Stormwater Management Plan

Lot 51 Wilkinson Road, Tuan

5 June 2024

J9009 v1.1

STORM WATER CONSULTING

Job No: J9009 v1.1

Job Name: Lot 51 Wilkinson Road, Tuan

Report Name	Date	Report No.
Stormwater Management Plan	22 May 2024	J9009 v1.0
Stormwater Management Plan	5 June 2024	J9009 v1.1

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1.0 INTRODUCTION

Storm Water Consulting Pty Ltd was commissioned by M & JM Grunske to prepare a Stormwater Management Plan for the proposed development on Lot 51 Wilkinson Road, Tuan.

This report has been prepared to address the following issues associated with the proposed Reconfiguration of Lot (ROL):

- Identify the extent of flooding during a major overland flow event, assess potential impacts on neighbouring properties and set minimum lot levels.
- Assess potential stormwater quantity impacts from the proposed development.
- Conceptualise a stormwater quality treatment train for the proposed development.

2.0 SITE CONDITIONS

2.1 Existing Site

The site is a vacant lot vegetated by short grass and sparse tree cover. The site is bound by Wilkinson Road to the east, Tuan Forest to the south and west and residential properties to the north. An existing site plan is presented in Figure 1, Appendix A. A locality plan is presented in Figure 2.1 below.

Figure 2.1 – Locality Plan (Source: Google Earth)

2.2 Developed Site

It is proposed to subdivide the site into freehold lots (Reconfiguration of Lot). A new road is proposed to be constructed to provide access to the new lots (new cross drainage culverts are proposed below the new road, in front of the site). Drainage pipes are proposed through the site to maintain some flows to the existing dams north of the site (as per the neighbouring property owners' requests). A bio-retention basin is proposed for the development to meet water quality objectives. A widened open drain and diversion berm is proposed on the upstream Tuan Forest land. A developed site plan is presented in Figure 2, Appendix A. Design plans are presented in Appendix E.

The site is located within the Great Barrier Reef wetland protection area, as demonstrated in Figure 2.2 on the following page. The proposed development avoids the use of wetlands for stormwater treatment, as the proposed stormwater treatment device is located outside of the mapped wetland area. The proposed development also avoids the direct discharge of stormwater into the mapped wetland area. The widened open drain and diversion berm proposed within the Tuan Forest land would generally maintain the surface water hydrology by directing the runoff northward along its current flow path. The proposed development would comply with PO3, PO4 and PO5 of State Code 9 (extract presented in Figure 2.3 below).

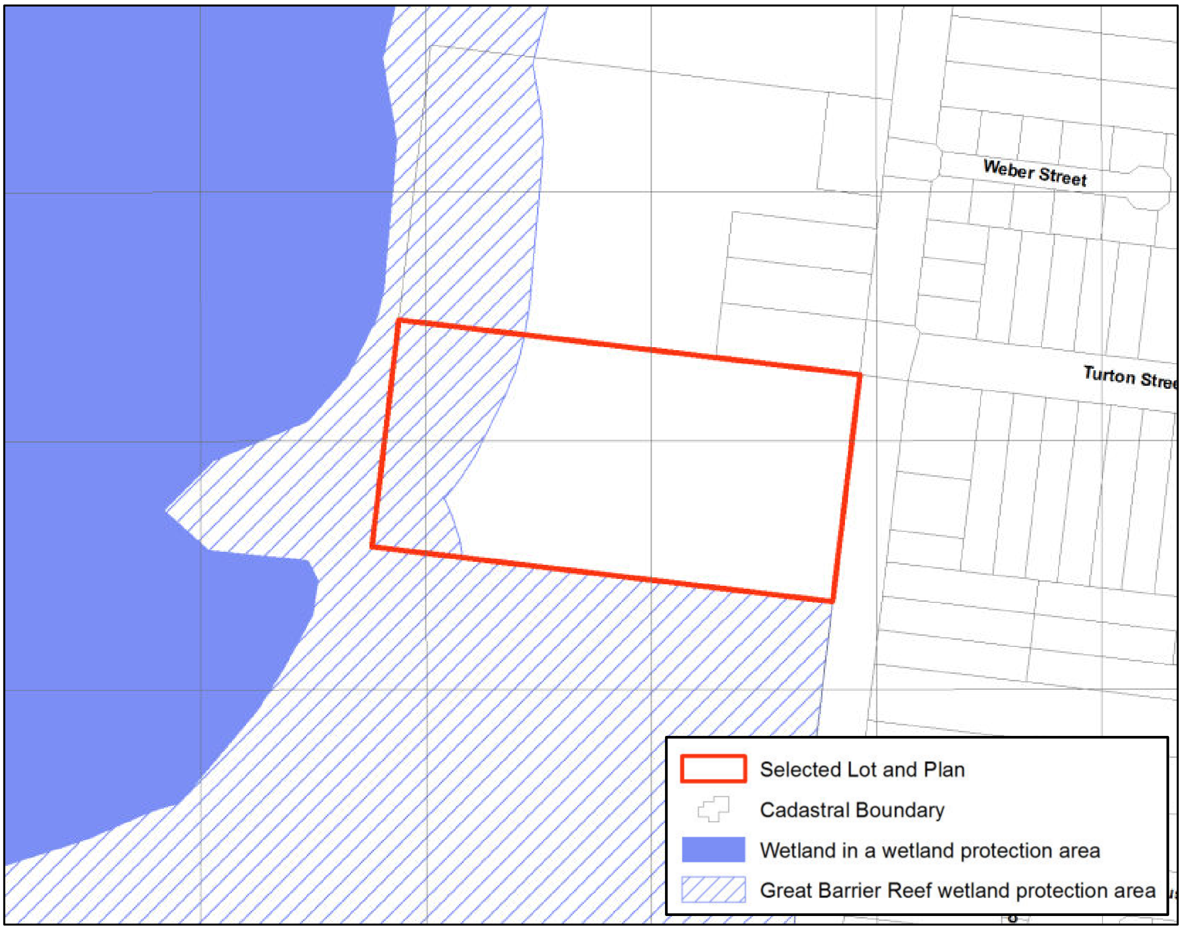

Figure 2.2 – Extract from Map of Great Barrier Reef Wetland Protection Areas

Hydrology
PO3 Development maintains or improves the existing surface and groundwater hydrology in a **wetland protection area**.
Water quality
PO4 Development does not unacceptably impact the water quality of the **wetland** in the **wetland protection area** and in the **wetland buffer**.
PO5 Development does not use the **wetland** in the **wetland protection area** for stormwater treatment.

Figure 2.3 – Extract from State Code 9: Great Barrier Reef Wetland Protection Areas

3.0 HYDROLOGIC ANALYSIS

3.1 Hydrologic Impact Assessment

The property is affected by overland flow from a catchment to the west, which flows through the site toward the north-eastern site corner (Point-1). An open drain is located at the rear of the site, within Tuan Forest. The open drain flows in a northerly direction, before turning to flow in an easterly direction where flows spread out, flowing across bushland before traversing across Wilkinson Road at Point-2, heading toward the Great Sandy Strait. A catchment plan is presented in Figure 3, Appendix A.

Rational Method calculations were undertaken for the catchments flowing to Point-1 and Point-2 (in accordance with recommendations contained in QUDM 2016). A summary of the peak flows is presented in Table 3.1 below. Detailed Rational Method calculations are presented in Appendix C.

Table 3.1 – Rational Method Calculation Summary

AEP	Point-1 Peak Flow	Point-2 Peak Flow
%	m^3/s	m^3/s
63	1.16	6.49
50	1.39	7.82
20	2.13	12.01
10	2.67	15.08
5	3.24	18.41
2	4.20	24.03
1	4.93	28.29

URBS hydrologic modelling was undertaken to assess the potential stormwater quantity impacts resulting from the proposed development at Point-1, as well as to produce inflow hydrographs for input into the TUFLOW hydrodynamic model. A schematic representation of the existing URBS model (existing site catchment, developed external catchment, with existing routing) is presented in Figure 4a, Appendix A. URBS data files are presented in Appendix D. A summary of the adopted URBS parameters is presented in Table 3.2 on the following page.

Table 3.2 – URBS Model Parameters

AEP	Storage Coefficient	Non-Linearity Index	Initial Rainfall Loss	Continuing Rainfall Loss
%	α	m	mm	mm/hr
63	1.2	0.8	15	2.5
50	1.2	0.8	15	2.5
20	1.2	0.8	15	2.5
10	1.2	0.8	15	2.5
5	1.2	0.8	15	2.5
2	1.2	0.8	15	2.5
1	1.2	0.8	0	2.5

A comparison of the peak URBS flows (existing site catchment, developed external catchment) and Rational Method flows at Point-1 and Point-2 is presented in Tables 3.3 and 3.4 below.

Table 3.3 – Comparison of Flows at Point-1

AEP	Rational Method Flows	URBS Flows	Difference	Difference
%	m^3/s	m^3/s	m^3/s	%
63	1.13	1.07	0.06	5%
50	1.36	1.30	0.06	4%
20	2.08	2.11	0.03	1%
10	2.60	2.74	0.14	5%
5	3.16	3.44	0.28	9%
2	4.10	4.43	0.33	8%
1	4.81	5.29	0.48	10%

Table 3.4 – Comparison of Flows at Point-2

AEP	Rational Method Flows	URBS Flows	Difference	Difference
%	m^3/s	m^3/s	m^3/s	%
63	5.68	4.65	1.03	18%
50	6.84	6.00	0.84	12%
20	10.55	10.23	0.32	3%
10	13.28	13.75	0.47	4%

5	16.25	17.54	1.29	8%
2	21.29	23.05	1.76	8%
1	25.12	27.51	2.39	10%

The results presented above show that the URBS flows compare favourably with the Rational Method flows. The URBS model would therefore generate flows suitable for comparison of peak flows at Point-1, as well as for adoption in the TUFLOW model as boundary conditions.

A widened open drain and diversion berm is proposed within Tuan Forest upstream of the site. The catchment contributing to flows at Point-1 would be reduced, as the berm would divert a portion of the upstream catchment away from the site. A schematic representation of the developed URBS model (developed site catchment, developed external catchment, with developed routing) is presented in Figure 4b, Appendix A. The impervious fraction of the URBS sub area representing the site was increased to reflect the proposed development. URBS sub area routing was modified to reflect the surface flow regime following the adoption of the widened open drain and diversion berm.

A comparison of the peak URBS flows from the existing and developed URBS model at Point-1 is presented in Table 3.5 below.

Table 3.5 – Comparison of Flows at Point-1 (Existing v Developed)

AEP	Existing URBS	Developed URBS	Increase	Increase
%	m^3/s	m^3/s	m^3/s	%
63	1.07	0.39	-0.68	-64%
50	1.30	0.45	-0.85	-65%
20	2.11	0.70	-1.41	-67%
10	2.74	0.90	-1.84	-67%
5	3.44	1.07	-2.37	-69%
2	4.43	1.31	-3.12	-70%
1	5.29	1.61	-3.68	-70%

The above results show that the proposed development (with the widened open drain and diversion berm) would not increase the peak discharges flowing to Point-1. As such, on-site detention would not be considered to be required for the proposed development.

A comparison of the peak URBS flows from the existing and developed URBS model at Point-2 is presented in Table 3.6 on the following page.

Table 3.6 – Comparison of Flows at Point-2 (Existing v Developed)

AEP	Existing URBS	Developed URBS	Increase	Increase
%	m³/s	m³/s	m³/s	%
63	4.65	4.70	0.05	1.1%
50	6.00	6.04	0.04	0.7%
20	10.23	10.29	0.06	0.6%
10	13.75	13.87	0.12	0.9%
5	17.54	17.69	0.15	0.9%
2	23.05	23.22	0.17	0.7%
1	27.51	27.80	0.29	1.1%

The above results show that the proposed works would result in minor increases to peak discharges at Point-2. The hydraulic impacts of the proposed works at this location are further assessed in TUFLOW (refer Section 4.0).

3.2 Hydraulic Model Boundary Conditions

Inflow hydrographs from the URBS model for flows contributing to the diversion berm (i.e upstream of the site) were adopted as boundary conditions in TUFLOW to assess the impacts of flow diversion (i.e. adopting the diversion berm). The 1% AEP inflow hydrographs adopted in TUFLOW are presented in Figure 3.1 below.

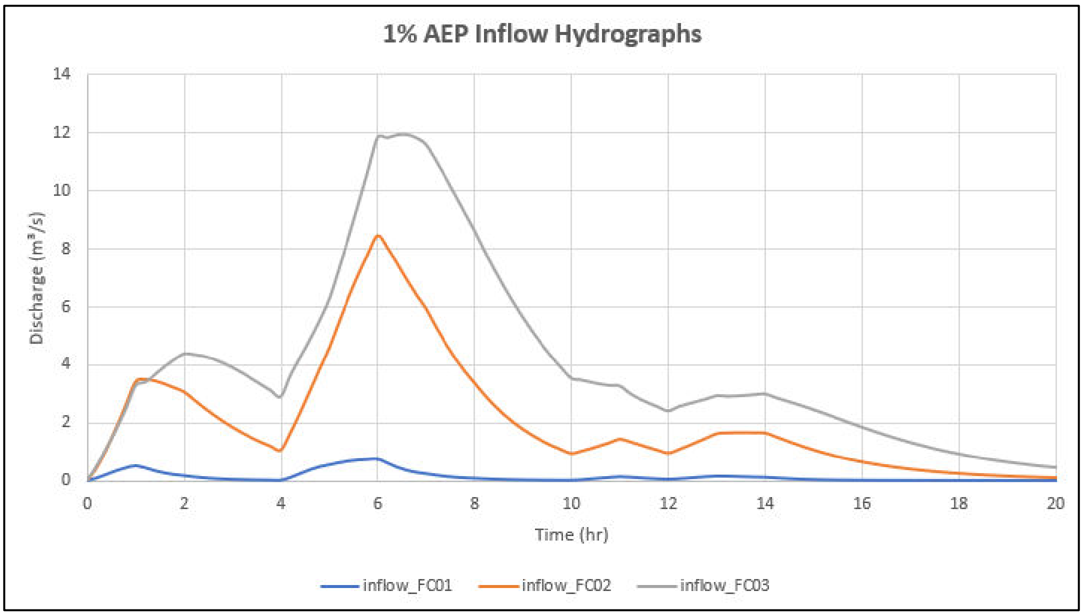

Figure 3.1 – Inflow Hydrographs for TUFLOW

4.0 HYDRODYNAMIC MODELLING

TUFLOW 2D hydrodynamic modelling was undertaken to determine the extent of inundation, to assess potential hydraulic impacts and to set minimum lot levels for the proposed development. The model setup and results are discussed below.

4.1 Existing TUFLOW Model

A schematic of the existing TUFLOW model is presented in Figure 5, Appendix A. The TUFLOW model was based on a 2m grid size with elevation data assigned from the ALS survey data sourced from the Queensland State Government. The inflow hydrographs presented in Figure 3.1 were input into the model as a discharge-time (QT) boundary condition. The downstream boundary condition was set as a height-discharge (HQ) relationship based on the natural ground slope. Manning's roughness coefficient values of n=0.10 and n=0.02 were used in the model to represent private properties and roads respectively.

