YARRABILBA

PRECINCT 8 ROL1

STORMWATER MANAGEMENT PLAN

VERSION 2

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV-2026-YAR-4663

Date: 5 June 2026

Queensland Government

DesignFlow

Prepared for Stockland

April 2026

Document Control Sheet

Report Title:	Yarrabilba Precinct 8 ROL1 Stormwater Management Plan
Suggested Reference:	Yarrabilba Precinct 8 ROL1 Stormwater Management Plan (DesignFlow, 202)
Version:	2
Client:	Stockland
Author(s):	Nic Smith
Reviewed By:	Shaun Leinster
Approved By:	Shaun Leinster RPEQ: 15637
Date:	09/04/2026
File Location:	S:\Projects\4543
Circulation:	Electronic Copies: Stockland, RPS, KN Group

Disclaimer

Potential implications of climate change

Unless expressly stated otherwise, historical climate data has been used in, or underpins, the analyses that are presented in this report. The historical climate is not necessarily a valid indicator of future climate, which may contain prolonged periods that are wetter or drier than the historical record used for this analysis. There is significant uncertainly surrounding how climate, and in particular, rainfall, will be impacted by various levels of greenhouse gas accumulation in the atmosphere. Rainfall has a much greater spatial variability than temperature and some areas are likely to become wetter whilst other areas become drier. Further to this there may be changes in the seasonality and intensity of rainfall. Such changes in climate could affect the conclusions and recommendations of this report.

Inherent natural variability in soils and plants

Where particular types of soils are recommended, such recommendations are based on information provided by soils suppliers, laboratories and published industry guidelines. There can be inconsistencies in the behaviour of soils under field conditions compared to laboratory conditions, and, for both natural and blended soils, many soils are non-homogenous and properties and behaviour can be variable. Where particular plant species have been recommended, such recommendations are based on botanical knowledge and observations of similar species growing in similar, but not identical conditions. Plants can be sensitive to subtle changes in climate, hydrology, soil and surrounding ecological conditions. Further to this, plant health is often closely linked to the level of maintenance provided. No warranty or guarantee, whether explicit or implied is made with respect to the suitability or performance of soils or plant species recommended in this report

Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

The Yarrabilba Priority Development (PDA) is located within the Logan City Council area and occupies a former pine plantation situated south of Logan Village. The Yarrabilba PDA was declared by regulation under the Economic Development Act (2012). Yarrabilba is part of a regional growth area identified in the South East Queensland Regional Plan, which identifies a need for a further 70,000 dwellings across a number of localities in the Logan City Council area by 2031. The Yarrabilba development aims to provide approximately 17,000 dwellings for a population of 45,000.

Precinct 8 ROL1 (subject site) covers an area of approximately 63 ha which includes around 33.5 ha of development lots, 19.4 ha of roads 7.2 ha of recreational land linear park and just over 3 ha of drainage open space.

This document presents the stormwater management strategy for the subject site to meet the requirements set out in the *Context Planning Area Strategy – Precinct 8 & 9* (RPS, 2024). These are generally consistent with the S*tate Planning Policy*, *Yarrabilba Total Water Cycle Management Strategy* (DesignFlow, 2024) and *Yarrabilba Stormwater Infrastructure Master Plan* (DesignFlow, 2024). This report provides details of the proposed stormwater quality treatment and waterway stability management including location, conceptual sizing and functional earthworks.

This report focuses on the construction phase erosion/sediment control and operational phase stormwater quality and waterway elements specific to Precinct 8 ROL1. Flood management has been addressed separately in the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) as the flood management strategy spans numerous current and future precincts requiring site wide planning. No flood detention infrastructure is required within the subject precinct.

2 SITE CHARACTERISTICS

2.1 LOCATION

Precinct 8 ROL1 (P8 ROL1) lies in the central portion of the Stockland Yarrabilba site and forms the south west corner of the broader Precinct 8 zone as shown in Figure 1. The subject development area covers a total area of approximately 63 ha. It forms part of the broader Precinct 8 & 9 Context Planning Area Strategy (CPAS) endorsed by EDQ (DEV2011/187/31, 25 February 2025)

2.2 TOPOGRAPHY, CATCHMENTS AND DRAINAGE

The existing topography across Precinct 8 exhibits reasonably consistent grades in the order of 4-5% falling generally east and west off a central ridgeline with lower gradients along the waterways. Waterway corridors define the north eastern and western edge of development while existing P6 ROL3 zone adjoins to the east. Elevation varies from 32mAHD to 64mAHD within the P8 ROL1 site. The site topography is shown in Figure 2.

Precinct 8 ROL1 sits generally within flood Catchment QC-4 of the broader Yarrabilba development site as defined in Figure 2 of the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024).

2.2.1 Lawful Point of Discharge

The lawful point of discharge for stormwater from Precinct 8 ROL1 is to the existing waterways on the northeastern and western boundaries, which confluence and flow north to the southern tributary of Quinzeh Creek as illustrated in Figure 1 and Figure 2. This watercourse (south of the Powerlink easement) is mapped as a drainage feature under the Water Act (2000). Quinzeh Creek flows through Yarrabilba before discharging north (between Precinct 3A and 3C) near Steele Road approximately 3 km downstream of Precinct 8 ROL1.

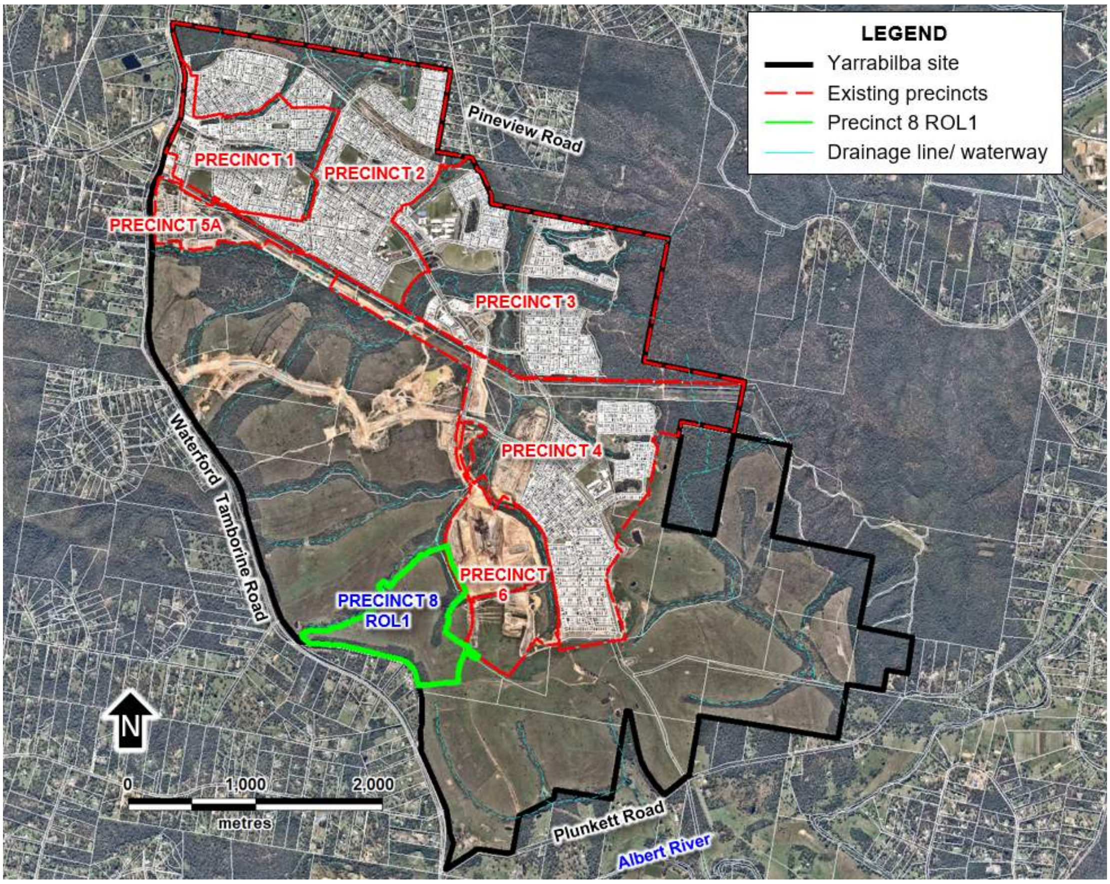


Figure 1: Yarrabilba Precinct 8 ROL1 locality

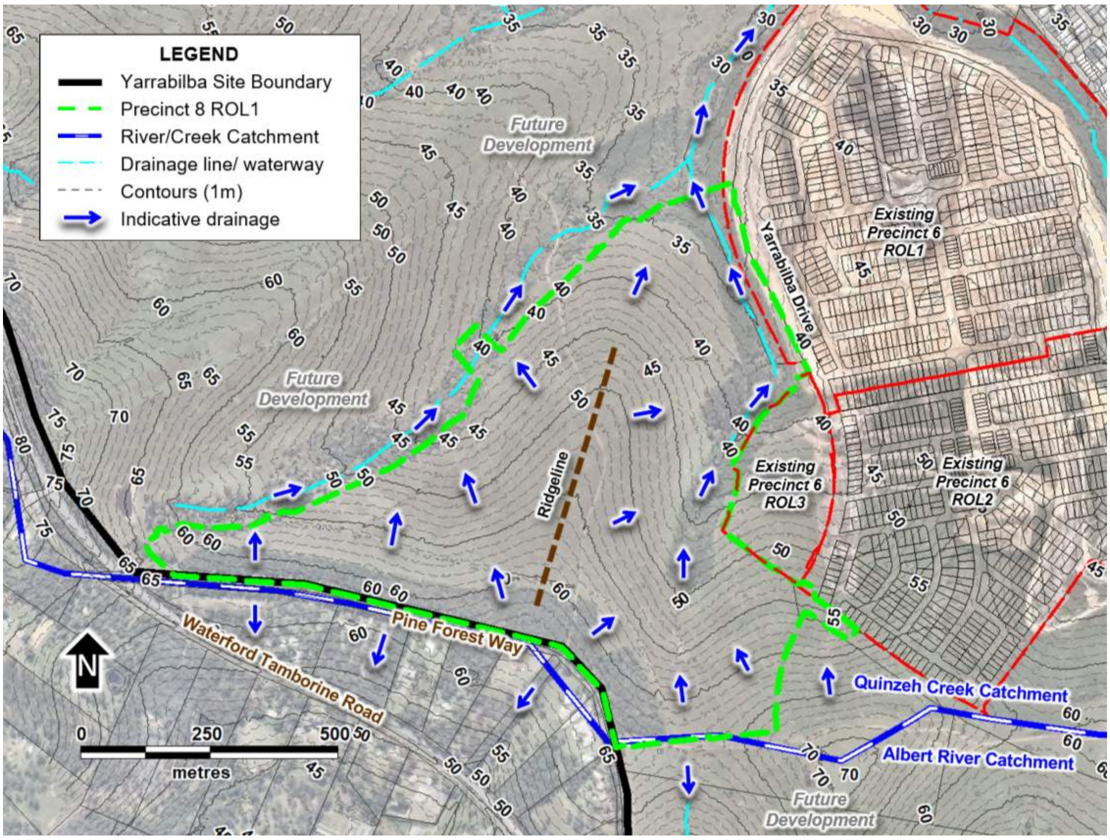


Figure 2: Existing topography, catchments and drainage

2.3 GEOLOGY AND SOILS

Geological mapping indicates Precinct 8 ROL1 is located across two geological units:

- Woogaroo sub-group (RJbw)
- Alluvium (Qa)

Broad scale geotechnical investigations completed across the site (Bowler, 2004) indicate subsurface soils are typically sands overlying silty clays and weathered sandstones. The soil conditions for much of Precinct 8 ROL1 are not expected to vary significantly from those encountered in the balance of Precinct 3 and 4 previously (i.e. those within the lower slope development zones). The alluvium zones (northern portion of P8 ROL1) have often displayed deep sand zones in localised areas where historic channel/creek incisions have been filled with sediment eroded from upslope catchments. Further site specific geotechnical investigations will occur within Precinct 8 ROL1 to confirm soil conditions for civil engineering design.

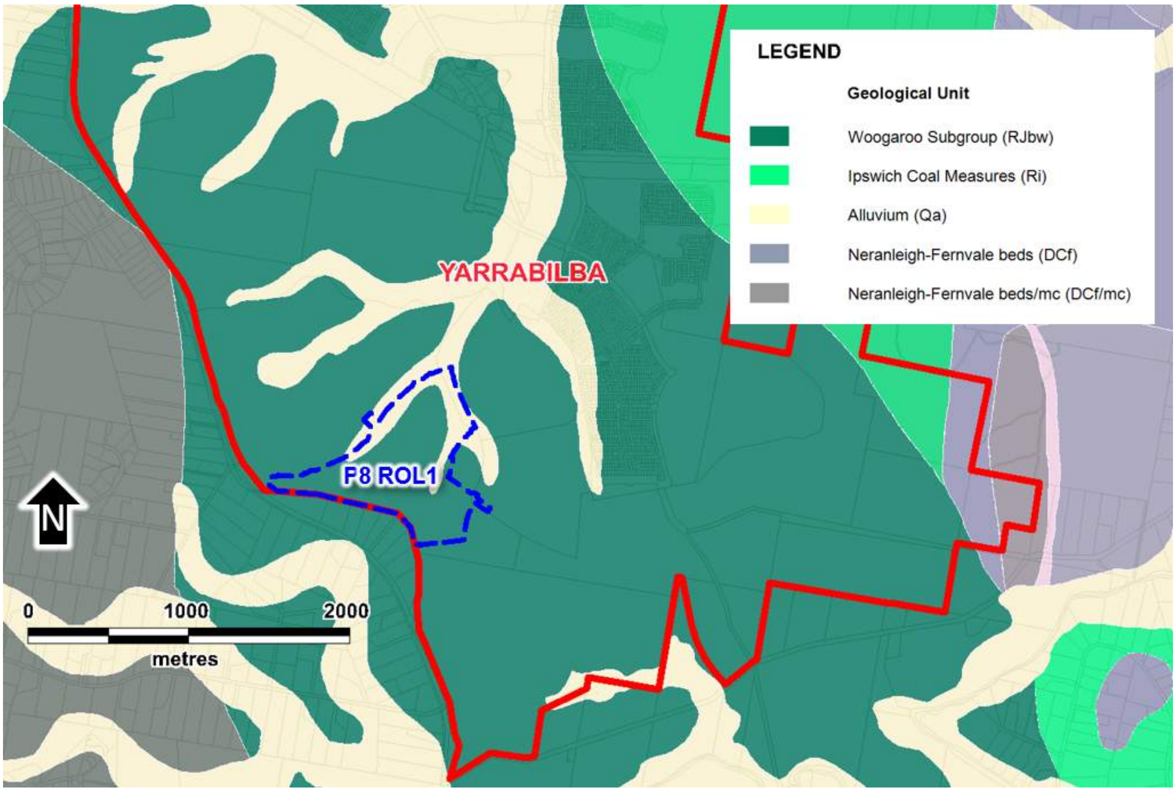


Figure 3: Geology and soils

2.4 VEGETATION

The majority of the Yarrabilba site was previously pine plantation, with most vegetation associated with grassland or pine and eucalypt/acacia regrowth of limited ecological value. Historical aerial imagery illustrates grassland and pine areas represent around 80% of the previous land use across the Yarrabilba site, which have subsequently been cleared and are currently grazed or covered with regrowth vegetation (refer Figure 2). Moderate to dense vegetation generally occurs along drainage lines in the development area.

