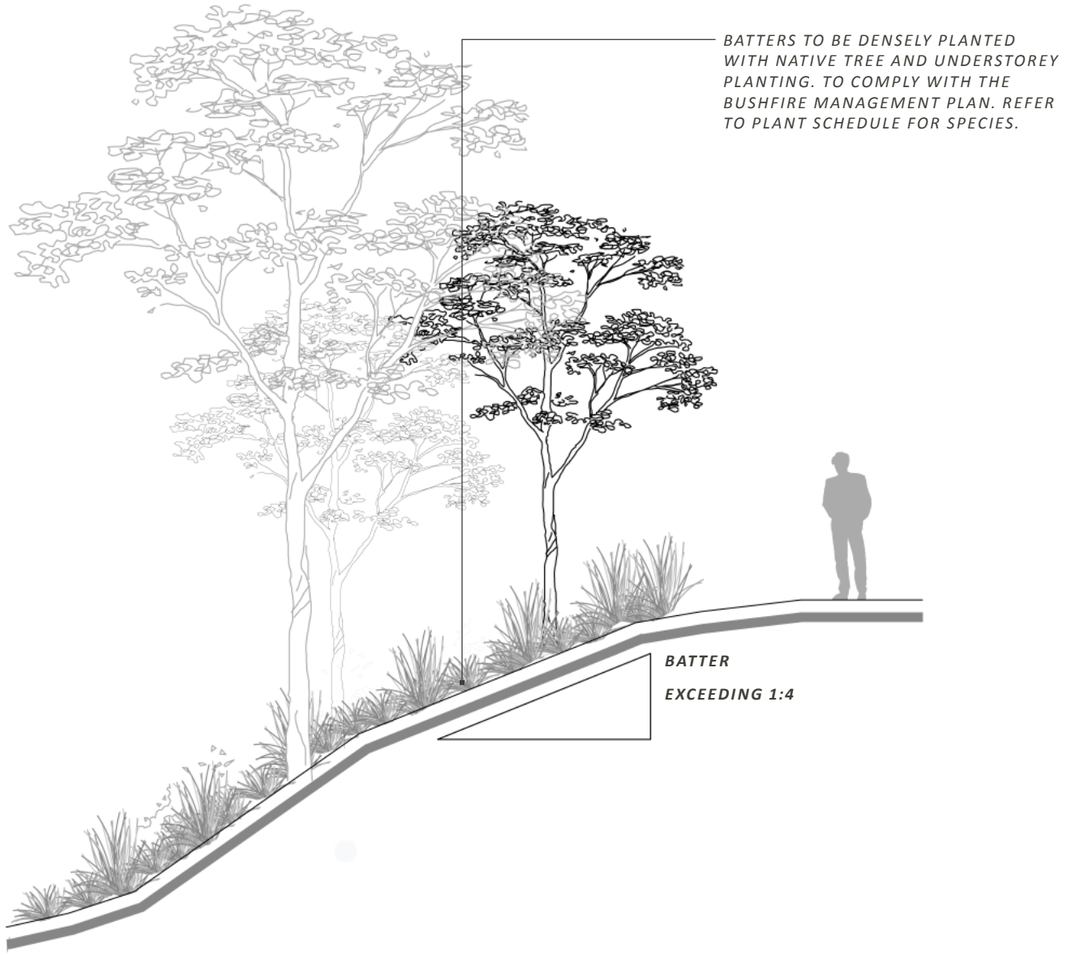
SHRUBS

		STREETSCAPE	PLAYGROUND PARK	ENTRY	BIORETENTION	FEATURE POND	BUFFER	REVEGETATION	VEGETATED BANKS FOR BATTERS GREATER THAN 1:4
ACMENA SMITHII “ALLYNS MAGIC”	ALLYNS MAGIC		✓	✓					
BREYNIA OBLONGIFOLIA	COFFEE BUSH		✓	✓			✓	✓	✓
CORDYLINE PETORALIS	BROAD-LEAVED PALM LILY		✓	✓				✓	
CORDYLINE RUBRA	RED-FRUITED PALM LILY		✓	✓				✓	
MELASTOMA AFFINE	NATIVE LASIANDRA		✓			✓	✓	✓	
PHYLLANTHUS MINUTIFLORUS	PHYLLANTHUS		✓				✓		
PITTOSPORUM REVOLUTUM	HAIRY PITTOSPORUM		✓			✓	✓	✓	
PITTOSPORUM UNDULATUM	SWEET PITTOSPORUM		✓			✓	✓	✓	
PULTENAEA SPINOSA	PULTENAEA						✓	✓	
SYZYGIUM “HINTERLAND GOLD”	GOLD LILLY PILLY		✓				✓		
SYZYGIUM AUSTRALE “AUSSIE SOUTHERN”	AUSSIE SOUTHERN		✓				✓		
WESTRINGEA “WYNYABBIE GEM”	COASTAL ROSEMARY		✓						
WESTRINGEA FRUITOCOSA “ZENA”	ZENA		✓	✓					
CARISSA OVATA	CURRANT BUSH						✓		
CRYPTOCARYA LAEVIGATARS	GLOSSY LAUREL								✓
MELASTOMA AFFINE	NATIVE LASIANDRA	✓	✓						✓
ACMENA HEMILAMPRARS	BROAD LEAVED LILLY-PILLY	✓	✓						
ACMENA SMITHII	COMMON LILLY PILLY	✓	✓						
PITTOSPORUM MULTIFLORUM	ORANGE THORN						✓		
PITTOSPORUM REVOLUTUM	HAIRY PITTOSPORUM						✓		
PITTOSPORUM UNDULATUM	SWEET PITTOSPORUM						✓		
ALPINIA CAERULEA	NATIVE GINGER							✓	✓
HIBBERTIA SCANDENS	SNAKE VINE							✓	✓

NOTE: Species to comply with the Bushfire Management Plan, review to occur at Construction Certificate Phase.

			STREETSCAPE	PLAYGROUND PARK	ENTRY	BIORETENTION	FEATURE POND	BUFFER	REVEGETATION	VEGETATED BANKS FOR BATTERS GREATER THAN 1:4
GROUNDCOVERS, SEDGES AND CLIMBERS	PARSONIA STRAMINEA	MONKEY ROPE			✓			✓	✓	✓
	PANDOREA JASMINOIDES	BOWER VINE		✓						
	HOYA AUSTRALIS	NATIVE HOYA		✓						✓
	CISSUS ANTARCTICA	WATER VINE					✓			
	CISSUS HYPOGLAUCA	FIVE-LEAF WATER VINE					✓			
	CRINUM PEDUNCULATUM	CRINUM LILY		✓		✓	✓			
	ADIANTUM HISPIDULUM	ROUGH MAIDENHAIR		✓						
	PELLAEA FALCATA	SICKLE FERN					✓	✓		
	ASPLENIUM AUSTRALASICUM	BIRD'S NEST FERN					✓	✓		
	DIPLAZIUM DILATATUM	LADY FERN					✓	✓		
	BLECHNUM CARTILAGINEUM	GRISTLE FERN					✓	✓		
	BLECHNUM INDICUM	SWAMP WATER FERN					✓	✓		
	DOODIA ASPERA	RASP FERN					✓	✓		
	CYATHEA LEICHHARDTIANA	PRICKLY TREE FERN			✓		✓	✓		
	LEPIDOSPERMA LATERALE	VARIABLE SWORD-SEDGE				✓		✓	✓	✓
	LOMANDRA LONGIFOLIA	LONG-LEAVED MATRUSH				✓		✓	✓	✓
	GEITONOPLESIUM CYMOSUM	SCRAMBLING LILY						✓	✓	✓
	ALOCASIA BRISBANENSIS	CUNJEVOI			✓					
	DIANELLA CAERULEA	BLUE FLAX LILY	✓	✓	✓	✓		✓	✓	
	ERAGROSTIS SP.	LOVEGRASS						✓	✓	✓
	ALPINIA CAERULEA	NATIVE GINGER		✓						
	DICHONDRA REPENS	KIDNEY WEED							✓	✓
	MYOPORUM ELLIPTICUM	COASTAL BOOBIALLA							✓	✓
	PLECTRANTHUS GRAVEOLENS	NATIVE COLEUS							✓	✓
	COMMELINA CYANEA	SCURVEY WEED							✓	✓
	DIANELLA BREVIPENDUNCULATA	SHORT FLOWERED FLAX LILY							✓	✓
	DOODIA CAUDATA	SMALL RASP FERN							✓	✓
	LOMANDRA LONGIFOLIA	MAT RUSH							✓	✓
	PLECTRANTHUS PARVIFLORUS	COCKSPUR FLOWER							✓	✓

NOTE : Species to comply with the Bushfire Management Plan, review to occur at Construction Certificate Phase.



VEGETATED BANKS FOR BATTER GREATER THAN 1:4

PLANTING PALETTE

ANNEXURE E

JWA PTY LTD
Ecological Consultants
ABN 56 066 448 879

REVISED VEGETATION MANAGEMENT AND REHABILITATION PLAN

ALTITUDE ASPIRE
TERRANORA, NSW

A Report Prepared for Newland Developers Pty Ltd

AS AMENDED
APRIL 2019

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DOCUMENT CONTROL

Document

Title	Revised Vegetation Management and Rehabilitation Plan
Job Number	N09031
File Reference	N09031/Reports/2018/VMRP
Version and Date	RW6 18.04.19
Client	Newland Developers Pty Ltd

Revision History **(office use only)**

Issue	Version	Draft/Final	Date Sent	Distributed To	No. Copies	Media	Delivery Method
1	Rw2	FINAL	26.03.15	Shaun Nicholson	1	PDF	email
2	Rw3	Draft	08.07.15	A. McArthur	1	.doc	email
3	Rw3	Draft	08.07.15	Shaun Nicholson	1	PDF	email
4	Rw4	FINAL	14.07.15	Shaun Nicholson	1	PDF	email
5	Rw5	FINAL	05.11.18	Shaun Nicholson	1	PDF	email
6	Rw6	FINAL	18.04.19	Shaun Nicholson	1	PDF	email

Client Issue

Version	Date	Author		Approved by	
		Name	Initials	Name	Initials
Rw1	24.03.15	M. Jenkins	MJ	J. Warren	JW
Rw2	25.03.15	J. Warren	JW	J. Warren	JW
Rw3	08.07.15	M. Jenkins	MJ	A. McArthur	AM
Rw4	14.07.15	M. Jenkins	MJ	A. McArthur	AM
Rw5	05.11.18	A. McArthur	AM	A. McArthur	AM
Rw6	18.04.19	A. McArthur	AM	A. McArthur	AM

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by Newland Developers Pty Ltd to prepare a Revised Vegetation Management and Rehabilitation Plan (VMRP) for the proposed subdivision of land at the southern end of Fraser Drive, Terranora referred to as 'Altitude Aspire'.

Under section 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a major projects application was lodged with the Department of Planning. Director General's Environmental Assessment Requirements (DGEARs) were issued dated 23rd November 2009 **(**MP 09_0166**).**

The VMRP was specifically prepared to respond to the following DGEARs:

> *2.7 Outline the long-term management and maintenance of any areas of open space or conservation including ownership and control, management and maintenance funding, public access, revegetation and rehabilitation works and bushfire management.*
>
> *13.8 Provide a detailed Vegetation Management Plan (VMP) for the area of the site zoned 7(a) Environmental Protection (Wetlands and Littoral Rainforests) and for future dedication to the Tweed Shire Council. As a minimum the VMP should incorporate scoped and appropriate performance requirements for any habitat/wetland rehabilitation works (e.g. in relation to the diversity and density of plantings, seedling survival and growth rates, cumulative crown coverage, and the abundance and diversity of weed species) referenced to appropriate benchmarks (such as comparable, undisturbed vegetation communities).*

1.2 Revision History

The Environmental Assessment Report, including the VMRP, was assessed by the NSW Department of Planning and a Test of Adequacy response issued (dated 5th November 2010). JWA subsequently amended the VMRP, dated June 2010, to address these comments.

Following submissions from the public and State Agencies, and subsequent amendments to the proposed Concept Plan, the VMRP was further revised in 2015 to provide additional information and to address Condition B44 of the Planning Assessment Commission (PAC) Project Approval, dated 30th May 2014 **(ANNEXURE 1)**.

1.3 Current Version

A Part 3A modification application was lodged in April 2018. This report has now been further revised to address minor changes to the proposed staging of the development, revisions to the landscape management intent of the central drainage

corridor, minor amendments to stormwater treatment devices, and to address the following submission from Tweed Shire Council (dated 27th September 2018) in relation to a proposed increase in the extent of bulk earthworks in Lot 1 DP 175234 No. 93 Parkes Lane:

> *The Revised Vegetation Management and Rehabilitation Plan April 2013 will require revision in order to incorporate the ongoing management requirement.*

It should be noted that Section 6 of the VMRP previously dealt specifically with the translocation of *Macadamia tetraphylla* from areas of the site proposed for development to the conservation area. Offsets for proposed impacts on *Macadamia tetraphylla* are now being addressed separately under the Biodiversity Offset Scheme in consultation with Council and the NSW Office of Environment and Heritage (OEH).

1.4 The Subject site

1.4.1 Site description

The subject site encompasses several land parcels consisting of:

- Lot 1 DP 304649;
- Lot 1 DP 175235;
- Lot 1 DP 781687;
- Lot 2 DP 778727;
- Lot 1 DP 781697;
- Lot 1 DP 169490; and
- Lots 40 & 43 DP 254416.

An aerial photograph of subject site is shown in **FIGURE 1**. The majority of the site has been cleared of native vegetation and is comprised of grazing land and abandoned crops.

State Environmental Planning Policy (SEPP) No. 14 Wetland No. 23 occurs immediately adjacent to the northern boundary of the subject site (Note: SEPP 14 – Coastal Wetlands was the applicable planning instrument at the time of the development application but has since been replaced by the Coastal Management SEPP). The location of this SEPP 14 wetland in relation to the subject site is shown in **FIGURE 2**.

1.4.2 Landuse Zones

In accordance with the Tweed LEP (2000), the predominant zoning over the subject site is 2(c) Residential (Urban Expansion). A strip of land along the eastern boundary of the subject site is zoned 7(a) Environmental Protection (**FIGURE 3**).



LEGEND

Site Outline

N

0 50m 100m

1 : 4000

SOURCE: Google Earth July 2017 Aerial Photo

SCALE: 1 : 4000 @ A3

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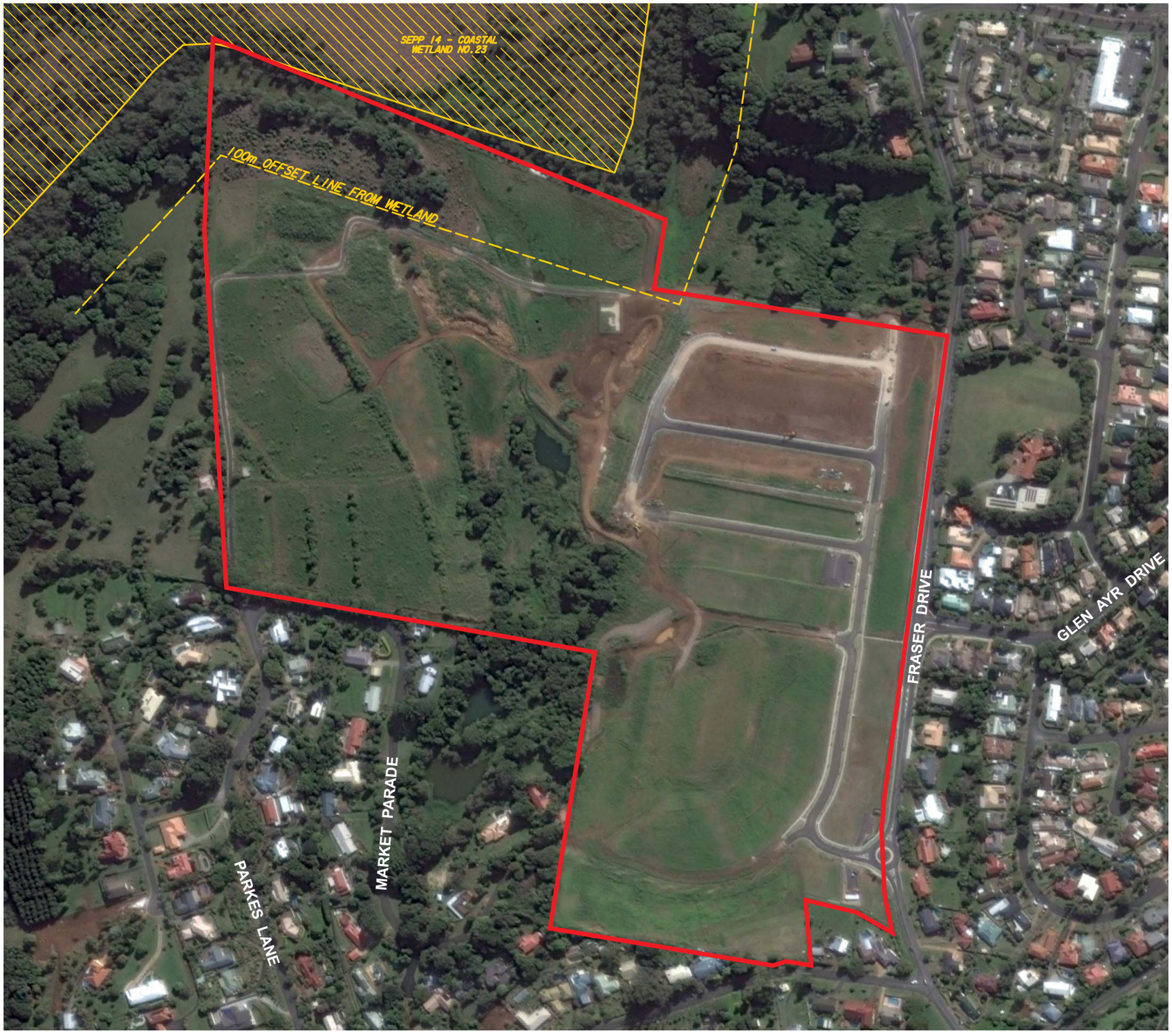
PROJECT
Revised Vegetation Mgt & Rehabilitation Plan
Altitude Aspire
Fraser Drive, South Terranora, NSW
Shire of Tweed

FIGURE 1

PREPARED: BW
DATE: 18 April 2019
FILE: N09031_VMRP_Aerial.cdr

TITLE

AERIAL PHOTOGRAPH



LEGEND

SEPP14 Coastal Wetland
Site Outline

N

0 50m 100m

1 : 4000

SOURCE: State Env. Planning Policy No. 14; Google Earth July 2017 Aerial Photograph

SCALE: 1 : 4000 @ A3

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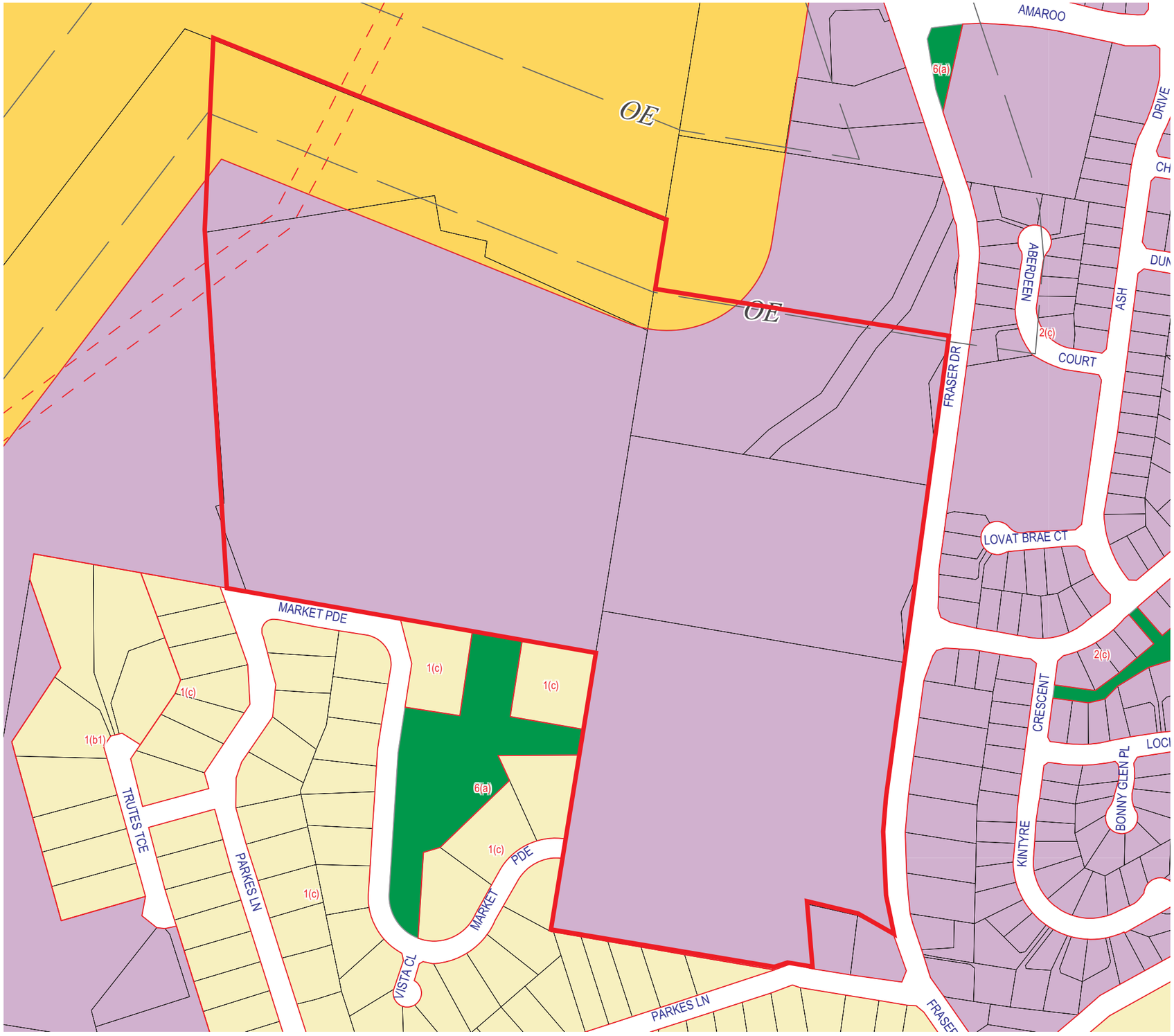
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FIGURE 2

PREPARED: BW
DATE: 18 April 2019
FILE: N09031_VMRP_SEPP14.cdr

TITLE

SEPP 14 COASTAL WETLANDS



LEGEND

- 1(b1) Agricultural Protection
- 1(c) Rural Living
- 2(c) Urban Expansion
- 6(a) Open Space
- 7(a) Environmental Protection (Wetlands & Littoral Rainforests)
- Site Outline

0 50m 100m

1 : 4000

SOURCE: Tweed LEP 2000

SCALE: 1 : 4000 @ A3

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FIGURE 3

PREPARED: BW
DATE: 25 March 2015
FILE: N09031_VMRP_LEP.cdr

TITLE

TWEED LOCAL ENVIRONMENT PLAN

On the 13th December 2011 Tweed Shire Council adopted the Area E Development Control Plan (Section B24) which includes the subject site (**FIGURE 4**).

1.5 Aims and Objectives

The aim of this VMRP is to direct the rehabilitation and management of proposed Open Space and Conservation areas which can be separated into four (4) distinct categories **(FIGURE 5):**

1. Casual Open Space;
2. Stormwater treatment areas;
3. Managed Landscape Zone; and
4. Conservation Area.

The specific objectives of this VMRP are to:

- Identify areas of retained vegetation that will be maintained through weed control and general maintenance;
- Identify areas that will be rehabilitated using natural regeneration or revegetation plantings;
- Provide management guidelines for the revegetation, natural regeneration and weed control measures to be implemented;
- Outline a maintenance and monitoring program for the site; and
- Provide management guidelines for the on-going conservation of vegetation on the site.

This VMRP must commence prior to the commencement of works on the site in order to maximise lead time for restoration and rehabilitation works.

1.6 Structure of the VMRP

This Vegetation Management and Rehabilitation Plan has been divided into the following Sections:

Section 2 – Management Intent;

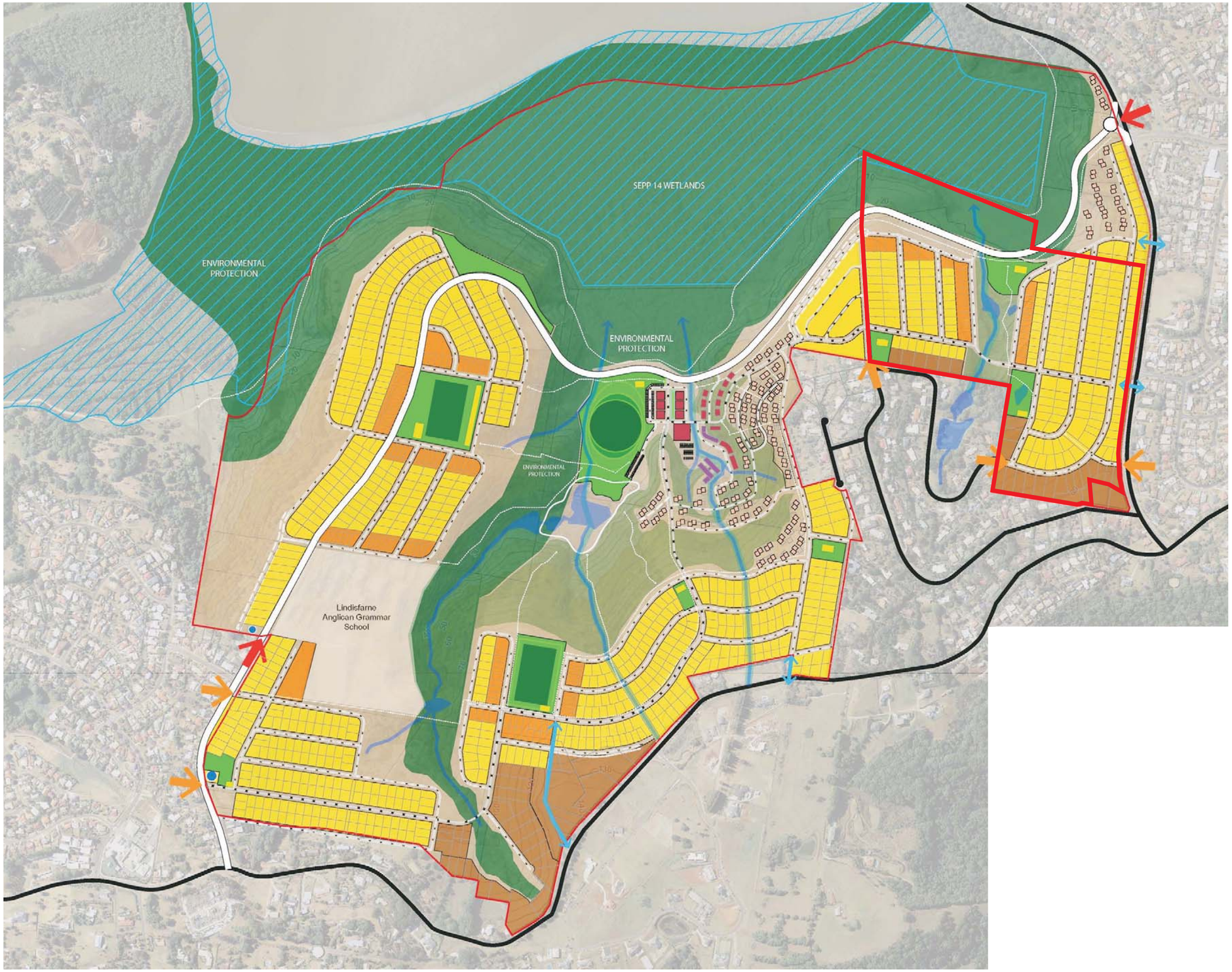
Section 3 – Construction Phase Management;

Section 4 – Landscape Management;

Section 5 – Rehabilitation Strategy;

Section 6 – Monitoring; and

Section 7 – Adaptive Management.



LEGEND

- SEPP 14 Wetland
- LEP 2000 - Environmental Protection Zone
- Draft LEP 2010 - Bushland
- Village Centre, Shop Top, RFB, Aged Care
- Sports Clubs
- Community Buildings
- Environmental Centre
- Casual Open Space
- Landscape Buffer
- Sports Fields
- Community Garden
- Criterion & Bike Track
- Walk & Mountain Bike, Bushtracks
- Drainage Reserve
- Watercourses, Dams, Springs
- Water Reservoir RL 130 & RL 105 (Indicative Location Only)
- Broadwater Parkway
- Indicative Road
- Aged Care
- Residential Flat Building
- Small Lot & Medium Density - Plexes, Row House, Town House, Dual Occupancy
- Low Density 600-1200sqm
- Large Lot >1200sqm
- Topographically Constrained Development (Community Title Development)
- Primary Vehicular Access
- Secondary Vehicular Access
- Site Pedestrian Access
- Site Outline

N

0 300m

1 : 10 000

SOURCE: Area E Urban Release Development Code - Figure 2.2 Indicative Structure Plan

SCALE: 1 : 10 000 @ A3

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FIGURE 4

PREPARED: BW
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FILE:N09031_VMRP_AreaEDCP.cdr

TITLE

AREA E DCP INDICATIVE STRUCTURE PLAN



LEGEND

- Casual Open Space
- Stormwater Treatment Areas
- Managed Landscape Zone
- Conservation Area
- Detention Bund
- Stage Boundary
- Site Outline

N

0 50m 100m

1 : 4000

SOURCE: JWA; Meinhardt (Ref: X_116964-base DATED 17-04-2019.dwg); Form Landscape Architects (Ref: 100906_DA18_2019-04-17.pdf)
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FIGURE 5

PREPARED: BW
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FILE:N09031_VMRP_Rehab.cdr

TITLE

REHABILITATION AREAS

2 MANAGEMENT INTENT

2.1 Introduction

This section identifies the management intent for areas of:

1. Casual Open Space;
2. Stormwater treatment areas;
3. Managed Landscape Zone; and
4. Conservation Area.

2.2 Casual Open Space

No rehabilitation will be undertaken in these areas with the exception of landscape plantings, revegetation with lawn grasses and maintenance (i.e. mowing). The specific treatment of these areas will be in accordance with the Landscape Masterplan (Form Landscape Architects 2019) (**FIGURE 6**).

2.3 Stormwater Treatment Areas

A number of Stormwater treatment areas are proposed throughout the subject site (**FIGURE 5).** The concept and design details can be reviewed in the Bioretention Basin and Drainage Reserve Design Report (BIOME Consulting Pty Ltd 2019).

The treatment of urban stormwater runoff and the delivery of high quality water to the adjacent wetland habitats is the primary focus of these areas. Revegetation works will be completed (immediately following disturbance) both within and surrounding the stormwater devices. Aquatic species will be planted within the stormwater treatment areas and wetland trees, shrubs and groundcovers will be planted in the surrounds.

Vehicular access to Stormwater treatment areas will be restricted to maintenance vehicles. Access by the public will generally be restricted. Access will be restricted through the use of exclusion fencing and a locked gate will be provided for maintenance vehicles.

The specific treatment of these areas is discussed further in **Section 5.3** and also within the Landscape Masterplan (Form Landscape Architects 2019) (**FIGURE 6**).

2.4 Managed Landscape Zone

Several areas have been identified as a Managed Landscape Zone on the subject site and are identified in **FIGURE 5.** These areas provide, primarily, for activities such as nature walking and other low impact activities. Other activities, such as leashed walking of pets, that do not impinge upon the passive recreation of others or wildlife, may also occur within these areas.



LEGEND

- 1 Entry Precinct
- 2 Community Park Node
- 3 Pocket Park
- 4 Floodplain Grasslands
- 5 Drainage Corridor
- 6 Fraser Drive Entry
- 7 Q100
- Site Outline

Note: Street tree locations are for indicative purposes only.

N

0 50m 100m

1 : 4000

SOURCE: Form Landscape Architects (Ref: 100906_DA18_2019-04-17.pdf)

SCALE: 1 : 4000 @ A3

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Shire of Tweed

FIGURE 6

PREPARED: BW
DATE: 18 April 2019
FILE:N09031_VMRP_Landscape.cdr

TITLE

LANDSCAPE MASTERPLAN

Revegetation works where necessary (in a manner that does not create a bushfire risk), and the provision of low impact recreation facilities such as walking tracks, will be the focus of the Managed Landscape Zone. The specific treatment of these areas have been the subject of consultation with an appropriately qualified bushfire consultant and will be in accordance with the Landscape Masterplan (Form Landscape Architects 2019). The Landscape Masterplan also identifies the locations of low impact recreational facilities including walking paths, park shelters and viewing platforms.

The Managed Landscape Zone on the subject site will also form a fauna movement corridor between council owned land to the south of the site and the SEPP 14 Wetland to the north. The design of the Broadwater Parkway has considered fauna movements and incorporates a bebo arch bridge.

Vehicular access to the Managed Landscape Zone will be restricted to maintenance vehicles. Access will be restricted through the use of bollards or similar structures and a locked gate will be provided for maintenance vehicles.

2.5 Conservation Area

The area of the subject site proposed for conservation purposes is shown in **FIGURE 5.** This area is intended to provide a buffer between the proposed development and the SEPP 14 Wetland which occurs adjacent to the northern site boundary.

No recreation is proposed within the Conservation Area. The primary focus within this area will be the retention and protection of existing native vegetation, the rehabilitation of degraded areas (including the degraded Freshwater wetland EEC), and the provision of offsets for the removal of small degraded patches of Lowland rainforest EEC from the development footprint.

Vehicular access to Open Space areas will restricted to maintenance vehicles. Public access to this area will be prohibited. Access will be restricted through the use of bollards or similar fauna-friendly structures and a locked gate will be provided for maintenance vehicles.

The specific treatment of these areas is discussed further in **Section 5.3.**

2.6 Implementation Period

Vegetation management and rehabilitation is to be maintained by the proponent until an agreement for dedication of the lands to Council has been reached.

3 CONSTRUCTION PHASE MANAGEMENT

3.1 Introduction

In order to protect the ecological values of the site, vegetation management practices will be of the highest importance during the clearing, construction and rehabilitation phases of the development. Native vegetation will be retained, rehabilitated and protected within the identified Conservation area.

The regeneration and revegetation works proposed within the Conservation area and Stormwater treatment areas are discussed in detail in **Section 5**.

The methods proposed to ensure the retention and protection of existing native vegetation where appropriate during the construction phase are discussed below.

3.2 Extent of Vegetation Disturbance

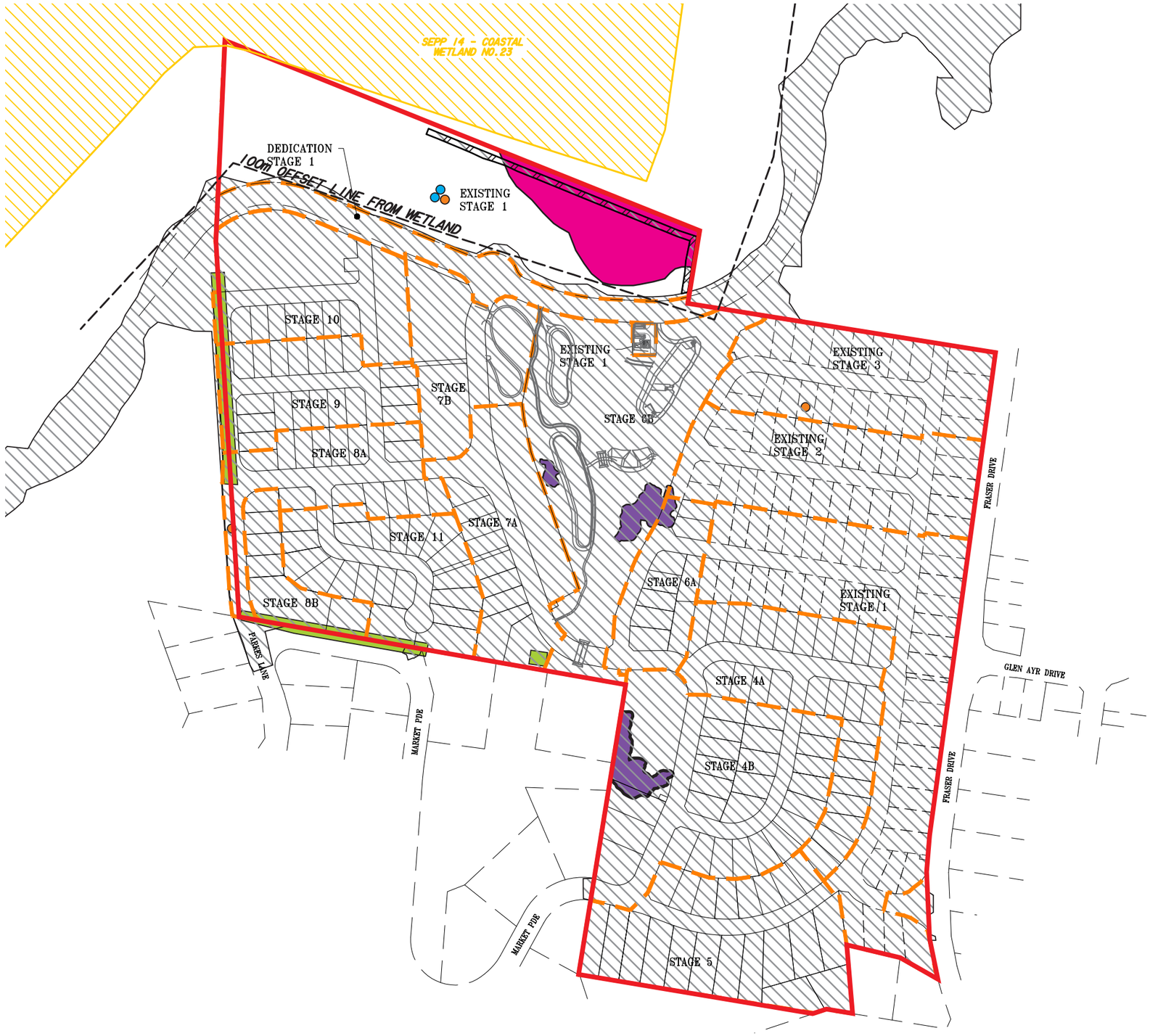
The construction of access roads, services and stormwater treatment devices will require bulk earthwork activities across the majority of the site (**FIGURE 7**). During this time vegetation disturbance should be minimised to the absolute area necessary, in order to conserve ecological values within the proposed Conservation area.

Existing native vegetation will be retained within the Conservation area and weed infestations removed before any supplementary planting is carried out in accordance with the Rehabilitation Strategy (i.e. **Section 5**). Any vegetation to be retained will be clearly identified and access to these areas will be restricted prior to the commencement of any earthworks.

3.3 Vegetation Protection Measures

Retained vegetation areas should be protected from the following possible disturbances:

- Earthworks;
- Construction of pathways;
- Machinery storage;
- Site waste dumping;
- Stockpiling of mulch/chipped material or soil;
- Erosion;
- Unauthorised vegetation removal;
- Herbicide application; and
- Introduction of exotic flora species.



LEGEND

- Lowland Rainforest Endangered Ecological Community (EEC)
- Freshwater Wetland Endangered Ecological Community (EEC)
- Rough-shelled bush nut (*Macadamia tetraphylla*)
- Planted Macadamia (Hybrid Species)
- Veiny lace flower (*Archidendron muellerianum*) (ROTAP)
- SEPP 14 Wetland
- Extent of Earthworks
- Detention Bund
- Stage Boundary
- Site Outline

N

0 50m 100m

1 : 4000

SOURCE: JWA; Burchills (Figure_5.1_Vegetation_Associations_Significant_Flora_Locations.pdf); Meinhardt (X_116964-base DATED 17-04-2019.dwg); Form Landscape Architects (100906.6_Key Plan.dwg)

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FIGURE 7

PREPARED: BW
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TITLE
IMPACTS ON EEC, SIGNIFICANT PLANTS & SEPP 14 WETLANDS

Appropriate vegetation management strategies during the construction phase of the development are outlined below:

- Prior to the commencement of any vegetation clearance, the Contractor shall identify all native vegetation to be retained on construction plans and in the field.
- Protective fencing is to be erected around areas of retained vegetation prior to the commencement of works and shall be maintained during the construction period. The exclusion fencing shall ensure the protection of retained vegetation, understorey and root zone. Within these excluded areas the following activities shall not be permitted:
    - Storage and mixing of materials;
    - Vehicle parking;
    - Liquid disposal;
    - Machinery repairs and/or refuelling;
    - Construction site office or shed;
    - Combustion of any material;
    - Stockpiling of soil, rubble or debris;
    - Any filling or excavation including trench line, topsoil skimming and/or surface excavation, unless otherwise approved by the Project Manager; and
    - Unauthorised pesticide, herbicide or chemical applications.

  Mulch stock piles may be stored within the Open Space areas to be utilised for landscaping purposes.
- All activities in an area adjacent to any protected tree or area shall be carried out in such a manner as to minimise any damage to trees and/or the conserved area.
- When trenching or excavation is to be undertaken within the root zone of any tree, roots will be severed cleanly rather than torn with a backhoe or other excavation equipment. All roots are to be exposed first and then cut cleanly with a sharp saw or loppers. Exposed roots are to be kept moist and covered with hessian for the duration of the exposure. Where roots with a diameter larger than 50 mm are encountered excavation should be undertaken by hand and such roots tunnelled under.
- Trees deemed by an Ecologist to be potentially impacted upon, shall be protected by the application of carpet underlay, 1.8 m high palings strapped to the trunk and/or corrugated iron, or some other similar material to encase the trunk of the tree.
- No clearing shall occur outside nominated clearing zones.
- The erosion and sediment control measures shall not be dismantled until areas to be rehabilitated have been covered by mulch to a minimum depth of 150 mm.

3.4 Vegetation Removal and Disposal Methods

Any hollow logs or other habitat resources shall be collected and relocated to the Conservation Area prior to commencement of clearing works.

Clearing shall occur in the sequence of cutting, shearing of felled vegetation and tub grinding. Upon completion, grubbing operations shall ensure the site is left free draining with no ponding of stormwater. Any cleared native vegetation is to be chipped and utilised as mulch on site. Declared and/or environmental weeds shall be disposed of at an appropriate Council green waste facility.

Any timber that is too large for chipping may be sold for milling. Combustion disposal methods are prohibited on and off the site.

3.5 Erosion and Sediment Control

Design details for erosion and sediment control measures have been discussed in detail within the Bioretention Basin and Drainage Reserve Design Report (BIOME Consulting Pty Ltd 2019). This section provides a summary of the erosion and sediment control measures proposed across the site that will mitigate the potential impacts on Open Space and Conservation areas during the construction phase of the development.

Erosion and sediment control devices (e.g. silt fences and temporary sedimentation ponds) shall be installed prior to the commencement of work in each stage. Sediment and erosion control fences will be installed along all boundaries between Open Space areas and the developable areas. All runoff from disturbed areas shall be collected via surface drains and diverted to a sedimentation pond. Temporary sedimentation ponds may only be removed once the site has been revegetated following the completion of bulk earthworks. Erosion and sedimentation control measures within Open Space areas should be maintained until landscaping has been completed and becomes established.

All erosion and sediment controls will remain installed and maintained by the developer during the entire construction and maintenance phases of development up until handover to Council. Erosion and sediment control measures will require inspection and maintenance throughout the course of construction works, during the maintenance period and following each rainfall event. All temporary and permanent erosion control measures are to be inspected monthly as well as following rainfall events.

4 LANDSCAPE MANAGEMENT

The intention of the proposed development is to select native trees that will:

- continue the landscape character of existing native vegetation within and surrounding the subject site;
- be visually appealing to help promote and market the proposed development; and
- be compatible with the existing site and proposed development conditions.

All landscaping within the proposed development should utilise locally endemic species of proven local provenance and be completed in accordance with the Landscape Masterplan (Form Landscape Architects 2019) (**FIGURE 6**).

5 REHABILITATION STRATEGY

5.1 Introduction

The Rehabilitation Strategy for the subject site proposes a combination of assisted natural regeneration, where appropriate, and revegetation works. Several areas of the subject site have been identified for rehabilitation works, particularly within Freshwater wetland EEC in the proposed Conservation Area (**FIGURE 5**). Revegetation works are also proposed within the Conservation Area to offset the unavoidable loss of degraded Lowland rainforest EEC from the development footprint. Additional revegetation works are also proposed where appropriate within Stormwater Treatment areas.

The objectives of the Rehabilitation Strategy are:

- To enhance the vegetation to be conserved;
- To revegetate disturbed areas where appropriate with endemic species;
- To provide offsets for the unavoidable loss of Lowland rainforest EEC from the development footprint;
- To rehabilitate the area of degraded Freshwater wetland EEC on the subject site;
- To reduce detrimental edge effects and other disturbance related impacts on the adjacent SEPP 14 Wetland;
- To improve the value of the subject site as habitat for fauna groups;
- To manage weeds using plantings of endemic species and best practice control methods; and
- Contribute a significant area of native habitat (existing and restored) to the Regional Corridor.

An overview of the principals underpinning this report is provided in **ANNEXURE 2**.

5.2 Assisted Natural Regeneration

5.2.1 Background

The majority of vegetation on the subject site has experienced both historical and current anthropogenic alterations, principally due to high levels of clearance, planting of crops and grazing grasses, and cattle grazing. This high level disturbance has provided opportunities for weed species to invade the landscape.

In particular the Freshwater wetland EEC on the subject site is heavily degraded by weeds. Exotic species have persisted and competed with native species for limited resources (e.g. light, nutrients and water). This acts as a limiting factor for regeneration of native species. Therefore, in order to enhance the natural values of the Freshwater wetland EEC, weed control and weed removal techniques are required at varying levels.

Assisted regeneration will be encouraged within areas identified in **FIGURE 8**. The objectives of the site rehabilitation strategy are to:

- Remove weeds utilising "best practice" protocols;
- Improve the current habitat values of the site; and
- Provide a buffer to ecological features from potential impacts of the proposed development.

Natural regeneration will be continually monitored for the life of the program. Where natural recruitment is poor, active revegetation through planting will be completed. If necessary, revegetation methods will follow those outlined below in **Section 5.3**.

5.2.2 Primary Weeding

Weed eradication will be undertaken within areas identified for assisted regeneration on a progressive basis through localised treatment of grass species via mechanical removal (hoe/rake, hand pulling and/or slashing) or with Roundup Biactive©. A list of weed species recorded on the subject site is provided in **ANNEXURE 3**. Woody weed species will be hand pulled or controlled using weed control techniques listed within **ANNEXURE 4.**

Weed control will particularly focus along the edge of the adjacent SEPP 14 wetland and within the degraded Freshwater wetland EEC on the subject site.

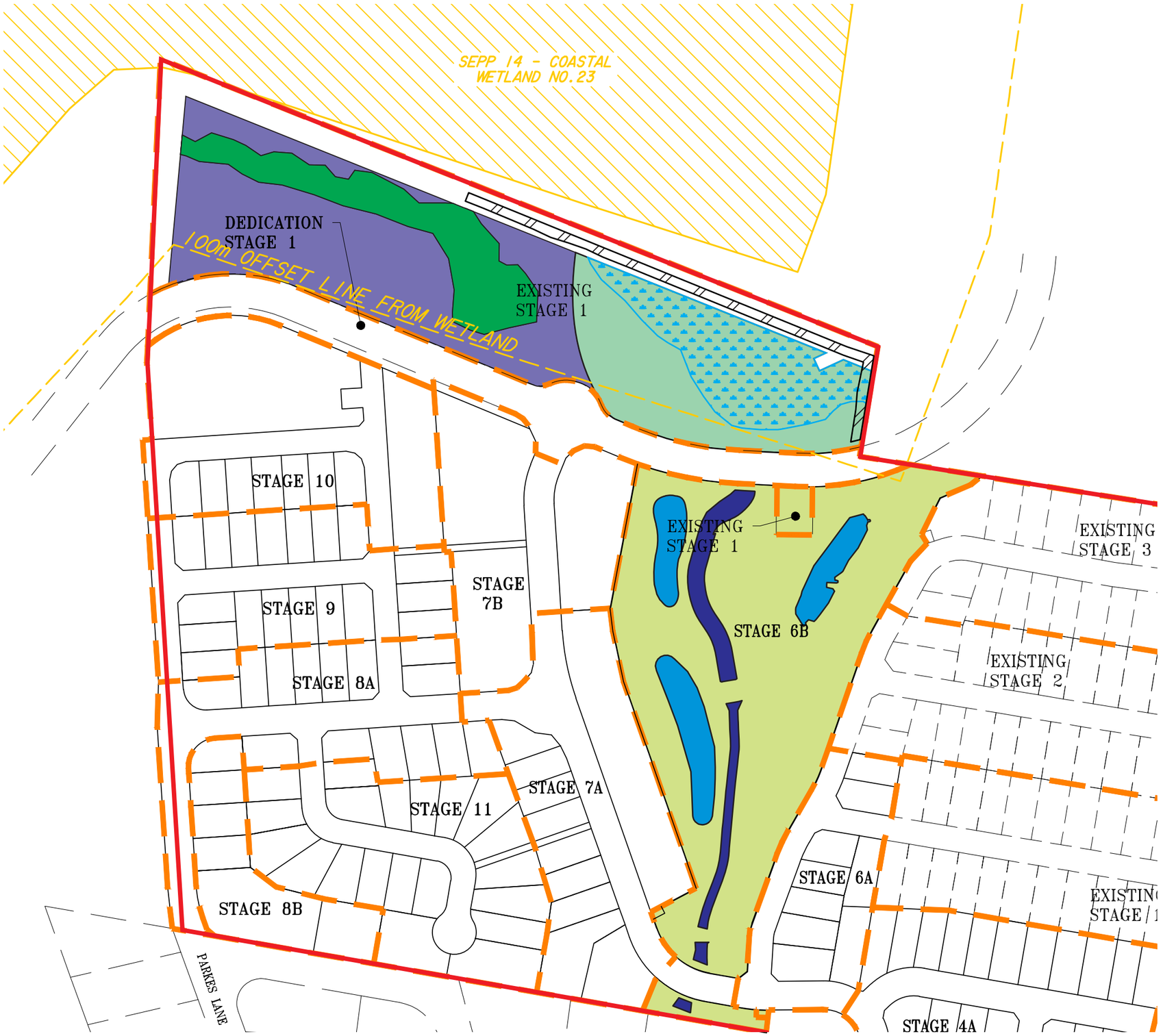
All chemical users should be experienced and licensed in accordance with the relevant legislation. Utmost care must be taken when utilising chemicals to ensure that no drift occurs outside of the treatment area. Spraying should not occur on windy days or within 24 hours of predicted rainfall.

Primary weeding should commence at the start of the active growing period (approximately November), or on an as needed basis. Preparation before spraying, in the form of manual clearing weeds from around native plants, must be carried out.

Weed material that does not contain any fertile parts will be mulched and spread on the ground and any weeds that may have fertile parts present will be disposed of at an approved waste disposal facility such as Council landfills or transfer stations.

5.2.3 Secondary Weeding

Secondary weeding involves the eradication of weeds that have been overlooked or re-shoot after primary treatment. Secondary weeding will occur 3 to 4 months after primary weeding and no later than 6 months.



SOURCE: JWA; Meinhardt (Ref: X_116964-base DATED 17-04-2019.dwg); Form Landscape Architects (Ref: 100906_DA18_2019-04-17.pdf)
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FIGURE 8

PREPARED: BW
DATE: 18 April 2019
FILE:N09031_VMRP_rehab strat.cdr

TITLE
PROPOSED REGENERATION & REVEGETATION AREAS

5.3 Revegetation

5.3.1 Background

Within disturbed areas, competition between native propagules and exotic weeds often favours exotic pioneering species. In order to enhance the ecological functioning of areas degraded by exotic species, revegetation works will provide a framework by which indigenous species may reclaim lost habitat via the processes of natural recruitment and succession. Therefore, the aim of revegetation works is to restore the historical ecological values of the site through the use of weed removal techniques and the provision of indigenous canopy species. Further discussion on the principles of ecological restoration works is contained in **ANNEXURE 2**.

Revegetation will be required within all areas identified in **FIGURE 8.** Revegetation will commence no later than six (6) months after the primary weeding is completed. At this time, an assessment will be made as to level of natural regeneration present within these areas. Any areas where the native seedling germination is considered to be low will require revegetation.

5.3.2 Revegetation Phases

Site revegetation works will be undertaken where required in six (6) phases. These are:

- **Phase 1**: Site preparation - will commence as soon as possible after disturbance and when the area has been designated as suitable for revegetation.
- **Phase 2**: Initial planting - will commence as soon as the horticulturalist is satisfied that weed species have been successfully controlled.
- **Phase 3**: Growth and maintenance.
- **Phase 4**: Supplementary planting to replace dead seedlings - will commence within two (2) months of the initial planting in each area and replacement of any seedlings that have perished will occur.
- **Phase 5**: Additional plantings - works can commence where advanced canopy growth is evident, and the Horticulturist determines that supplementary planting is necessary to satisfy the aims of the site revegetation plan.
- **Phase 6**: Ongoing maintenance - will continue indefinitely on an as needs basis for a period not more than five (5) years from the completion of Phase 1.

5.3.3 Site Preparation (Weed Control)

Site preparation will be completed in accordance with the Site Regeneration Strategy (**Sections 5.2.2** and **5.2.3**).

5.3.4 Propagation

Plants to be used in the revegetation are to be either propagated in a nursery using material (seeds, cuttings, tissues, etc.) from species which occur onsite or obtained from a local nursery able to supply stock from local provenance. Where existing nursery stock from local provenance is not available, collection should be carried out as detailed below. The following details will be collected from each source plant:

- Location (GPS position);
- Date of collection;
- Name of collector;
- Soil type;
- Health of plant; and
- Collection method.

Whenever possible, seed will be removed directly from plants by shaking or cutting branches over a tarpaulin. Secateurs will be sterilised between each use. Seed will be placed in small envelopes with the collection details clearly marked. If the seed is extremely small, it will be stored in glass or plastic vials to avoid undue loss.

It is expected that during the seed collection program, a site will be visited on several occasions to ensure optimum seed ripeness. The seed collection program will be prepared in consultation with Council and NSW National Parks and Wildlife Service (NSW NPWS) prior to commencement. The program will be prepared by the Nursery/Revegetation team in consultation with the Horticulturist.

The amount of seed collected will not exceed 5% per plant. Seed will not be collected from isolated populations or rare plants.

The seed will be cleaned, its viability checked and prepared for storage. Seed that has lost viability will not be used in the revegetation works due to the dangers of genetic aberration.

If seed collection proves difficult or impossible, other forms of propagation, such as cuttings, may be attempted.

5.3.5 Planting Program

5.3.5.1 Terrestrial revegetation areas

Terrestrial revegetation areas are identified on **FIGURE 8.**

Seedlings will be sufficiently developed so as to have a significant chance of survival. Seedlings will be at least the sixth leaf stage and/or 20 cm in height.

Tube stock seedlings will primarily be used for the plant-out.

Tube stock will be sun hardened (plants should be held in full sunlight and systematically stressed to the point of wilting for at least two months prior to planting).

All exclusionary fencing will be in place before planting occurs.

Planting will occur at the optimum time of the year when there is high soil moisture (between January and May), unless irrigation is available and accessible.

If required, the Horticulturist may make minor alterations to this revegetation strategy depending on the site requirements. The following strategy will be employed:

- Seedling sites will be spot sprayed with Roundup Biactive© one (1) week prior to commencement;
- All seedlings will be soaked in water overnight prior to planting;
- All seedlings will be provided with a wetting agent such as rain-saver[1] crystals;
- Weeds will be controlled, in the short term, through the application of suitable mulch around individual plantings and with spot applications of an appropriate herbicide.
- All seedlings will be protected by a tree guard (commercial tubing or equivalent); and
- Watering will be undertaken after the seedlings have been planted on an 'as needed' basis.

The plants growing medium should be soaked prior to planting and the plant cores should be buried to approx. 1-2 cm deep.

The seedlings shall be planted on the same day (or as soon as practicable) as their transport from the nursery. No seedlings will be left unprotected on the site whilst awaiting planting. Planted seedlings will be marked with a piece of biodegradable tape and staked.

Only nitrogenous fertilisers will be used to avoid the introduction of Phosphorous, Potassium and other micronutrients.

Planting in areas exposed to full sun or westerly sun will be avoided in the peak summer months, where possible.

[1] Rain-saver is a polymer water crystal that has been specifically developed for plants. The polymer absorbs and holds water and nutrients at a specific tension which makes it available to plant roots but does not release to the soil. Rain-saver has proven very successful in more difficult environments (e.g. Roadside plantings on the Pacific Motorway between Brisbane and the Gold Coast and in frontal dunes at Pottsville (R. Keene *pers comm*. 2000).

5.3.5.2 Aquatic revegetation areas

Aquatic revegetation areas are identified on **FIGURE 8** and include the proposed stormwater treatment devices and the central drainage corridor. Revegetation within bio-retention basins and surrounding open space areas will be completed immediately following disturbance.

The constructed wetlands manual recommends planting into damp or dry soil and then to irrigate after planting. Planting into wet mud or shallow free water is also possible (DLWC 1998). The manual provides the following information on planting wetland species:

- Where possible planting is to occur into the available dry substrates, when this is not practical, planting will occur in the shallow water;
- Wetland plants should be planted in the appropriate zones with regard to water depth;
- Plants are to be manually planted to ensure that recommended densities are achieved;
- The manual planting methods to be undertaken involve:
    - Selection of planting area;
    - Selection of species to be planted and appropriate density;
    - Using string line to determine area for each planting zone;
    - Digging small spade holes in the appropriate mean water depth;
    - Place roots zones into small spade holes;
    - Cover and compress the sediment around the roots; and
- The planting out of the aquatic species is to be completed by the regeneration team.

5.3.6 Planting Density and Species Selection

5.3.6.1 Terrestrial revegetation areas

Revegetation will occur in both terrestrial and aquatic (i.e. Stormwater treatment areas) situations. Terrestrial revegetation will aim to establish pre-disturbance vegetation communities. A list of species to be used for planting within these revegetation areas is provided in **ANNEXURE 5.**

These revegetation areas will be planted according to the following densities (plants/100 m^2):

- 10 large trees;
- 10 small trees;
- 10 shrubs; and
- 25 groundcover plants.

Species diversity will be maintained throughout these revegetation areas and consist of the following densities (plants/100 m^2):

- A minimum of three (3) different large tree species;
- A minimum of three (3) different small tree species;
- A minimum of five (5) different shrub species; and
- A minimum of five (5) different groundcover species.

5.3.6.2 Aquatic revegetation areas

A list of species to be used for planting within the Stormwater treatment areas and planting densities is provided in **ANNEXURE 6.**

5.3.7 Fencing

The boundary of the Conservation Area will be marked with star pickets and tape and will be erected immediately before revegetation work commences. Signage is to be erected stating: "No Entry – Native Plant Revegetation Area". All contractors are to be made aware of restrictions applying to the exclusion zones.

5.4 Indicative Maintenance Schedule

Maintenance work will be undertaken for up to five (5) years. Vegetation management and rehabilitation is to be maintained by the proponent until an agreement for dedication of the lands to Council has been reached. An indicative maintenance schedule has been formulated to provide the best rehabilitation outcomes (**TABLE 1**).

TABLE 1
INDICATIVE MAINTENANCE SCHEDULE

Activity	Zones	Timing
Watering	Revegetation area	During planting and as needed within the first six (6) weeks after planting.
Mulch	Revegetation area	Applied to 10 cm thick ASAP after the site preparation has been completed
Weed and Litter control	Revegetation and Assisted regeneration areas	Initial weed control during site preparation. Secondary weeding immediately before planting revegetation area. Ongoing weed maintenance will be monthly from the secondary weeding.
Sediment control and fencing inspections	Along edge of canal bank vegetation	Monthly
Replacement plantings	Revegetation area	Plant survival will be assessed monthly during maintenance visits. A 100% survival rate will be required during the maintenance period. Any losses

Activity	Zones	Timing
		less than 10% will be replaced at the expense of the rehabilitation contractor with the exception of vandalism, natural disaster, or other unforeseen event. In this case, or in the event of deaths in greater than 10% of the trees, the cost of replacement will be on the owner.

5.5 Performance indicators

5.5.1 Introduction

To assess the effectiveness of the rehabilitation strategy the following performance indicators have been developed. Assessment of these indicators will be undertaken during the site monitoring visits and reported 6 monthly.

5.5.2 Performance Indicators

1. All contractors are to be fully aware of responsibilities under the rehabilitation section of this VMRP and other relevant management plans.
2. No unauthorised activities have been undertaken with in the rehabilitation area.
3. Protection fencing has been erected prior to any rehabilitation work.
4. No retained trees have been damaged or removed during rehabilitation activities.
5. At the end of the establishment period the rehabilitation area will include trees, shrubs and ground covers planted, established and protected so that they will not perish without watering or herbicide in excess of a normal Council maintenance regime.
6. At the end of the five (5) year Maintenance period or when the site becomes self-sustaining the rehabilitation area will include:
    a. All State declared weeds controlled;
    b. Assisted regeneration/revegetation has progressed to the extent that canopy closure has been achieved, reducing the need for weed removal.
    c. The understorey free of large swathes of groundcover weeds and exotic grasses;
    d. The shrub layer free of understorey weeds such Leucaena, Camphor laurel and Lantana; and
    e. The upper canopy shall be free of woody weeds such as Camphor laurel.
7. Reports will be produced by the site manager/rehabilitation contractor and forwarded to Council on an annual basis.

8. Sediment and erosion controls, vegetation management, surface water management, dust and air quality management, waste management, cultural heritage, and traffic management shall comply with Tweed Shire Council conditions and approved management plans.

5.6 Long Term Management

The revegetation and regeneration areas will be subject to ongoing monitoring over a five (5) year period. Over that period, the following management strategies will be utilised:

- Progressive weed control (as needed), determined during routine monitoring;
- Follow-up watering as required and determined by landscape contractors;
- Installation of erosion and sedimentation control measures prior to any construction activities, weed control or revegetation activities in adjacent areas, where necessary (e.g. if large areas of weeds are to be physically removed);
- Maintenance of existing vegetation except where water sensitive urban design facilities/devices are required. Landscaping of infiltration drains, swales and other stormwater management facilities/devices will also be implemented to facilitate integration of these facilities/devices into the surrounding natural environment; and
- Fencing and/or restricting access.

5.7 Tendering of Works

A suitably qualified Bushland Restoration Team will be engaged via a tender process. If necessary, an annual tender process for each stage of the revegetation strategy may be undertaken.

If the species listed in **ANNEXURES 5** and **6** are not available, provision will be made to secure and plant these species at a later stage. If certain species contained in this document are not considered suitable then a justification should be recorded by the Horticulturist and lodged with Council.

The Restoration Team will provide the Horticulturist with a revegetation strategy which will include a program for the collection of material (seed and cuttings) to be utilised in vegetative revegetation. The strategy will discuss the following points:

- Collection proposal;
- Species mix and density;
- The source of seeds/cuttings to be utilised;
- Size of the cuttings/seedlings to be utilised;
- Date at which revegetation is to commence; and
- Strategies for early care and monitoring of the revegetation area.