The existing 1% AEP overland flow contours, depths, velocities and velocity-depths are presented in Figures 6a to 6d, Appendix A respectively. The model results show that the majority of the property would be inundated during a 1% AEP event.

4.2 Developed TUFLOW Model

A schematic of the developed TUFLOW model is presented in Figure 7, Appendix A. The developed model replicates the existing model and incorporates changes to the site condition based on the proposed development. A civil design TIN of the proposed development, widened open drain and diversion berm (prepared by Tony McVey Pty Ltd) was input into the model. Fill was not proposed all the way to the site boundary to allow minor surface runoff to be conveyed around the development. The proposed drainage systems on the site and in front of the site were incorporated using 1d_nwk layers. All other model parameters and inputs remain the same as the existing model.

The developed 1% AEP overland flow contours, depths, velocities and velocity-depths are presented in Figures 8a to 8d, Appendix A respectively. An afflux impact plot of the model results is presented in Figure 9, Appendix A. The plot shows that the proposed development would not create any adverse impacts on neighbouring private properties. The majority of the impacts are contained within the road reserve, within the Tuan Forest land, or in a location where no existing buildings or structures exist.

It is understood that preliminary agreements have been sourced from the stakeholders of Tuan Forest to accept flood impacts within the forest land. Formal agreements would need to be sourced and finalised. In addition, agreements would need to be sourced from neighbouring property owners to accept the minor localised hydraulic impacts on adjoining lands.

4.3 Minimum Lot Levels

Lots are recommended to be set above the highest upstream 1% AEP overland flow level. The highest upstream 1% AEP overland flow level along the western boundary is 3.6 m AHD. The finished surface levels at the rear of Lots 9 to 12 are recommended to be above 3.6 m AHD. The highest upstream 1% AEP overland flow level along the northern boundary is 3.0 m AHD. The finished surface levels of Lots 1 to 8 are recommended to be above 3.0 m AHD. The highest upstream 1% AEP overland flow level along the southern boundary is 3.1 m AHD. The finished surface levels of Lots 13 to 18 are recommended to be above 3.1 m AHD. The proposed finished surface levels for each lot would comply with these recommendations.

5.0 STORMWATER QUALITY MANAGEMENT

5.1 State Planning Policy (July 2017)

The State Planning Policy (SPP) sets out the requirements for water quality in the interest of the State. Developments which trigger the requirements summarised in Table 5.1 below would need to meet water quality objectives listed in Table B, Appendix 2 of the SPP.

Table 5.1 – Development Applications affecting Receiving Waters

State Planning Policy Criteria	Application to Development
(1) A material change of use for urban purposes that involves a land area greater than 2500 square metres that: (a) will result in an impervious area greater than 25 per cent of the net developable area, or	Criterion is NOT applicable to development.
(b) will result in six or more dwellings, or	Criterion is NOT applicable to development.
(2) Reconfiguring a lot for urban purposes that involves a land area greater than 2500 square metres and will result in six or more lots, or	Criterion is applicable to development.
(3) Operational works for urban purposes that involve disturbing more than 2500 square metres of land.	Criterion is NOT applicable to development.

The proposed development triggers the SPP, hence water quality objectives indicated in Table B, Appendix 2 of the SPP would need to be met.

5.2 Water Quality – Construction Phase

During the construction phase of a development, the pollutants listed in Table 5.2 are typically generated. Measures are required during the construction phase to manage each of these pollutants. These measures may include but are not limited to; bins and mini-skips, erosion and sediment control measures (discussed below), wash down and spill containment areas, bunds, spill clean-up kits, street sweeping and chemical agents.

Table 5.2 – Pollutants Generated during the Construction Phase

Pollutant	Source
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building operations
Hydrocarbons	Fuel and oil spills leaks from construction equipment
Toxic materials	Cement slurry, asphalt primer, solvents, cleaning agents, wash waters (e.g. from tile works)
pH altering substances	Acid sulphate soils, cement slurry and wash waters

5.2.1 Erosion and Sediment Control

During the construction phase of the development, an Erosion and Sediment Control Program (E&SCP) is required to minimise water quality impacts. Such an E&SCP should provide complete and detailed instructions on the following procedures;

- Before construction activities begin, sediment fences should be constructed on the downstream site boundaries and at the base of all proposed soil stockpiles;
- Areas for plant and construction material storage should be designated. Runoff from these areas should be directed to small holding ponds in case of spillages;
- Catch drains at the downstream boundary of construction activities should also be created to ensure that any sediment-laden runoff is contained and directed into a sediment basin and not permitted to flow unmitigated to downstream areas;
- Sediment basins should be constructed at appropriate locations to collect sediment at the downstream ends of the catch drains that convey runoff from exposed areas;
- Site personnel should be educated on the sediment and control measures implemented on site; and
- Following rainfall events greater than 20mm, inspection of silt fences, sedimentation basins and other erosion control measures should be carried out. Where necessary, collected material should be removed and damaged equipment should be replaced immediately.

5.3 Water Quality – Operational Phase

During the operational (post-construction) phase of the proposed development, the following pollutants are typically generated;

- Sediment,
- Litter,
- Faecal coliforms,
- Hydrocarbons,
- Heavy Metals,
- Thermal Pollution,
- Nutrients (N & P) and
- Surfactants.

5.3.1 Water Quality Objectives

Key pollutant levels will be reduced to the levels indicated in Table B, Appendix 2 of the State Planning Policy. The Water Quality Objectives are summarised in Table 5.3 below.

Table 5.3 – Water Quality Objectives for Central Queensland (South)

Parameter	Load-based Reduction
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%
Gross Pollutants > 5mm	90%

Note that the percentage reduction refers to a comparison between the un-mitigated developed site and the mitigated developed site.

6.0 STORMWATER QUALITY MODELLING

A stormwater treatment train is proposed to meet the WQOs stated in Section 5.3.1. The Stormwater Quality Improvement Device (SQID) for the treatment train was selected based on site constraints, opportunities and practicality.

A bio-retention basin has been selected to meet the water quality objectives. Details of the MUSIC stormwater quality analysis and specifications of the proposed system are presented below.

6.1 Source Nodes

A schematic of the MUSIC sub catchments is presented in Figure 10, Appendix A. The MUSIC source nodes, their areas, node type and fraction impervious proportions are summarised in Table 6.1 below. The adopted roof area for each new lot is 250 m². The small area around the perimeter of the site which remains as grass and which would not flow to the bio-retention basin have been excluded from the MUSIC model.

Table 6.1 – Source Node Fractions Impervious

Source Node	Area	Type	Fraction Impervious
Residential Roof	0.450 ha	Residential Roof	100%
Residential Roads	0.373 ha	Residential Road	60%
Residential Ground	2.897 ha	Residential Ground	15%

Rainfall-runoff parameters were assigned to the source nodes in accordance with the Water by Design MUSIC Modelling Guidelines Version 1.0 – 2010 Residential Use of the site. These parameters are summarised in Table 6.2 below.

Table 6.2 – Rainfall – Runoff Parameters

Parameter		Residential
Impervious Area Properties	Rainfall threshold (mm/day)	1
Pervious Area Properties	Soil storage capacity (mm)	500
	Initial storage (% of capacity)	10
	Field Capacity (mm)	200
	Infiltration Capacity Coefficient – a	211
	Infiltration Capacity Exponent – b	5
Groundwater Properties	Initial depth (mm)	50
	Daily recharge rate (%)	28
	Daily base flow rate (%)	27
	Daily deep seepage rate (%)	0

Pollutant export parameters were assigned according to the Water by Design MUSIC Modelling Guidelines Version 1.0 – 2010. The pollutant export parameters adopted in the MUSIC model are summarised in Table 6.3 below.

Table 6.3 – Pollutant Export Parameters (Residential)

Source		Log_{10} TSS (mg/L)		Log_{10} TP (mg/L)		Log_{10} TN (mg/L)	
		Base flow	Storm flow	Base flow	Storm flow	Base flow	Storm flow
Roof	Mean	NA	1.30	NA	-0.89	NA	0.26
	Std Dev	NA	0.39	NA	0.31	NA	0.23
Road	Mean	1.00	2.43	-0.97	-0.30	0.20	0.26
	Std Dev	0.34	0.39	0.31	0.31	0.20	0.23
Ground	Mean	1.00	2.18	-0.97	-0.47	0.20	0.26
	Std Dev	0.34	0.39	0.31	0.31	0.20	0.23

6.2 Treatment Node – Bio-Retention

A bio-retention basin is proposed to meet water quality objectives. The input parameters adopted in MUSIC are presented in Table 6.4 below.

Table 6.4 – Bio-Retention Parameters

Inlet Properties	Bio-Retention
Low Flow Bypass (m^3/s)	0
High Flow Bypass (m^3/s)	100
Extended Detention Depth	0.3 m
Surface Area	500 m^2
Filter Area	500 m^2
Unlined Filter Media Perimeter	0.01 m
Saturated Hydraulic Conductivity	200 mm/hr
Filter Depth	0.6 m
Exfiltration Rate	0 mm/hr

A potential location for the bio-retention basin is presented on plans in Appendix E. The final location and specifications for the basin would be finalised during the detailed design stage.

6.2.1 Maintenance

A bio-retention basin maintenance checklist is presented in Appendix F.

6.3 MUSIC Analysis

The quality of stormwater runoff and the impact of the proposed SQIDs were analysed using MUSICX version 1.10.0 in accordance with the water quality objectives from Table B, Appendix 2 of the State Planning Policy.

The MUSIC model was based on the 1991 to 2000 rainfall series for Maryborough with 6-minute time steps. The MUSIC model schematic is presented in Figure 6.1 below. The MUSIC modelling results are presented in Table 6.5 below.

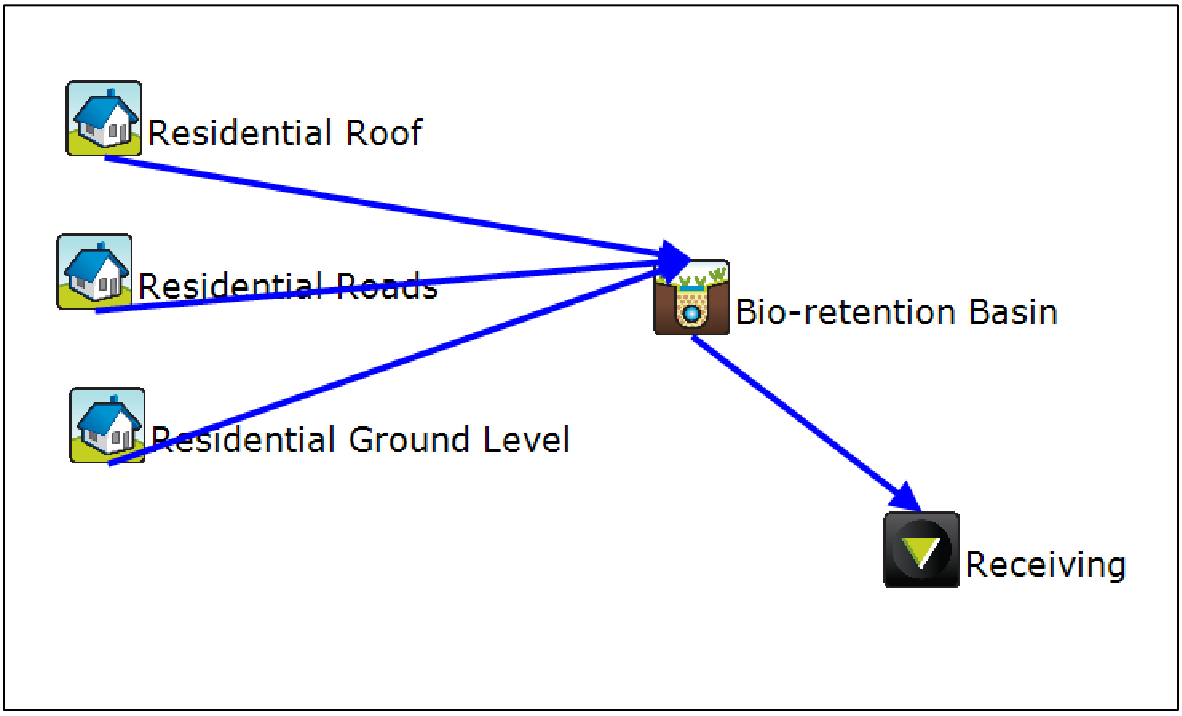

Figure 6.1 – MUSIC Model Schematic

Table 6.5 – MUSIC Model Results

Indicator	Annual Loads (kg/yr)		Reduction	
	Without SQIDs	With SQIDs	Actual	Target
TSS	2221.43	256.09	88%	85%
TP	4.64	0.85	81%	60%
TN	26.25	10.29	60%	45%
GP	328.26	0.00	100%	90%

The results above indicate that the required water quality objectives are met for the proposed development.

7.0 CONCLUSIONS

This report has been prepared to address the following issues associated with the proposed Reconfiguration of Lot (ROL) on Lot 51 Wilkinson Road, Tuan:

- Identify the extent of flooding during a major overland flow event, assess potential impacts on neighbouring properties and set minimum lot levels.
- Assess potential stormwater quantity impacts from the proposed development.
- Conceptualise a stormwater quality treatment train for the proposed development.

The TUFLOW model results show that the proposed development would not create any adverse impacts on neighbouring private properties. The majority of the impacts are contained within the road reserve, within the Tuan Forest land, or in a location where no existing buildings or structures exist. Minimum lot level recommendations are presented in Section 4.3.

URBS hydrologic model results show that the proposed development would not increase the peak discharges flowing to the location immediately downstream of the site. There would not be any adverse impacts on downstream properties. As such, on-site detention would not be considered to be required for the proposed development.

MUSIC model results show that a 500 m^2 filter area bio-retention basin would ensure the proposed development meets the water quality objectives required under the State Planning Policy (July 2017).

The site is located within the Great Barrier Reef wetland protection area. The proposed development avoids the use of wetlands for stormwater treatment, as the proposed stormwater treatment device is located outside of the mapped wetland area. The proposed development also avoids the direct discharge of stormwater into the mapped wetland area. The widened open drain and diversion berm proposed within the Tuan Forest land would generally maintain the surface water hydrology by directing the runoff northward along its current flow path. The proposed development would comply with PO3, PO4 and PO5 of State Code 9.