Vegetation management will generally be undertaken in accordance with *Yarrabilba Development: Natural Environment Site Strategy* (Natura Consulting, 2024 or later) which highlights vegetation management procedures with regards to clearing approvals, revegetation, monitoring/compliance and design requirements. Strategy 14 in the CPAS provides the individual mapping for waterway, flora and fauna constraints as well as bushfire setbacks for the Precinct 8 ROL1 development.

2.5 WATERWAYS

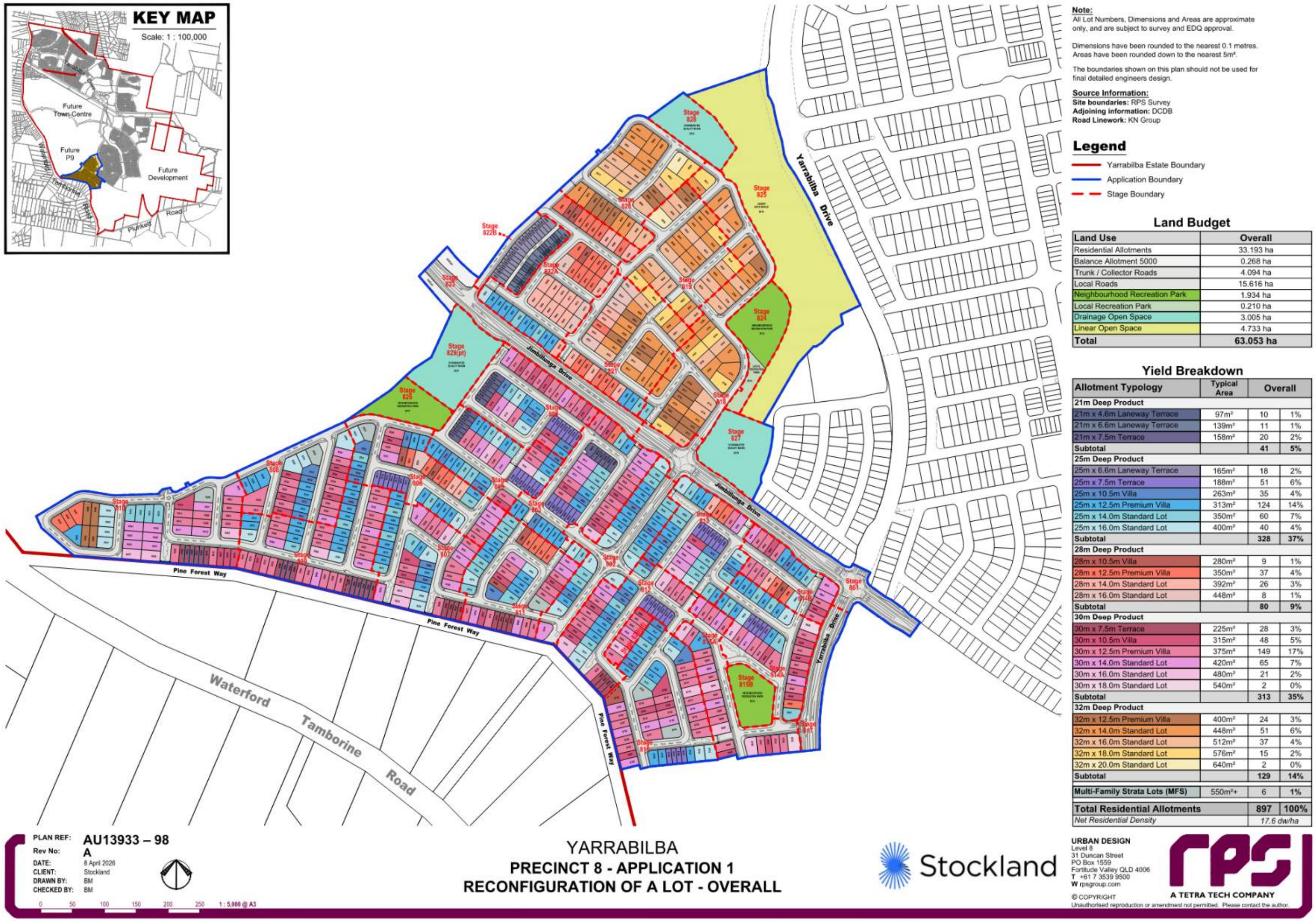
An ephemeral waterway exists within the northeastern boundary P8 ROL1 (and extending north adjacent to P6). This waterway is broadly defined as being in good overall condition based on the previous Precinct 6 ROL2 & ROL3 condition assessment (DesignFlow, 2023). This waterway interfaces with multiple future precincts so management of stability and vegetation values will be an important aspect of the planning for these development areas.

An ephemeral waterway also lies outside the western boundary of the Precinct that forms the interface between Precinct 8 and future Precinct 9 to the west. This waterway will be referred to herein in terms of a receiving waterway for the purpose of minor flow management (for waterway stability) but will be detailed further as part of the future precinct 9 stormwater management plan(s) (in terms of condition and rehabilitation management).

Minimum buffers of 15m set out in the *Stormwater Infrastructure Master Plan* (DesignFlow, 2024) have been applied to these waterways with any additional setbacks as required by the ecological and bushfire assessments also applied.

2.6 PROPOSED DEVELOPMENT

Precinct 8 ROL1 (subject site) covers an area of approximately 63.1 ha which includes around 33.2 ha of development lots, 19.7 ha of roads, 6.9ha of recreational and linear park and just over 3 ha of drainage open space. The precinct layout is shown in Figure 4.



Land Budget

Land Use	Overall
Residential Allotments	33.193 ha
Balance Allotment 5000	0.268 ha
Trunk / Collector Roads	4.094 ha
Local Roads	15.616 ha
Neighbourhood Recreation Park	1.934 ha
Local Recreation Park	0.210 ha
Drainage Open Space	3.005 ha
Linear Open Space	4.733 ha
Total	**63.053 ha**

Yield Breakdown

Allotment Typology	Typical Area	Overall	
21m Deep Product			
21m x 4.6m Laneway Terrace	97m²	10	1%
21m x 6.6m Laneway Terrace	139m²	11	1%
21m x 7.5m Terrace	158m²	20	2%
Subtotal		**41**	**5%**
25m Deep Product			
25m x 6.6m Laneway Terrace	165m²	18	2%
25m x 7.5m Terrace	188m²	51	6%
25m x 10.5m Villa	263m²	35	4%
25m x 12.5m Premium Villa	313m²	124	14%
25m x 14.0m Standard Lot	350m²	60	7%
25m x 16.0m Standard Lot	400m²	40	4%
Subtotal		**328**	**37%**
28m Deep Product			
28m x 10.5m Villa	280m²	9	1%
28m x 12.5m Premium Villa	350m²	37	4%
28m x 14.0m Standard Lot	392m²	26	3%
28m x 16.0m Standard Lot	448m²	8	1%
Subtotal		**80**	**9%**
30m Deep Product			
30m x 7.5m Terrace	225m²	28	3%
30m x 10.5m Villa	315m²	48	5%
30m x 12.5m Premium Villa	375m²	149	17%
30m x 14.0m Standard Lot	420m²	65	7%
30m x 16.0m Standard Lot	480m²	21	2%
30m x 18.0m Standard Lot	540m²	2	0%
Subtotal		**313**	**35%**
32m Deep Product			
32m x 12.5m Premium Villa	400m²	24	3%
32m x 14.0m Standard Lot	448m²	51	6%
32m x 16.0m Standard Lot	512m²	37	4%
32m x 18.0m Standard Lot	576m²	15	2%
32m x 20.0m Standard Lot	640m²	2	0%
Subtotal		**129**	**14%**
Multi-Family Strata Lots (MFS)	550m²+	6	1%
Total Residential Allotments		**897**	**100%**
Net Residential Density		*17.6 dw/ha*	

Figure 4: Precinct 8 ROL1 proposed layout

3 STORMWATER QUALITY

3.1 DESIGN OBJECTIVES

The stormwater quality management objectives that apply to the operational phase of Yarrabilba Precinct 8 ROL1 are listed in Table 1 as defined by *the Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024), which are consistent with the State Planning Policy (DSDIP, 2017).

These objectives require the reduction of pollutant loads discharged from the development site once all construction works are complete. These load reductions are aimed at protecting the environmental values of downstream receiving waterways from the impacts of urban stormwater runoff.

Table 1: Stormwater quality objectives

Pollutant	Discharge criteria (% reduction in mean annual load)
Total suspended solids (TSS)	80%
Total phosphorous (TP)	60%
Total nitrogen (TN)	45%
Gross pollutants (GP)	90%

3.2 STORMWATER QUALITY MANAGEMENT STRATEGY

A stormwater management strategy has been developed for Precinct 8 ROL1 based on a review of the site characteristics, constraints and masterplan for the proposed development zones. The proposed strategy has been developed in collaboration with the design team to ensure it is well integrated with both engineering and landscape aspects of the design.

When developing the treatment strategy, several key principles were considered:

- Adopt multiple use open space principles where possible
- Locate treatments in waterway buffer zones, where applicable, as per *Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024)
- Adopt similar treatment philosophy to Precincts 1 to 6 development areas to maintain successful integration of treatment with development and outcomes
- Minimise the impact on existing vegetation and ecosystems
- Ensure future development/catchments are allowed for in precinct scale systems.

Figure 5 shows the overall proposed treatment strategy for Precinct 8 ROL1 (including parts of existing P6 ROL3) with details of treatment systems provided in Table 2. Basins

6C1-6C3 are referred to below as they include a portion of Precinct 8 ROL1. However, the stormwater management strategy for this catchment has been documented previously in the P6 ROL3 SMP (DesignFlow, 2025) and will not be assessed further in this report.

Design levels and the relevant flood immunity details are provided in Table 3. Further details of performance assessments of the proposed treatment strategy are presented in Section 3.3.1. All basins in Precinct 8 combine 63.2% AEP minor storm detention above the treatment areas for waterway stability management. Refer to Section 5.2 for the hydraulic assessment of these basins.

Table 2: Stormwater treatment elements

Treatment Type and ID	Size	Catchments	Comment
Sediment Pond 6C1 *Bioretention 6C2-6C3*	*350 m²* *2 x 850 m²*	*6C1, 6C2a, 6C2b, 6C3*	*Refer to Precinct 6 ROL3 SMP previously*
Sediment Pond 8A1 Bioretention 8A2	300 m² 700 m²	8A	Sediment pond pre-treatment to bio
Sediment Pond 8B1 Bioretention 8B2/8B3	300 m² 2 x 700 m²	8B1, 8B2	Sediment pond pre-treatment to dual bios
Bioretention 8C1/8C2	2 x 650 m²	8C1, 8C2	Dual basins with sediment forebays

The concept layout and earthworks for the proposed stormwater quality management basins has been documented in the functional design plans by KN Group (Appendix A). Key design parameters are summarised in Table 3. These are subject to detailed design as part of operational works and some flexibility in configuration exists in these basins to enable design response to ultimate catchment and landscape outcomes in these zones (e.g. sediment ponds may be replaced with sediment forebays where future drainage design dictates).

Table 3: Basin 8A concept design summary

Parameter	Sed 8A1	Bio 8A2
Area	300 m²	700 m²
Surface level	RL44.1	RL44.0
Bunds	RL45.5 (min.) [2]	
1% AEP flood (in adjacent waterway)	*Note 1*	*Note 1*

Notes:

1. Regional flood mapping does not interface directly with this treatment system. Local overland flow within upper waterway extent is well below basin design levels (as outflow from bypass spillway in Basin 8A)
2. Internal bunds between basins will be lower than the design external bund level noted above

Table 4: Basin 8B concept design summary

Parameter	Sed 8B1	Bio 8B2/8B3
Area	300 m²	2 x 700 m²
Surface level	RL44.6	RL44.5
Bunds	RL46.0 (min.) [1]	
1% AEP flood (in adjacent waterway)	RL43.5	RL42.5

Notes:

1. Internal bunds between basins will be lower than the design external bund level noted above

Table 5: Basin 8C concept design summary

Parameter	Bio 8C1/8C2
Area	2 x 650 m²
Surface level	RL35.0
Bunds	RL36.5 (min.) [2]
1% AEP flood (in adjacent waterway)	RL34.0

Notes:

1. Contributing catchments taken as approximately equal for preliminary design. Final pipe drainage network may change the catchment to each basin and sizing may vary accordingly. However, balance pipe between basins can ensure these systems operate as one treatment system regardless.
2. Internal bunds between basins will be lower than the design external bund level noted above

3.2.1 External catchments

As shown in Figure 5 over page, there are 5 external catchments draining into Precinct 8 from the south and west, primarily from Pine Forest Way. Catchment data is provided in Table 6.

Table 6: External catchment summary

External catchment	Area (ha)	Drains to P8 Catchment	Proportion of total catchment (incl. ext.)
Ext-8A1	0.1	8A (12.8 ha)	0.8%
Ext-8A2	0.2		1.5%
Ext-8B1	0.5	8B1 (12.2 ha)	3.4%
Ext-8B2	0.7		4.8%
Ext-8B3	1.3		8.8%

External catchments Ext-8A1 and Ext-8A2 represent a very minor fraction (~2%) of the total catchment 8A draining to the respective basin within Precinct 8. Ultimate hydraulic design of the stormwater drainage network and basin overflow structures will account for these external catchments. No changes are proposed to the water quality sizing or performance assessment of the receiving basin Sediment Pond 8A1 and Bioretention Basin 8A2 due to the very minor area of external catchment. Similarly, external catchment Ext-8B1 represents just over 3% of catchment 8B1 with no modification made to the water quality function of the receiving Sediment Pond 8B1 and Bioretention 8B2/8B3, while the hydraulic design of the drainage network and basin overflow will account for these flows.

External catchment Ext-8B2 and Ext-8B3 represent over 13% of catchment 8B1 which results in a more significant hydraulic impact on the downstream drainage network. As there is no requirement to treat or detain external flows, allowance in the drainage network to divert all flows in excess of the local 63.2% AEP (Q1 in Figures 1 above) from the western extent of catchment 8B1 ensures Precinct 8 development low flows are preferentially directed to treatment and minor detention with bypass of excess local P8 flow (and external flows) to the adjacent waterway corridor via a flow split manhole (typically as an internal weir within the manhole). As above, the ultimate hydraulic design of the stormwater drainage network will account for this external catchment.

In all cases, flows in excess of pit and pipe capacity will be conveyed via dedicated overland flow paths (from external catchments) and internal roads (within Precinct 8) and discharge to basins or waterways at designated road sag locations.