6 MONITORING

6.1 Introduction

A well-designed restoration monitoring program will allow project managers to detect results months, years, or decades following implementation of a plan. Monitoring data can be used by project managers to demonstrate the ability of the project to meet stated goals and objectives.

This section outlines the monitoring programs required. Monitoring will be completed within the following areas:

- Natural Regeneration Areas;
- Revegetation Areas; and
- Freshwater Wetland EEC and SEPP 14 wetland.

6.2 Performance Targets

TABLE 2 summarises the proposed Performance Targets for the Regeneration and Revegetation of the Restoration Area on the subject site.

TABLE 2
PERFORMANCE TARGETS

Performance Indicator	Target
Survival and continued growth of seedlings (i.e. planted stock)	90% survival of planted stock
Establishment of a native ground cover	60% after 2-3 years
Average native ground cover	80% after 5th year
Establishment of a native canopy cover	60% after 2-3 years
Average percentage of a native canopy cover	80% after 5th year
Height of any planted tree	minimum of 1.5 m at Year 3; 2.5 m after Year 5
Natural recruitment of native seedlings throughout planting areas	Evidence of natural recruitment
Establishment of a healthy SEPP 14 Buffer Zone	After Year 5
Environmental weeds	<1%
Infrastructure functional and well-maintained	Infrastructure in a state suitable for hand over to Tweed Shire Council

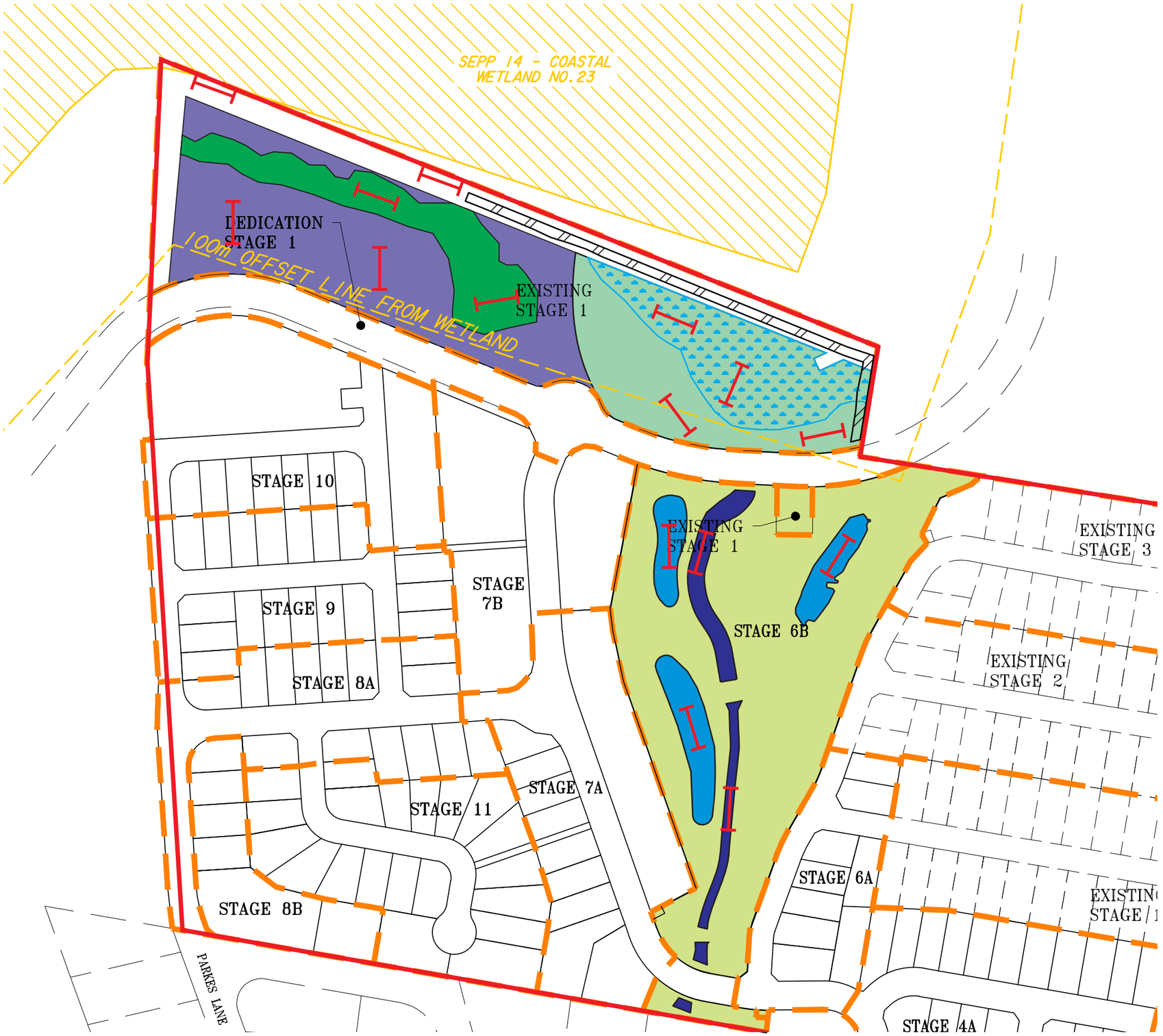
6.3 Monitoring of Natural Regeneration Areas

The monitoring program will include regular monitoring by a qualified ecologist who is to complete the following:

- **Transects**
    - Four (4) transects are to be placed within the natural regeneration areas – two (2) within terrestrial regeneration areas, and two (2) within aquatic regeneration areas (**FIGURE 9**);
    - Transect locations are to be permanently marked;
    - Transects are to be 25 metres in length;
    - During monitoring visits tape measures are to be placed on the ground and the specific measurable features recorded along the transects;
    - Specific measurable features include:
        - Areas of native vegetation cover;
        - Areas of weed cover;
        - Areas of deceased plants/bare ground/mud; and
    - Results are to be shown in a table which is to be presented in the monitoring reports.

- **Quadrats**
    - Three (3) Quadrats (5 m^2) are to be placed along each of the transects;
    - Quadrats must be placed 5 m apart along the length of the transect;
    - Quadrats are to be placed semi randomly within five (5) meters of the transect line;
    - The boundary of the quadrat with respect to the tape measure (e.g. between 5 – 10 metres on tape measure) will be recorded;
    - For each quadrat the following specific measurable features will be recorded:
        - Plant species occurring
        - Percentage cover
        - Height
        - Relative abundance of native species; and
    - Results are to be shown in a table which is to be presented in the monitoring reports.

- **Fixed Photo Points**
    - Permanent photo stations are to be located on each transect;
    - Four (4) photos are to be taken from each transect. Photos are to be taken to the north, south, east and west;



LEGEND

- Indicative Location of Monitoring Transect (25m)
- Site Outline
- Stage Boundary

Regeneration Areas

- Assisted Natural Regeneration (0.6ha)
- Assisted Wetland Regeneration (1.3ha)

Revegetation Areas

- Revegetation (Terrestrial Species) (1.6ha)
- Revegetation (Aquatic Species) - Stormwater Treatment Areas (0.4ha)
- Revegetation (Aquatic Species) - Central Drainage Channel (0.2ha)

Other Areas

- Existing Wetland Community
- Detention Bund
- SEPP14 Coastal Wetland
- Managed Landscape Zone

N

SOURCE: JWA; Meinhardt (Ref: X_116964-base DATED 17-04-2019.dwg); Form Landscape Architects (Ref: 100906_DA18_2019-04-17.pdf)
SCALE: 1 : 2500 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
Newland Developers Pty Ltd

PROJECT
Revised Vegetation Mgt & Rehabilitation Plan
Altitude Aspire
Fraser Drive, South Terranora, NSW
Shire of Tweed

FIGURE 9

PREPARED: BW
DATE: 18 April 2019
FILE:N09031_VMRP_Monitoring.cdr

TITLE

MONITORING TRANSECTS

- Photos should be labelled with the:
  - Transect code
  - Direction of view
  - The date and time; and
- Photos must be supplied in the monitoring reports in a form of prints no smaller than 4" x 6" and must be colour.

6.4 Monitoring of Revegetation Areas

This monitoring program is to be completed at the same time as the monitoring of natural regeneration areas. The monitoring is to be completed by a qualified ecologist who is to complete the following:

- **Transects**
  - Four (4) transects are to be placed within revegetation areas – two (2) within terrestrial revegetation areas, and two (2) within aquatic revegetation areas (**FIGURE 9**);
  - Transect locations are to be permanently marked;
  - Transects are to be 25 metres in length;
  - During monitoring visits, the transects are to be walked and specific measurable features recorded along the length of the transect;
  - Specific measurable features include:
    - Areas of vegetation cover (revegetation species);
    - Areas of weed cover;
    - Areas of deceased plants/bare ground/mud; and
  - Results are to be shown in a table which is to be presented in the monitoring reports.

- **Quadrats**
  - Three (3) Quadrats (5 m^2) are to be placed along each of the transects;
  - Quadrats must be placed 5 m apart along the length of the transect;
  - Quadrats are to be placed semi randomly within five (5) meters of the transect line;
  - For each quadrat the following specific measurable features will be recorded:
    - Plant species occurring
    - Percentage cover
    - Height
    - Relative abundance of native species; and

- Results are to be shown in a table which is to be presented in the monitoring reports.

- **Fixed Photo Points**
  - Permanent photo stations are to be located on each transect;
  - Four (4) photos are to be taken from each transect. Photos are to be taken to the north, south, east and west;
  - Photos should be labelled with the:
    - Transect code
    - Direction of view
    - The date and time; and
  - Photos must be supplied in the monitoring reports in a form of prints no smaller than 4" x 6" and must be colour.

6.5 Monitoring of Freshwater Wetland EEC and SEPP 14 Wetland

This monitoring program is to be completed in conjunction with other monitoring programs. This monitoring will be completed within the Freshwater Wetland EEC occurring on the subject site along with the adjacent SEPP 14 wetland. Monitoring will be completed during construction and for two (2) years after the final stage of development is completed.

- **Visual Assessment of Wetland Values**

  Impacts on wetland values and functions will be assessed through visually monitoring changes in the physical attributes over time. Baseline studies will focus on assessing the following attributes:
  - Integrity of beds and banks of the wetlands;
  - Cover and condition of wetland vegetation;
  - Location and extent of any weed infestations; and
  - Visual signs of water contamination (i.e. oil and grease, litter, evidence of ASS leachate.

- **Transects**
  - Four (4) transects are to be placed within revegetation areas – two (2) within terrestrial revegetation areas, and two (2) within aquatic revegetation areas (**FIGURE 9**);
  - Transect locations are to be permanently marked;
  - Transects are to be 25 metres in length;
  - During monitoring visits the transects are to be walked and specific measurable features recorded along the length of the transect;
  - Specific measurable features include:

        - Areas of vegetation cover (revegetation species);
        - Areas of weed cover;
        - Areas of deceased plants/bare ground/mud; and
    - Results are to be shown in a table which is to be presented in the monitoring reports.

- **Quadrats**
    - Three (3) Quadrats (5 m^2) are to be placed along each of the transects;
    - Quadrats must be placed 5 m apart along the length of the transect;
    - Quadrats are to be placed semi randomly within five (5) meters of the transect line;
    - For each quadrat the following specific measurable features will be recorded:
        - Plant species occurring
        - Percentage cover
        - Height
        - Relative abundance of native species; and
    - Results are to be shown in a table which is to be presented in the monitoring reports.

- **Fixed Photo Points**
    - Permanent photo stations are to be located on each transect;
    - Four (4) photos are to be taken from each transect. Photos are to be taken to the north, south, east and west;
    - Photos should be labelled with the:
        - Transect code
        - Direction of view
        - The date and time; and
    - Photos must be supplied in the monitoring reports in a form of prints no smaller than 4” x 6” and must be colour.

6.6 Timing

The monitoring is to be completed by a qualified ecologist.

In relation to monitoring of Natural Regeneration Areas (**Section 6.3**), Revegetation Areas (**Section 6.4**), and Freshwater Wetland EEC and SEPP 14 Wetland (**Section 6.6**), site visits should occur:

- Six (6) weeks after primary weeding;

- Six (6) weeks after initial plant-out;
- Every three (3) months thereafter until plants are sufficiently established (between two (2) - three (3) years); and
- Every six (6) months until project is completed (estimated 5 years).

6.7 Reporting of Monitoring Results

Following each inspection by the qualified ecologist, a report will be prepared that will include tables and photographs from the monitoring visits. The report will discuss the following:

- Works undertaken;
- Progress of regeneration/revegetation areas against performance targets using photos and tables showing the results of the monitoring visits;
- Significant problems encountered (death of seedlings, broken fences, vandalism etc.) and the effect of these on the plantings and aims of the revegetation or regeneration strategy;
- Success or failures of measures implemented to rectify previously identified problems; and
- Measures to be taken to rectify new problems.

All monitoring reports are to be forwarded to Council on an annual basis.

A Final Monitoring Report will be completed at the end of the five (5) year program. The Final report will determine if the Performance Targets have been met. If the performance targets have not been met, recommendations will be made for corrective actions and/or additional monitoring.

7 ADAPTIVE MANAGEMENT

The principles of adaptive management have been incorporated into the administration of restoration projects within a variety of governmental funding authorities and programs (Thom 1997). Comprehensive, long-term monitoring is a component of adaptive management, which relies on the accumulation of evidence (via long-term monitoring) to support a decision that demands action. If established early in the project planning phase and implemented during successive monitoring and management phases, adaptive management can be a powerful method to systematically assess and improve the performance of restored ecosystems (Thom 2000).

Before the implementation of any Adaptive management strategies a report is to be provided to the Tweed Shire Council detailing the proposed management actions and the predicted outcomes from such management practices.

ANNEXURE 1 – PROJECT APPROVAL CONDITIONS

Stormwater

B33 Impact on SEPP 14 Wetlands

The hydrologic impact of the development on the downstream SEPP 14 Wetland is to be confirmed as part of the detailed design of the development. The results of this assessment and demonstration that adequate measures are in place to ameliorate any impacts on the SEPP 14 Wetland are to be submitted to Council for approval prior to the issue of the Construction Certificate for each stage of the subdivision.

Landscaping and Vegetation Management

B44 Vegetation Management & Rehabilitation Plan

The commencement of the *Vegetation Management & Rehabilitation Plan* ("VMRP") (Annexure 10 to the Preferred Project Report) is to occur prior to the commencement of works on the site and continue to be implemented by the proponent until the performance targets are met and until such time that an agreement has been reached with Council for the dedication of the lands to which the plan applies. Prior to Issue of a Construction Certificate the VMRP is to be revised to the satisfaction of Council to incorporate the following:-

1) Commencement - The VMRP must commence prior to the commencement of works on the site in order to maximise lead time for restoration and rehabilitation works;
2) Implementation Period – the VMRP must state that vegetation management and rehabilitation is to be maintained by the proponent until an agreement for dedication of the lands to Council has been reached;
3) Performance standards and management actions – The VMRP must include performance standards and management actions relating to the two stages of rehabilitation, i.e. an initial establishment phase and the ongoing maintenance period;
4) Monitoring programs – The VMRP must provide monitoring programs for "Revegetation Areas" and "Natural Regeneration Areas", a clear outline as to the responsibility for the maintenance of these areas throughout the duration of the plan and whether monitoring will be carried out in the planted areas within the open space and stormwater detention areas;
5) Monitoring reports – the VMRP must state that all monitoring reports are to be forwarded to Council on an annual basis;
6) Survival of planted stock – the VMRP must provide monitoring parameters for recording the survival of planted stock; and
7) Bioretention basins – the VRMP must state that the planting out of bioretention basins and surrounding open space areas should be undertaken immediately following disturbance.
8) Monitoring of Freshwater Wetland EEC and SEPP 14 Wetland – The VMRP must provide a monitoring program for the Freshwater Wetland EEC and SEPP 14 Wetland which will be undertaken during the construction and for two years after the final stage of the development is completed too ensure that these communities are resilient enough to cope with any changes in hydrology (peak velocities). The VMRP must set out appropriate contingency mitigation measures in the event that impacts are identified.

Monitoring

B50 Stormwater Monitoring Plan

In order to demonstrate that the stormwater management system satisfactorily complies with the intended design and the *Tweed Shire Council Development Control Plan Stormwater Design Specification,* a Stormwater Monitoring Plan shall be submitted with the s68 Stormwater Application to Council for approval prior to issue of the Construction Certificate for the first stage of the project. Due to the proximity of the SEPP 14 wetlands, the plan shallconsider the appropriate water quality objectives of the *Tweed Urban Stormwater Quality Management Plan, 2012,* for drainage of stages 4, 5 and 6 for approval of the council.

ANNEXURE 2 - ECOLOGICAL RESTORATION PRINCIPLES

Ecological restoration aims to restore pre-existing indigenous ecosystems and ecological processes on disturbed sites, maintaining and developing the natural ecosystem to self-perpetuate (Perkins 1992). Perkins (1992) put forward a *restoration continuum* spanning from assisted natural regeneration, the least interventionist, to reconstruction (of original communities on cleared sites) and fabrication (of new communities on changed sites). These activities are undertaken in different circumstances in the field, but the boundaries are blurred, allowing practitioners to consider sites on an individual basis, according to the level of disturbance and the restoration potential identified in the site. The aim of ecological restoration is to restore to the highest practicable extent, and to develop a system that is sustainable in the long term.

In disturbed areas that cannot solely rely on natural regeneration potential, revegetation can be undertaken to reconstruct the original forested communities. Cleared sites can be replanted with species grown from seed collected in nearby local native vegetation. The use of seed of local provenance (origin) is a key principle underpinning the integrity of the work, and avoids possible genetic pollution of local woodland when future pollen exchange takes place between remnant and replanted woodland.

Unfortunately the suite of species that is available is often narrow, determined by practicalities of seed collection, the ability to propagate in a nursery and limits on field establishment in the environmental conditions prevailing on cleared land. Conceptually, this is merely establishing a framework into which additional plant and animal diversity can recruit or be reintroduced once the environment is modified (Perkins 1992).

Cleared sites are seldom completely devoid of native species. It is common to observe paddocks supporting threads of the original ground cover vegetation. This is often apparent in paddocks historically sown with exotic grasses to improve pasture. While the introduced grasses are usually dominant, a surprising diversity of native grasses and groundcovers can often persist. They have remained through a history of sustained grazing and are by definition adapted to grazing. The act of excluding livestock or other management activities can threaten native diversity, as biomass from the introduced grasses smothers these plants. Alternative biomass reduction can be achieved with slashing and fire however these have different effects and their own practical limitations.

Total groundcover biomass is reduced under a developing canopy, a phenomenon also evident in re-growing forest communities. The vigour of exotic grasses is greatly diminished, and some are unable to grow, leaving room for native plants that are adapted to the woodland ecosystem. Of course some native plants lose vigour in the forest canopy as well. Revegetation is thus forming an important mechanism for grassland manipulation and as a tool for creating a variety of niches in the ground layer. At the same time, revegetation is achieving the obvious objectives of increasing habitat values, restoring normal hydrology and increasing the range of

species available to recover in a site after disturbance. Revegetation needs to be used in combination with other techniques, and these processes will need to be studied in detail before they can be conclusively described as positive.

The mechanism of planting is likely to be a most important strategy in revegetation of the site, not as an end in itself, but as an important tool to ameliorate changed sites and release ecosystem resilience. While prolonged monitoring needs to be maintained in revegetation areas, there are indications that environmental conditions within the site will change in interesting ways as revegetation develops.

Reference

Perkins, I. 1992. *Land and Vegetation Management Plan for the Horsley Park Corridor*.

ANNEXURE 3 - WEED SPECIES LIST

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Anacardiaceae	*Mangifera indica*	Mango
Dicotyledons	Araliaceae	*Schefflera actinophylla*	Umbrella tree
Dicotyledons	Asclepiadaceae	*Gomphocarpus physocarpus*	Balloon cotton bush
Dicotyledons	Asteraceae	*Ageratina adenophora*	Crofton weed
Dicotyledons	Asteraceae	*Ageratina riparia*	Mistflower
Dicotyledons	Asteraceae	*Ageratum houstonianum*	Blue billygoat weed
Dicotyledons	Asteraceae	*Baccharis halimifolia*	Groundsel bush
Dicotyledons	Asteraceae	*Bidens pilosa*	Cobblers pegs
Dicotyledons	Asteraceae	*Carduus sp.*	Milk thistle
Dicotyledons	Asteraceae	*Cirsium vulgare*	Black thistle
Dicotyledons	Asteraceae	*Conyza albida*	Fleabane
Dicotyledons	Asteraceae	*Crassocephalum crepidioides*	Thickhead
Dicotyledons	Asteraceae	*Hypochoeris radicata*	Flatweed
Dicotyledons	Asteraceae	*Senecio madagascariensis*	Fireweed
Dicotyledons	Asteraceae	*Soliva pterosperma*	Bindii
Dicotyledons	Asteraceae	*Tagetes minuta*	Stinking roger
Dicotyledons	Asteraceae	*Taraxacum officinale*	Dandelion
Dicotyledons	Asteraceae	*Wedelia trilobata*	Singapore daisy
Dicotyledons	Asteraceae	*Xanthium occidentale*	Noogoora burr
Dicotyledons	Basellaceae	*Anredera cordifolia*	Madeira vine
Dicotyledons	Caesalpiniaceae	*Senna pendula* var. *glabrata*	Winter senna
Dicotyledons	Convolvulaceae	*Ipomoea cairica*	Coastal morning glory
Dicotyledons	Convolvulaceae	*Ipomoea indica*	Morning glory
Dicotyledons	Fabaceae	*Desmodium uncinatum*	Silver-leaved desmodium
Dicotyledons	Lauraceae	*Cinnamomum camphora*	Camphor laurel
Dicotyledons	Musaceae	*Musa paradisica*	Banana
Dicotyledons	Ochnaceae	*Ochna serrulata*	Mickey mouse plant
Dicotyledons	Oleaceae	*Ligustrum lucidum*	Large-leaved privet
Dicotyledons	Oleaceae	*Ligustrum sinense*	Small-leaved privet
Dicotyledons	Passifloraceae	*Passiflora edulis*	Passionfruit
Dicotyledons	Passifloraceae	*Passiflora suberosa* var. *suberosa*	Corky passionfruit
Dicotyledons	Passifloraceae	*Passiflora subpeltata*	White passionflower
Dicotyledons	Phytolaccaceae	*Rivina humilis*	Coral berry
Dicotyledons	Polygonaceae	*Persicaria strigosa*	Smartweed
Dicotyledons	Solanaceae	*Solanum mauritianum*	Wild tobacco tree
Dicotyledons	Solanaceae	*Solanum nigrum*	Black-berry nightshade
Dicotyledons	Solanaceae	*Solanum seaforthianum*	Brazilian nightshade
Dicotyledons	Verbenaceae	*Lantana camara*	Lantana
Monocotyledons	Asparagaceae	*Asparagus aethiopicus*	Asparagus fern
Monocotyledons	Asparagaceae	*Asparagus plumosus*	Climbing asparagus fern

Grouping	Family	Botanical Name	Common Name
Monocotyledons	Cyperaceae	*Cyperus eragrostis*	Tussock sedge
Monocotyledons	Poaceae	*Andropogon virginicus*	Whiskey grass
Monocotyledons	Poaceae	*Axonopus fissifolius*	Narrow-leaf carpet grass
Monocotyledons	Poaceae	*Chloris gayana*	Rhodes grass
Monocotyledons	Poaceae	*Cynodon dactylo*	Couch grass
Monocotyledons	Poaceae	*Digitaria didactyla*	Queensland blue couch
Monocotyledons	Poaceae	*Eragrostis* sp.	Lovegrass
Monocotyledons	Poaceae	*Melinis minutiflora*	Molasses grass
Monocotyledons	Poaceae	*Melinis repens*	Red natal grass
Monocotyledons	Poaceae	*Paspalum conjugatum*	Sour grass
Monocotyledons	Poaceae	*Paspalum dilatatum*	Paspalum
Monocotyledons	Poaceae	*Paspalum wettsteinii*	Broad-leaved paspalum
Monocotyledons	Poaceae	*Setaria* sp.	Pigeon grass
Monocotyledons	Poaceae	*Urochloa mutica*	Para grass

ANNEXURE 4 - WEED CONTROL METHODS

The following are control techniques that are to be utilised during site regeneration works:

- **Cut Stump Method** - This method involves cutting plant stems as close to ground level as possible and immediately painting the cut stump with herbicide. This treatment can also be applied as a basal bark application to the first 15-20 cm (entire circumference) of an uncut stem if the adult bark has not yet developed. Chemical use with this application is dependent upon the proximity of the weed to naturally ponding water or waterways and whether or not the chemical is registered for aquatic use.

- **Stem Injection** - Herbicides may be applied directly to the plant via stem injection. This involves applying an herbicide to the plant directly by drilling a hole into the stem and inserting the chemical. Axe cuts for stem injection can also be used. Cuts can be made at regular intervals around the stem and should leave a "pocket" in to which the chemical must be immediately injected. Axe cuts should penetrate the cambium layer, but not the hardwood.

- **Spray Method** - There are two (2) types of spraying methods that will be employed where appropriate:

    - Selective blanket spraying: The area must initially be checked for the presence of any native species. Any weeds within 2 m of the drip zone of existing native species will be removed by hand. Alternatively, native species will be covered with impermeable material (e.g. a tarpaulin) for protection during spraying;
    - Spot spraying: The spray nozzle will be kept close to ground to avoid any overspray. Individual weeds will be spot-sprayed at the site. This method of spraying will be employed as native species are interspersed throughout the exotic grasses; and
    - Herbicides specific to each target species, where appropriate, will be identified prior to the implementation of any works. Herbicides will be applied in accordance with the manufacturer's specifications and when environmental conditions are most preferred (e.g. wind and rainfall).

- **Cutting and Chipping** - Manual weeding may involve cutting and chipping, pulling, digging or slashing and is preferred, depending on the growth stage and situation as detailed:

    - Where native plants are growing within a weed infestation and the use of selective herbicide is not possible;
    - Where inadequate foliage is present to allow for successful uptake of herbicide e.g. Mile-a-minute runners typically exhibit this trait; and

  - When hand weeding, the stem must be grasped firmly at the base of the plant and pulled. A trowel, mattock or sharp knife may be needed to loosen the soil. Care must be taken not to leave behind stems or other plant pieces that may re-shoot. Hand weeding should also be undertaken at times when weeds are not seeding to reduce dispersal and spread. Hand pulling is not recommended for some weed species as they readily sucker if their roots are disturbed e.g. *Lantana camara*. This method will be employed when removing exotic grass species within retained vegetation.

- **Ring Barking -** This method involves removing the lower bark from the stem using a sharp implement to expose the phloem and xylem tissue to the outer environment thereby destroying it.

- **Basal Bark Method** - This method involves applying a herbicide to the lower 35-45 cm bark around the entire stem using a hand-pump backpack sprayer fitted with a shut-off at the wand tip and an adjustable cone nozzle or a small, ATV- (All-Terrain Vehicle) mounted sprayer with a shut-off at the wand tip and an adjustable cone nozzle.

ANNEXURE 5 – REVEGETATION SPECIES LIST

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Acanthaceae	*Pseuderanthemum variabile*	Pastel flower
Dicotyledons	Amaryllidaceae	*Crinum pedunculatum*	Crinum lily
Dicotyledons	Anacardiaceae	*Euroschinus falcata*	Ribbonwood
Dicotyledons	Apocynaceae	*Alyxia ruscifolia*	Prickly alyxia
Dicotyledons	Apocynaceae	*Carissa ovata*	Currant bush
Dicotyledons	Apocynaceae	*Melodinus australis*	Southern melodinus
Dicotyledons	Apocynaceae	*Parsonsia straminea*	Common silkpod
Dicotyledons	Apocynaceae	*Tabernaemontana pandacaqui*	Banana bush
Dicotyledons	Araliaceae	*Polyscias elegans*	Celerywood
Dicotyledons	Arecaceae	*Archontophoenix cunninghamiana*	Bangalow palm
Dicotyledons	Asclepiadaceae	*Hoya australis*	Native hoya
Dicotyledons	Bignoniaceae	*Pandorea jasminoides*	Bower vine
Dicotyledons	Boraginaceae	*Ehretia acuminata*	Koda
Dicotyledons	Casuarinaceae	*Allocasuarina littoralis*	Black she-oak
Dicotyledons	Casuarinaceae	*Casuarina glauca*	Swamp she-oak
Dicotyledons	Celastraceae	*Denhamia celastroides*	Denhamia
Dicotyledons	Cunoniaceae	*Caldcluvia paniculosa*	Soft corkwood
Dicotyledons	Cunoniaceae	*Pseudoweinmannia lachnocarpa*	Rose Marara
Dicotyledons	Dilleniaceae	*Hibbertia scandens*	Climbing guinea flower
Dicotyledons	Dioscoreaceae	*Dioscorea transversa*	Native yam
Dicotyledons	Ebenaceae	*Diospyros pentamera*	Myrtle ebony
Dicotyledons	Elaeocarpaceae	*Elaeocarpus grandis*	Blue quandong
Dicotyledons	Elaeocarpaceae	*Elaeocarpus obovatus*	Hard quandong
Dicotyledons	Elaeocarpaceae	*Elaeocarpus reticulatus*	Blueberry ash
Dicotyledons	Elaeocarpaceae	*Sloanea woollsii*	Yellow carabeen
Dicotyledons	Euphorbiaceae	*Breynia oblongifolia*	Coffee bush
Dicotyledons	Euphorbiaceae	*Glochidion ferdinandi* var. *ferdinandi*	Cheese tree
Dicotyledons	Euphorbiaceae	*Glochidion sumatranum*	Umbrella cheese tree
Dicotyledons	Euphorbiaceae	*Homalanthus populifolius*	Native bleeding heart
Dicotyledons	Euphorbiaceae	*Macaranga tanarius*	Macaranga
Dicotyledons	Euphorbiaceae	*Mallotus claoxyloides*	Green Kamala
Dicotyledons	Euphorbiaceae	*Mallotus phillippensis*	Red kamala
Dicotyledons	Eupomatiaceae	*Eupomatia laurina*	Bolwarra
Dicotyledons	Fabaceae	*Callerya megasperma*	Native wistaria
Dicotyledons	Faboideae	*Castanospermum australe*	Black bean
Dicotyledons	Faboideae	*Kennedia rubicundra*	Purple running pea
Dicotyledons	Lauraceae	*Cryptocarya laevigata*	Glossy laurel
Dicotyledons	Lauraceae	*Cryptocarya microneura*	Murrogun
Dicotyledons	Lauraceae	*Cryptocarya obovata*	Pepperberry tree
Dicotyledons	Lauraceae	*Cryptocarya triplinervis var pubens*	Three-veined laurel (hairy form)
Dicotyledons	Lauraceae	*Endiandra globosa*	Black walnut
Dicotyledons	Lauraceae	*Endiandra pubens*	Hairy walnut

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Lauraceae	*Endiandra sieberi*	Hard corkwood
Dicotyledons	Lauraceae	*Neolitsea dealbata*	White bolly gum
Dicotyledons	Lauraceae	*Pratia purpurascens*	White root
Dicotyledons	Melastomataceae	*Melastoma affine*	Native lasiandra
Dicotyledons	Meliaceae	*Dysoxylum fraserianum*	Rosewood
Dicotyledons	Meliaceae	*Synoum glandulosum*	Scentless rosewood
Dicotyledons	Menispermaceae	*Stephania japonica*	Snake vine
Dicotyledons	Mimosaceae	*Archidendron muellerianum*	Veiny lace flower
Dicotyledons	Monimiaceae	*Wilkiea austroqueenslandica*	Smooth wilkiea
Dicotyledons	Monimiaceae	*Wilkiea huegeliana*	Veiny wilkiea
Dicotyledons	Moraceae	*Ficus coronata*	Creek sandpaper fig
Dicotyledons	Moraceae	*Ficus macrophylla*	Moreton bay fig
Dicotyledons	Moraceae	*Ficus virens*	White fig
Dicotyledons	Moraceae	*Ficus watkinsiana*	Strangler fig
Dicotyledons	Moraceae	*Streblus brunonianus*	Whalebone tree
Dicotyledons	Moraceae	*Trophis scandens*	Burny vine
Dicotyledons	Myrtaceae	*Acmena hemilampra*	Broad leaved lilly-pilly
Dicotyledons	Myrtaceae	*Acmena smithii*	Common lilly pilly
Dicotyledons	Myrtaceae	*Corymbia intermedia*	Pink bloodwood
Dicotyledons	Myrtaceae	*Lophostemon suaveolens*	Swamp box
Dicotyledons	Myrtaceae	*Lophostemon confertus*	Brushbox
Dicotyledons	Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved paperbark
Dicotyledons	Myrtaceae	*Pilidiostigma glabrum*	Plum myrtle
Dicotyledons	Myrtaceae	*Syzygium oleosum*	Blue lilly pilly
Dicotyledons	Oleaceae	*Notelaea longifolia*	Large mock olive
Dicotyledons	Oleaceae	*Olea paniculata*	Native Olive
Dicotyledons	Pittosporaceae	*Pittosporum multiflorum*	Orange thorn
Dicotyledons	Pittosporaceae	*Pittosporum revolutum*	Hairy pittosporum
Dicotyledons	Pittosporaceae	*Pittosporum undulatum*	Sweet pittosporum
Dicotyledons	Rhamnaceae	*Alphitonia excelsa*	Red ash
Dicotyledons	Rubiaceae	*Atractocarpus benthamiana*	Native gardenia
Dicotyledons	Rubiaceae	*Morinda jasminoides*	Morinda
Dicotyledons	Rubiaceae	*Pomax umbellata*	Pomax
Dicotyledons	Rubiaceae	*Psychotria loniceroides*	Hairy pyschotria
Dicotyledons	Rutaceae	*Melicope elleryana*	Pink-flowered doughwood
Dicotyledons	Rutaceae	*Zieria smithii*	Sandfly ziera
Dicotyledons	Sapindaceae	*Arytera distylis*	Twin–leaved coogera
Dicotyledons	Sapindaceae	*Cupaniopsis newmanii*	Long-leaved tuckeroo
Dicotyledons	Sapindaceae	*Elattostachys nervosa*	Green tamarind
Dicotyledons	Sapindaceae	*Guioa semiglauca*	Guioa
Dicotyledons	Sapindaceae	*Jagera pseudorhus*	Foambark
Dicotyledons	Sapindaceae	*Mischocarpus pyriformis*	Yellow pear fruit
Dicotyledons	Sapotaceae	*Pouteria chartacea*	Thin-leaved condoo
Dicotyledons	Sterculiaceae	*Commersonia bartramia*	Brown kurrajong
Dicotyledons	Thymelaeaceae	*Wikstroemia indica*	Wikstromeia
Dicotyledons	Ulmaceae	*Aphananthe philippinensis*	Rough–leaved elm

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Vitaceae	*Cissus antarctica*	Water vine
Dicotyledons	Vitaceae	*Cissus hypoglauca*	Five-leaf water vine
Ferns and Fern Allies	Adiantaceae	*Adiantum hispidulum*	Rough maidenhair
Ferns and Fern Allies	Adiantaceae	*Pellaea falcata*	Sickle fern
Ferns and Fern Allies	Aspleniaceae	*Asplenium australasicum*	Bird's nest fern
Ferns and Fern Allies	Athyriaceae	*Diplazium dilatatum*	Lady fern
Ferns and Fern Allies	Blechnaceae	*Blechnum cartilagineum*	Gristle fern
Ferns and Fern Allies	Blechnaceae	*Blechnum indicum*	Swamp water fern
Ferns and Fern Allies	Blechnaceae	*Doodia aspera*	Rasp fern
Ferns and Fern Allies	Cyatheaceae	*Cyathea leichhardtiana*	Prickly tree fern
Ferns and Fern Allies	Dennstaedtiaceae	*Pteridium esculentum*	Bracken
Ferns and Fern Allies	Dryopteridaceae	*Lastreopsis munita*	Naked shield fern
Ferns and Fern Allies	Glecheniaceae	*Histiopteris incisa*	Batswing fern
Ferns and Fern Allies	Schizaeaceae	*Lygodium microphyllum*	Climbing snake fern
Monocotyledons	Araceae	*Alocasia brisbanensis*	Cunjevoi
Monocotyledons	Araceae	*Pothos longipes*	Pothos vine
Monocotyledons	Arecaceae	*Calamus muelleri*	Lawyer vine
Monocotyledons	Arecaceae	*Livistona australis*	Cabbage palm
Monocotyledons	Asteliaceae	*Cordyline petiolaris*	Broad-leaved palm lily
Monocotyledons	Asteliaceae	*Cordyline rubra*	Red-fruited palm lily
Monocotyledons	Commelinaceae	*Commelina cyanea*	Native wandering jew
Monocotyledons	Cyperaceae	*Gahnia sieberiana*	Red-fruited saw-sedge
Monocotyledons	Cyperaceae	*Lepidosperma laterale*	Variable sword-sedge
Monocotyledons	Flagellariaceae	*Flagellaria indica*	Whip vine
Monocotyledons	Lomandraceae	*Lomandra longifolia*	Long-leaved matrush
Monocotyledons	Luzuriagaceae	*Eustrephus latifolius*	Wombat berry
Monocotyledons	Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling lily
Monocotyledons	Phormiaceae	*Dianella caerulea*	Blue flax lily
Monocotyledons	Poaceae	*Entolasia stricta*	Wiry panic
Monocotyledons	Poaceae	*Eragrostis* sp.	Lovegrass
Monocotyledons	Poaceae	*Hemarthria uncinata*	Matgrass
Monocotyledons	Poaceae	*Imperata cylindrica*	Blady grass
Monocotyledons	Ripogonaceae	*Ripogonum album*	White supplejack
Monocotyledons	Smilacaceae	*Smilax australis*	Prickly smilax
Monocotyledons	Smilacaceae	*Smilax glyciphylla*	Smooth smilax
Monocotyledons	Zingiberaceae	*Alpinia caerulea*	Native ginger

ANNEXURE 6 – AQUATIC REVEGETATION

A palette of species recommended for planting in the wetland areas of the site has been developed based on the existing local flora assemblages and the recommendations contained in the Constructed Wetlands Manual (DLWC 1998).

A list of suitable species is also provided within the Landscape Masterplan (Form Landscape Architects 2019).

A comprehensive wetland species list is provided below.

AQUATIC REVEGETATION SPECIES LIST

Planting zone	Common Name	Botanical Name	Plant Density/m^2*
1	Bare twigrush	*Baumea juncea*	2-3
	Gristle fern	*Blechnum cartilagineum*	
	Swamp water fern	*Blechnum indicum*	
	Rough saw sedge	*Gahnia aspera*	
	Red-fruited saw sedge	*Gahnia sieberiana*	
	Slender matrush	*Lomandra hystrix*	
	Long-leaved matrush	*Lomandra longifolia*	
	Water Couch	*Paspalum distichum*	
	Common spike-rush	*Eleocharis acuta*	
2	Twigrush	*Baumea rubiginosa*	3-4
		Carex appressa	
	Sedge	*Cyperus exaltatus*	
	Knobby club rush	*Isolepis nodosa*	
	Soft rush	*Juncus kraussiana*	
	Common rush	*Juncus usitatus*	
	Giant sedge	*Lepironia articulata*	
	Variable sword sedge	*Lepidosperma laterale*	
	Marsh Clubrush	*Bolboschoenus fluviatilis*	
	River clubmarsh	*Schoenoplectus validus*	
	Spike rush	*Eleocharis equisetina*	
3	Jointed Twigrush	*Baumea articulata*	3
	Rusty finger rush	*Fimbristylis ferruginea*	
		Schoenoplectus mucronatus	
4	Tall spikerush	*Eleocharis sphacelata*	3-4
	Giant sedge	*Lepironia articulata*	

* Denotes total plant density within each zone.

Planting zones have been derived from the Constructed Wetlands Manual (DLWC 1998) and are as follows:

1) Mostly dry (75%) – some seasonal water logging;
2) Wet (50%)/ Dry (50%);
3) 0.25m – 0.5m deep;

4) 0.5m – 2m deep.

It should be noted that planting densities shown are the estimated maximum planting density for each planting zone. Natural recruitment of native species in some areas will reduce necessary planting densities.

ANNEXURE F

BURCHILLS
SCIENCE AND ENGINEERING



Altitude Aspire, Terranora

Ecological Assessment

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Executive Summary

Burchills was engaged by Newland Developers Pty Ltd to prepare an Ecological Assessment for a Development Application over Lot 1 DP175234, 93 Parkes Lane, Terranora (subject site).

This ecological assessment was prepared to comply with the provisions of the NSW Biodiversity Conservation Act 2016 and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The Tweed Local Environment Plan zones the majority of the subject site as General Residential with the balance zoned Deferred Matter.

Results of desktop surveys indicate seven (7) matters of local environmental significance are mapped as occurring on the site:

- SEPP Coastal Management 2018 coastal wetlands, coastal environment and coastal use;
- Bioregional Fauna Corridor;
- Tree Preservation;
- Areas of very high ecological status;
- Areas of high ecological sensitivity;
- Drainage channels of 2nd order or above; and
- Priority areas for bushland and non-bushland habitat rehabilitation.

Flora and fauna surveys were undertaken across the site during April and May 2017. A total of 163 species of flora were identified within the site, comprising 108 native species and 55 non-native species.

One (1) threatened flora species was recorded during the surveys – Rough-shelled bushnut (*Macadamia tetraphylla*). A single juvenile specimen (1.2m high) was recorded in Vegetation Association A, on the site's eastern boundary in close vicinity to the existing dwelling. A subsequent site investigation (JWA, 2018b) found four (4) additional specimens in close proximity to this individual. This species is listed as Vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). All specimens of *Macadamia tetraphylla* will be translocated prior to earthworks commencing in accordance with the Translocation Plan (JWA, 2018b).

The flora survey recorded a total of 37 weed species (23% of the site's total flora species) within the site including seven (7) identified as a biosecurity matter under the NSW *Biosecurity Act 2015*. Camphor laurel was the most widely recorded weed, detected in all mapped vegetation associations.

Vegetation communities were verified through ground truthing and classified as follows:

Type A. Tall Closed Forest (*Cinnamomum camphora*);
Type B. Tall Open/Closed Swamp Sclerophyll Forest (*Archontophoenix cunninghamiana*,-*Melaleuca quinquenervia*);
Type C. Tall Open/Closed Moist Sclerophyll Forest with Rainforest Understorey;
Type D. Mid-high Wet Grassland / Sedgeland

Type E. Maintained Anthropogenic Grassland.

Vegetation Association B represents an alliance of the TSC Act Endangered Ecological Community (EEC) Swamp Sclerophyll Forest on Coastal Floodplains. This EEC falls within a protected area under the plan of development and will not be impacted by the proposed development.

Fauna surveys detected three (3) threatened species on the subject site including:

- *Nyctimene robinsoni* (Eastern tube-nosed bat);
- *Ptilinopus regina* (Rose-crowned fruit-dove); and
- *Daphoenositta chrysoptera* (Varied sittella).

Though these species were detected within the development footprint, their primary habitat (Vegetation Association B) falls within a protected area under the plan of development and will not be impacted by the proposed development.

The site falls within a koala management area under the *Tweed Coast Comprehensive Koala Plan of Management 2014* so this species was targeted during surveys. No koalas or evidence of recent activity by this species was detected.

An assessment of significance pursuant to Part 7 (7.3) of the *Biodiversity Conservation Act 2016* was performed for all threatened flora, fauna and ecological communities likely to occur within the subject site. Criteria used to select the threatened species for assessment included:

- Distribution of the species;
- Database records within 10 km of the site; and
- Availability of the species' habitat on the site.

Based on the results of the assessments of significance, it was concluded that the proposed development would not contribute to a reduction in local populations of affected species nor remove any critical foraging or breeding habitat.

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Appendices

Appendix A – EPBC Act Protected Matters Search Results

Appendix B – Flora Species Recorded on Site

1. Introduction

Burchills Engineering Solutions Pty Ltd (Burchills) was engaged by Newland Developers Pty Ltd to prepare a Detailed Ecological Assessment over Lot 1 DP175234, located at 93 Parkes Lane, Terranora within the Tweed Shire local government area (the subject site).

The intent of this assessment is to detail the ecological features and functions within the subject site and identify any potential impacts to these values as a result of development. The report includes desktop assessments and field investigations. Development approval has been granted and a Planning Agreement between the proponent and Tweed Shire Council established for the initial stages of the Altitude Aspire neighbourhood, located to the immediate east of the subject site.

1.1 Objectives

The objectives of this Ecological Assessment are to:

- Map site features such as Vegetation Associations, topographical features, and existing infrastructure;
- Assess ecological features including:
    - Location of expected and known significant flora, fauna and habitat;
    - Location of poorly conserved ecosystems;
    - Significant weed infestations;
    - All waterbodies and drainage lines;
    - Location and tenure of conservation reserves; and
    - Location of areas subject to *Voluntary Conservation Agreements*;
- Perform Assessments of Significance for threatened species confirmed or potentially occurring on the subject site (including 7 Part Tests of Significance);
- Assess the proposed development against the Tweed Coast Comprehensive Koala Plan of Management;
- Assess ecological functions, including core habitat areas and ecological corridors;
- Assess the potential impacts of the development on matters of environmental significance;
- Provide recommendations to mitigate the impacts of development on matters of environmental significance; and
- Propose any additional management plans required to conserve matters of environmental significance identified in the study area.

1.2 Site Description and Surrounding Land Use

The subject site is located at 93 Parkes Lane, Terranora, within the Tweed Shire Council local government area. The site has a total area of approximately 31 ha. The site is currently undeveloped and is used for cattle grazing at present. Historically, the site has been used for agriculture and cattle grazing. There are several sheds on the site and a disused dwelling.

The surrounding land use pattern is characterised by rural living and low-scale residential to the south east. The site's northern boundary adjoins Trutes Bay, part of the Terranora Broadwater (Terranora Creek).

Site access is via Parkes Lane in the south-eastern corner (Figure 1.1). The site was cleared historically for agricultural use with parts of the site vegetated with regrowth and Camphor laurel.

Under the *Tweed Local Environmental Plan 2014* (Tweed LEP), the majority of the site is zoned as R1 – General Residential. The northern third of the site is mapped as Deferred Matter. Under the superseded LEP 2000, this area was mapped as Environmental Protection (Wetland and Littoral Rainforest) zoning is present along the northern site boundary (7a in Figure 1.2) and the western boundary is zoned Environmental Protection (Scenic / Escarpment) (7d in Figure 1.2). The majority of the site falls within the Urban Release area under the Tweed LEP.

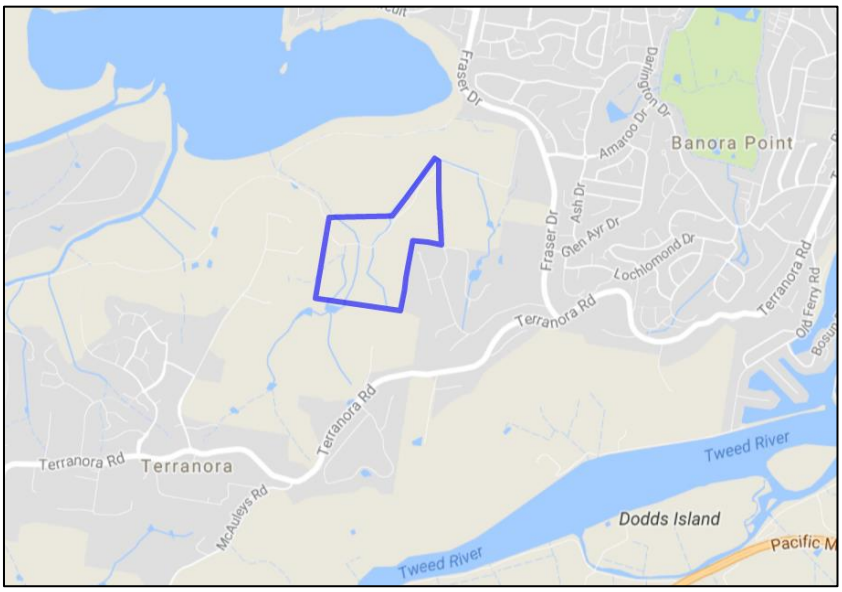


Figure 1.1 Site Location Map (Source: Nearmaps 2017)

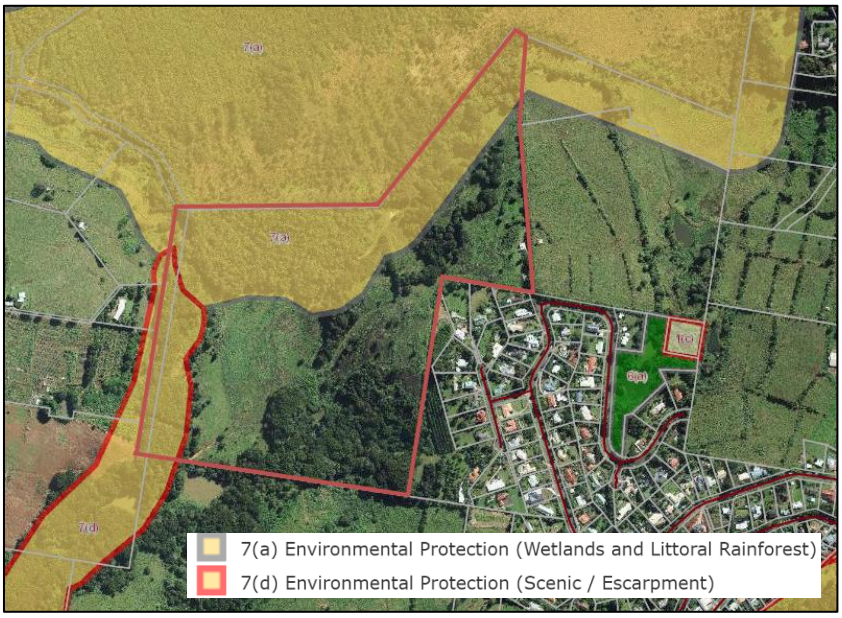


Figure 1.2 Tweed LEP 2014 Zoning

2. Description of Proposed Development

The proposed development comprises 131 residential lots, four (4) unit sites, two (2) shop precincts, public reserves and drainage reserves. The development will be staged commencing on the eastern boundary to connect with the existing Altitude Aspire development. Figure 2.1 shows the proposed layout over recent satellite imagery.

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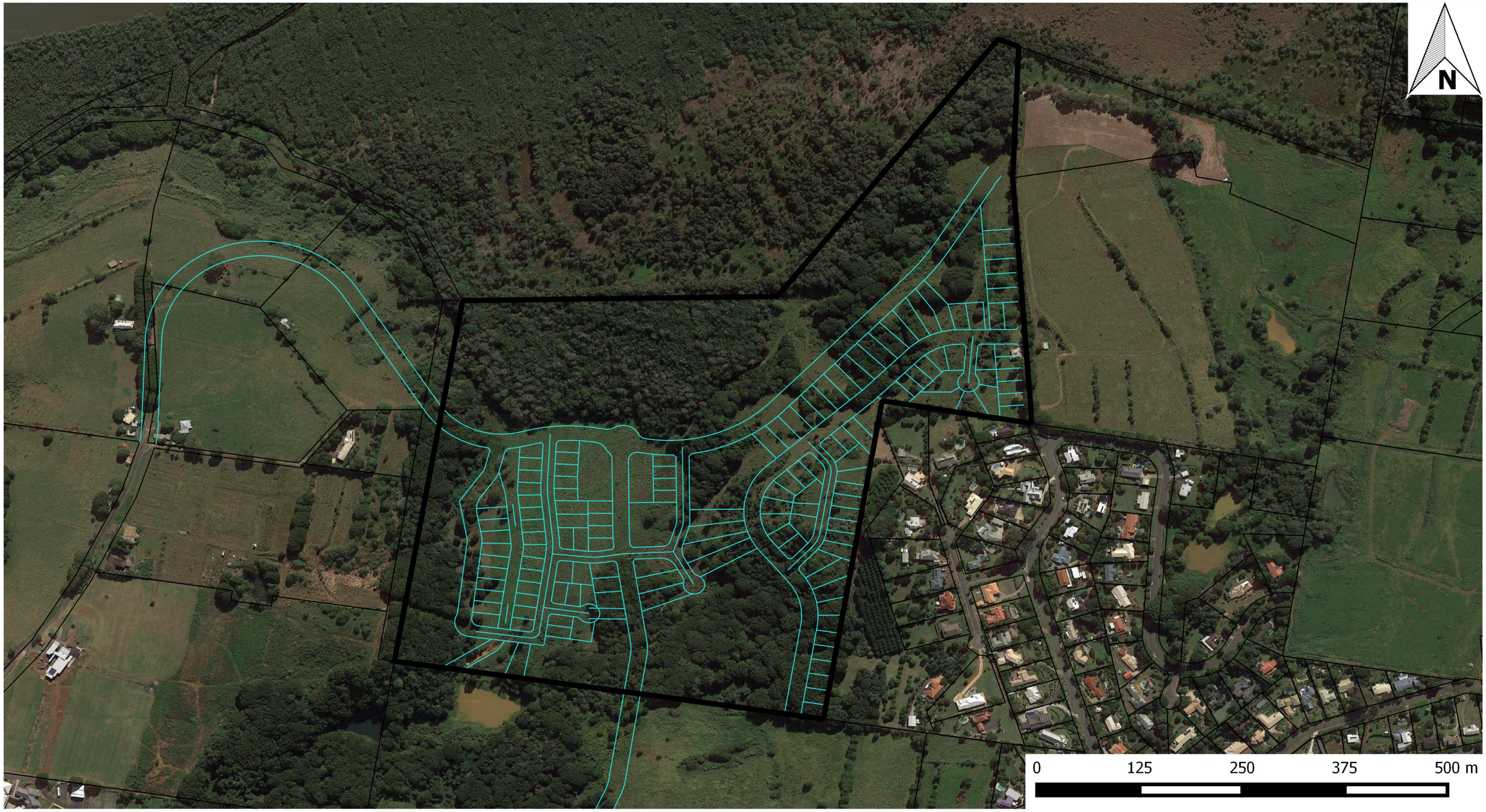


FIGURE 2.1 Aerial Imagery
LOT 1 ON DP175234
NEWLAND DEVELOPERS PTY LTD

PROJECTION: GDA94/MGA ZONE 56
PROJECT: BE170043
DATE: JULY 2017

LEGEND

- Site_Location
- Proposed Layout BPS 170308

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3. Abiotic Environment

To provide a background and context for the investigation of ecological features and functions for the site, a desktop review of abiotic parameters associated with the site has been undertaken. The following sections present the findings of these assessments.

3.1 Topography and Drainage

The site generally slopes north-westerly from a ridgeline at approximately 55-60m AHD in the south east to an alluvial flat in the north-west of the site at approximately 2-5AHD (Figure 3.1).

Stormwater flows northerly through the site mostly by sheet flow but also via a number of small drainage lines to the wetland area north of the site. This wetland flows into the Terranora Broadwater (part of Terranora Ck).

3.2 Soils and Geology

The geology of the local area including the subject site comprises aeolian and marine quartz sand sheets overlying peat and alluvium in the lower areas, with deep soils (>200 cm) and basalt derived Ferrosols on the slopes and higher ground (Morand 1996).

The Soil Landscapes of the Murwillumbah-Tweed Heads 1:100,000 mapping (OEH, 1996) indicates the site soils are classified as “Estuarine Cobaki” and “Erosional Billinudgel” (Figure 3.1). A small area of the site on the higher ridgeline at the south-eastern corner is classified as “Carool Variant a”.

The Billinudgel Soil Landscape is described as: *Palaeozoic Neranleigh-Fernvale Group - Thinly bedded fissile shales, siltstones and sandstones with occasional more massive greywackes, volcanic tuffs, agglomerates, sandstones and massive cobble conglomerates* (Morand 1996).

The Cobaki Landscape is described as: *Pleistocene sand sheets overlying peat and alluvium. Soils are commonly (up to 100 cm) brownish black peaty loam (field pH 5.5), overlying >200 cm of dark buttery silty marine clay (field pH 5.5 – 7.0 when wet but which may drop to 2.0 – 3.0 when exposed)* (Morand 1996).

The Carool Soil Landscape is described as: *Lamington Volcanics – Tertiary basalt with members of rhyolite, trachyte, tuff, agglomerate, conglomerate* (Morand 1996).

3.3 Acid Sulfate Soils

The *Tweed Local Environmental Plan 2014* (LEP) - Acid Sulfate Soils Planning Map classifies the site as Class 2 (works below the ground surface) and Class 5 (works within 500m of adjacent class 1, 2, 3 or 4 land which are likely to lower the watertable below 1m AHD in class 1, 2, 3, or 4 land) within the development footprint (Figure 3.2). In accordance with Part 7, Section 7.1, Clause 3 of the LEP, no works may be carried out on the allotted land parcel unless an Acid Sulfate Soils Management Plan has been prepared and has been provided to the consent authority (Tweed Shire Council).

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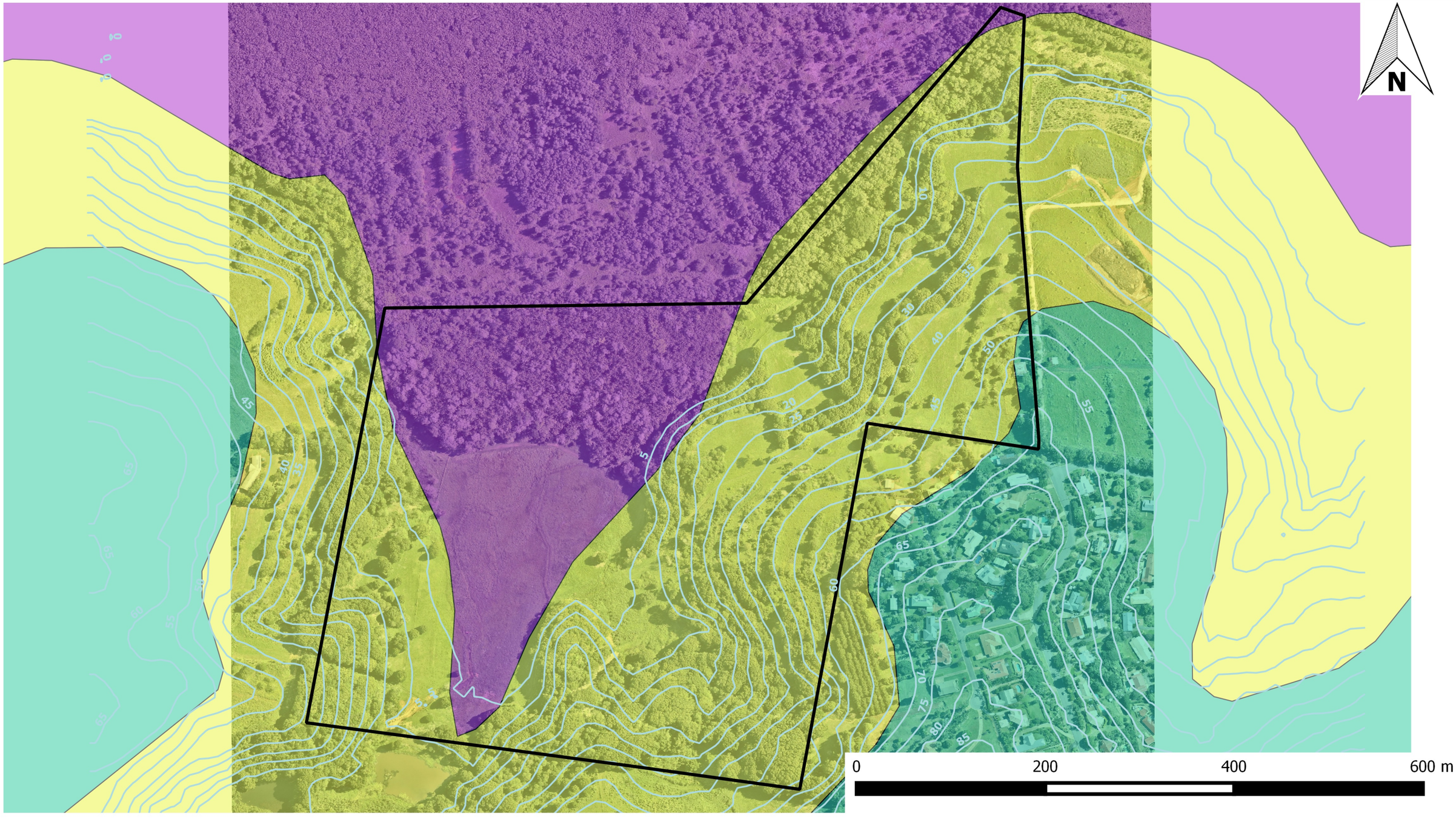


FIGURE 3.1 Soil Landscapes and 5m Contours
LOT 1 ON DP175234
NEWLAND DEVERLOPERS PTY LTD

PROJECTION: GDA94/MGA ZONE 56
PROJECT: BE170043
DATE: APRIL 2017

LEGEND

Soils Landscapes OEH 1996

- BILLINUDGEL
- CAROOL variant a
- COBAKI

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3.4 Flooding Hazard

Tweed Shire Council Planning Maps indicates an area in the north of the site is subject to flooding. The design flood level is at 2.6M AHD (Figure 3.2). Design flood levels are based on the 100-year average recurrence interval (ARI) year flood, or a flood that has a 1% chance of occurring in a given year.

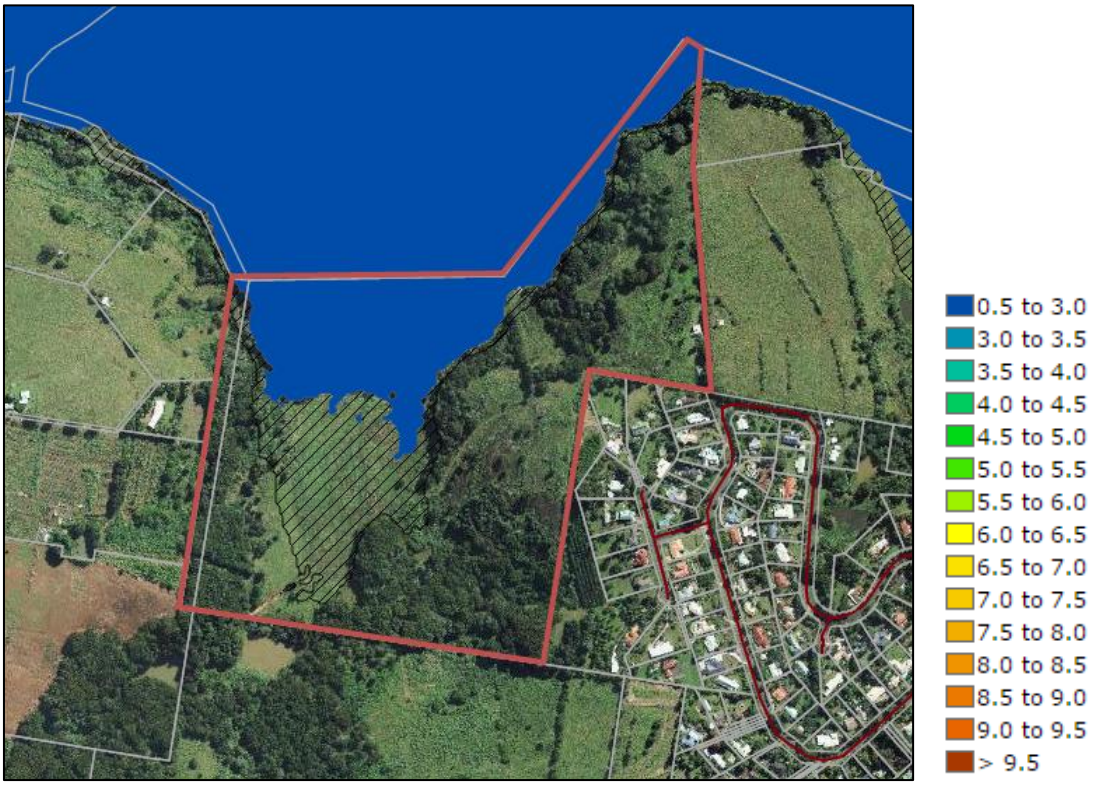


Figure 3.2 Tweed Shire Council Design Flood Levels (Source: Tweed Local Environment Plan 2014)

3.5 Bush Fire Prone Land

The NSW Rural Fire Service's *Guide for Bush Fire Prone Land Mapping* document identifies two (2) categories of vegetation with relation to bush fire prone land:

- Vegetation Category 1:
  - Areas of forest, woodlands, heaths (tall and short), forested wetlands and timber plantations.
  - Remnant and Short Fire Run vegetation within 30 metres of each other where the combined area is greater than 2.5 hectares.
- Vegetation Category 2:
  - Grasslands, freshwater wetlands, semi-arid woodlands, arid shrublands and rainforests.
  - Remnant vegetation and short fire runs greater than 100 metres lateral separation from Category 1 vegetation and 30 metres from other Category 2 vegetation.