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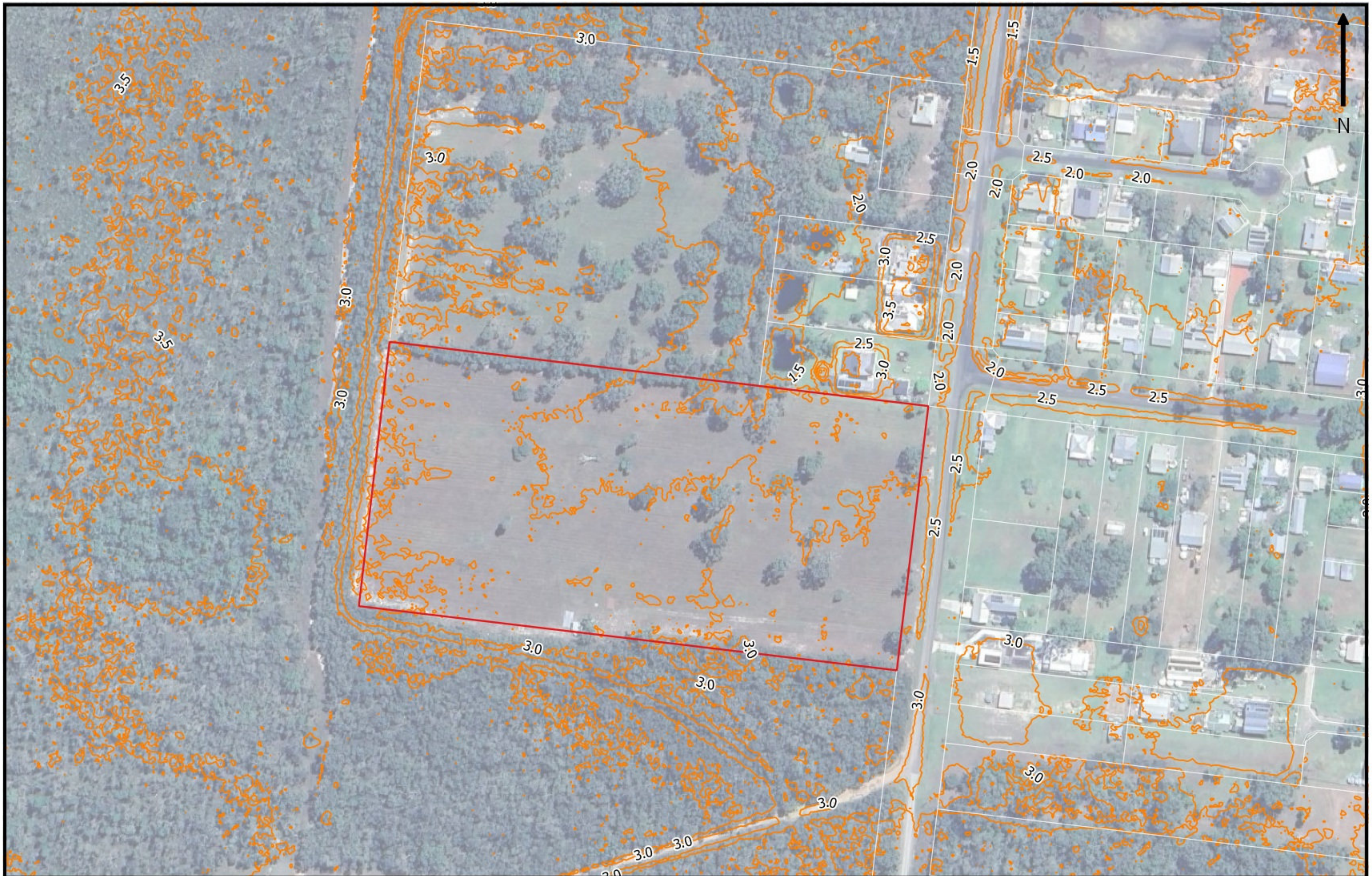
LIST OF APPENDICIES

APPENDIX A

Figures



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Lot 51 Wilkinson Road, Tuan

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Figure 1

Existing Site Plan

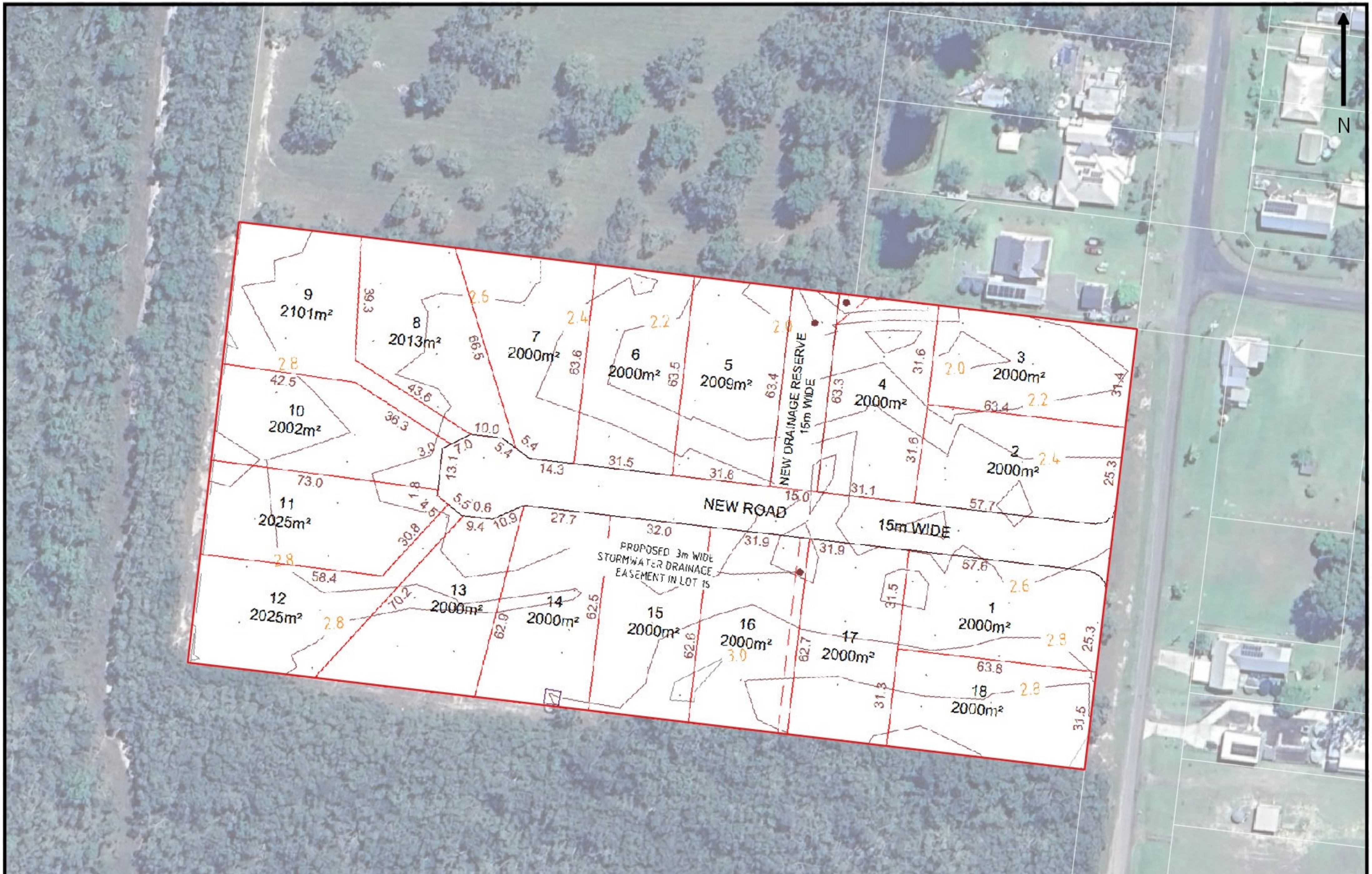

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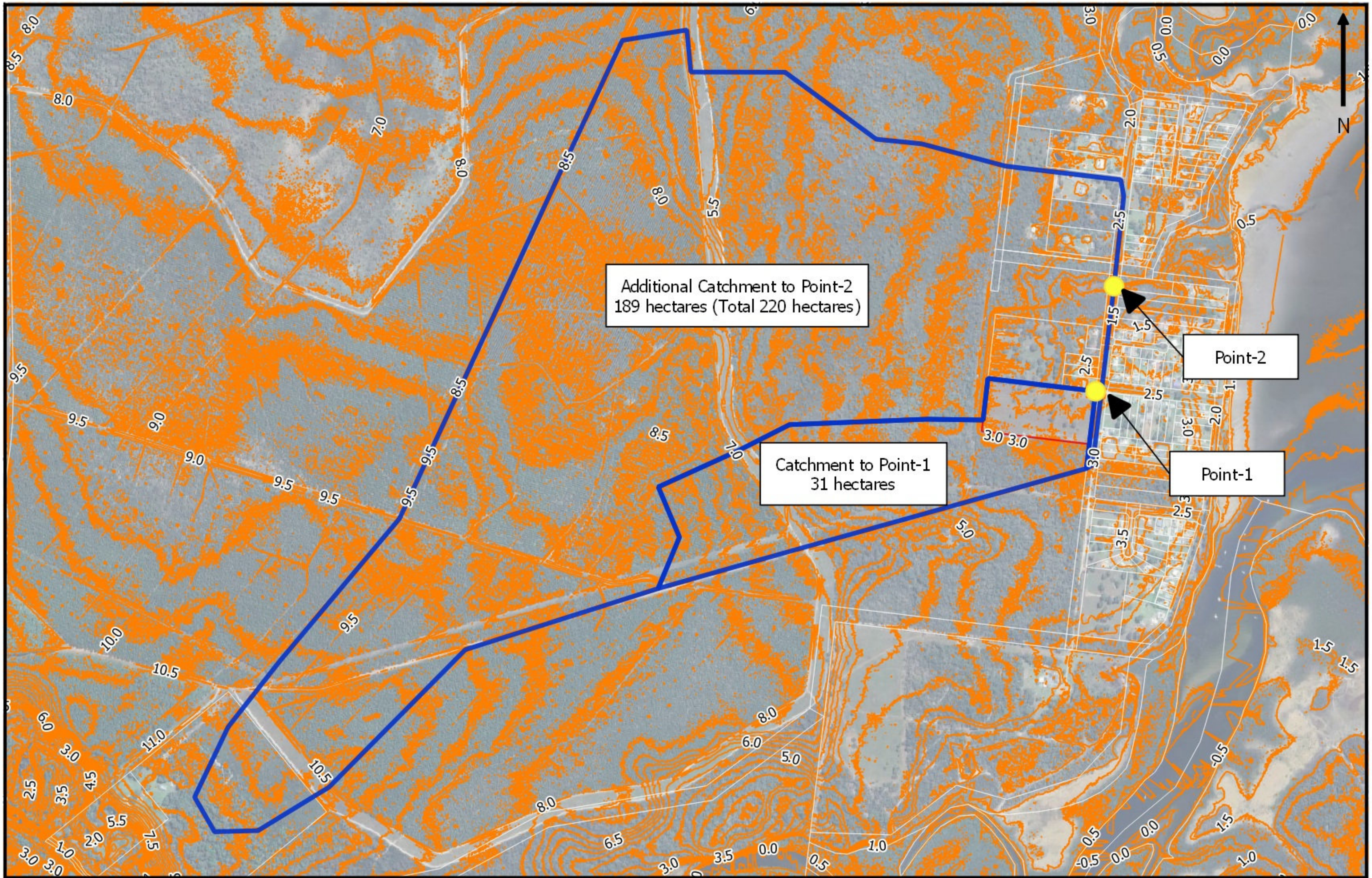
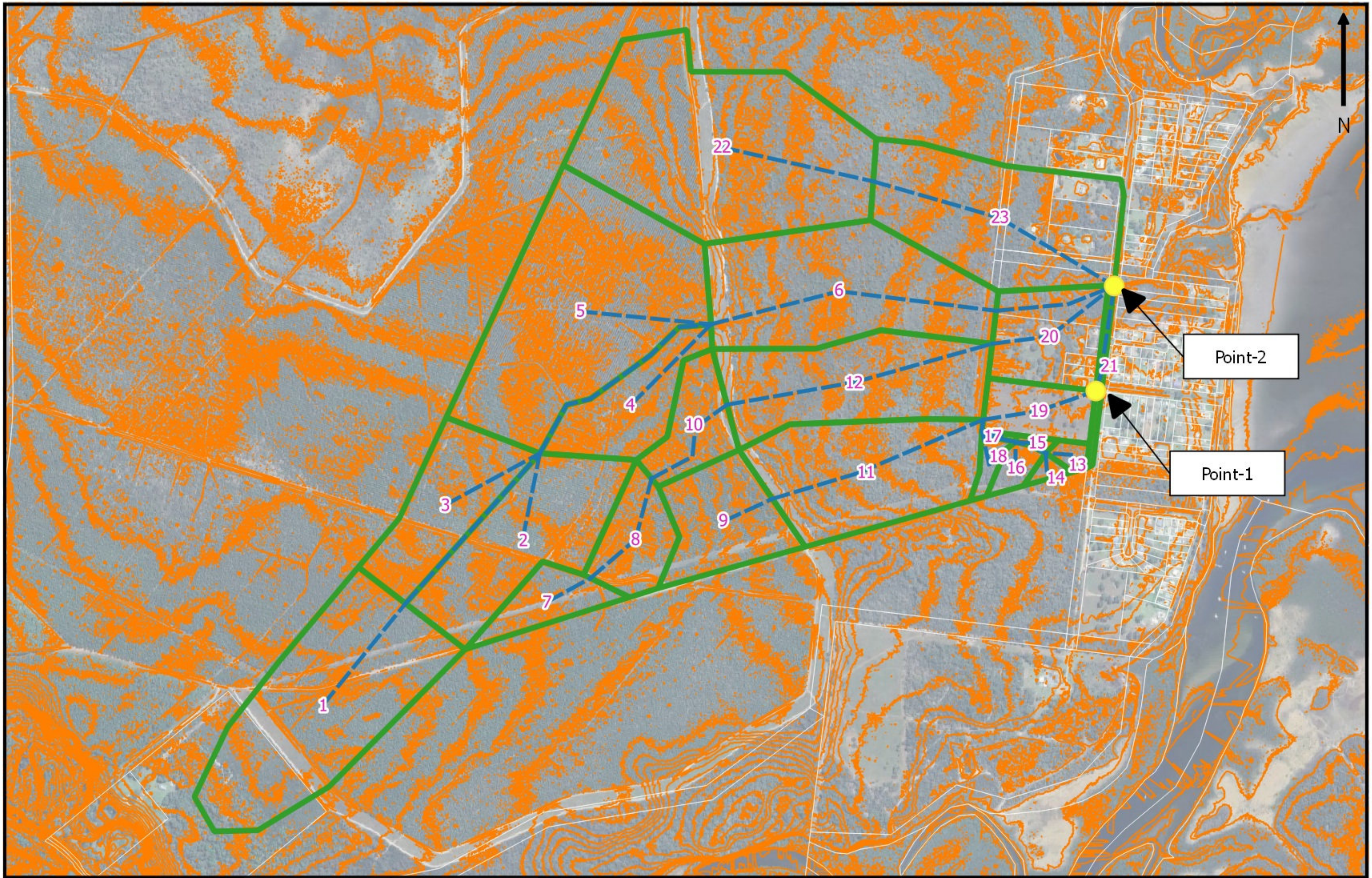
Figure 2