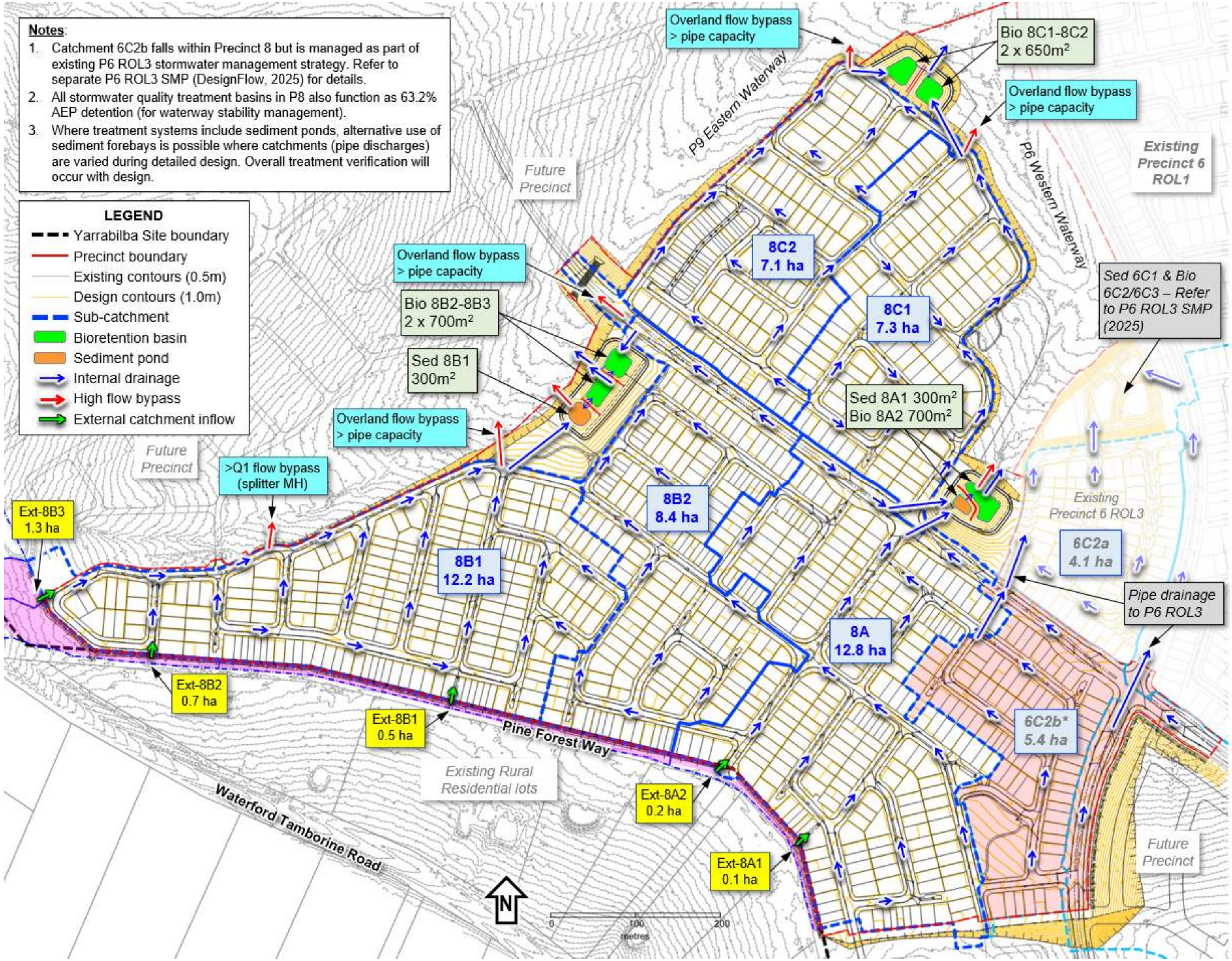


Figure 5: Precinct 8 ROL1 stormwater quality management strategy

3.3 STORMWATER QUALITY ASSESSMENT

MUSIC modelling was undertaken to assess the stormwater treatment performance of the proposed treatment strategy. MUSIC Version 6.3 was used for the assessment.

3.3.1 Model Structure

The structure of the MUSIC model is shown in Figure 6 with the general data provided in Table 7. MUSIC model parameters were adopted generally in accordance with the *MUSIC Modelling Guidelines* (Water by Design, 2010/2018) using 10 years (1990-2000) of modified Shailer Park meteorological data. Six minute rainfall data and monthly average evapotranspiration data was used. The Shailer Park station was selected for adoption as it is the closest rainfall station to the site with 6 minute data. The rainfall data set was modified to generate a data set closer representing Logan Village rainfall. The Shailer Park 6 minute rainfall was scaled by a factor of 0.849 to produce a rainfall data set with a similar annual total to Logan Village (950mm) for the period considered. Discussion of this was provided in Section 5.1 of the *Precinct 1 Stormwater Management Plan* (DesignFlow, 2011) and has been consistently used in all subsequent applications since that time.

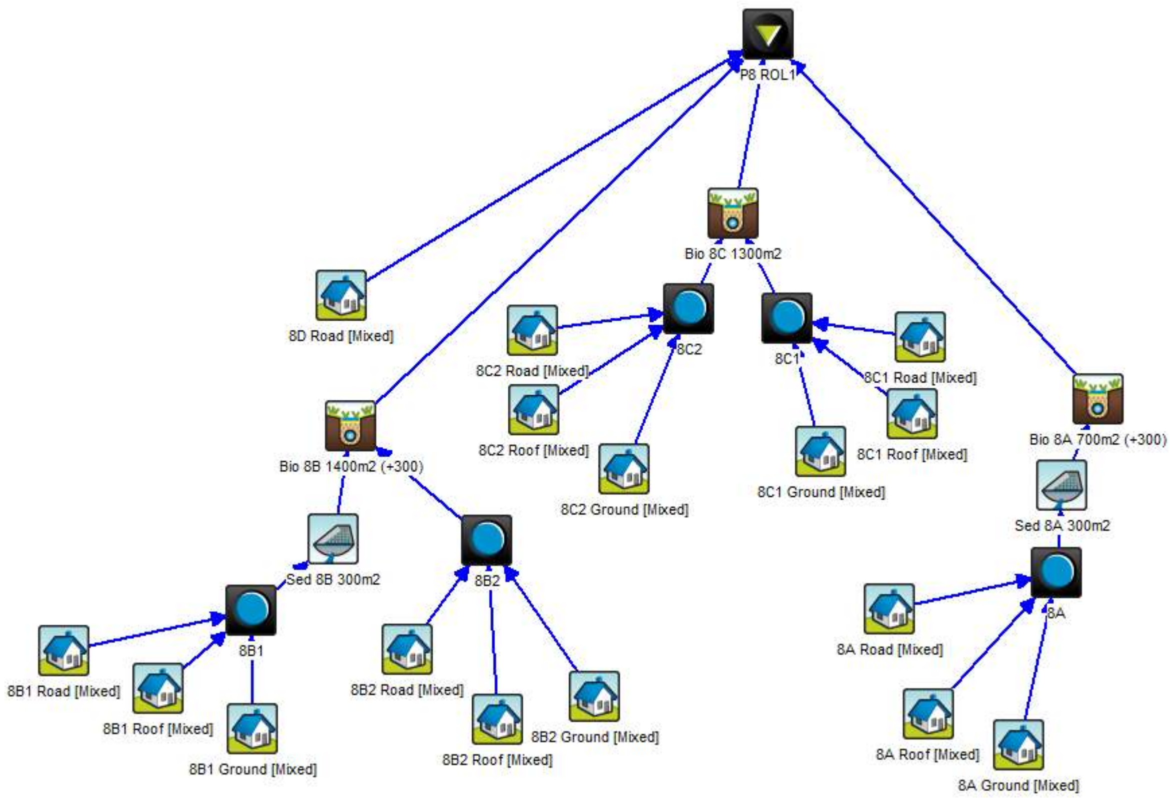


Figure 6: MUSIC model layout

Table 7: MUSIC modelling parameters

Parameter	Value
Source Data	
Rainfall data set	1990-99– Modified Shailer Park Station 040715
Modelled time step	6 minute
Mean annual rainfall 1990-2000	950 mm
Potential evapotranspiration	1,446 mm
Soil properties (runoff generation parameters)	Table 3.7 Music Modelling Guidelines (as appropriate depending on land use)
Pollutant concentrations (base flow and storm flow concentration)	Table 3.8 Music Modelling Guidelines (as appropriate depending on land use)
Percent impervious	Table 3.5 and 3.6 Music Modelling Guidelines (as appropriate depending on land use)
Treatment Devices	
Bioretention	Filter media depth = 0.6 m Extended detention depth = 0.3 m Extended detention area = Bio area (when stand-alone) or Bio + wetland + sed pond (when in combined system) Seepage = 0 mm/hr TN content 400 mg/kg Orthophosphate content 30 mg/kg Overflow weir width = bio area/10
Sediment Basin	Extended detention depth (EDD) = 0.01 m (extended detention depth over 0.01m is included in bio basin where linked) Evaporative loss 75% of PET Notional detention time = <0.1hr (upstream of wetland or bioretention basin) Overflow weir width = sediment pond area/10

3.3.2 Assumptions

1. A split catchment approach was adopted for modelling. Split land use percent imperviousness is generally in accordance with Table 3.5 in MUSIC Modelling Guidelines (Water by Design, 2010/2018).

2. Sediment ponds connect via culverts or weirs to bioretention basins with minimal flow restriction (i.e. minimum allowable 0.01m extended detention adopted in MUSIC with large pipe connection to freely convey inflows)

3. Bioretention basins cells 8B and 8C are modelled as combined total surface area (where actual design will split these into multiple cells to ensure flow distribution across filter).

4. Bioretention basins have 0.3m extended detention depth before overflowing to discharge pits. Extended detention area is taken as the sum of 'shared' area over bioretention and sediment pond (refer also to item 2 above) as bioretention controls rapid water level drawdown for all these systems.

5. All overflow weirs from treatment systems adopt the treatment area/10 for the weir width as per the *MUSIC Modelling Guideline* which ensures conservatively large weirs and avoids any additional treatment resulting from extended detention above weirs. No allowances have been made for the minor flood attenuation function of the basin has been made in the water quality modelling.

The above assumptions ensure the functional design of all treatment systems is conservative and allows for sufficient earthworks, treatment and maintenance access space allowances within the current layout. All systems will be subject to detailed hydraulic and MUSIC model verification at detailed design stage to optimise the sizing for the contributing catchments and surrounding open space integration.

3.3.3 Catchment Data

The catchment areas draining to each treatment system have been derived from the urban design and drainage layouts for sub-stages where available. Table 2 previously identified catchments contributing to each treatment element. Table 8 below lists the catchment area and percent impervious for each sub-catchment modelled with a detailed breakdown of surface types. All land use is based on low density residential.

Table 8: MUSIC model catchment split data

Catchment ID (refer to Figure 5)	Total Area (ha)	% Impervious	Surface Type	Sub-Area (ha)	Impervious %
8A	12.8	60%	Road	4.80	60%
			Roof	4.80	100%
			Ground	3.20	20%
8B1	12.2	60%	Road	4.06	60%
			Roof	4.88	100%
			Ground	3.26	20%
8B2	8.4	60%	Road	3.14	60%
			Roof	3.16	100%
			Ground	2.10	20%
8C1	7.3	65%	Road	2.29	100%
			Roof	3.01	20%
			Ground	2.00	60%
8C2	7.1	65%	Road	2.60	100%
			Roof	2.70	20%
			Ground	1.80	60%
8D	0.3	70%	Road	0.30	70%
Total	48.1	63%		48.1	63%

3.3.4 Results

The results of the MUSIC modelling are presented in Table 9. All water quality objectives can be readily achieved with the proposed treatment strategy.

Table 9: MUSIC results

Catchments	Treatment ID	Pollutant	Inflows (kg/yr)	Outflows (kg/yr)	Reduction (%)
8A	Sed 8A, Bio 8A	TSS	13600	2440	82.1
		TP	28.2	8.22	70.9
		TN	164	88.9	45.7
		GP	2060	0	100
8B1 + 8B2	Sed 8B, Bio 8B	TSS	21800	4320	80.2
		TP	43.9	12.7	71.1
		TN	263	139	47
		GP	3320	0	100
8C1 + 8C2	Bio 8C	TSS	14600	2630	81.9
		TP	30.4	8.1	73.4
		TN	185	90.2	51.1
		GP	2320	0	100
8D	nil	TSS	773	773	0
		TP	1.23	1.23	0
		TN	3.99	3.99	0
		GP	53.5	53.5	0
TOTAL P8		TSS	50800	9950	80.4 ✓
		TP	104	29.7	71.4 ✓
		TN	616	319	48.1 ✓
		GP	7760	53.5	99.3 ✓

These results indicate conservative outcomes which enables the detailed design of the basins or stormwater drainage network (or earthworks updates) to divert flows to different parts of the catchment without adversely impacting overall treatment performance. It also provides flexibility in design for integration (and downsizing) of treatment systems in open space areas. This will be resolved in conjunction with civil and landscape design with verification MUSIC modelling provided with each basin.

3.4 COMPLIANCE AND CERTIFICATION

Design and construction certification of operational stormwater quality measures is to occur in accordance with the following guidelines:

- Water by Design (2014). *Bioretention Technical Design Guidelines (Version 1.1)* Healthy Waterways Ltd, Brisbane

- Water by Design (2009), *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands*, SEQ Healthy Waterways Partnership. Brisbane, Queensland.
- Water by Design (2012), *Transferring Ownership of Vegetated Stormwater Assets Version 1*. Healthy Waterways Partnership. Brisbane, Queensland.

4 WATERWAY MANAGEMENT

As noted in Section 2.5, P8 ROL1 discharges to two waterway tributaries which also receive inflows from existing precinct 6 to the east and future Precinct 9 to the west (and are herein referred to as the P6 western waterway and P9 eastern waterway). The portion of waterway (east) that falls within the P8 ROL1 boundary is summarised in detail below from the previous Precinct 6 ROL3 Stormwater Management Plan while the P9 western waterway (within Precinct 9) is referred to but not yet assessed in detail as this will include the management strategies as part of future Precinct 9.

4.1.1 Waterway Stability

The waterway stability objectives adopted for the site are based on protecting high value waterways from erosion due to increased flow from urban development or, where average or degraded waterways exist, provide improvements and rehabilitation to enable function and stability under developed hydrology. This applies to waterways and drainage lines within the site as well as downstream receiving waterways beyond the development boundary. Due to the large size of the site and significant variation in waterway types and riparian and in-stream condition, the waterway stability objective has been derived for a range of situations as shown in Table 10. These objectives are consistent with *Yarrabilba Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and *State Planning Policy* (DSDIP, 2017).