The LEP – Bushfire Prone Land Map (2012) shows large areas of Vegetation Category 1 and 2 over the site. Buffers surround these areas (Figure 3.3).

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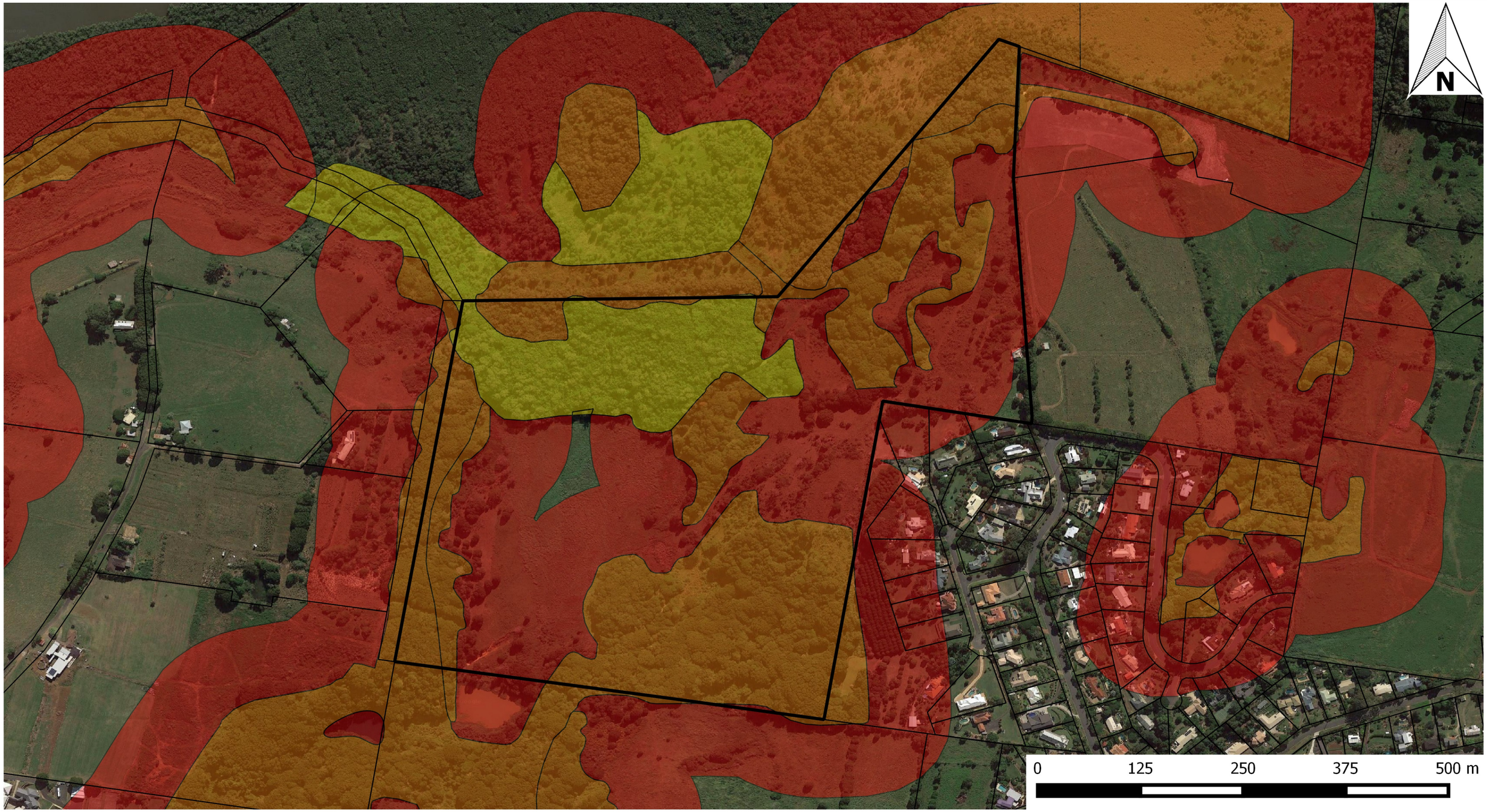


FIGURE 3.3 Potential Bushfire Areas
LOT 1 ON DP175234
NEWLAND DEVELOPERS PTY LTD

PROJECTION: GDA94/MGA ZONE 56
PROJECT: BE170043
DATE: JULY 2017

LEGEND

Bushfire Hazard Category

- Vegetation Buffer
- Vegetation Category 1
- Vegetation Category 2

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4. Matters of Environmental Significance

A desktop assessment was conducted to evaluate the national, state and local matters of environmental significance within and proximate to the subject site. The outcomes of these investigations are presented in the following sections.

4.1 Desktop Survey Overview

To provide a background and context for the investigation of ecological features and functions for the site, and to devise the methodology and survey effort for field investigations relating to vegetation communities and their associated fauna, a desktop analysis was undertaken. The likely quality of potential fauna habitat and any potentially significant species that may be using the site or local area was also investigated using these methods. The following sections present the findings of these assessments.

The following desktop search tools and databases were analysed to obtain information relating to the site:

- Previous site investigations;
- Tweed Shire Council *Local Environmental Plan 2014* mapping;
- Tweed Shire Council *Vegetation Management Strategy 2004* mapping;
- BioNet Atlas of NSW Wildlife Records; and
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool.

A brief discussion in relation to the results, search parameters and rationale for search parameters for the desktop survey are presented in the following sections.

4.2 Matters of National Environmental Significance

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Federal legislation that provides a framework for the protection and management of nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the Act as *Matters of National Environmental Significance*.

A significant impact is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. All of these factors should be considered when determining whether an action is likely to have a significant impact on the environment. If a proposed action is likely to have a significant impact on a Matter of National Environmental Significance, it must be referred to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities for assessment against the EPBC Act.

The Protected Matters Search Tool was used to determine if matters of National significance were present on the subject site. No confirmed matters protected under the EPBC Act were present on the site.

Based on an assessment of the environmental features, functions and values of the site, and the geographical location, scale and potential impacts associated with the proposal, there are no impacts

that could be considered as important, notable or significant at a national level, or other factors associated with the subject site or development that trigger the provisions of EPBC Act. Therefore, it has been concluded that the proposal does not require referral to the Australian Government Minister for the Environment, Heritage and the Arts.

4.3 Matters of State Environmental Significance

Planning in NSW is largely governed by two pieces of legislation; the *Environmental Planning and Assessment Act 1979* and the *Environmental Planning and Assessment Regulation 2000*. Whilst both legislative instruments provide the overarching structure for planning in NSW, there are several other statutory documents that support this structure including; State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs) (NSW Planning and Environment, 2015).

State Environmental Planning Policies (SEPPs) deal with matters of State or regional environmental planning significance.

There are three (3) SEPPs that are applicable to the site or in immediately adjacent areas. These SEPPs include:

- State Environmental Planning Policy (Coastal Management) 2018;
- State Environmental Planning Policy No. 44 - Koala Habitat Protection; and
- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017.

4.3.1 State Environmental Planning Policy (Coastal Management) 2018

The aim of Coastal Management State Environmental Planning Policy 2018 is to protect and manage the natural, cultural, recreational and economic attributes of the NSW coast. It defines the four coastal management areas in the *Coastal Management Act 2016* through detailed mapping and specifies assessment criteria that are tailored for each coastal management area.

The Coastal Management Act defines the four (4) coastal management areas in the coastal zone as:

- Coastal wetlands and littoral rainforests area;
- coastal vulnerability area;
- coastal environment area; and
- coastal use area.

Development consent is required where land falls within one of the four management areas. Figures 4.1 - 4.3 indicate the site falls within a coastal wetland area, coastal environment and coastal use area. No maps are currently available for coastal vulnerability areas. Therefore, development consent is required.

This policy requires certain development applications where there is deemed to be a cumulative impact of the development on the environment to be referred to the Director-General for comment.

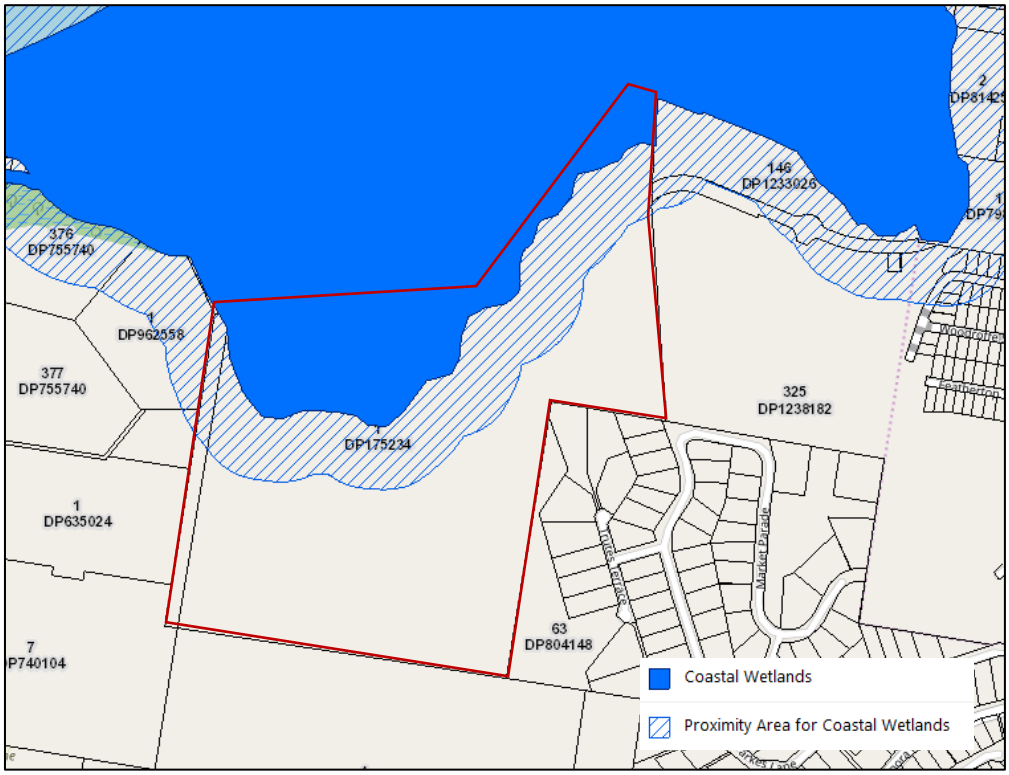


Figure 4.1 Coastal Wetlands and Proximity Areas Mapping

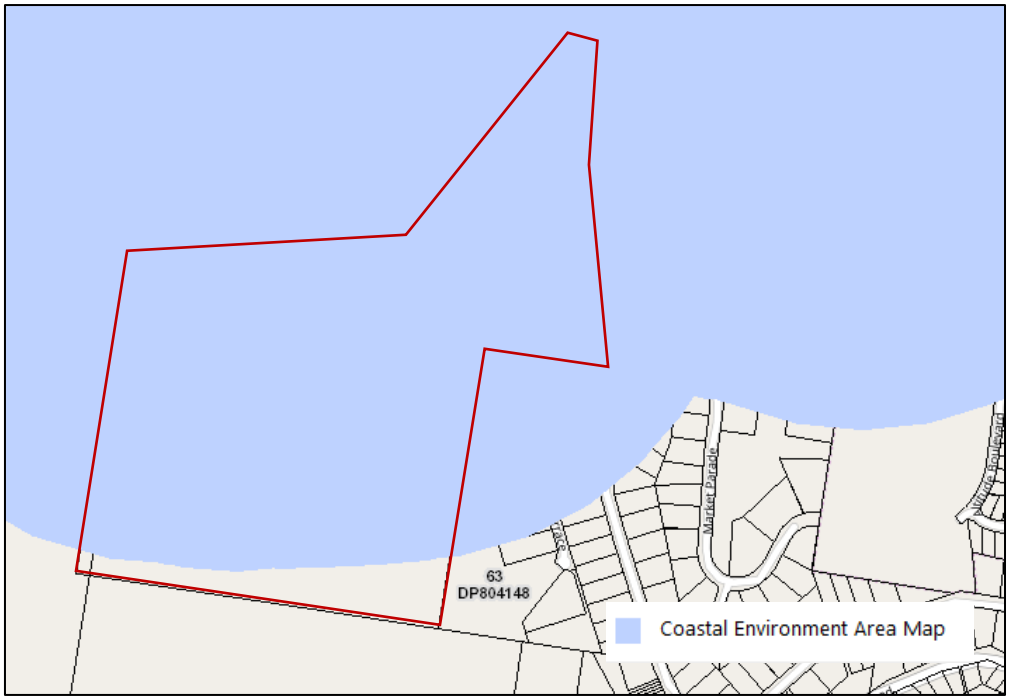


Figure 4.2 Coastal Environment Area Mapping

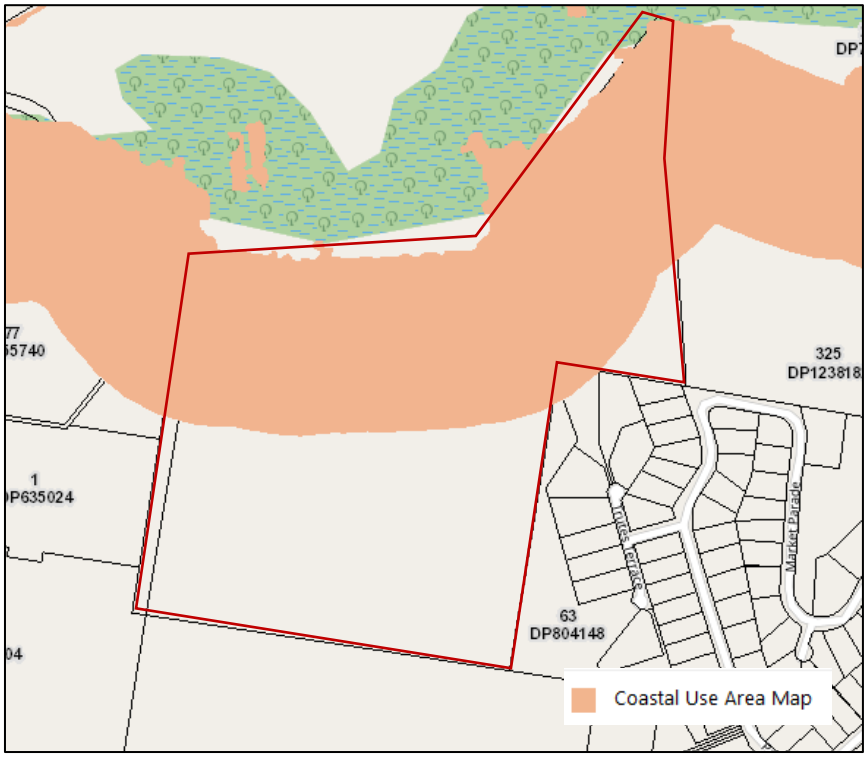


Figure 4.3 Coastal Use Area Map

Tweed Area E Local Environment Study identifies the wetland to the immediately north of the subject site as "significant ecological areas not suitable for development" (Parsons Brinckerhoff, 2004, p47). Parsons Brinckerhoff (2004) also indicates that a 50m buffer is required to this area.

4.3.2 State Environmental Planning Policy No. 44 – Koala Habitat Protection

The *State Environmental Planning Policy No. 44 – Koala Habitat Protection* encourages the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range. The policy applies to 107 local government areas, including the Tweed. Local councils cannot approve development in an area affected by the policy without an investigation of core koala habitat. The policy provides the state-wide approach needed to enable appropriate development to continue, while ensuring there is ongoing protection of koalas and their habitat.

Before a council may grant consent for a development, it must satisfy itself whether or not the land is a potential koala habitat. If the land is considered potential koala habitat, it needs to be determined if the land is core koala habitat. The definition of core and potential koala habitat is as follows:

- **Core koala habitat** means an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.
- **Potential koala habitat** means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Where it is determined that the land is core koala habitat, a plan of management is required.

Tweed Shire mapping indicates areas to the north of the site and along the northern boundary contain areas of preferred koala habitat (green shaded areas on Figure 4.5).



Figure 4.4 Koala Habitat Mapping

4.3.3 State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

The State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017 (Vegetation SEPP) works together with the *Biodiversity Conservation Act 2016* and *the Local Land Services Amendment Act 2016* to create a framework for the regulation of clearing of native vegetation in NSW.

The Vegetation SEPP will regulate clearing of native vegetation on urban land and land zoned for environmental conservation/management that does not require development consent.

The Vegetation SEPP applies to clearing of:

1. Native vegetation above the Biodiversity Offset Scheme (BOS) threshold where a proponent will require an approval from the Native Vegetation Panel established under the *Local Land Services Amendment Act 2016*; and

2. Vegetation below the BOS threshold where a proponent will require a permit from Council if that vegetation is identified in the council's development control plan (DCP).

4.3.4 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BCA) establishes an integrated legislative framework for land management and biodiversity conservation. Biodiversity components include provisions for offsetting and private land conservation, as well as setting out the direction for threatened species conservation and the management of human-wildlife interactions.

Biodiversity values are defined under the act as:

- Vegetation integrity—being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state;
- Habitat suitability—being the degree to which the habitat needs of threatened species are present at a particular site; and
- Biodiversity values, or biodiversity-related values, prescribed by the regulations.

Under the BCA, proponents must apply the test of significance (under Section 7.3) to determine whether the proposed activity is likely to significantly affect threatened species or ecological communities, or their habitats.

If the activity is likely to have a significant impact, or will be carried out in a declared area of outstanding biodiversity value, the proponent must either apply the Biodiversity Offsets Scheme or prepare a species impact statement.

4.3.4.1 Biodiversity Offsets Scheme

The Biodiversity Offsets Scheme (BOS) helps to compensate for potential impact on biodiversity from development. Under the BOS, applications for development or clearing approvals must set out how impacts on biodiversity will be avoided and minimised.

BOS applies to local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that triggers the Biodiversity Offsets Scheme threshold or is likely to significantly affect threatened species based on the test of significance in section 7.3 of the *Biodiversity Conservation Act 2016*.

The *Biodiversity Conservation Regulation 2017* sets out threshold levels for when the BOS will be triggered. The threshold has two elements:

1. Whether the amount of native vegetation being cleared exceeds a threshold area; or
2. Whether the impacts occur on an area mapped on the Biodiversity Values Map.

The area threshold varies depending on the minimum lot size and are presented in Table 4.1.

Table 4.1 Area Threshold for Biodiversity Offsets

Minimum lot size	Threshold for clearing, above which the BAM and BOS apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	0.5 ha or more
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

The Biodiversity Values Map identifies land with high biodiversity value, as defined by clause 7.3(3) of the *Biodiversity Conservation Regulation 2017.* Figure 4.5 shows that a very small area along the northern boundary is within a high biodiversity area. This area is excluded from the development footprint. The balance of the site does not fall within a high biodiversity area.

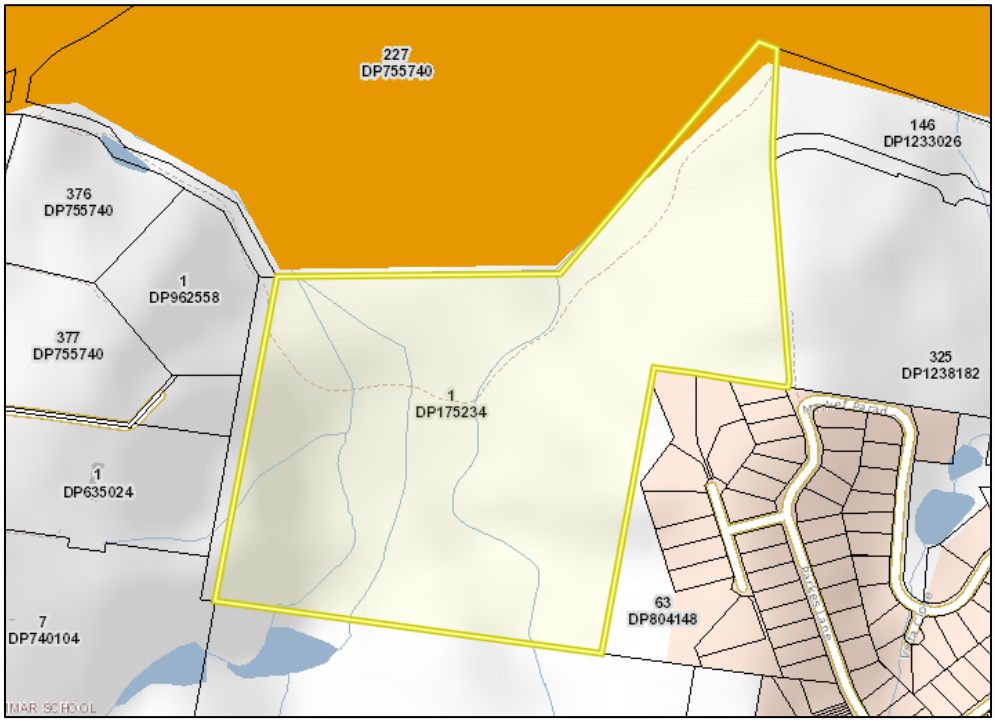


Figure 4.5 Biodiversity Values Map

The BOS applies to all clearing of native vegetation and other biodiversity impacts prescribed by clause 6.1 of the *Biodiversity Regulation 2017* on land identified on the map.

When either of these threshold levels apply, the Biodiversity Assessment Method (BAM) must be used to determine the level of impacts.

The BAM assesses the biodiversity value of land and calculates likely losses in biodiversity values resulting from clearing of native vegetation and habitat destruction. The *Biodiversity Conservation Regulation 2017* includes principles for determining which impacts are 'serious and irreversible impacts on biodiversity values'.

The proposed developed does not trigger either of the thresholds for BOS, therefore, no offsets are applicable.

For developments not triggered by the threshold, the 'test of significance' in Part 7 (7.3) of the *Biodiversity Conservation Act 2016* must be used to determine whether a development is likely to significantly affect threatened species. Where a significant affect is likely, the proponent must carry out a detailed evaluation and produce a Biodiversity Development Assessment Report (BDAR) prior to the development application being lodged for assessment.

Tests of significance have been conducted to determine the impacts to threatened species identified on the site during field and desktop assessments.

4.4 BioNet Atlas of NSW Wildlife Records

For the purposes of ensuring that all management strategies are based on current and integrated data sets, the Atlas of NSW Wildlife Records database was queried. The search area included a 10km radius of the site, the minimum search distance allowable. The co-ordinates for this search area are provided in Table 4.2.

Table 4.2 BioNet Database Query Search Parameters

Parameter	Value
North	-28.17
West	153.46
East	153.56
South	-28.27

While the result from the database query will provide the most comprehensive potential species list, it should be noted that this search parameter considers a variety of vegetation community types and environmental features (e.g. alluvial flats, marine environments) that are not present within the site. Therefore, it could be reasonably expected that the search might return a result that over-represents the potential number and type of flora species that could be expected to utilise the site.

4.4.1 Flora

The BioNet database search reported that 36 flora species that are threatened in New South Wales or Nationally, have previously been recorded within 10 km of the site (Table 4.3). Threatened species are those that have a conservation status of vulnerable, endangered or critically endangered.

Table 4.3 Threatened Flora (BioNet Records)

Scientific Name	Common Name	TSCA Status#	EPBC Act Status*
Ochrosia moorei	Southern Ochrosia	E1,P	E
Diospyros mabacea	Red-fruited Ebony	E1,P	E
Diospyros yandina	Shiny-leaved Ebony	E1,P	
Acalypha eremorum	Acalypha	E1,P	
Cassia marksiana		E1,P	
Acacia bakeri	Marblewood	V,P	
Archidendron hendersonii	White Lace Flower	V,P	
Xylosma terrae-reginae	Queensland Xylosma	E1,P	
Grammitis stenophylla	Narrow-leaf Finger Fern	E1,P,3	
Cryptocarya foetida	Stinking Cryptocarya	V,P	V
Endiandra hayesii	Rusty Rose Walnut	V,P	V
Endiandra muelleri subsp. bracteata	Green-leaved Rose Walnut	E1,P	
Lindsaea brachypoda	Short-footed Screw Fern	E1,P,3	
Lindsaea fraseri	Fraser's Screw Fern	E1,P,3	
Gossia fragrantissima	Sweet Myrtle	E1,P	E
Syzygium hodgkinsoniae	Red Lilly Pilly	V,P	V
Syzygium moorei	Durobby	V,P	V
Geodorum densiflorum	Pink Nodding Orchid	E1,P,2	
Oberonia titania	Red-flowered King of the Fairies	V,P,2	

Scientific Name	Common Name	TSCA Status[#]	EPBC Act Status*
Peristeranthus hillii	Brown Fairy-chain Orchid	V,P,2	
Phaius australis	Southern Swamp Orchid	E1,P,2	E
Floydia praealta	Ball Nut	V,P	V
Grevillea hilliana	White Yiel Yiel	E1,P	
Hicksbeachia pinnatifolia	Red Boppel Nut	V,P	V
Macadamia tetraphylla	Rough-shelled Bush Nut	V,P	V
Randia moorei	Spiny Gardenia	E1,P	E
Acronychia littoralis	Scented Acronychia	E1,P	E
Bosistoa transversa	Yellow Satinheart	V,P	V
Coatesia paniculata	Axe-Breaker	E1,P	
Cupaniopsis serrata	Smooth Tuckeroo	E1,P	
Diploglottis campbellii	Small-leaved Tamarind	E1,P,2	E
Lepiderema pulchella	Fine-leaved Tuckeroo	V,P	
Niemeyera whitei	Rusty Plum, Plum Boxwood	V,P	
Symplocos baeuerlenii	Small-leaved Hazelwood	V,P	V
Centranthera cochinchinensis	Swamp Foxglove	E1,P	
Corokia whiteana	Corokia	V,P	V

*****Status under the Commonwealth EPBC Act: V = Vulnerable, E = Endangered

[#]Status under the *Threatened Species Conservation Act 1995* unless otherwise noted.

E1 Endangered **E2** Endangered Population **E3** Endangered Ecological Community **E4** Presumed Extinct **E4A** Critically Endangered **E4B** Critically Endangered Ecological Community **P** Protected (*National Parks & Wildlife Act 1974*) **V** Vulnerable **V2** Vulnerable Ecological Community

4.4.2 Ecological Communities

The BioNet database was also interrogated for the presence of endangered ecological communities. Nine (9) endangered ecological communities have been recorded within this search area (Table 4.4). Discussion on the likelihood of these ecological communities occurring on the subject site is provided in Section 6.6.

Table 4.4 Endangered Ecological Communities (BioNet Records)

Endangered Community Name	TSCA Status	EPBC Act Status*
Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion	EEC	
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	V
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	CE
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	EEC	CE
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	EEC	CE

Endangered Community Name	TSCA Status	EPBC Act Status*
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	EEC	
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC	

***** Status under the Commonwealth EPBC Act: V = Vulnerable, E = Endangered, CE = Critically endangered

4.4.3 Fauna

The database search reported that 54 threatened fauna species have previously been recorded within 10 km of the site (Table 4.5). Threatened species are those that have a conservation status of vulnerable, endangered or critically endangered.

Table 4.5 Threatened Fauna (BioNet Records)

Scientific Name	Common Name	TSCA Status	EPBC Act Status
Amphibians			
Litoria olongburensis	Olongburra frog	V,P	
Crinia tinnula	Wallum froglet	V,P	V
Birds			
Anseranas semipalmata	Magpie Goose	V,P	
Ptilinopus magnificus	Wompoo Fruit-Dove	V,P	
Ptilinopus regina	Rose-crowned Fruit-Dove	V,P	
Ardenna carneipes	Flesh-footed Shearwater	V,P	J,K
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P	
Ixobrychus flavicollis	Black Bittern	V,P	
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P	C
Hieraaetus morphnoides	Little Eagle	V,P	
Pandion cristatus	Eastern Osprey	V,P,3	
Amaurornis moluccana	Pale-vented Bush-hen	V,P	
Burhinus grallarius	Bush Stone-curlew	E1,P	
Esacus magnirostris	Beach Stone-curlew	E4A,P	
Haematopus fuliginosus	Sooty Oystercatcher	V,P	
Haematopus longirostris	Pied Oystercatcher	E1,P	
Charadrius leschenaultii	Greater Sand-plover	V,P	V,C,J,K
Charadrius mongolus	Lesser Sand-plover	V,P	E,C,J,K
Irediparra gallinacea	Comb-crested Jacana	V,P	
Calidris canutus	Red Knot	P	E,C,J,K
Calidris ferruginea	Curlew Sandpiper	E1,P	CE,C,J,K
Calidris tenuirostris	Great Knot	V,P	CE,C,J,K
Limosa limosa	Black-tailed Godwit	V,P	C,J,K
Numenius madagascariensis	Eastern Curlew	P	CE,C,J,K

Scientific Name	Common Name	TSCA Status	EPBC Act Status
Xenus cinereus	Terek Sandpiper	V,P	C,J,K
Sternula albifrons	Little Tern	E1,P	C,J,K
Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P,2	
Glossopsitta pusilla	Little Lorikeet	V,P	
Ninox connivens	Barking Owl	V,P,3	
Tyto longimembris	Eastern Grass Owl	V,P,3	
Todiramphus chloris	Collared Kingfisher	V,P	
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V,P	
Gavicalis fasciogularis	Mangrove Honeyeater	V,P	
Daphoenositta chrysoptera	Varied Sittella	V,P	
Coracina lineata	Barred Cuckoo-shrike	V,P	
Carterornis leucotis	White-eared Monarch	V,P	
Mammals			
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E
Planigale maculata	Common Planigale	V,P	
Phascolarctos cinereus	Koala	V,P	V
Phascolarctos cinereus	Koala Phascolarctos cinereus (Goldfuss, 1817) between the Tweed and Brunswick Rivers east of the Pacific Highway	E2,V,P	V
Nyctimene robinsoni	Eastern Tube-nosed Bat	V,P	
Pteropus poliocephalus	Grey-headed Flying-fox	V,P	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P	
Mormopterus lumsdenae	Northern Free-tailed Bat	V	
Mormopterus norfolkensis	Eastern Freetail-bat	V,P	
Chalinolobus nigrogriseus	Hoary Wattled Bat	V,P	
Miniopterus australis	Little Bentwing-bat	V,P	
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P	
Myotis macropus	Southern Myotis	V,P	
Nyctophilus bifax	Eastern Long-eared Bat	V,P	
Reptiles			
Caretta caretta	Loggerhead turtle	E1,P	E
Chelonia mydas	Green turtle	V,P	V
Eretmochelys imbricata	Hawksbill Turtle	P	V
Invertebrates			
Thersites mitchellae	Mitchell's Rainforest Snail	E1	CE

*****Status under the Commonwealth EPBC Act: V = Vulnerable, E = Endangered, C = Listed under the CAMBA, J = Listed under JAMBA, K = Listed under RoKAMBA.

[#]Status under the *Threatened Species Conservation Act 1995* unless otherwise noted.

E1 Endangered **E2** Endangered Population **E3** Endangered Ecological Community **E4** Presumed Extinct **E4A** Critically Endangered **E4B** Critically Endangered Ecological Community **P** Protected (*National Parks & Wildlife Act 1974*) **V** Vulnerable **V2** Vulnerable Ecological Community **1** Sensitivity Class 1 (Sensitive Species Data Policy) **2** Sensitivity Class 2 (Sensitive Species Data Policy) **3** Sensitivity Class 3 (Sensitive Species Data Policy).

An assessment of the likelihood of occurrence of these threatened species on the site and the impacts of the proposed development is provided in Section 5 of this report.

4.5 Matters of Local Environmental Significance

In NSW, each local government area has a Local Environmental Plan (LEP) to guide development and protect natural resources such as waterways and heritage within local government areas. LEPs are prepared by local Councils.

Although the rules and guidelines for land use within local Council areas are dictated to some degree by State Environmental Planning Policies, local Councils can administer more specific rules about land use through their Local Environmental Plans, and can provide additional guidance in their development control plans (DCPs).

Matters of local environmental significance for the subject site were determined using the Tweed Council's planning and land use mapping, results of which are presented in the following sections.

4.5.1 Tweed Shire Council *Local Environmental Plan 2014* Mapping

The Planning Services of the Tweed Shire Council have an online, web based mapping tool. The *Tweed Vegetation Mapping 2009*, indicates that much of the site is highly modified and disturbed (Figure 4.6). A narrow band of *Miscellaneous Map Units* exist along the western boundary. The northern boundary is predominantly mapped as *Rainforest and Riparian Communities* with smaller areas of *Melaleuca and Swamp She-oak Forests.* The entire site falls within a regional fauna corridor (red hatching Figure 4.6).

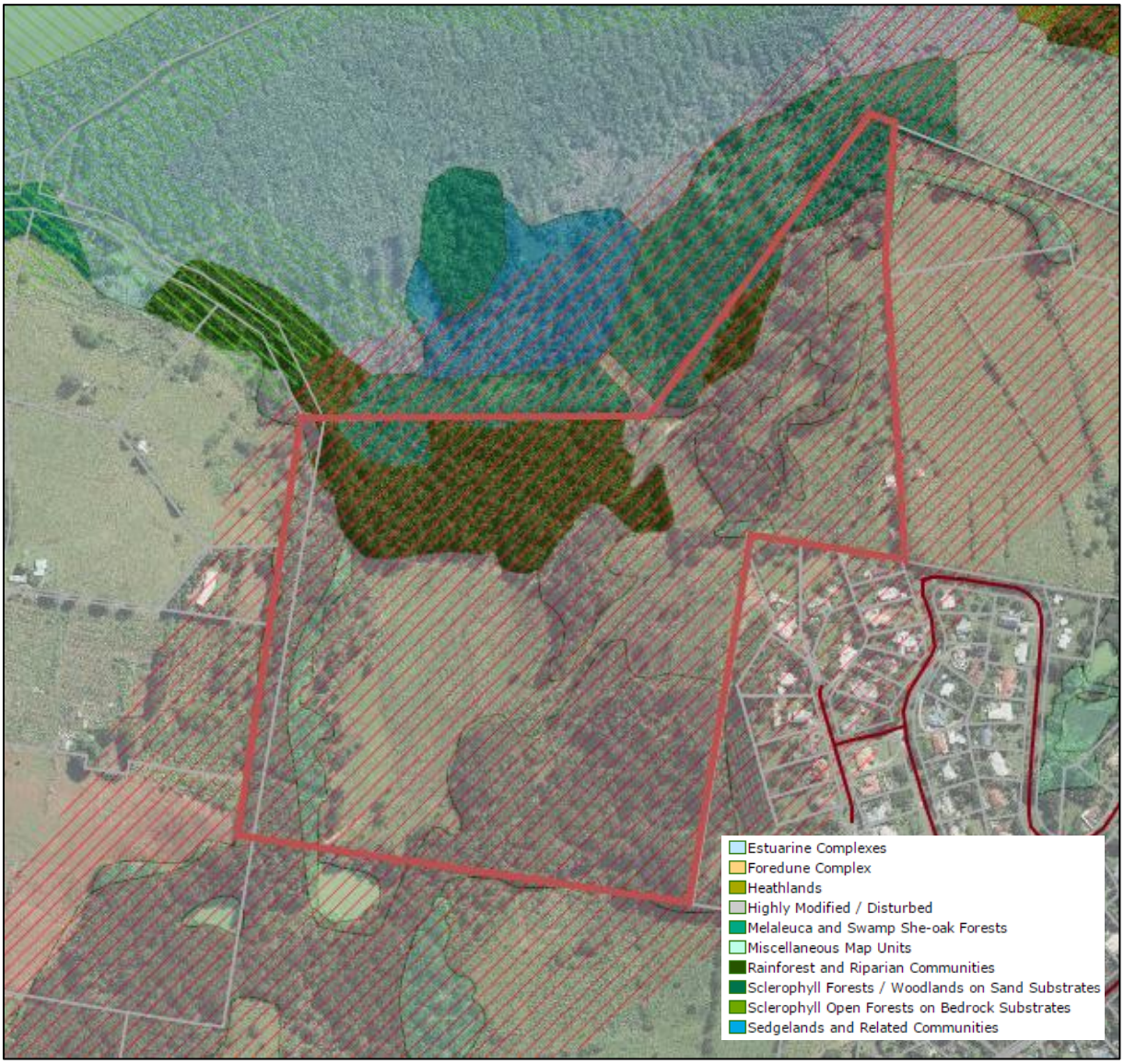


Figure 4.6 Tweed Shire Council Vegetation Mapping 2009 (Source: Local Environmental Plan 2014)

4.5.2 DCP A16 - Tree Preservation

Tweed Shire Council has tree management planning controls for prescribed vegetation through the Tweed Development Control Plan Section A16 - Preservation of Trees or Vegetation (DCP A16).

Prescribed vegetation is classified as any one of the following:

- Local native trees equal to or greater than 5 m in height and/or;
- Local native vegetation (of any height) that occurs as part of a bushland community and/or;
- Very large trees (trunk diameter = 0.8 m, measured at 1.4 m above natural ground level) and/or;
- Primary Koala feed trees - *Eucalyptus robusta* (swamp mahogany), *E. Tereticornis* (forest red gum), *E. Microcorys* (tallowwood) and *E. Propinqua* (small-fruited grey gum) greater than 5 m in height and/or;
- Threatened plant species, population or community listed under the *Biodiversity Conservation Act 2016* (BCA) or EPBC Act and/or;

- Listed significant vegetation e.g. heritage listed tree under Schedule 2 of DCP A16.

Prescribed vegetation cannot be removed from applicable zones under DCP A16 without an application unless:

- An exemption applies under Schedule 1 of DCP A16;
- Works are in accordance with an approved Property Vegetation Plan; or
- Works are part of an approved Development Application.

DCP A16 applies if a property is zoned under the TLEP 2014 as:

- Residential Zones (R1, R2, R3);
- Village (RU5); and
- All Environmental Protection Zones.

As the site is falls mostly within the R1 zone, under the TLEP 2014, an application will need to be made to remove any prescribed vegetation.

4.5.3 Tweed Shire Council *Vegetation Management Strategy 2004* (TVMS)

The *Tweed Vegetation Management Strategy 2004* (TVMS) provides information regarding the status of Tweed's natural and environmentally sensitive areas, outlining co-ordinated planning framework in accordance with the *Native Vegetation Act 2003* and the *Environmental Planning and Protection Act 1979* to protect and enhance local and regional native biodiversity. A review of TVMS Maps 1-7 was undertaken to help inform the planning and design for the proposed development.

4.5.3.1 Vegetation Associations

The TVMS (2004) mapped broad vegetation communities and dominant Vegetation Associations. The vegetated areas on the subject site are broadly classified as rainforest and riparian communities, Melaleuca and Swamp Oak forests and highly modified areas (Figure 4.8). The highly disturbed areas are further classified as camphor laurel dominated forest. The rainforest and riparian community is mapped as lowland rainforest on floodplain. The Melaleuca and swamp oak forest is mapped as broad-leaved paperbark closed forest to woodland (Figure 4.9).

Map 3 of the TVMS indicates areas where camphor laurel is present within the shire. As shown in Figures 4.9 and 4.10, the site has large areas of camphor laurel, especially in the southern portion.



Figure 4.7 Tree Preservation Order Mapping (Source: Local Environmental Plan 2014)

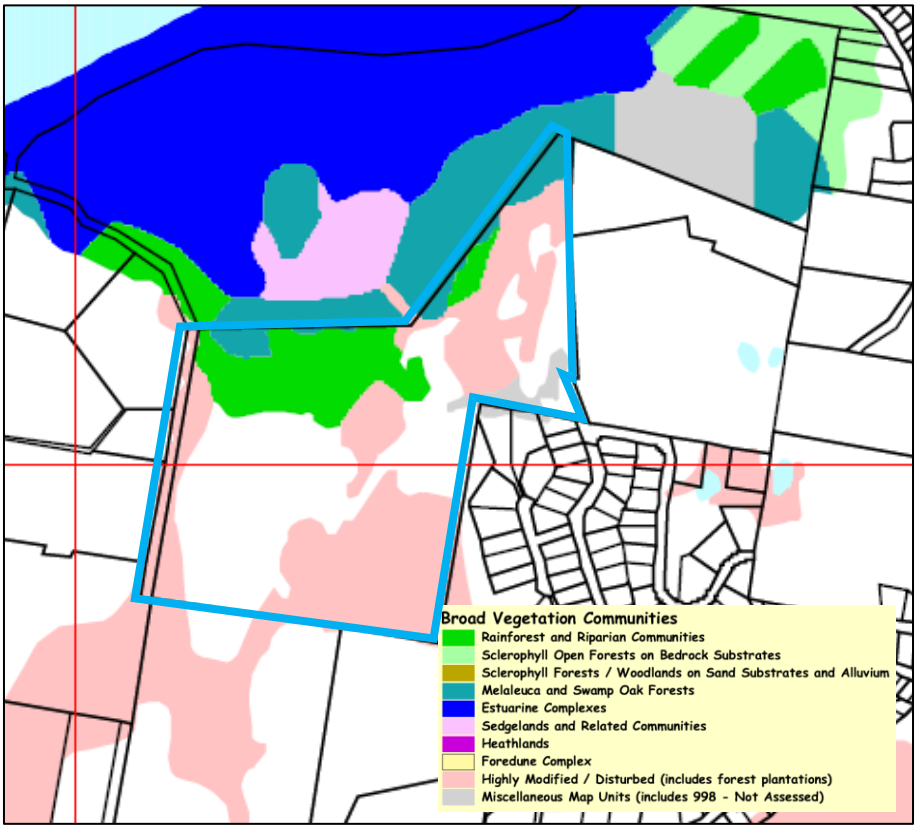


Figure 4.8 Broad Vegetation Associations (Source: TVMS 2004)

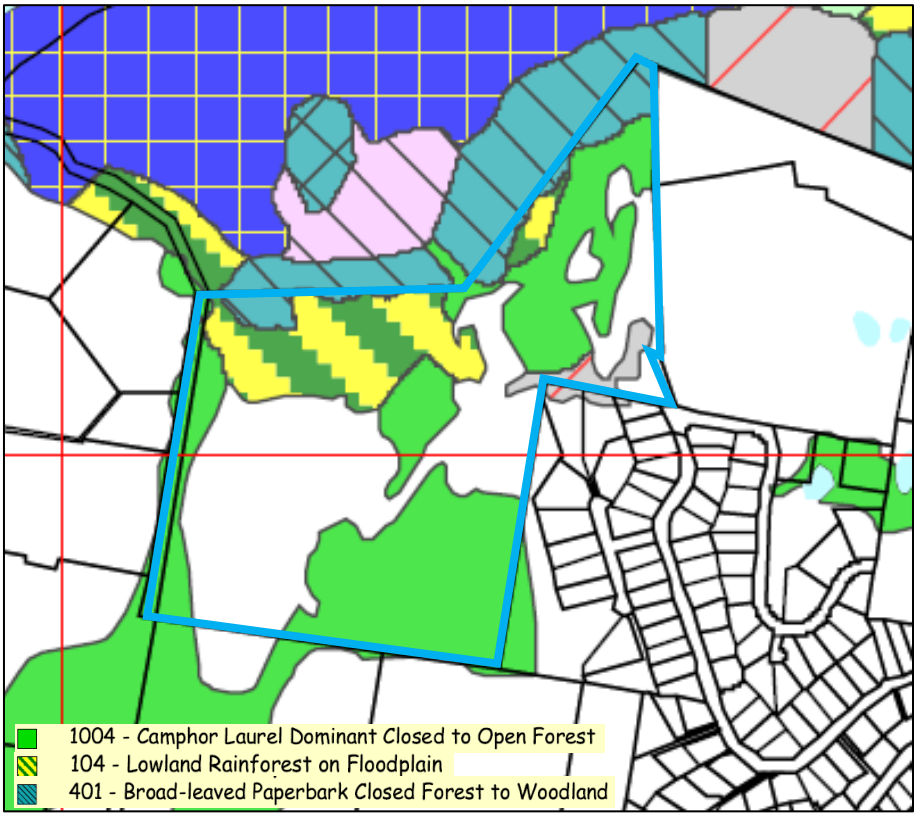


Figure 4.9 Vegetation Associations (Source: TVMS, 2004)

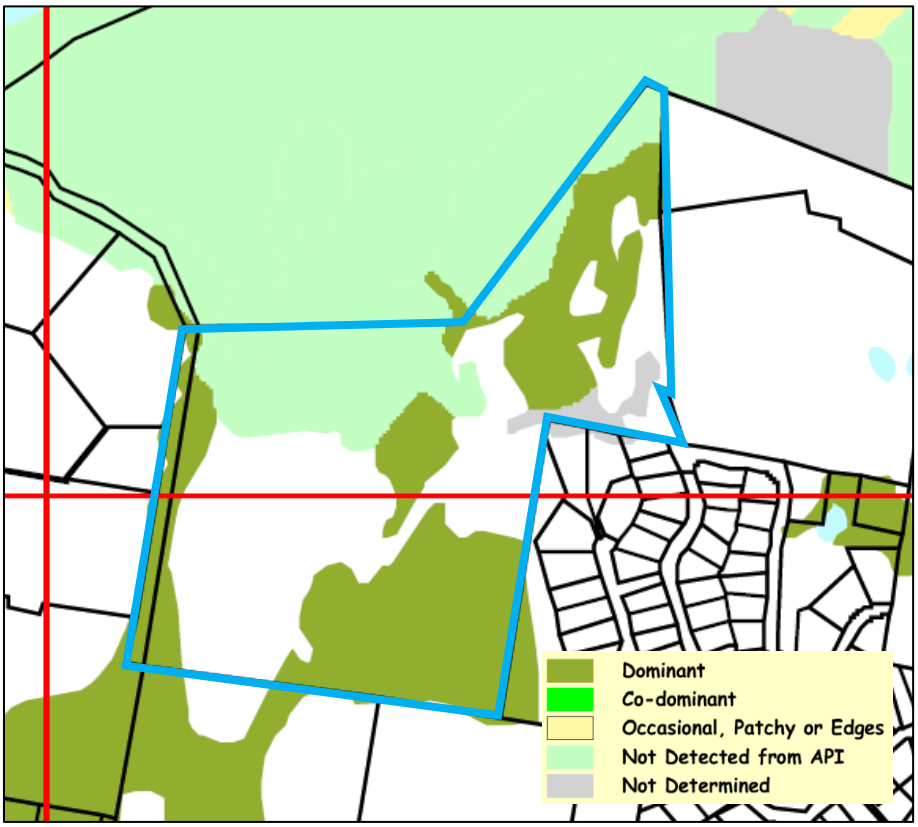


Figure 4.10 Camphor laurel abundance (Source: TVMS, 2004)

Ecological Values

The TVMS (2004) mapped areas based on their ecological status and then assigned an ecological sensitivity criterion. Ecological sensitivity criteria were determined by an area's sensitivity to degradation. The site is mapped as containing areas of high sensitivity and very high ecological status (Figure 4.11).

Areas mapped as having very high ecological status generally identifies areas with special ecological values. This includes areas which are either very poorly conserved or highly depleted as well as old growth forest, or significant ecosystems such as riparian areas and wetlands above certain area thresholds.

Ecological sensitivity measures those components of the ecological system that are sensitive to degradation. Degradation may take many forms, but inevitably results in a decline in the quality of an area of vegetation. Sensitivity can be considered a broad measure of the extent of degradation likely without deliberate human disturbance. On the highest end of the spectrum are areas where degradation is likely under prevailing environmental conditions – i.e. without active human disturbance. Within the fragmented landscape, forest edges are often susceptible to weed invasion and other biological changes without any active intervention.

At the lower end of the sensitivity spectrum are areas that are more resilient to all forms of disturbance and would require considerable human input to cause degradation. For example, wetlands are susceptible to changes in the water table caused by drainage works. Drainage works require a level of intervention above prevailing environmental conditions. Clearing is a further example of high level intervention. Under TVMS mapping, three (3) broad categories of sensitivity are defined: High, Moderate, and Low. Areas classified as the most sensitive (High) are subject to degradation without human disturbance (TVMS, 2004).

The subject site contains areas of very high ecological status and high ecological sensitivity along the northern boundary.

Soil Landscapes, Steep Land and Drainage

The TVMS maps on a broad scale the soil landscape of the Shire, areas of steep land and drainage lines. Characteristics of both soils and landforms contribute to land degradation hazards. Mapping indicates that drainage lines of 2nd order or above are present on the subject site (Figure 4.12). The protection of lands within, or within 20m of a prescribed stream is mandated under the *Native Vegetation Act 2003*. In these areas, consent must be sought to clear native vegetation and exotic trees.

The soil landscape on the site consists Cobaki (cb). Suggestions for sustainable land use as provided in TVMS (2004) are as follows:

Cobaki. *Maintain undisturbed areas. Within residential areas appropriate effluent disposal systems (avoid septic systems) should be established. Minimal tillage and incorporation of organic matter is recommended to reduce soil structure decline. Appropriate guidelines should be followed to manage actual and potential acid sulphate soils*

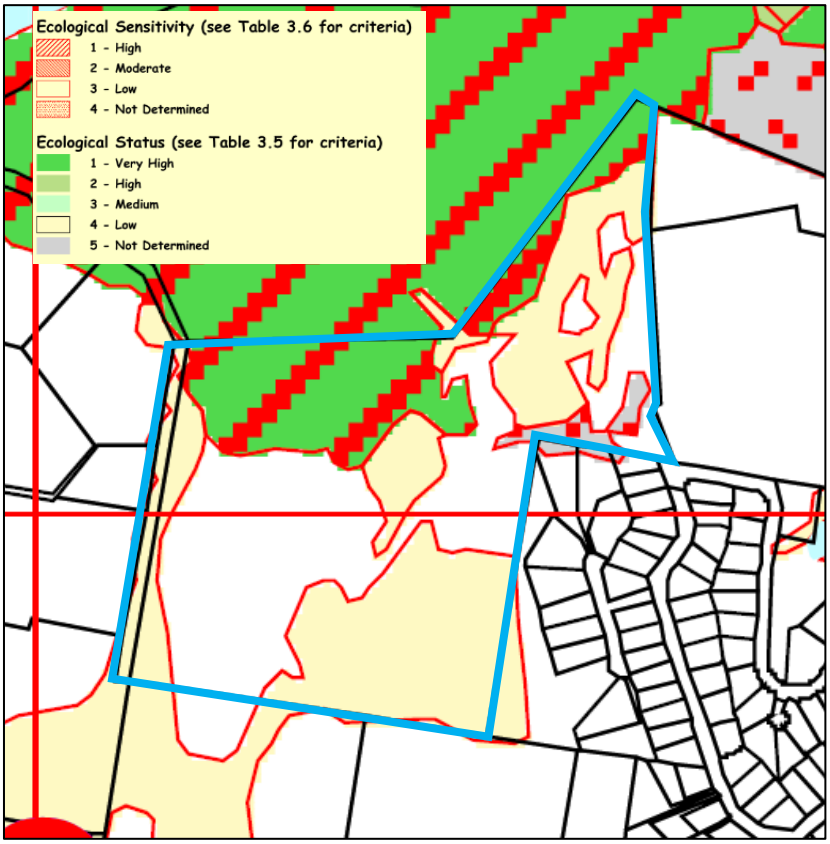


Figure 4.11 Tweed Shire Council Vegetation Association Map 4 – Ecological Values (Source: TVMS, 2004)

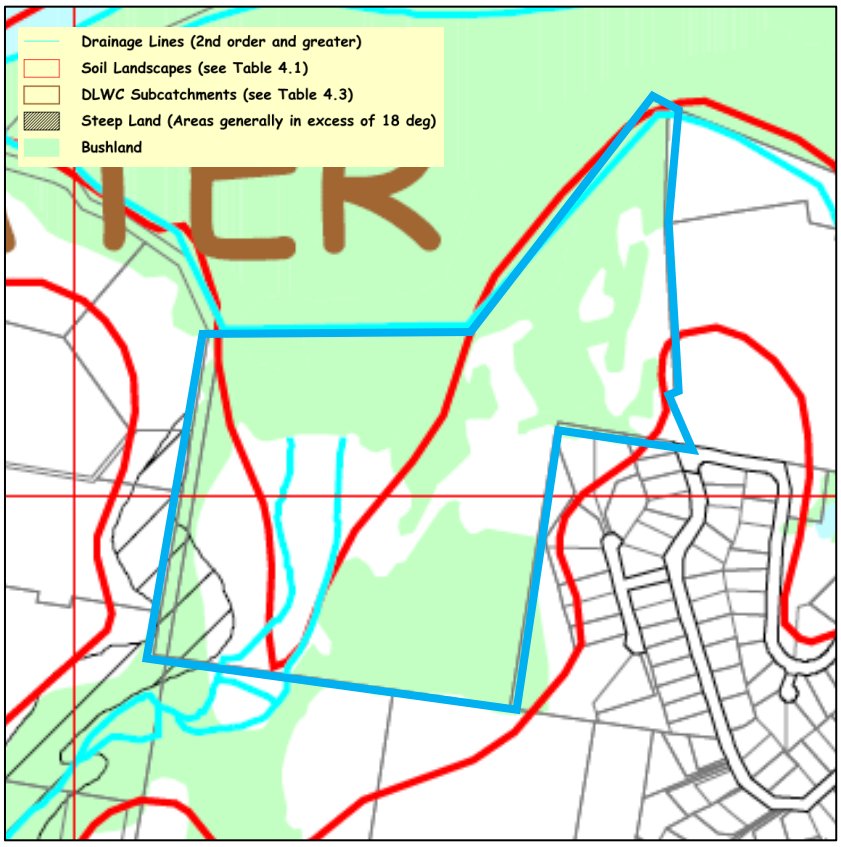


Figure 4.12 Soil Landscape, steep land and drainage (Source: TVMS, 2004).

Rehabilitation Priorities

Under the TVMS, the Shire was mapped with consideration to the rehabilitation priorities for existing bushland and potential non-bushland habitat areas. The site has been mapped as being part of the NPWS Regional Corridor and having riparian linkages (Figure 4.13). These are considered priority non-bushland habitat areas. HCV Bushland is also mapped as occurring on the site. These are priority bushland areas for rehabilitation.

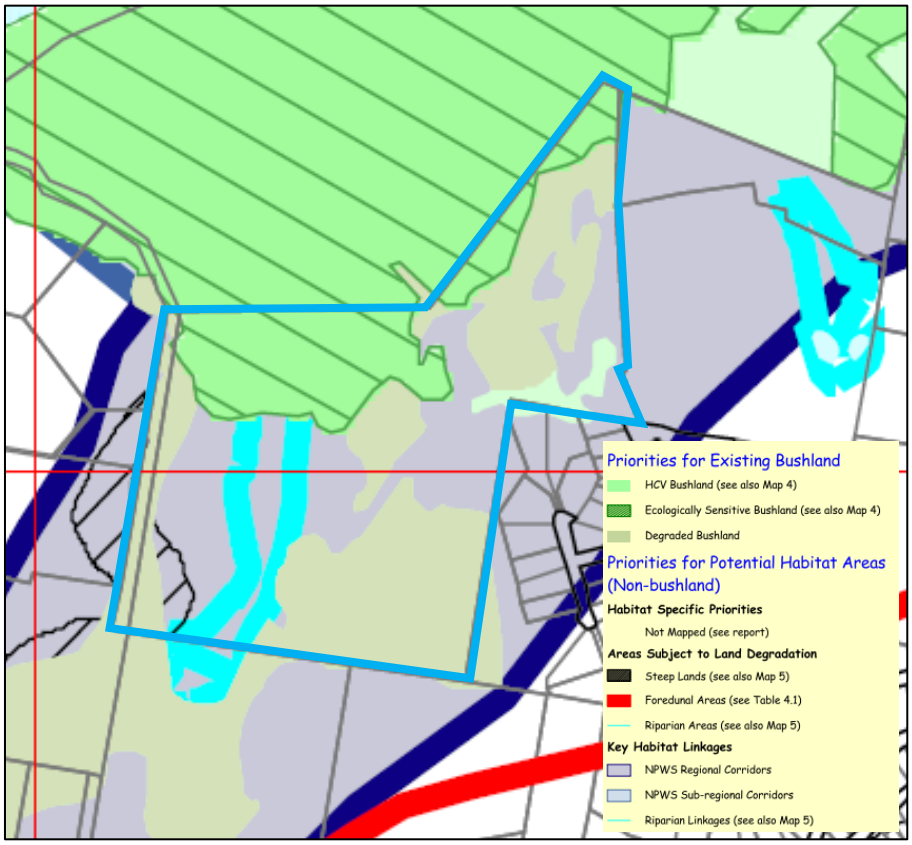


Figure 4.13 Rehabilitation Priorities (Source: TVMS, 2004)

4.6 Previous Site Investigations

The subject site was subject to an ecological assessment in 2008 (JWA, 2009). Results of these surveys determined that there were six (6) vegetation communities on the subject site (Figure 4.14). One (1) threatened bird species - Rose-crowned fruit-dove (*Ptilinopus regina*) and two (2) threatened mammalian species - Grey-headed flying-fox (*Pteropus poliocephelus*), and Eastern long-eared bat (*Nyctophilus bifax*) were recorded during these surveys.

The adjacent Altitude Aspire development to the east, was subject to ecological assessments in 2010 and 2011 (JWA, 2012; 2013). This site was found to contain two (2) degraded endangered ecological communities; lowland rainforest and freshwater wetlands. One (1) threatened flora species, Rough-shelled bush nut (*Macadamia tetraphylla*) was recorded. No threatened fauna species were recorded during these survey events. However, eight (8) threatened fauna species were considered a possible occurrence based on the availability of suitable habitat:

- Pale-vented bush-hen (*Amaurornis moluccana*)
- Collared kingfisher (*Todiramphus chloris*)

- Eastern bent-wing bat (*Mormopterus schreibersii oceanensis*)
- Eastern long-eared bat (*Nyctophilus bifax*)
- Grey-headed flying fox (*Pteropus poliocephalus*)
- Little bent-wing bat (*Miniopterus australis*)
- Rose-crowned fruit dove (*Ptilinopus regina*)
- Yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)

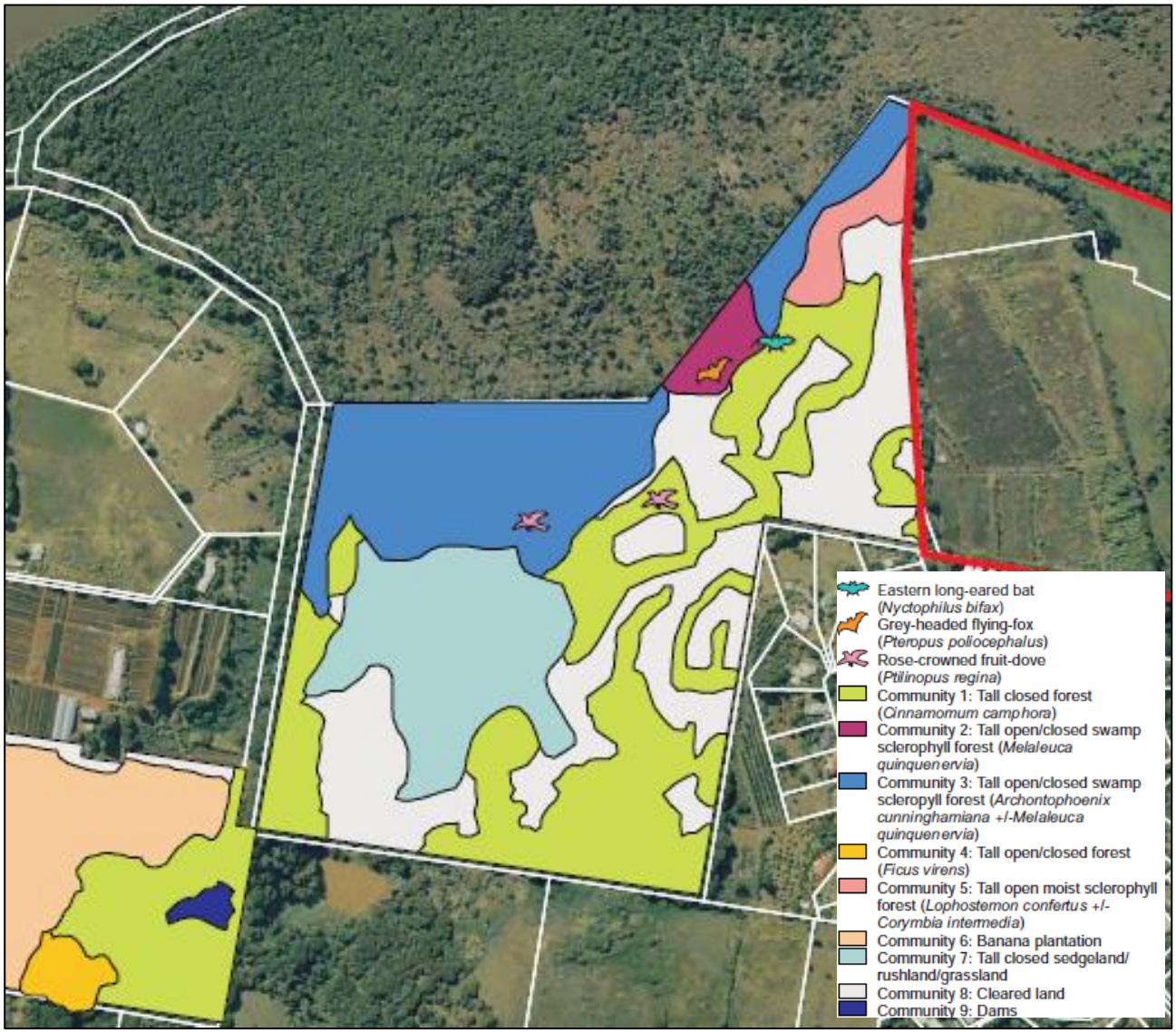


Figure 4.14 Vegetation Communities (Source: JWA, 2013)

4.7 Desktop Assessment Summary

The subject site contains seven (7) matters of local environmental significance:

- Mapped vegetation communities;
- Fauna corridor;
- Tree Preservation Order;
- Areas of very high ecological significance;
- Areas of high ecological sensitivity;
- Drainage channels of 2nd order or above; and
- Priority areas for bushland and non-bushland habitat rehabilitation.