Developed Site Plan



STORM WATER CONSULTING	Drawn	JH	Lot 51 Wilkinson Road, Tuan
1/820 Old Cleveland Rd, Carina QLD 4152	Checked	SNH	Figure 3
Phone (07) 3398 4992	Date	22/05/24	Catchment Plan
	Scale	1:12,500 (A4)	Job No. J9009



Drawn	JH	Lot 51 Wilkinson Road, Tuan	Figure 4a
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Date	22/05/24		
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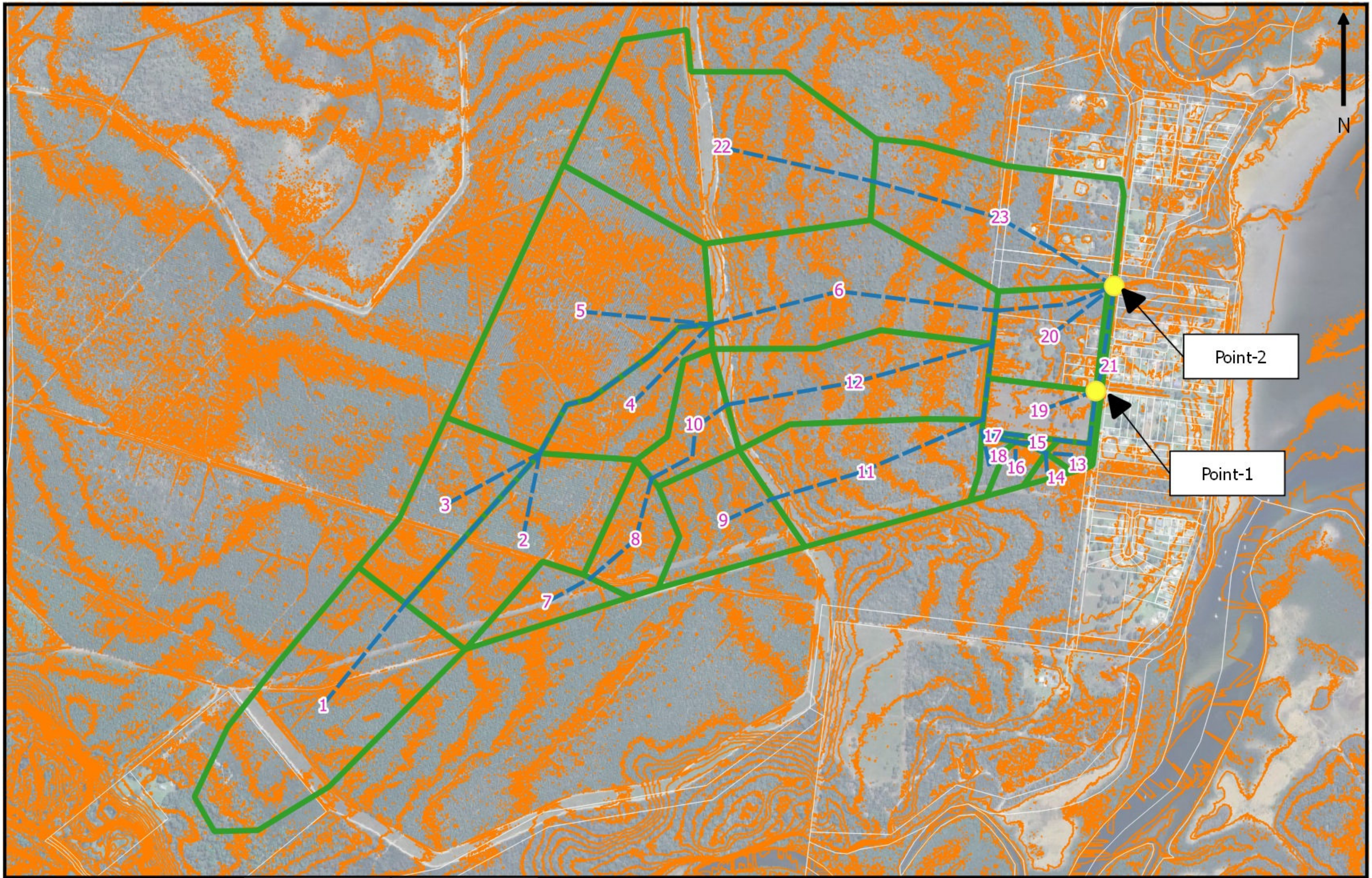

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Date	22/05/24		Developed URBS Model Schematic
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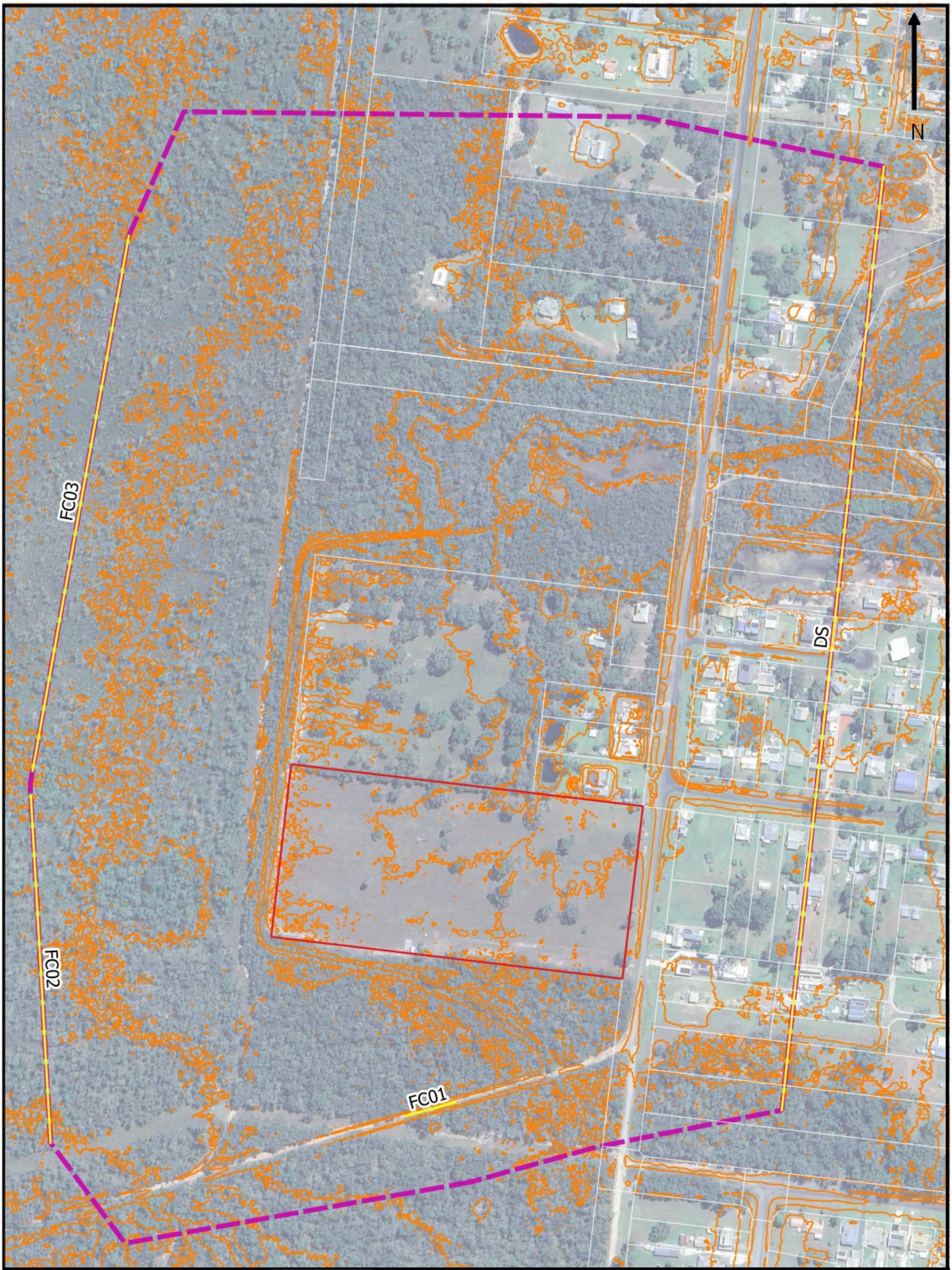
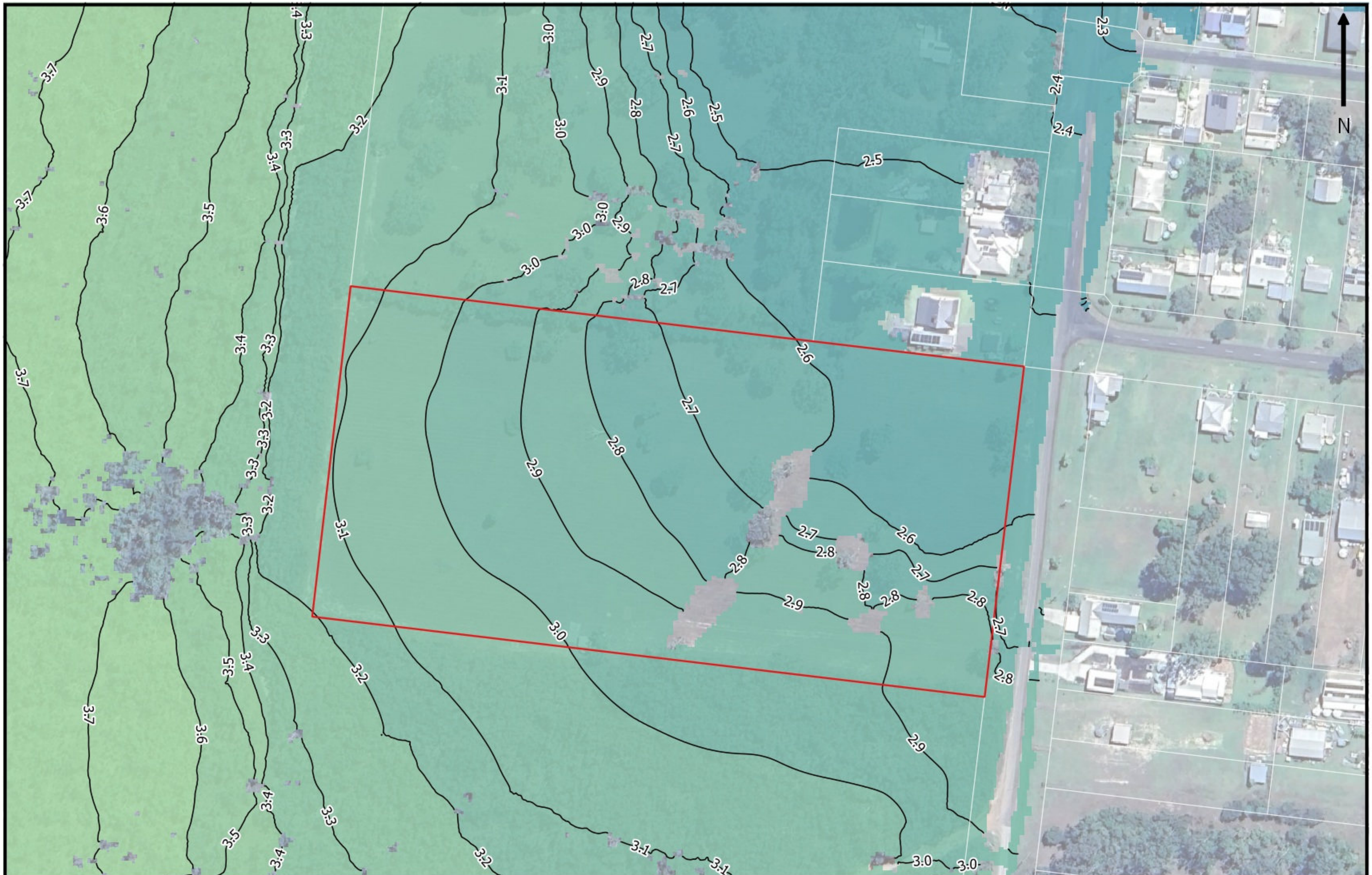


STORM WATER CONSULTING	Drawn	JH	Lot 51 Wilkinson Road, Tuan		Figure 5
	Checked	SNH			
1/820 Old Cleveland Rd Carina QLD 4152 Phone (07) 3398 4992	Date	22/05/24			
	Scale	1:4,000 (A4)	Job No.	J9009	Existing TUFLOW Model



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Drawn	JH
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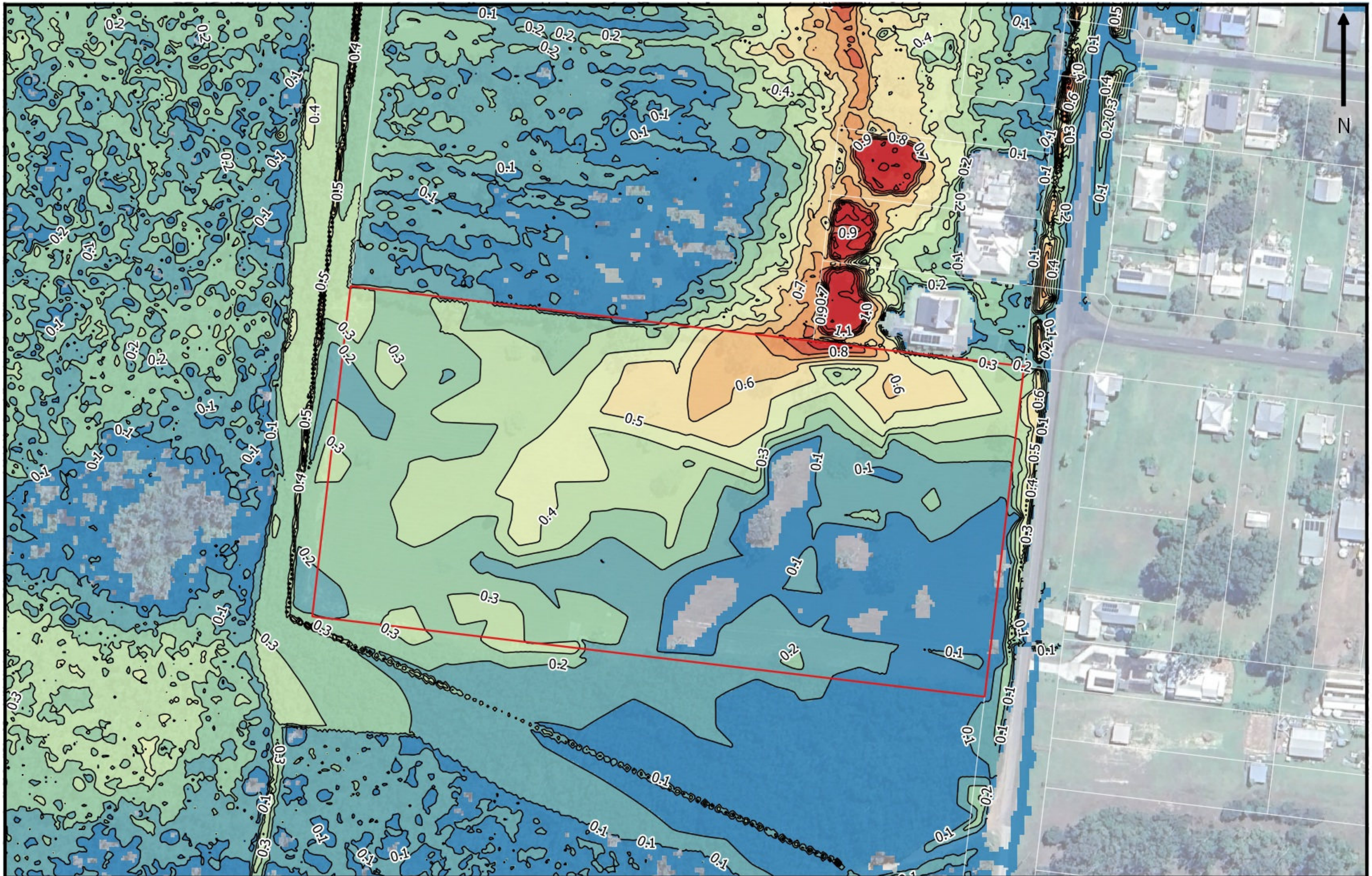
Date	22/05/24
Scale	1:2,000 (A4)