Table 10: Derived waterway stability objectives

Waterway classification	Waterway Stability Criteria
Site waterway reach in good condition [1] (i.e. well vegetated and stable waterway)	Limit post development 63.2% AEP flows in waterway to pre-development conditions; <u>OR</u> Review the geomorphic conditions under pre- and post development hydrology to determine stability risks and if required define a waterway specific response [2]
Site waterway reach in average to poor condition[3] (i.e. poorly vegetated or active erosion)	Where ecological assessment justifies the retention of the waterway/drainage line[3], reconstruct / rehabilitate waterway to convey the post development 63.2% AEP flows without the risk of increased erosion [4]
External waterways	Limit 63.2% AEP flows at site boundary for critical duration event to pre-development conditions

Notes:

1. Refer to Stormwater IMP for preliminary waterway condition rating
2. Localised increases in 63.2% AEP flows can be accepted provided a geomorphic assessment by a suitably qualified geomorphologist can justify accordingly. Note: This approach of focussing on outcomes within the specific waterway rather than pre and post development flows was adopted successfully in the waterways within the early Precincts of Yarrabilba (i.e. waterways remain stable even with an increased flows). It focusses on the requirements of the particular waterway and proposed rehabilitation rather than a coarse flow objective which was derived as a broad target for the State Planning Policy.
3. Ephemeral waterways which are average to poor condition may be assessed in further detail to identify if they should be retained and rehabilitated or removed and greater resources/efforts put into

rehabilitation of adjacent/downstream waterway reaches. This shall be undertaken in accordance with the *PDA Guideline no. 12 – Environmental values and sustainable resource use* (EDQ, 2015).

4. The approach supports the rehabilitation of degraded waterways and allows local increases in 63.2% AEP flow provided the rehabilitation design provides an appropriately stable waterway for the increased flows. The rehabilitation is to be designed / reviewed by a suitable qualified geomorphologist.

4.2 WATERWAY ASSESSMENT

The stability assessment for the waterways in or adjacent to P8 ROL1 has been based on previous site investigations (for Precinct 6 ROL3 as it relates to the eastern side of P8) and the detailed hydraulic (Tuflow) modelling undertaken as part of the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) which included modelling of the 63.2% AEP discharge as well as velocity and bed shear stress analysis of minor and major flood flows. The assessment included below is generally confined to those areas of waterway that are within the extent of waterway mapping and/or within the modelled floodways. The overall waterway layout is provided in Figure 7.

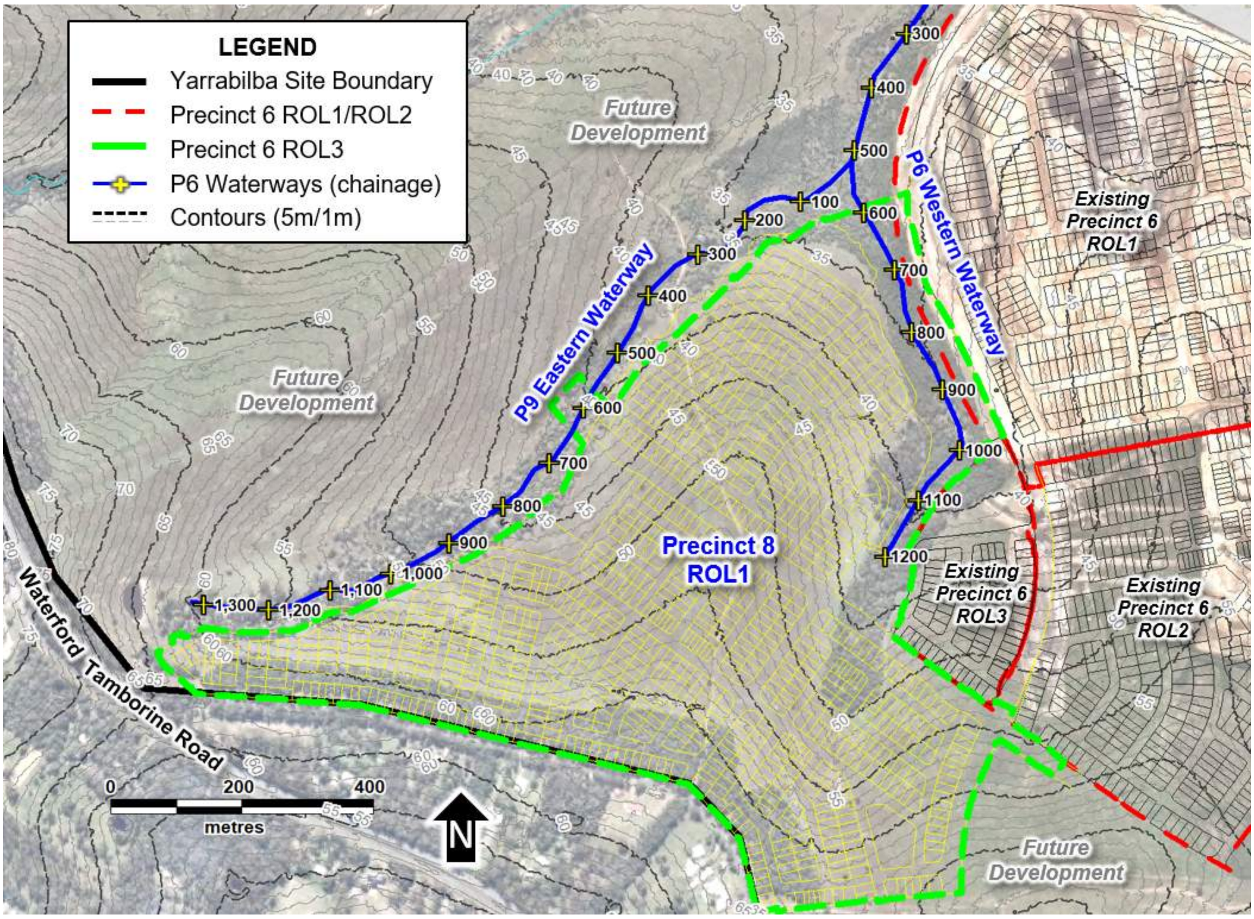


Figure 7: Precinct 8 ROL1 waterway layout

4.2.1 Characteristics

The P6 western waterway grades up at around 0.7% from the upper Quinzeh Creek confluence (adjacent to the northern part of P6 ROL1) increasing to just under 2.6% in the uppermost reaches adjacent to P8 ROL1. These grades are greater than the P6 eastern waterway (reported in previous P6 ROL1 and ROL2 stormwater management plans) and indicate potential for locally higher velocity flows and potential for greater instability. The P9 eastern waterway grades at around 1.6% from the confluence with the mid-point of the P6 western waterway increasing to 2.5% in the upper reaches. Localised areas of steeper channel exist where incision or change to bed level has resulted from vehicle or livestock crossings.

The overall waterway condition ratings for both of these waterway tributaries provided in the *Yarrabilba Waterway Condition Assessment* (DesignFlow, 2023) indicates generally good overall condition based on habitat and stability considerations.

A more detailed review of the P6 western waterway carried out on 29 August 2023. This was done to further assess the characteristics and condition of the waterways in Precinct 6 ROL2 (and ROL3) since the original field work undertaken in 2013 for the overall site waterway condition assessment. A brief overview of these findings (as relevant to P8 ROL1) is provided below. Figure 7 provides the Precinct 6 western waterway layout and chainage locations referred to in the following sections.

The detailed assessment of the P9 eastern waterway will be completed as part of the subsequent Precinct 9 stormwater management plan once the location and sizing of stormwater treatment basins in P9 are resolved to ensure the overall strategy is consistent with both P8 and P9 development interfaces and discharge.

P6 Western Waterway Inspection

This inspection occurred in late winter 2023 following an extended period of low rainfall. No surface or groundwater seepage was observed throughout the waterway at this time.

The western waterway of P6 extends generally south-west to south from the main upper Quinzeh Creek floodway (at the northern part of P6 ROL1). The lower reach (chainage 0-500 in Figure 7) is very broad with low gradient (~0.7%) and intermittent low flow channel (very narrow and shallow) and localised scour pools. Generally good grass groundcover exists with scattered trees and shrubs and local areas of more dense trees (regrowth). Localised ground disturbance and grazing was evident from native and feral animals (kangaroos and pig observed) and livestock (horses and goats in adjacent areas) but no significant instabilities present. While no standing water was present, evidence of scattered shallow scour holes/former ponds and emergent water plants was observed (now died back and dry).

The mid reach (chainage 500-1000 in Figure 7) shows a gradual increase in slope to around 1.1% with the broad, well vegetated waterway profile continuing. Tree density increased in this area compared to lower reach. Localised and scattered scour pools were evident (now dry) towards the upper end of this reach and typically associated with livestock tracks. Just upstream of CH950, a localised open area with lower tree density exists just south of a vehicle access track (slightly mounded) crossing the waterway. Evidence of former shallow ponding and water plants (now died back and dry) exists in this location.

The upper reach (CH1000-1200) is characterised by an increase in grade to around 2.5% with greater presence of a localised low flow channel (scour gully) and localised scour/head cut. Between about Ch1150-1200, a pronounced scour has occurred and moved upstream evidenced by an expanded erosion head at CH1200. Weak and/or dispersive soils appear to be partly responsible combined with increased waterway slope and flow concentration. Surrounding areas remain wooded and partially grassed.

4.2.2 Modelling

The existing flood model for the Yarrabilba site (within Quinzeh Creek) was used to extract hydraulic information to assist with the assessment and development of an appropriate waterway stability management strategy. This model does not include any localised waterway stability detention basins so represents the unmitigated 63.2% AEP case within these waterways. The resolution of the flood model (5m grid) is such that very localised scour issues will not necessarily be identifiable from model outputs and therefore should not be relied upon solely for the management of specific areas. The adoption of both targeted engineering approaches as well as an adaptive monitoring and management of stability issues will ensure that the strategy presented in Section 4.3 below responds to changes over time.

Table 11 provides a broad scale analysis of the flow characteristics at the mid and lower reaches of the P6 western waterway for pre and post-development (unmitigated) catchment conditions adjacent to and downstream of P6 ROL1 (receiving P8 ROL1 flows). This data is based on the fully developed site conditions (i.e. existing Precinct 6 plus Precinct 8 and future Precinct 9 developed).

Table 11: 63.2% AEP discharge in P8 receiving waterways (unmitigated)

Waterway Chainage	Tuflow PO Location	Flow (m^3/s)		Peak Velocity (m/s)	
		Existing	Developed	Existing	Developed
P6 Western CH600	L_42	1.6	9.0	0.54	0.92
P9 Eastern CH100	L_44	1.6	6.3	0.69	0.95
P6 Western (downstream) CH200 [3]	L_40	3.5	12.1	0.32	0.62

Notes:

1. Data extracted from Tuflow models B01d and P01d at the respective plot output reporting locations
2. Peak velocity is highest point velocity within cross section (typically near invert) and not an average velocity over total cross section.
3. P6 Western CH200 taken from downstream reach of waterway adjacent to P6 for combined discharge reference.

This data indicates that while the unmitigated peak discharge at the lower (CH200) and mid (CH600) reaches of the P6 western drainage line increases significantly because of urbanisation (unmitigated results presented), the actual velocity increases are comparatively small and very low in overall magnitude under both pre- and post-development (unmitigated) scenarios. This is in most parts due to the broad flat profile of the drainage lines that can experience significant increase in flow rate (and flow width) with only very minor increase in flow depth and velocity. Similarly, the P9 eastern waterway (branching off the mid-point of the P6 western waterway) shows a similar outcome in terms of flow versus velocity increases.

Further analysis and discussion of the pre and post-development flood modelling is provided Section 4.2.3 below with reference to Figure 8 with consideration of waterway slopes, vegetation and soil conditions.

4.2.3 Discussion

Bed shear stress modelling provided in Figure 8 has been derived from of the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024) at a 5m grid to broadly identify the relative bed shear stress changes and does not specifically account for:

- Any localised precinct stormwater quality management basins
- Very localised spatial variations in vegetation and tree coverage (i.e. Tuflow roughness/materials layers are more broad scale and representative of a total reach)
- Very minor areas of bare soil and scour and/or woody debris causing flow deflection
- Longer term rehabilitation and regrowth of channel vegetation

Due to these constraints and the limited justification for updating the catchment flood model to this level of detail, the bed shear stress mapping was used as a reference point for the development of the Waterway Stability Management Strategy (Section 4.3 below). A brief appraisal of the subject waterways based on model results and (where available) site inspection is provided in the following sections.

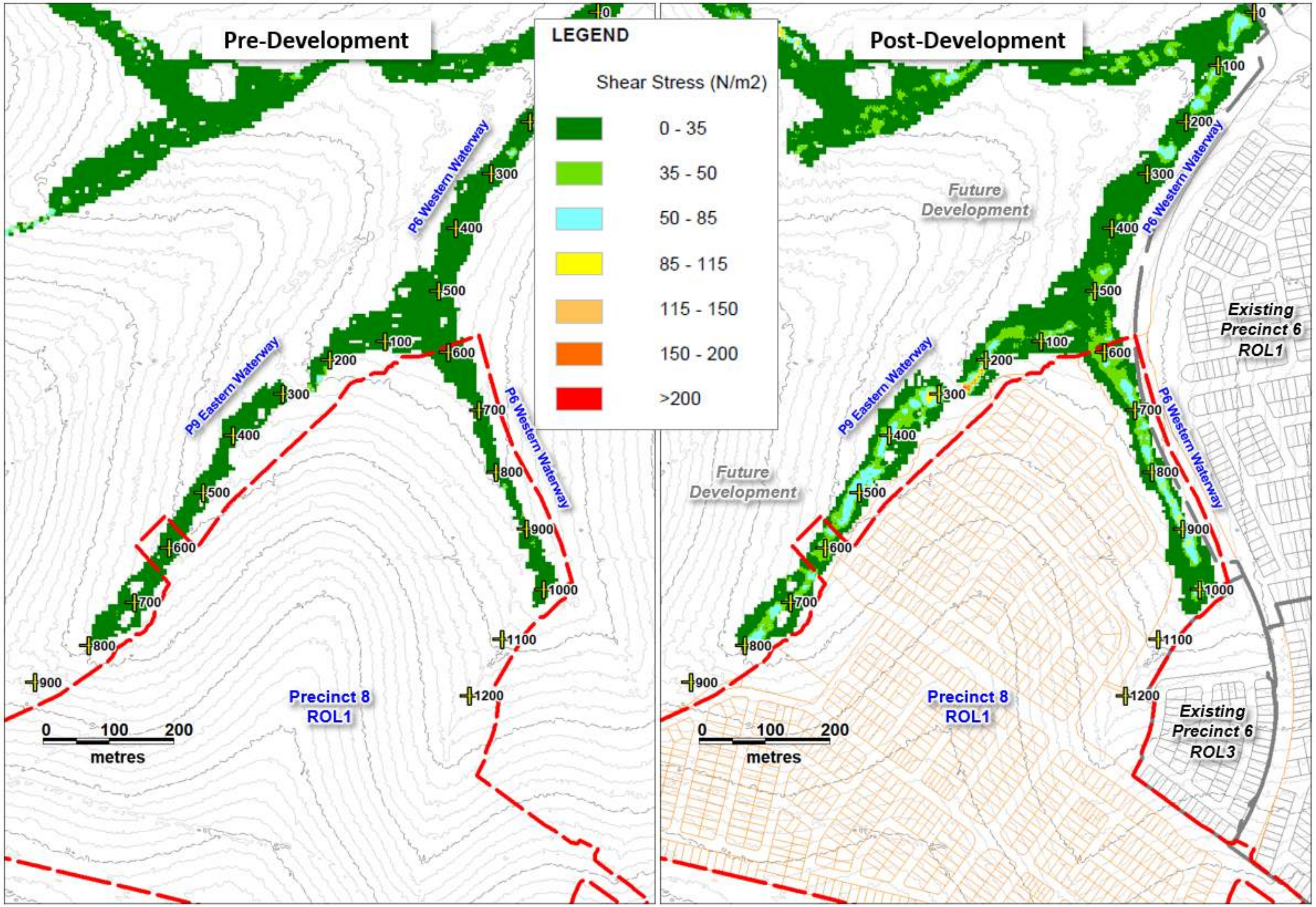


Figure 8: 63.2% AEP bed shear stress comparison (no local mitigation)

P6 Western Waterway

Bed shear stress mapping in the lower and mid reaches of the P6 western waterway indicates that under pre-development conditions, the bed shear stress (in the order of 35 N/m^2 or less) represents relatively minor and localised instability (i.e. model outputs were broadly correlated with site based investigations/observations of current conditions (from P6 ROL2 and ROL3 SMP previously). Under post-development hydrology, the bed shear stress magnitude generally remains in this range for much of the lower waterway but extends over a broader area across the channel invert (refer Figure 8). The mid to upper reach (chainage 600-1000) there are areas of higher bed sheer stress that may be attributed to the gradual increase in waterway slope in the western waterway and these are expected to be exacerbated in the areas at and upstream of the limit of flood modelling available (where slopes increase to around 2.5%).