The results of the desktop survey indicate that the site and surrounding area (i.e. within a 10km radius of the site) may provide potential habitat for 90 species of flora and fauna listed as threatened under State or Commonwealth legislation. Nine (9) threatened ecological communities are also known to occur within 10km of the site. Assessment of the likelihood of the threatened species occurring on the subject site is discussed in Section 6 of this report.

Three (3) State Environmental Planning Policies are applicable to the site (SEPP 44 – Koala Habitat Protection, SEPP Coastal Management 2018 and SEPP Vegetation in Non-Rural Areas 2017).

5. Site Survey

This section outlines the methods and results of the flora and fauna surveys.

5.1 Methods – Flora Survey

To ground-truth the information obtained through the desktop assessment, field surveys were undertaken within the subject site over three days in late April to early May 2017. Where relevant, observations regarding floristic values on adjacent sites were also recorded.

Vegetation structure and floristics have been described in accordance with Hnatiuk *et al.* (2009). This classification is equivalent to the *Level IV: Broad floristic subformation* description under the National Vegetation Information System (NVIS) established by the Executive Steering Committee for Australian Vegetation Information (ESCAVI). This level of reporting incorporated data collection for structural formations (i.e. growth form, stratum intervals, crown cover and height) and floristic associations (i.e. species diversity).

Survey methodology comprised an initial visual audit, followed by quantitative assessment of vegetation associations and communities. The initial visual audits consisted of a random meander over the site to ground-truth desktop investigations and satellite imagery. Site locations for quantitative assessments were subsequently determined based on information obtained from the initial visual audit.

Vegetation mapping was undertaken by interpolating site survey data and recent Nearmaps satellite imagery (2017). The results of previous vegetation mapping over the site by other consultants and Council was also considered in the mapping process.

Quantitative data collected at each site includes structural formation (i.e. growth form, stratum intervals, crown cover and height) and floristics as well as level and type of disturbance.

Unless otherwise noted, all quantitative observations were recorded as follows:

- Individual site survey data entered into excel proforma on tablet in situ;
- Single point locations where required (e.g. site survey locations, significant species / habitat trees) was recorded by GPS in easting and northing Universal Transverse Mercator (UTM) projected co-ordinates;
- Growth form – determined in accordance with pp 88-93 of Hnatiuk *et al.* (2009);
- Stratum intervals – determined by recording the median height of the top of each stratum. Strata were defined in accordance with Table 5.1 which is summarised from Hnatiuk *et al.* (2009);
- Crown cover – determined using a field estimation of the crown separation ratio in accordance with Table 5.2, which is reproduced from Hnatiuk *et al.* (2009).

Table 5.1 Criteria for Defining Vegetation Strata

Stratum	Description
Emergent	Tallest plants in vegetation associations/communities that are so sparsely distributed that they do not form the dominant or most significant layer (e.g. large trees that rise above a distinct canopy layer).
Dominant or Upper Stratum	In most cases the tallest stratum will be the dominant stratum (i.e. except when emergents are present).
Mid-stratum	If present, this stratum is between the dominant (upper) stratum and the ground stratum. There are no pre-conceived height limits for this stratum. Where multiple strata are present between the dominant (upper) stratum and the ground stratum, the mid-stratum can be subdivided in order of decreasing height (i.e. the highest mid-stratum is termed Mid-stratum 1, the next highest mid-stratum is termed Mid-stratum 2 etc).
Ground stratum	Typically consists of herbaceous ferns, forbs and graminoids; although can also include juvenile species from other strata. The ground stratum can also be the dominant stratum (e.g. where grass cover is closed and trees are very sparse). There are no pre-conceived height limits for this stratum; however, it is usually less than 2.0 m tall.

Table summarised from Hnatiuk *et al.* (2009).

Table 5.2 Crown Cover Classes

Criteria Assessed in Field	Description	Crown Separation Ratio	Crown Cover (%)	Foliage Cover (%)
Crowns touching to overlapping	Closed or Dense	<0*	>80	>70
Crowns touching or slightly separated	Mid Dense	0-0.25	50-80	30-70
Crowns clearly separated	Sparse or Open	0.25-1	20-50	10-30
Crowns well separated	Very Sparse	1-20	0.25-20	0.2-10
Isolated plants (trees approximately 100 m apart; shrubs approximately 20 m apart)	Isolated Plants	>20	<0.25	<0.20
Isolated clumps of 2 to many plants approximately 200 m apart	Isolated Clumps	>20	<0.25	<0.20
Emergent	Emergents	>3	<5 % total crown cover	<3% of total foliage cover

Where crown overlap occurs, the crown ratio has a negative value: the larger the negative value, the greater the overlap.
Table reproduced from Table 17 in Hnatiuk *et al.* (2009).

Subsequent to collection of quantitative data at each site, additional qualitative data was gathered by undertaking a random meander through the balance of the vegetation community/association. Specifically, assessment of disturbance and any additional plant species occurring in each stratum were recorded.

When compiling strata-specific species lists, epiphytes, vines and mistletoes were assigned to the strata in which they occurred.

Binomial nomenclature follows the Census of Australian Plant Species Taxa list of the NSW National Herbarium.

5.2 Results – Flora Survey

A total of 166 species of flora were identified within the site, comprising 110 native species and 56 non-native species (Appendix B).

The vegetation communities of the site are described as follows:

Type A. Tall Closed Forest (*Cinnamomum camphora*);
Type B. Tall Open/Closed Swamp Sclerophyll Forest (*Archontophoenix cunninghamiana-Melaleuca quinquenervia*);
Type C. Tall Open/Closed Moist Sclerophyll Forest with Rainforest Understorey;
Type D. Closed Sedgeland/Rushland/Grassland; and
Type E. Maintained Anthropogenic Grassland.

The locations and mapped extent of the described vegetation associations are presented in Figure 5.1.

The results of the flora survey are described in the following sections.

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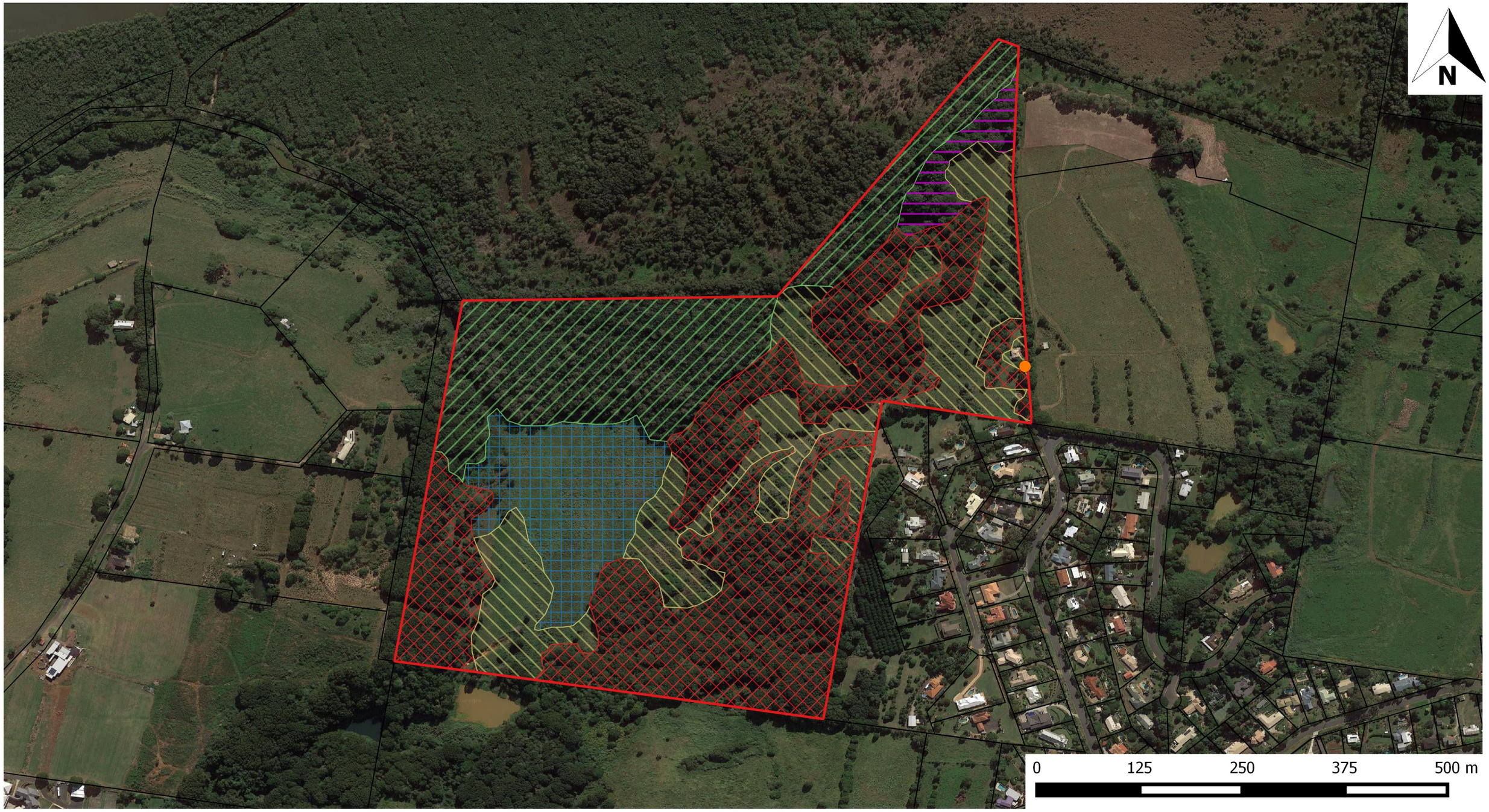


Figure 5.1 Vegetation Associations
LOT 1 ON DP175234
NEWLAND DEVELOPERS PTY LTD

PROJECTION: GDA94/MGA ZONE 56
PROJECT: BE170043
DATE: May 2018

LEGEND

- Site Boundary
- Type A: Tall Closed Forest *(Cinnamomum camphora)*
- Type B: Tall Open/Closed Swamp Sclerophyll Forest *(Archontophoenix cunninghamiana +/- Melaleuca quinquenervia)* **- EEC**
- Type C: Tall Open Moist Sclerophyll Forest *(Lophostemon confertus +/- Corymbia intermedia)*
- Type D: Tall Closed Sedgeland/Rushland/Grassland
- Type E: Maintained Anthropogenic Grassland
- Rough Shelled Bush Nut *(Macadamia tetraphylla)* **- Vulnerable under the TSC Act**
- Aerial Imagery - Google December 2016

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5.2.1 Vegetation Association A - Tall Closed Forest (*Cinnamomum camphora*)

Vegetation Association A is dominated by Camphor laurel (*Cinnamomum camphora*) as a canopy layer dominant with the mid storey containing a mix of rainforest regrowth and exotic weeds.

The results of the quantitative assessments and floristic formations are listed in Table 5.3 and Table 5.4 respectively. The species encountered within each stratum in this vegetation unit are provided in Appendix B.

Table 5.3 Vegetation Association A Quantitative Assessments

Stratum†	Growth Form	Crown Separation Ratio	Stratum Height (m)
Upper	tree	<0	12-18
Mid	small tree / shrub	0-0.25	5-12
Mid 2	Shrub	0-0.25	1.5-3
Ground	sedge / fern	0.25-1	0.5-1

†Strata that were not present have been omitted.

Table 5.4 Vegetation Association A Floristic Formation

Stratum†	Species
Upper	Camphor laurel (*Cinnamomum camphora*), Bennett's ash (*Flindersia bennettii*), Tuckeroo (*Cupaniopsis anacardioides*), Foambark (*Jagera pseudorhus*)
Mid	Maiden's wattle (*Acacia maidenii*), Tuckeroo (*Cupaniopsis anacardioides*), Guioa (*Guioa semiglauca*), Brown kurrajong (*Commersonia bartramia*), Foambark (*Jagera pseudorhus*), Macaranga (*Macaranga tanarius*), Umbrella tree (*Schefflera actinophylla**), Sweet pittosporum (*Pittosporum undulatum*), Umbrella cheese tree (*Glochidion sumatranum*), Red kamala (*Mallotus philippensis*), Bennett's ash (*Flindersia bennettii*), Rough leaved elm (*Aphananthe philippinensis*), Red bean (*Dysoxylum mollissimum* subsp. *Molle),* Cudgerie (*Flindersia schottiana*), Scrub turpentine (*Rhodamnia rubescens*), Birds nest fern (*Asplenium australasicum*), Cocos palm (*Syagrus romanzoffiana*)*
Mid 2	Camphor laurel (*Cinnamomum camphora*)*, Lantana (*Lantana camara*)*, Mickey mouse plant (*Ochna serrulata*)*, Winter senna (*Senna pendula var. glabrata*)*, Cockspur (*Maclura cochinchinensis*), Common silkpod (*Parsonsia straminea*), Large-leaved privet (*Ligustrum lucidum*)*, Passionfruit (*Passiflora edulis*)*, Guava (*Psidium guajava*)*, Burney vine (*Trophis scandens subsp. scandens*), Cat's claw creeper (*Dolichandra unguis-cati*)*, Corky prickle vine (*Caesalpinia subtropica*), Smooth Clerodendrum (*Clerodendrum floribundum*)
Ground	Climbing Asparagus fern (*Asparagus plumosus**), Asparagus fern (*Asparagus africanus*)*, Gristle fern (*Blechnum cartilagineum*), Scrambling lily (*Geitonoplesium cymosum*), Prickly smilax (*Smilax australis*), Rough maidenhair fern (*Adiantum hispidulum*), Blue flax lily (*Dianella caerulea*), Mat rushes (*Lomandra hystrix, L. longifolia*)

†Species are listed in order of dominance.

Based on the data obtained from the quantitative assessment, the broad floristic subformation (Hnatiuk *et al*., 2009) of Vegetation Association A is: Tall closed forest over dense mid strata over open fern and sedge ground stratum.

Variation

The majority of this vegetation unit is dominated by Camphor laurel with some floristic variation attributed to weed incursion and rainforest regrowth.

Disturbance

This Association is dominated by Camphor laurel in the upper stratum while the mid-layer is dominated by wattles, lantana, rainforest regrowth and weedy vines. This association is considered to be highly disturbed and modified as the dominant stratum (canopy) is dominated by the invasive tree-weed, Camphor laurel. This weed is currently suppressing the natural succession of this community which is unlikely to recover naturally without intervention by weed control.

Significance

The floristic composition of this association does not represent a significant ecological community (as listed under the TSC Act). Camphor laurel dominates ecologically dominant layer – the Upper Canopy; and the Mid2 stratum. Though rainforest species are present in the Upper and Mid strata, the predominance of Camphor laurel in these strata precludes it from meeting the criteria of an ecological community listed under the schedules of the TSC Act.

One (1) threatened flora species was recorded during the surveys – Rough-shelled bushnut (*Macadamia tetraphylla*). A single juvenile specimen (1.2m high) was recorded in Vegetation Association A, on the site's eastern boundary in close vicinity to the existing dwelling. A subsequent site investigation (JWA, 2018b) found four (4) additional specimens in close proximity to this individual. All specimens of *Macadamia tetraphylla* will be translocated prior to earthworks commencing in accordance with the Translocation Plan (JWA, 2018b).



Figure 5.2 Vegetation Association A

5.2.2 Vegetation Association B – Tall Closed Swamp Sclerophyll Forest (*Archontophoenix cunninghamiana / Melaleuca quinquenervia*)

This association occupies the northern parts of the site generally below 2.6AHD, outside of the development footprint. The results of the quantitative assessments and floristic formations are listed in Table 5.5 and Table 5.6 respectively. The species encountered within each stratum in this vegetation unit are provided in Appendix B.

Table 5.5 Vegetation Association B Quantitative Assessments

Stratum†	Growth Form	Crown Separation Ratio	Stratum Height (m)
Upper	tree	<0	15-22
Mid	Tree/shrub/fern	0.25-1	3-5
Ground	Sedge/fern	0.25-1	0.5-1.5

†Strata that were not present have been omitted.

Table 5.6 Vegetation Association B Floristic Formation

Stratum†	Species
Upper	Bangalow palm (*Archontophoenix cunninghamiana*), Paperbark (*Melaleuca quinquenervia*), Strangler fig (*Ficus watkinsiana*)
Mid	Prickly tree fern (*Cyathea leichhardtiana*), Cockspur (*Maclura cochinchinensis*), Creek sandpaper fig (Ficus coronata), Common silkpod (*Parsonsia straminea*), Lantana (*Lantana camara*)*, Winter senna (*Senna pendula var. glabrata*)*, Mickey mouse plant (*Ochna serrulata*)*, Small-leaved privet (*Ligustrum sinense*)*, Broad-leaved palm lily (*Cordyline petiolaris*), Red-fruited palm lily (*Cordyline rubra*), Red ash (Alphitonia excelsa), Whip vine (*Flagellaria indica*), White supplejack (*Ripogonum album*), Blue lilly pilly (*Syzygium oleosum*), Lilly pilly (*Acmena smithii*), Blueberry ash (*Elaeocarpus reticulatus*), Cheese tree (*Glochidion ferdinandi*), Camphor laurel (*Cinnamomum camphora*)*
Ground	Smartweed (*Persicaria strigosa),* Mistflower (*Ageratina riparia*),* Swamp water fern (*Blechnum indicum),* Prickly smilax (*Smilax australis),* Corky passionfruit (*Passiflora suberosa var. suberosa*),* White passionflower (*Passiflora subpeltata*),* Coral berry (*Rivina humilis*),* Jointed twig-rush (*Baumea articulata),* Bare twig-rush (*Baumea juncea),* Soft twig-rush (*Baumea rubiginosa),* Zig-zag bog rush (*Schoenus brevifolius),* Native yam (*Dioscorea transversa),* Water vine (*Cissus antarctica),* Five-leaf water vine (*Cissus hypoglauca),* Mangrove Fern (*Acrostichum speciosum*), Common Reed (*Phragmites australis*), Cunjevoi (*Alocasia brisbanensis*), Crinum lily (*Crinum pedunculatum*)

†Species are listed in order of dominance.

Based on the data obtained from the quantitative assessment, the broad floristic subformation (Hnatiuk *et al*., 2009) of Vegetation Association A is: Tall dense to closed forest over open understorey over open fern and sedge groundcover.

The floristic composition represents Tweed VMS 2004 Vegetation Type 401 - Broad-leaved paperbark closed forest to woodland.

Variation

Canopy dominants alternate between Bangalow palm and Broad-leaved paperbark. The majority of the map unit is dominated by Bangalow palm however small sections in the eastern and far western ends of the map unit are dominated by Broad-leaved paperbark.

Disturbance

Vegetation Association B represents remnant vegetation and is moderately undisturbed. Existing disturbance is limited to weed incursion, altered hydrology and degraded water quality from agricultural runoff.

Significance

This association represents an alliance of the TSCA Endangered Ecological Community (EEC) Swamp Sclerophyll Forest on Coastal Floodplains. The final determination listing advice for this EEC states: “On the Tweed lowlands, this community includes …***'Archontophoenix cunninghamiana-Melaleuca quinquenervia*** **very tall feather palm swamp forest'** (F9) (Pressey and Griffith 1992).” (NSW Scientific Committee, February 2011).

No significant species were recorded in this association however survey sites were limited to the southern periphery given the exclusion of this area from the development footprint.



Figure 5.3 Vegetation Association B – looking northwards from Vegetation Association D



Figure 5.4 Vegetation Association B



Figure 5.5 Vegetation Association B



Figure 5.6 Vegetation Association B interface with Vegetation Association D

5.2.3 Vegetation Association C – Tall Open/Closed Moist Sclerophyll Forest (*Lophostemon confertus*) with Rainforest Understory

This Vegetation Association occurs within the north-eastern corner of the site, south of Vegetation Association B and comprises a predominantly Brushbox (*Lophostemon confertus*) canopy with a closed rainforest understorey. The results of the quantitative assessments and floristic formations are listed in Table 5.7 and Table 5.8 respectively. The species encountered within each stratum in this vegetation unit are provided in Appendix B.

Table 5.7 Vegetation Association C Quantitative Assessments

Stratum†	Growth Form	Crown Separation Ratio	Stratum Height (m)
Upper	tree	0.25-1	18-28
Mid	tree	0-0.25	3-12
Mid 2	shrub	0-0.25	1-2
Ground	Fern/sedge	0.25-1	0.5-1.2

†Strata that were not present have been omitted.

Table 5.8 Vegetation Association C Floristic Formation

Stratum†	Species
Upper	Brushbox (*Lophostemon confertus*), Flooded gum (*Eucalyptus grandis*), Pink bloodwood (*Corymbia intermedia*), Strangler fig (*Ficus watkinsiana*)
Mid 1	Camphor laurel (*Cinnamomum camphora*)*, Bangalow palm (*Archontophoenix cunninghamiana*), Paperbark (*Melaleuca quinquenervia*), Strangler fig (*Ficus watkinsiana*)
Mid 2	Foambark (*Jagera pseudorhus*), Scentless rosewood (*Synoum glandulosum*), Red bean (*Dysoxylum mollissimum subsp. molle*), Macaranga (*Macaranga tanarius*), Tuckeroo (*Cupaniopsis anacardioides*), Umbrella tree (*Schleffera actinophylla*)*, Sweet pittosporum (*Pittosporum undulatum*), Brown kurrajong (*Commersonia bartramia*), Umbrella cheese tree (*Glochidion sumatranum*), Strangler fig (*Ficus watkinsiana*), Plum myrtle (*Pilidiostigma glabrum*), Cudgerie (*Flindersia schottiana*), White bolly gum (*Neolitsea dealbata*), Red kamala (*Mallotus philippensis*), Bennett's ash (*Flindersia bennettii*), Bangalow palm (*Archontophoenix cunninghamiana*), Camphor laurel (*Cinnamomum camphora*)*, Paperbark (*Melaleuca quinquenervia*), Rough leaved elm (*Aphananthe philippinensis*), Smooth Clerodendrum (*Clerodendrum floribundum*), Scrub turpentine (*Rhodamnia rubescens*), Birds nest fern (*Asplenium australasicum*), Lantana (*Lantana camara*)*, Cocos palm (*Syagrus romanzoffiana*)*
Mid 3	Mickey mouse plant (*Ochna serrulata*)*, Winter senna (*Senna pendula var. glabrata*)*, *Lantana camara**, Large-leaved privet (*Ligustrum lucidum*)*, Passionfruit (*Passiflora edulis*)*, Climbing Asparagus fern (*Asparagus plumosus**), Zig zag vine (*Uvaria leichhardtii*)
Ground	Gristle fern (*Blechnum cartilagineum*), Asparagus fern (*Asparagus africanus*)*, Cockspur (*Maclura cochinchinensis*), Common silkpod (*Parsonsia straminea*), Scrambling lily (*Geitonoplesium cymosum*), Prickly smilax (*Smilax australis*),

Stratum†	Species
	Rough maidenhair fern (*Adiantum hispidulum*), Blue flax lily (*Dianella caerulea*), Mat rush (*Lomandra hystrix, L. longifolia*)

†Species are listed in order of dominance.

Based on the data obtained from the quantitative assessment, the broad floristic subformation (Hnatiuk *et al*., 2009) of Vegetation Association D is: Very tall closed/open sclerophyll forest over closed to dense rainforest mid-strata over open fern groundcover.

This unit is in a successional stage with floristics generally representative of TVMS Vegetation Type 204: Brushbox open forest complex. With continued fire exclusion this association may in time resemble Lowland Subtropical Rainforest on Floodplain (TVMS Type 104).

Variation and Disturbance

This association has been subjected to clearing in the past, altering the dominant canopy floristics - and is subject to widespread weed incursion. The canopy weed, Camphor laurel, forms a sub-dominant component of the upper mid-stratum. Where Camphor laurel forms a canopy dominant, vegetation is mapped as Vegetation Association A.

Significance

The Tweed Vegetation Management Strategy (Ecograph 2004) states that Vegetation Type 204: Brushbox open forest complex represents approximately 14.88 % of the vegetated land in the shire and is adequately conserved. The conservation status of this community is therefore considered to be low to moderate.

This successional community contains floristic elements of TVMS Type 104 Lowland Rainforest on Floodplain in the understorey which represents the TSCA listed Lowland Rainforest on Floodplain EEC. However the structure of the dominant ecological layer (upper canopy) of the site's vegetation more closely resembles TVMS 204 - Brushbox open forest complex.

No significant species were recorded in this association.



Figure 5.7 Vegetation Association C



Figure 5.8 Vegetation Association C on left, Vegetation Association B on right of track



Figure 5.9 Vegetation Association C

5.2.4 Vegetation Association D – Mid-high Wet Grassland / Sedgeland

This vegetation community occurs in the cleared, lower flood prone area in the central part of the site and has been historically modified and maintained for rural purposes. The results of the quantitative assessments and floristic formations are listed in Table 5.9 and Table 5.10 respectively. The species encountered within each stratum in this vegetation unit are provided in Appendix B.

Table 5.9 Vegetation Association D Quantitative Assessments

Stratum†	Growth Form	Crown Separation Ratio	Stratum Height (m)
Upper	-	-	-
Mid	-	-	-
Ground	graminoid	0-0.25	0.3-1.2

†Strata that were not present have been omitted.

Table 5.10 Vegetation Association D Floristic Formation

Stratum†	Species
Ground	Pigeon grass (*Setaria sphacelata**), Paspalum (*Paspalum dilatatum**), Kikuyu (*Pennisetum clandestinum**), Rhodes grass (*Chloris virgata**), Water couch (*Paspalum distichum*), Crofton weed (*Ageratina adenophora**), Mistflower (*Ageratina riparia**), Blue billygoat weed (*Ageratum houstonianum**), Native wandering jew (*Commelina cyanea*), Common rush (*Juncus*

	usitatus), Cumbungi *(Typha domingensis),* Nutgrass (*Cyperus rotundus*),* Couch grass (*Cynodon dactylon*),* Cobblers pegs (*Bidens pilosa**), Cunjevoi (*Alocasia brisbanensis),* Tussock sedge (*Cyperus eragrostis*),* Sour grass (*Paspalum conjugatum*),* Broad-leaved paspalum (*Paspalum mandiocanum*),* Para grass (*Urochloa mutica**), Smartweed (*Persicaria strigosa*), White eclipta (*Eclipta prostrata), B*unchy sedge (*Cyperus polystachyos var polystachyos),* Pennywort (*Centella asiatica),* Hydrocotyle (*Hydrocotyle peduncularis),* Elephant grass *(Pennisetum purpureum*)*

†Species are listed in order of dominance.

Based on the data obtained from the quantitative assessment, the broad floristic subformation (Hnatiuk *et al*., 2009) of Vegetation Association D is: Low closed, mid-dense sedge and grassland.

The floristic composition is generally representative of Tweed VMP 2004: Code 701_Sedgeland / Rushland with a predominance of exotic graminoid flora over native species.

Variation and Disturbance

This association is considered to be disturbed and modified due to the dominance of exotic species. This map unit is similar in floristic composition to Vegetation Association E but comprises boggy areas with a sedgeland component.

Significance

No significant flora species were recorded in this association. Due to the predominance of exotic flora in this association it does not resemble a natural or significant ecological community.



Figure 5.10 Vegetation Association D



Figure 5.11 Vegetation Association D

5.2.5 Vegetation Association E – Cleared Land

This association occurs over a substantial proportion of the site which has been historically modified and currently maintained for grazing purposes. The results of the quantitative assessments and floristic formations are listed in Table 5.11 and Table 5.12 respectively. All species encountered within each stratum in this vegetation unit are provided in Appendix B. This association does not represent a natural community.

Table 5.11 Vegetation Association E Quantitative Assessments

Stratum†	Growth Form	Crown Separation Ratio	Stratum Height (m)
Emergent	tree	>3	5-12
Mid	shrub	>20	0.5-2.5
Ground	graminoid	0-0.25	0.3-0.6

†Strata that were not present have been omitted.

Table 5.12 Vegetation Association E Floristic Formation

Stratum†	Species
Upper	Camphor laurel (*Cinnamomum camphora*), Blackwood (*Acacia melanoxylon*), Bennett's ash (*Flindersia bennettii*), Tuckeroo (*Cupaniopsis anacardioides*), Foambark (*Jagera pseudorhus*), Mango *(Mangifera indica*),* Brown kurrajong *(Commersonia bartramia)*

Mid	Lantana *(Lantana camara*)*, Mickey mouse plant *(Ochna serrulata*),* Easter Cassia (*Senna pendula* var *glabrata*), Wild tobacco tree *(Solanum mauritianum*), Macaranga tanarius*, Cockspur *(Maclura cochinchinensis),* Banana *(Musa paradisiaca*),* Large-leaved privet *(Ligustrum lucidum*),* Small-leaved privet *(Ligustrum sinense*), Guava (Psidium guajava*)*
Ground	Kikuyu (*Pennisetum clandestinum**), Pigeon grass *(Setaria sphacelata*),* Rhodes grass *(Chloris gayana*),* Paspalum (*Paspalum dilatatum**), Couch grass *(Cynodon dactylon*),* Blady grass *(Imperata cylindrica),* Narrow-leaf carpet grass *(Axonopus fissifolius),* Mistflower *(Ageratina riparia*),* Cobblers pegs *(Bidens pilosa*),* Fireweed *(Senecio madagascariensis*),* Morning glory *(Ipomoea indica*),* Silver-leaved desmodium *(Desmodium uncinatum*),* Tussock sedge *(Cyperus eragrostis*),* Molasses grass *(Melinis minutiflora*),* Sour grass *(Paspalum conjugatum*),* Queensland blue couch *(Digitaria didactyla*),* Balloon cotton bush *(Gomphocarpus physocarpus*),* Crofton weed *(Ageratina adenophora*),* Blue billygoat weed *(Ageratum houstonianum*),* Fleabane *(Conyza albida*),* Chick weed *(Stellaria media*),* Whiskey grass *(Andropogon virginicus*),* Red natal grass *(Melinis repens*),* Black-berry nightshade *(Solanum nigrum*),* Groundsel bush *(Baccharis halimifolia*),* Elephant grass *(Pennisetum purpureum*),* Black thistle *(Cirsium vulgare*),* Bindii *(Soliva pterosperma*),* Stinking roger *(Tagetes minuta*),* Dandelion *(Taraxacum officinale*),* Noogoora burr *(Xanthium occidentale*),* Cunjevoi *(Alocasia brisbanensis)*

†Species are listed in order of dominance.



Figure 5.12 Vegetation Association E



Figure 5.13 Vegetation Association E

5.2.6 Conservation Significant Flora

For the purposes of this report, a significant flora species has been defined as a species that is:

- Scheduled as Critically Endangered, Endangered, Vulnerable or Conservation Dependent under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); and/or
- Scheduled as Endangered or Vulnerable under the NSW *Threatened Species and Conservation Act 1995* (TSCA).

One significant flora species was recorded during surveys – Rough shelled bush nut (*Macadamia tetraphylla*). A single juvenile specimen was recorded near the dwelling on the eastern boundary of the property in Vegetation Association A at the following coordinates (refer Figure 5.1 for location):

Easting:	550998.720	**Northing:**	6877406.447
Latitude:	-28 ° 13 ' 41.60000 ''	**Longitude:**	153 ° 31 ' 11.22000 ''

A subsequent site investigation (JWA, 2018b) found four (4) additional specimens in close proximity to this individual.

5.2.7 Endangered Ecological Communities (EECs)

Desktop investigations revealed nine (9) endangered ecological communities (EECs) potentially occurring on site (Table 4.4). One (1) of these EECs was verified to be present on the site during

surveys: Swamp sclerophyll forest on coastal floodplains. This EEC is represented on site in Vegetation Association B.

5.2.8 Weed Infestations

For the purposes of this report, a plant is considered a weed if identified as such in the *North Coast Regional Strategic Weed Management Plan 2017-2022*, published by North Coast Local Land Services ('the Plan'). The Plan provides a framework for regional weed management to support the implementation of the NSW *Biosecurity Act 2015.* The *Biosecurity Act 2015* (the Act) repeals the *Noxious Weeds Act 1993*, which previously provided regulatory controls and powers to manage noxious weeds in NSW.

Under the Act, private land owners and occupiers have a 'General Biosecurity Duty' (GBD), meaning any person dealing with biosecurity matter must take measures to prevent, eliminate or minimise the biosecurity risk (as far as is reasonably practicable). The GBD applies equally to a carrier of biosecurity matter and to any person who knows or ought to know of the biosecurity risks associated with the activity.

A total of 37 weed species were recorded within the subject site (Table 5.13) including seven (7) species identified as a biosecurity matter under the Act. Prevalent weeds are indicated in bold.

Table 5.13 Weeds observed on site

Species	Common name	Status
Ageratina adenophora	Crofton weed	O
Ageratina riparia	Mistflower	O
Ageratum houstonianum	Blue billygoat weed	O
Andropogon virginicus	Whiskey grass	P
Anredera cordifolia	Madeira vine	AP
Asparagus aethiopicus	Asparagus fern	AP
Asparagus plumosus	**Climbing asparagus fern**	AP
Baccharis halimifolia	Groundsel bush	C
Chloris gayana	**Rhodes grass**	O
Cinnamomum camphora	**Camphor laurel**	O
Conyza albida	Fleabane	O
Desmodium uncinatum	Silver-leaved desmodium	O
Gomphocarpus physocarpus	Balloon cotton bush	O
Ipomoea cairica	Coastal morning glory	O
Ipomoea indica	Morning glory	O
Lantana camara	**Lantana**	AP
Ligustrum lucidum	Large-leaved privet	O
Ligustrum sinense	Small-leaved privet	O
Melinis minutiflora	**Molasses grass**	O
Nephrolepis cordifolia	Fishbone fern	O
Ochna serrulata	**Mickey mouse plant**	O
Paspalum conjugatum	Sour grass	O
Paspalum dilatatum	**Paspalum**	O
Paspalum mandiocanum	Broad-leaved paspalum	O

Species	Common name	Status
Passiflora edulis	Passionfruit	O
Pennisetum clandestinum	Kikuyu	O
Pennisetum purpureum	Elephant grass	O
Passiflora suberosa var. suberosa	Corky passionfruit	O
Passiflora subpeltata	**White passionflower**	O
Rivina humilis	Coral berry	O
Senecio madagascariensis	Fireweed	AP
Senna pendula var. glabrata	**Winter senna**	O
Setaria sphacelata	**Pigeon grass**	O
Solanum mauritianum	**Wild tobacco tree**	O
Wedelia trilobata	Singapore daisy	O
Urochloa mutica	Para grass	O
Xanthium occidentale	Noogoora burr	O

*Status under the *North Coast Regional Strategic Weed Management Plan 2017-2022*: P = Prevention - To prevent the weed species arriving and establishing in the Region. C = Containment - To prevent the ongoing spread of the species in all or part of the Region. AP = Asset Protection - To prevent the spread of the species to key sites/assets of high economic, environmental and/or social value or to reduce impact on these values if spread has already occurred. O = Other: Either listed as a species if concern in the Plan or not listed under the Plan but recognised as an Environmental Weed by TSC by way of policy.

5.3 Methods - Fauna Survey

With consideration given to the information obtained within the desktop assessment, Burchills Environmental Scientists undertook field surveys on 10th and 11th April 2017. Relevant environmental parameters for the survey period are provided in Table 5.14. Weather observations are taken from the closest Bureau of Meteorology weather station, located at the Coolangatta airport (station number 040717) and willyweather.com.au.

Table 5.14 Environmental Parameters during Field Investigations

Parameter	10 April 2017	11 April 2017
Min. temperature	17.7ºC	11.2 ºC
Max. temperature	30.4 ºC	25.8 ºC
Rainfall (mm)	0	0
Cloud cover (9am)	0	0
Sunrise	0600	0601
First light	0537	0537
Sunset	1733	1732
Last light	1757	1756
Moon phase	Waxing Gibbous	Full
% moon visible	99	100

Where relevant, observations regarding fauna habitat values on adjacent sites were also recorded. However, as permission for access to adjacent sites had not been secured, observations of fauna habitat values external to the site were limited to those that were discernible from within the subject site and/or from publicly accessible land.

The survey methodology incorporated the following survey techniques:

- Amphibian surveys;
- Diurnal bird surveys;
- Spotlighting surveys;
- Nocturnal call playback surveys;
- Diurnal active searches;
- Nocturnal searches;
- Camera trapping;
- Opportunistic records and observations of inferential evidence; and
- Targeted searches for conservation significant species.

The following sections provide an overview of the methodology employed during fauna surveys following the Terrestrial Fauna Survey Guidelines for Queensland (Eyre et. al., 2014). Survey locations are presented in Figure 5.15.

5.3.1 Amphibian Surveys

Amphibian surveys were undertaken on the evening of April 10th 2017. Transects were walked through the site around the dam, in the wetland area and along the creek lines. Frogs were identified visually or aurally.

5.3.2 Diurnal Bird Surveys

Diurnal bird surveys were undertaken within the site for a period of 10 minutes by one observer. This was repeated six (6) times during the survey period. Two surveys were carried out within two (2) hours of sunrise, two surveys within 2–4 hours of sunrise, one survey more than four (4) hours after sunrise and one within two (2) hours of sunset. Bird species were identified through direct observations (i.e. visual sighting) and/or vocalisations.

Each survey involved the observer walking slowly and quietly through the site for ten minutes, looking and listening for birds, taking a different path through the site on each occasion.

5.3.3 Spotlighting Surveys

Spotlighting searches were undertaken through the entire site. Searches were conducted in the wetter areas of the site on foot by two (2) Burchills Environmental Scientists, using 30-watt spotlights. Other areas of the site were searched while driving at walking speed using hand-held 30-watt spotlights.

5.3.4 Nocturnal Call Playback Surveys

Nocturnal call playback surveys were undertaken adjacent the wetland area, within one hour of sunset and prior to the spotlighting survey. This survey technique involved broadcasting pre-recorded species vocalisations (Stewart, 1999) through a portable stereo system. Species calls were broadcast in a specified order, separated by a period of several minutes dedicated to listening for auditory responses.

Calls were broadcast for approximately three (3) minutes per species, with two (2) minute listening breaks between species in the following order:

- *Phascolarctos cinereus* (koala);
- *Ninox connivens* (barking owl);
- *Tyto longimembris* (eastern grass owl); and
- *Burhinus grallarius* (bush stone-curlew).

The species chosen for call-playback were based on the desktop assessment of likely threatened species occurring on the site.

After completion of all call playbacks, the immediate vicinity of the playback site was surveyed by two (2) Burchills Environmental Scientists to account for any target taxa that may have been attracted by the playbacks. Surveys were conducted on foot, using 30-watt spotlights, for duration of approximately 10 minutes. Nocturnal call playbacks were undertaken prior to the completion of spotlighting surveys to increase the chances of detecting a delayed response.

5.3.5 Diurnal Active Searches

Active searches can detect many reptile species that trapping rarely does. Active searching primarily focuses on detecting reptiles and amphibians but will also detect small terrestrial mammals and signs of other somewhat cryptic species (e.g. tracks, scats, nests and feeding signs) (Eyre et. al., 2014).

Active searching involves scanning for active animals as well as turning rocks and logs, raking through leaf litter, looking under bark and in crevices and other suitable microhabitat for cryptic animals.

Two active searches are conducted on the site; one on the eastern side of the site and the other in the west. Each search was conducted for 30 minutes during the hottest part of the day within a 50m x 50m area.

5.3.6 Nocturnal searches

Nocturnal searches were undertaken to detect reptiles and amphibians that are active during the night. These nocturnal searches were predominantly observational with little destructive searching and involved scanning for active reptiles, looking for eye-shine and listening for activity.

One nocturnal search was conducted on the site for one (1) person hour over a 100m x 100m area.

5.3.7 Camera Trapping

Camera trapping involves using a remotely triggered camera to capture images or video of animals which pass in front of the camera or are lured by bait.

Camera trapping has been demonstrated to be a far more successful method than many trapping techniques for many cryptic or wary vertebrate species including quolls, bandicoots and other small to medium-sized mammals (e.g. de Bondi et al., 2010; Claridge et al., 2010; Burnett 2010).

Studies have also shown that the use of camera traps to survey for small mammals compares favourably with Elliott and cage trapping techniques. The use of camera traps is more cost-effective, especially where the detection of the presence of a species rather than abundance is the desired project outcome (de Bondi et al., 2010).

Six (6) camera traps were set up on the site. The traps were focused at a height of 20-40cm from ground level. A wooden stake marked at 5cm intervals was placed within the focal range of the camera to provide a scale. Bait, in the form of peanut butter and honey, was attached to this stake via a tea diffuser (Figure 5.7).

Camera traps were deployed for a period of eight (8) nights (from 10 April to 19 April, 2017). Fauna species were identified from images captured over this period.



Figure 5.14 Camera Trapping Bait Lure

5.3.8 Opportunistic Records and Observations of Inferential Evidence

Observations of inferential evidence and opportunistic fauna encounters were recorded throughout the duration of flora and fauna investigations. Inferential evidence included observation of scratches, scats, tracks, shed skins, diggings and nests, as well as targeted inspections and searches for potential habitat features such as hollow bearing limbs and trunks, arboreal termite mounds with holes, nests and dreys. Opportunistic observations involved the recording of all fauna sighted or heard outside of systematic fauna surveys.

This survey technique incorporated all times outside of systematic fauna surveys.

5.3.9 Targeted Searches for Conservation Significant Species

Targeted surveys focused on the threatened fauna considered likely to be occurring on the site. The list of potential threatened species was taken from the BioNet database within 10km of the site. The likelihood of occurrence was determined based on the ecological requirements of the species and availability of suitable habitat on the site. The results of this assessment are presented in Section 6 of this report.

It was considered that the standard survey methods outlined in Section 5.3.1-5.3.7 were adequate for the detection of the other threatened species identified in the desktop assessment.

Phascolarctos cinereus (Koala) searches

In addition to spotlighting and call-playback surveys, searches were made for Koala scats to determine habitat occupancy of the species. Faecal pellets of koala and their distinctive scratch marks on smooth-barked trees, are readily identifiable and persist post-departure of the animal from the area (Woosnam-Merchez et. al., 2012). The identification of traces of koala allows for the presence of this species to be confirmed and involved minimal habitat disturbance.

Koala scat searches were conducted in accordance with Phillips and Callaghan 2011. The sampling location was selected initially on the presence of koala food trees. The sampling site was further refined by selecting a koala food tree as a central starting point. The closest 29 trees from the central tree and which had a diameter at breast height (DBH) of greater than 100m, were searched for koala evidence (scats within 1m from the base of the tree, or scratch marks on the trunks of smooth-barked trees). Survey effort dedicated to the faecal pellet search was two (2) person minutes per tree, or until a Koala faecal pellet was found – whichever occurred first.

The NSW Recovery Plan for the Koala (Department of Environment and Climate Change, 2008) provided a list of koala food trees for the North Coast Koala Management Area (in which the site falls). This has been reproduced in Table 5.15.

Table 5.15 Koala Food Tree Species in North Coast KMA

Botanical Name	Common Name
Primary Food Tree Species	
Eucalyptus tereticornis	Forest red gum
Eucalyptus microcorys	Tallowwood
Eucalyptus robusta	Swamp mahogany
Eucalyptus parramattensis	Paramatta red gum
Eucalyptus bancroftii	Orange gum
Eucalyptus amplifolia	Cabbage gum
Secondary Food Tree Species	
Eucalyptus seeana	Narrow-leaved red gum
Eucalyptus glaucina	Slaty red gum
Eucalyptus propinqua	Small-fruited grey gum
Eucalyptus resinifera	Red mahogany
Eucalyptus notabilis	Mountain mahogany
Eucalyptus moluccana	Grey box
Eucalyptus melliodora	Yellow box
Eucalytpus largeana	Craven grey box
Eucalyptus biturbinata	Grey gum
Eucalyptus canaliculata	Large-fruited grey gum
Eucalyptus rummeryi	Steel box
Eucalyptus rudderi	Rudder's box
Eucalyptus quadrangulata	White-topped box

Within the Tweed Shire, Phillips et al. (2011) determined that *Eucalyptus robusta, E. tereticornis, E. microcorys* and *E. propinqua* that were the most preferred tree species for koalas.

Due to the vegetation on the site and the heavy infestation of camphor laurel, only one location was deemed suitable for conducting a koala spot assessment.

***Calyptorhynchus lathami* (Glossy black-cockatoo) searches**

Glossy black-cockatoos inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. They feed almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species) (Office of Environment and Heritage, 2015). As the birds feed, they drop the remnants of the she-oak cones after stripping the cone of seeds. These distinctive 'orts' are used to determine if Glossy black-cockatoos have been feeding in the area. Within the subject site, searches were made for she-oaks. The ground underneath these trees was searched for orts.

As with other cockatoo species, the Glossy black-cockatoo is dependent on large hollow-bearing eucalypts for nest sites. Searches were made for suitable nesting trees within the subject site.

***Amaurornis moluccana* (Pale-vented bush-hen)**

The Pale-vented Bush-hen is secretive and cryptic, usually remaining in dense vegetation near watercourses or at the edges of wetlands, and often only detected by its loud, distinctive calls (NSW EH, 2017a). In areas of potential habitat for this species, call-playback techniques were employed. Suitable habitat was present along the dam margins and within the wetland area of the site.

Acid Frog Searches

Crinia tinnula, *Litoria freycineti* and *Litoria olongburensis* are collectively known as acid frogs. They are associated with acidic, tannin stained water (Robinson, 1993).

Searches were made for suitable habitat within the site. The species of frogs heard calling from within and adjacent to the site were recorded. Frog species can be distinguished based on call (Meyer *et al*., 2005). Call playback was used to encourage additional calling activity. Calls were broadcast through a handheld speaker for a period of one minute, followed by a listening period of two minutes.



N

0 200 400 600 m

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FIGURE 5.15 Survey Locations
LOT 1 ON DP175234
NEWLAND DEVELOPERS PTY LTD

PROJECTION: GDA94/MGA ZONE 56
PROJECT: BE170043
DATE: APRIL 2017

LEGEND

- Site Location
- Call Playback
- Camera Trap
- Diurnal Active Search
- KSAT
- Pale-Vented Bush-Hen Call Playback

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5.3.10 Survey Limitations

It should be noted that the fauna survey that was undertaken only provides a very limited 'snap-shot' of the species present and detectable on the subject site at the time of the survey. Therefore, it is acknowledged that the full inventory of fauna species utilising the site is unlikely to have been recorded. Although assessments of habitat and species ecology do provide an additional measure to predict the presence of species (i.e. in lieu of direct observation), it should be noted that there are no methodologies that can be used to predict, with absolute certainty, the absence of a species from marginal or potential habitat.

There may be species that utilise habitats within the region like those that occur on-site, but have not been detected due to their occasional usage of the habitat types, rarity or cryptic nature. For example, some species might only occasionally visit a specific site that forms part of a much larger home range, or only visit an area during peak flowering periods. Alternatively, other species that have low detectability – as they are difficult to trap or observe directly – may tend to be under-represented in surveys that are not replicated within and across seasons and years.

5.4 Fauna Field Survey – Results

Sixty-seven species of fauna have been identified to utilise the subject site, including five (5) amphibian species, four (4) reptile species, 49 bird species and nine (9) mammal species. Sixty-three species encountered were native and four (4) are introduced (Table 5.16). Three (3) species – varied triller, rose-crowned fruit-dove and eastern tube-nosed, are listed as vulnerable under state legislation.

5.4.1 Amphibians

Five (5) species of amphibian were recorded during the field survey, one of which is the introduced cane toad (*Rhinella marina*).

Surveying at a core calling period does not guarantee that individuals will be calling at the time of the survey. Environmental conditions, such as temperature and recent rainfall, affect the calling activity of frogs. Unfavourable climatic conditions may curtail calling activity and could prevent frogs from being detected in an area where they are otherwise common (Lemckert and Mahony, 2008).

The presence of the wetland, dams and small creeks within the site provides potential amphibian breeding habitat for species tolerant of disturbed environments.

Acid Frogs

Crinia tinnula requires ephemeral or temporary water bodies that are generally shallow (i.e. >1 m), acidic (i.e. pH <6.0) and tannin stained (Meyer *et al*., 2005). It is found along drainage lines in sub-coastal wet heath, in acid Melaleuca swamps, as well as sedge swamps in areas of sandy soil and sandstone (Meyer *et al*., 2005).

Litoria olongburensis occur in fore-dune swamps and lagoon systems in areas of habitat frequently inundated with water (Lewis and Goldingay, 2005). Studies on this species have found that populations fluctuated from year to year and that timing of recent rainfall influenced habitat use by adult frogs. Adult frogs were more frequently encountered within a day of rain (Lewis and Goldingay, 2005). The site survey was *not* conducted during a period when the detectability of this species was highest. The survey was also conducted outside of the peak calling period for this species; October

and March (NSW DECC, 2009). This species requires high water levels in the sedge swamps for breeding (Lewis and Goldingay, 2005).

No acid frogs were detected during the survey period.

5.4.2 Reptiles

Four (4) species of reptiles were recorded during the field survey including the introduced *Hemidactylus frenatus* (Asian house gecko). All species observed are common with broad habitat requirements, they are tolerant of disturbed environments and are often recorded in rural-residential environments of the local region (Cogger, 2000).

5.4.3 Birds

Of the 49 bird species identified during the field survey, two (2) are listed as vulnerable under the NSW *Threatened Species Conservation Act 1995*; rose-crowned fruit-dove (*Ptilinopus regina*) and varied triller (*Daphoenositta chrysoptera*). Call playback surveys did not return any positive results for any avian target species. It is possible that the site forms part of a larger home range that may provide occasional foraging opportunities for predatory nocturnal and a larger diversity of diurnal bird species.

5.4.4 Mammals

Nine (9) mammal species was recorded from the subject site including one (1) introduced species – *Vulpes vulpes* (Red fox). Positive identification was unable to be made on two (2) of the species observed – one microbat was observed flying along the forest margins near the wetland and a flying-fox was observed flying over the site. No flying-fox roosts were noted on site. The eastern tube-nosed bat is listed as vulnerable under the NSW *Threatened Species Conservation Act 1995.*

Koala

Despite intensive efforts to determine the presence of koala on the site, no direct or indirect evidence was found. The absence of any evidence of koalas is attributable to the lack of suitable habitat on the site.

5.4.5 Threatened Species

Three (3) species of threatened fauna have been identified to utilise the subject site, including two (2) bird species and one (1) mammal species.

An assessment was made to determine the likelihood of threatened species identified in the BioNet database search, occurring on the subject site (Table 5.17). This assessment was based on the ecological requirements of each species and the availability of suitable habitat on the site. Seabirds (e.g. shearwater, albatross), shorebirds (e.g. Terek sandpiper, Little tern) and marine species (e.g. green turtle) have not been included in this assessment as suitable habitat for these species is not present on the site.

To satisfy 'Section 5A' of the *Environmental Planning and Assessment Act 1979* an assessment of significance has been performed for the threatened species observed, or considered having potential to occur on the site. These are presented in Section 6 of this report.

Locations where the threatened species were observed is presented in Figure 5.8.

Table 5.16 Fauna Species Recorded

Scientific Name	Common Name	Status*	Method	Survey Type
Amphibians				
Rhinella marina	Cane toad	I	V	AS
Crinia signifera	Common Eastern Froglet	C	H	AS
Litoria fallax	Eastern sedgefrog	C	H	OO
Limnodynastes peronii	Striped marshfrog	C	H	AS
Adelotus brevis	Tusked frog	C	H	OO
Birds				
Sphecotheres vieilloti	Australasian figbird	C	V	BS
Alectura lathami	Australian brush-turkey	C	V	BS
Cracticus tibicen	Australian magpie	C	V	BS
Pelecanus conspicillatus	Australian pelican	C	V (F/O)	OO
Threskiornis molucca	Australian white ibis	C	V (F/O)	BS
Geopelia humeralis	Bar-shouldered dove	C	V	BS
Coracina novaehollandiae	Black-faced cuckoo-shrike	C	V	BS
Entomyzon cyanotis	Blue-faced honeyeater	C	V	BS
Macropygia amboinensis	Brown cuckoo-dove	C	V	BS
Accipiter fasciatus	Brown goshawk	C	V	OO
Lichmera indistincta	Brown honeyeater	C	H	BS
Bubulcus ibis	Cattle egret	C	V	OO
Psophodes olivaceus	Eastern whipbird	C	H	OO
Eopsaltria australis	Eastern yellow robin	C	V	BS
Pachycephala pectoralis	Golden whistler	C	H	BS
Cisticola exilis	Golden-headed cisticola	C	V	OO
Rhipidura albiscapa	Grey fantail	C	V	BS

Scientific Name	Common Name	Status*	Method	Survey Type
Dacelo novaeguineae	Laughing kookaburra	C	V	BS
Meliphaga lewinii	Lewin's honeyeater	C	H	BS
Phalacrocorax sulcirostris	Little black cormorant	C	V (F/O)	BS
Cacatua sanguinea	Little corella	C	H (F/O)	BS
Grallina cyanoleuca	Magpie-lark	C	H	BS
Dicaeum hirundinaceum	Mistletoebird	C	S	BS
Philemon corniculatus	Noisy friarbird	C	H	BS
Manorina melanocephala	Noisy miner	C	V	BS
Oriolus sagittatus	Olive-backed oriole	C	V	BS
Anas superciliosa	Pacific black duck	C	H	OO
Cracticus nigrogularis	Pied butcherbird	C	V	BS
Strepera graculina graculina	Pied currawong (eastern australia)	C	V	BS
Merops ornatus	Rainbow bee-eater	C	V	BS
Trichoglossus haematodus moluccanus	Rainbow lorikeet	C	V	BS
Malurus melanocephalus	Red-backed fairy-wren	C	V	OO
Ptilinopus regina	Rose-crowned fruit-dove	V	V	BS
Pachycephala rufiventris	Rufous whistler	C	V	BS
Todiramphus sanctus	Sacred kingfisher	C	H	OO
Myzomela sanguinolenta	Scarlet honeyeater	C	H	BS
Zosterops lateralis cornwalli	Silvereye (eastern)	C	H	BS
Dicrurus bracteatus bracteatus	Spangled drongo (eastern australia)	C	V	BS
Streptopelia chinensis	Spotted dove	I	V	BS
Pardalotus striatus	Striated pardalote	C	V	BS
Cacatua galerita	Sulphur-crested cockatoo	C	V (F/O)	BS
Megalurus timoriensis	Tawny grassbird	C	V	OO

Scientific Name	Common Name	Status*	Method	Survey Type
Lopholaimus antarcticus	Topknot pigeon	C	V	BS
Corvus orru	Torresian crow	C	V	BS
Lalage leucomela	Varied triller	V	V	BS
Egretta novaehollandiae	White-faced heron	C	V (F/O)	BS
Columba leucomela	White-headed pigeon	C	V	BS
Lalage tricolor	White-winged triller	C	V	BS
Rhipidura leucophrys	Willie wagtail	C	V	BS
Mammals				
Rattus rattus	Black rat	C	V	CT
Rattus fuscipes	Bush rat	C	V	CT
Trichosurus vulpecula	Common brushtail possum	C	V	SS
Nyctimene robinsoni	Eastern tube-nosed bat	V	H	SS
Tachyglossus aculeatus	Short-beaked echidna	C	V	CT
Pteropus spp.	Flying-fox		V	SS
	Microbat spp.		V	SS
Vulpes vulpes	Red fox	I	V	CT
Wallabia bicolor	Swamp wallaby	C	V	CT
Reptiles				
Dendrelaphis punctulatus	Green tree snake	C	V	OO
Hemidactylus frenatus	House gecko	I	H	OO
Varanus varius	Lace monitor	C	V	OO
Carlia vivax	Tussock rainbow-skink	C	C	DS

Status under the NSW *Threatened Species Conservation Act 1995*: E = Endangered, V = Vulnerable, I = Introduced, C = Common

[#]Status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*: V = Vulnerable

Method: V = Visually identified, H = Identified through call, C = Caught by hand, F/O = Flying Overhead

Survey Type: BS = Bird Survey, SS = Spotlight Survey, NS = Nocturnal Search, DS = Diurnal Active Search, CT = Camera Trap, AS = Amphibian Search, OO = Opportunistic Observation

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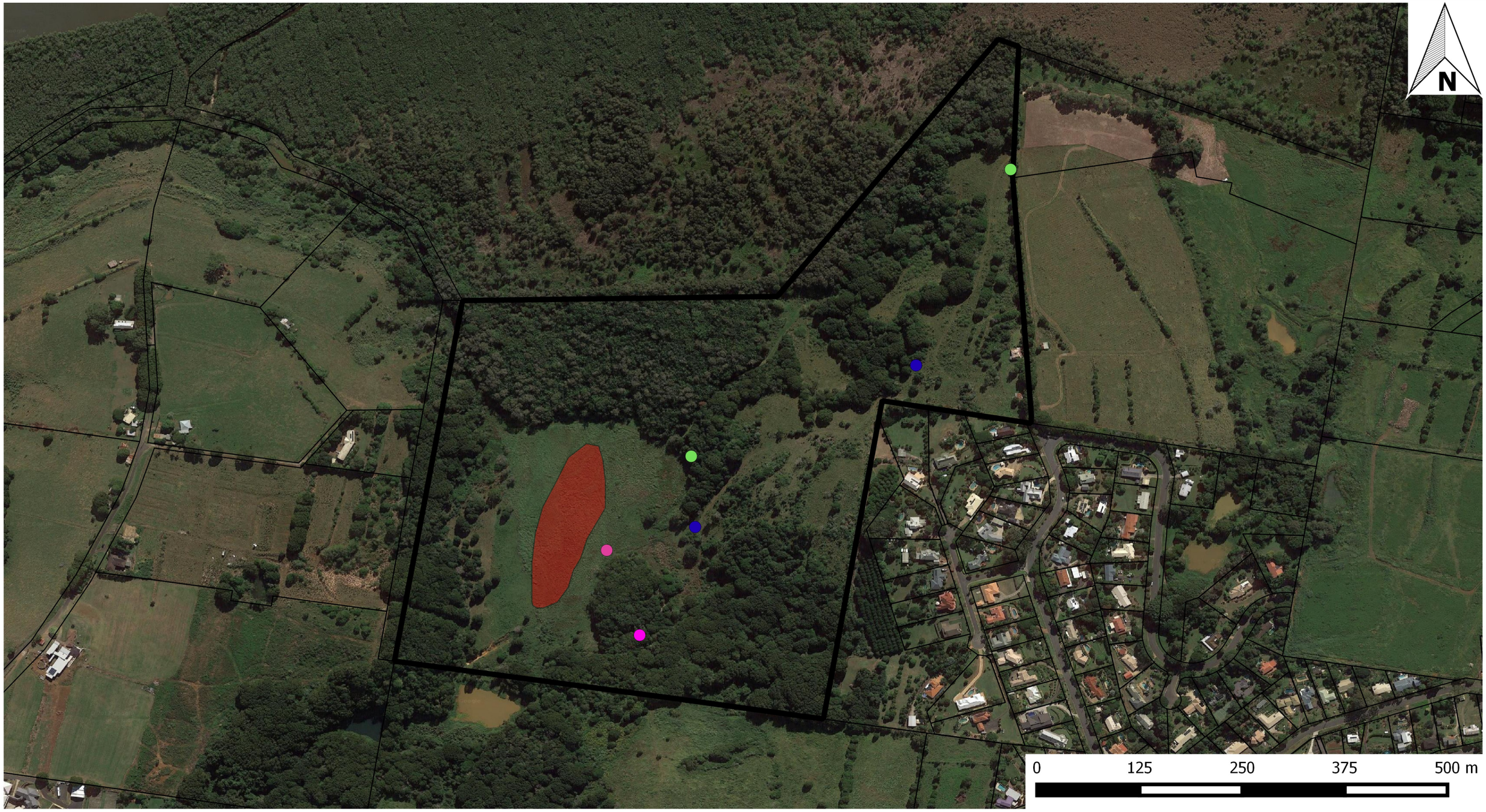


Figure 5.16 Threatened Species Observations
LOT 1 ON DP175234
NEWLAND DEVELOPERS PTY LTD

PROJECTION: GDA94/MGA ZONE 56
PROJECT: BE170043
DATE: JULY 2017

LEGEND

- Site Location
- Eastern Tube-Nosed Bat
- Flying-Fox spp.
- Flying-Fox spp.
- Rose-Crowned Fruit-Dove
- Varied Triller

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Table 5.17 Expected Threatened Species at the Subject Site