Lot 51 Wilkinson Road, Tuan

Job No. J9009

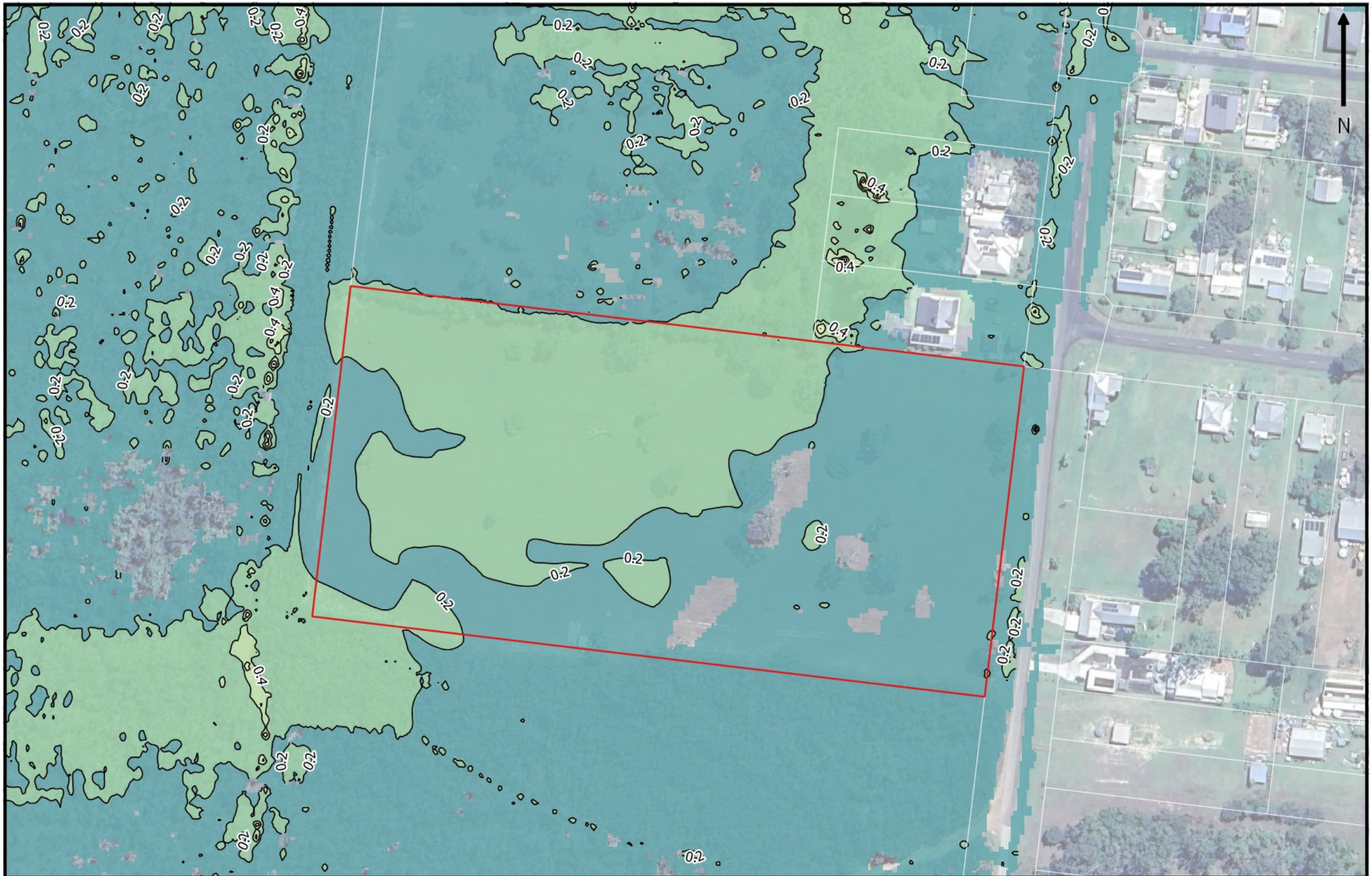
Figure 6a

Existing 1% AEP Levels (m AHD)



Drawn	JH	Lot 51 Wilkinson Road, Tuan	Figure 6b
Checked	SNH		
Date	22/05/24		Existing 1% AEP Depths (metres)
Scale	1:2,000 (A4)	Job No. J9009	

STORM WATER CONSULTING
1/820 Old Cleveland Rd, Carina QLD 4152
Phone (07) 3398 4992



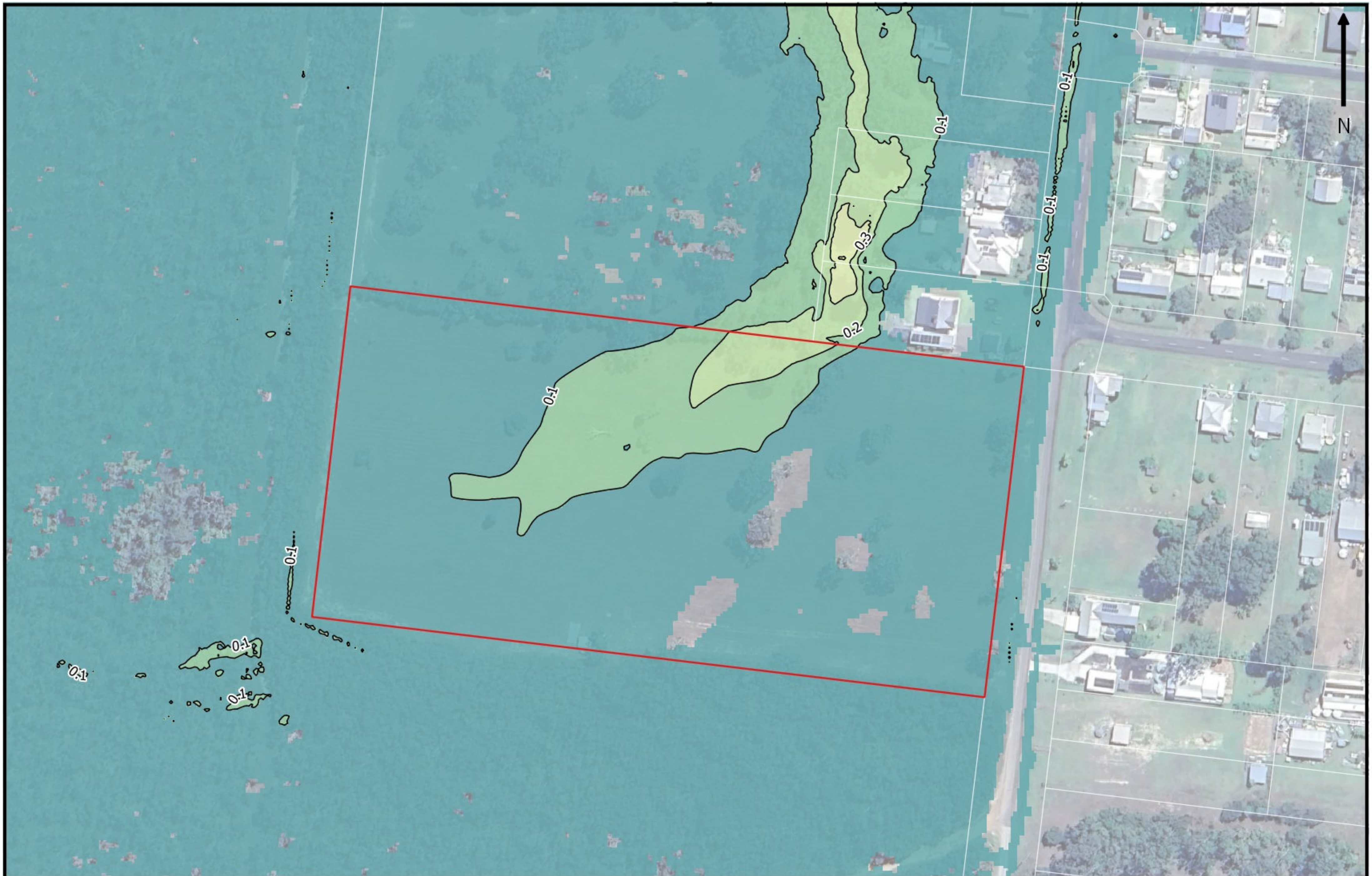
STORM WATER CONSULTING
1/820 Old Cleveland Rd, Carina QLD 4152
Phone (07) 3398 4992

Drawn	JH
Checked	SNH
Date	22/05/24
Scale	1:2,000 (A4)
Job No.	J9009

Lot 51 Wilkinson Road, Tuan

Figure 6c

Existing 1% AEP Velocity (m/s)



STORM WATER CONSULTING
1/820 Old Cleveland Rd, Carina QLD 4152
Phone (07) 3398 4992

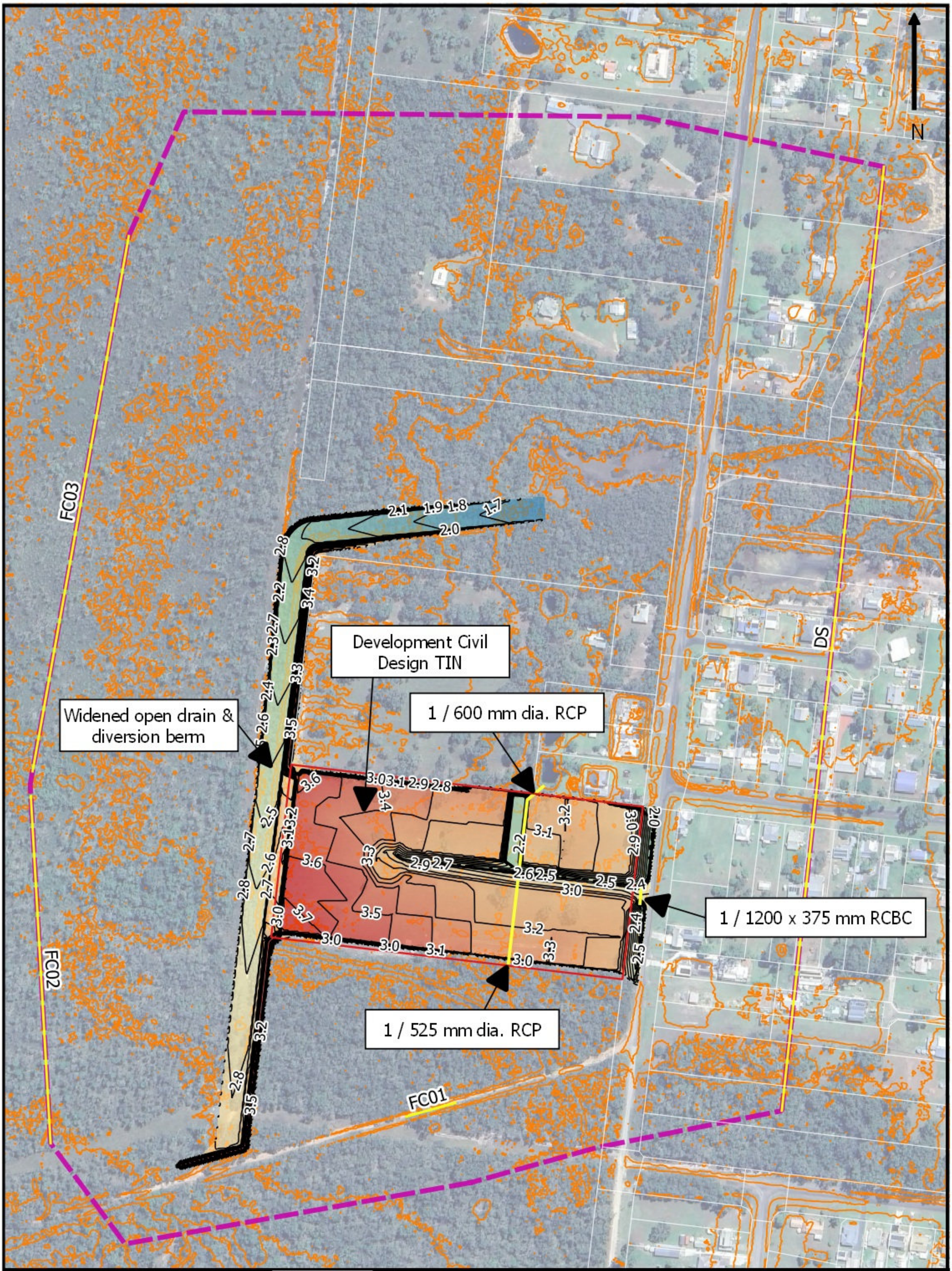
Drawn	JH
Checked	SNH
Date	22/05/24
Scale	1:2,000 (A4)

Lot 51 Wilkinson Road, Tuan

Job No. J9009

Figure 6d

Existing 1% AEP Velocity-Depth (m^2/s)