P9 Eastern Waterway

Similar to P6 western waterway, P9 eastern waterway comparatively low bed shear stress mapping under pre-development conditions with increases under unmitigated post development conditions over most of the waterway length due to the increased discharge and greater slope (similar to upper P6 western waterway). Localised areas of high shear stress occur between CH200 and CH300 where an existing vehicle track bund has created a constricted high flow point.

The targeted waterway management strategy for both waterways therefore aims to mitigate the increase in local 63.2% AEP discharge into the upper waterway via minor flow attenuation (detention) over stormwater treatment basin(s) while managing existing scour issues and revegetation/natural regeneration coupled with an adaptive management strategy that responds to the uncertainties in channel geomorphology. Preliminary hydraulic assessment of the local detention requirements for this waterway is provided in Section 5.2.

4.3 WATERWAY STABILITY MANAGEMENT STRATEGY

As described in Section 4.2.1, the waterways adjacent to and downstream of Precinct 8 ROL1 are considered to be in good condition (ecologically) while being relatively stable owing largely to the very low gradients and vegetation cover of these drainage lines. The exception being the upper reaches of both waterways that exhibit steeper gradients and increased risk of instability. The localised areas of instability combined with impacts of historical livestock interaction and future increases in flows from development dictates the need to provide protection and improvements to these areas to ensure long term sustainability of these waterways.

The following provides the recommended waterway stability management strategy which can be broadly defined by a number of main actions:

- Removal of livestock and feral animal access to waterways.

- Areas of very minor instability should be monitored to assess the success of natural regeneration of groundcover vegetation following the removal of livestock from waterways.

- Targeted stabilisation (local regrading/filling, revegetating, or rock and/or engineering structures) of scour pools and significant areas of instability.

- Scour protection at in-stream structures such as road crossing culverts and stormwater outlet headwalls.

- Ongoing monitoring of channel stability as development proceeds (including future adjacent precincts) to guide reactive management of channel stability. Particular attention should be given to those areas identified as currently eroding and those adjacent to infrastructure.

- Control of 63.2% AEP (Q1) peak discharge from local development areas into the upper reaches of the waterways (i.e. minor attenuation of Q1 discharge to match pre-development Q1 for equivalent catchment area).

A summary of key techniques adopted in previous areas of site are provided below for reference. These can be considered in conjunction with both the civil engineering design and ecological assessment and waterway rehabilitation plans developed by the ecologist for the waterway and vegetation corridors to be retained in P8.

4.3.1 Stabilisation Techniques

Rock Protection

Scoured areas and incised channels can be reshaped to flatten vertical edges and placement of rock or rock mattress over geofabric to armour underlying soil. Integrate planting within rock voids where practical. Rock protection must be formed with depressed centre to ensure flows are directed into and through the area and set down slightly below the natural ground level to avoid flow redirection around the edges (creating new scour).

Revegetation

Areas with little or no vegetation cover should be replanted with a mix of locally established species to create both a soil anchor (via roots) as well as flexible grasses that can lay flat during flow (as a surface armouring) to create a stable flow path. This is most appropriate to broad low gradient flow paths (where rock channel linings are not required). The use of pinned down jute or coir mat (not net) prior to planting is required to create a short term soil stabiliser until vegetation is established. Revegetation should also form part of any rock protection works.

In addition to stabilisation, revegetation (and landscape planting of development edges) will be an important part of the management of iron bacteria in waterways. While being a naturally occurring phenomenon in waterways with no known health risks, iron reducing bacteria (and the slimy deposits/oily sheens that result) can be unsightly when adjacent to urban areas. Further, the modification to the frequency and amount of stormwater input to local waterways (and infiltration to groundwater) will have potential to increase the prevalence of the iron bacteria. Vegetative screening is therefore critical to managing the amenity of local waterways.

Stormwater Outlets

All stormwater headwalls to be provided with rock aprons configured appropriately (in accordance with QUDM) to the size and number of pipes. Where natural channel just downstream of apron is susceptible to further instability, aprons should be enlarged or lengthened beyond unstable area. Further, if instream stabilisation has been identified, the rock apron should be linked to this zone to avoid potential scour between two areas.

Ongoing Monitoring

Where no (or very minor) erosion exists or potential future scour areas may occur based on high bed shear values (refer to Figure 8 previously) consideration should be given to minimising intervention in these areas where surrounded by very stable and/or well vegetated waterways zones. The potential impact of accessing these zones to undertake remedial activities (i.e. with earthmoving machinery) would likely create greater disturbance than benefit. Therefore, in the first instance, these areas will be monitored over the course of Precinct 8 development as well as into the adjoining precinct(s) development to review if these areas are degrading further. Reactive and targeted remediation can therefore be undertaken as required.

The adoption of this approach in Precinct 1-6 development areas indicates there is merit in limiting the intervention in degraded and disturbed waterways until development within the catchment has neared completion (unless major issues are evident prior). Allowing natural regeneration and succession of vegetation species within waterways (including weeds initially) has been shown to represent a beneficial and cost effective outcome for particular waterways. However, where overriding requirements for other fauna/flora management outcomes exist, these must be taken into consideration and adopted where necessary.

5 STORMWATER QUANTITY

5.1 FLOODING

Precinct 8 ROL1 is generally in accordance with the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024). No flood detention infrastructure is required as part of this precinct as it falls within the regional strategy that is managed by Flood Basin 15 (Expedition Rd/Fauna Way) (approved and constructed previously as part of Precinct 3B). No further flood impact assessment is therefore required as part of this stormwater management plan.

A review of the preliminary earthworks design of the proposed development area in relation to local flood levels is provided in Figure 9. The development lies adjacent to the uppermost reach of local waterways and at the reporting limit of the flood mapping. This indicates that P8 ROL1 is well above the 1% AEP flood level being conveyed through the adjacent waterways and ultimately downstream to the southern tributary of Quinzeh Creek.

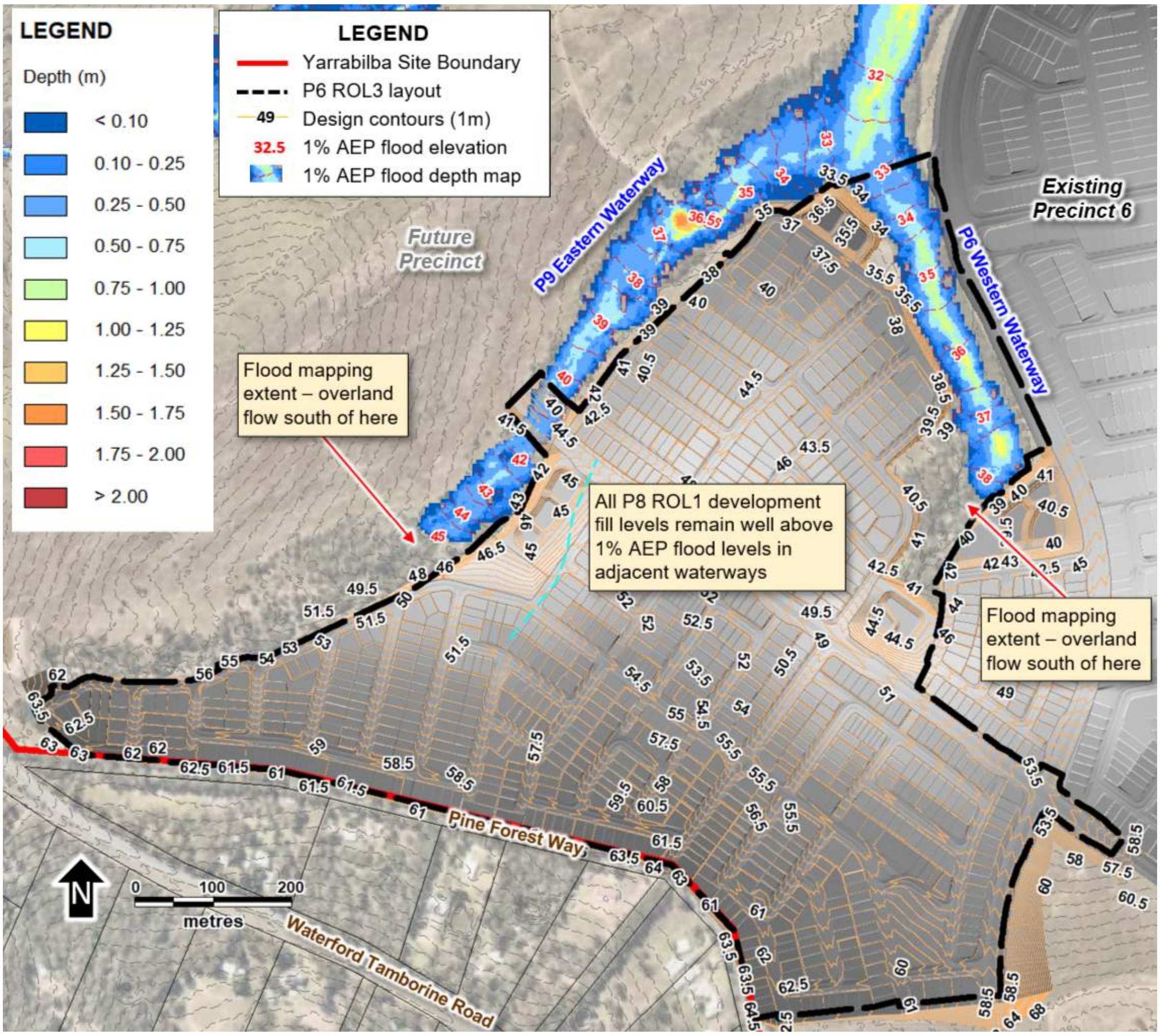


Figure 9: 1% AEP Flood levels and preliminary earthworks

5.2 WATERWAY STABILTY FLOW ATTENUATION

As noted previously in Section 4.3, the upper reaches of the P6 western waterway and P9 eastern waterways require post-development minor flow attenuation to manage the potential waterway stability issues outlined in Section 4.2.3. While these waterways will receive discharge from multiple development precincts, the proposed approach to minor flow management (63.2% AEP / 1 Year ARI) is to maintain equivalent pre-development peak discharge from the respective development catchments at each location. The assessment below applies to the three stormwater treatment basins proposed as part of P8 ROL1.

5.2.1 Hydrological and Hydraulic Assessment

XPSWMM (1d) was used to assess the pre and post development catchment discharge and derive an appropriately sized storage (co-located with local stormwater treatment basin) to achieve the objectives. The ensemble storms approach was used in line with ARR2019 using the latest rainfall data from the Bureau of meteorology (BOM). Temporal patterns, losses and pre-burst data was sourced from the ARR Data Hub (Appendix B). Durations from 10 minutes to 6 hours were assessed with the critical duration for the basin storage and discharge being 1 hr duration for the minor 63.2% AEP at all three basins.

5.2.2 Catchments

The assessment was undertaken on equivalent areas pre and post development catchment areas to derive an appropriate detention storage. Future development in adjoining precincts is expected to apply local detention storage at similar rates (m^3/ha) depending on the change in imperviousness and slope between pre and post development earthworks (as slope is a key parameter in peak discharge with all other factors remaining equal). Catchment data used in XPSWMM (Figure 10) is provided in Table 12 which is derived from the current layout and grading.

Pre-development area is taken as equivalent developed catchment in order to define indicative unit rate of detention required for this catchment (with adjoining developed catchments to apply similar approach in future). Pre-development slopes and roughness values have been taken from the corresponding catchments (weighted by area intersecting) in the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024). Post development slopes have reduced from pre-development through cut and fill earthworks and road layout. Fraction impervious values have been taken as the average of recommended values from QUDM for low density urban residential (including roads).