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
Amphibians				
Crinia tinnula	Wallum froglet	V	Currently, within the scientific literature, there is there is little information regarding non-breeding habitat requirements, factors limiting distribution, or population, structure, dynamics and genetics for this species. However, specific habitat attributes that are known requirements for this species include ephemeral to temporary water bodies. Water bodies are generally shallow (i.e. >1 m), acidic (i.e. pH <6.0) and tannin stained (Meyer *et al*., 2005). This species is found along drainage lines in sub-coastal wet heath, in acid Melaleuca swamps, as well as sedge swamps in areas of sandy soil and sandstone (Meyer *et al*., 2005).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat is not present on the site and it is considered unlikely that *C. tinnula* would utilise the site.
Litoria olongburensis	Olongburra frog	V, V[#]	*Litoria olongburensis* occur in foredune swamps and lagoon systems in areas of habitat frequently inundated with water (Lewis and Goldingay, 2005). Studies on this species have found that populations fluctuated from year to year and that timing of recent rainfall influenced habitat use by adult frogs. Adult frogs were more infrequently encountered within a day of rain (Lewis and Goldingay, 2005).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat is not present on the site and it is considered unlikely that *L. olongburensis* would utilise the site.
Birds				
Anseranas semipalmata	Magpie Goose	V,P	The magpie goose is mainly found in shallow wetlands (less than 1 m deep), dry ephemeral swamps, wet grasslands and floodplains with dense growth of rushes or sedges. It roosts in tall vegetation near the foraging areas (NSW OEH, 2016d).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable habitat for this species exists on the site.
Ptilinopus magnificus	Wompoo Fruit-Dove	V,P	The wompoo fruit-dove occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula in Queensland (NSW EH, 2016a). It inhabits rainforests, or bushland near rainforest, low elevation moist eucalypt forest and brush box forests (NSW EH, 2016a).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable habitat for this species exists on the site.
Ptilinopus regina	Rose-crowned Fruit-Dove	V,P	The rose-crowned fruit-dove occurs along the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria (NSW OEH, 2012h).	**OBSERVED** This species was observed on the site during the survey.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			Rose-crowned fruit-doves inhabit mainly sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful (NSW OEH, 2012h).	
Ephippiorhynchus asiaticus	Black-necked Stork	E1,P	Black-necked storks have a distribution across Australia from the Pilbara, WA to eastern Qld and south along a narrow coastal strip in NSW as far as the Hunter River. It is also present in southern New Guinea (Garnett and Crowley, 2000). Black-necked storks are more commonly found in freshwater swamps and only occasionally in mangroves and on coastal mudflats (Serventy, 1985). They feed in shallow water up to 0.5m deep. Large stick nests are made in trees near foraging areas (Garnett and Crowley, 2000).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable foraging habitat for this species exists on the site. No nests were observed on the site.
Ixobrychus flavicollis	Black Bittern	V,P	The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia (NSW OEH, 2014b). The species inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves (NSW OEH, 2014b). Black bitterns are nocturnal. During the day, it roosts in trees or on the ground amongst dense reeds (NSW OEH, 2014b).	**NOT OBSERVED – UNLIKELY TO OCCUR** While suitable foraging habitat for this species exists on the site, dense reed vegetation favoured for roosting does not.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V,P, C[#]	The White-bellied sea-eagle (*Haliaeetus leucogaster*) is distributed throughout India, southern China, South-East Asia, the Philippines, Wallacea and New Guinea to Australia. Within Australia, the White-bellied sea-eagle is distributed along the coastline of mainland Australia and Tasmania, with its distribution also extending inland along some of the larger waterways, especially in eastern Australia. White-bellied Sea-eagles are restricted to water, with nests in south-east Queensland and northern NSW being situated at a maximum distance of approximately 1km from a major waterbody, and a minimum distance of 220m to 1.1km from human settlement. (Department of the Environment, 2017).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable foraging habitat does not exist on the site, but is within 1km. The site lacks large eucalypt species in which the species nests.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			White-bellied Sea-eagles generally choose nest trees in open forest, or remnant trees of a pasture environment. The nest is a large structure composed of sticks and lined with leaves, grass or seaweed and may be built in a variety of natural sites including tall trees (especially Eucalyptus species), bushes, mangroves, cliffs, rocky outcrops, caves, crevices, on the ground. White-bellied Sea-eagles do not nest on artificial platforms, and will only nest in large live trees such as *Eucalyptus* spp. with branching forks providing radial support for the nest. Pairs usually return to the same breeding territory each year, and often the same nest, although territories tend to contain one or two additional, less developed nests (Department of the Environment, 2017). White-bellied sea-eagles feed opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal (Department of the Environment, 2017).	
Hieraaetus morphnoides	Little Eagle	V,P	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It inhabits open eucalypt forest, woodland or open woodland (NSW OEH, 2015d). The species nests in tall living trees in a large stick nest. It preys on birds, reptiles and mammals (NSW OEH, 2015d).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat is not present on the site.
Pandion cristatus	Eastern Osprey	V,P,3	The eastern osprey has a global distribution. Eastern osprey are found right around the Australian coast line, except for Victoria and Tasmania. The species favours coastal areas, especially the mouths of large rivers, lagoons and lakes (NSW OEH, 2017a). Eastern osprey feed on fish over clear, open water (NSW OEH, 2017a).	**NOT OBSERVED – UNLIKELY TO OCCUR** No suitable foraging habitat exists on the site for this species. No nests are located on the site.
Amaurornis moluccana	Pale-vented Bush-hen	V,P	In Australia, the pale-vented bush-hen occurs mainly in coastal and sub-coastal regions from the Top End of the Northern Territory and Cape York Peninsula south through eastern Queensland to north-eastern NSW. In NSW, bush-hens are an uncommon resident from the Queensland border south to the Nambucca River (NSW OEH, 2012g). The pale-vented bush-hen inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or	**NOT OBSERVED – POTENTIAL TO OCCUR** The preferred habitat for this species is present on the site. However, attempts to elicit a response to call playback was

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. It also occurs in secondary forest growth, rank grass or reeds, thickets of weeds, such as lantana (*Lantana camara*), pastures and crops or urban gardens where they border forest and streams or wetlands, such as farm dams. The species can also occur in and around mangroves, though rarely do so, if at all, in NSW (NSW OEH, 2012g). The diet of the bush-hen consists of seeds, plant matter, earthworms, insects and some frogs, taken from ground cover or by wading at edges of streams or wetlands (NSW OEH, 2012g).	unsuccessful during the survey period..
Burhinus grallarius	Bush Stone-curlew	E1,P	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania (NSW OEH, 2015a). The species inhabits open forests and woodlands with a sparse, grassy ground layer and fallen timber. It is largely nocturnal, being especially active on moonlit nights (NSW OEH, 2015a).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat for this species does not exist on the site.
Esacus magnirostris	Beach Stone-curlew	E4A,P	In Australia, the Beach Stone-curlew occurs along coastlines from about Point Cloates in Western Australia, across northern and north-eastern Australia south to north-eastern NSW, with occasional vagrants to south-eastern NSW and Victoria. Outside Australia, the species also occurs in south-eastern Asia, from the Malay Peninsula through Indonesia and southern New Guinea, the Solomon Islands, Vanuatu and New Caledonia (NSW OEH, 2016a). Beach Stone-curlews are forage in the intertidal zone and are found exclusively along the coast, on beaches, islands, reefs and in estuaries, and are often be seen at the edges of or near mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees and among open mangroves (NSW OEH, 2016a).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat for this species does not exist on the site.
Irediparra gallinacea	Comb-crested Jacana	V,P	The Comb-crested Jacana occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW. Outside Australia, the Comb-crested Jacana occurs from Borneo and the Philippines, throughout Sulawesi, the Moluccas and Lesser Sunda	**NOT OBSERVED – UNLIKELY TO OCCUR** No suitable habitat for this species exists on the site.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			Islands, to the Aru Islands, New Guinea and New Britain (NSW OEH, 2012c). The species inhabits permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation (NSW OEH, 2012c).	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P,2	The Glossy black-cockatoo (*Calyptorhynchus lathami*) has a patchy distribution in Australia, occurring from the coast near Eungella in eastern Queensland to Mallacoota in Victoria (NSW OEH, 2015c). Glossy black-cockatoos inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. They feed almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species). The birds' presence is often indicated by a layer of cracked cones and fragments that have accumulated under favoured casuarina trees. These are referred to as orts. It is selective in its choice of food trees, choosing casuarinas that produce seeds with a high nutrient value (NSW OEH, 2015c). They are dependent on large hollow-bearing eucalypts for breeding. Breeding takes place from March to August (NSW OEH, 2015c).	**NOT OBSERVED – UNLIKELY TO OCCUR** No suitable foraging or breeding habitat for this species exists on the site.
Glossopsitta pusilla	Little Lorikeet	V,P	The little lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. Nomadic movements are common in this species and is influenced by season and food availability. The species forages primarily in the canopy of open *Eucalyptus* forest and woodland. It nests in proximity to feeding areas, most typically selecting hollows in the limb or trunk of riparian trees (NSW OEH, 2016c).	**NOT OBSERVED – UNLIKELY TO OCCUR** Potential foraging habitat for this species does not exist on the site.
Ninox connivens	Barking Owl	V,P,3	The barking owl is found throughout continental Australia except for the central arid regions (NSW OEH, 1998). It inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. The species hunts small arboreal mammals such as squirrel gliders and ringtail possums. It will also feed on birds, invertebrates and terrestrial mammals such as rodents and rabbits when arboreal mammals are limited (NSW OEH, 1998).	**NOT OBSERVED – UNLIKELY TO OCCUR** While it is possible that the site may be part of a home range of this species, the lack of tree hollows, limit the likelihood of barking owls utilising the site.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			Barking owls require very large permanent territories in most habitats. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats (NSW OEH, 1998). The species nest in the hollows of large, old eucalypt trees (NSW OEH, 1998).	Attempts to elicit a response to call-playback during the survey period was unsuccessful.
Tyto longimembris	Eastern Grass Owl	V,P,3	Eastern Grass Owls have been recorded in all mainland states of Australia but are most common in northern and north-eastern Australia. In NSW they are more likely to be resident in the north-east (NSW OEH, 2014d). Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains (NSW OEH, 2014d).	**NOT OBSERVED – UNLIKELY TO OCCUR** While the site's vegetation does contain grassland pasture, grazing and the regular maintenance regime limits the suitability of the site to grass owls. It is considered unlikely that this species would occur on the site.
Todiramphus chloris	Collared Kingfisher	V,P	In Australia, the distribution of the collared kingfisher extends around the northern coasts, from Shark Bay in northern Western Australia to the estuary of the Tweed River in far north-eastern NSW. In NSW, the species is observed regularly only at Ukerebagh and nearby Cobaki Broadwater, and it breeds along the Tweed River estuary. Outside of Australia, the species is widely distributed from the Red Sea and Arabian Gulf in the Middle East, through southern and south-eastern Asia to Indonesia and New Guinea and east to the Solomon Islands, Vanuatu, Fiji, Tonga and Samoa (NSW OEH, 2012a). The species is restricted to mangrove associations of estuaries, inlets, sheltered bays and islands, and the tidal flats and littoral zone bordering mangroves (NSW OEH, 2012a). Nests are usually in holes in trunks of large, live or dead mangrove trees, though they sometimes nest in hollows or in arboreal termite nests in large eucalypts or paperbarks adjacent to mangroves or estuarine foraging habitats (NSW OEH, 2012a).	**NOT OBSERVED – UNLIKELY TO OCCUR** Foraging and nesting habitat for this species does not exist on the site.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V,P	The eastern subspecies of the brown treecreeper lives in eastern NSW in eucalypt woodlands through central NSW and in coastal areas with	**NOT OBSERVED – UNLIKELY TO OCCUR**

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			drier open woodlands. It mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey (NSW OEH, 2014c). It nests in hollows in standing dead or live trees and tree stumps (NSW OEH, 2014c).	No foraging habitat exists on the site for this species.
Gavicalis fasciogularis	Mangrove Honeyeater	V,P	The mangrove honeyeater is confined to the coastal fringe and offshore islands of eastern Australia, from Townsville in Queensland, south to the northern coast of NSW (NSW OEH, 2016e). The primary habitat of the species is mangrove woodlands and shrublands but will also range into adjacent forests, woodlands and shrublands, including casuarina and paperbark swamp forests and associations dominated by eucalypts or banksias (NSW OEH, 2016e). The species nests in a densely foliaged mangrove tree (NSW OEH, 2016e).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat for this species does not exists on the site, however, potential habitat is present to the north.
Daphoenositta chrysoptera	Varied Sittella	V,P	The varied sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. Foraging and nesting habitat for this species are eucalypt forests and woodlands, where there are rough-barked trees like stringybarks and ironbarks or mature trees with hollows or dead branches (NSW OEH, 2016h).	**OBSERVED** This species was observed foraging on the site.
Coracina lineata	Barred Cuckoo-shrike	V,P	Barred cuckoo-shrike are distributed along coastal eastern Australia from Cape York to the Manning River in NSW. It is considered rare in NSW (NSW OEH, 2012b). The species is found in rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses (NSW OEH, 2012b).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable foraging habitat for this species exists on the site, however, it was not observed during the survey period.
Carterornis leucotis	White-eared Monarch	V,P	The white-eared monarch occurs in the coastal lowlands and eastern slopes of the Great Divide of eastern Australia, extending from Cape York Peninsula south to north-eastern NSW. In NSW, white-eared monarchs are generally found from the Queensland border south to Iluka at the mouth of the Clarence River, and inland as far as the Richmond Range (NSW OEH, 2012i).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable foraging habitat for this species exists on the site, however, it was not observed during the survey period.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			In NSW, the species inhabits littoral rainforest, wet and dry sclerophyll forests, swamp forest and regrowth forest. They appear to prefer the ecotone between rainforest and other open Vegetation Associations or the edges of rainforest (NSW OEH, 2012i). They breed from about September to March, usually nesting high in the canopy, and often at the edge of patches of rainforest (NSW OEH, 2012i).	
Mammals				
Dasyurus maculatus	Spotted-tailed Quoll	V,P, E#	The spotted-tailed quoll is found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania (NSW OEH, 2017b). The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites (NSW OEH, 2017b).	**NOT OBSERVED – UNLIKELY TO OCCUR** No suitable habitat for this species exists on the site.
Planigale maculata	Common Planigale	V,P	The common planigale occupies a range of habitats including rainforests, sclerophyll forests, savanna woodlands, heathlands, sedgelands, grasslands and rocky areas (Denny 1982). In northern NSW, native vegetation on sandy soils of the coastal plain constitute core habitat particularly swamp forests, banksia woodlands, wallum heaths and dry and moist open forests (Milledge 1991; Miller, 1998). Higher than average leaf litter cover and logs were important habitat features for common planigales (Miller, 1998).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable habitat for this species is present on the site.
Phascolarctos cinereus	Koala	V,P, V#	*Phascolarctos cinereus* inhabits dry open sclerophyll forests and woodlands occurring on fertile soils (Van Dyck, 1995; Menkhorst and Knight, 2001; Environmental Protection Agency, 2006). Communities containing denser vegetation and larger trees are generally preferred; however *Phascolarctos cinereus* can also inhabit less optimal habitat such as young forests, highly fragmented vegetation communities, and small remnants (Environmental Protection Agency, 2006). They mainly feed on *Eucalyptus* species, along with some *Corymbia*, *Angophora*, *Lophostemon*, *Melaleuca*, and *Leptospermum* species (Environmental Protection Agency, 2006).	**NOT OBSERVED – UNLIKELY TO OCCUR** This species was not recorded during surveys and no scats of *P. cinereus* were found. There is very limited habitat for this species on the subject site.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
Nyctimene robinsoni	Eastern Tube-nosed Bat	V,P	The eastern tube-nosed bat is distributed along the coastal areas of north-eastern Australia from Cape York south to the far north-east corner of NSW (NSW OEH, 2012f). The species favours streamside habitats within coastal subtropical rainforest and moist eucalypt forests with a well-developed rainforest understorey (NSW OEH, 2012f).	**OBSERVED** This species was heard during spotlighting surveys on the site.
Pteropus poliocephalus	Grey-headed Flying-fox	V,P, V#	The grey-headed flying-fox occurs in the coastal belt from Rockhampton to Melbourne. The grey-headed flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands (Eby, 1998). None of the vegetation communities used by the Grey-headed Flying-fox produce continuous foraging resources throughout the year, so the species selectively forages where food is available. Consequently, patterns of occurrence and relative abundance within its distribution vary widely between seasons and between years. At a local scale, the species is generally present intermittently and irregularly (Eby & Lunney, 2002). The Grey-headed Flying-fox roosts in aggregations of various sizes on exposed branches. They most frequently travel around 15km from a roost site to feed (Tidemann, 1998), although can travel up to 50km as food resources change (Eby, 1991).	**POTENTIAL TO OCCUR** No roost sites were found on-site, however, the grey-headed flying-fox would forage on the flowering trees on site at appropriate times of the year. A flying-fox was observed flying over the site during the spotlighting surveys, however, positive identification was unable to be made.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P	The yellow-bellied sheathtail-bat is a wide-ranging species found across northern and eastern Australia. It roosts singly or in groups of up to six, in tree hollows and buildings (NSW OEH, 2016i).	**NOT OBSERVED – POTENTIAL TO OCCUR** It is possible that the site makes up part of a foraging range for this species.
Mormopterus lumsdenae	Northern Free-tailed Bat	V	The northern free-tailed bat is widely distributed across northern Australia from Western Australia to Queensland, extending south to the north-east corner of NSW (NSW OEH, 2016f). The species occurs in a range of Vegetation Associations in northern Australia, from rainforests to open forests and woodlands, and are often recorded along watercourses (NSW OEH, 2016f).	**NOT OBSERVED – POTENTIAL TO OCCUR** It is possible that the site makes up part of a foraging range for this species.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
			Roost sites are mainly in tree hollows but relatively large colonies have been found under house roofs in urban areas in Queensland. The only confirmed record in NSW is of a colony found in the roof of a house in Murwillumbah, however, calls have been detected from a few other locations in the far north east of the State (NSW OEH, 2016f).	
Mormopterus norfolkensis	Eastern Freetail-bat	V,P	The eastern freetail-bat is found along the east coast from south Queensland to southern NSW. It occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range (NSW OEH, 2015b). The species roost mainly in tree hollows but will also roost under bark or in man-made structures (NSW OEH, 2015b).	**NOT OBSERVED – POTENTIAL TO OCCUR** It is possible that the site makes up part of a foraging range for this species.
Chalinolobus nigrogriseus	Hoary Wattled Bat	V,P	The hoary wattled bat is widely distributed across northern Australia, although is absent from the arid centre. In north east NSW, it extends from Port Macquarie in the south, north to the Queensland border (NSW OEH, 2014e). In NSW, the Hoary Wattled Bat occurs in dry open eucalypt forests, favouring forests dominated by spotted gum, boxes and ironbarks, and heathy coastal forests where red bloodwood and scribbly gum are common (NSW OEH, 2014e). The species roosts in hollows and rock crevices (NSW OEH, 2014e).	**NOT OBSERVED – UNLIKELY TO OCCUR** Suitable habitat for this species does not exist on the site.
Miniopterus australis	Little Bentwing-bat	V,P	The little bentwing-bat occurs along the east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW (NSW OEH, 2014f). It inhabits moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, melaleuca swamps, dense coastal forests and banksia scrub. It is generally found in well-timbered areas (NSW OEH, 2014f). Little bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats (NSW OEH, 2014f).	**NOT OBSERVED – POTENTIAL TO OCCUR** It is possible that the site makes up part of a foraging range for this species.

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P	Eastern Bentwing-bats occur along the east and north-west coasts of Australia (NSW OEH, 2016b). The species forages in a range of habitats including rainforest, wet and dry schlerophyll forest, open woodland, paperbark forests and grasslands (Churchill, 1998). Caves are the primary roosting habitat, but the species will also use derelict mines, storm-water tunnels, buildings and other man-made structures (Churchill, 1998).	**NOT OBSERVED – POTENTIAL TO OCCUR** While suitable foraging habitat exists on the site for this species, roosting habitat is not present.
Myotis macropus	Southern Myotis	V,P	The southern myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers (NSW OEH, 2016g). The species generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage (NSW OEH, 2016g). Southern myotis forage over streams and pools catching insects and small fish by raking their feet across the water surface (NSW OEH, 2016g).	**NOT OBSERVED – UNLIKELY TO OCCUR** No suitable foraging or roosting habitat exists on the site.
Nyctophilus bifax	Eastern Long-eared Bat	V,P	This species is found from Cape York through eastern Queensland to the far north-east corner of NSW. In NSW, they appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area (NSW OEH, 2012e). The species inhabits lowland subtropical rainforest and wet sclerophyll and swamp eucalypt forest, extending into adjacent moist eucalypt forest (NSW OEH, 2012e). Eastern long-eared bats roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings (NSW OEH, 2012e).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable foraging and roosting habitat is present on the site.
Invertebrates				

Species Name	Common Name	Status	Species Ecology	Likelihood of Occurrence
Thersites mitchellae	Mitchell's Rainforest Snail	E1, CE[#]	This species is found in remnant vegetation on the coastal plain between the Richmond River and Tweed River on the NSW north coast. It occupies remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils. The slightly higher ground around the edges of wetlands with palms and fig trees are particularly favoured habitat (NSW EH, 2017o). This species is usually found amongst leaf litter on the forest floor, and occasionally under bark in trees where it feeds on leaf litter, fungi and lichen (NSW EH, 2017o).	**NOT OBSERVED – POTENTIAL TO OCCUR** Suitable habitat for this species exists on the site.

*****Status under the Commonwealth EPBC Act: V = Vulnerable, E = Endangered, C = Listed under the CAMBA, J = Listed under JAMBA, K = Listed under RoKAMBA.
[#]Status under the *Threatened Species Conservation Act 1995* unless otherwise noted.
E1 Endangered **E2** Endangered Population **E3** Endangered Ecological Community **E4** Presumed Extinct **E4A** Critically Endangered **E4B** Critically Endangered Ecological Community **P** Protected (*National Parks & Wildlife Act 1974*) **V** Vulnerable **V2** Vulnerable Ecological Community **1** Sensitivity Class 1 (Sensitive Species Data Policy) **2** Sensitivity Class 2 (Sensitive Species Data Policy) **3** Sensitivity Class 3 (Sensitive Species Data Policy).

6. Assessment of Impacts of Proposed Development

An assessment on the presence or absence of environmentally significant areas on the site, based on desktop and field investigations has been made. The potential impacts of the development are discussed within the following sections. Table 6.1 provides a summary of these findings.

Table 6.1 Summary of Matters of Environmental Significance

Schedule of Matters of Environmental Significance	Site Characteristics
Threatened Ecological Communities, Populations or Species, as identified under the Commonwealth EPBC Act.	Threatened Ecological Communities listed under the Commonwealth EPBC Act have been identified on the site. The Endangered Ecological Community (EEC) Swamp Sclerophyll Forest on Coastal Floodplains. Is represented on site as Vegetation Type B. **Threatened fauna species have been observed foraging on the site.** **One (1) threatened flora species was recorded on site – *Macadamia tetraphylla* (Vulnerable under the TSC Act).**
The presence of World or National Heritage properties as identified under the EPBC Act.	The site is not a national or world heritage property
Wetlands of international importance (Ramsar sites).	No Ramsar sites are located on the site.
Areas providing essential habitat for species listed under JAMBA, CAMBA, RoKAMBA and the Bonn Convention.	The subject site is not considered to provide essential habitat for any species listed under JAMBA, CAMBA, RoKAMBA and/or the Bonn Convention.
Areas subject to a Conservation Plan.	No areas within the study site are subject to a Conservation Plan.
Ecologically sensitive areas or of high ecological value are identified on site.	**Areas that have high ecological value and ecological sensitivity are present on the site.**
Areas providing core habitat for threatened species under the *Threatened Species Conservation Act, 1995*	No core habitat for threatened species is present within the development footprint of the site.
Wetlands identified under *State Planning Policy Coastal Management 2018* or the Tweed *Vegetation Management Strategy 2004*	**Coastal wetlands identified under SEPP Coastal Management are mapped within the site.**
Areas owned or managed by the Tweed Shire Council for nature conservation purposes.	The subject site is not owned or managed by the Tweed Shire Council for nature conservation purposes.
Areas containing environmental corridors required to link matters of environmental significance	The site does not provide a critical link to areas containing environmentally significant areas external to site.

6.1 General Impacts on Native Vegetation and Habitat

The development footprint falls within the predominantly cleared areas of the site avoiding impacts on ecologically significant areas. Some clearing is required to facilitate the development, however this vegetation is highly modified/disturbed and/or well represented in protected remnant vegetation in the local and regional area.

The final location of the proposed development ensures that the development footprint:

- does not impact on retained vegetation;
- does not require the clearing of habitat trees; and
- does not occur within an ecologically significant area.

The ecological impacts of the proposed development upon vegetation within a local and regional context are negligible and able to be mitigated through restoration.

Notwithstanding the above, uncontrolled clearing operations undertaken during the Construction Phase have the potential to impact upon vegetation to be retained within the construction site. Recommendations have been provided to mitigate this impact during the construction phase (refer to Section 8).

6.2 Impacts on Significant Flora Species - Assessment of Significance

6.2.1 *Macadamia tetraphylla* (Rough-shelled bushnut)

NSW TSC Act Status: Vulnerable

Table 6.2 Assessment of Significance for *Macadamia tetraphylla* (Rough-shelled bushnut)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The NSW OEH Bionet Atlas database holds 29 valid records for this species within a 10km radius of the subject site and 270 valid records in the Tweed LGA. One (1) specimen was recorded during site investigations and a further four (4) specimens were detected during subsequent site investigations (JWA, 2018b). Two (2) specimens were recorded on the adjoining development to the east by JWA (2013). This species is found in subtropical rainforest and has a very limited natural range. It is recorded from the north of the Richmond River in north-east NSW, to just across the border into south east Qld (NSW NPWS, 2002 and OEH 2018). The specimens detected on the subject site will be translocated to more suitable habitat (protected area away from earthworks) in accordance with the translocation plan (JWA 2018b). The translocation management plan includes provisions for planting of additional *Macadamia tetraphylla* plants and surrogate habitat, ensuring a net gain of this species and this species' habitat results from the proposed development.

Factors of Assessment	Response
	It is highly unlikely that the proposed development will result in the local extinction of this species.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the Rough-shelled bushnut is subtropical rainforest near the coast in the Richmond and Tweed Valleys (PlantNET 2018). This ecological community type was not recorded on the subject site. A lowland rainforest community that will provide suitable surrogate habitat for this species will be restored within a conservation reserve as part of the larger estate development. Details with regard to this project are provided in the Altitude Aspire Revised Vegetation Management and Rehabilitation Plan (JWA 2018a).
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species. A targeted strategy for managing this species has been developed under the OEH *Saving Our Species* program. This species is allocated to the 'Site-managed' management stream under this program. Species threats and management objectives / actions identified as part of the SOS include: • Risk of adverse fire/wildfire: reduce risk of fire through site-based weed control • Residential development: Ensure land management is sympathetic to the long-term requirements of the species through negotiation of land management agreements. Implementation of the Altitude Aspire Revised Vegetation Management and Rehabilitation Plan (JWA 2018a) will meet the SOS objectives and actions for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes are listed in Schedule 3 of the TSC Act (1995). Relevant Key Threatening Processes for this species and the proposed development include: • Weed invasion; • Vegetation clearing; • Altered fire regime; and • Infection by *Phytophthora cinnamomi*. The implementation of the Altitude Aspire Revised Vegetation Management and Rehabilitation Plan (JWA 2018a) will mitigate these potential impacts and ensure effective management of the restored habitat for this species.

6.3 Impacts on Significant Ecological Communities - Assessment of Significance

An assessment of significance is designed to improve the standard of consideration afforded to ecological communities through the planning and assessment process. The assessment of significance allows a qualitative analysis of the likely impacts, and ultimately, whether further assessment needs to be undertaken through a species impact statement.

Desktop investigations and site surveys determined that a threatened ecological community, at least in part, occurs on the subject site. An assessment of significance was performed and the results are provided in Table 6.2.

Table 6.3 Assessment of Significance - Endangered Ecological Community - Swamp Sclerophyll Forest

Factors of Assessment	Response
In the case of an endangered ecological community or critically endangered ecological community whether the action proposed: (i) ecological community such that its local occurrence is likely to be placed at risk of extinction; and (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	The extent of the EEC is outside of the development footprint and protected from the proposed works by an appropriate (50m) buffer. The local occurrence of this EEC will not be reduced or impacted by the proposed works. The proposed works will not impact the EEC such that its local occurrence is likely to be placed at risk of extinction. Additionally, the proposed development will not substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction. The implementation of an approved restoration plan will ensure the ecological function and values of the EEC are not impacted by the proposed development.
In relation to the habitat of a threatened species, population or ecological community: (iii) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (iv) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (v) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The proposed works will not remove / modify / fragment or isolate the existing EEC provided appropriate management actions are implemented including: • Retain a buffer of at least 50m to the EEC; and • Implement best practise construction management, stormwater quality management, weed management and habitat restoration management.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this EEC.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	A “threatening process” means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes are listed in Schedule 3 of the TSC Act (1995). Relevant Key Threatening Processes for this species and the proposed development include: • Weed invasion;

Factors of Assessment	Response
	• Vegetation clearing; • Altered fire regime; and • Infection by *Phytophthora cinnamomi*. The implementation of an approved vegetation management plan will mitigate these potential impacts and ensure effective protection of this EEC.

6.4 Threatened Fauna Confirmed On-Site - Assessment of Significance

The fauna survey design incorporated a concentrated survey effort within the proposed disturbance footprint and surrounding areas to ensure that the potential impacts of the proposed development could be accurately identified and evaluated.

The assessment of significance is designed to improve the standard of consideration afforded to threatened species and their habitats through the planning and assessment process, and to ensure that the consideration is transparent. The assessment of significance allows a qualitative analysis of the likely impacts, and ultimately, whether further assessment needs to be undertaken through a species impact statement.

For each of the threatened species positively identified as occurring on the site, an assessment of significance (7-part test) has been conducted. These assessments are presented in the following sections.

6.4.1 *Ptilinopus regina* (Rose-crowned fruit-dove)

NSW Status: Vulnerable

Rose-crowned fruit-dove were observed foraging in camphor laurel on the subject site.

Table 6.4 Assessment of Significance for *Ptilinopus regina* (Rose-crowned fruit-dove)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The rose-crowned fruit-dove occurs along the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York (NSW OEH, 2012h). Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest (NSW OEH, 2012h). They feed entirely on fruit from a variety of plants. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May (NSW OEH, 2012h). The potential habitat for this species is outside of the building footprint. It is therefore unlikely that the proposed development would place the local population of the rose-crowned fruit-dove at risk of extinction. However, the rose-crowned fruit-dove feeds on camphor laurel and the removal of all of these

Factors of Assessment	Response
	weeds from the site will reduce the foraging potential of this species.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The key habitat of the rose-crowned fruit-dove is outside of the building footprint. The key habitat of this species will not be modified, fragmented or isolated. However, additional foraging resources (camphor laurel) will be removed from the site. The loss of this resource will be offset with the rehabilitation of existing key habitat areas.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing and fragmentation of low to mid-elevation rainforest. • Logging and roading in moist eucalypt forest with well-developed rainforest understorey. • Burning of remnant rainforest habitat. • Invasion of habitat by introduced weed species. • Removal of Camphor Laurel food source without appropriate mitigation measures (NSW OEH, 2012h). It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the re-establishment of native foraging resources as camphor laurel is systematically removed from the site.

6.4.2 *Daphoenositta chrysoptera* (Varied sittella)

NSW Status: Vulnerable

Varied sittella were observed and heard foraging in the heavily vegetated areas of the site.

Table 6.5 Assessment of Significance for *Daphoenositta chrysoptera* (Varied sittella)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The varied sittella inhabits most of mainland Australia except the treeless deserts and open grasslands. It inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland (NSW OEH, 2016h).

Factors of Assessment	Response
	The varied sittella inhabits eucalypt forests and woodlands where it feeds on arthropods gleaned from the bark of the trees (NSW OEH, 2016h). Clearing outside of the key foraging habitat for this species is excluded from the development footprint. Impacts to this species are therefore expected to be minimal and the local population is unlikely to be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the varied sittella is outside of the development footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: Habitat destruction. • Dominance of noisy miners in woodland patches. • Infestation of habitat by invasive weeds. • Inappropriate fire regimes. • Climate change impacts including reduction in resources due to drought. • Overgrazing by stock impacting on leaf litter and shrub layer (NSW OEH, 2016h). It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site.

6.4.3 *Nyctimene robinsoni* (Eastern tube-nosed bat)

NSW Status: Vulnerable

Eastern tube-nosed bats were heard flying over the wetland areas during the spotlighting survey.

Table 6.6 Assessment of Significance for *Nyctimene robinsoni* (Eastern tube-nosed bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The eastern tube-nosed bat inhabits coastal areas of north-eastern Australia from Cape York south to the far north-east corner of NSW. There are few records from NSW, including the Nightcap, Tweed and Burringbar Ranges and in the vicinity of Mt Warning (NSW OEH, 2012f). The species favours streamside habitats within coastal subtropical rainforest and moist eucalypt forests with a well-developed rainforest understorey (NSW OEH, 2012f). At night, they fly rapidly and with great manouverability just above or below the forest canopy, making a distinctive, high-pitched whistling call. They feed mainly on fruit and nectar from trees in the rainforest canopy (NSW OEH, 2012f). Primarily a rainforest species, it roosts either singly or in small groups amongst the foliage. Roost sites are generally close to feeding areas and have been recorded in primary and secondary forest and mangroves (Australian Museum, 2017). Foraging and roosting habitat is available on the subject site. However, as the proposed development is restricted to the cleared areas of the site, it is unlikely that the local population of eastern tube-nosed bats would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the eastern tube-nosed bat is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing and fragmentation of rainforest and wet eucalypt forest for agriculture and residential development. • Loss and degradation of habitat due to disturbance of rainforest and wet eucalypt forest from timber harvesting. • Invasion of rainforest habitat by introduced weeds. • Destruction of Black Bean, an important food tree, because the seeds are toxic to cattle. • Predation by cats particularly while foraging on low hanging fruit and flowers.

Factors of Assessment	Response
	• Entanglement on barbed wire fences, particularly around feed trees, along wildlife corridors, over/near water and new fences. It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site. As there is no planned exclusion of domestic animals from the development site, the risk of predation from uncontrolled cats remains.

6.4.4 *Pteropus poliocephalus* (Grey-headed flying-fox)

NSW Status: Vulnerable

Commonwealth Status: Vulnerable

One flying-fox was spotlighted flying over the site during the spotlighting survey. While positive identification was unable to be made, a precautionary approach has been adopted and it is assumed that the flying-fox observed was a grey-headed flying-fox.

Table 6.7 Assessment of Significance for *Pteropus poliocephalus* (Grey-headed flying-fox)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The grey-headed flying-fox roosts and breeds in large aggregations. These are not present on the subject site. Foraging resources for this species are often widely distributed and seasonally abundant. The removal of isolated trees upon which flying-foxes may seasonally feed, will not impact this species on a local level. As the development footprint is largely restricted to the cleared areas of the site, there will be few trees required to be cleared. One flying-fox was seen flying over the site during the survey period and it will be assumed to be a grey-headed flying-fox as a precaution.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or	No roosting/breeding habitat will be affected by the proposed development. Given the vastness of the foraging ranges of this species, the removal of isolated trees to facilitate the construction of the proposed development, will not fragment, isolate or significantly modify the habitat.

Factors of Assessment	Response
isolated to the long-term survival of the species, population or ecological community in the locality	
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	A draft National Recovery Plan for this species has been produced. The proposed development does not compromise any of the actions listed within this recovery plan.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	Threats to this species are listed as: • Loss of roosting and foraging sites. • Electrocution on powerlines, entanglement in netting and on barbed-wire. • Heat stress. • Conflict with humans. Roosting sites are not impacted by this development as they are not present on the site or in adjacent areas. Conflict with humans is not believed to be an issue. Minimal foraging resources (flowering trees) will be removed as a result of this development proceeding.

6.5 Fauna Potentially Occurring On-Site – Assessment of Significance

An assessment of significance was conducted for all those species that were considered having *potential* to occur on the site. A species was considered to potentially occur on the site based on its distribution, database recordings within 10 km of the subject site and availability of habitat on site.

Under sections 53-55 of the *Threatened Species Conservation Act 1995*, four declarations of critical habitats are in force including:

- Gould's Petrel - critical habitat declaration
- Little penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stott’s Island Nature Reserve
- Wollemi Pine - critical habitat declaration

None of these critical habitats are applicable to the subject site.

6.5.1 *Anseranas semipalmata* (Magpie goose)

NSW Status: Vulnerable

Table 6.8 Assessment of Significance for *Anseranas semipalmata* (Magpie goose)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Magpie Goose is widespread throughout coastal northern and eastern Australia. It can be seen from Fitzroy River, Western Australia, through northern Australia to Rockhampton, Queensland, and has been extending its range

Factors of Assessment	Response
	into coastal New South Wales to the Clarence River and further south (Birdlife, 2015). Key foraging habitats for this species are wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off. Breeding mostly breeding occurs in monsoonal areas. Breeding is unlikely in NSW. It roosts in tall vegetation (NSW OEH, 2016d). Potential foraging habitat for this species exists on the subject site. However, the wetland area is ephemeral and this foraging area would only be available periodically throughout the year. The key nesting habitat for this species is outside of the building footprint and is buffered from development. It is therefore unlikely that the proposed development would place the local population of magpie geese at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The key foraging habitat of magpie geese is only periodically available after heavy and/or prolonged rain. It is considered that the potential foraging habitat for this species on the subject site is insignificant over a local or regional scale.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Inappropriate hydrological regimes of wetland habitats through drainage of swamps, ponds, dams and other wetlands for agricultural and other human purposes. • Degradation of habitat through water pollution (e.g. salinity, chemicals, eutrophication). • Modification of habitat and nest loss from trampling and overgrazing. • Predation on eggs and goslings. • Too-frequent burning of wetlands (NSW OEH, 2016d). The implementation of the stormwater management plan will reduce the risk of water quality and hydrology changes to the waterways near the site.

6.5.2 *Ptilinopus magnificus* (Wompoo fruit-dove)

NSW Status: Vulnerable.

Table 6.9 Assessment of Significance for *Ptilinopus magnificus* (Wompoo fruit dove)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The wompoo fruit-dove occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula (NSW OEH, 2012j). The species occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. It is most often seen in mature forests, but also found in remnant and regenerating rainforest (NSW OEH, 2012j). Wompoo fruit-doves feed on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit (NSW OEH, 2012j). The potential habitat for this species is outside of the building footprint. It is therefore unlikely that the proposed development would place the local population of the wompoo fruit-dove at risk of extinction. However, the wompoo fruit-dove feeds on camphor laurel and the removal of all of these weeds from the site will reduce the foraging potential of this species.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The key habitat of the wompoo fruit-dove is outside of the building footprint. The habitat of this species will not be modified, fragmented or isolated. However, additional foraging resources (camphor laurel) will be removed from the site. The loss of this resource will be offset with the rehabilitation of existing key habitat areas.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing and fragmentation of low to mid-elevation rainforest due to coastal development and grazing. • Logging and creating roads in moist eucalypt forest with well-developed rainforest understorey. • Increased fire regime. • Infestation of rainforest habitat by invasive weeds (NSW OEH, 2012j).

Factors of Assessment	Response
	It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the re-establishment of native foraging resources as camphor laurel is systematically removed from the site.

6.5.3 *Ephippiorhynchus asiaticus* (Black-necked stork)

NSW Status: Endangered

Table 6.10 Assessment of Significance for *Ephippiorhynchus asiaticus* (Black-necked stork)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	In Australia, Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (NSW EH, 2014a). The key habitat for this species are floodplain wetlands (swamps, billabongs, watercourses and dams). Black-necked storks build nests in tall trees close to water. The species forages for vertebrate and invertebrate prey in water 5-30 cm deep (NSW EH, 2014a). Potential foraging habitat for this species exists on the subject site. However, the wetland area is ephemeral and this foraging area would only be available periodically throughout the year. It is therefore unlikely that the proposed development would place the local population of black-necked stork at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	Potential foraging habitat for this species is ephemeral and this foraging area would only be available periodically throughout the year after heavy or prolonged rainfall. However, given the home range of this species is estimated to average 9,000 ha (NSW OEH, 2014a), it is likely that this habitat would be used only on an occasional basis, if at all.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the	Threats for these species have been listed as: • Powerlines, especially close to wetlands or over floodplains.

Factors of Assessment	Response
operation of, or increase the impact of, a key threatening process	• Modification or degradation of wetlands through changes in natural water flows. • Loss of wetland habitat through clearing and draining for development. • Loss of key habitat as a result of wetland drainage for flood mitigation and agricultural development. • Degradation of wetland habitats through pollution. • Loss of paddock trees used for nesting. • Degradation of wetlands as a result of salinity (NSW OEH, 2014a). The implementation of the stormwater management plan will reduce the risk of water quality and hydrology changes to the waterways on and in close proximity to the site.

6.5.4 *Amaurornis moluccana* (Pale-vented bush-hen)

NSW Status: Vulnerable

Table 6.11 Assessment of Significance for *Amaurornis moluccana* (Pale-vented bush-hen)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	In Australia, the pale-vented bush-hen occurs mainly in coastal and sub-coastal regions from the Top End of the Northern Territory and Cape York Peninsula south through eastern Queensland to north-eastern NSW. In NSW, bush-hens are an uncommon resident from the Queensland border south to the Nambucca River (NSW OEH, 2012g). Outside Australia, the species occurs in the Moluccas, western and southern New Guinea, the Bismarck Archipelago and the Solomon Islands. The pale-vented bush-hen inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. It also occurs in rank grass or reeds, thickets of weeds, pastures and crops or urban gardens where they border forest and streams or wetlands, such as farm dams. The species can also occur in and around mangroves (NSW OEH, 2012g). While the habitat of this species does exist on the site, it is largely excluded from the building footprint. Areas of dense native vegetation within the site will be retained, buffered and rehabilitated. It is therefore unlikely that the local population of pale-vented bush-hen will be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community:	The primary habitat of the pale-vented bush-hen is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.

Factors of Assessment	Response
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing, filling and draining of wetlands. • Pollution of wetlands from agricultural, urban and industrial run-off, including herbicides and pesticides. • Changes to wetlands caused by weed invasion, often associated with sedimentation or grazing. • Predation by introduced, feral and domestic predators, particularly red foxes (*Vulpes vulpes*) and cats (*Felis catus*). • Destruction of habitat and predation by feral pigs (*Sus scrofa*). • Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands. • Loss of dense and rank understorey vegetation near streams and wetlands with clearing associated with urban and semi-rural developments (NSW OEH, 2012g). The implementation of the stormwater management plan will reduce the risk of water quality and hydrology changes to the waterways on and in close proximity to the site. As there are no planned restrictions on domestic pets in the proposed development, the risk of predation by uncontrolled dogs and cats remains. Loss of dense rank understorey vegetation around the site's dam and in the wetland area will occur as a result of the development. However, the rainforest habitat will be buffered and rehabilitated, potentially increasing the long-term habitat availability for this species.

6.5.5 *Coracina lineata* (Barred cuckoo-shrike)

NSW Status: Vulnerable

Table 6.12 Assessment of Significance for *Coracina lineata* (Barred cuckoo-shrike)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The barred cuckoo-shrike occurs in coastal eastern Australia from Cape York to the Manning River in NSW. Barred Cuckoo-shrikes are generally uncommon in their range, and are rare in NSW (NSW OEH, 2012b). The species inhabits rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. They are usually seen in pairs or small flocks foraging among foliage of trees for insects and fruit (NSW OEH, 2012b). Suitable foraging habitat exists on the site. However, this habitat is outside of the development footprint, so it is unlikely that the local population would be placed at risk of extinction as a result of the development. However, the removal of camphor laurel from the site may reduce the foraging resources for this species.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The key habitat of the barred cuckoo-shrike is outside of the building footprint. The habitat of this species will not be modified, fragmented or isolated. The implementation of a habitat restoration plan and the staged removal of camphor laurel will result in a net gain of foraging habitat for this species.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: Reduction of habitat, particularly rainforest, due to clearing for agriculture, development and timber harvesting (NSW OEH, 2012b). It is unlikely that the proposed development will contribute to increased impacts from these threats as the rainforest habitat is excluded from development and buffered. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site.

6.5.6 *Carterornis leucotis* (White-eared monarch)

NSW Status: Vulnerable

Table 6.13 Assessment of Significance for *Carterornis leucotis* (White-eared monarch)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The white-eared monarch occurs in the coastal lowlands and eastern slopes of the Great Divide of eastern Australia, extending from Cape York Peninsula south to north-eastern NSW. In NSW, white-eared monarchs are generally found from the Queensland border south to Iluka at the mouth of the Clarence River, and inland as far as the Richmond Range (NSW OEH, 2012i). In NSW, the species inhabits littoral rainforest, wet and dry sclerophyll forests, swamp forest and regrowth forest. They appear to prefer the ecotone between rainforest and other open Vegetation Associations or the edges of rainforest (NSW OEH, 2012i). Suitable foraging and nesting habitat exists on the site. However, this habitat is outside of the development footprint, so it is unlikely that the local population would be placed at risk of extinction because of the development.
In relation to the habitat of a threatened species, population or ecological community: (iv) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The key habitat of the white-eared monarch is outside of the building footprint. The habitat of this species will not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing and increasing fragmentation and isolation of habitat, especially low-elevation subtropical rainforest, littoral rainforest and wet sclerophyll forest. • Forest management that results in conversion of multi-aged forests to young, even-aged stands. • Invasion of forests by weeds. • Inappropriate fire regimes that degrade habitat or allow invasion by weeds.

Factors of Assessment	Response
	• Degradation or loss of habitat through grazing of stock (NSW OEH, 2012i). It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site.

6.5.7 *Planigale maculate* (Common planigale)

NSW Status: Vulnerable

Table 6.14 Assessment of Significance for *Planigale maculate* (Common planigale)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The common planigale is found in coastal north-eastern NSW, coastal eastern Queensland and Arnhem Land (NSW OEH, 2012d). The species is known to inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. They are active at night and during the day shelter in saucer-shaped nests built in crevices, hollow logs, beneath bark or under rocks (NSW OEH, 2012d). Foraging habitat for this species exists on the site. However, as the proposed development is restricted to the cleared areas of the site, it is unlikely that the local population of common planigale would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the common planigale is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.

Factors of Assessment	Response
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Predation by foxes. • Predation by cats • Predation and poisoning by cane toads • Loss and fragmentation of habitat through clearing for agriculture and development in coastal areas. • Frequent burning that reduces ground cover such as hollow logs and bark. • Over grazing that reduces ground cover • Disturbance of vegetation surrounding water bodies (NSW OEH, 2012d). It is unlikely that the proposed development will contribute to increased impacts from these threats. However, as there are no planned restrictions on domestic animals in the development, the risk of predation by uncontrolled dogs and cats remains.

6.5.8 *Saccolaimus flaviventris* (Yellow-bellied sheathtail-bat)

NSW Status: Vulnerable

Table 6.15 Assessment of Significance for *Saccolaimus flaviventris* (Yellow-bellied sheathtail-bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. It forages in most habitats across its very wide range, with and without trees. The species appears to defend an aerial territory (NSW OEH, 2016i). When foraging for insects, yellow-bellied sheathtail-bats fly high and fast over the forest canopy, but lower in more open country (NSW OEH, 2016i. The yellow-bellied sheathtail-bat roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows (NSW OEH, 2016i). Breeding has been recorded from December to mid-March, when a single young is born (NSW OEH, 2016i). Given the broad foraging habitat for this species, potential foraging habitat exists on the site. However, as the proposed development is restricted to the cleared areas of the site, it is unlikely that the local population of yellow-bellied sheathtail-bats would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community:	Given the broad habitat requirements of this species, the proposed development will have a negligible impact on the

Factors of Assessment	Response
(vi) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (vii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (viii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	species at a local or regional scale. The habitat of this species will not be fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Disturbance to roosting and summer breeding sites. • Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions. • Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat. • Pesticides and herbicides may reduce the availability of insects, or result in the accumulation of toxic residues in individuals' fat stores. It is unlikely that the proposed development will contribute to increased impacts from these threats. Woodland and rainforest foraging habitat is buffered from the development. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site. The provision of artificial nest boxes would potentially increase roosting locations for this species.

6.5.9 *Mormopterus lumsdenae* (Northern free-tailed bat)

NSW Status: Vulnerable

Table 6.16 Assessment of Significance for *Mormopterus lumsdenae* (Northern free-tailed bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The northern free-tailed bat is widely distributed across northern Australia from Western Australia to Queensland, extending south to the north-east corner of NSW. The only confirmed record in NSW is of a colony found in the roof of a house in Murwillumbah, however, calls have been detected from a few other locations in the far north east of the State (NSW OEH, 2016f).

Factors of Assessment	Response
	The species is found in a range of Vegetation Associations in northern Australia, from rainforests to open forests and woodlands, and are often recorded along watercourses. Northern free-tailed bats are known to roost mainly in tree hollows but relatively large colonies have been found under house roofs in urban areas in Queensland (NSW OEH, 2016f). Foraging habitat for this species exists on the site. However, as the proposed development is largely restricted to the cleared areas of the site, it is unlikely that the local population of northern freetail-bats would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (ix) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (x) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (xi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the northern freetail-bat is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Loss of hollow-bearing trees. • Loss of foraging habitat. • Application of pesticides in or adjacent to foraging areas (NSW EH, 2017m). It is unlikely that the proposed development will contribute to increased impacts from these threats. Foraging habitat is buffered from the development, reducing disturbance. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site. The provision of artificial nest boxes would potentially increase roosting locations for this species.

6.5.10 *Mormopterus norfolkensis* Eastern freetail-bat

NSW Status: Vulnerable

Table 6.17 Assessment of Significance for *Mormopterus norfolkensis* (Eastern freetail-bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The eastern freetail-bat is found along the east coast from south Queensland to southern NSW (NSW OEH, 2015b). The species inhabits dry sclerophyll forest, woodland, swamp forests and mangrove forests. They are known to roost mainly in tree hollows but will also roost under bark or in man-made structures (NSW OEH, 2015b). Foraging habitat for this species exists on the site. However, as the proposed development is largely restricted to the cleared areas of the site, it is unlikely that the local population of eastern freetail-bats would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (xii) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (xiii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (xiv) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the eastern freetail-bat is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Loss of hollow-bearing trees. • Loss of foraging habitat. • Application of pesticides in or adjacent to foraging areas. • Artificial light sources spilling onto foraging and/or roosting habitat. • Large scale wildfire or hazard reduction burns on foraging and/or roosting habitat (NSW OEH, 2015b). It is unlikely that the proposed development will contribute to increased impacts from these threats. Foraging habitat is buffered from the development, reducing light spill and disturbance. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site. The provision of artificial nest boxes would potentially increase roosting locations for this species.

6.5.11 *Miniopterus australis* (Little bentwing-bat)

NSW Status: Vulnerable

Table 6.18 Assessment of Significance for *Miniopterus australis* (Little bentwing bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Little bentwing-bats are known to forage for insects in rainforest, Melaleuca swamps and dry sclerophyll forests (NSW OEH, 2014f). These habitat types are not impacted by the proposed development, which is largely restricted to the cleared areas of the site. It is considered unlikely, given the habitat of this species is not within the development footprint, that the survivability of local populations of little bentwing-bat will be impacted.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	No foraging or roosting habitat will be impacted by the proposed development. The habitat of this species will not be modified, fragmented or removed.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	Threats for this species have been listed as: • Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic. • Destruction of caves that provide seasonal or potential roosting sites. • Changes to habitat, especially surrounding maternity/nursery caves and winter roosts. • Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals. • Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges. • Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges • Introduction of exotic pathogens such as the white-nosed fungus. • Hazard reduction burning and wildfire during the breeding season.

Factors of Assessment	Response
	• Large scale wildfire or hazard reduction burning can impact on foraging resources. • Poor knowledge of reproductive success and population dynamics (NSW OEH, 2014f). It is considered unlikely that the proposed development will result in or increase these threats.

6.5.12 *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)

NSW Status: Vulnerable

Table 6.19 Assessment of Significance for *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Eastern bentwing-bats occur along the east and north-west coasts of Australia (NSW OEH, 2016b). The species is known to forage in freshwater wetlands and grassy woodlands in the Northern Rivers area of NSW. Limestone caves are the primary roosting habitat, but they will also use derelict mines, storm-water tunnels, buildings and other man-made structures (NSW OEH, 2016b). Maternity caves are used in spring and summer. At other times of the year, the populations can disperse up to 300 km from the maternity caves (NSW OEH, 2016b). No maternity caves or potential roost sites are present on the subject site. Foraging habitat for this species exists on the site. However, as the proposed development is restricted to the cleared areas of the site, it is unlikely that the local population of eastern bentwing-bats would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the eastern bentwing-bat is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.

Factors of Assessment	Response
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Disturbance by recreational cavers and general public accessing caves and adjacent areas particularly during winter or breeding. • Loss of high productivity foraging habitat. • Introduction of exotic pathogens, particularly white-nose fungus. • Cave entrances being blocked for human health and safety reasons, or vegetation (particularly blackberries) encroaching on and blocking cave entrances. • Hazard reduction and wildfire fires during the breeding season (NSW OEH, 2016b). It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site.

6.5.13 *Nyctophilus bifax* (Eastern long-eared bat)

NSW Status: Vulnerable

Table 6.20 Assessment of Significance for *Nyctophilus bifax* (Eastern long-eared bat)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The eastern long-eared bat is found from Cape York through eastern Queensland to the far north-east corner of NSW. In NSW they appear to be confined to the coastal plain and nearby coastal ranges, extending south to the Clarence River area, with a few records further south around Coffs Harbour (NSW OEH, 2012e). The key habitat for this species is coastal rainforest and patches of coastal scrub. It roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings (NSW OEH, 2012e). The broad habitat for this species is found on the subject site. However, as the proposed development is restricted to the cleared areas of the site, it is unlikely that the local population of eastern long-eared bats would be placed at risk of extinction.

Factors of Assessment	Response
In relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of the eastern long-eared bat is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing, fragmentation and isolation of lowland subtropical rainforest, wet and swamp eucalypt forest and coastal scrub, particularly forest and scrub close to the coast. • Loss of hollow-bearing trees and stands of palms and rainforest trees used for roosting and maternity sites. • Invasion of habitat by weeds. • Use of pesticides (NSW OEH, 2012e). It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site.

6.5.14 *Thersites mitchellae* (Mitchell's rainforest snail)

NSW Status: Endangered

Commonwealth Status: Critically Endangered

Table 6.21 Assessment of Significance for *Thersites mitchellae* (Mitchell's rainforest snail)

Factors of Assessment	Response
In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Mitchell's rainforest snail is found in remnant vegetation on the coastal plain between the Richmond River and Tweed River on the NSW north coast. It inhabits remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils. It favours slightly higher ground around the edges of wetlands with palms and fig trees (NSW OEH, 2014g).

Factors of Assessment	Response
	This species is typically found amongst leaf litter on the forest floor, and occasionally under bark in trees. It is active at night and feeds on leaf litter, fungi and lichen (NSW OEH, 2014g). The broad habitat for this species is found on the subject site. However, as the proposed development is restricted to the cleared areas of the site, it is unlikely that the local population of Mitchell's rainforest snail would be placed at risk of extinction.
In relation to the habitat of a threatened species, population or ecological community: (iv) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and (v) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and (vi) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality	The primary habitat of Mitchell's rainforest snail is outside of the building footprint. The habitat of this species will therefore, not be modified, fragmented or isolated.
Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan	There is no recovery or threat abatement plan for this species.
Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process	The threats to this species are listed as: • Clearing of lowland rainforest, swamp forest and wetland margins for agriculture. • Clearing of lowland rainforest, swamp forest and wetland margins for urban development. • Damage to remnant areas of habitat from grazing by domestic stock. • Damage to remnant areas of habitat by fire. • Damage to remnant areas of habitat by weed invasion. • Predation of snails by introduced rats. • Habitat fragmentation increasing edge effects including increasing the severity of disturbance from fire, weeds and predation by introduced rats. • Use of herbicides and pesticides in and near areas of habitat. • Impacts on habitat as a result of dieback caused by root rot fungus (*Phytophthora cinnamomi*). • Loss of coastal populations from sea level rise and climate change. • Damage to habitat from changes in hydrology. • Poor knowledge of species distribution.

Factors of Assessment	Response
	• Lack of awareness of the species within the community (NSW OEH, 2014g). It is unlikely that the proposed development will contribute to increased impacts from these threats. The implementation of a restoration plan will assist in the control of weeds to bushland areas of the site.

6.6 Tweed Coast Comprehensive Koala Plan of Management

The proposed development has been assessed against the Tweed Coast Comprehensive Koala Plan of Management.

The site falls with the Tweed Coast Koala Management Area (KMA). The objectives of the Tweed Coast KMA are:

- To minimise harm to remaining animals through habitat retention and other protective measures.
- To ensure that any development affecting koala habitat contributes to koala recovery being undertaken elsewhere on the Tweed Coast.
- To periodically review the management intent for this area in the event that koala numbers are observed to increase.

North of the Tweed River, there is evidence of a highly depleted koala population on the brink of local extinction. The recovery of the koala population in this area does not appear possible due to lack of suitable habitat to support a long-term population and ongoing urban intensification (TCCKPM, 2015).

Surveys for koala were conducted using the following methodologies:

- Call-playback
- Spotlighting
- Faecal pellet and signs searches.

Faecal pellets of koala and their distinctive scratch marks on smooth-barked trees, are readily identifiable and persist post-departure of the animal from the area (Woosnam-Merchez et. al., 2012). The identification of traces of koala allows for the presence of this species to be confirmed and involved minimal habitat disturbance.

Despite intensive search efforts, no koala or koala sign were located. It was concluded that suitable habitat with primary or secondary food trees of koala was not present on the site.

7. Recommendations

Several actual and potential impacts associated with the proposed development have been identified. All actual and potential impacts are minor, and none of these impacts are inconsistent with the applicable planning provisions. Most of these impacts, can be mitigated during the construction and operational phases. The following sections outline the recommendations for minimising the impact of the proposed development on environmental values associated with the site and surrounding area.

7.1 Vegetation

The proposed development requires vegetation clearing within the development footprint. Field surveys have determined that this vegetation is highly modified and disturbed. Significant vegetation (Swamp Sclerophyll Forest EEC) is the northern part of the site is proposed to be protected and buffered.

One (1) threatened flora species was recorded during the surveys – Rough-shelled bushnut (*Macadamia tetraphylla*). A single juvenile specimen (1.2m high) was recorded in Vegetation Association A, on the site's eastern boundary in close vicinity to the existing dwelling. A subsequent site investigation (JWA, 2018b) found four (4) additional specimens in close proximity to this individual. All specimens of *Macadamia tetraphylla* will be translocated prior to earthworks commencing in accordance with the Translocation Plan (JWA, 2018b).

To mitigate potential impacts to retained vegetation in adjacent areas during construction, all clearing will be undertaken in accordance with an approved Vegetation Plan and conditions of a Vegetation Clearing Permit issued under the *Preservation of Trees or Vegetation Tweed Development Control Plan – Section A16* (DCP A-16). It is anticipated that appropriate protection measures for retained vegetation will be identified during this process.

To minimise waste from the site, it is recommended that all felled vegetation be recycled (milled, chipped or mulched) and where feasible incorporated into the landscape features, batter stabilisation techniques or other approved site works. Any hollows should be translocated into the protected areas of the site.

To compensate for the loss of any floristic values from the site, landscaping and revegetation will incorporate species from the site's preclearing ecosystems.

As camphor laurel is an important food source to many native species, including the vulnerable bird species identified on the site during the surveys, it is recommended to stage the removal of this species. The preparation and implementation of a habitat restoration plan is recommended for this site.

7.2 Fauna

To mitigate the risk of injury and / or death to fauna during construction operations, the site will be assessed by an experienced ecologist prior to the commencement of any clearing activities. Where necessary, a Spotter-Catcher or experienced ecologist, should be present on-site during clearing operations. A restoration program should incorporate relocation of habitat features (hollows, logs etc.) from the development footprint and habitat supplementation through installation of custom-designed nest boxes in appropriate areas.

8. Conclusions

Flora and fauna surveys were undertaken across the site during April-May 2017. A total of 163 species of flora were identified within the site, comprising 108 native species and 55 non-native species. The vegetation communities were verified and mapped through ground truthing and classified as follows:

Type A. Tall Closed Forest (*Cinnamomum camphora*);
Type B. Tall Open/Closed Swamp Sclerophyll Forest (*Archontophoenix cunninghamiana*,-*Melaleuca quinquenervia*);
Type C. Tall Open/Closed Moist Sclerophyll Forest with Rainforest Understorey;
Type D. Mid-high Wet Grassland / Sedgeland
Type E. Maintained Anthropogenic Grassland.

Vegetation Type B – Tall Closed Swamp Sclerophyll Forest (*Archontophoenix cunninghamiana* / *Melaleuca quinquenervia*) represents an alliance of the TSCA Endangered Ecological Community (EEC) Swamp Sclerophyll Forest on Coastal Floodplains. This vegetation will be protected and buffered as part of the proposed development.

One (1) threatened flora species was recorded during the surveys – Rough-shelled bushnut (*Macadamia tetraphylla*). A single juvenile specimen (1.2m high) was recorded in Vegetation Association A, on the site's eastern boundary in close vicinity to the existing dwelling. A subsequent site investigation (JWA, 2018b) found four (4) additional specimens in close proximity to this individual. All specimens of *Macadamia tetraphylla* will be translocated prior to earthworks commencing in accordance with the Translocation Plan (JWA, 2018b).

Three (3) significant species of fauna were encountered on-site: *Ptilinopus regina* (Rose-crowned fruit-dove), *Daphoenositta chrysoptera* (Varied sittella), and *Nyctimene robinsoni* (Eastern tube-nosed bat). These highly mobile species will not be impacted by the proposed development. The proposed restoration works will increase the available habitat for these species.

Under Section 5A of the *Environmental Planning and Assessment Act 1979*, assessments of significance were performed for all threatened species recorded on the site. In addition, threatened fauna with potential to occur on the site were also assessed. For all species and threatened ecological communities, it was concluded that the proposed development design would not contribute to a reduction in the local population nor remove any critical foraging or breeding habitat.

The site is mapped as containing potential koala habitat. However, it was concluded that the site does not contain suitable habitat for this species.

The proposed development incorporates a buffer to the coastal wetlands to the north (identified on the SEPP Coastal Management 2018 mapping). To ensure the efficacy of this buffer, a habitat restoration program should be undertaken in the disturbed parts of the wetland vegetation. The program should target weeds and supplement existing habitat to improve the existing ecological function of the buffer and the bioregional corridor that passes through the site.

In summary, it is not expected that the proposed development will have a significant impact on the local and regional ecology provided all recommendations in this report are adopted.