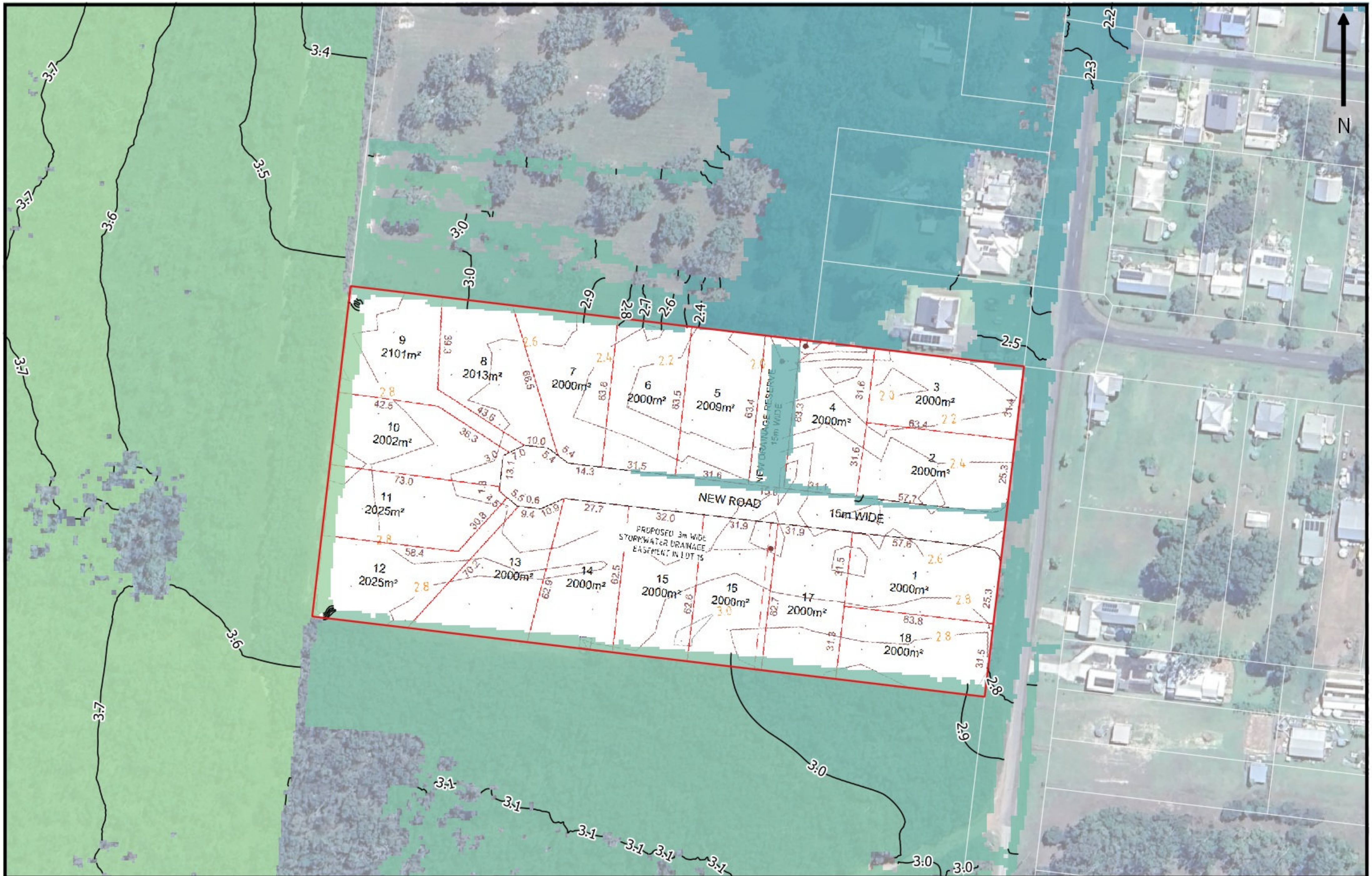
STORM WATER CONSULTING
1/820 Old Cleveland Rd
Carina QLD 4152
Phone (07) 3398 4992

Drawn	JH
Checked	SNH
Date	22/05/24
Scale	1:4,000 (A4)
Job No.	J9009

Lot 51 Wilkinson Road, Tuan

Figure 7

Developed TUFLOW Model



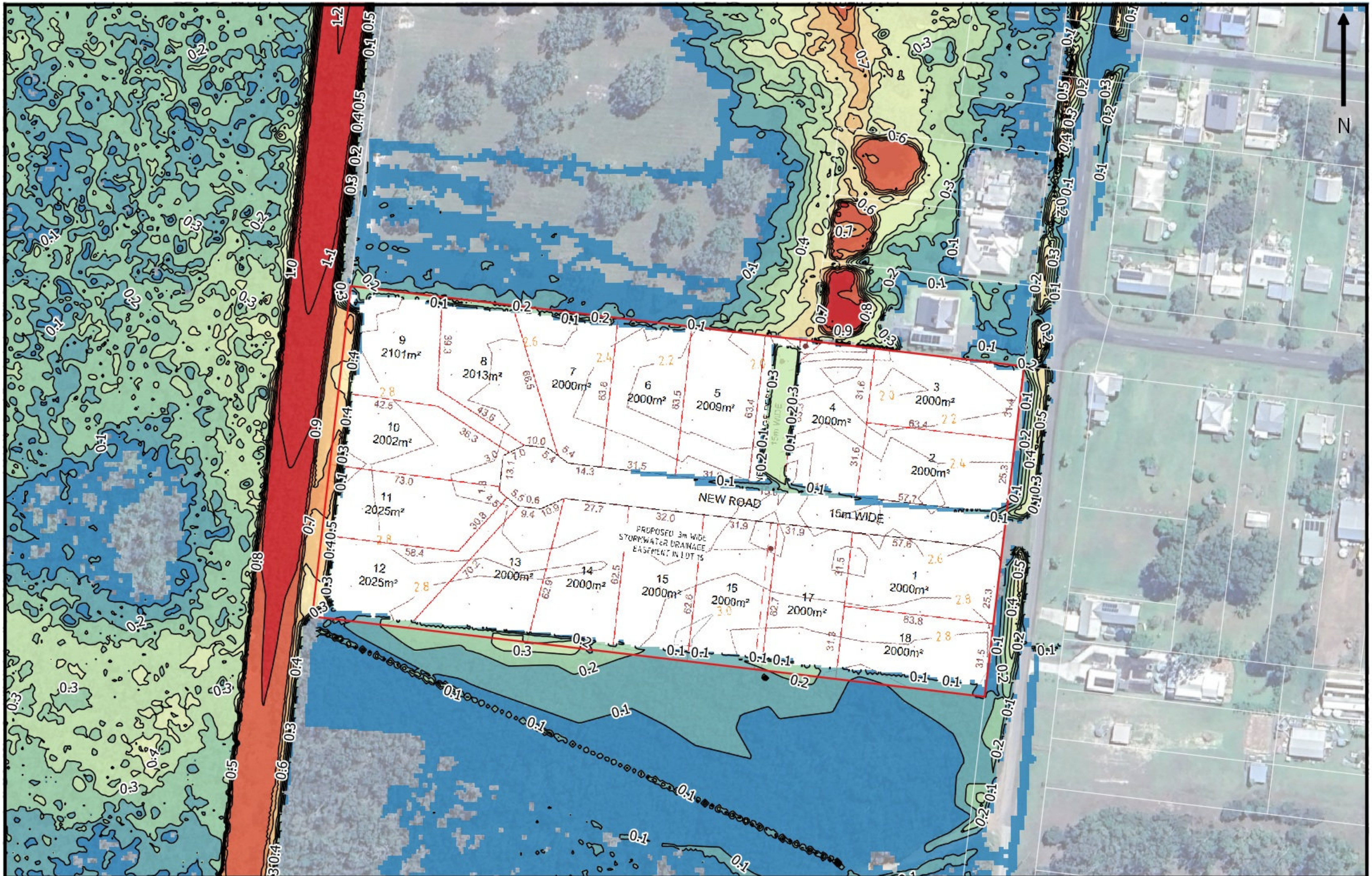
STORM WATER CONSULTING
1/820 Old Cleveland Rd, Carina QLD 4152
Phone (07) 3398 4992

Drawn	JH
Checked	SNH
Date	22/05/24
Scale	1:2,000 (A4)
Job No.	J9009

Lot 51 Wilkinson Road, Tuan

Figure 8a

Developed 1% AEP Levels (m AHD)



STORM WATER CONSULTING

1/820 Old Cleveland Rd, Carina QLD 4152
Phone (07) 3398 4992

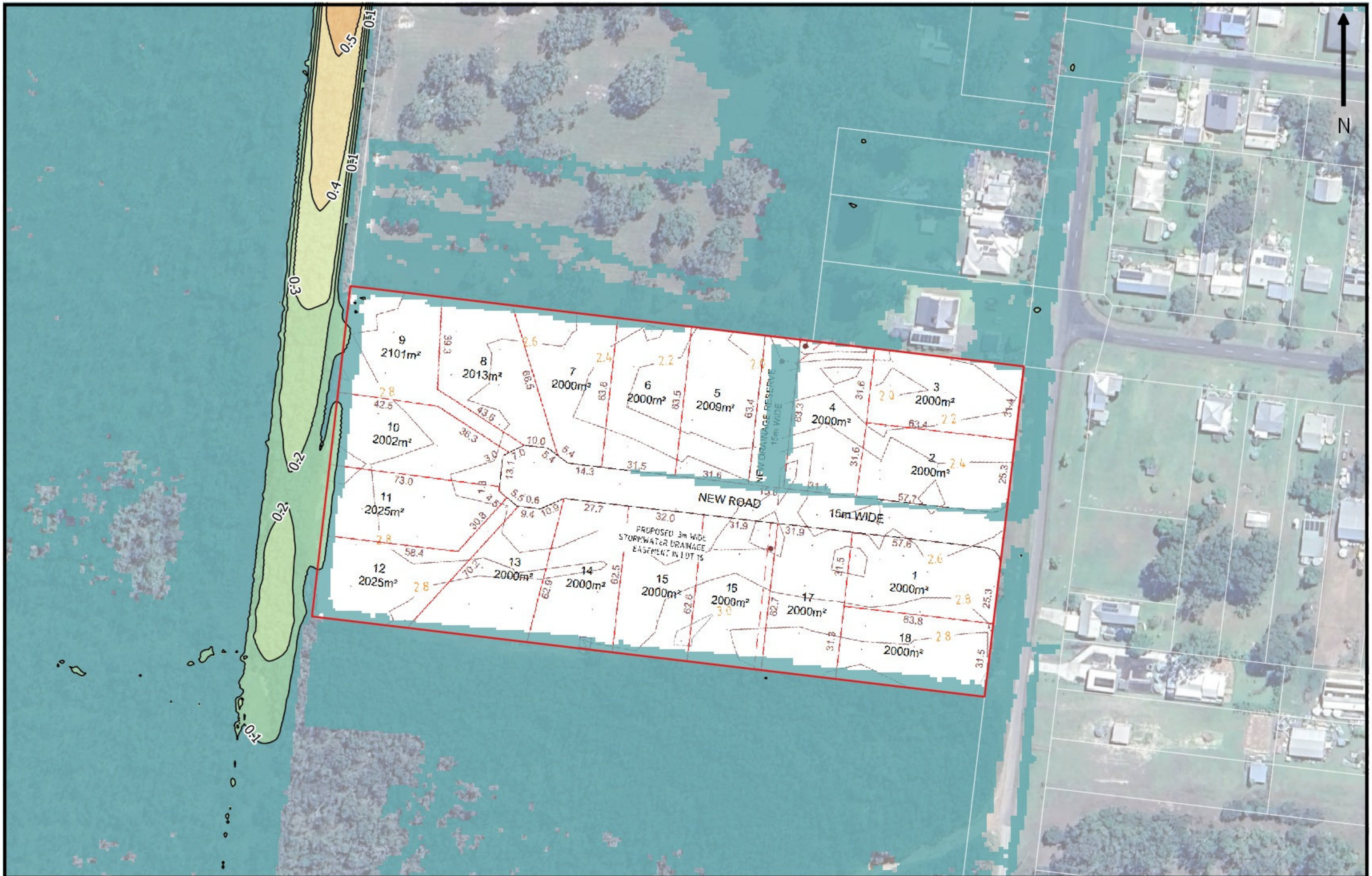
Drawn	JH
Checked	SNH
Date	22/05/24
Scale	1:2,000 (A4)
Job No.	J9009

Lot 51 Wilkinson Road, Tuan

Figure 8b

Developed 1% AEP Depths (metres)

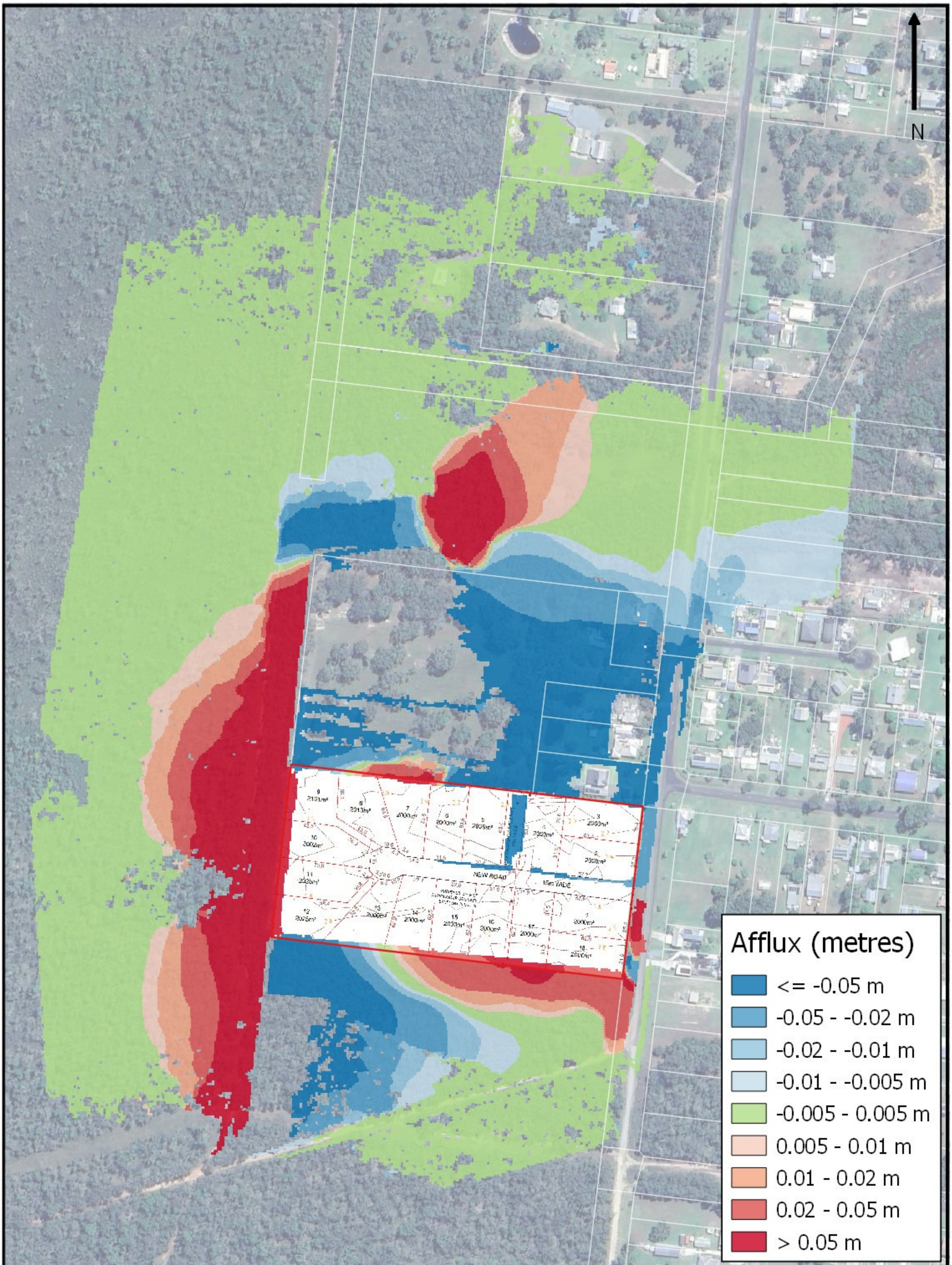
STORM WATER CONSULTING	Drawn	JH	Lot 51 Wilkinson Road, Tuan
1/820 Old Cleveland Rd, Carina QLD 4152	Checked	SNH	Figure 8c
Phone (07) 3398 4992	Date	22/05/24	Developed 1% AEP Velocity (m/s)
	Scale	1:2,000 (A4)	Job No. J9009