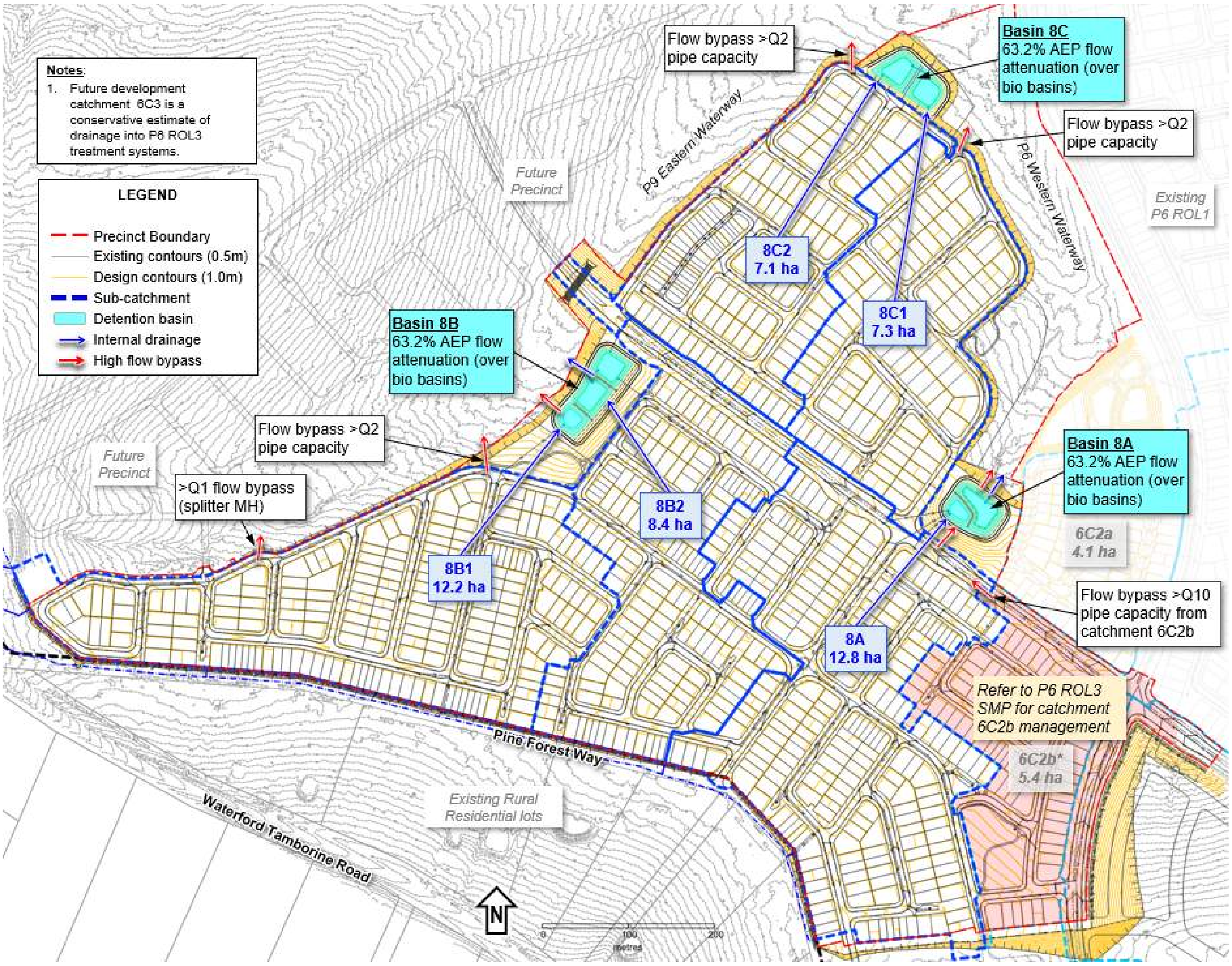


Figure 10: XPSWMM catchment layout

Table 12: Catchment data

Catchment	Area	Slope %	Impervious %	Pervious Roughness	Impervious Roughness
8A	12.8	2.1%	65%	0.035	0.015
8B1	8.4	2.2%	65%	0.035	0.015
8B2	12.2	2.3%	65%	0.035	0.015
8C1	7.3	1.7%	65%	0.035	0.035
8C2	7.1	1.8%	65%	0.035	0.015
Pre Development Equiv. Area					
8A	12.8	4.6%	0%	0.08	n/a
8B1/8B2	20.6	4.3%	0%	0.08	n/a
8C1/8C2	14.4	3.1%	0%	0.08	n/a

5.2.3 Rainfall and losses

Rainfall data has been obtained from the Bureau of Meteorology rainfall data system while losses (Table 13) and temporal patterns were extracted from the ARR Data Hub for the location co-ordinates below. Pre-burst rainfall has been included in the analysis to translate total storm loss (Table 13) into burst loss which varies with AEP and duration. The Data Hub extract is provided in Appendix B.

- Longitude 153.122°
- Latitude -27.835°
- ARR division: East Coast North

Table 13: Rainfall losses

	Pervious	Impervious
Initial Loss (mm)	26	1
Continuing Loss (mm/hr)	1.9	0

5.2.4 Minor and major drainage

Preliminary grading and drainage layout by KN Group has been used to derive indicative minor and major flows to basins (where road sag locations discharge to basins) and potential bypass flows directly to waterway corridors (where sag locations are not adjacent to basins). These locations are shown in Figure 10 and are represented in SMP SWMM as surcharge from drainage in events larger than the nominal pipe capacity.

5.2.5 Detention storage volumes

The preliminary assumptions for the stage-storage relationship for the minor detention basins are represented by the volume over the sediment pond and/or bioretention basins, with the depth above this being dedicated to minor flood storage. Refined modelling of the detailed earthworks will occur as part of design with hydraulic model verification.

An initial water level has been applied to each basin to represent the first 0.3m of depth being full (stormwater quality volume) prior to the storm burst.

Table 14: Preliminary stage storage data

Depth (m)	Elevation (mAHD)	Stage Area (m^2) [1,2]
Basin 8A		
0	44.0 [3]	1364
1	45.0	2718
1.5	45.5	3472
Basin 8B		
0	44.5 [3]	2162
1	45.5	4125
1.5	46.0	5296
Basin 8C		
0	35.0	1411
1	36.0	2841
1.5	36.5	3756

Notes:

1. XPSWMM utilises stage-area relationship to calculate the incremental volume internal to the model.
2. Stage area tabulated above are combined for area over sediment pond and/or bio basins. Model has assigned sub areas to each of sediment pond and bio basin(s).
3. A 0.3m initial depth has been applied to the basins for stormwater treatment volume being full prior to storm burst.

5.2.6 Basin concept design

Preliminary design details for each basin are provided in Table 15 with concept layouts shown in Figure 11 to Figure 13.

Table 15: Precinct 8 basin preliminary design

Parameter	Basin 8A	Basin 8B	Basin 8C
Basin floor (bio filter surface)	RL44.0	44.5	35.0
Bund	RL45.5 (min.)	RL46.0 (min.)	RL36.5 (min.)
Stormwater quality	300m² sediment pond, 1 x 700m² bioretention basin (with culvert or weir connection between). Batters/storage areas typically 1:6 or flatter.	300m² sediment pond, 2 x 7000m² bioretention basins (with culvert or weir connection between). Sediment forebays on northern inlets. Batters/storage areas typically 1:6 or flatter.	2 x 650m² bioretention basins (with culvert or weir connection between). Sediment forebays on each inlet. Batters/storage areas typically 1:6 or flatter
Basin Outlet Structures			
Low level outlet [1]	1.5m x 1.5m pit at RL44.3, 375mm dia pipe from pit at IL42.95, 1% grade (with orifice plate in pit to reduce outlet area to equiv. 300mm dia pipe).	2 x 1.5m x 1.5m pits at RL44.8, 375mm dia pipe from pits at IL43.45, 1% grade (with orifice plate in pit to reduce outlet area to equiv. 280mm dia pipe).	2 x 1.5m x 1.5m pits at RL35.3, 375mm dia pipe from pits at IL42.95, 1% grade (with orifice plate in pit to reduce outlet area to equiv. 240mm dia pipe).
Secondary outlet (Pit manhole)	1.5m x 1.5m pit at RL44.9, 1050mm dia pipe at IL42.85, 0.5% grade to outlet.	1.5m x 1.5m pit at RL45.35, 900mm dia pipe at IL43.35, 0.5% grade to outlet.	1.5m x 1.5m pit at RL35.9, 900mm dia pipe at IL33.85, 0.5% grade to outlet.
High flow weir	20m at RL 45.05	18m at RL 40.50	13m at RL36.10

Notes:

1. Low level outlets set bioretention basin extended detention depth required for treatment

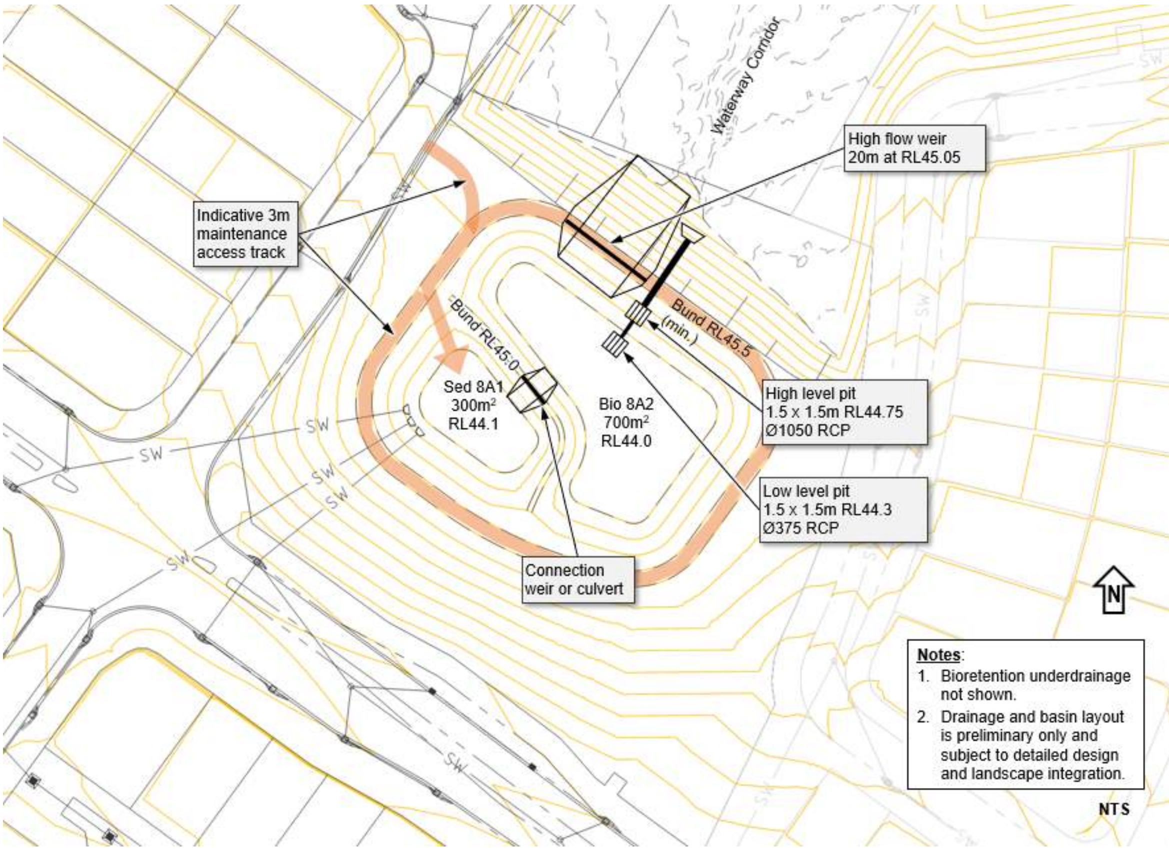


Figure 11: Basin 8A concept design

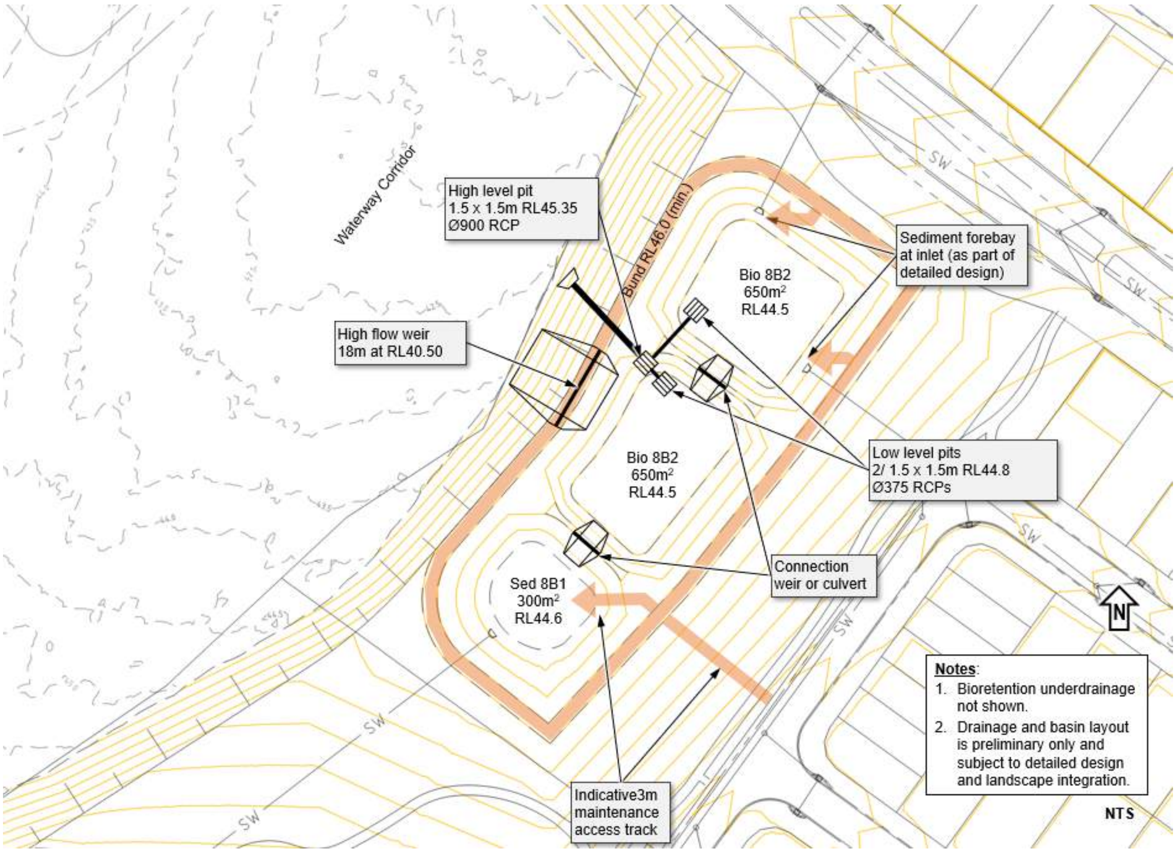


Figure 12: Basin 8B concept design

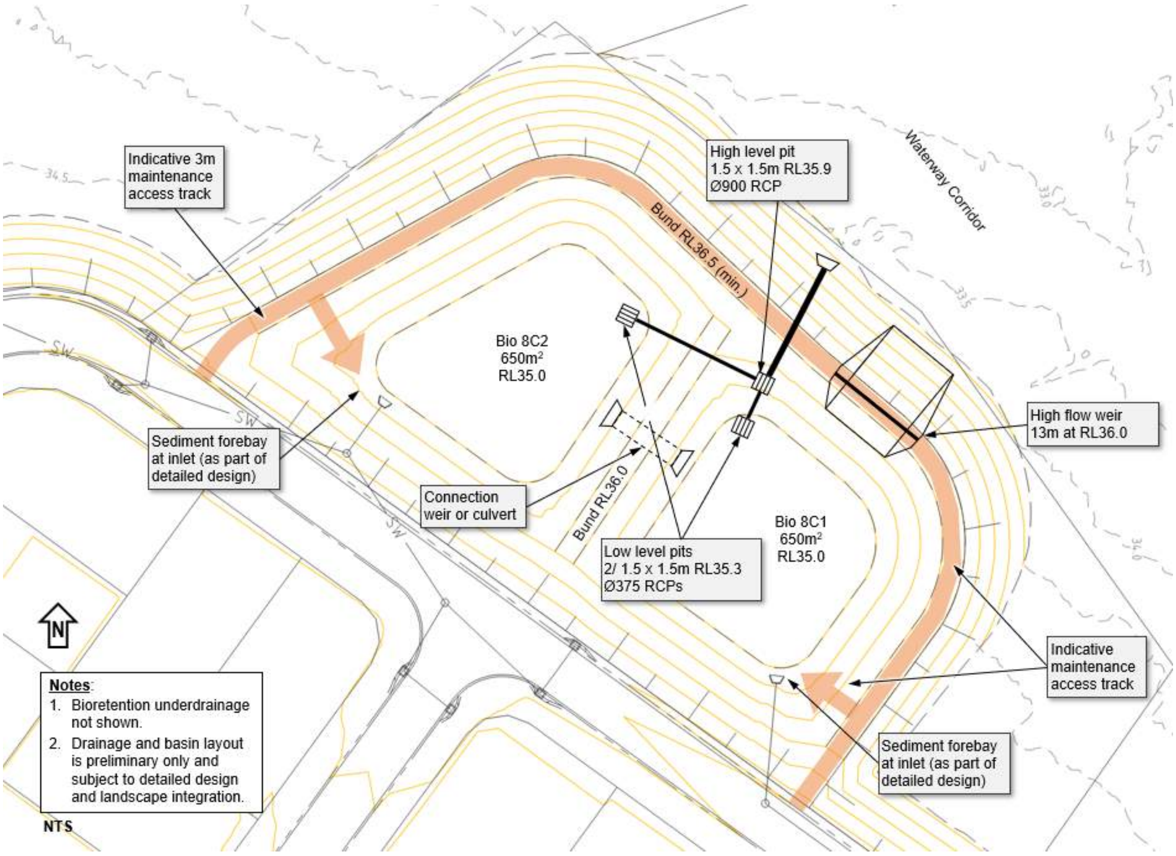


Figure 13: Basin 8C concept design

5.2.7 Results

Table 16 provides the pre and post development discharge results for the minor detention basins 8A to 8C which adequately manage the 63.2% AEP flows for downstream waterway stability. Results are reported as the median peak results for the full range of ensemble storms and durations. Discharge results for the larger events are not reported as they are not required to be mitigated to pre-development conditions. The broader flood mitigation strategy is provided through the regional scale detention basin downstream in Precinct 3 as described previously in Section 5.1.