9. Definitions

DCP	Development Control Plan
DBH	Diameter at Breast Height
EA	Ecological Assessment
EH	Department of Environment and Heritage
EPA Act	*Environmental Protection and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
LEP	Local Environmental Plan
MNES	Matters of National Environmental Significance
RBH	Radius at Breast Height
SAT	Spot Assessment Technique
SEPP	State Environmental Planning Policy
SMP	Stormwater Management Plan
TSC Act	*Threatened Species Conservation Act 1995*
TVMS	Tweed Vegetation Management Strategy

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Appendix A – EPBC Act Protected Matters Search Results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

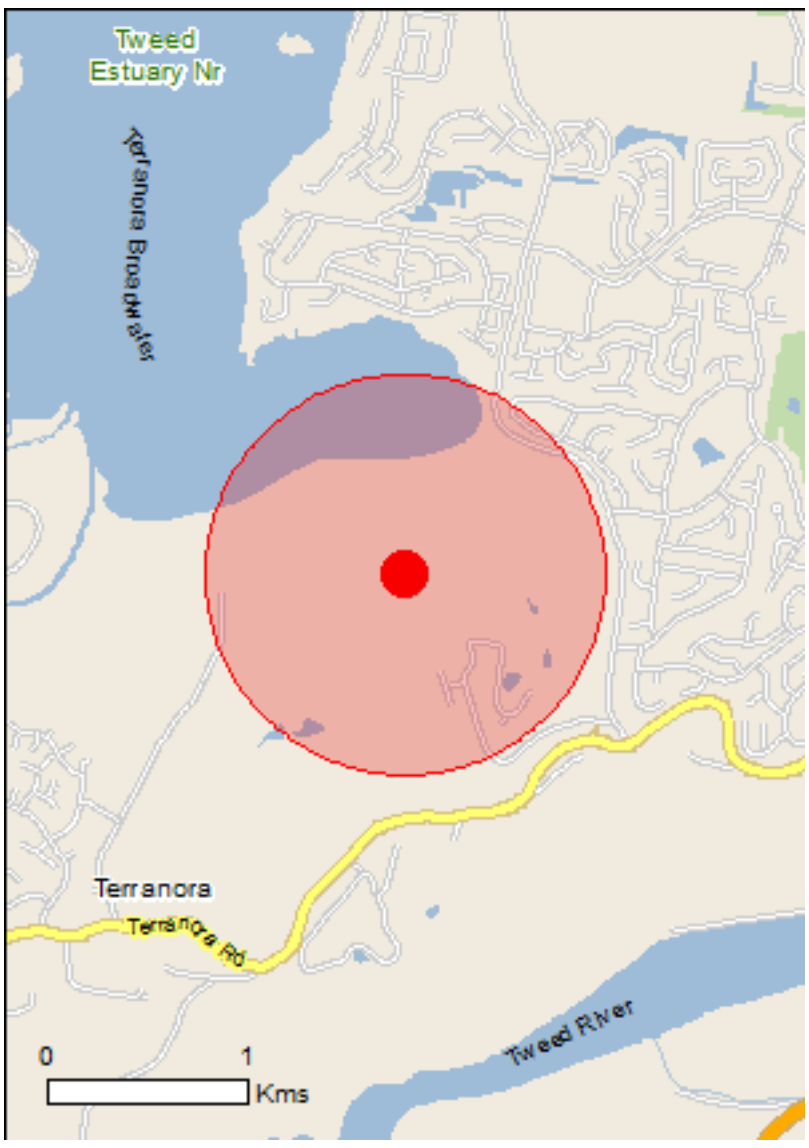
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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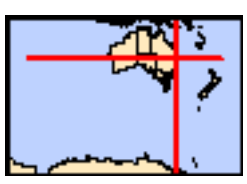
Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	67
Listed Migratory Species:	56

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	67
Whales and Other Cetaceans:	2
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	31
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Poephila cincta cincta Southern Black-throated Finch [64447]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		

Name	Status	Type of Presence
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area
Frogs		
Litoria olongburensis		
Wallum Sedge Frog [1821]	Vulnerable	Species or species habitat may occur within area
Insects		
Argynnis hyperbius inconstans		
Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Phyllodes imperialis smithersi		
Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Other		
Thersites mitchellae		
Mitchell's Rainforest Snail [66774]	Critically Endangered	Species or species habitat likely to occur within area
Plants		
Arthraxon hispidus		
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Baloghia marmorata		
Marbled Balogia, Jointed Baloghia [8463]	Vulnerable	Species or species habitat may occur within area
Cryptocarya foetida		
Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Diploglottis campbellii Small-leaved Tamarind [21484]	Endangered	Species or species habitat likely to occur within area
Endiandra hayesii Rusty Rose Walnut, Velvet Laurel [13866]	Vulnerable	Species or species habitat likely to occur within area
Gossia fragrantissima Sweet Myrtle, Small-leaved Myrtle [78867]	Endangered	Species or species habitat likely to occur within area
Hicksbeachia pinnatifolia Monkey Nut, Bopple Nut, Red Bopple, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut, Red Boppel Nut, Ivory Silky Oak [21189]	Vulnerable	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Macadamia tetraphylla Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Randia moorei Spiny Gardenia [10577]	Endangered	Species or species habitat likely to occur within area
Sophora fraseri [8836]	Vulnerable	Species or species habitat may occur within area
Syzygium hodgkinsoniae Smooth-bark Rose Apple, Red Lilly Pilly [3539]	Vulnerable	Species or species habitat likely to occur within area
Syzygium moorei Rose Apple, Coolamon, Robby, Durobby, Watermelon Tree, Coolamon Rose Apple [12284]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Delma torquata Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area

Name	Threatened	Type of Presence
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata		
Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis		
Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Calidris ruficollis](#) Red-necked Stint [860]		Roosting known to occur within area
[Calidris tenuirostris](#) Great Knot [862]	Critically Endangered	Roosting known to occur within area
[Calonectris leucomelas](#) Streaked Shearwater [1077]		Species or species habitat known to occur within area
[Charadrius bicinctus](#) Double-banded Plover [895]		Roosting known to occur within area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
[Charadrius mongolus](#) Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
[Charadrius ruficapillus](#) Red-capped Plover [881]		Roosting known to occur within area
[Cuculus saturatus](#) Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
[Diomedea antipodensis](#) Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
[Diomedea epomophora](#) Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
[Diomedea exulans](#) Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
[Diomedea gibsoni](#) Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
[Fregata minor](#) Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Roosting known to occur within area
[Gallinago megala](#) Swinhoe's Snipe [864]		Roosting likely to occur within area
[Gallinago stenura](#) Pin-tailed Snipe [841]		Roosting likely to occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
[Heteroscelus brevipes](#) Grey-tailed Tattler [59311]		Roosting known to occur within area
[Himantopus himantopus](#) Black-winged Stilt [870]		Roosting known to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus africanus Climbing Asparagus, Climbing Asparagus Fern [66907]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-28.2265 153.51718

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix B – Flora Species Recorded on Site

Family	Species	Common name	Status	A	B	C	D	E
Acanthaceae	*Pseuderanthemum variabile*	Pastel flower				X		X
Amaryllidaceae	*Crinum pedunculatum*	Crinum lily			X			
Anacardiaceae	*Euroschinus falcata*	Ribbonwood				X		
Anacardiaceae	*Mangifera indica*	Mango	Y	X		X		X
Apiaceae	*Centella asiatica*	Pennywort		X			X	X
Apiaceae	*Hydrocotyle peduncularis*	Hydrocotyle					X	X
Apocynaceae	*Melodinus australis*	Southern melodinus				X		
Apocynaceae	*Parsonsia straminea*	Common silkpod		X	X	X		
Apocynaceae	*Tabernaemontana pandacaqui*	Banana bush				X		
Araliaceae	*Astrotricha latifolia*	Broad-leaf flannel bush		X				
Araliaceae	*Polyscias elegans*	Celerywood				X		
Araliaceae	*Schefflera actinophylla*	Umbrella tree		X		X		
Arecaceae	*Archontophoenix cunninghamiana*	Bangalow palm			X	X		
Asclepiadaceae	*Gomphocarpus physocarpus*	Balloon cotton bush	Y					X
Asteraceae	*Ageratina adenophora*	Crofton weed	Y	X	X	X	X	X
Asteraceae	*Ageratina riparia*	Mistflower	Y	X	X	X	X	X
Asteraceae	*Ageratum houstonianum*	Blue billygoat weed	Y	X		X	X	X
Asteraceae	*Baccharis halimifolia*	Groundsel bush	Y				X	X
Asteraceae	*Bidens pilosa*	Cobblers pegs	Y	X			X	X
Asteraceae	*Cirsium vulgare*	Black thistle	Y	X	X		X	X
Asteraceae	*Conyza albida*	Fleabane	Y			X	X	X
Asteraceae	*Crassocephalum crepidioides*	Thickhead	Y					X
Asteraceae	*Eclipta prostrata*	White eclipta					X	X
Asteraceae	*Hypochaeris radicata*	Flatweed	Y				X	X
Asteraceae	*Senecio madagascariensis*	Fireweed	Y				X	X
Asteraceae	*Soliva pterosperma*	Bindii	Y					X
Asteraceae	*Tagetes minuta*	Stinking roger	Y				X	X

Family	Species	Common name	Status	A	B	C	D	E
Asteraceae	*Taraxacum officinale*	Dandelion	Y					X
Asteraceae	*Wedelia trilobata*	Singapore daisy	Y	X		X		
Asteraceae	*Xanthium occidentale*	Noogoora burr	Y					X
Basellaceae	*Anredera cordifolia*	Madeira vine	Y	X				
Caesalpiniaceae	*Senna pendula var. glabrata*	Winter senna	Y				X	
Caesalpinioideae	*Caesalpinia subtropica*	Corky prickle vine		X		X		
Caryophyllaceae	*Stellaria media*	Chick weed	Y					X
Casuarinaceae	*Allocasuarina littoralis*	Black she-oak		X				
Celastraceae	*Denhamia celastroides*	Denhamia		X		X		
Convolvulaceae	*Ipomoea cairica*	Coastal morning glory	Y	X		X		
Convolvulaceae	*Ipomoea indica*	Morning glory	Y	X				
Cunoniaceae	*Caldcluvia paniculosa*	Soft corkwood		X	X	X		
Dioscoreaceae	*Dioscorea transversa*	Native yam		X	X	X		
Elaeocarpaceae	*Elaeocarpus obovatus*	Hard quandong				X		
Elaeocarpaceae	*Sloanea woollsii*	Yellow carabeen				X		
Euphorbiaceae	*Baloghia inophylla*	Brush bloodwood				X		
Euphorbiaceae	*Breynia oblongifolia*	Coffee bush				X		
Euphorbiaceae	*Glochidion ferdinandi var. ferdinandi*	Cheese tree				X		
Euphorbiaceae	*Glochidion sumatranum*	Umbrella cheese tree		X				
Euphorbiaceae	*Homalanthus populifolius*	Native bleeding heart				X		
Euphorbiaceae	*Macaranga tanarius*	Macaranga		X		X		X
Euphorbiaceae	*Mallotus claoxyloides*	Green Kamala				X		
Euphorbiaceae	*Mallotus philippensis*	Red kamala		X		X		
Fabaceae	*Desmodium uncinatum*	Silver-leaved desmodium	Y	X			X	X
Faboideae	*Castanospermum australe*	Black bean				X		
Lauraceae	*Cinnamomum camphora*	Camphor laurel	Y	X	X	X		X
Lauraceae	*Cryptocarya microneura*	Murrogun				X		

Family	Species	Common name	Status	A	B	C	D	E
Lauraceae	*Cryptocarya obovata*	Pepperberry tree				X		
Lauraceae	*Cryptocarya triplinervis var pubens*	Three-veined laurel		X		X		
Lauraceae	*Neolitsea dealbata*	White bolly gum				X		
Lauraceae	*Pratia purpurascens*	White root					X	X
Meliaceae	*Dysoxylum mollissimum subsp. molle*	Red bean		X		X		
Meliaceae	*Synoum glandulosum*	Scentless rosewood				X		
Menispermaceae	*Stephania japonica*	Snake vine			X	X		
Mimosaceae	*Acacia maidenii*	Maiden's wattle		X				
Mimosaceae	*Acacia melanoxylon*	Blackwood wattle		X				X
Moraceae	*Ficus coronata*	Creek sandpaper fig			X			
Moraceae	*Ficus macrophylla*	Moreton bay fig		X	X	X		
Moraceae	*Ficus watkinsiana*	Strangler fig			X			
Moraceae	*Maclura cochinchinensis*	Cockspur		X	X	X		X
Moraceae	*Streblus brunonianus*	Whalebone tree		X				
Moraceae	*Trophis scandens*	Burny vine				X		
Musaceae	*Musa paradisiaca*	Banana	Y					X
Myrtaceae	*Acmena smithii*	Common lilly pilly				X		
Myrtaceae	*Corymbia intermedia*	Pink bloodwood				X		
Myrtaceae	*Lophostemon suaveolens*	Swamp box			X			
Myrtaceae	*Lophostemon confertus*	Brushbox				X		
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved paperbark			X			
Myrtaceae	*Pilidiostigma glabrum*	Plum myrtle				X		
Myrtaceae	*Syzygium oleosum*	Blue lilly pilly			X	X		
Ochnaceae	*Ochna serrulata*	Mickey mouse plant	Y	X	X	X		X
Oleaceae	*Ligustrum lucidum*	Large-leaved privet	Y	X	X	X		X
Oleaceae	*Ligustrum sinense*	Small-leaved privet	Y	X	X	X		X
Oleaceae	*Notelaea longifolia*	Large mock olive		X		X		

Family	Species	Common name	Status	A	B	C	D	E
Passifloraceae	*Passiflora edulis*	Passionfruit	Y					X
Passifloraceae	*Passiflora suberosa var. suberosa*	Corky passionfruit	Y	X	X	X		X
Passifloraceae	*Passiflora subpeltata*	White passionflower	Y	X	X	X		X
Phytolaccaceae	*Rivina humilis*	Coral berry	Y	X	X	X		
Pittosporaceae	*Pittosporum multiflorum*	Orange thorn		X		X		
Pittosporaceae	*Pittosporum revolutum*	Hairy pittosporum				X		
Pittosporaceae	*Pittosporum undulatum*	Sweet pittosporum		X		X		
Polygonaceae	*Persicaria strigosa*	Smartweed			X		X	
Proteaceae	*Macadamia tetraphylla*	Rough-shelled bush nut	V	X				
Ranunculaceae	*Ranunculus inundatus*	River buttercup					X	X
Rhamnaceae	*Alphitonia excelsa*	Red ash		X	X	X		
Rubiaceae	*Morinda jasminoides*	Morinda				X		
Rubiaceae	*Psychotria loniceroides*	Hairy psychotria		X		X		
Sapindaceae	*Elattostachys nervosa*	Green tamarind			X			
Sapindaceae	*Guioa semiglauca*	Guioa		X		X		
Sapindaceae	*Jagera pseudorhus*	Foambark		X	X	X		X
Sapindaceae	*Mischocarpus pyriformis*	Yellow pear fruit				X		
Sapotaceae	*Pouteria chartacea*	Thin-leaved coondoo		X	X			
Solanaceae	*Solanum mauritianum*	Wild tobacco tree	Y	X				X
Solanaceae	*Solanum nigrum*	Black-berry nightshade	Y	X	X	X		X
Solanaceae	*Solanum seaforthianum*	Brazilian nightshade	Y		X	X		
Sterculiaceae	*Commersonia bartramia*	Brown kurrajong		X		X		X
Thymelaeaceae	*Wikstroemia indica*	Wikstroemia				X		
Ulmaceae	*Aphananthe philippinensis*	Rough–leaved elm		X		X		
Verbenaceae	*Lantana camara*	Lantana	Y	X	X	X		X
Vitaceae	*Cissus antarctica*	Water vine			X	X		
Vitaceae	*Cissus hypoglauca*	Five-leaf water vine			X			

Family	Species	Common name	Status	A	B	C	D	E
Adiantaceae	*Adiantum hispidulum*	Rough maidenhair		X	X	X		
Aspleniaceae	*Asplenium australasicum*	Bird's nest fern		X		X		
Blechnaceae	*Blechnum cartilagineum*	Gristle fern				X		
Blechnaceae	*Blechnum indicum*	Swamp water fern			X			
Blechnaceae	*Doodia aspera*	Rasp fern				X		
Cyatheaceae	*Cyathea leichhardtiana*	Prickly tree fern			X			
Davalliaceae	*Nephrolepis cordifolia*	Fishbone fern	Y	X				X
Dennstaedtiaceae	*Pteridium esculentum*	Bracken		X		X	X	
Pteridaceae	*Acrostichum speciosum*	Mangrove fern			X			
Araceae	*Alocasia brisbanensis*	Cunjevoi					X	X
Asparagaceae	*Asparagus aethiopicus*	Asparagus fern	Y	X	X	X		X
Asparagaceae	*Asparagus plumosus*	Climbing asparagus fern	Y	X		X		
Asteliaceae	*Cordyline petiolaris*	Broad-leaved palm lily			X			
Asteliaceae	*Cordyline rubra*	Red-fruited palm lily			X			
Commelinaceae	*Commelina cyanea*	Native wandering jew					X	
Cyperaceae	*Baumea articulata*	Jointed twig-rush			X			
Cyperaceae	*Baumea juncea*	Bare twig-rush			X			
Cyperaceae	*Baumea rubiginosa*	Soft twig-rush			X			
Cyperaceae	*Cyperus eragrostis*	Tussock sedge	Y				X	X
Cyperaceae	*Cyperus polystachyos var polystachyos*	Bunchy sedge					X	
Cyperaceae	*Cyperus rotundus*	Nutgrass	Y				X	X
Cyperaceae	*Lepidosperma laterale*	Variable sword-sedge				X		
Cyperaceae	*Schoenus brevifolius*	Zig-zag bog rush			X			
Flagellariaceae	*Flagellaria indica*	Whip vine			X			
Juncaceae	*Juncus usitatus*	Common rush					X	X
Lomandraceae	*Lomandra longifolia*	Long-leaved matrush		X	X	X		
Luzuriagaceae	*Eustrephus latifolius*	Wombat berry				X		

Family	Species	Common name	Status	A	B	C	D	E
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling lily		X		X		
Philydraceae	*Philydrum lanuginosum*	Frogsmouth						
Phormiaceae	*Dianella caerulea*	Blue flax lily		X	X	X	X	
Poaceae	*Andropogon virginicus*	Whiskey grass	Y					X
Poaceae	*Axonopus fissifolius*	Narrow-leaf carpet grass	Y					X
Poaceae	*Chloris gayana*	Rhodes grass	Y				X	X
Poaceae	*Cynodon dactylon*	Couch grass	Y				X	X
Poaceae	*Digitaria didactyla*	Queensland blue couch	Y				X	X
Poaceae	*Digitaria parviflora*	Small-flowered finger grass					X	X
Poaceae	*Entolasia stricta*	Wiry panic		X		X		
Poaceae	*Hemarthria uncinata*	Matgrass					X	X
Poaceae	*Imperata cylindrica*	Blady grass		X	X	X	X	X
Poaceae	*Ischaemum australe*	Swamp grass					X	
Poaceae	*Leersia hexandra*	Swamp ricegrass			X		X	
Poaceae	*Megathyrsus maximus*	Guinea grass	Y					X
Poaceae	*Melinis minutiflora*	Molasses grass	Y					X
Poaceae	*Melinis repens*	Red natal grass	Y	X				X
Poaceae	*Paspalum conjugatum*	Sour grass	Y				X	X
Poaceae	*Paspalum dilatatum*	Paspalum	Y	X			X	X
Poaceae	*Paspalum distichum*	Water couch					X	X
Poaceae	*Paspalum mandiocanum*	Broad-leaved paspalum	Y				X	X
Poaceae	*Pennisetum clandestinum*	Kikuyu					X	X
Poaceae	*Pennisetum purpureum*	Elephant grass						X
Poaceae	*Phragmites australis*	Common reed			X			
Poaceae	*Setaria sphacelata*	Pigeon grass	Y				X	X
Poaceae	*Urochloa mutica*	Para grass	Y				X	X
Ripogonaceae	*Ripogonum album*	White supplejack			X			

Family	Species	Common name	Status	A	B	C	D	E
Smilacaceae	*Smilax australis*	Prickly smilax			X	X		
Smilacaceae	*Smilax glyciphylla*	Smooth smilax				X		
Typhaceae	*Typha domingensis*	Bulrush					X	

ANNEXURE G

JWA PTY LTD
Ecological Consultants
ABN 56 066 448 879

REPLY TO: BALLINA OFFICE

Ref: AM/N09031/Lw2

13th December 2018

Shaun Nicholson
Newland Developers Pty Ltd
PO Box 4176
Robina TC Qld 4230

Dear Shaun,

RE: DEVELOPMENT APPLICATION DA09/0701.03 - AMENDMENT TO DEVELOPMENT CONSENT DA09/0701 FOR A 256 LOT RESIDENTIAL SUBDIVISION (DEPARTMENT OF PLANNING APPLICATION MP09_0166 MOD 3)

I refer to the above modification application and note that I have reviewed the relevant correspondence prepared by the NSW Office of Environment and Heritage (OEH) dated 24th August 2018 (**ATTACHMENT 1**), and Tweed Shire Council (TSC) dated 27th September 2018 (**ATTACHMENT 2**). The OEH and TSC correspondence was prepared in response to the Proponents' Response to Submissions (dated 6th August 2018) regarding the subject Modification application (MP09_0166 MOD 3**)**.

Summary of OEH Issues

The correspondence from OEH requested that:

> *"The ecological assessment of the impacts arising from the proposed cut and fill works and any other development in Lot 1 DP 175234 should be assessed in accordance with the Biodiversity Assessment Method by an accredited assessor and a Biodiversity Development Assessment Report prepared."*

JWA Response

JWA were engaged by Newland Developers Pty Ltd to prepare a Biodiversity Development Assessment Report (BDAR) (**ATTACHMENT 3**) to address the small area of additional vegetation clearing, on land formally described as Lot 1 DP175234, associated with the Modification to a Part 3A project application under the *Environmental Planning and Assessment Act 1979* (EP&A Act). A detailed assessment of composition, structure and function of site vegetation was completed on the 19th September 2018 utilising the Biodiversity Assessment Method (OEH

2017). This assessment was completed a suitably qualified person and accredited assessor under the accreditation scheme prepared under Section 6.10 of the *Biodiversity Conservation Act 2016* (BC Act).

The assessment determined that one (1) Plant Community Type (PCT), covering approximately 0.29 hectares, occurs within the development area that most likely represents a very highly degraded form of PCT 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion.

One (1) threatened flora species – rough-shelled bush-nut (*Macadamia tetraphylla*), listed as Vulnerable under the BC Act and *Environment Protection and Biodiversity Conservation Act 1999* – was recorded from the subject site. A total of four (4) stems were detected as described in previous assessments associated with the Altitude Aspire development. An additional two (2) threatened species were considered possible occurrences as species credit species based on the availability of potentially suitable habitat.

A number of measures to avoid and mitigate impacts on existing flora, fauna and habitat values of the site have been discussed. The proposed development will however result in unavoidable impacts on 0.29 ha of highly degraded areas of PCT 1302. No Serious or Irreversible Impact entities are considered to occur on the subject site.

It was determined that impacts to the degraded area of PCT 1302 are not required to be offset as the vegetation integrity score of this community is below those set out in Paragraph 10.3.1.1 of the BAM. Therefore no ecosystem credits are required. However, a total of 12 species credits for threatened species have been calculated as applicable for the unavoidable loss of site vegetation/habitat as follows:

- Rough-shelled bush-nut (*Macadamia tetraphylla*) = 8 credits
- Slender Marsdenia (*Marsdenia longiloba*) = 2 credits
- Common Planigale (*Planigale maculata*) = 2 credits

In accordance with the requirements of the NSW Biodiversity Offsets Scheme, proponents have two primary ways that they can satisfy their offset credit obligation:

1. They can identify and purchase the required 'like for like' credits in the market and then retire those credits via OEH Biodiversity Offsets and Agreement Management System (BOAMS). For example, credits could be located by using the OEH registers or by retaining a broker to locate credits for them.

OR

2. They can use the Offsets Payment Calculator to determine the cost of its credit obligation, and transfer this amount to the Biodiversity Conservation Fund via OEH BOAMS. The Biodiversity Conservation Trust is then responsible for identifying and securing the credit obligation.

In this regard, it is understood that Newland Developers Pty Ltd wishes to satisfy their offset credit obligations via payment to the Biodiversity Conservation Trust. At the time of writing, the following credit prices were generated by the Offsets Payment Calculator within the BOAMS (**ATTACHMENT 4**):

- Rough-shelled bush-nut (*Macadamia tetraphylla*) = $8,314.81
- Slender Marsdenia (*Marsdenia longiloba*) = $4,117.38
- Common Planigale (*Planigale maculata*) = $1,253.99

Summary of TSC Issues

The TSC submission dated 27th September 2018 included a section headed "*Macadamia tetraphylla* Translocation Plan July 2018 and Revised Ecological Assessment July 2018". This section requested a number of amendments to the *Macadamia tetraphylla* Translocation Plan (JWA 2018) previously prepared for the site.

As discussed above, the small area of additional vegetation clearing has subsequently been assessed utilising the BAM as requested by OEH (**ATTACHMENT 3**). The BDAR identified that 8 species credits would be required for the unavoidable loss of four (4) stems of Rough-shelled bush-nut (*Macadamia tetraphylla*). These credits will need to be purchased or retired as an offset for the removal of site vegetation.

As Newland Developers Pty Ltd wishes to satisfy these offset credit obligations via payment to the Biodiversity Conservation Trust, the translocation of the four (4) stems of Rough-shelled bush-nut would no longer be required. Consequently, the *Macadamia tetraphylla* Translocation Plan (JWA 2018) would not be required to be amended or implemented.

I trust the above responses and attachments provide the additional information necessary for Council and OEH to complete their assessment of the proposed Modification to a Part 3A project application under the EP&A Act. Please do not hesitate to contact me if you require any further information.

Yours faithfully,
JWA Pty Ltd



Adam McArthur
Director / Principal Ecologist

Attachment 1 – OEH correspondence (dated 24th August 2018)

NSW GOVERNMENT | Office of Environment & Heritage

Our Ref: DOC18/553652
Your Ref: Email dated 6 August 2018

Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

Attention: Ms Emma Butcher, Planning Officer

Dear Mr Witherdin

Re: Response to Submissions, Altitude Aspire Residential Subdivision (MP 09_0166 MOD 3), Terranora Tweed LGA

Thank you for your email dated 6 August 2018 about the Response to Submissions (RtS) for the Altitude Aspire Residential Subdivision MP 09_0166 seeking comments from the Office of Environment and Heritage (OEH). I appreciate the opportunity to provide input.

We have reviewed the RtS and associated documents supplied. In our submission we advised that an environmental study should be prepared in accordance with the Framework for Biodiversity Assessment (FBA). The proponent instead has provided an ecological assessment that is stated to be in accordance with the *Biodiversity Conservation Act 2016 (BC Act)*. However, this has not been prepared by an accredited assessor nor does it comply with the prescribed methodology which is the Biodiversity Assessment Method (BAM).

As this assessment concerns a modification to a Part 3A project, the Department of Planning and Environment (DPE) can determine the appropriate assessment methodology. The OEH suggests that, in this case, the BAM be applied and a Biodiversity Development Assessment Report (BDAR) be prepared to assess the impacts on the adjoining Lot 1 DP 175234. This is recommended as the impacts from the proposed residential subdivision on the adjoining site will also have to be assessed and offset in accordance with the BAM.

The OEH has also reviewed the Aboriginal Cultural Heritage Report (ACHAR) and generally agrees with the findings presented. However, there is a need to ensure that all local cultural sources of knowledge are canvassed for information regarding intangible cultural values that may be present within the subject lands, and that staff carrying out the ground disturbing works are fully informed about likely ACH values and Aboriginal objects and any unexpected finds will be managed appropriately.

These issues are discussed in detail in **Attachment 1** to this letter.

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Federation House, Level 8, 24 Moonee Street
Coffs Harbour NSW 2450
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In summary, the OEH recommends:

1. The ecological assessment of the impacts arising from the proposed cut and fill works and any other development in Lot 1 DP 175234 should be assessed in accordance with the Biodiversity Assessment Method by an accredited assessor and a Biodiversity Development Assessment Report prepared.

2. Further consultation with other members of the local Aboriginal community not represented by the Tweed Byron Local Aboriginal Land Council should be undertaken.

3. The Aboriginal Cultural Heritage Report should be amended as follows:

    a) Recommendation 2 should require site inductions for all staff, particularly those actively engaged in any ground disturbing works.

    a. Recommendation 5 should be expanded to include the requirement to notify the OEH North East Branch of any such finds.

If you have any further questions about this issue, Ms Rachel Lonie, Senior Conservation Planning Officer, Conservation and Regional Delivery, OEH, can be contacted on 6650 7130 or at rachel.lonie@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 24 August 2018

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Conservation and Regional Delivery

Enclosure: Attachment 1: Detailed OEH Comments – Response to Submissions (RtS) for the Altitude Aspire Residential Subdivision MP 09_0166

Attachment 1: Detailed OEH Comments – Response to Submissions (RtS) for the Altitude Aspire Residential Subdivision MP 09_0166

1. Extension of bulk earthworks

The OEH previously raised the issue of whether the proposal could be considered given the works are on the adjoining Lot 1 DP 175234 that was not part of the 'subject site' for the Part 3A project. The Department of Planning and Environment (DPE) has advised that it considers the works on the adjoining property can be considered within the scope of a Part 3A Modification.

2. Ecological assessment

In our submission, the OEH recommended the impacts on the adjoining land should be assessed in accordance with the Framework for Biodiversity Assessment (FBA). Applications for major projects can be considered under the previous legislation if:

- substantial environmental assessment was undertaken before 25 August 2017 (as determined in writing by the Secretary of DPE) and the application is made within 18 months of the Secretary's determination, or

- environmental assessment requirements were issued before 25 August 2017 and the application is made before 25 February 2019. If the environmental assessment requirements are reissued, the application must instead be made within 18 months of the reissue, but no later than 24 August 2020.

The applicant instead has provided a revised ecological assessment (EA) by Burchills dated July 2018 for the adjoining site that states it has been prepared in accordance with the *Biodiversity Conservation Act 2016 (BC Act)* and the Biodiversity Offset Scheme (BOS).

Although the BOS applies to development consents under Part 4 and Part 5.1 of the Environmental Planning and Assessment Act there appears to be nothing that could preclude the requirement to address the BOS and prepare a Biodiversity Development Assessment Report (BDAR) for this modification proposal. The following comments are provided on the basis that this is the legislation that will be applied.

The ecological assessment has not complied with the BC Act and has not been prepared in accordance with the BAM. There is no BDAR prepared by an accredited assessor as required under the BC Act. The EA does not map vegetation communities to Plant Community Types (PCTs), nor provide survey results and assess integrity scores. It does not assess threatened species habitat, demonstrate the required surveys have been undertaken or identify threatened species polygons such as for *Macadamia tetraphylla* in accordance with the BAM.

The EA states that the proposed development does not trigger the clearing threshold for the Biodiversity Offset Scheme (BOS). This conclusion appears to be founded on an assumption that vegetation mapped as Vegetation Association A is not vegetation for the purposes of the BAM and BOS. It maps the vegetation on Lot 1 DP 175234 in the area to be impacted by the bulk earthworks as Type A Tall Closed Forest (*Cinnamonum camphora*). The previous OEH advice referred to the species list in Table 5.4 for the Type A Tall Closed Forest (*Cinnamonum camphora*) which indicated some species were consistent with the *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions* endangered ecological community (EEC).
The OEH does not agree with the conclusion that the development does not trigger the clearing threshold. The assessment of the proposed cut and fill in Lot 1 DP 175234 should be undertaken in accordance with the BAM.

Further, the Altitude Central development planned for Lot 1 DP 175234 will be required to be assessed under the *Biodiversity Conservation Act 2016* and a Biodiversity Development Assessment Report (BDAR) will need to be prepared by an accredited assessor for that development.

As the OEH previously advised, *Macadamia tetraphylla* and the EEC should also be considered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and may require a separate approval, noting the *Lowland Rainforest of Subtropical Australia* is a critically endangered ecological community under the EPBC Act.

OEH Recommendation

1. The ecological assessment of the impacts arising from the proposed cut and fill works and any other development in Lot 1 DP 175234 should be assessed in accordance with the Biodiversity Assessment Method by an accredited assessor and a Biodiversity Development Assessment Report prepared.

3. Aboriginal cultural heritage

The OEH has reviewed the Altitude Aspire Western Earthworks: Aboriginal Cultural Heritage Report (ACHAR) (Everick July 2018) provided in support of the proposal. Although the OEH has found some minor inconsistencies and deficiencies, we generally agree with the findings presented.

The OEH notes that consultation with the local Aboriginal community for this project was limited to the Tweed Byron Local Aboriginal Land Council (TBLALC). We recommend that, although not required by legislation, further consultation with other members of the local Aboriginal community not represented by the TBLALC is undertaken. This will ensure that all local cultural sources of knowledge are canvassed for information regarding intangible cultural values that may be present within the subject lands.

We also suggest changes to two of the recommendations within the ACHAR as follows:

Recommendation 2 regarding cultural heritage inductions states that supervisors and senior operational staff should undergo Cultural Heritage Inductions. The OEH strongly recommends that any site inductions include *all* staff, particularly those actively engaged in any ground disturbing works. This will ensure that those staff carrying out the ground disturbing works have an idea of the likely ACH values and Aboriginal objects that may be present and will be able to notice any unexpected finds and deal with them in a culturally and scientifically appropriate manner.

Recommendation 5 is to notify the OEH AHIMS unit of any Aboriginal objects located during the works. OEH supports this recommendation, as failure to do so would constitute a breach of S89A of the *National Parks & Wildlife Act 1974*. The OEH recommends that Recommendation 5 is expanded to include the requirement to notify OEH Northeast Planning Unit of any such finds in order to ensure that they are managed appropriately.

OEH Recommendations

2. Further consultation with other members of the local Aboriginal community not represented by the Tweed Byron Local Aboriginal Land Council be undertaken.

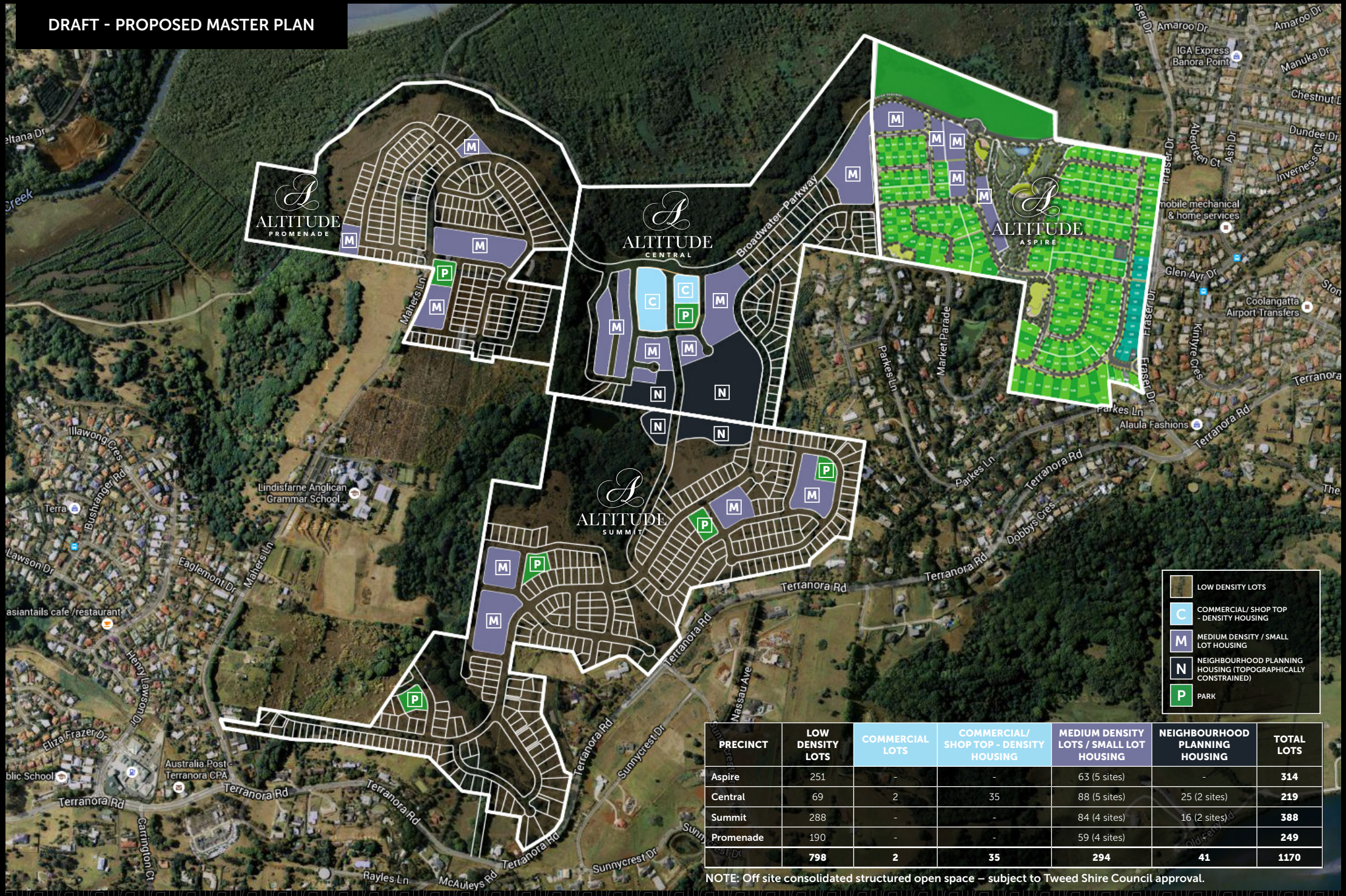
3. The Aboriginal Cultural Heritage Report be amended as follows:

    a. Recommendation 2 to require site inductions for all staff, particularly those actively engaged in any ground disturbing works.

    b. Recommendation 5 be expanded to include the requirement to notify OEH North East Planning Unit of any such finds.

Attachment 2 – TSC correspondence (dated 27th September 2018)

DRAFT - PROPOSED MASTER PLAN



PRECINCT	LOW DENSITY LOTS	COMMERCIAL LOTS	COMMERCIAL/ SHOP TOP - DENSITY HOUSING	MEDIUM DENSITY LOTS / SMALL LOT HOUSING	NEIGHBOURHOOD PLANNING HOUSING	TOTAL LOTS
Aspire	251	-	-	63 (5 sites)	-	**314**
Central	69	2	35	88 (5 sites)	25 (2 sites)	**219**
Summit	288	-	-	84 (4 sites)	16 (2 sites)	**388**
Promenade	190	-	-	59 (4 sites)		**249**
	798	**2**	**35**	**294**	**41**	**1170**

NOTE: Off site consolidated structured open space – subject to Tweed Shire Council approval.

Proposed Residential Development Altitude Aspire and Proposed Future Stages - Subject to Local & State Government Approvals. Outlines, images and descriptions are indicative and for illustrative purposes only. Internal OIffice use only. This information, including images and descriptions should not be relied upon. Please speak to Newland Developers Pty Ltd for detailed information. 080617

PROUDLY DEVELOPED BY: newland

Attachment 3 – BDAR (JWA 2018)

JWA PTY LTD
Ecological Consultants
ABN 56 066 448 879

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT (BDAR)

Lot 325 DP 1238182 and Part Lot 1 DP 175234 Altitude Aspire, Terranora

A Report Prepared for
Newland Developers

DECEMBER 2018

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DOCUMENT CONTROL

Document

Title	Biodiversity Development Assessment Report (BDAR)
Job Number	N09031
File Reference	
Version and Date	Rw2 10/12/18
Client	Newland Developers

Revision History (office use only)

Issue	Version	Draft/Final	Date Sent	Distributed To	No. Copies	Media	Delivery Method
1	Rw1	DRAFT	05.11.18	Client	1	pdf	email
2	Rw2	DRAFT	10.12.18	Client	1	pdf	email
3	Rw3	FINAL	13.12.18	Client	1	pdf	email
4							
5							

Client Issue

Version	Date	Author		Approved by	
		Name	Initials	Name	Initials
Rw1	05.11.18	Matt Jenkins	MJ	Adam McArthur	AM
Rw2	10.12.18	Matt Jenkins / Adam McArthur	MJ / AM	Adam McArthur	AM
Rw3	13.12.18	Matt Jenkins / Adam McArthur	MJ / AM	Adam McArthur	AM

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EXECUTIVE SUMMARY

This Biodiversity Development Assessment Report (BDAR) has been prepared to address a small area of additional vegetation clearing, on land formally described as Lot 1 DP175234, associated with an extension of bulk earthworks for the adjacent Altitude Aspire development. This assessment concerns a Modification to a Part 3A project under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

A detailed assessment of composition, structure and function of site vegetation was completed on the 19th September 2018 utilising the Biodiversity Assessment Method (OEH 2017). This assessment was completed a suitably qualified person and accredited assessor under the accreditation scheme prepared under Section 6.10 of the *Biodiversity Conservation Act 20016* (BC Act).

The assessment has determined that one (1) Plant Community Type (PCT), covering approximately 0.29 hectares, occurs within the development area that most likely represents a very highly degraded form of PCT 1302 White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion. This determination has been made with consideration of soil type, vegetation types occurring in similar locations in the locality, regenerating native species (where present) and community structure and descriptive attributes provided in the BioNet Vegetation Classification. Given that the subject site vegetation is heavily dominated by high threat exotic weeds in all strata, has been highly modified by previous clearing and land use, and is currently missing structural layers and other diagnostic features, this community is not considered to represent the TEC - Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions.

One (1) threatened flora species - rough-shelled bush-nut (*Macadamia tetraphylla*), listed as Vulnerable under the *Biodiversity Conservation Act 2016* and *Environment Protection and Biodiversity Conservation Act 1999* - was recorded from the subject site. A total of four (4) stems were detected as described in previous assessments associated with the Altitude Aspire development. An additional two (2) threatened species were considered possible occurrences as species credit species based on the availability of potentially suitable habitat.

A number of measures to avoid and mitigate impacts on existing flora, fauna and habitat values of the site have been discussed. The proposed development will however result in unavoidable impacts on 0.29 ha of highly degraded areas of PCT 1302. No Serious or Irreversible Impact entities are considered to occur on the subject site.

Impacts to the degraded area of PCT 1302 are not required to be offset as the vegetation integrity score of this community is below those set out in Paragraph 10.3.1.1 of the BAM. Therefore no ecosystem credits are required. A total of 12 species credits for threatened species have been calculated as applicable for the unavoidable loss of site vegetation/habitat as follows:

- Rough-shelled bush-nut (*Macadamia tetraphylla*) = 8 credits
- Slender Marsdenia (*Marsdenia longiloba*) = 2 credits

- Common Planigale (*Planigale maculata*) = 2 credits

In accordance with the requirements of the NSW Biodiversity Offsets Scheme, proponents have two primary ways that they can satisfy their offset credit obligation:

1. They can identify and purchase the required 'like for like' credits in the market and then retire those credits via OEH Biodiversity Offsets and Agreement Management System (BOAMS). For example, credits could be located by using the OEH registers or by retaining a broker to locate credits for them.

OR

2. They can use the Offsets Payment Calculator to determine the cost of its credit obligation, and transfer this amount to the Biodiversity Conservation Fund via OEH BOAMS. The Biodiversity Conservation Trust is then responsible for identifying and securing the credit obligation.

In this regard, it is understood that the proponent wishes to satisfy these offset credit obligations via payment to the Biodiversity Conservation Trust. At the time of writing, the following credit prices were generated by the Offsets Payment Calculator within the BOAMS:

- Rough-shelled bush-nut (*Macadamia tetraphylla*) = $8,314.81
- Slender Marsdenia (*Marsdenia longiloba*) = $4,117.38
- Common Planigale (*Planigale maculata*) = $1,253.99

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by Newland Developers to prepare a Biodiversity Development Assessment Report (BDAR) addressing a small area of additional vegetation clearing, on land formally described as Lot 1 DP175234, associated with an extension of bulk earthworks for the adjacent Altitude Aspire development. This assessment concerns a Modification to a Part 3A project under the *Environmental Planning and Assessment Act 1979* (EP&A Act).

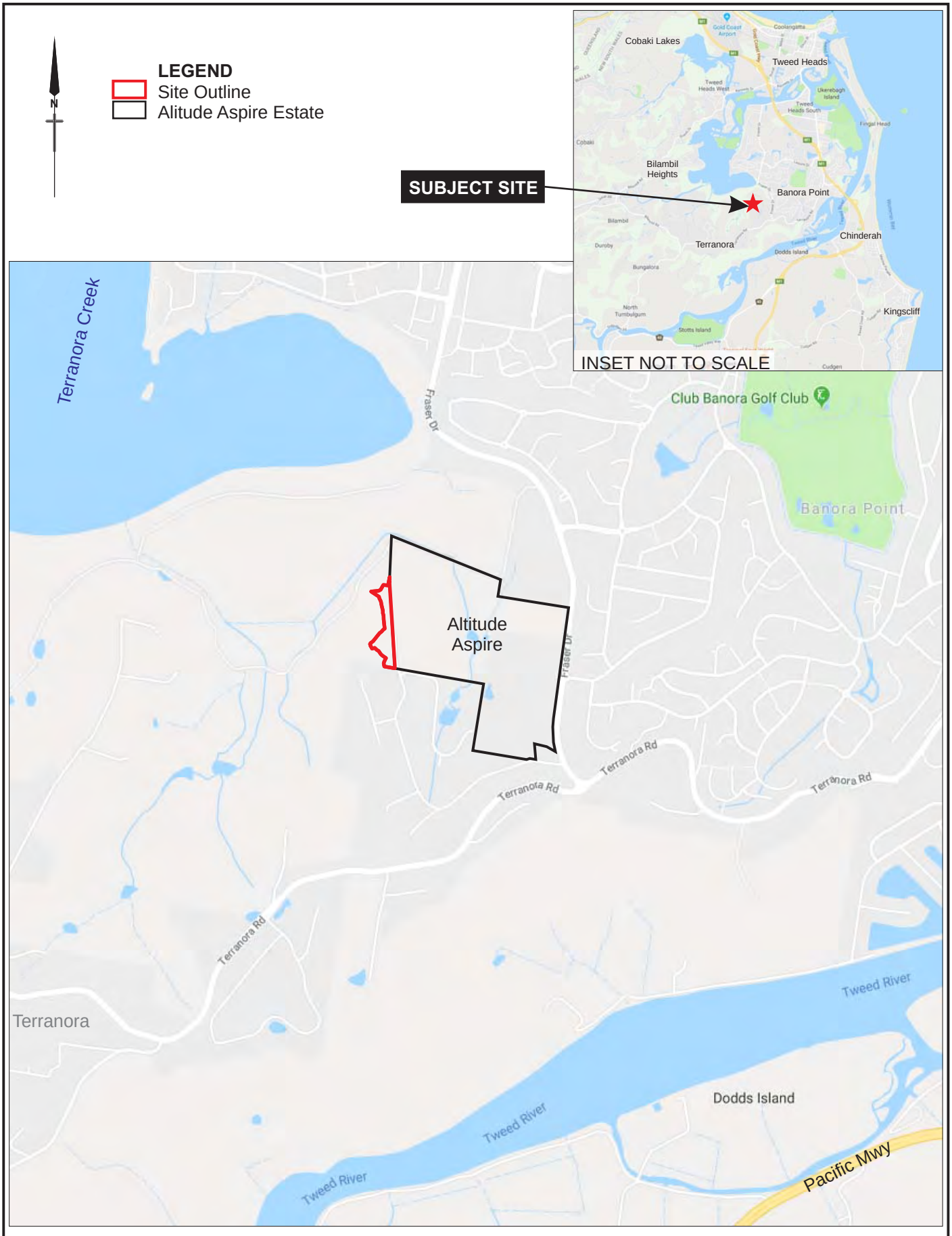
In accordance with the requirements of the *Biodiversity Conservation Regulations 2017* (BCR), this report has been prepared by Mr Matt Jenkins, a suitably qualified person and accredited assessor under the accreditation scheme prepared under Section 6.10 of the *Biodiversity Conservation Act 20016* (BC Act) (Certification No. BAAS18029).

The preparation of the BDAR has involved the following:

- An assessment of the biodiversity values of the additional clearing area utilising the Biodiversity Assessment Method (BAM) (OEH 2017) including:
    - An assessment of the landscape features and site context;
    - Determining the presence of Threatened Ecological Communities (TECs), Plant Community Types (PCTs), and the condition (vegetation integrity) of native vegetation on the subject site;
    - Determining the habitat suitability for Threatened species on the subject site
- An impact assessment of the proposed vegetation removal on biodiversity values in accordance with the requirements of the BAM including:
    - Documenting measures to avoid and/or minimise impacts of the proposed vegetation removal;
    - Assessing direct and indirect impacts on native vegetation and habitat;
    - Discussing measures to mitigate and manage unavoidable impacts;
    - Identification of any serious and irreversible impacts; and
    - Calculating the offset requirement associated with the proposed additional clearing area.

1.2 Locality

The Locality is defined as the area within a 10km radius of the Subject site for the purposes of this assessment. The locality therefore extends from Tugun south to Duranbah and from Glengarrie to the Pacific Ocean (FIGURE 1). Prominent features in the locality include the towns of Tweed Heads/Coolangatta, Banora Point, Kingscliff, Tweed River, Terranora Broadwater, Cudgen Lake, Cudgen Creek, Stotts Island Nature



SOURCE: Google Maps SCALE: 1 : 20 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT Newland Developers Pty Ltd PROJECT Biodiversity Development Assessment Report Lot 1 DP175234, Terranora NSW Tweed Shire Council LGA	**FIGURE 1** PREPARED: BW DATE: 25 October 2018 FILE: N09031_Locality.cdr	TITLE **LOCALITY PLAN**

Reserve, Cudgen Nature Reserve, Tweed Estuary Nature Reserve and Ukerebagh Nature Reserve.

1.3 The Subject Site

The subject site represents the proposed additional clearing limit of works, which covers an area of approximately 1.52 ha and is bounded to the north and west by vegetated and agricultural (grazing) land. Land to east comprises the Altitude Aspire development site and residential properties occur to the south of the subject site. A recent aerial photograph of the site is provided in FIGURE 2.

1.4 Planning Context

The subject site is located within the Tweed Shire Council LGA. The subject site is therefore subject to the Tweed Local Environmental Plan 2014 (Tweed LEP) and associated plans, policies and controls. Under the Tweed LEP the site is zoned as R1 - General Residential (FIGURE 3).

1.5 The Proposed Development

The proposed development represents an extension of bulk earthworks and associated vegetation clearing. The proposed earthworks footprint is shown in FIGURE 4.

1.6 Sources of Information

Sources of information used in the assessment, including reports and spatial data are as follows:

- Proposed development layouts provided by the proponent;
- Reports and management plans completed for the Altitude Aspire site;
- Australian Government's Species Profiles and Threats database (SPRAT) http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl
- Department of Environment and Climate Change NSW (DECC) (2002). Descriptions for NSW (Mitchell) Landscapes, Version 2.
- Environment Australia (2001) A Directory of Important Wetlands in Australia. 3rd Edition. Environment Australia, Canberra.
- NSW OEH's BAM Calculator https://www.lmbc.nsw.gov.au/bamcalc
- NSW OEH's threatened species database http://www.threatenedspecies.environment.nsw.gov.au/index.aspx
- OEH Threatened Species Profiles
- Office of Environment and Heritage (OEH) (2007). Mitchell Landscapes with per cent cleared estimates.
- Office of Environment and Heritage (OEH) (2017). Biodiversity Assessment Method.



N

LEGEND

Subject Site

Scale 1:2000 - Lengths in metres

20 0 20 40 60 80 100

SOURCE: B&P Surveys (2015 Aerial Photo & 21889B-prelim-180418.dwg)

SCALE: 1 : 2000 @ A3

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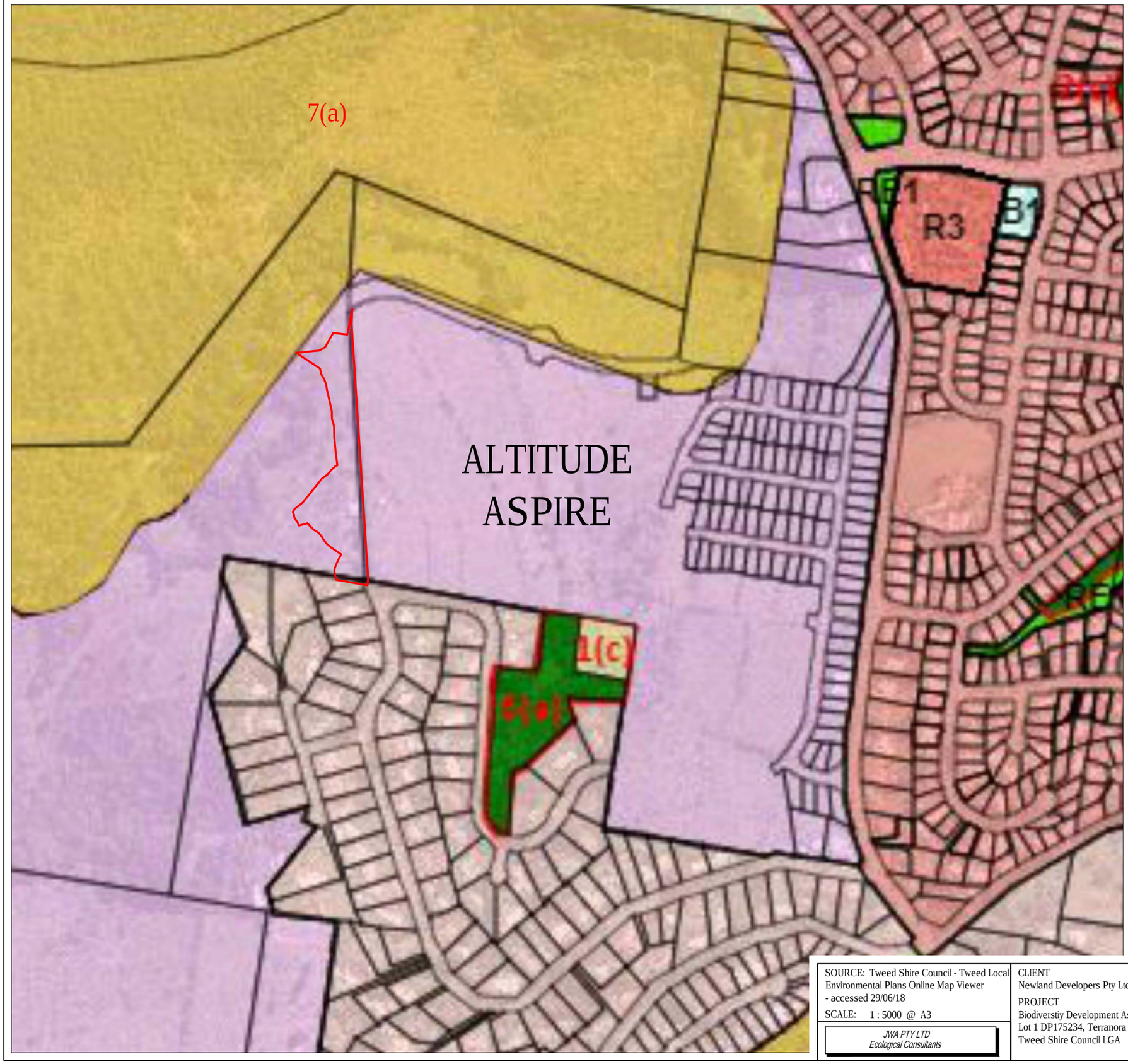
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FIGURE 2

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DATE: 25 October 2018
FILE: N09031_BDAR.dwg

TITLE

AERIAL PHOTOGRAPH



LEGEND

- Cadastre
- Subject Site

Tweed LEP 2014

- R1 - General Residential
- R2 - Low Density Residential
- R3 - Medium Density Residential
- R5 - Large Lot Residential
- B1 - Neighbourhood Centre
- RE1 - Public Recreation
- DM - Deferred Matter

Tweed LEP 2000

- 1(a) - Rural
- 6(a) - Open Space
- 7(a) - Environmental Protection (Wetlands and Littoral Rainforest)

Scale 1:5000 - Lengths in metres

50 0 50 100 150 200 250 300

SOURCE: Tweed Shire Council - Tweed Local Environmental Plans Online Map Viewer - accessed 29/06/18

SCALE: 1 : 5000 @ A3

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FIGURE 3

PREPARED: BW
DATE: 25 October 2018
FILE: N09031_BDAR.dwg

TITLE

ZONING PLAN

PROPOSED EXTENT OF CUT DAYLIGHTING WITH EXISTING SURFACE

FUTURE ALTITUDE CENTRAL

FUTURE ALTITUDE CENTRAL

EXISTING ROUGH-SHELLED BUSH NUT (*Macadamia tetraphylla*) TO BE TRANSLOCATED
EXISTINING COORDINATES:
EASTING: 550998.720
NORTHING: 6877406.447

EXTENT OF PREVIOUSLY SHOWN EARTHWORKS

MAWSONS PEAK BLVD (FUTURE)

BROADWATER PARKWAY

PARKES LANE

TOWNSEND CRESCENT

TOWNSEND CRESCENT

STAGE 8B

STAGE 9

STAGE 10

STAGE 11

STAGE 8A

PROPOSED PUBLIC RESERVE

LIMIT OF WORKS

LEGEND

- Cut Areas
- Fill Areas
- Stage Boundary
- 10 Existing Surface Contours
- 12 Finished Surface Contours
- Nominal Kerb Line
- Proposed Batter Top
- Proposed Batter Toe
- Site Boundary

0 25m
1 : 1 000

SOURCE: Bradlees Civil Consulting (Ref: SK6524.pdf)
SCALE: 1 : 1000 @ A3
JWA PTY LTD Ecological Consultants

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FIGURE 4
PREPARED: BW
DATE: 25 October 2018
FILE: N09031_Layout.cdr

TITLE
PROPOSED DEVELOPMENT LAYOUT

2 LANDSCAPE FEATURES

2.1 Introduction

This section of the BDAR provides details of landscape features at the development site (in accordance with Sections 4.2 and 4.3 of the BAM) including:

- IBRA bioregions and subregions, NSW landscape region and area (ha);
- native vegetation extent and cleared areas within the buffer area;
- rivers and streams (classified according to stream order);
- wetlands within, adjacent to and downstream of the site;
- connectivity features;
- areas of geological significance and soil hazard features; and
- site context components, including:
    - identification of method applied (i.e. linear or site-based); and
    - percent native vegetation cover in the landscape (development site and biodiversity stewardship site).

2.2 IBRA Bioregions and Subregions, NSW Landscape Region and Area

The subject site is located within the Burringbar-Conondale Ranges subregion of the South East Queensland IBRA bioregion (SEQ03). Mitchell (2002) mapping places the majority of the subject site within the Mount Warning Exhumed Slopes NSW landscape region, which covers an area of 89,287 ha. A small area in the southern extent of the subject site occurs within an area mapped as Lamington Volcanic Slopes NSW landscape region.

A site map showing the above features at a scale of 1:12,500 is provided as FIGURE 5.

2.3 Native Vegetation Extent and Cleared Areas in the Buffer Area

Native vegetation and cleared areas occurring within a 1,500 m buffer area to the subject site are shown in FIGURE 6. It is estimated that the extent of native vegetation on the subject site and within the buffer area is approximately 224.54 ha. Vegetated areas that are predominantly comprised of camphor laurel (*Cinnamomum camphora*) have been included in this calculation due to the presence of native species in some areas to varying degrees.

2.4 Rivers and Streams

Waterways occurring on and adjacent to the development site can be seen in FIGURE 5. The Tweed River, including Terranora Broadwater, is classified as a 4th order stream according to Strahler (1952).



N

LEGEND

- Subject Site
- IBRA Region - South Eastern Queensland
- IBRA Subregion
  - SEQ03 Burringbar-Conondale Ranges
- NSW (Mitchell) Landscape
  - BTP Byron - Tweed Alluvial Plains
  - LAV Lamington Volcanic Slopes
  - MWE Mount Warning Exhumed Slopes
  - EST/WAT Estuary/Water Added

Scale 1:12 500 - Lengths in metres

100 0 100 200 300 400 500

SOURCE: B&P Surveys (2015 Aerial Photo & 21889B-prelim-180418.dwg)

SCALE: 1 : 12 500 @ A3

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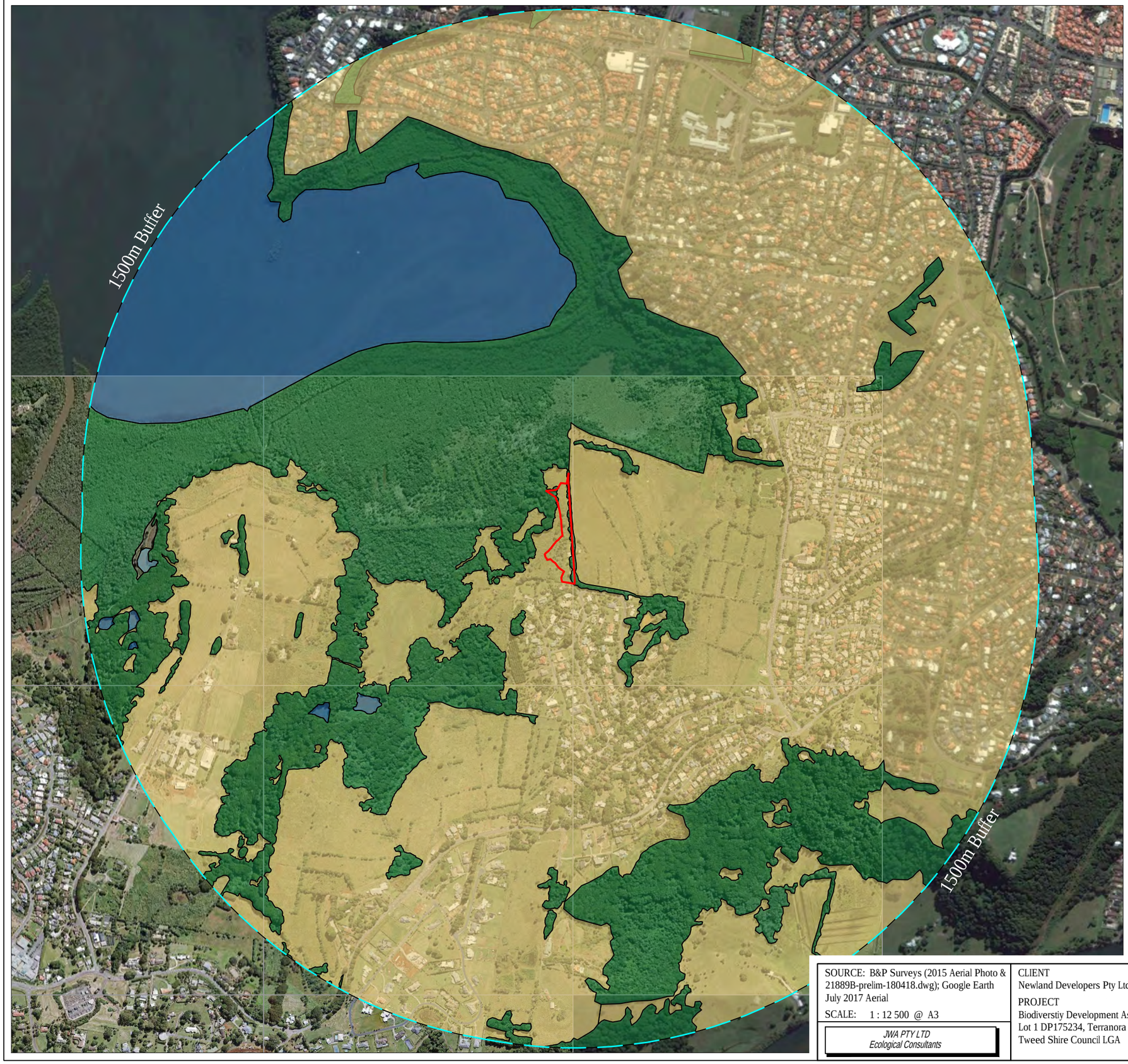
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FIGURE 5

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DATE: 25 October 2018
FILE: N09031_BDAR.dwg

TITLE

IBRA & NSW
LANDSCAPE REGIONS



N

LEGEND

- Native Vegetation
- Cleared Areas
- Waterbodies
- Subject Site

Scale 1:12 500 - Lengths in metres

100 0 100 200 300 400 500

SOURCE: B&P Surveys (2015 Aerial Photo & 21889B-prelim-180418.dwg); Google Earth July 2017 Aerial

SCALE: 1 : 12 500 @ A3

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FIGURE 6

PREPARED: BW
DATE: 25 October 2018
FILE: N09031_BDAR.dwg

TITLE

NATIVE VEGETATION & CLEARED AREAS WITHIN 1500M BUFFER

2.5 Wetlands Within, Adjacent to and Downstream of the Site

A coastal wetland area as mapped by the State Environmental Planning Policy (Coastal Management) 2018 occurs to the north of the subject site (FIGURE 7).