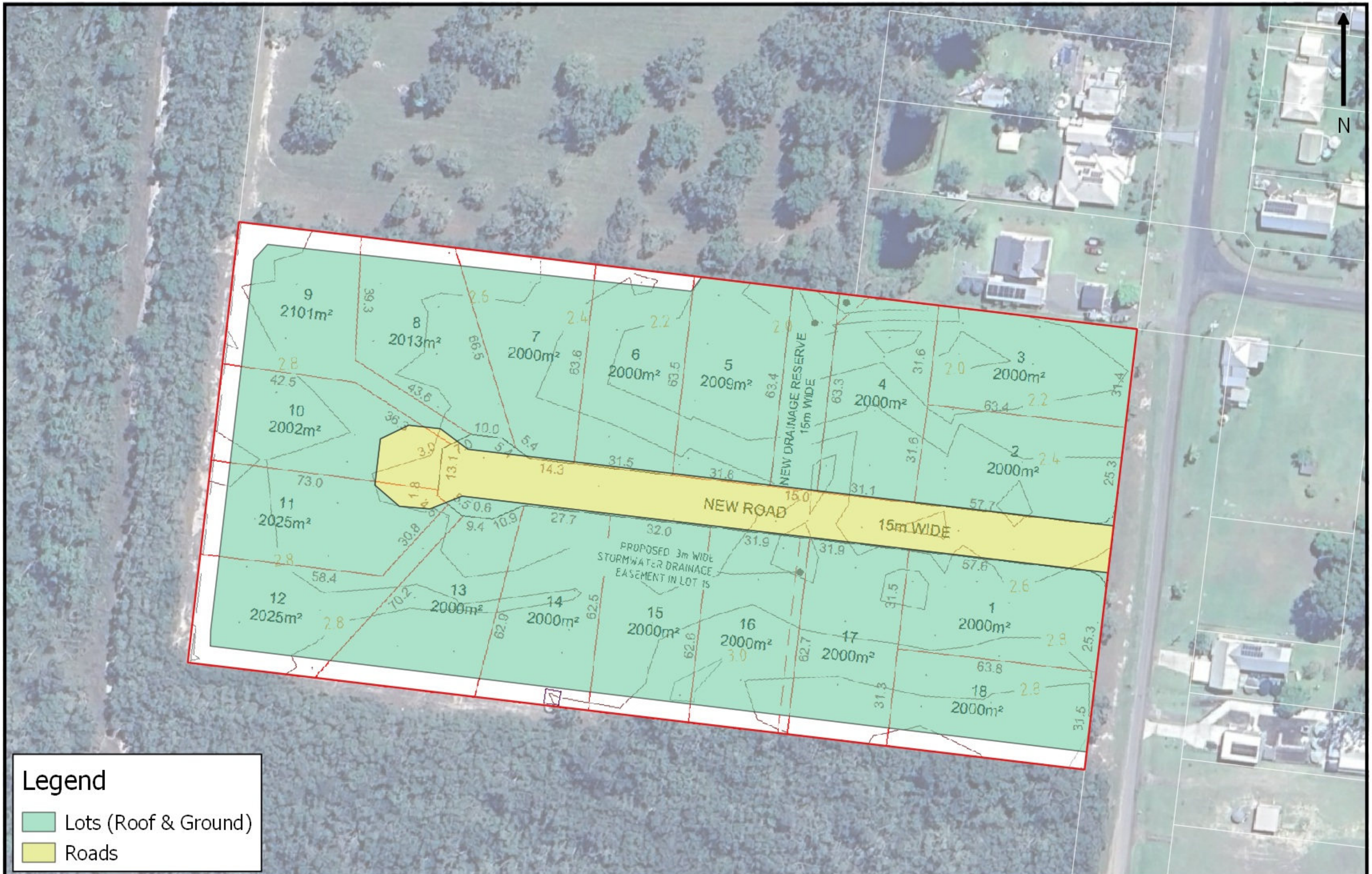
STORM WATER CONSULTING 1/820 Old Cleveland Rd, Carina QLD 4152 Phone (07) 3398 4992	Drawn	JH	Lot 51 Wilkinson Road, Tuan
	Checked	SNH	
	Date	22/05/24	
	Scale	1:2,000 (A4)	Job No. J9009

Figure 8d

Developed 1% AEP Velocity-Depth (m^2/s)



STORM WATER CONSULTING 1/820 Old Cleveland Rd Carina QLD 4152 Phone (07) 3398 4992	Drawn	JH	Lot 51 Wilkinson Road, Tuan	Figure 9
	Checked	SNH		
	Date	22/05/24		
	Scale	1:4,000 (A4)	Job No. J9009	Afflux Impact Plot (metres)



STORM WATER CONSULTING
1/820 Old Cleveland Rd, Carina QLD 4152
Phone (07) 3398 4992

Drawn	JH
Checked	SNH
Date	22/05/24
Scale	1:1,500 (A4)
Job No.	J9009

Lot 51 Wilkinson Road, Tuan

Figure 10

MUSIC Sub Areas

APPENDIX B

Photographs

Photograph 1 – Existing site condition (looking west)

APPENDIX C

Rational Method Calculations

STORM WATER CONSULTING — RATIONAL METHOD CALCULATIONS

Table C 1 a

Project: Tuan | **J9009**

Location: Point 1 - Total Flow - DS

Comments:

Time of Concentration

Upper Catchment Slope	0.5%	
100m sheet flow across dense grass	30	min
Travel Length	1000	metres
Fall	6	metres
Travel Time (Argue)	13	min
Delta for	4	
Time of Concentration	**82.0**	**min**

Rainfall Data:
Rainfall Intensity Frequency Duration data for TUAN

Sub-Areas and Runoff Coefficients

	Area	C10		Areas included in Calculations				Separate c100 > 1.0 and c100 < 1.0					
	ha	Exist	Dev	Condition	Area	C10	C10 x A	C10	C10	C10 x A	C10 x A	Area	Area
Cmt to P1	31.00	0.00	0.53	**Developed**	**31.00**	**0.53**	**16.43**	0.53		16.43		31.00	
Cmt to P2	220.00	0.00	0.53										
					31.00		Sum			16.43	0.00	31.00	0.00
							Total		0.530		16.430		31.000
							Individual	0.530	0.000	16.430	0.000	31.000	0.000

Discharge Calculations

tc			**82.0**
C100>1	Average	c10	**0.000**
		Area (ha)	**0.00**
C100<1 **c10 - 2**	Average		**0.530**
		Area (ha)	**31.00**

Total Catchment
31 ha

Depth	AEP	Fy	Runoff Coefficients		Rainfall	Discharge m^3/s		
mm	%		C100>1	C100<1	(mm/hr)	1	2	Total
42	**63**	0.80	0.00	0.42	30.99	0.00	1.13	**1.13**
48	**50**	0.85	0.00	0.45	35.02	0.00	1.36	**1.36**
65	**20**	0.95	0.00	0.50	47.91	0.00	2.08	**2.08**
78	**10**	1.00	0.00	0.53	56.98	0.00	2.60	**2.60**
90	**5**	1.05	0.00	0.56	66.00	0.00	3.16	**3.16**
107	**2**	1.15	0.00	0.61	78.17	0.00	4.10	**4.10**
120	**1**	1.20	0.00	0.64	87.88	0.00	4.81	**4.81**
137	**0.5**	1.20	0.00	0.64	99.99	0.00	5.48	**5.48**
160	**0.2**	1.20	0.00	0.64	117.27	0.00	6.42	**6.42**

EY	Discharge m^3/s	% of 63% AEP
12	0.283	25%
6	0.453	40%
4	0.566	50%
3	0.679	60%
2	0.849	75%
1.3	1.018	90%
1	1.132	100%

STORM WATER CONSULTING — RATIONAL METHOD CALCULATIONS

Table C 1 b

Project: Tuan | **J9009**

Location: Point 2 - Total Flow - DS

Comments:

Time of Concentration

Upper Catchment Slope	0.5%	
200m sheet flow across dense grass	40	min
Travel Length	2500	metres
Fall	8	metres
Travel Time (Argue)	24	min
Delta for	4	
Time of Concentration	**136.0**	**min**

Rainfall Data:
Rainfall Intensity Frequency Duration data for TUAN

Sub-Areas and Runoff Coefficients

	Area	C10		Areas included in Calculations				Separate c100 > 1.0 and c100 < 1.0					
	ha	Exist	Dev	Condition	Area	C10	C10 x A	C10	C10	C10 x A	C10 x A	Area	Area
Cmt to P1	31.00	0.00	0.53										
Cmt to P2	220.00	0.00	0.53	**Developed**	**220.00**	**0.53**	**116.60**	0.53		116.60		220.00	
					220.00		Sum			116.60	0.00	220.00	0.00
							Total		0.530		116.600		220.000
							Individual	0.530	0.000	116.600	0.000	220.000	0.000

Discharge Calculations

tc			**136.0**
C100>1	Average	c10	**0.000**
		Area (ha)	**0.00**
C100<1 **c10 - 2**	Average		**0.530**
		Area (ha)	**220.00**

Total Catchment
220 ha

Depth	AEP	Fy	Runoff Coefficients		Rainfall	Discharge m^3/s		
mm	%		C100>1	C100<1	(mm/hr)	1	2	Total
50	**63**	0.80	0.00	0.42	21.93	0.00	5.68	**5.68**
56	**50**	0.85	0.00	0.45	24.86	0.00	6.84	**6.84**
78	**20**	0.95	0.00	0.50	34.29	0.00	10.55	**10.55**
93	**10**	1.00	0.00	0.53	40.99	0.00	13.28	**13.28**
108	**5**	1.05	0.00	0.56	47.79	0.00	16.25	**16.25**
130	**2**	1.15	0.00	0.61	57.16	0.00	21.29	**21.29**
146	**1**	1.20	0.00	0.64	64.63	0.00	25.12	**25.12**
167	**0.5**	1.25	0.00	0.66	73.69	0.00	29.83	**29.83**
196	**0.2**	1.30	0.00	0.69	86.49	0.00	36.42	**36.42**

EY	Discharge m^3/s	% of 63% AEP
12	1.421	25%
6	2.273	40%
4	2.842	50%
3	3.410	60%
2	4.263	75%
1.3	5.115	90%
1	5.684	100%

APPENDIX D

URBS Data

9009_Ex.DAT

```
"Index","Area","UF","UR","I"
#1,0.23117,1.00,0.00,0.05
#2,0.13860,1.00,0.00,0.05
#3,0.09571,1.00,0.00,0.05
#4,0.07232,1.00,0.00,0.05
#5,0.27893,1.00,0.00,0.05
#6,0.20129,1.00,0.00,0.05
#7,0.03762,1.00,0.00,0.05
#8,0.05160,1.00,0.00,0.05
#9,0.08068,1.00,0.00,0.05
#10,0.04885,1.00,0.00,0.05
#11,0.15386,1.00,0.00,0.05
#12,0.15437,1.00,0.00,0.05
#13,0.00655,1.00,0.00,0.05
#14,0.00454,1.00,0.00,0.05
#15,0.00272,1.00,0.00,0.05
#16,0.01157,1.00,0.00,0.05
#17,0.00128,1.00,0.00,0.05
#18,0.00868,1.00,0.00,0.05
#19,0.04047,0.00,1.00,0.05
#20,0.07365,0.00,1.00,0.20
#21,0.00742,0.00,1.00,0.80
#22,0.30520,1.00,0.00,0.05
#23,0.19305,0.80,0.20,0.15
```

9009_Ex.U

```
Tuan - Existing
MODEL: Basic
USES: L, U
Default Parameters: alpha=1.20 m=0.8
Catchment File=9009_Ex.dat

Rain    #13     L=0.067
Store.
Rain    #14     L=0.046
Get.
Route thru      #15     L=0.086
Store.
Rain    #15     L=0.059
Store.
Rain    #16     L=0.067
Get.
Get.
Route thru      #17     L=0.097
Store.
Rain    #17     L=0.053
Store.
Rain    #18     L=0.090
Get.
Get.
Route thru      #11     L=0.030
Store.
Rain    #9      L=0.140
Route thru      #11     L=0.241
Add Rain        #11     L=0.356
Get.
Route thru      #19     L=0.148
Add Rain        #19     L=0.161
Print. P1
Route thru      #21     L=0.042
Add Rain        #21     L=0.241
Store.
Rain    #7      L=0.131
Route thru      #8      L=0.157
Add Rain        #8      L=0.167
Route thru      #10     L=0.200
Add Rain        #10     L=0.104
Route thru      #12     L=0.344
Add Rain        #12     L=0.378
Route thru      #20     L=0.153
Add Rain        #20     L=0.217
Store.
Rain    #1      L=0.346
Route thru      #2      L=0.534
Store.
Rain    #2      L=0.231
Store.
```

```
Rain    #3      L=0.286
Get.
Get.
Route thru      #4      L=0.599
Store.
Rain    #4      L=0.301
Store.
Rain    #5      L=0.351
Get.
Get.
Route thru      #6      L=0.350
Add Rain        #6      L=0.419
Route thru      #20     L=0.323
Store.
Rain    #22     L=0.412
Route thru      #23     L=0.347
Add Rain        #23     L=0.354
Get.
Get.
Get.
Print. P2
end of catchment details.
```

9009_Dev1.DAT

```
"Index","Area","UF","UR","I"
#1,0.23117,1.00,0.00,0.05
#2,0.13860,1.00,0.00,0.05
#3,0.09571,1.00,0.00,0.05
#4,0.07232,1.00,0.00,0.05
#5,0.27893,1.00,0.00,0.05
#6,0.20129,1.00,0.00,0.05
#7,0.03762,1.00,0.00,0.05
#8,0.05160,1.00,0.00,0.05
#9,0.08068,1.00,0.00,0.05
#10,0.04885,1.00,0.00,0.05
#11,0.15386,1.00,0.00,0.05
#12,0.15437,1.00,0.00,0.05
#13,0.00655,1.00,0.00,0.05
#14,0.00454,1.00,0.00,0.05
#15,0.00272,1.00,0.00,0.05
#16,0.01157,1.00,0.00,0.05
#17,0.00128,1.00,0.00,0.05
#18,0.00868,1.00,0.00,0.05
#19,0.04047,0.00,1.00,0.31
#20,0.07365,0.00,1.00,0.20
#21,0.00742,0.00,1.00,0.80
#22,0.30520,1.00,0.00,0.05
#23,0.19305,0.80,0.20,0.15
```