Table 16: Local 63.2% AEP basin discharge results

Location	Median Peak Discharge (m^3/s)	
	Existing	Developed (mitigated)
Basin 8A	0.36	0.34
Basin 8B	0.52	0.49
Basin 8C	0.34	0.34

Notes: Discharge results based on zero blockage to outlets structures (i.e. no reliance of blockage to achieve discharge control)

Table 17 provides the basin water levels for the minor 63.2% and major 1% AEP to verify the overall basin functionality for both the free basin discharge (no blockage) as well as with 50% and 100% blockage applied to all pit structures to review water level increases and freeboard. All results are reported as the median peak results for the full range of ensemble storms and durations.

Table 17: Basin water levels

Design Event	Median Peak Water Level (mAHD) and depth (m)		
	No Pit Blockage	50% Pit Blockage	100% pit Blockage
Basin 8A			
63.2% AEP	44.82 (0.82m)	44.87 (0.87m)	n/a
1% AEP	45.2 (1.20m)	45.22 (1.22m)	45.28 (1.28m)
Basin 8B			
63.2% AEP	45.32 (0.82m)	45.39 (0.89m)	n/a
1% AEP	45.69 (1.19m)	45.72 (1.22m)	45.81 (1.31m)
Basin 8C			
63.2% AEP	35.76 (0.76m)	35.85 (0.85m)	n/a
1% AEP	36.12 (1.12m)	36.16 (1.16m)	36.26 (1.26m)

Notes: 100% blockage only assessed for 1% AEP event to review bund overtopping risk.

Table 18 summarises the detention volume required for the 63.2% minor flow attenuation plus the corresponding unit volume per hectare of development that this equates to. For Precinct 8, this is consistently in the order of approximately 100-120m^3/ha. Additional volume within the basins above this is required for the safe conveyance of larger events into and out of the basin via the high flow bypass weir.

Table 18: Local 63.2% AEP basin storage volumes

Location	Median Storage Volume (m^3)	Unit Volume (m^3/ha)
Basin 8A	1516	118
Basin 8B	2372	115
Basin 8C	1436	100

5.2.8 Discussion

The preliminary design of the stormwater quality and minor flow detention basins provides adequate attenuation of local development runoff to mitigate discharge back to the equivalent pre-development 63.2% AEP discharge. This affords protection to downstream waterway stability in line with the objectives provided in Table 10 previously in Section 4.1.1.

Analysis of blockage conditions within the basins (both design blockage of 50% and extreme blockage of 100%) indicates that all events up to the 1% AEP remain below the top of bund with controlled discharge to the waterway corridor via the high flow bypass weir. With all basin pits designed with raised dome grates, this level of blockage is considered conservative and unlikely to occur in practice.

Detailed design of the basins will involve further review of the water quality basin design within the floor of the system, outlet structures and considerations of the ultimate pipe drainage network design (and catchment) to this location. This current assessment provides adequate support for the current functional design of this basin area for both water quality management and minor flow attenuation.

6 EROSION AND SEDIMENT CONTROL

6.1 DESIGN OBJECTIVES

The management of stormwater runoff during the construction phase is a critical part of protecting the Yarrabilba waterways and drainage lines. Construction phase design objectives for Precinct 8 ROL1 are provided in Table 19 which are generally in accordance with the *Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and the State Planning Policy (DSDIP, 2017).

Table 19: Construction phase stormwater quality

Issue	Desired outcomes
Drainage control	1. Manage stormwater flows around or through areas of exposed soil to avoid contamination. 2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion. 3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2). 4. Provide emergency spillways for sediment basins to achieve the construction phase stormwater management design objectives for emergency spillways on temporary sediment basins (part 3).
Erosion control	1. Stage clearing and construction works to minimise the area of exposed soil at any one time. 2. Effectively cover or stabilise exposed soils prior to predicted rainfall. 3. Prior to completion of works for the development, and prior to removal of sediment controls, all site surfaces must be effectively stabilised* using methods which will achieve effective short-term stabilisation.
Sediment control	1. Direct runoff from exposed site soils to sediment controls that are appropriate to the extent of disturbance and level of erosion risk. 2. All exposed areas greater than 2500 metres2 must be provided with sediment controls which are designed, implemented and maintained to a standard which would achieve at least 80% of the average annual runoff volume of the contributing catchment treated (i.e. 80% hydrological effectiveness) to 50mg/L Total Suspended Solids (TSS) or less, and pH in the range (6.5–8.5).
Litter, hydrocarbons and other contaminants	1. Remove gross pollutants and litter. 2. Avoid the release of oil or visible sheen to released waters. 3. Dispose of waste containing contaminants at authorised facilities.
Waterway stability and flood flow management	1. Where measures are required to meet post-construction waterway stability objectives (specified in table B), these are either installed prior to land disturbance and are integrated with erosion and sediment controls, or equivalent alternative measures are implemented during construction. 2. Earthworks and the implementation of erosion and sediment controls are undertaken in ways which ensure flooding characteristics (including stormwater quantity characteristics) external to the development site are not worsened during construction for all events up to and including the 1 in 100 year ARI (1% AEP).

*Note: An effectively stabilised surface is defined as one that does not, or is not likely to result in visible evidence of soil loss caused by sheet, rill or gully erosion or lead to sedimentation water contamination.

6.2 MANAGEMENT STRATEGY

6.2.1 Local Erosion and Sediment Control

Erosion and sediment control (ESC) will occur on a development stage by stage basis in accordance with *Best Practice Erosion and Sediment Control* (IECA, 2008) to achieve the objectives listed in Table 1. This will involve a combination of:

- Erosion control - Ensuring that all exposed surfaces are stabilised as soon as possible and that erosion of un-stabilised areas of works are minimised
- Drainage control - Ensuring that provision is made to control all on site runoff to designated treatment areas and to enable appropriate bypass of external flows which do not require treatment
- Sediment capture - Ensuring that mobilised sediment is captured through a combination of source controls such as silt fences and appropriately designed sediment basins. Where possible sediment basins for construction will be located within the voids required for the future stormwater quality treatment systems (sediment basins, bioretention basins, wetlands etc.).

The details of the local erosion and sediment controls for bulk earthworks and for each stage of development are not provided in this report given the high level nature of the document. However, prior to any works commencing on a particular development stage in Precinct 8 ROL1, a site specific Erosion and Sediment Control Plan (E&SCP) will be documented for the development stage in question prior to works starting. This will occur as part of the operational works application but can be adjusted by the contractor and site supervisor prior to commencement of construction provided the E&SCP complies with Best Practice Erosion and Sediment Control (IECA, 2008) and delivers the objectives listed previously in Table 19.

6.2.2 High Efficiency Sediment (HES) Basins

Given the importance of managing construction runoff into the waterways downstream of Yarrabilba and the potential impact on the ecology and residents, HES sediment basins are being strategically adopted (where practical) across Precinct 8 ROL1. HES basins offer an improved technology for construction sediment management which essentially converts batch sediment basins into continuous flow treatment systems that respond in real time to storm events. The design sought to be achieved by HES basins that ensures at least 80% of the average annual runoff volume treated to 50mg/L TSS or less

The HES basin essentially comprises:

- Flocculent dosing system
- Inlet zone for mixing, flow distribution and efficient removal of coarse sediment
- Settling basin
- Outlet(s)

Implementation of HES basins have the potential to significantly reduce the fine and dispersive sediment load discharge from the site by a further 50% compared to traditional batch sediment basins.

6.3 MONITORING AND AUDITING

6.3.1 Principal Contractor

Site inspections and monitoring are to be undertaken by the principal contractor in accordance with Sections 6.17 and 7.4 of *the Best Practice Erosion and Sediment Control Document* (IECA, 2008) as detailed below. Best practice site management requires all ESC measures to be inspected at the following frequencies and include the following checks as a minimum:

Daily site inspections (during rainfall):

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- All site discharge points (including dewatering activities as appropriate)

Weekly site inspections (even if work is not occurring on-site)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
- Litter and waste receptors
- Oil, fuel and chemical storage facilities

Prior to anticipated runoff producing rainfall (within 24 hours of expected rainfall)

- All drainage, erosion and sediment control measures
- All temporary flow diversion and drainage works

Following runoff producing rainfall (within 18 hours of rainfall event)

- All drainage, erosion and sediment control measures
- Occurrences of excessive sediment deposition (whether on-site or off-site)
- Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements

6.3.2 CPESC Compliance Audits

The ESC measures implemented at the site are proposed to be inspected on a bi-monthly to quarterly basis by a CPESC (Certified Professional in Erosion and Sediment Control) who is independent of the principal contractor and an audit report kept on file. The purpose of the audits to is to ensure the developer and the contractors are meeting their obligations for ESC under the Environmental Protection Act (EP Act). The site will be assessed against these requirements in accordance with *Procedural Guideline: Standard work method for the assessment of the lawfulness of releases to waters from construction sites in South East Queensland EM1135* (DEHP, 2011).

The compliance audits will involve:

- Site inspection with the contractors to assess ESC actions on the site against the ESC plans and the requirements of EP Act and DEHP Procedural Guideline.
- Identifying non-compliances on the site, photographing and recording these for reporting.
- Where the rectification action is simple, these will be recorded and verbally communicated to the contractor for action.
- Review of any water quality and rainfall information for the site
- Compilation of a ESC Audit report which:
  - Identifies the ESC obligations;
  - ESC issue and non-compliances; and
  - Actions (simple) to be taken to rectify the issues and non-compliances.

The triggers for inspections and reporting by the CPESC are as follows:

- Prior to the commencement of clearing works in each catchment;
- Prior to the commencement of bulk earthworks;
- Prior to the commencement of civil works; and
- At regular monthly intervals during works.

7 CONCLUSION

A stormwater management strategy for Yarrabilba Precinct 8 ROL1 development has been prepared to meet the requirements of the *Yarrabilba Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and Context Plan Area Strategy.

The strategy adopts stormwater treatment measures including sediment pond and bioretention basins that manage the Precinct 8 ROL1 development area. These treatment systems integrate with the local urban and natural environment to ensure the stormwater quality objectives are achieved for the precinct while providing protection or enhancement to the local waterways and amenity. Sufficient space has been allowed for in the development layout for the stormwater treatment measures which have been verified via preliminary layout plans.

Site design has also ensured all development lots are above the local 1% AEP flood level and provided with adequate flow conveyance for external catchment discharge. No flood detention infrastructure is required as part of the precinct as the regional flood basin (at Fauna Way) has already been constructed downstream as part of existing Precinct 3B works.

Local waterway stability management has been integrated into the overall development by considering the current condition of receiving waterways and proposing protection and/or rehabilitation strategies that incorporate local scour protection works, revegetation and exploiting natural regeneration process where practical. Minor flow management (as 63.2% AEP storage over treatment basins) is proposed for the P8 ROL1 waterways where localised instability risks have been identified and warrant minor flow management.

Construction phase stormwater management objectives have been established for the site, in accordance with State Planning Policy (DSDIP, 2017). Preparation of detailed erosion and sediment control plan(s) are required prior to works commencing plus ongoing staging and updates to these plans to ensure the ESC strategy responds to the changing site conditions. Audits will be completed during construction to ensure compliance with State Planning Policy and Environment Protection Act.