2.6 Site Context Components

2.6.1 Introduction

The assessment of site context involved the application of the site-based method. The following landscape attributes were assessed:

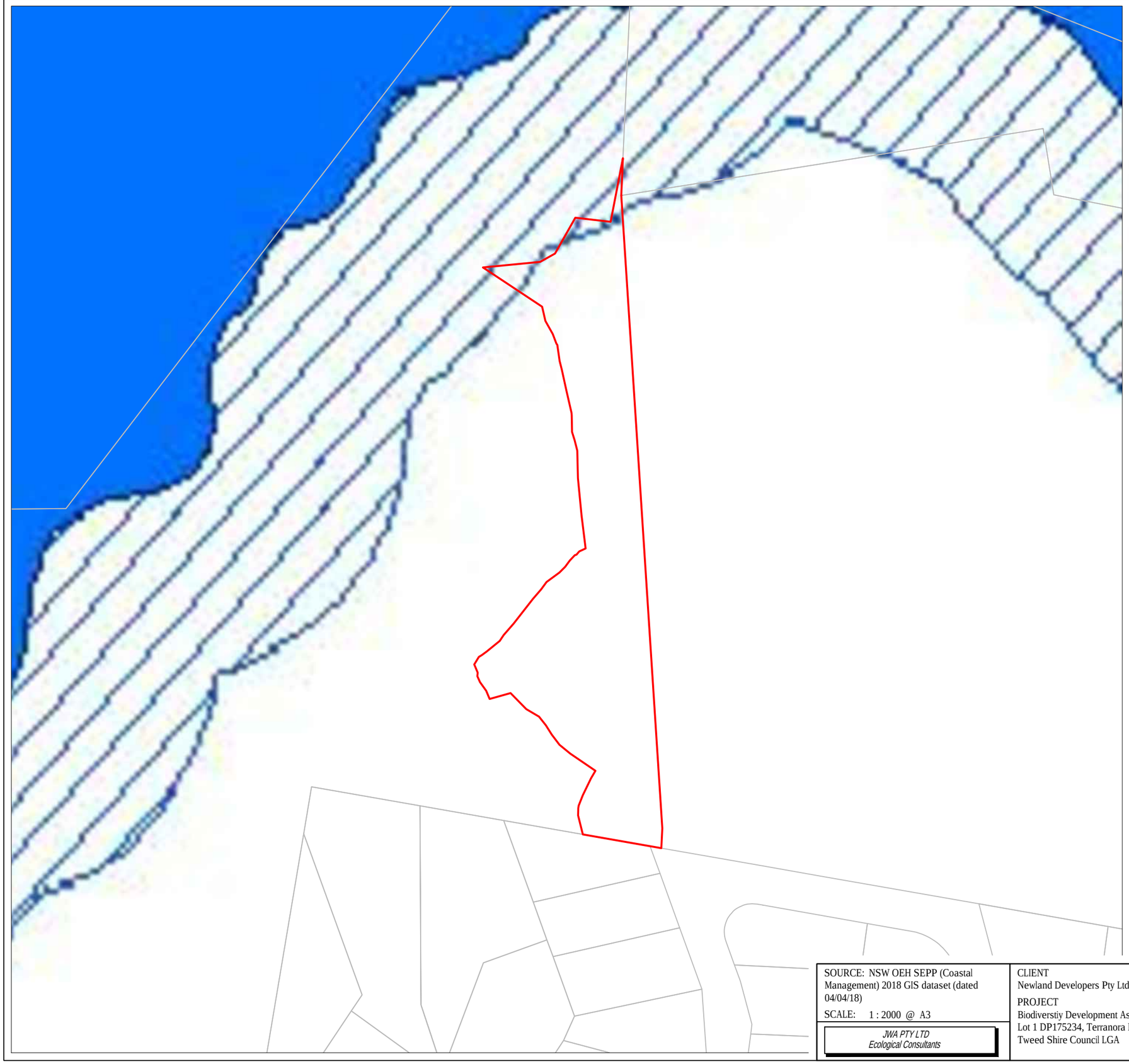
- Percent native vegetation cover in the landscape; and
- Patch size.

2.6.2 Percent Native Vegetation Cover

Native vegetation and cleared areas occurring within a 1,500 m buffer area to the subject site are shown in FIGURE 6. It is estimated that the native vegetation cover within the buffer area is 27%. The >10-30% native vegetation cover class has therefore been used to assess the habitat suitability of the subject site for Threatened species in SECTION 4. As discussed in SECTION 2.3, a significant proportion of the mapped vegetation is dominated by camphor laurel. However, this has been included due to the occurrence of some native components.

2.6.3 Patch Size

Native vegetation (including areas where camphor laurel dominates the canopy) and cleared areas occurring within a 1,500 m buffer area to the subject site are shown in FIGURE 6. The patch size in which the subject vegetation occurs has been estimated to be 39.82 ha. The 25-100 ha patch size class has therefore been used to assess the habitat suitability of the subject site for Threatened species in SECTION 4.



LEGEND

- Coastal Wetlands
- Proximity Area for Coastal Wetlands
- Cadastre
- Subject Site

SOURCE: NSW OEH SEPP (Coastal Management) 2018 GIS dataset (dated 04/04/18)

SCALE: 1 : 2000 @ A3

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FIGURE 7

PREPARED: BW
DATE: 25 October 2018
FILE: N09031_BDAR.dwg

TITLE
COASTAL MANAGEMENT SEPP 2018 - COASTAL WETLANDS

3 NATIVE VEGETATION ASSESSMENT

3.1 Introduction

This section of the BDAR identifies native vegetation extent within the development site, including any cleared areas (in accordance with the requirements of Section 5 of the BAM). This section describes Plant Community Types (PCTs) within the development site including:

- vegetation class;
- vegetation type;
- area (ha) for each vegetation type;
- species relied upon for identification of vegetation type and relative abundance;
- justification of evidence used to identify a PCT (as outlined in Paragraph 5.2.1.12 of the BAM);
- Threatened Ecological Community (TEC) status (as outlined in Paragraphs 5.2.1.14-5.2.1.15 of the BAM); and
- estimate of percent cleared value of PCT (as outlined in Paragraph 5.2.1.16 of the BAM).

This Section also includes the results of a vegetation integrity assessment of the development site, including:

- mapping vegetation zones (in accordance with Subsection 5.3.1 of the BAM);
- patch size;
- assessing vegetation integrity using benchmark data (in accordance with Subsection 5.3.3 of the BAM);
- survey effort (as described in Subsection 5.3.4 of the BAM); and
- determining the vegetation integrity score (in accordance with Appendix 6 of the BAM) including:
    - composition condition score;
    - structure condition score;
    - function condition score; and
    - vegetation integrity score.

3.2 Methodology

3.2.1 Site Assessment

Site vegetation was assessed on 19 September 2018 using a plot-based vegetation survey based on a 20 m x 20 m plot. The information contained in TABLE 1 below was collected.

TABLE 1
VEGETATION SURVEY DATA COLLECTED AT THE SUBJECT LAND

Attribute	Survey requirement
Stratum (and layer)	Stratum and layer in which each species occurs
Growth form	Growth form for each recorded species
Species name	Scientific name and common name
Cover	Estimate the % foliage cover across the plot of each species rooted in or overhanging the plot. Cover should be recorded in decimals if less than 1% (0.1, 0.2…), or whole numbers up to 5% (1,2,3…), or to the nearest 5% where greater than 5% cover (5,10,15,20,25…)
Abundance rating	For species with cover less than or equal to 5%, count or estimate the number of individuals or shoots of each species within the plot, using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, 1500, 2000, etc. Numbers above 20 are estimates only, and the recorded abundance is the upper end of each class (e.g. 50 represents an estimated abundance of between 20 and 50). For species with cover greater than 5%, abundance estimates are not required (but may be recorded if desired)

As the vegetation zone being assessed was <2 ha in size, one (1) plot/transect was surveyed, the location of which is shown in FIGURE 8.

3.2.2 Identifying PCTs and TECs

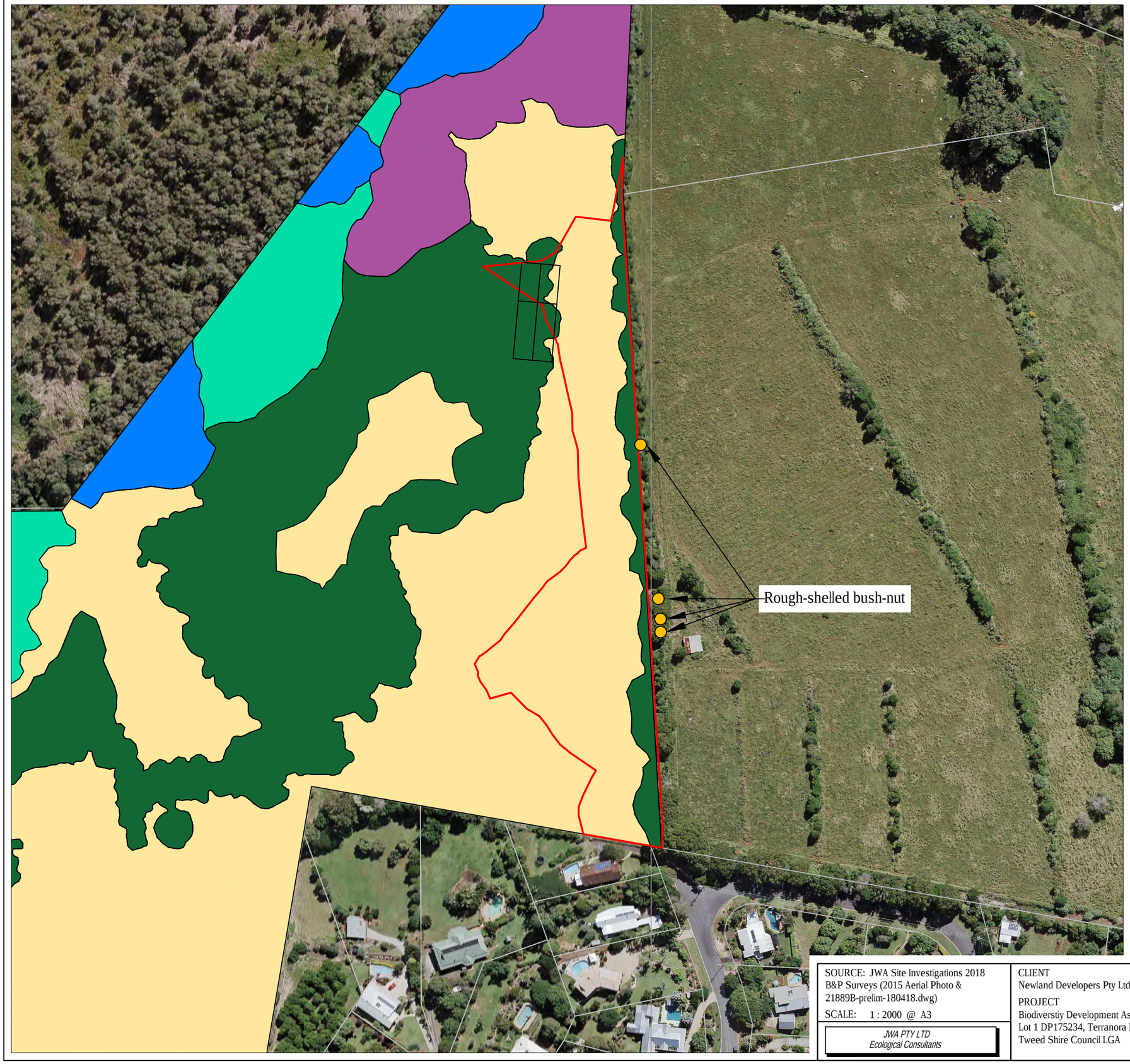
Identification of PCTs and potential TECs on the subject site was completed by comparing data collected from site to:

1. detailed descriptions of PCTs and relevant geographic distributions within the BioNet Vegetation Classification;
2. detailed descriptions of TECs on the OEH website and in the relevant NSW Scientific Committee Determinations;
3. survey data and/or individual species records held in BioNet; and
4. existing maps of native vegetation in the area i.e. Tweed Vegetation Management Strategy (Ecograph 2004).

3.2.3 Vegetation Integrity Assessment (Site Condition)

The survey plot was established around a central 50m transect as follows:

a) One (1) 400 m^2 plot (standard 20 m x 20 m) was used to assess all of the composition and structure attributes. The plot used for the floristic vegetation survey (FIGURE 8) was also used as a vegetation integrity plot.



N

LEGEND

Survey Plot

Subject Site

Threatened Flora Records

- Rough-shelled bush-nut (*Macadamia tetraphylla*)

Vegetation Communities

- Community 1 - Tall closed forest (*Cinnamomum camphora*)
- Community 2 - Tall open / closed swamp sclerophyll forest (*Melaleuca quinquenervia*)
- Community 3 - Tall open/closed swamp sclerophyll forest (*Archontophoenix cunninghamiana* / *Melaleuca quinqunervia*)
- Community 4 - Tall open moist sclerophyll forest (*Lophostemon confertus* +/- *Corymbia intermedia*)
- Community 5 - Substantially cleared land / pasture with scattered exotic regrowth

Scale 1:2000 - Lengths in metres

20 0 20 40 60 80 100

SOURCE: JWA Site Investigations 2018
B&P Surveys (2015 Aerial Photo & 21889B-prelim-180418.dwg)

SCALE: 1 : 2000 @ A3

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FIGURE 8

PREPARED: BW
DATE: 25 October 2018
FILE: N09031_BDAR.dwg

TITLE
VEGETATION COMMUNITIES & SURVEY PLOT LOCATION

b) One (1) 1,000 m^2 plot (standard 20 m x 50 m) was used to assess the function attributes: number of large trees, tree regeneration, stem size class, length of logs, high threat exotic weed cover and number of trees with hollows.

c) Five (5) 1 m^2 sub-plots are used to assess average litter cover (and other optional groundcover components) for the plot.

The composition, structure and relevant function attributes listed in TABLE 2 below were assessed.

TABLE 2
GROWTH FORM GROUPS AND ATTRIBUTES USED TO ASSESS THE COMPOSITION, STRUCTURE AND FUNCTION COMPONENTS OF VEGETATION INTEGRITY

Growth form groups used to assess composition and structure	Attributes used to assess function
a) Tree	a) Number of large trees
b) Shrub	b) Tree regeneration
c) Grass and grass like	c) Tree stem size class
d) Forb	d) Total length of fallen logs
e) Fern	e) Litter cover
f) Other	f) High threat exotic weed cover
	g) Hollow bearing trees

3.3 Results

3.3.1 Vegetation Communities

3.3.1.1 Location and Area

Surveys of the subject site recorded only one (1) vegetation community described as Tall closed forest (*Cinnamomum camphora*). This community occurs as a row of trees along a fence line/driveway on the eastern boundary of the site and a disturbed patch occurring in the north-western portion of the site. The mapped extent of this community on the subject site covers a total area of approximately 0.29 ha (FIGURE 8).

3.3.1.2 Description

This community is highly disturbed with a closed canopy of camphor laurel to a height of approximately 12-14m. Other species occurring in low numbers in the canopy include red kamala (*Mallotus philippensis*), foambark (*Jagera pseudorhus*) and blackwood (*Acacia melanoxylon*).

The midstorey and ground layers of the vegetation community are also highly disturbed and sparse to absent in most areas. The threatened species[1] rough-shelled bush-nut (*Macadamia tetraphylla*) occurs adjacent to the eastern boundary of the subject site as shown in FIGURE 8.

[1] Listed as Vulnerable under the *Biodiversity Conservation Act 2016* and *Environment Protection and Biodiversity Conservation Act 1999.*

The midstorey is dominated by the weed species[2] Mickey mouse plant* (*Ochna serrulata*), lady-of-the-night* (*Cestrum nocturnum*) and lantana* (*Lantana camara*). Other occurrences in the midstorey include red kamala, macaranga (*Macaranga tanarius*), guioa (*Guioa semiglauca*), umbrella tree* (*Schefflera actinophylla*), cockspur thorn (*Maclura cochinchinensis*), rough lemon* (*Citrus x taitensis*), common guava* (*Psidium guajava*) and giant devil's fig* (*Solanum chrysotrichum*).

The ground layer is heavily dominated by climbing asparagus fern* (*Asparagus plumosus*) and areas of broadleaf paspalum* (*Paspalum mandiocanum*), elephant grass* (*Pennisetum purpureum*) and Chinese burr* (*Triumfetta rhomboidea*). Scattered occurrences of annual ragweed* (*Ambrosia artemisiifolia*), spiked mavalstrum* (*Malvastrum americanum*), *Cyclosorus interruptus* and rough maidenhair fern (*Adiantum hispidulum*) also occur.

3.3.2 Applicable PCT and TEC

In accordance with Paragraph 5.2.1.4 (a) the most likely PCT that would have occurred prior to disturbance has been determined, as the subject vegetation has been highly modified to the extent that it has reduced species richness and is missing structural layers.

The vegetation community described above is considered to most likely represent a very highly degraded form of PCT 1302 White Booyong – Fig subtropical rainforest of the NSW North Coast Bioregion. This determination has been made with consideration of soil type, vegetation types occurring in similar locations in the locality, regenerating native species (where present) and community structure and descriptive attributes provided in the BioNet Vegetation Classification.

Given that the subject site vegetation is heavily dominated by high threat exotic weeds in all strata, has been highly modified by previous clearing and land use, and is currently missing structural layers and other diagnostic features, this community is not considered to represent the TEC - Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions.

3.3.3 Vegetation Integrity (Site Condition) Score

3.3.3.1 Background

To determine the vegetation integrity score, the composition score, structure score and function score were calculated by entering the collected plot survey data (APPENDIX 1) into the online BAM Calculator. The relevant BAM Calculator workings are summarised below.

[2] Weed species are indicated by the use of an asterisk*.

3.3.3.2 Composition Condition

Item	Tree	Shrub	Grass & Grass Like	Forb	Fern	Other
Benchmark	25	13	2	3	6	13
Observed mean ($\bar{x}$)	5	1	1	0	2	3
Unweighted composition score (UCS_i)	8.6	0.8	59.1	0	27.6	8.6
Weighted composition score (WCS_i)	3.4	0.2	1.8	0	2.6	2
Dynamic weighting (w_i)	0.39	0.2	0.03	0.05	0.09	0.23

Composition condition score =10

3.3.3.3 Structure Condition

Item	Tree	Shrub	Grass & Grass Like	Forb	Fern	Other
Benchmark	168	28	1	1	25	48
Observed mean ($\bar{x}$)	30	0.5	0	0	0.1	0.5
Unweighted composition score (USS_i)	6.6	0	0	0	0	0
Weighted composition score (WSS_i)	4.1	0	0	0	0	0
Dynamic weighting (w_i)	0.62	0.1	0	0	0.09	0.18

Structure condition score = 4.1

3.3.3.4 Function Condition

Item	Number of Large Trees	Litter Cover	Coarse Woody Debris	Stem Size Class	Regeneration Stems <5cm DBH	High Threat Weed Cover
Benchmark	6	81	48	4	Present	
Observed mean ($\bar{x}$)	0	91.6	40	4	1	90
Weighted function score (WFS_i)	0	15	19.3	15	15	
Weighting (w_i)	0.35	0.15	0.2	0.15	0.15	

Function condition score = 64.3

3.3.3.5 Final Vegetation Integrity Score

Current Vegetation integrity score = 13.8

4 THREATENED SPECIES ASSESSMENT

4.1 Introduction

This section of the BDAR assesses habitat suitability for Threatened species (in accordance with Section 6 of the BAM). In particular, this section of the BDAR identifies:

- ecosystem credit species associated with PCTs on the development site (in accordance with Section 6.2 of the BAM) including:
    - list of species derived; and
    - justification for exclusion of any ecosystem credit species predicted.
- species credit species on the development site (in accordance with Sections 6.3 to 6.5 of the BAM) including:
    - list of candidate species;
    - justification for inclusions and exclusions based on habitat features;
    - indication of presence based on targeted survey or expert report;
    - details of targeted survey technique, effort, timing and weather;
    - species polygons; and
    - biodiversity risk weighting for the species.

4.2 Ecosystem Credit Species

In accordance with Section 3.1.1.3 of the BAM if, during the assessment of biodiversity values for any type of development, clearing or biodiversity certification proposal as required by Chapter 5, the assessor determines that:

a) an area of land does not contain native vegetation, or

b) a vegetation zone has a vegetation integrity score <15 where the PCT is representative of an endangered or critically endangered ecological community, or

c) a vegetation zone has a vegetation integrity score <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or

d) a vegetation zone has a vegetation integrity score <20 where the PCT is not representative of a TEC or associated with threatened species habitat

then for that vegetation zone:

e) assessment of native vegetation is not required beyond Section 5.4, and

f) an assessment of threatened species habitat according to Section 6.2 and Paragraph 6.2.1.4 is not required.

As discussed above, the vegetation in question returned a vegetation integrity score of 13.8. Therefore, in accordance with the BAM no further assessment of the vegetation values as habitat for ecosystem credit threatened species is required.

4.3 Species Credit Species

TABLE 3 lists the species credit species that have been derived from the BAM Calculator. Details of required habitat components, geographic limitations, applicable sensitivity classes, whether any targeted surveys were completed, indication of presence based on targeted surveys, indication of where presence was assumed and/or where presence was determined by expert report, and the biodiversity risk weighting for each species is also provided.

Extensive flora surveys have been completed on the subject site and adjacent lands during the original and subsequent ecological assessments. A thorough search for any threatened flora species occurring within subject site habitats was also undertaken at the time of the plot-based vegetation survey. Only the previously recorded rough-shelled bush-nut stems were detected.

TABLE 3
SUMMARY OF SPECIES CREDIT SPECIES ASSESSMENT

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Marblewood (*Acacia bakeri*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Acalypha (*Acalypha eremorum*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Scented Acronychia (*Acronychia littoralis*)	n/a	Within 5km of coast	Yes	High	Yes	No	n/a	High (2)
Giant fern (*Angiopteris evecta*)	n/a	n/a	Yes	Moderate	Yes	No	n/a	High (2)
White lace flower (*Archidendron hendersonii*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)
Hairy jointgrass (*Arthraxon hispidus*)	n/a	n/a	No	High	n/a	n/a	n/a	n/a
Needle-leaf fern (*Belvisia mucronata*)	n/a	n/a	Yes	Moderate	Yes	No	n/a	High (2)
Yellow satinheart (*Bosistoa transversa*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Mark's Cassia (*Cassia marksiana*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Eastern pygmy-possum (*Cercartetus nanus*)	n/a	n/a	No	High	n/a	n/a	n/a	n/a
Giant ironwood (*Choricarpia subargentea*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Axe-breaker (*Coatesia paniculata*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)	• Leaf and bark litter • Fallen/standing dead timber including logs • Timber and logs on the ground	n/a	No	High	n/a	n/a	n/a	n/a
Corokia (*Corokia whiteana*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Stinking Cryptocarya (*Cryptocarya foetida*)	n/a	n/a	Yes	Moderate	Yes	No	n/a	Moderate (1.5)
Smooth tuckeroo (*Cupaniopsis serrata*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Coxen's fig-parrot (*Cyclopsitta diophthalma coxeni*)	n/a	n/a	No	Very High	n/a	n/a	n/a	n/a
White-flowered wax plant (*Cynanchum elegans*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Missionary nutgrass (*Cyperus semifertilis*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)
Davidson's plum (*Davidsonia jerseyana*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Smooth Davidson's plum (*Davidsonia johnsonii*)	n/a	n/a	Yes	Very High	Yes	No	n/a	Very High (3)
Gympie stinger (*Dendrocnide moroides*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Thorny pea (*Desmodium acanthocladum*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Red-fruited ebony (*Diospyros mabacea*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Shiny-leaved ebony (*Diospyros yandina*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Giant spear lily (*Doryanthes palmeri*)	• Cliffs • Cliff top, steep rock faces or rocky outcrops	n/a	No	High	n/a	n/a	n/a	n/a
Basket fern (*Drynaria rigidula*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Nightcap oak (*Eidothea hardeniana*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)
Hairy quandong (*Elaeocarpus williamsianus*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Crystal creek walnut (*Endiandra floydii*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Rusty rose walnut (*Endiandra hayesii*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Ball nut (*Floydia praealta*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Southern fontainea (*Fontainea australis*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Sweet myrtle (*Gossia fragrantissima*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
White yiel yiel (*Grevillea hilliana*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Harnieria hygrophiloides	n/a	Within 5 km of Brunswick Heads township	No	High	n/a	n/a	n/a	n/a
Red bopple nut (*Hicksbeachia pinnatifolia*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Pale-headed snake (*Hoplocephalus bitorquatus*)	n/a	n/a	No	High	n/a	n/a	n/a	n/a
Isoglossa (*Isoglossa eranthemoides*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Fine-leaved tuckeroo (*Lepiderema pulchella*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)
Short-footed screw fern (*Lindsaea brachypoda*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Green-thighed frog (*Litoria brevipalmata*)	n/a	n/a	No	Moderate	n/a	n/a	n/a	n/a
Rough-shelled bush-nut (*Macadamia tetraphylla*)	n/a	n/a	Yes	High	Yes	Yes	n/a	High (2)
Slender Marsdenia (*Marsdenia longiloba*)	n/a	n/a	Yes	High	No	n/a	Yes	High (2)
Coast euodia (*Melicope vitiflora*)	n/a	n/a	Yes	High	Yes	no	n/a	High (2)
Little bentwing-bat (Breeding) (*Miniopterus australis*)	n/a	n/a	No	Very High	n/a	n/a	n/a	n/a
Eastern bentwing-bat (Breeding) (*Miniopterus schreibersii oceanensis*)	n/a	n/a	No	Very High	n/a	n/a	n/a	n/a

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Giant barred frog (*Mixophyes iteratus*)	• Land within 50m of semi permanent and permanent drainages	n/a	No	Moderate	n/a	n/a	n/a	n/a
Southern Myotis (*Myotis macropus*)	• Hollow-bearing trees • Within 200m of riparian zone • Bridges, caves or artificial structures within 200m of riparian zone	n/a	No	High	n/a	n/a	n/a	n/a
Ripple-leaf muttonwood (*Myrsine richmondensis*)	n/a	n/a	Yes	High	Yes	No	n/a	
Smooth-leaved plum (*Niemeyera chartacea*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Rusty plum (*Niemeyera whitei*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Powerful owl (breeding) (*Ninox strenua*)	n/a	n/a	No	High	n/a	n/a	n/a	n/a
Yellow-flowered King of the Fairies (*Oberonia complanata*)	n/a	n/a	Yes	Moderate	Yes	No	n/a	Very High (3)
Southern ochrosia (*Ochrosia moorei*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)
Onion cedar (*Owenia cepiodora*)	n/a	n/a	Yes	High	Yes	No	n/a	Very High (3)
Wollumbin dogwood (*Ozothamnus vagans*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Brown Fairy-chain orchid (*Peristeranthus hillii*)	n/a	Within 5 km of coast	Yes	Moderate	Yes	No	n/a	Moderate (1.5)

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Brush sauropus (*Phyllanthus microcladus*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Southern pink underwing moth (*Phyllodes imperialis*) (southern subspecies)	n/a	n/a	No	Moderate	n/a	n/a	n/a	n/a
Common Planigale (*Planigale maculata*)	n/a	n/a	Yes	High	No	n/a	Yes	High (2)
McPherson Range pomaderris (*Pomaderris notata*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Grey-headed flying-fox (Breeding) (*Pteropus poliocephalus*)	n/a	n/a	No	High	n/a	n/a	n/a	n/a
Spiny gardenia (*Randia moorei*)	n/a	n/a	Yes	Very High	Yes	No	n/a	Very High (3)
Blotched sarcochilus (*Sarcochilus weinthalii*)	n/a	n/a	Yes	Moderate	Yes	No	n/a	Very High (3)
Rainforest Cassia (*Senna acclinis*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Brush Sophora (*Sophora fraseri*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Small-leaved hazelwood (*Symplocos baeuerlenii*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Red lilly pilly (*Syzygium hodgkinsoniae*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Durroby (*Syzygium moorei*)	n/a	n/a	Yes	High	Yes	No	n/a	High (2)
Mitchell's rainforest snail (*Thersites mitchellae*)	n/a	n/a	No	High	n/a	n/a	n/a	n/a

Species	Habitat Constraints	Geographic limitations	Confirmed Candidate Species	Sensitivity to Gain Class	Targeted Surveys Completed	Presence Indicated by Targeted Survey	Presence Assumed	Biodiversity Risk (& Weighting)
Arrow-head vine (*Tinospora tinosporoides*)	n/a	n/a	Yes	Moderate	Yes	No	n/a	Moderate (1.5)
Queensland Xylosma (*Xylosma terrae-reginae*)	n/a	Within 5 km of coast	Yes	High	Yes	No	n/a	High (2)

The following species credit species are assumed to be present on the subject site, with the exception of *Macadamia tetraphylla,* which was directly recorded. However, it should be noted that the highly disturbed site vegetation represents marginal habitat for species assumed to be present:

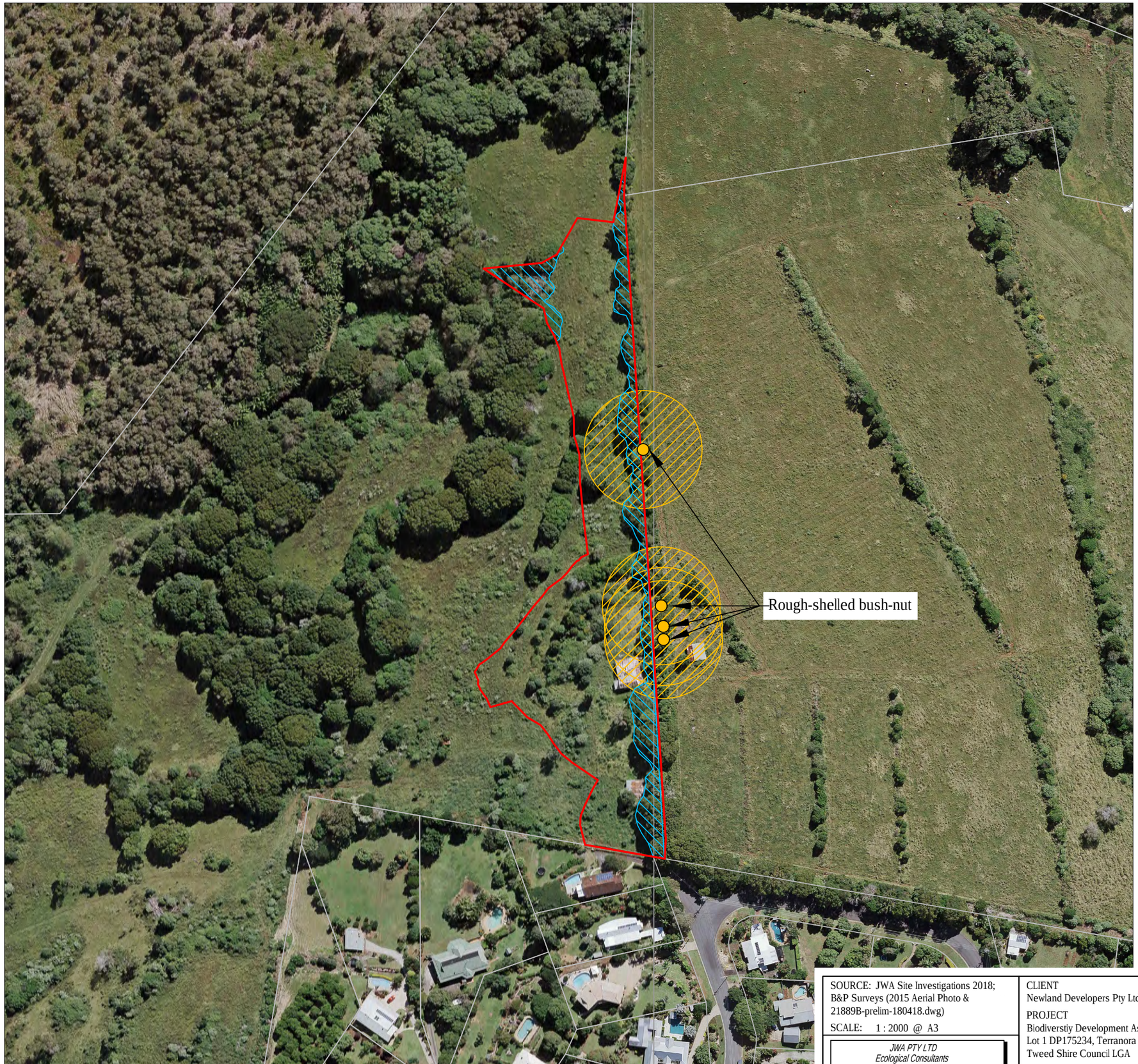
- Rough-shelled bush-nut (*Macadamia tetraphylla*) recorded adjacent to the eastern boundary of the subject site;
- Slender marsdenia (*Marsdenia longiloba*) assumed to be present as flora surveys were not completed at the appropriate time to detect this species; and
- Common Planigale (*Planigale maculata*) assumed to be present.

Species polygons have been prepared and are provided in FIGURE 9. The species polygon for rough-shelled bush-nut includes a 30m buffer around the outside of individual plants in accordance with Paragraph 6.4.1.29 of the BAM. The species polygon for the remaining species is considered to be inclusive of the entire area of PCT 1302 occurring on the subject site (i.e. 0.29 ha).

A number of species credit species were considered to be highly unlikely to occur on the subject land after an assessment of site habitats. This is primarily due to the absence of suitable habitat components and/or high levels of disturbance and degradation. Species that were removed from the candidate species list, along with the rationale behind the decision to remove them, are provided in TABLE 4.

TABLE 4
SPECIES CREDIT SPECIES REMOVED FROM CANDIDATE SPECIES LIST

Species	Reason for determining that species is unlikely to occur on the subject land
Hairy jointgrass (*Arthraxon hispidus*)	Subject land does not contain wet/moist areas such as creeks, soaks or swamps and has north and west facing slopes that are unsuitable for this species due to excessive light exposure.
Eastern pygmy possum (*Cercartetus nanus*)	No tree hollows and general lack of nectar/pollen producing plants such as *Banksia* spp., *Eucalyptus* spp. and *Callistemon* spp.
Three-toed snake-tooth skink (*Coeranoscincus reticulatus*)	Subject land does not contain suitable loamy or sandy, alluvial soils.
Coxen's fig parrot (*Cyclopsitta diopthalma coxeni*)	Subject land does not contain fig trees or other fruiting rainforest species.
Giant spear lily (*Doryanthes palmeri*)	Subject land does not contain cliffs, rocky outcrops or rock faces.
Harnieria hygrophiloides	Subject land does not occur within 5km of Brunswick Heads township.
Pale-headed snake (*Hoplocephalus bitorquatus*)	This species generally occurs in dry eucalypt forests and woodlands and is highly dependent on tree hollows, which do not occur on the subject land.
Green-thighed frog (*Litoria brevipalmata*)	Subject land is elevated and does not contain suitable habitat i.e. areas where surface water would gather after rain forming temporary pools and flooded areas.



N

LEGEND

Subject Site

Threatened Flora Records

Rough-shelled bush-nut (*Macadamia tetraphylla*)

Species Polygons

Species Polygon for Rough-shelled bush-nut (*Macadamia tetraphylla*)

Species Polygon for Slender marsdenia (*Marsdenia longiloba*) & Common planigale (*Planigale maculata*)

Scale 1:2000 - Lengths in metres

20 0 20 40 60 80 100

SOURCE: JWA Site Investigations 2018; B&P Surveys (2015 Aerial Photo & 21889B-prelim-180418.dwg)

SCALE: 1 : 2000 @ A3

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FIGURE 9

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SPECIES POLYGONS

Species	Reason for determining that species is unlikely to occur on the subject land
Little bentwing-bat (Breeding) (*Miniopterus australis*)	Maternity caves are not present on the subject land. Only five nursery sites/maternity colonies are known in Australia.
Eastern bentwing-bat (Breeding) (*Miniopterus schreibersii oceanensis*)	Maternity caves are not present on the subject land.
Giant barred frog (*Mixophyes iteratus*)	Subject land does not contain, or occur within 50m of, semi-permanent or permanent streams or other water bodies.
Southern myotis (*Myotis macropus*)	Subject land does not contain water bodies, hollow bearing trees or occur within 200m of a riparian zone.
Powerful owl (Breeding) (*Ninox strenua*)	Absence of large tree hollows required as a breeding habitat component.
Pink underwing moth (*Phyllodes imperialis* southern subspecies)	The highly disturbed nature of rainforest vegetation and lack of food plant *Carronia multisepalea* would preclude the occurrence of this species on the subject land.
Grey-headed flying-fox (Breeding) (*Pteropus poliocephalus*)	No roosting sites (camps) representing breeding habitat occur on the subject land.
Mitchell's rainforest snail (*Thersites mitchellae*)	Subject land does not contain rainforest or swamp forest on alluvial soils. The elevation and highly degraded/disturbed nature of vegetation occurring on the subject site would preclude the occurrence of this species i.e. does not contain a significant proportion of palm or fig trees or areas adjacent to wetlands.

5 AVOIDANCE & MINIMISATION OF IMPACTS

5.1 Introduction

This section of the BDAR discusses methods to avoid and minimise impact of the proposed development including:

- Details of efforts to avoid and minimise impact on biodiversity values (in accordance with Section 8 of the BAM); and
- An assessment of direct and indirect impacts unable to be avoided at the development site (in accordance with Sections 9.1 and 9.2 of the BAM).

The assessment of impacts has considered and included the type, frequency, intensity, duration and consequence of impacts.

5.2 Avoidance and Minimisation Measures

5.2.1 Pre-Construction/Design Phase

5.2.1.1 Locating the Project

The location of the proposed extension of bulk earthworks is limited to grazing land comprising pasture grasses and small areas of highly disturbed vegetation, predominantly consisting of high threat exotic weed species.

5.2.1.2 Project Design

As described above, the project design avoids and minimises the clearing of native vegetation and habitat by locating temporary and permanent ancillary construction and maintenance facilities in areas that are in the poorest condition (i.e. have a low vegetation integrity score).

5.2.2 Construction Phase

5.2.2.1 Education of Site Personnel

A construction personnel induction program shall be developed by the Proponent to highlight the presence of significant vegetation and habitat values on the site. The general induction of all construction personnel will cover such matters as:

- Areas of the site in which significant vegetation and habitat values occur;
- Threats to significant vegetation and habitat values associated with construction activities;
- Requirement to report any incidents within the significant vegetation and habitat areas, and actions required;
- Construction personnel are prohibited from bringing dogs onto the site; and
- Requirements of any relevant Management Plan, particularly protocols for vegetation clearing and measures to protect retained native vegetation.

5.2.2.2 Fauna Protection Measures

Vegetation and rocky areas will be inspected for fauna by a suitably qualified ecologist immediately prior to the commencement of clearing/earthworks. Built structures (i.e. abandoned house/sheds) shall be inspected for fauna (particularly microchiropteran bats) immediately prior to demolition. Any fauna detected within proposed clearing areas or buildings to be demolished will be relocated to suitable habitat outside of the subject site. Consideration will be given to appropriate release times and locations for specific fauna groups and a record kept of all species encountered/relocated.

Habitat features such as fallen timber, hollow logs and/or rocks shall be retained if possible or relocated to an appropriate location within retained vegetation or proposed Conservaton Areas as replacement habitat for ground-dwelling fauna.

5.2.2.3 Vegetation Protection Measures

During construction activities, temporary high visibility fencing will be erected to assist in the protection of retained vegetation from all construction activities by restricting access from machinery and contractors. This fencing will be erected in accordance with *Australian Standard 4970-2009 Protection of Trees* and the requirements of the VMRP prepared for the adjacent Altitude Aspire project site. Temporary signage will be provided along all temporary fencing during the construction phase stating "Conservation Area – No Unauthorised Entry".

No machinery, rubbish or spoil will be stored within retained vegetation during the construction phase of the development. Vehicle/equipment wash-down areas or access tracks will not be located in or immediately adjacent to retained vegetation.

5.2.3 Post-construction/Operational Phase

5.2.3.1 Appropriate Landscaping

Landscape species should comprise locally occurring native species to reduce the potential for weed invasion.

5.2.3.2 Regeneration and Revegetation Measures

A Vegetation Management and Rehabilitation Plan (VMRP) has been prepared for the Altitude Aspire development outlining specific measures to:

- Enhance the vegetation to be retained within Conservation Areas;
- Revegetate disturbed areas where appropriate with locally-occurring native species to achieve fully structured vegetation communities;
- Provide offsets for the unavoidable loss of Lowland rainforest EEC from the development footprint;
- Rehabilitate the area of degraded Freshwater wetland EEC on the subject site;
- Reduce detrimental edge effects and other disturbance related impacts on the adjacent SEPP 14 Wetland;

- Improve the value of the subject site as habitat for fauna groups;
- Manage weeds using plantings of locally-occurring native species and best practice weed control methods; and
- Contribute a significant area of native habitat (existing and restored) to the Regional Corridor.

The measures prescribed within the Vegetation Management and Rehabilitation Plan should be implemented on the subject site where relevant and appropriate.

5.2.4 Monitoring and Reporting

The VMRP prepared for the Altitude Aspire development provides monitoring and reporting requirements and specific measurable performance targets. Monitoring will be completed within the following areas:

- Proposed natural regeneration areas;
- Revegetation areas;
- Freshwater wetland EEC and adjacent SEPP 14 Wetland; and
- Stormwater treatment areas and central drainage channel.

6 IMPACT SUMMARY

6.1 Introduction

This section of the BDAR identifies, assesses and summarises the likely direct and indirect impacts of the proposed development. Furthermore, impacts of the proposed development are identified that are:

- considered to be potentially serious and irreversible impacts (in accordance with Section 10.2); and
- require offsets (in accordance with Section 10.3 of the BAM).

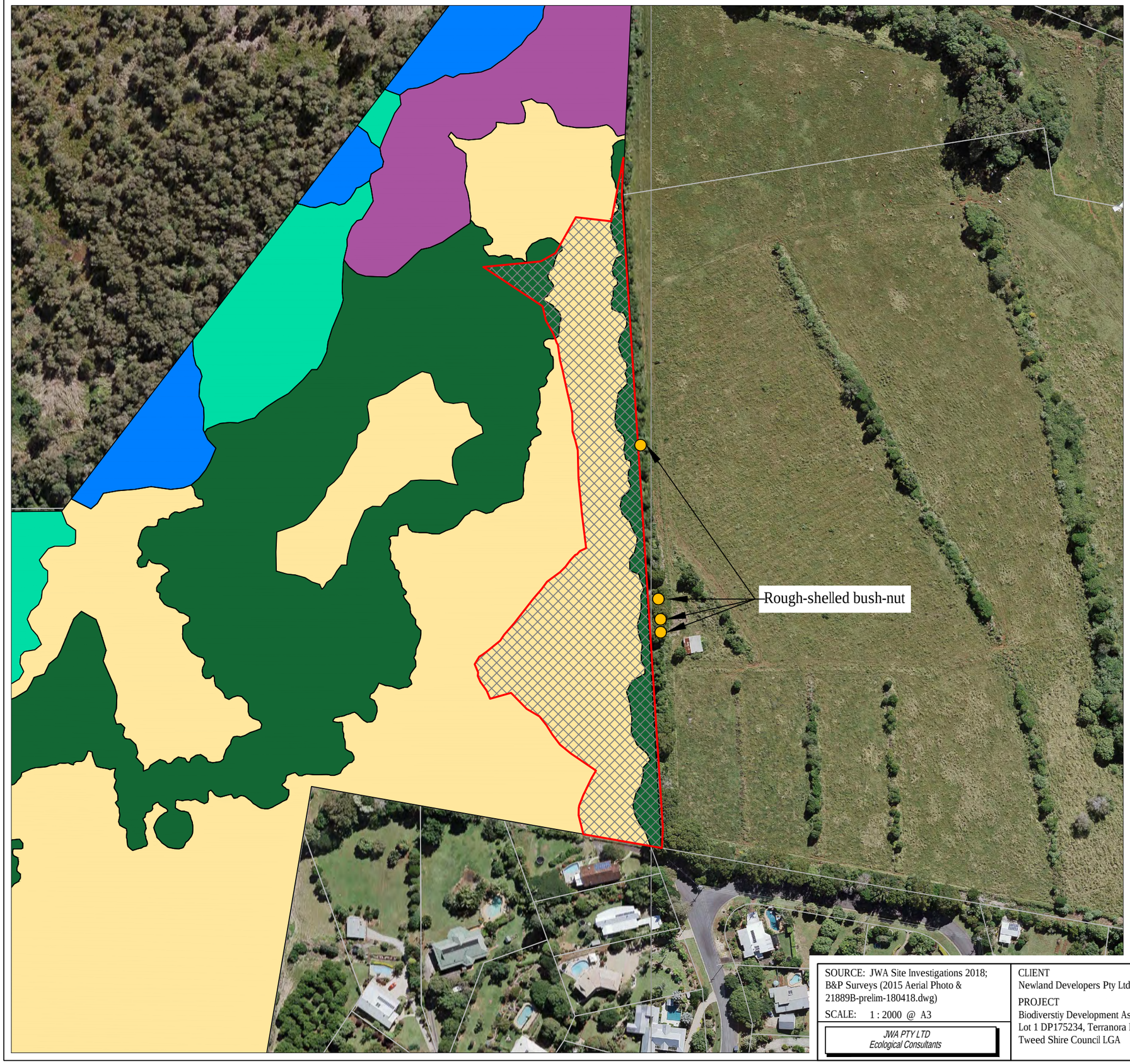
6.2 Direct Impacts on Native Vegetation/Habitat

The proposed development will result in the removal of approximately of 0.29 ha of highly degraded vegetation representing PCT 1302. Direct impacts on vegetation communities as a result of the proposed additional clearing are shown in FIGURE 10.

The direct impacts on PCT 1302 will reduce the vegetation integrity score over this area (0.29 ha) from 13.8 to 0.

6.3 Potential Indirect Impacts

The proposed development may contribute to potential indirect impacts on native vegetation and habitat beyond the subject site. A summary of indirect impacts is provided in TABLE 5, including a description of the nature, extent and duration of impacts, along with the threatened species, threatened ecological communities and habitats likely to be affected.



N

LEGEND

Impact Area

Subject Site

Threatened Flora Records

Rough-shelled bush-nut (*Macadamia tetraphylla*)

Vegetation Communities

Community 1 - Tall closed forest (*Cinnamomum camphora*)

Community 2 - Tall open / closed swamp sclerophyll forest (*Melaleuca quinquenervia*)

Community 3 - Tall open/closed swamp sclerophyll forest (*Archontophoenix cunninghamiana* / *Melaleuca quinqunervia*)

Community 4 - Tall open moist sclerophyll forest (*Lophostemon confertus* +/- *Corymbia intermedia*)

Community 5 - Substantially cleared land / pasture with scattered exotic regrowth

Scale 1:2000 - Lengths in metres

20 0 20 40 60 80 100

SOURCE: JWA Site Investigations 2018; B&P Surveys (2015 Aerial Photo & 21889B-prelim-180418.dwg)

SCALE: 1 : 2000 @ A3

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FIGURE 10

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TITLE

IMPACTS ON VEGETATION COMMUNITIES

TABLE 5
SUMMARY OF INDIRECT IMPACTS

Indirect impact	Likelihood of impact occurring	Extent and nature of impact	Timing and duration of impact	Threatened species and/or ecological communities and habitats affected
Inadvertent impacts on adjacent habitat or vegetation	Low	Accidental damage to vegetation outside the proposed limit of clearing, particularly contiguous vegetation to the west of the subject site	During vegetation clearing works and bulk earthworks	Highly degraded lowland rainforest vegetation representing sub-optimal potential habitat for threatened flora and fauna species
Reduced viability of adjacent habitat due to edge effects, noise, dust or light spill	Low	The viability of subject site and adjacent habitats is currently reduced due to high levels of disturbance, fragmentation of habitat and associated edge effects	The proposed works are unlikely to represent a significant increase to the duration of this impact	n/a
Transport of weeds and pathogens from the site to adjacent vegetation	Low	Subject site and adjacent habitats are currently heavily dominated by weed species. The proposed works would not represent an increase in the current potential for the spread of weeds and pathogens.	There is some potential for weed material to be transported during vegetation clearing works and bulk earthworks	Unlikely to be affected due to the current high degree of weed infestation
Increased risk of starvation, exposure and loss of shade or shelter	Low	Disturbance to small areas of degraded habitat on the subject site (i.e. vegetation, bush rock, logs and leaf litter) represents a minor reduction in shade and shelter sites. However, higher quality habitat will be retained in adjacent areas.	Permanent removal of some shade and shelter sites	Primarily ground-dwelling fauna that are able to occupy low condition, highly modified habitats

Indirect impact	Likelihood of impact occurring	Extent and nature of impact	Timing and duration of impact	Threatened species and/or ecological communities and habitats affected
Loss of breeding habitats	Unlikely	Potential breeding habitats are not considered to occur on the subject site due to high levels of disturbance and modification of habitat	n/a	n/a
Trampling of threatened flora species	Low	There is some potential for accidental trampling of threatened flora species occurring in offsite habitats associated with human access	Long-term following occupation of the subject site	Threatened flora seedlings potentially occurring within adjacent habitats
Inhibition of nitrogen fixation and increased soil salinity	Unlikely	The extent of this impact is expected to be negligible given the current levels of modification and disturbance	n/a	n/a
Fertiliser drift	Nil	Fertiliser spray is not proposed	n/a	n/a
Rubbish dumping	Moderate	There is some potential for rubbish dumping in habitats occurring on or immediately adjacent to future lots	Long-term following occupation of the subject site	Highly degraded lowland rainforest vegetation representing sub-optimal potential habitat for threatened flora and fauna species
Wood collection	Moderate	There is potential for wood collection for firewood from within habitats occurring on or immediately adjacent to future lots	Long-term following occupation of the subject site	Logs on the ground (particularly hollow logs) represent potential habitat for ground-dwelling threatened fauna species such as the common planigale (*Planigale maculata*)

Indirect impact	Likelihood of impact occurring	Extent and nature of impact	Timing and duration of impact	Threatened species and/or ecological communities and habitats affected
Bush rock removal and disturbance	High	Some areas containing bush rock will be disturbed as a result of the proposed earthworks. There is potential for bush rock removal and/or disturbance from within or adjacent to future lots	Short-term during the proposed works. Long-term following occupation of the subject site	Bush rock represents potential habitat for some ground-dwelling threatened fauna species such as the common planigale (*Planigale maculata*)
Increase in predatory species or pest animal populations	Low - Moderate	There is some potential for a minor increase in the number of domestic animals straying in adjacent habitats. Stray dogs and cats have the potential to prey on native fauna species and may contribute to an increase in feral populations.	Long-term following occupation of the subject site	Threatened fauna species at risk of predation such as the common planigale (*Planigale maculata*)
Increased risk of fire	Low	There is potential for a minor increase in the risk of fire spreading into adjacent bushland as a result of inappropriate and/or unauthorised fires on private land	Long-term following occupation of the subject site	Highly degraded lowland rainforest vegetation representing sub-optimal potential habitat for threatened flora and fauna species
Disturbance to specialist breeding and foraging habitat e.g. beach nesting for shorebirds	Nil	No specialist breeding or foraging habitat is considered to occur on or adjacent to the subject site	n/a	n/a
Alteration to drainage and hydrological regimes	High	It is likely that the proposed earthworks and future development of the subject site would result in minor alterations to the current drainage and hydrological regimes on the subject site and adjoining areas	Long-term following earthworks and installation of infrastructure	Highly degraded lowland rainforest vegetation representing sub-optimal potential habitat for threatened flora and fauna species

Indirect impact	Likelihood of impact occurring	Extent and nature of impact	Timing and duration of impact	Threatened species and/or ecological communities and habitats affected
Decline in water quality entering adjacent waterways e.g. sediment load, pH, influx of pollutants, nutrient loading	Low	There is some potential for a minor reduction in the quality of water leaving the subject site and entering adjacent waterways (e.g. sedimentation associated with earthworks and nutrients/pollutants associated with future lots)	Short-term during the proposed works. Long-term following occupation of the subject site	Threatened flora, fauna and ecological communities associated with waterways occurring downstream of the subject land

6.4 Prescribed Biodiversity Impacts

6.4.1 Background

In accordance with Clause 6.1 of the BC Regulation:

1) The impacts on biodiversity values of the following actions are prescribed (subject to subclause (2)) as biodiversity impacts to be assessed under the biodiversity offsets scheme:
    a. the impacts of development on the following habitat of threatened species or ecological communities:
        i. karst, caves, crevices, cliffs and other geological features of significance,
        ii. rocks,
        iii. human made structures,
        iv. non-native vegetation,
    b. the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,
    c. the impacts of development on movement of threatened species that maintains their lifecycle,
    d. the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),
    e. the impacts of wind turbine strikes on protected animals,
    f. the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.
2) The additional biodiversity impacts prescribed by this clause:
    a. are prescribed for the purposes of assessment and biodiversity assessment reports under the Act, but are not additional biodiversity impacts for the purposes of calculating the number and class of biodiversity credits that are required under a biodiversity assessment report to be retired to offset the residual impact on biodiversity values of proposed development, proposed clearing of native vegetation or proposed biodiversity certification of land, and
    b. may be taken into account in the determination of the biodiversity credits required to be retired (or other conservation measures required to be taken) under a planning approval or vegetation clearing approval or under a biodiversity certification of land.

6.4.2 Applicability to the Assessment Area

6.4.2.1 Habitat of Threatened Species or Ecological Communities

The assessment area contains basalt rocks and boulders, particularly in the western portion of the subject site associated with PCT 1302. Rocky areas of the site are considered to represent marginal potential habitat for the common planigale (*Planigale maculata*). The removal of rocks and other ground cover from the subject site would represent a long-term impact to shelter and refuge sites for this species if it occurs onsite. However, the local and bioregional persistence of this or any other threatened species (with potential to use these areas as habitat) is unlikely to be significantly affected with consideration of the following:

- Small scale and extent of impact to this habitat feature;
- High degree of modification and disturbance levels within existing habitat;
- Sub-optimal nature of existing habitats on and adjacent to the subject site;
- Relative abundance of comparable habitats in the immediate locality; and
- Retention of habitat features, including the relocation/placement of rocks and other ground cover (e.g. logs, stumps and fallen timber) in conservation areas/retained vegetation.

6.4.2.2 Connectivity

The proposed development will occur on an area that is predominantly cleared and/or highly disturbed. The development is therefore not considered to result in any additional impacts on connectivity between habitat areas.

6.4.2.3 Movement of Threatened Species that Maintains their Lifecycle

As discussed above, the proposed development will occur on an area that is predominantly cleared and/or highly disturbed. The development is therefore not considered to result in any additional impacts on the movements of threatened species that maintains their lifecycles.

6.4.2.4 Water Quality, Water Bodies and Hydrological Processes that Sustain Threatened Species and Threatened Ecological Communities

Although there are likely to be some minor alterations to the existing hydrology of the subject site, it is considered unlikely that the small-scale of proposed additional clearing would impact on water quality, water bodies and/or hydrological processes that sustain threatened species and threatened ecological communities.

6.4.2.5 Impacts of Wind Turbine Strikes

Not applicable to the proposed development.

6.4.2.6 Impacts of Vehicle Strikes

It is considered unlikely that the small-scale of proposed additional clearing would increase the impact of vehicle strikes in the short-term. Future development and occupation of the subject site and adjacent areas (as part of the Altitude Aspire project) may contribute to an increase in the risk of vehicle strikes, particularly in areas where roads are proposed in close proximity to habitat edges.

6.5 Potential Serious and Irreversible Impacts

6.5.1 Background

Serious and irreversible impacts (SAII) are those impacts that:

- Will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline; or
- Will further reduce the population of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size; or
- Are impacts on the habitat of a species or area of ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution; or
- Are impacts on a species or ecological community is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

It is the role of the decision-maker to determine whether or not any of the residual impacts of a proposed development, activity, biodiversity certification or vegetation clearing on biodiversity values (that is, the impacts that would remain after any proposed avoid or mitigate measures have been taken) are serious and irreversible

To assist a decision-maker with this task, the BC Act (and the BCR) provides a framework to make this determination. The framework consists of a series of principles defined in the BC Regulation and supporting guidance, provided for under section 6.5 of the BC Act, to interpret these principles.

6.5.2 Applicability to the Assessment Area

Step 1: Identify Relevant Potential Entities

No SAII entities, as listed within *Appendix 2: List of potential species (and their habitat) that meet the SAII principles and criteria* within *Guidance to assist a decision-maker to determine a serious and irreversible impact* (the guide), occur on the subject site.

Step 2: Evaluate Nature of Impact on a Potential Entity

N/A.

Step 3: Determine if the Impacts Exceed the Threshold

N/A.

Step 4: Evaluate a Serious and Irreversible Impact

N/A.

Step 5: Decision-making

Where the decision-maker is of the opinion that a proposal is likely to have a serious and irreversible impact on biodiversity values, the BC Act and the LLS Act sets out the following requirements in relation to any approval or consent of the proposal (TABLE 6).

TABLE 6
ROLE OF THE DECISION MAKER FOR DIFFERENT TYPES OF DEVELOPMENT PROPOSALS

Type of proposal	Role of the decision maker
Application for development consent under Part 4 of the Environmental Planning & Assessment Act 1979 (EP&A Act) (other than an application for state significant development or an application for a complying development certificate) See section 7.16(2) of the BC Act	Required to refuse to grant development consent
Application for development consent for state significant development or for approval for state significant infrastructure under the EP&A Act See section 7.16(3) of the BC Act	Required to: • take likely SAII into consideration, and • determine if there are any additional and appropriate measures that will minimise the impact if consent or approval is granted
Part 5 activity (where the proponent has elected to obtain a biodiversity assessment report under Division 2 of the BC Act) See section 7.16(4) of the BC Act	Required to: • take likely SAII into consideration, and • determine if there are any additional and appropriate measures that will minimise the impact if the activity is to be carried out or approved
Biodiversity certification of land See section 8.8(2) of the BC Act	Required to: • take likely SAII into consideration in determining the application, and • determine if there are any additional and appropriate measures that will minimise the impacts

Type of proposal	Role of the decision maker
Approval for clearing native vegetation under section 60ZF of the LLS Act	Required to refuse to grant approval
Approval for clearing native vegetation under clause 14 of the State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017	Required to refuse to grant approval

6.6 Impacts Requiring an Offset

6.6.1 Ecosystem Credits

Impacts to the degraded area of PCT 1302 are not required to be offset as the vegetation integrity score is below those set out in Paragraph 10.3.1.1 of the BAM. Refer to the BAM Biodiversity Credit Report (APPENDIX 2) for further details.

6.6.2 Threatened Species

Impacts on the following threatened species will require offsets:

- Rough-shelled bush-nut (*Macadamia tetraphylla*)
- Slender Marsdenia (*Marsdenia longiloba*)
- Common Planigale (*Planigale maculata*)

Refer to the BAM Biodiversity Credit Report (APPENDIX 2) for further details.

7 BIODIVERSITY CREDIT REPORT

7.1 Ecosystem Credits

No ecosystem credits will be required to offset impacts of the proposed development on a highly degraded area of PCT 1302.

Refer to the BAM Biodiversity Credit Report (APPENDIX 2) for further details.

7.2 Species Credits

Threatened species requiring offset and the number of species credits required are provided below in TABLE 8. Refer to the BAM Biodiversity Credit Report (APPENDIX 2) for further details.

TABLE 8
SPECIES CREDIT SUMMARY

Species	Credits required
Rough-shelled bush-nut (*Macadamia tetraphylla*)	8
Slender marsdenia (*Marsdenia longiloba*)	2
Common planigale (*Planigale maculata*)	2

APPENDIX 1 - PLOT SURVEY DATA

Vegetation composition and structure data assessed within 20m x 20m plot

Plot No: 1			PCT: 1302		Total number of native species: 13		
Scientific name	Common name	Dominant species for each growth form (x)	Stratum/layer in which species occurs	Native (N), exotic (E) or high threat exotic (HTE)	Percentage foliage projective cover (%)	Abundance rating for species with cover <5% (stem count)	Notes (e.g. regen stems for trees present within veg zone)
Tree (TG)				Total number of native trees: 6			
Cinnamomum camphora	Camphor laurel	x	All	HTE	72		Dominant and regenerating
Mallotus philippensis	Red kamala	x	All	N	28		
Jagera pseudorhus	Foambark		Ground	N		6	Regenerating stems
Guioa semiglauca	Guioa		Midstorey	N		1	
Macaranga tanarius	Macaranga		Midstorey	N		3	
Schefflera actinophylla	Umbrella tree		Midstorey	HTE		1	
Acacia melanoxylon	Blackwood wattle		Canopy/ground	N		2	
Schinus terebinthifolius	Broad-leaved pepper tree		Ground	HTE		1	
Shrub (SG)				Total number of native shrubs: 1			
Ochna serrulata	Mickey mouse plant	x	Midstorey/ground	HTE	65		
Lantana camara	Lantana		Midstorey	HTE	5		
Solanum mauritianum	Wild tobacco		Midstorey	E		5	
Citrus x taitensis	Rough lemon		Midstorey	E		3	
Maclura cochinchinensis	Cockspur thorn		Midstorey	N		2	
Psidium guajava	Common guava		Midstorey	E		1	
Solanum chrysotrichum	Giant devil's fig		Midstorey	E		4	
Grass and grass like (GG)				Total number of native grasses and grasslike: 1			
Paspalum mandiocanum	Broadleaf paspalum	x	Ground	HTE	15		
Pennisetum purpureum	Elephant grass		Ground	E	2		

Oplismenus imbecillis	Creeping beard grass		Ground	N		3	
Forb (FG)				Total number of native forbs: 0			
Cestrum nocturnum	Lady-of-the-night	x	Ground	E	12		
Sida rhombifolia	Paddy's lucerne		Ground	E		1	
Triumfetta rhomboidea	Chinese burr	x	Ground	E	8		
Ambrosia artemisiifolia	Annual ragweed		Ground	E		15	
Oxalis sp.			Ground	E		4	
Gomphocarpus physocarpus	Balloon cotton bush		Ground	E		5	
Malvastrum americanum	Spiked malvastrum		Ground	E		8	
Fern (EG)				Total number of native ferns: 2			
Adiantum hispidulum	Rough maidenhair fern		Ground	N		2	
Cyclosorus interruptus		x	Ground	N		4	
Other (OG)				Total number of native other: 3			
Asparagus plumosus	Asparagus fern	x	Ground/midstorey	HTE	33		
Archontophoenix cunninghamiana	Bangalow palm		Midstorey	N		1	Palm and palm-like growth form
Vigna luteola	Dalrymple vigna		Ground	N		1	
Stephania japonica	Snake vine		Ground	N		1	
Passiflora subpeltata	White passionflower		Ground	E		1	

Vegetation function attributes assessed within 50m x 20m plot

Number of large trees	Tree regeneration (Y/N)	Tree stem size diversity DBH (cm) <5, 5-9, 10-19, 20-29, 30-49, 50-79, 80+ (presence/absence)	Total length of fallen logs >10cm diameter	Litter cover (5x1m^2 subplots along 50m transect) average percentage ground cover	High Threat Exotic vegetation cover (%)	Number of trees with hollows
0	Yes	All classes under 50cm	40m	91.6	90	0

APPENDIX 2 - BAM BIODIVERSITY CREDIT REPORT



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00012271/BAAS18029/18/00012272

Proposal Name
Altitude Aspire

BAM data last updated *
24/02/2018

Assessor Name
Matt Jenkins

Assessor Number
BAAS18029

BAM Data version *
3

Proponent Names

Report Created
31/10/2018

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Candidate Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

BAM Biodiversity Credit Report (Like for like)

No Changes

Ecosystem Credit Summary

PCT	TEC	Area	Credits
1302-White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion	Not a TEC	0.3	0.00

Credit classes for 1302

Like-for-like options

Any PCT in the below Class	And in any of below trading groups	Containing HBT	In the below IBRA subregions
Subtropical Rainforests (including PCT's 670, 845, 1068, 1201, 1302)	Subtropical Rainforests - ≥ 70% - <90% cleared group (including Tier 4 or higher).	No	Burringbar-Conondale Ranges,Scenic Rim and Sunshine Coast-Gold Coast Lowlands. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Macadamia tetraphylla / Rough-shelled Bush Nut	4.0	8.00

Marsdenia longiloba / Slender Marsdenia	0.3	2.00
Planigale maculata / Common Planigale	0.3	2.00

Macadamia tetraphylla/ Rough-shelled Bush Nut	1302_Classname1	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Macadamia tetraphylla/Rough-shelled Bush Nut	Any in NSW
Marsdenia longiloba/ Slender Marsdenia	1302_Classname1	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Marsdenia longiloba/Slender Marsdenia	Any in NSW
Planigale maculata/ Common Planigale	1302_Classname1	**Like-for-like options**	
		Only the below Spp	In the below IBRA subregions
		Planigale maculata/Common Planigale	Any in NSW

Planigale maculata/ Common Planigale	1302_Classname1

Attachment 4 – Offsets Payment Calculator

Biodiversity Offset Payment Calculator

Version: 1.3.4.0
Last updated: 09/11/2018 1

() Credit Offset Payment Calculator () Payments ()

Message!