9009_Dev1.U

```
Tuan - Development1
MODEL: Basic
USES: L, U
Default Parameters: alpha=1.20 m=0.8
Catchment File=9009_Dev1.dat

Rain    #13     L=0.067
Store.
Rain    #14     L=0.046
Get.
Route thru      #15     L=0.086
Store.
Rain    #15     L=0.059
Store.
Rain    #16     L=0.067
Get.
Get.
Route thru      #17     L=0.097
Store.
Rain    #17     L=0.053
Store.
Rain    #18     L=0.090
Get.
Get.
Route thru      #17     L=0.287
Route thru      #21     L=0.141
```

```
Store.
Rain    #19     L=0.161
Get.
Print. P1
Route thru      #21     L=0.042
Add Rain        #21     L=0.241
Store.
Rain    #9      L=0.140
Route thru      #11     L=0.241
Add Rain        #11     L=0.356
Route thru      #12     L=0.203
Store.
Rain    #7      L=0.131
Route thru      #8      L=0.157
Add Rain        #8      L=0.167
Route thru      #10     L=0.200
Add Rain        #10     L=0.104
Route thru      #12     L=0.344
Add Rain        #12     L=0.378
Get.
Route thru      #6      L=0.088
Store.
Rain    #1      L=0.346
Route thru      #2      L=0.534
Store.
Rain    #2      L=0.231
Store.
Rain    #3      L=0.286
Get.
Get.
Route thru      #4      L=0.599
Store.
Rain    #4      L=0.301
Store.
Rain    #5      L=0.351
Get.
Get.
Route thru      #6      L=0.350
Add Rain        #6      L=0.419
Get.
Route thru      #20     L=0.323
Store.
Rain    #20     L=0.217
Store.
Rain    #22     L=0.412
Route thru      #23     L=0.347
Add Rain        #23     L=0.354
Get.
Get.
Get.
Print. P2
end of catchment details.
```

APPENDIX E

Design Plans

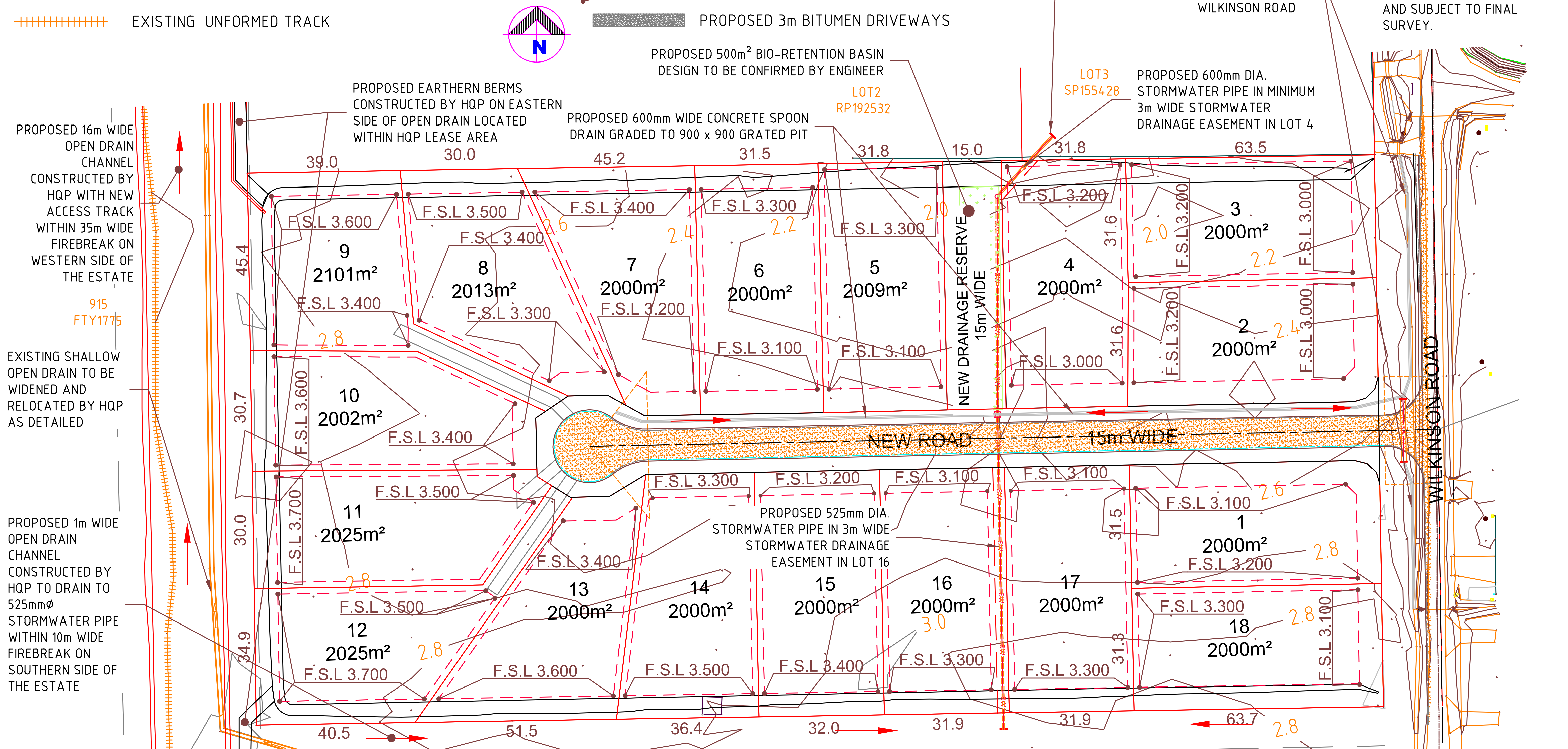
APPENDIX A

LEGEND

- EXISTING CONTOUR (0.20m) A.H.D. (12.40)
- EXISTING STORMWATER DRAINAGE LINE (SW)
- EXISTING EDGE OF BITUMEN
- EXISTING GRADE OF OPEN DRAIN
- EXISTING TELSTRA SERVICE (PIT)
- EXISTING O/H ELECTRICITY (POWER POLE)
- EXISTING UNFORMED TRACK
- PROPOSED AC SURFACED ROAD PAVEMENT
- PROPOSED MOUNTABLE KERB (TYPE L)
- PROPOSED EDGE RESTRAINT (TYPE Q)
- PROPOSED OPEN CHANNEL DRAIN
- PROPOSED CONCRETE SPOON DRAIN
- F.S.L 3.300 PROPOSED TOPSOILED F.S. PAD LEVELS
- PROPOSED 3m BITUMEN DRIVEWAYS

R.P. DETAILS
LOT 51
MCH 567

NOTES
1. PROPOSED STAGE 1: LOTS 1 TO 3 & 18.
2. PROPOSED LOT DIMENSIONS AND AREAS ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEY.



No	DATE	AMENDMENTS

ASSOCIATED PLANNING CONSULTANT
URBAN PLANET

ASSOCIATED SURVEYING CONSULTANT
PACIFIC COAST SURVEYS PTY LTD

CLIENT
MARK & JULIANNE GRUNSKE

PROJECT
PROPOSED SUBDIVISION AT WILKINSON STREET TUAN

SIGNED: A.J. McVey 26/04/24
for and on behalf of
TONY McVEY Pty Ltd
ABN 18 061 348 436
Consulting Engineer
P.O. BOX 941, HERVEY BAY 4655
Phone: (07) 4128 4699
Mobile: 0427 062 952
Email: hbmcvey@bigpond.com
Director: Tony McVey B.E.(Civil), M.I.E.Aust., R.P.E.Q. No. 2648

DESIGNED BY: T. McVey
DRAWN BY: T. McVey
CHECKED BY: T. McVey
APPROVED BY: T. McVey

DATE: 26/04/2024
SCALES: 1:1000 (0 10 20)

TITLE
ESTATE EARTHWORKS, ROADWORKS & STORMWATER DRAINAGE LAYOUT PLAN

JOB NUMBER: C20057
SHEET SIZE: A3
DRAWING NUMBER: 20057-Sk5

LEGEND

- EXISTING CONTOUR (0.20m) A.H.D.
- EXISTING STORMWATER DRAINAGE LINE
- EXISTING EDGE OF BITUMEN
- EXISTING GRADE OF OPEN DRAIN
- EXISTING TELSTRA SERVICE (PIT)
- EXISTING O/H ELECTRICITY (POWER POLE)
- EXISTING UNFORMED TRACK

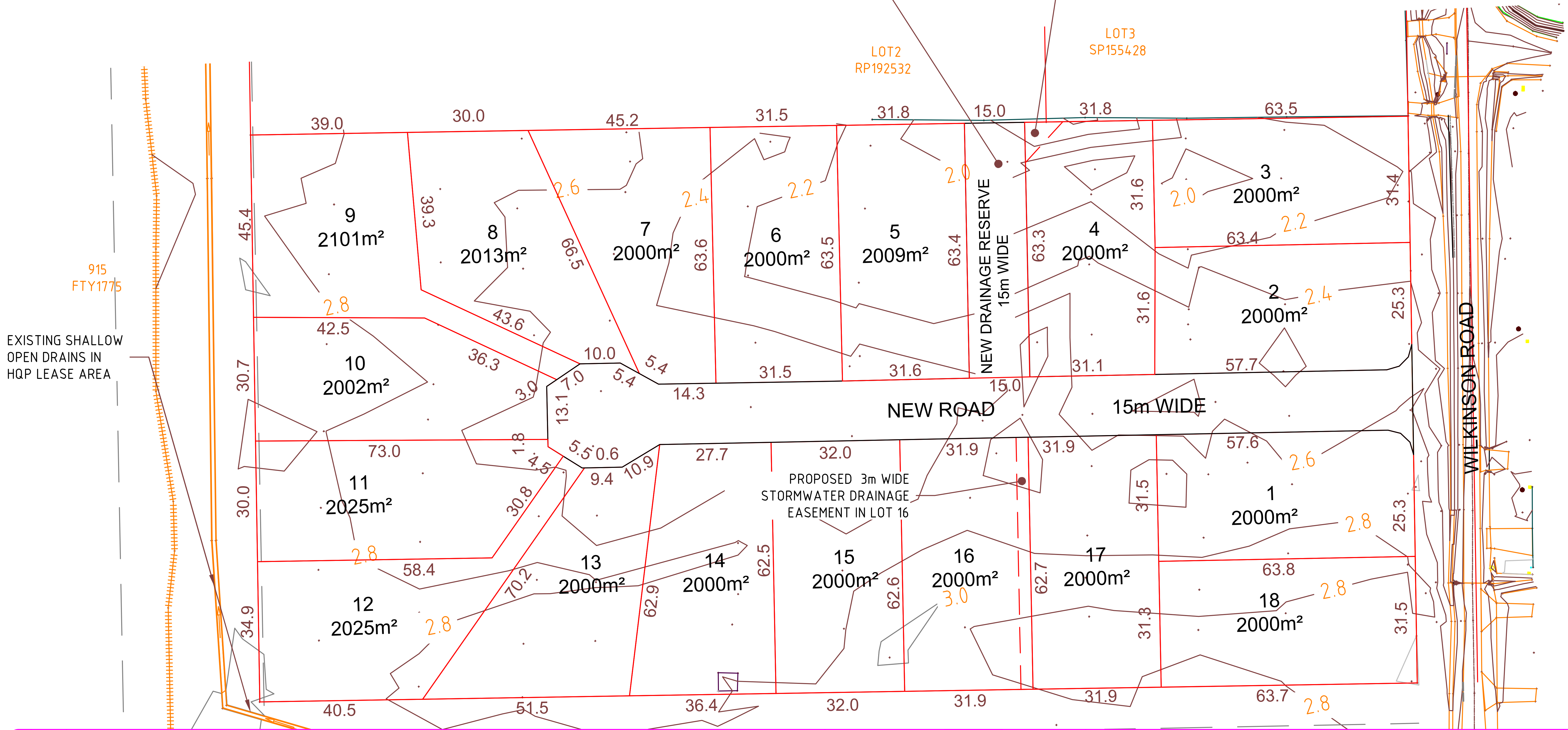
PROPOSED 15m WIDE DRAINAGE RESERVE FOR PROPOSED 500m² BIO-RETENTION BASIN DESIGN TO BE CONFIRMED BY ENGINEER

PROPOSED MINIMUM 3m WIDE STORMWATER DRAINAGE EASEMENT IN LOT 4 TO DISCHARGE INTO DAM ON LOT3 SP155428 WITH WRITTEN AGREEMENT OF EXISTING OWNER

R.P. DETAILS
LOT 51
MCH 567

NOTES
1. PROPOSED STAGE 1: LOTS 1 TO 3 & 18.

2. PROPOSED LOT DIMENSIONS AND AREAS ARE APPROXIMATE ONLY AND SUBJECT TO FINAL SURVEY.



No	DATE	AMENDMENTS

ASSOCIATED PLANNING CONSULTANT
URBAN PLANET

ASSOCIATED SURVEYING CONSULTANT
PACIFIC COAST SURVEYS PTY LTD

CLIENT
MARK & JULIANNE GRUNSKE

PROJECT
PROPOSED SUBDIVISION AT WILKINSON STREET TUAN

SIGNED: A.J. McVey 26/04/24
for and on behalf of
TONY McVEY Pty Ltd
ABN 18 061 348 436
Consulting Engineer
P.O. BOX 941, HERVEY BAY 4655
Phone : (07) 4128 4699
Mobile: 0427 062 952
Email: hbmcvey@bigpond.com
Director: Tony McVey B.E.(Civil), M.I.E.Aust., R.P.E.Q. No. 2648

DESIGNED BY T. McVey | DRAWN BY T. McVey
CHECKED BY T. McVey | APPROVED BY T. McVey

FIGURED DIMENSIONS TAKE PRECEDENCE OVER SCALES
VERIFY ALL DIMENSIONS ON SITE.

DATE 26/04/2024

SCALES 1:1000
0 10 20

TITLE
ESTATE LOT LAYOUT PLAN

JOB NUMBER C20057
SHEET SIZE A3
DRAWING NUMBER 20057-Sk6

APPENDIX F

Bio-Retention Basin Maintenance Checklist

BIORETENTION BASIN MAINTENANCE CHECKLIST				
Inspection Frequency:	1 to 6 monthly		Date of Visit:	
Location:				
Description:				
Asset I.D.				
Site Visit by:				
INSPECTION ITEMS:		Y	N	Action Required (details)
Sediment accumulation at inflow points?				
Litter within basin?				
Erosion at inlet or other key structures?				
Traffic damage present?				
Evidence of dumping (e.g. building waste)?				
Vegetation condition satisfactory (density, weeds etc)?				
Watering of vegetation required?				
Replanting required?				
Mowing/slashing required?				
Clogging of drainage points (sediment or debris)?				
Evidence of ponding?				
Damage/vandalism to structures present?				
Surface clogging visible?				
Drainage system inspected?				
Resetting of system required?				
COMMENTS				