If you would like to meet your offset obligation by making a payment to the Biodiversity Conservation Fund, please contact the BCT team at **bct@environment.nsw.gov.au (mailto:bct@environment.nsw.gov.au)**

Species credits for threatened species

Species profile ID	Species	Threat Status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10499	***Macadamia tetraphylla*** (Rough-shelled Bush Nut)	Vulnerable	$816.33	24.8700%	$20.00	8	$8,314.81
10635	***Planigale maculata*** (Common Planigale)	Vulnerable	$486.10	24.8700%	$20.00	2	$1,253.99
10507	***Marsdenia longiloba*** (Slender Marsdenia)	Endangered	$1,632.65	24.8700%	$20.00	2	$4,117.38
						Subtotal (excl. GST)	**$13,686.18**
						GST	**$1,368.62**
						Total species credits (incl. GST)	**$15,054.80**

Calculated as on: **10-12-2018 12:33:05** **Grand total** **$15,054.80**

ANNEXURE H



ALTITUDE ASPIRE WESTERN EARTHWORKS: ABORIGINAL CULTURAL HERITAGE REPORT

PREPARED FOR NEWLANDS DEVELOPERS PTY LTD

EVERICK HERITAGE CONSULTANTS

NOVEMBER 2018

Report Reference:
Hill, T., A. Piper & R. Mazlin 2018 *Altitude Aspire Bulk Earthworks, Terranora: Aboriginal Cultural Heritage Assessment* (November 2018). Everick Heritage Consultants Pty Ltd. Unpublished report prepared for Newland Developers Pty Ltd, Robina.

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EXECUTIVE SUMMARY

The following report details an Aboriginal Cultural Heritage Assessment ('ACHA') for the Application to modify the approved 'Altitude Aspire' residential subdivision at Parkes Lane Terranora NSW. The modification will provide for the extension of the bulk earthworks onto the adjacent lands, being Lot 1 DP175234 located at 93 Parkes Lane Terranora (the 'Project Area', Figure 1). The Altitude Aspire project was previously assessed (Everick 2012) for the Altitude Aspire residential subdivision covering Lot 229 DP1237760 located at 37 Fraser Dive Terranora. The intent of this ACHA is to supplement the previous assessment (Everick 2012) by assessing the potential for the proposed 'bulk earthworks modification' to impact on Aboriginal heritage values.

Everick Heritage Consultants (the 'Consultant') was commissioned by Newlands Developers Pty Ltd (the 'Proponent') to undertake an ACHA in response to advice from the Office of Environment and Heritage ('OEH') requiring additional assessment of the lands subject to bulk earthworks but not included in the original ACHA (Everick 2010). The assessment will also consider potential impacts to locally significant heritage items should they exist with the Project Area.

The methods used for this assessment are in compliance with the Office of Environment and Heritage ('OEH') Code *of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (2010) and all relevant legislation as described in Section 2 of this Report. The following report complies with the accepted methodology for undertaking a *Cultural Heritage Assessment* under the *National Parks and Wildlife Act 1974* ('NPW Act'). The methods employed in this assessment included:

a) a search of relevant heritage registers and regional heritage literature;

b) a review of relevant environmental data and previous land uses for the Project Area;

c) application of the Due Diligence Code criteria to identify cultural sites and places warranting further investigation;

d) assessment of the archaeological and cultural heritage significance of Aboriginal sites; and

e) report on findings and recommended management strategies.

The proposed bulk earthworks include cut and fill excavations of a ridge crest and upper slope along the western margin of the Project Area (Figure 1 and Figure 2). Fill material will be utilised elsewhere within the Altitude residential development.

A preliminary site inspection was undertaken by Everick Senior Archaeologist Adrian Piper on 12 June 2018 to consider the potential for the Project Area to contain sites and to confirm the nature and extent of disturbance across the Project Area.

The Project Area is within the area administered for Aboriginal cultural heritage purposes by the Tweed Byron Local Aboriginal Land Council ('TBLALC'). It is noted that the assessment for the Altitude Aspire residential development was subject to a survey by Tweed Byron LALC which would have included the ridge crest and upper slope immediately adjacent to the current study (Everick 2012). This survey did not identify any culturally sensitive areas in the immediate vicinity of the Project Area (see Appendix 1 below). A site inspection with Mr Warren Phillips and Maurice Gannon From Tweed Byron LALC was undertaken on Wednesday 20 June. The outcomes of this site inspection where that they considered there to be no additional requirement for archaeological investigation on the grounds of previous disturbance.

The field inspection located no Aboriginal sites within the Project Area. Overall the survey was constrained by improved pastures and regrowth bush. The survey confirmed the analysis of the historic aerial photography that the ridge crest and upper slopes have been subject to moderate to intensive disturbance as a result of cropping. Whilst Aboriginal sites are known to occur on ridge crests in the Tweed River valley, the ridge crest which comprises the Project Area is moderate to steep and relatively narrow in nature. As such, irrespective of disturbance, it is unlikely that archaeological sites, should they have existed on the ridge, would have remained in situ during the repeated phases of forest clearing that occurred across the Terranora Hills in the historic period. Further, the soils are typical of the red podzols of the Northern Rivers which are associated with rainforest and wet forests. Aboriginal sites are typically rare on these soil formations in part due to the nature of the pre-contact vegetation. Specifically, organic materials within the podzolic soils are vulnerable to decomposition as the clay content and acidity are not conducive to the preservation of sites in high rainfall areas.

There were no items of historic heritage found during the site inspection. Further, the Project Area is not known to be associated with any particular people or events which made a significant contribution to the local area. The residential and agricultural dwellings are not unique examples of regional architecture.

The Consultant is of the opinion that the proposed bulk earthworks are unlikely impact on Aboriginal cultural heritage. The following recommendations are provided.

Recommendation 1: Additional Research and Consultation

Having consideration for the nature and extent of the proposed works, the absence of Aboriginal sites identified by the field study and the extent of existing disturbance across the Project Area it is considered unlikely that additional investigations or consultation in relation to the Project Area will identify Aboriginal sites. As such, it is not considered that additional archaeological investigations or Aboriginal community consultation is required prior to determination of the Development Application. However, as a cautionary measure it is recommended that the findings of this assessment are provided to certain members of the community known to be actively engaged in heritage management in the region, namely the McDonald Family and Minjungbal Aboriginal Cultural Centre.

Recommendation 2: Cultural Heritage Induction

It is recommended that a cultural heritage induction is provided to all staff involved with initial groundworks involving the removal of topsoil. The purpose of the cultural heritage induction is to:

- make staff aware of the survey effort to date and potential for the Project Area to contain Aboriginal sites;
- provide sufficient training for staff to identify Aboriginal objects should they be impacted during construction works; and
- ensure that staff are aware of response procedures in the event of any harm to Aboriginal sites during construction works.

It is recommended that the cultural heritage induction is provided by a suitably experienced member of the Aboriginal community or a qualified archaeologist.

Recommendation 3: Aboriginal Objects Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered as a result of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material;

d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010); and

e) should the works be deemed to have harmed the Aboriginal objects the OEH should be notified immediately via the EPA Enviro Hotline.

Recommendation 4: Aboriginal Human Remains

Although it is unlikely that Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station (Tweed Heads), the Tweed Byron LALC and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the OEH should be consulted as to how

the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 5: Notifying the OEH

It is recommended that if Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites on the AHIMS, managed by the OEH. It is also recommended that the OEH Northeast Planning Unit is notified in the event that any unexpected finds are encountered. Any management outcomes for the site will be included in the information provided to the AHIMS.

Recommendation 6: Conservation Principles

It is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values at all stages during the development works. If impacts are unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal community.

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DEFINITIONS

The following definitions apply to the terms used in this report:

Aboriginal Object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal Place means any place declared to be an Aboriginal Place (under s.84 of the NPW Act) by the Minister administering the NPW Act, by order published in the NSW Government Gazette, because the Minister is of the opinion that the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal objects.

ACHCR Guidelines means the OEH *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010).

Archaeological Code of Practice means the OEH *Code of Practice for Archaeological Conduct in New South Wales* (2010).

COPAI means Code *of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.*

Due Diligence Code means the OEH *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (2010).

NPW Act means the *National Parks and Wildlife Act 1974* (NSW).

NPW Regulations means the *National Parks and Wildlife Regulations 2009* (NSW).

OEH means the New South Wales Office of Environment and Heritage.

Project Area means the land subject to this assessment being parts of Lot 1 DP175234 located at 93 Parkes Lane Terranora NSW.

Proposed Works means all activities associated with the bulk earthworks for the Altitude Aspire residential development within the Project Area.

Proponent means Newlands Developers Pty Ltd of Robins TC QLD 4230 and all employees and contractors of the Proponent.

The Project means the bulk earthworks for the Altitude Aspire residential dwelling development located at 93 Parkes Lane Terranora, NSW.

The Consultant means qualified archaeological staff and/or contractors of Everick Heritage Consultants Pty Ltd.

1. INTRODUCTION

1.1 Purpose of the Assessment

The following report details an Aboriginal Cultural Heritage Assessment ('ACHA') for the Application to modify the approved 'Altitude Aspire' residential subdivision at Parkes Lane Terranora NSW. The modification will provide for the extension of the bulk earthworks onto the adjacent lands, being Lot 1 DP175234 located at 93 Parkes Lane Terranora (the 'Project Area', Figure 1). The Altitude Aspire project was previously assessed (Everick 2012) for the Altitude Aspire residential subdivision covering Lot 229 DP1237760 located at 37 Fraser Dive Terranora. The intent of this ACHA is to supplement the previous assessment (Everick 2012) by assessing the potential for the proposed 'bulk earthworks modification' to impact on Aboriginal heritage values.

1.2 Proponent & Project Brief

Everick Heritage Consultants (the 'Consultant') was commissioned by Newlands Developers Pty Ltd (the 'Proponent') to undertake an ACHA in response to advice from the Office of Environment and Heritage ('OEH') requiring additional assessment of the lands subject to bulk earthworks but not included in the original ACHA (Everick 2010). The assessment will also consider potential impacts to locally significant heritage items should they existing with the Project Area.

The methods used for this assessment are in compliance with the Office of Environment and Heritage ('OEH') Code *of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (2010) and all relevant legislation as described in Section 2 of this Report. The following report complies with the accepted methodology for undertaking a *Cultural Heritage Assessment* under the *National Parks and Wildlife Act 1974* ('NPW Act'). The methods employed in this assessment included:

a) a search of relevant heritage registers and regional heritage literature;

b) a review of relevant environmental data and previous land uses for the Project Area;

c) application of the Due Diligence Code criteria to identify cultural sites and places warranting further investigation;

d) assessment of the archaeological and cultural heritage significance of Aboriginal sites; and

e) report on findings and recommended management strategies.

1.3 Description of the Project

The proposed bulk earthworks include cut and fill excavations of upper slope and a portion of ridge crest along the western margin of the Project Area immediately adjacent to the approved Altitude Aspire residential subdivision (Figure 1 and Figure 2). Fill material will be utilised elsewhere within the Altitude Aspire residential development.

1.4 Report Authorship

The desktop study was undertaken by Senior Archaeologists Tim Hill and Adrian Piper and Archaeologist Robert Mazlin. The site inspection was undertaken by Adrian Piper. Aboriginal Community Consultation was conducted by Adrian Piper. This report was written by Tim Hill, Adrian Piper and Robert Mazlin.

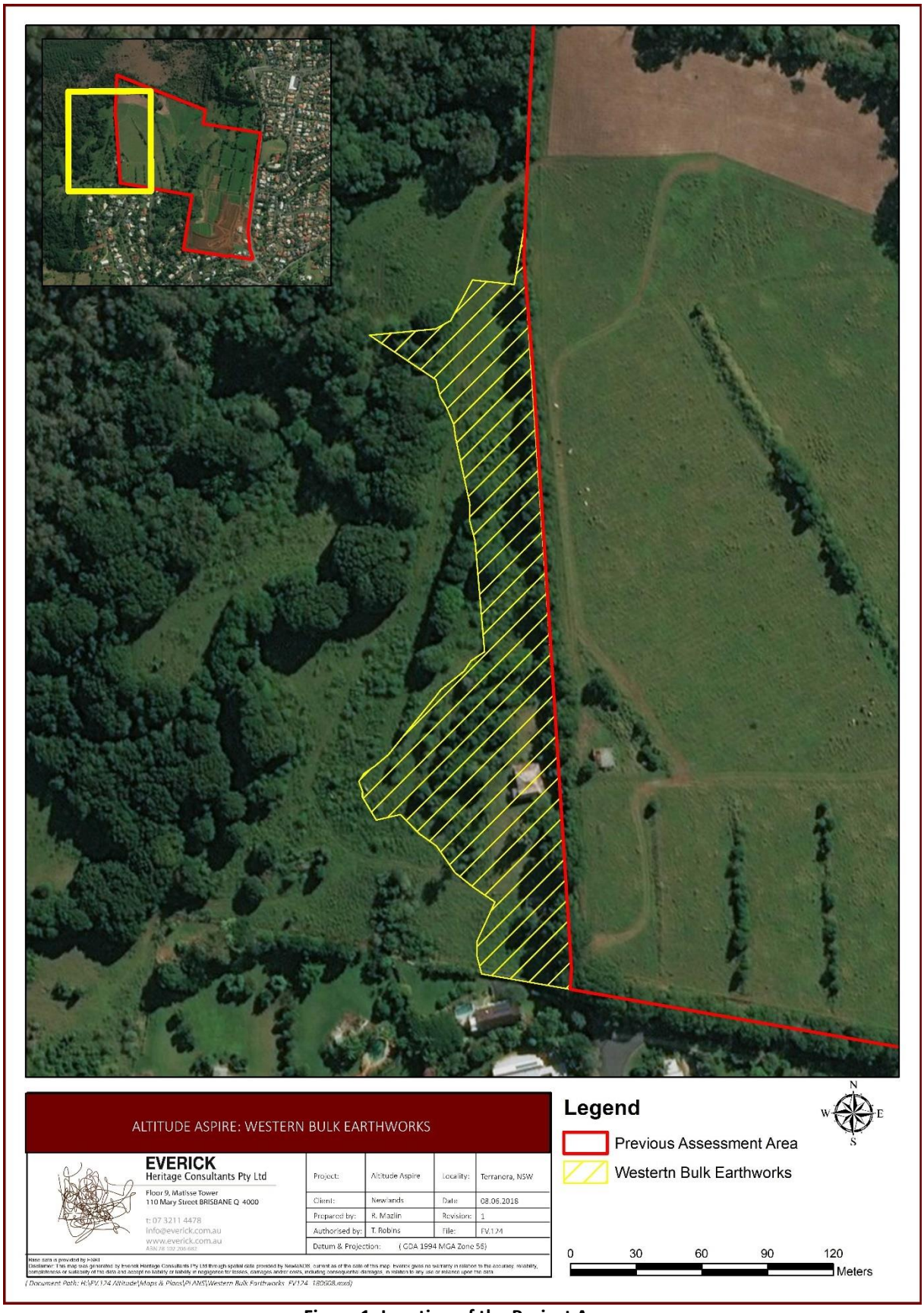


Figure 1: Location of the Project Area.

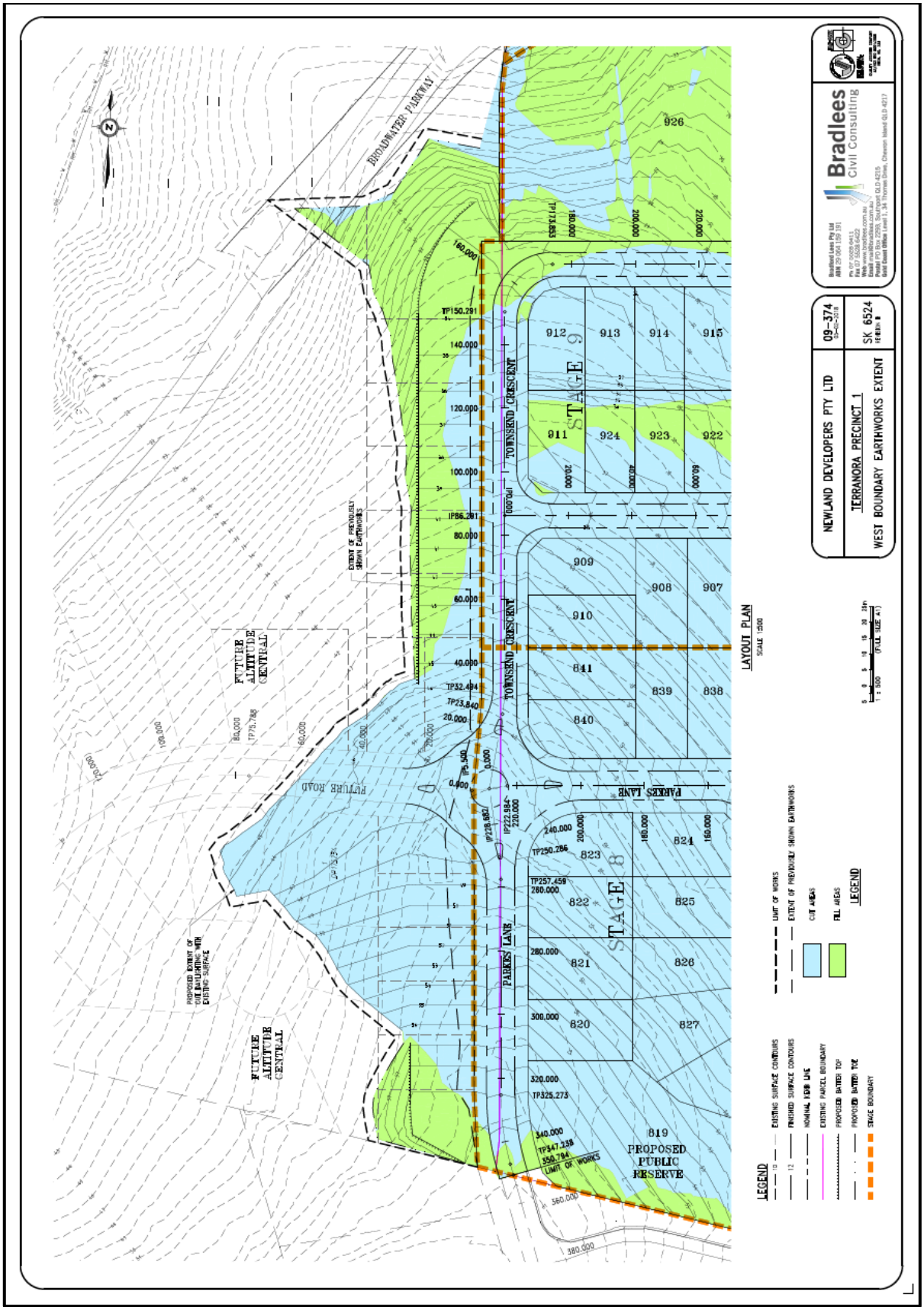


Figure 2: Bulk earthworks detail.

2. LEGISLATIVE AND PLANNING CONTEXT

The primary State legislation concerning cultural heritage in New South Wales is the *NPW Act 1974 (NSW),* the Tweed Shire Council Local Environment Plan 2014 ('LEP') and Development Control Plans ('DCP'). The Commonwealth also has a role in the protection of nationally significant cultural heritage through the *Environmental Protection and Biodiversity Conservation Act 1999* (Cth), *The Protection of Movable Cultural Heritage Act 1986* (Cth) and the *Historic Shipwrecks Act 1976* (Cth).

For the purposes of this assessment the State and local legislation are most relevant. The consent authorities will be the Tweed Shire Council ('TSC') and, where a referral agency is required, the OEH. Approval from the OEH will also be required should the Project impact on identified Aboriginal Objects. The information below lists the legislative and policy framework within which this assessment is set.

2.1 The National Parks and Wildlife Act 1974 (NSW)

The *National Parks and Wildlife Act 1974* (NSW) (NPW Act) is the primary legislation concerning the identification and protection of Aboriginal cultural heritage. It provides for the management of both Aboriginal Objects and Aboriginal Places. Under the NPW Act, an Aboriginal Object is any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area, regardless of whether the evidence of habitation occurred before or after non-Aboriginal settlement of the land. This means that every Aboriginal Object, regardless of its size or seeming isolation from other Objects, is protected under the Act.

An Aboriginal Place is an area of particular significance to Aboriginal people which has been *declared* an Aboriginal Place by the Minister. The drafting of this legislation reflects the traditional focus on Objects, rather than on Area of significance such as story places and ceremonial grounds. However, a gradual shift in cultural heritage management practices is occurring towards recognising the value of identifying the significance of Area to Indigenous peoples beyond their physical attributes.

With the introduction of the *National Parks and Wildlife Amendment Act 2010* (NSW) the former offence provisions under Section 86 of 'disturbing', 'moving', 'removing' or 'taking possession' of Aboriginal Objects or Places have been replaced by the new offence of 'harming or desecrating'. The definition of 'harm' is 'destroying, defacing or damaging an Object'. Importantly, in the context of the management recommendations in this assessment, harm to an Object that is 'trivial or negligible' will not constitute an offence.

The new amendments also significantly strengthen the penalty provisions. The issue of intent to harm Aboriginal cultural heritage has been formally addressed by separating it from inadvertent harm. The penalty for individuals

who inadvertently harm Aboriginal Objects has been set at up to $55,000, while for corporations it is $220,000. Also introduced is the concept of '*circumstances of aggravation*' which allows for harsher penalties (up to $110,000) for individuals who inadvertently harm Aboriginal heritage in the course of undertaking a commercial activity or have a record for committing similar offences. For those who knowingly harm Aboriginal cultural heritage, the penalty will rise substantially. The maximum penalty will be set at $275,000 or one year imprisonment for individuals, while for corporations it will rise to $1,100,000.

Where a land user has or is likely to undertake activities that will harm Aboriginal Objects, the Director General (OEH) has a range of enforcement powers, including stop work orders, interim protection orders and remediation orders. The amended regulations also allow for a number of penalties in support of these provisions. The NPW Act also now includes a range of defense provisions for unintentionally harming Aboriginal Objects:

a) Undertaking activities that are prescribed as 'Low Impact'.

b) Acting in accordance with the new *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (2010).

c) Using a consulting archaeologist who correctly applies the OEH *Code of Practice for Archaeological Conduct in New South Wales* (2010) ('Archaeological Code of Practice').

d) Acting in accordance with an *Aboriginal Heritage Impact Permit* ('AHIP').

The new regulations allow for a range of low impact activities to be undertaken without the need to consult the OEH or a consulting archaeologist. Generally, those who undertake activities of this nature will not be committing an offence, even if they inadvertently harm Aboriginal Objects. These activities include:

a) Maintenance – For example on existing roads and tracks, or on existing utilities such as underground power cables and sewage lines.

b) Farming and Land Management – for land previously disturbed by activities such as cropping, grazing, bores, fencing, erosions control etc. *

c) Removal of dead or dying vegetation - only if there is minimal ground disturbance.

d) Environmental rehabilitation – weed removal, bush regeneration.

e) Development in accordance with a Development Certificate issued under the EPA Act 1979 (provided the land is previously disturbed). *

f) Downhole logging, sampling and coring using hand held equipment.

g) Geochemical surveying, seismic surveying, costeaning or drilling. *

* This defense is only available where the land has been disturbed by previous activity. Disturbance is defined as a clear and observable change to the land's surface, including but not limited to land disturbed by the following: soil ploughing; urban development; rural infrastructure (such as dams and fences); roads, trails and walking tracks; pipelines, transmission lines; and storm water drainage and other similar infrastructure.

2.2 Due Diligence Code of Practice for the Protection of Aboriginal Objects 2010

The Due Diligence Code operates by posing a series of questions for land users before they commence development. These questions are based around assessing previous ground disturbance. An activity will generally be unlikely to harm Aboriginal Objects where it:

a) will cause no additional ground disturbance; or

b) is in a developed area; or

c) in a significantly disturbed area.

Where these criteria are not fulfilled, further assessment for Aboriginal cultural heritage will typically be required prior to commencing the activity.

2.3 The ACHCRP (2010)

The *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (2010) ('ACHCRP') provides an acceptable framework for conducting Aboriginal community consultation in preparation for impacts to Aboriginal cultural heritage. Proponents are required to follow them where a Project is likely to impact on cultural heritage and where required by Council. It is recommended by the OEH that all cultural heritage assessments involve this level of consultation, although it is not strictly a requirement unless it meets the above criteria.

The ACHCRP Guidelines typically take a minimum of 90 days to complete. The Guidelines require public notice of the assessment, preparation of a proposed methodology, undertaking site meetings and excavations where required, the production of a draft report, which is distributed to the registered Aboriginal groups and the production of a final report.

Although not strictly required, a thorough consultation process will treat the ACHCRP Guidelines as a minimum standard of community consultation. Generally, consultants must go to further effort to identify the significance of a given site to the Aboriginal community. This will likely include undertaking additional site inspections if requested by Aboriginal stakeholders, fully resourcing the community by providing copies of past archaeological

and environmental assessments in the region and meeting with community members to seek their opinions of the site.

2.4 The Tweed Local Environmental Plan 2014

The Tweed Shire LEP 2014 provides statutory protection for items already listed as being of heritage significance (Schedule 5), that is items that fall under the ambit of the *Heritage Act 1977* (NSW) and Aboriginal Objects under the *National Parks and Wildlife Act 1974* (NSW). It aims to ensure best practice components of the heritage decision making process are followed.

For listed heritage items, or building, work, relic or tree and heritage conservation Area, the following action can only be carried out with the consent of the TSC:

a) demolishing or moving a heritage item or a building, work, relic or tree within a heritage conservation area;

b) altering a heritage item or a building, work, relic, tree or place within a heritage conservation area, including (in the case of a building) making changes to the detail, fabric, finish or appearance of its exterior;

c) altering a heritage item that is a building by making structural changes to its interior;

d) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed;

e) disturbing or excavating a heritage conservation area that is a place of Aboriginal heritage significance;

f) erecting a building on land on which a heritage item is located or that is within a heritage conservation area; and

g) subdividing land on which a heritage item is located or that is within a heritage conservation area.

In addition, Council may not grant development consent without considering the effect the proposed development will have on the heritage significance of a heritage item or heritage conservation area concerned.

In regards to Aboriginal heritage significance (Part 5.10.8) the consent authority must, before granting consent under this clause to the carrying out of development in a place of Aboriginal heritage significance:

a) consider the effect of the proposed development on the heritage significance of the place and any Aboriginal object known or reasonably likely to be located at the place, and

b) notify the local Aboriginal communities (in such way as it thinks appropriate) about the application and take into consideration any response received within 28 days after the notice is sent.

2.5 The NSW Heritage Manual

The NSW Heritage Manual lists an 8-step process that is generally considered a best practice guide to assessing significant items. The process steps are:

- Summarise what is known about the item.
- Describe the previous and current uses of the item and the associations it may have to individuals or groups and its meaning for those people.
- Assess the significance using the NSW heritage criteria.
- Check if a sound analysis of the item's heritage significance can be made.
- Determine the item's level of significance.
- Prepare a succinct statement of heritage significance.
- Get feedback.
- Write up the information.

Contrary to common belief, a significant heritage item need not be particularly 'old' (the exception to the rule being the definition of an Archaeological Relic discussed above). Rather, the focus is on identifying what aspects of a particular item may be significant.

The NSW Heritage Manual contains a set of 7 assessment criteria that act as a guide to assessing significance. They are:

- **Criterion (a):** An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);
- **Criterion (b):** An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);
- **Criterion (c):** An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
- **Criterion (d):** An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;

- **Criterion (e):** An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);
- **Criterion (f):** An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area); and
- **Criterion (g):** An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places; or cultural or natural environments.

3. ABORIGINAL COMMUNITY CONSULTATION

3.1 Traditional Owner Knowledge

The Aboriginal community are the primary determinants of the significance of their cultural heritage. Members of the Aboriginal community will be consulted, and will continue to be consulted, with regard to their concerns not only about known archaeological sites in the region, but also about cultural values such as areas with historic and spiritual significance, and other values relating to flora and fauna of the area. Everick Heritage recognises that there is Traditional Owner knowledge associated with the region that may have to be treated in a confidential manner. Where there is potential for impacts upon Aboriginal heritage as a result of future development proposals, consultation under ACHCRP (2010) would apply.

3.2 Consultation with the Aboriginal stakeholders

It is noted that the assessment for the Altitude Aspire residential development was subject to a survey by Tweed Byron LALC which would have included the ridge crest and upper slope immediately adjacent to the current study (Everick 2012). This survey did not identify any culturally sensitive areas in the immediate vicinity of the Project Area (see Appendix 1 below).

A site inspection with Mr Warren Phillips and Maurice Gannon From Tweed Byron LALC was undertaken on Wednesday 20 June 2018. The outcomes of this site inspection where that they considered there to be no additional requirement for archaeological investigation on the grounds of previous disturbance.

Written correspondence to this effect was received from the Tweed Byron LALC on 03 July 2018 and is included in Appendix 1.

4. LANDSCAPE CONTEXT

4.1 Topography

The Proposed Works are located on a moderately steep north facing ridge crest located to the south of Trutes Bay (Figure 3). The ridge crest is immediately adjacent to a low-lying area of reclaimed swampland and is north of a ridgecrest which runs roughly parallel to the Tweed River. The Project Area is between approximately 20 and 60 m.a.s.l.

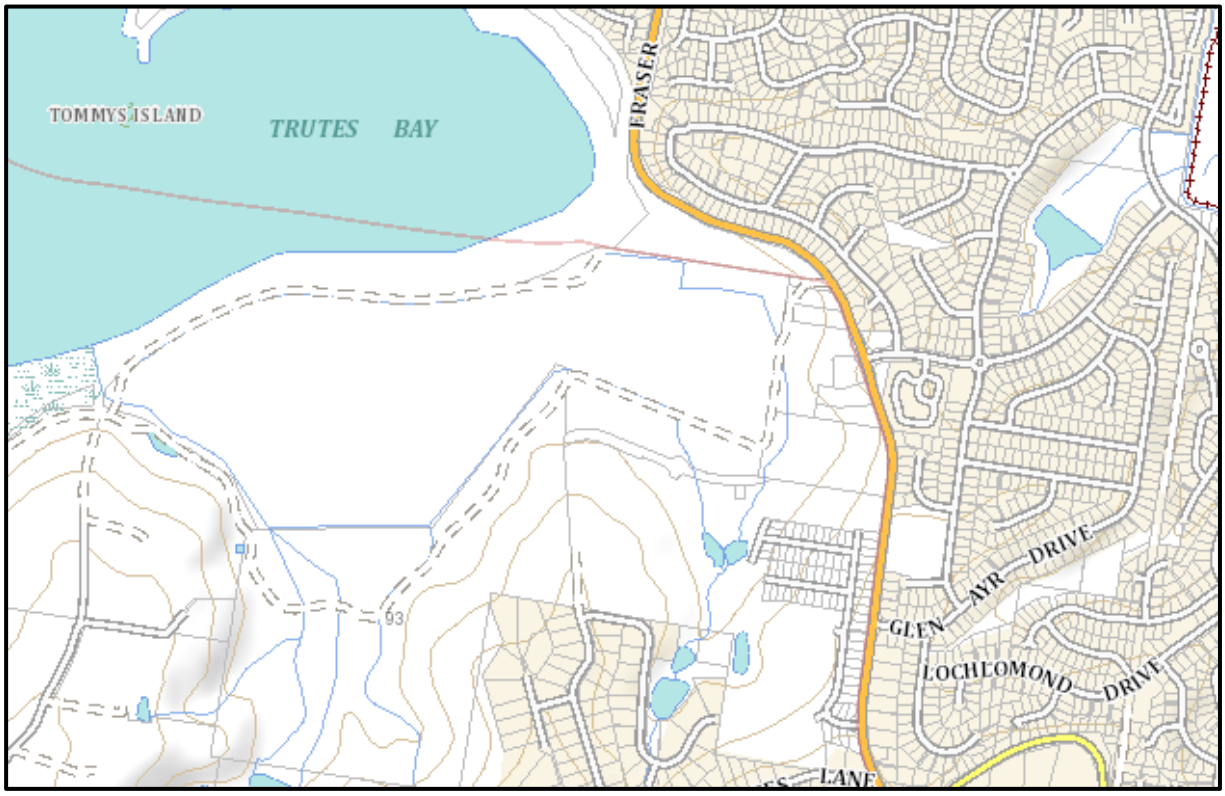


Figure 3: Topography of the Project Area.

4.2 Soil Landscape Description

The Project Area is mapped as part of the 'Billinudgel' soil Landscapes type (Morand 1990 see Figure 4), which is described as;

> "rolling hills on metamorphics of the Neranleigh-Fernvale Group. Relief is 50-100m, slopes 10-20% but may be >33% in places. Slopes moderately long (200-300m) ridges and crests are narrow (100-150m m). Partly to extensively cleared open-forest (wet schlerophyll)".

Soils are typically deep moderately well drained red podzols on crests. The underlying geology includes shales, siltstones and sandstones with occasional greywacke, volcanic tuffs and agglomerates.



Figure 4: Soil Landscape mapping.

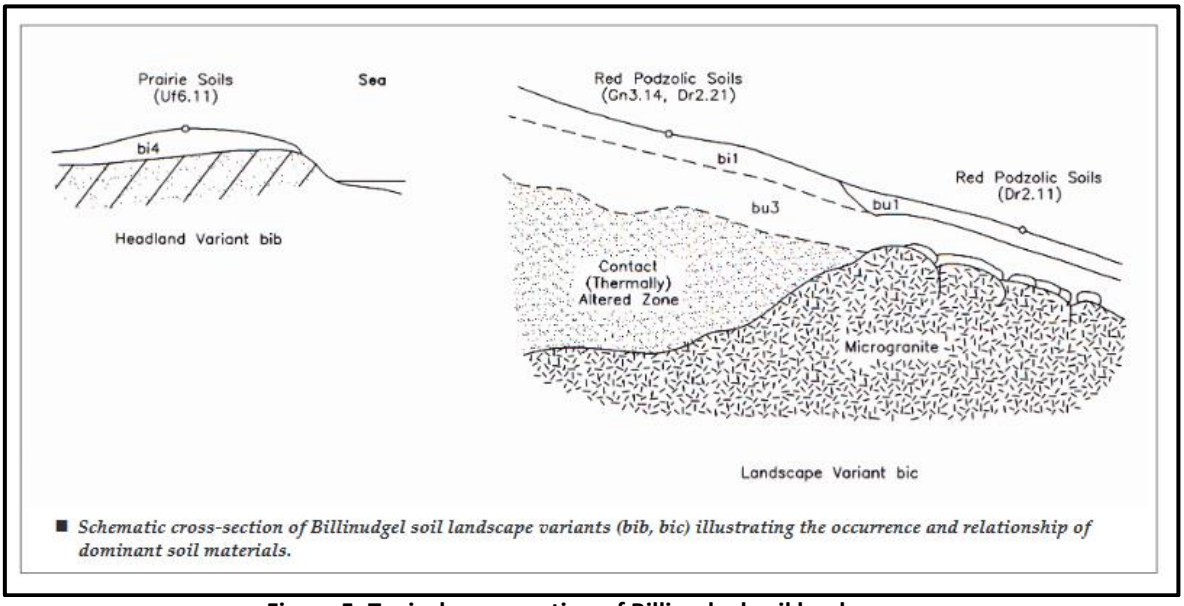


Figure 5: Typical cross-section of Billinudgel soil landscape.

4.3 Vegetation

Morand (1990:30) proposes the following vegetation model for the 'Billinudgel' soil landscape.

> Partly to extensively cleared open-forest (wet sclerophyll). Common trees include blackbutt (Eucalyptus pilularis), tallowwood (E.microcorys), flooded gum (E.grandis), pink bloodwood (E.intermedia), brush box (Lophostemonconfertus) and forest oak (Allocasuarinatorulosa). Small trees and shrubs include blackwood (Acaciamelanoxylon), guioa (Guioasemiglauca), macaranga (Macarangatanarius) and hop bush (Dodoneatriquetra). Near-ground level species include maidenhair fern (Adiantimsp.), wire grass (Aristidasp.), gristle fern (Blechnumcartillagineum), rasp fern (Doodiaaspera), blady grass (Imperatacylindrica), mat-rush (Lomandralongifolia) and bracken fern (Pteridiumesculentum).

4.4 Disturbance analysis

The Due Diligence Code of Practice (OEH 2010) provides the following definition of 'disturbed land';

> "*Land is disturbed if it has been the subject of human activity that has changed the land surface, being changes that remain clear and observable. Examples include ploughing, construction of rural infrastructure (such as dams and fences), construction of roads, trails and tracks (including fire trails and tracks and walking tracks), clearing vegetation, construction of buildings and erection of other structures, construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water and sewerage pipelines, stormwater drainage and other similar infrastructure), and construction of earthworks*" (OEH 2010:18)

The proposed earthworks will be located within land subject to the following types of disturbance:

- Historic vegetation clearing and maintenance over 40 years;
- grazing; and
- intensive small cropping requiring terracing and rock removal.

Analysis of historic aerial photographs of the Subject Lands was undertaken in order to develop a picture of past disturbance for the site. This information could then be used to aid in the predictive modelling of potential sites. Aerial photographs from 1962 (Figure 6) shows extensive small crop terracing and intensive agriculture over all of the PA with exception of the northern most point which appears to be grazing which would likely have resulted in the destruction of any archaeological sites should they have occurred.

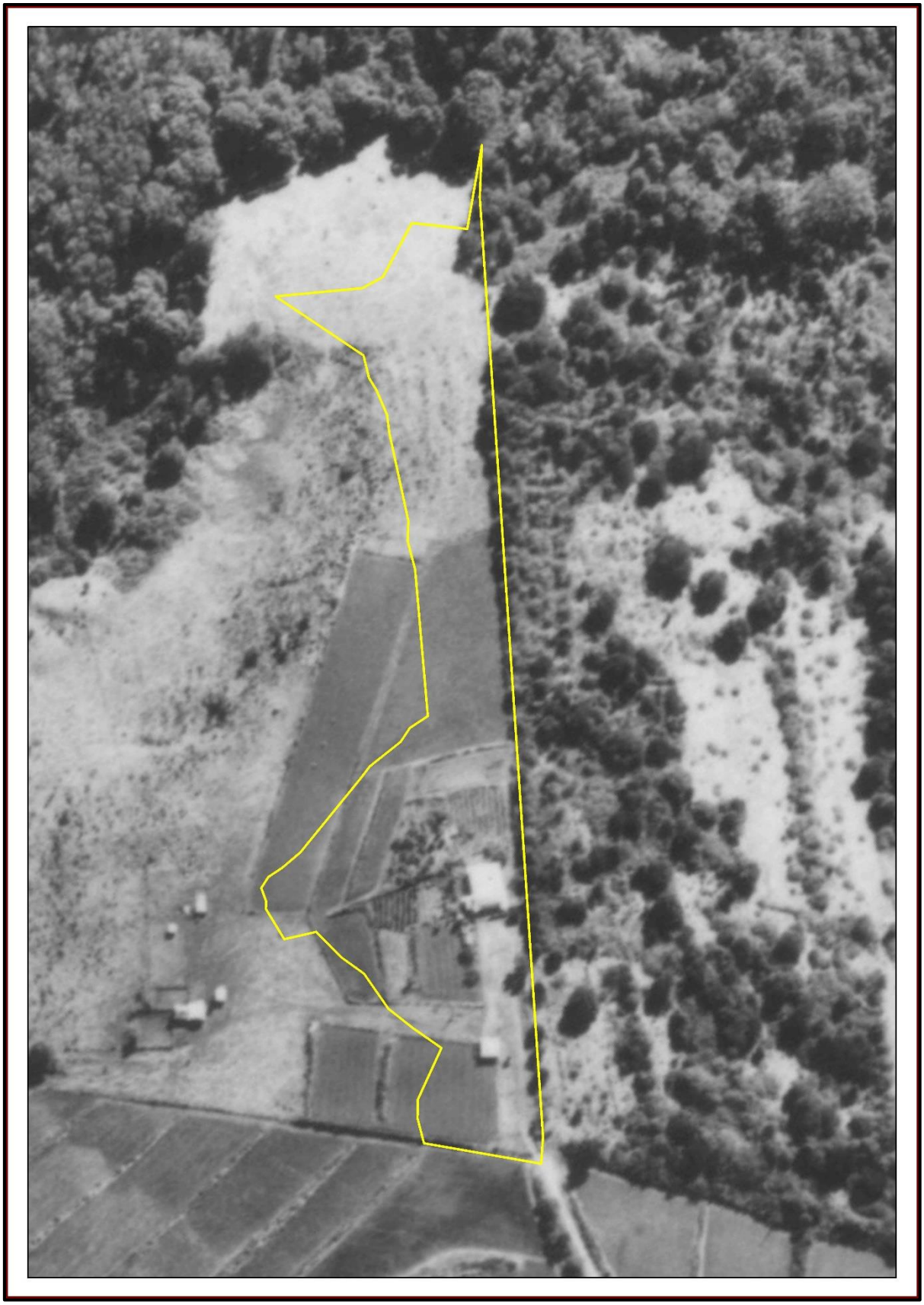


Figure 6: 1962 aerial photo of the Altitude Aspire land and adjacent Project Area.

5. HERITAGE REGISTERS: ABORIGINAL AND HISTORIC HERITAGE

5.1 The OEH Aboriginal Heritage Information Management System

Care should be taken when using the AHIMS database to reach conclusions about site prevalence or distribution. For example, a lack of sites in a given area should not be seen as evidence that the area was not occupied by Aboriginal people. It may simply be an indication that it has not been inspected for cultural heritage or that the survey was undertaken in areas of poor surface visibility. Further, care needs to be taken when looking at the classification of sites. For example, the decision to classify a site as an artefact scatter containing shell rather than a midden can be a subjective exercise, the threshold for which may vary between archaeologists. There may also be significant errors with the data.

An AHIMS extensive search was conducted on 13 June 2018 of the OEH Aboriginal Heritage Information Management System for Lot 1 DP175234 with a 100m buffer however the AHIMS system returned an error message despite repeated attempts (Table 1). The search returned a shell midden on Trutes Bay (#04-2-0205) and a restricted site (#04-2-0026) which is understood by Everick to be a stone axe not located within the Project Area.

Table 1: AHIMS search results (Client ID350670).

Site ID	Site name	Datum	Zone	Easting	Northing
04-2-0026	Restriction Applied				
04-2-0205	Trutes Bay Tweed ACH Shell Midden	GDA	56	551029	6878568

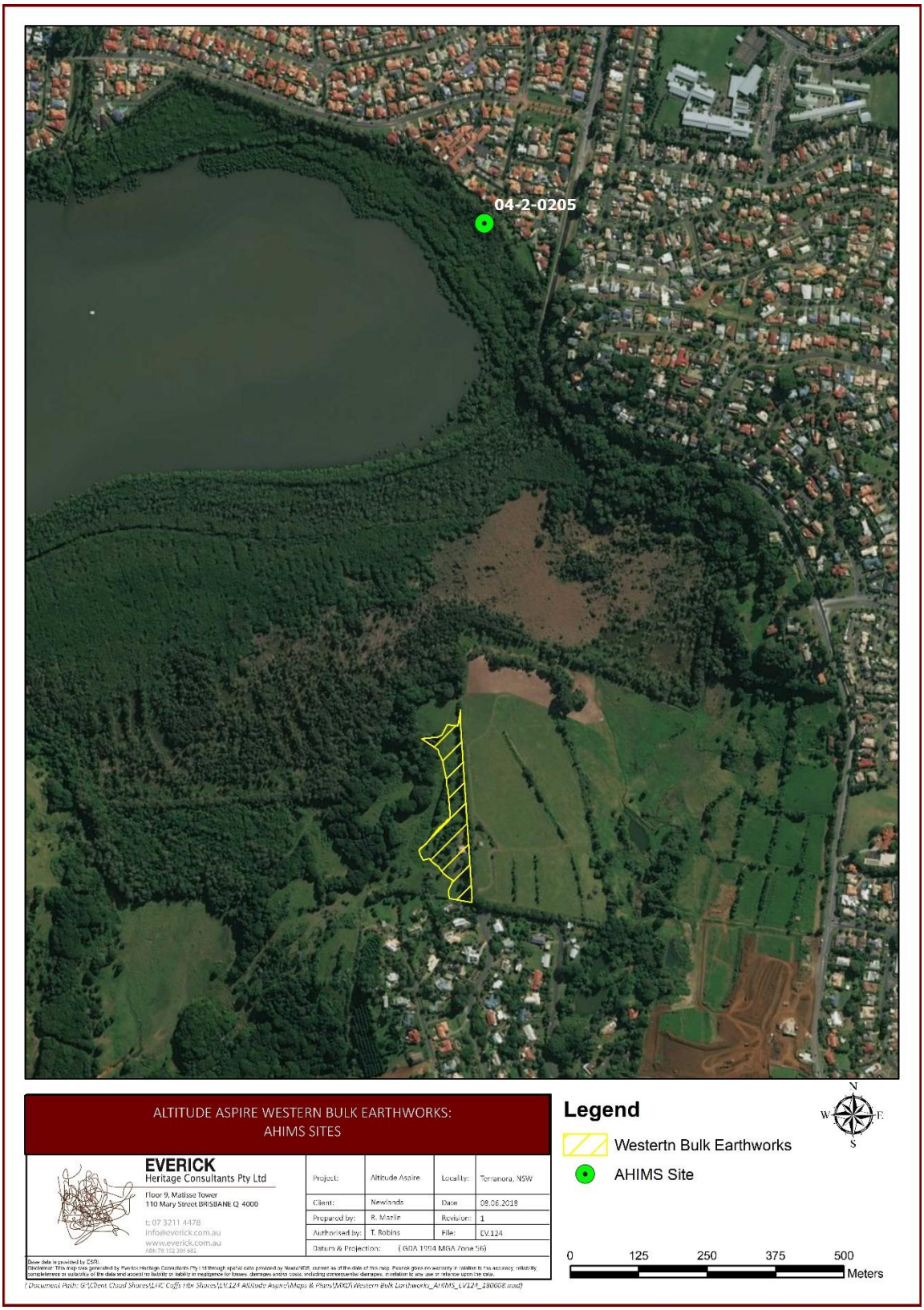


Figure 7:AHIMS search results (Client ID 350670).

5.2 Other Heritage Registers: Indigenous & Historic Cultural Heritage

The following heritage registers were accessed on 06 April 2018:

- **The National Heritage List (Australian Heritage Council):** Contains no Aboriginal heritage listings within or within close proximity to the Project Area.
- **Commonwealth Heritage List (Australian Heritage Council):** Contains no Aboriginal heritage listings within or within close proximity to the Project Area.
- **Register of the National Estate (Australian Heritage Council):** Contains no Aboriginal heritage listings within or within close proximity to the Project Area.
- **The State Heritage Register:**
    - contains no Aboriginal heritage listings in Section 1 (Items listed under the NPW Act as Aboriginal Places) within or within close proximity to the Project Area;
    - contains no Aboriginal heritage listings in Section 2 (Items listed under the NSW Heritage Act) within or within close proximity to the Project Area;
    - contains no Aboriginal heritage listings in Section 3 (Items listed by Local Government and State Agencies) within or within close proximity to the Project Area.
- **Tweed Heads LEP (2014):** Contains no Aboriginal heritage listings within or within close proximity to the Project Area.

5.3 PREVIOUS ARCHAEOLOGICAL STUDIES

5.3.1 Altitude Aspire (Everick 2012)

Everick (2012) undertook an archaeological assessment of the Altitude Aspire residential development on the land immediately east of the Project Area. This survey was undertaken in consultation with the Tweed Byron LALC and did not result in the identification of Aboriginal sites. Further, the study did not identify any Potential Archaeological Deposits.

5.3.2 Terranora Creek and Terranora Broadwater (Piper 1991)

The study of the foreshores of Terranora Creek and Terranora Broadwater (Piper 1991) recorded nine midden sites between Barneys Point Bridge and Tommys Island in Terranora Broadwater within a distance of approximately 5.0 km. These sites ranged in content from thin bands of estuarine shell eroding from slopes falling to the river to compacted (20–50 cm) deposits of shell and stone artefacts many metres in extent. The shell

contents of these sites were estuarine shell species; oyster, cockle and whelk. A small number of stone artefacts including a retouched flake were observed at Site 5 (# 04-02-79) and a bevelled pounder and stone axe were recorded at Site 10 (# 04-02-83). Poor visibility due to dense vegetation bordering the waterways hampered the effectiveness of the survey. However, 14 estuarine shell middens were located. The bank of midden sites (Sites 6–13) on the eastern shore of Terranora Broadwater was considered to be of high archaeological and Aboriginal significance (Piper 1991:16-18) because of there being few sites of concentrated deposits remaining.

5.3.3 Coastal uplands: Terranora and Bilambil Heights

Robins and Piper (2006) investigated 14.0 ha of the Terranora plateau over an area where a stone axe had previously been recorded and collected, however no further Aboriginal artefacts were found. A recent assessment conducted by Robins and Piper (2009) for the proposed Rise Development in Bilambil Heights located no Aboriginal items. The land is highly disturbed through clearing and cultivation over many years. The total evidence of Aboriginal use/occupation of the coastal uplands of the Terranora plateau is restricted to a small number of isolated stone artefacts. The effectiveness of archaeological assessments in these uplands is invariably diminished by poor surface visibility.

5.3.4 Cobaki Broadwater (Converge 2008)

A salvage excavation of a small disturbed midden deposit 200m above the entrance to Cobaki Broadwater at Anconnia Avenue, was found to be composed of estuarine shell species, mainly oyster, and one stone artefact. The report postulates the shell deposit represents a '…single ephemeral event – possibly a single meal for a small group of Aboriginal people…' The archaeological significance of the site was assessed as low. The social/cultural significance of the site to the local Aboriginal community was assessed as culturally significant (Converge 2008:26).

6. FIELD SURVEY: ABORIGINAL CULTURAL HERITAGE

6.1 Survey Team

A preliminary site inspection was undertaken by Everick Senior Archaeologist Adrian Piper on 12 June 2018 to consider the potential for the Project Area to contain sites and to confirm the nature and extent of disturbance across the Project Area.

The Project Area is within the area administered for Aboriginal cultural heritage purposes by the Tweed Byron Location Aboriginal Land Council ('TBLALC'). A request for attendance at the site inspection by Tweed Byron Local Aboriginal Land Council Aboriginal Sites Officers was completed on Tuesday 12 June 2018 by Everick graduate archaeologist Robert Mazlin. Attendance at the inspection was subsequently confirmed for Wednesday 20 June.

6.2 Survey Strategy

The archaeological survey was completed as meandering pedestrian transects across the terraced slopes which comprises the area of bulk earthworks (Figure 8). The survey targeted areas where erosion and disturbance had exposed sections of topsoil and also aimed to make general observations of the nature and extent of disturbance as it related to the potential for sub-surface soil deposits to contain Aboriginal objects.



Figure 8: Survey Landform and Survey Transects.

6.3 Survey Conditions

Table 2 is a summary of ground conditions within each survey unit. The Project Area primarily comprised cleared farmland with improved pastures of regrowth along the main boundary fence (Figure 9, Figure 10 and Figure 11). There is abundant evidence of mechanical terracing and rock piling of terracing and relocation of basalt boulders to stabilise terrace batters indicates that heavy machinery has been used on the ridge crest and upper slopes (Figure 12 and Figure 13).

Table 2: Field Conditions Summary.

Unit	Landform	Visibility	Disturbance level
Unit 1	Ridge Crest / upper slope	Moderate	Moderate. Forest clearing. High intensity agriculture (small cropping) Terracing and relocated stone/ earth batters.



Figure 9: Looking south along boundary fence.



Figure 10: Cattle pad along boundary fence.



Figure 11: Farm shed showing steep slope (looking east).



Figure 12: Terracing along upper slope (looking south).



Figure 13: Terracing and basalt rock batters.

6.4 Assessment Methods

The field assessment methods aimed to inspect exposed ground surfaces as conditions would allow; to record any archaeological material found and assess its significance; and assess the potential for concealed Aboriginal archaeological sites. The assessment also aims to establish if there are sites or areas of a non-archaeological nature significant to the Aboriginal community.

Photographs were taken as a record of general features and conditions and to document the degree of surface visibility. Notes were made of the degree of surface visibility, the area of visibility, ground cover, land uses and any other relevant features. Hand held GPS (GDA 94 datum) was used to record the extent of survey coverage except where fence lines, google and topographic mapping provided clear reference points.

Archaeological features may include evidence of stone artefact scatters or individual artefacts, traces of bone (human and animal), shell deposits, scarred trees and ash-stained earth that might represent fireplaces. When artefacts are found their location was recorded with a GPS, photographed and generally described. A note is made of artefact types and their numbers. General characteristics of the artefacts are noted including raw material type and condition including the degree of weathering and heat cracking. The length, width and thickness of a number of artefacts are recorded. Woodland areas with mature trees were inspected for evidence of Aboriginal scarring

due to bark removal or holes/notches cut into bark and tap wood. The details would be logged on standard OEH Site Recording Forms for registration with the OEH AHIMS.

6.5 Survey Coverage

To achieve as thorough and effective an archaeological assessment as possible a systematic ground survey of all surfaces is the best method to achieve effective coverage. However, in the Project Area the moderate surface visibility conditions due to grass cover and hilly topography dictated that a systematic grid pattern of search would be impractical. An opportunistic search was conducted with a particular focus on any exposed ground surfaces as the most effective method.

Table 3 and Table 4 presents information on the extent to which survey data provides sufficient evidence for an evaluation of the distribution of Aboriginal archaeological materials across the Project Area. The evaluation of survey coverage provides a measure of the effectiveness of the survey to reveal archaeological evidence. The calculations in Table 3 and Table 4 do not provide an exact percentage, but reasonable estimates.

Table 3: Summary of survey coverage.

Unit	Landform Element	Survey Unit Area (m^2)	Visibility %	Exposure %	Effective Coverage (m^2)	Effective Coverage (%)
1	Ridge crest & upper slope	1832	80	10	146.56	8

Table 4: Landform Summary

Unit	Landform Element	Landform Area (m^2)	Area Effectively Surveyed (m^2)	% of landform effectively surveyed	Number of Sites	Number of Artefacts or Features
1	Ridge crest & upper slope	14895	146	0.0.98	0	0

7. RESULTS AND DISCUSSION

7.1 Aboriginal Heritage

The field inspection located no Aboriginal sites within the Project Area. Overall the survey was constrained by improved pastures and regrowth bush. The survey confirmed the analysis of the historic aerial photography that the ridge crest and upper slopes have been subject to moderate to intensity disturbance as a result of cropping. Whilst Aboriginal sites are known to occur on ridge crests in the Tweed River valley, the ridge crest which comprises the Project Area is moderate to steep and relatively narrow in nature. As such, irrespective of disturbance, it is unlikely that archaeological sites, should they have existed on the ridge, would have remained in situ during the repeated phases of forest clearing that occurred across the Terranora Hills in the historic period. Further, the soils are typical of the red podzols of the Northern Rivers which are associated with rainforest and wet forests. Aboriginal sites are typically rare on these soil formations in part due to the nature of the pre-contact vegetation. Specifically, organic materials within the podzolic soils are vulnerable to decomposition as the clay content and acidity are not conducive to the preservation of sites in high rainfall areas.

7.2 Historic heritage

There were no items of historic heritage found during the site inspection. Further, the Project Area is not known to be associated with any particular people or events which made a significant contribution to the local area. The residential and agricultural dwellings are not unique examples of regional architecture.

8. RECOMMENDED MANAGEMENT & MITIGATION MEASURES

The Consultant is of the opinion that the proposed bulk earthworks are unlikely impact on Aboriginal cultural heritage. The following recommendations are provided.

Recommendation 1: Additional Research

Having consideration for the nature and extent of the proposed works, the absence of Aboriginal sites identified by the field study and the extent of existing disturbance across the Project Area it is considered unlikely that additional investigations or consultation in relation to the Project Area will identify Aboriginal sites. As such, it is not considered that additional archaeological investigations or Aboriginal community consultation is required prior to determination of the Development Application. However, as a cautionary measure it is recommended that the findings of this assessment are provided to certain members of the community known to be actively engaged in heritage management in the region, namely the McDonald Family and Minjungbal Aboriginal Cultural Centre.

Recommendation 2: Cultural Heritage Induction

It is recommended that a cultural heritage induction is provided to all staff involved with initial groundworks involving the removal of topsoil. The purpose of the cultural heritage induction is to:

- make staff aware of the survey effort to date and potential for the Project Area to contain Aboriginal sites;
- provide sufficient training for staff to identify Aboriginal objects should they be impacted during construction works; and
- ensure that staff are aware of response procedures in the event of any harm to Aboriginal sites during construction works.

It is recommended that the cultural heritage induction is provided by a suitably experienced member of the Aboriginal community or a qualified archaeologist.

Recommendation 3: Aboriginal Objects Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered as a result of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material;

d) if the material is found to be of Aboriginal origin, the Aboriginal community is to be consulted in a manner as outlined in the OEH guidelines: Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010); and

e) should the works be deemed to have harmed the Aboriginal objects the OEH should be notified immediately via the EPA Enviro Hotline.

Recommendation 4: Aboriginal Human Remains

Although it is unlikely that Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station (Tweed Heads), the Tweed Byron LALC and the OEH Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the OEH should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

It is also recommended that in all dealings with Aboriginal human remains, the Proponent should use respectful language, bearing in mind that they are the remains of Aboriginal people rather than scientific specimens.

Recommendation 5: Notifying the OEH

It is recommended that if Aboriginal cultural materials are uncovered as a result of development activities within the Project Area, they are to be registered as Sites on the AHIMS, managed by the OEH. It is also recommended that the OEH Northeast Planning Unit is notified in the event that any unexpected finds are encountered. Any management outcomes for the site will be included in the information provided to the AHIMS.

Recommendation 6: Conservation Principles

It is recommended that all effort must be taken to avoid any impacts on Aboriginal Cultural Heritage values at all stages during the development works. If impacts are unavoidable, mitigation measures should be negotiated between the Proponent, OEH and the Aboriginal community.

9. REFERENCES

Converge Heritage and Community

2008 Archaeological Excavation and Cultural Heritage Assessment of the Piggabeen Road Shell Midden. Unpublished report to Tweed Shire Council, West Tweed Heads.

Everick

2012 *Altitude Aspire, Terranora NSW: Cultural Heritage Assessment*. Everick Heritage Consultants Pty Ltd unpublished report prepared for Metricon Qld Pty Ltd.

Morand, D.T.

1996 Soil Landscapes of the Murwillumbah – Tweed Heads 1:100 000 Sheet Report, Department of Land and Water Conservation, Sydney

Office of Environment and Heritage

2010 Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.

Piper, A.

1991 An Archaeological Assessment and Aboriginal Consultations in relation to the Lower Tweed River Management Plan. Unpublished report to the NSW Public Works Department, Tweed Heads.

2000 An Archaeological Assessment at Fraser Drive, Tweed Heads South, NSW. Unpublished report for Jim Glazebrook & Associates Ltd., Murwillumbah

Robins, R. & Piper, A.

2007 Aboriginal Cultural Heritage Assessment at Fraser Drive, Tweed Heads South, NSW. Unpublished report to MFS Diversified Group, Bundall.

2009 Cultural Heritage Assessment for the Rise Development MP08-0234 Bilambil Heights, NSW. Unpublished report to Terranora Group Management Pty Ltd, Terranora.

APPENDIX 1: CORRESPONDENCE FROM TWEED BYRON LALC

TWEED BYRON LOCAL ABORIGINAL LAND COUNCIL

P.O. Box 1410
Kingscliff, NSW 2487
Telephone: (07) 5536 1763
Fax: (07) 5536 9832
E-mail: finance@tblalc.com.au
21/25 Ourimbah Road
Tweed Heads NSW 2485

ABN: 44 992 419 248

Helen Tomkins
Everick Heritage Consultants
47 Arthur Terrace
Red hill QLD 4059

Dear Helen

RE: Altitude One Development, Terranora nsw

The Tweed Byron Local Aboriginal Land Council has been consulted throughout the course of the Aboriginal Heritage Assessment of the Altitude One Development, Terranora undertaken by your office. We have reviewed a copy of the report and the Tweed Byron local Aboriginal Land Council are satisfied with the outcome.

On the 22nd of September 2009 we Cyril Scott had accompanied Helene Tomkins from Everick had inspected land at Altitude One . There were **no** artfacts found on the walk over, visability was at 80%.

Based on the impact of its past and current land use, chances of finding Aboriginal sites or relics within the area is very low.

Recommendation.
Tweed Byron LALC Supports the recommendations that were put forward in your report.

1. If human remains are located at any stage during construction works that are of Aboriginal origin, then the Site should be cordoned off and be left untouched and the Tweed Byron LALC must be informed.

2. If Aboriginal cultural material is uncovered during the development then work must stop in the area and the Site should be cordoned off and the Tweed Byron LALC must be informed.

Any questions please don't hesitate to contact us on the above number.

Thank you

Cyril Scott
Cultural Sites Officer
Tweed Byron Local Aboriginal Land Council

TWEED BYRON LOCAL ABORIGINAL LAND COUNCIL

July 3, 2018

Everick Heritage Consultants
Po Box 200
Coffs Harbour NSW 2450

By email: t.hill@everick.net.au

Re Altitude Aspire Western Earthworks – Aboriginal Cultural Heritage Report - June 2018

Thank you for providing a copy of the abovementioned report for comment. TBLALC agree with Recommendations set out in the Report.

I note that the larger, adjacent area of the Altitude One development was originally inspected by TBLALC's Cultural Sites Officer, Cyril Scott, on 22 September 2009. The subject of this report is an additional land parcel on the western perimeter of the original project area.

The additional parcel was inspected by myself and Warren Phillips, TBLALC Cultural Heritage Sites Officer and Adrian Piper, Archaeologist representing Everick, on 20 June 2018. No items of Aboriginal cultural heritage were located and it was noted that the area has been significantly disturbed by farming and grazing.

As this is, in effect, an addendum to the previous site inspection and report it was agreed that there is no reason for TBLALC to produce a detailed site inspection report on this occasion. TBLALC will retain all photographs and notes taken on-site on 20 June 2018 on its file.

Yours sincerely

Conservation Planning Officer
Tweed Byron Local Aboriginal Land Council
Cultural Heritage Unit (CHU)

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21/25 Ourimbah Road, Tweed Heads NSW 2485 PO Box 6967, Tweed Heads South, NSW 2486 Email:sites@tblalc.com

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