8 REFERENCES

DesignFlow (2024) *Yarrabilba Stormwater Infrastructure Master Plan*

DesignFlow (2023) *Yarrabilba Waterway Condition Assessment*

DesignFlow (2024) *Yarrabilba Masterplan Flood Risk Management Strategy*

DSDIP (2017) *State Planning Policy*

IECA (2008) *Best Practice Erosion and Sediment Control*

Water by Design (2010). *MUSIC Modelling Guidelines. SEQ Healthy Waterways Partnership.*

Water by Design (2018) *MUSIC Modelling Guidelines.* Water by Design, Healthy Land and Water Limited, Brisbane, Queensland. (https://waterbydesign.com.au/download/music-guideline-2018)

IPWEAQ (2016) *Queensland Urban Drainage Manual*

APPENDIX A FUNCTIONAL DESIGN PLANS

LEGEND

	STAGE BOUNDARY
	PROPOSED KERB FACE
S	PROPOSED SEWER
TS	PROPOSED TRUNK SEWER
SW	PROPOSED STORMWATER
W	PROPOSED WATER
TW	PROPOSED TRUNK WATER
S	EXISTING SEWER
TS	EXISTING TRUNK SEWER
SW	EXISTING STORMWATER
W	EXISTING WATER
TW	EXISTING TRUNK WATER
**	BIO BASIN/SEDIMENT POND REFER DESIGNFLOW'S REPORT: SMP - PRECINCT 8

STORMWATER PLAN

SCALE 1:1000

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK015-SK018-P08ROL1-FUNC-SW.dwg Plotted by: JS on 8/04/2026 1:35:25 PM

FOR APPROVAL

REVISIONS

No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	STAGE BDY NAMES AMENDED	SLK	JAS	RWM	10.06.25
C	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project

YARRABILBA

PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:39+10'00'

NORTH

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group
L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title

FUNCTIONAL LAYOUT
STORMWATER PLAN
SHEET 1

Scale: AS SHOWN

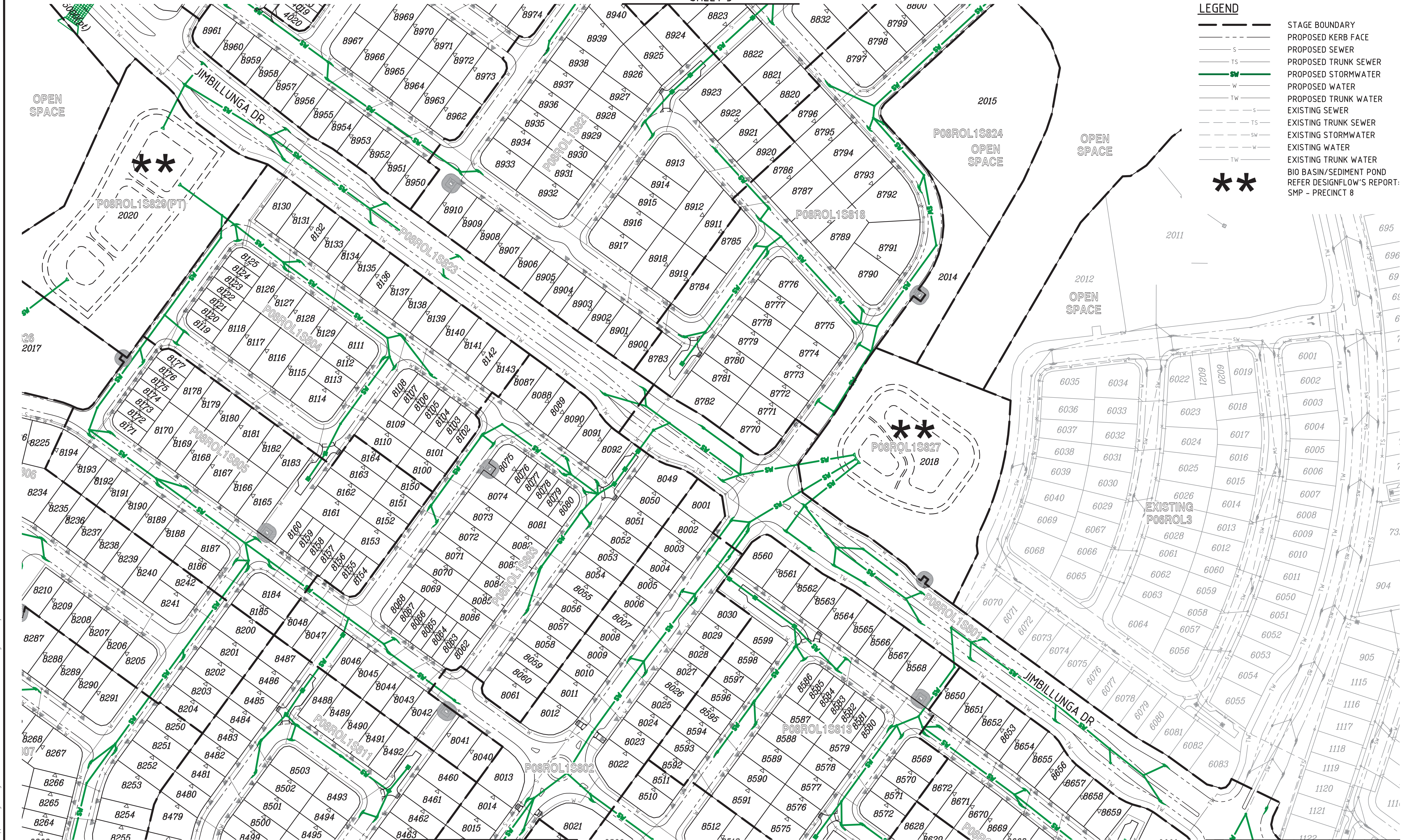
Sheet: 15 of 34

A1

Drawing No: 24-153-SK015

Revision: C

SHEET 3



LEGEND

	STAGE BOUNDARY
	PROPOSED KERB FACE
S	PROPOSED SEWER
TS	PROPOSED TRUNK SEWER
SW	PROPOSED STORMWATER
W	PROPOSED WATER
TW	PROPOSED TRUNK WATER
S	EXISTING SEWER
TS	EXISTING TRUNK SEWER
SW	EXISTING STORMWATER
W	EXISTING WATER
TW	EXISTING TRUNK WATER
**	BIO BASIN/SEDIMENT POND REFER DESIGNFLOW'S REPORT: SMP - PRECINCT 8

SHEET 1

STORMWATER PLAN

SCALE 1:1000

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

FOR APPROVAL

REVISIONS

No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project

YARRABILBA

PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:39+10'00'

NORTH

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group

L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

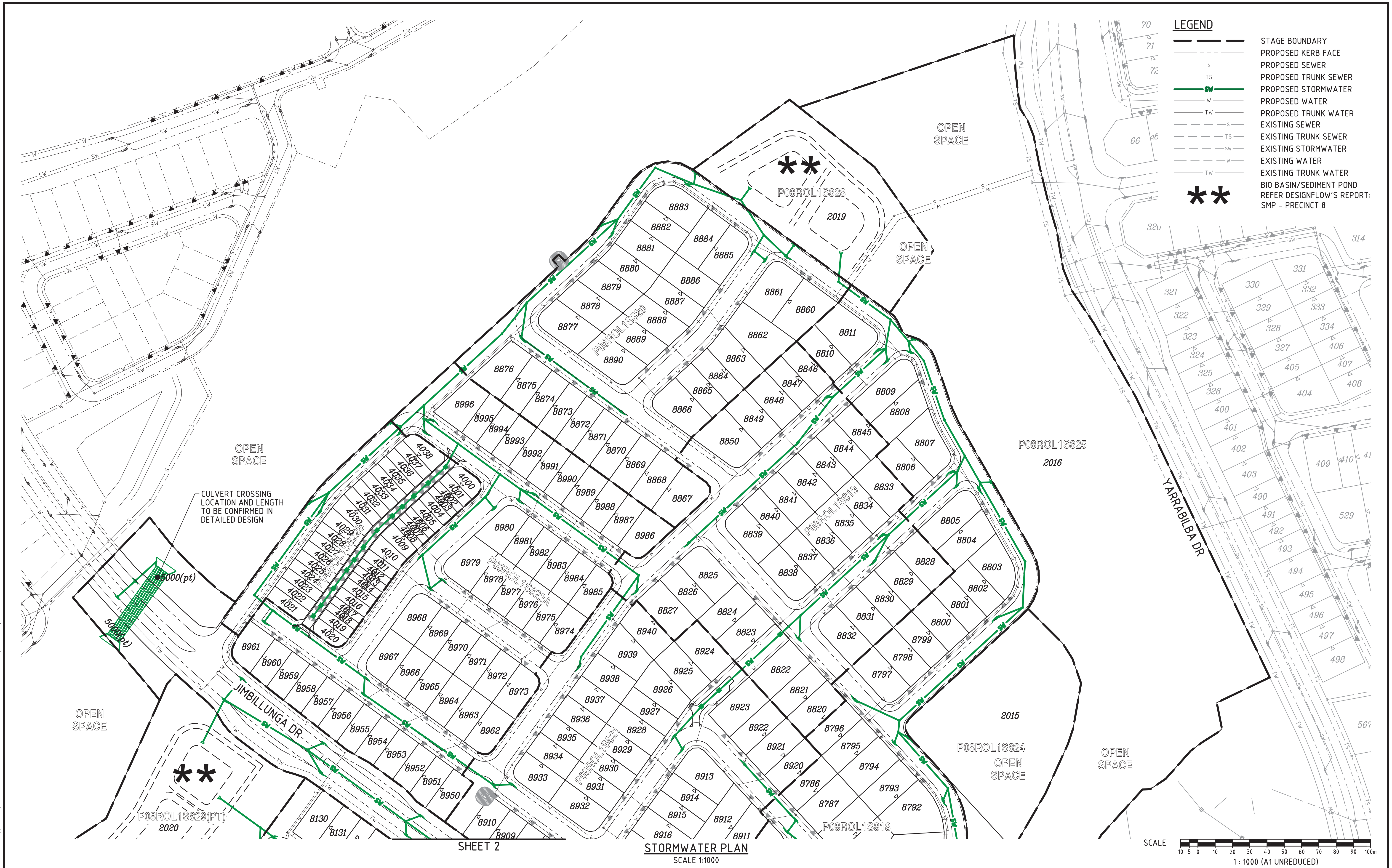
Drawing Title

FUNCTIONAL LAYOUT
STORMWATER PLAN
SHEET 2

Scale	Sheet
AS SHOWN	16 of 34

	Drawing No	Revision
A1	24-153-SK016	B

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK015-SK018-P08ROL1-FUNC-SW.dwg Plotted by: JS on 8/04/2026 1:35:26 PM



STORMWATER PLAN

SCALE 1:1000

FOR APPROVAL

REVISIONS					
No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project

YARRABILBA

PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:40+10'00'

NORTH

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group

L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title

FUNCTIONAL LAYOUT
STORMWATER PLAN
SHEET 3

Scale: AS SHOWN

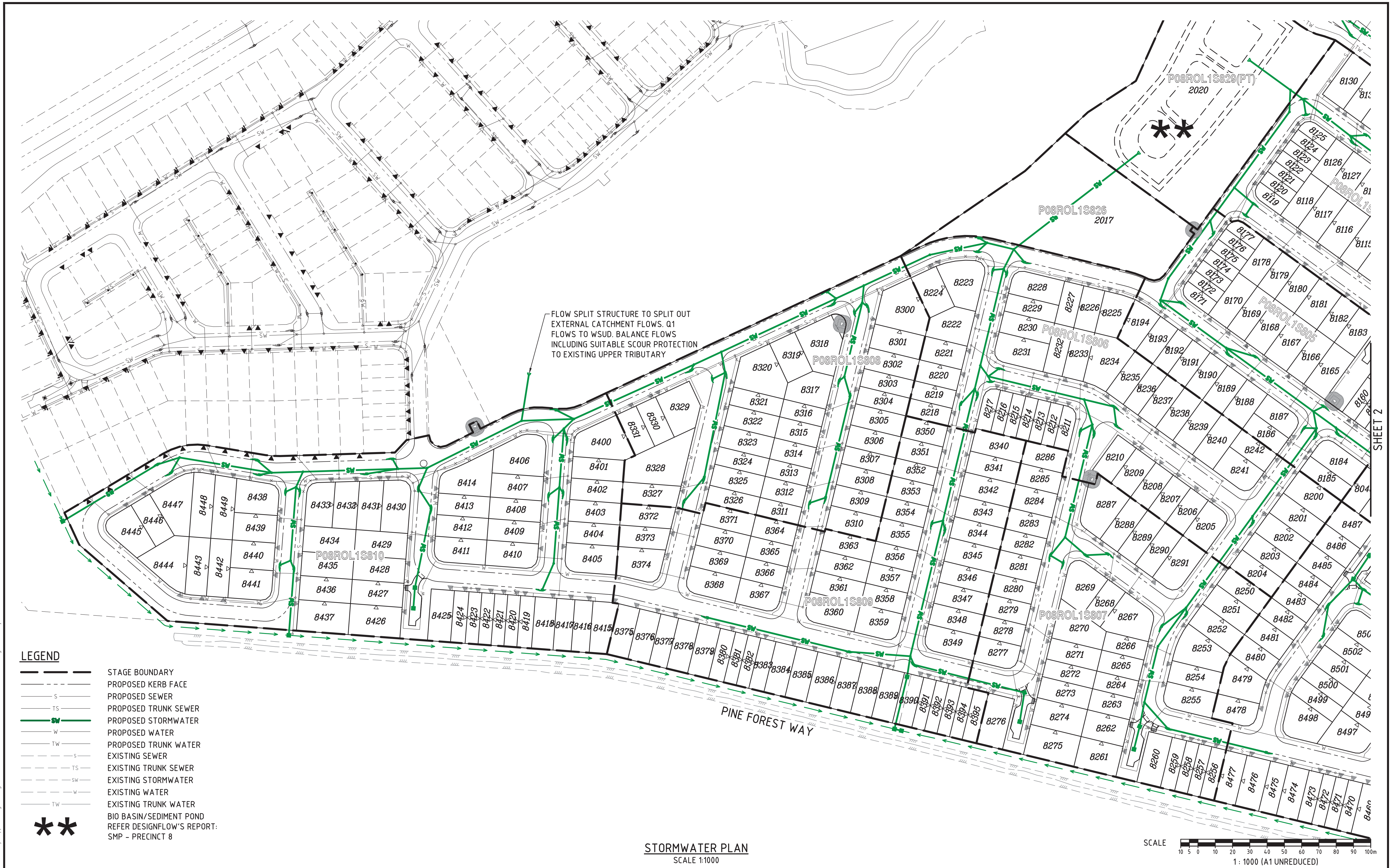
Sheet: 17 of 34

A1

Drawing No: 24-153-SK017

Revision: B

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK015-SK018-P08ROL1-FUNC-SW.dwg Plotted by: JS on 8/04/2026 1:35:27 PM



LEGEND

- STAGE BOUNDARY
- PROPOSED KERB FACE
- PROPOSED SEWER
- PROPOSED TRUNK SEWER
- PROPOSED STORMWATER
- PROPOSED WATER
- PROPOSED TRUNK WATER
- EXISTING SEWER
- EXISTING TRUNK SEWER
- EXISTING STORMWATER
- EXISTING WATER
- EXISTING TRUNK WATER
- ** BIO BASIN/SEDIMENT POND REFER DESIGNFLOW'S REPORT: SMP - PRECINCT 8

STORMWATER PLAN

SCALE 1:1000

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK015-SK018-P08ROL1-FUNC-SW.dwg Plotted by: JS on 8/04/2026 1:35:28 PM

FOR APPROVAL

REVISIONS

No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	FLOW SPLIT STRUCTURE ADDED, SEW AMENDED	SLK	JAS	RWM	30.10.25
C	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project

YARRABILBA

PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:40+10'00'

NORTH

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group

L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title

FUNCTIONAL LAYOUT
STORMWATER PLAN
SHEET 4

Scale	Sheet
AS SHOWN	18 of 34
A1	Drawing No 24-153-SK018	Revision C

LEGEND

	PROPOSED KERB FACE
28.0	PRELIMINARY CONTOURS
27.0	EXISTING CONTOURS (LIDAR)
	BATTER LINE - TOP
	BATTER LINE - BOTTOM
	CUT
	FILL
	COMBINED CONSTRAINT LINE

EARTHWORKS CONTOUR PLAN

SCALE 1:1000

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m
1 : 1000 (A1 UNREDUCED)

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK027-SK030-P08ROL1-FUNC-EWKS.dwg Plotted by: JS on 8/04/2026 1:35:51 PM

FOR APPROVAL

REVISIONS

No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project
YARRABILBA
PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client
Stockland

Approved - RPEQ 12805
Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:44+10'00'

NORTH
DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

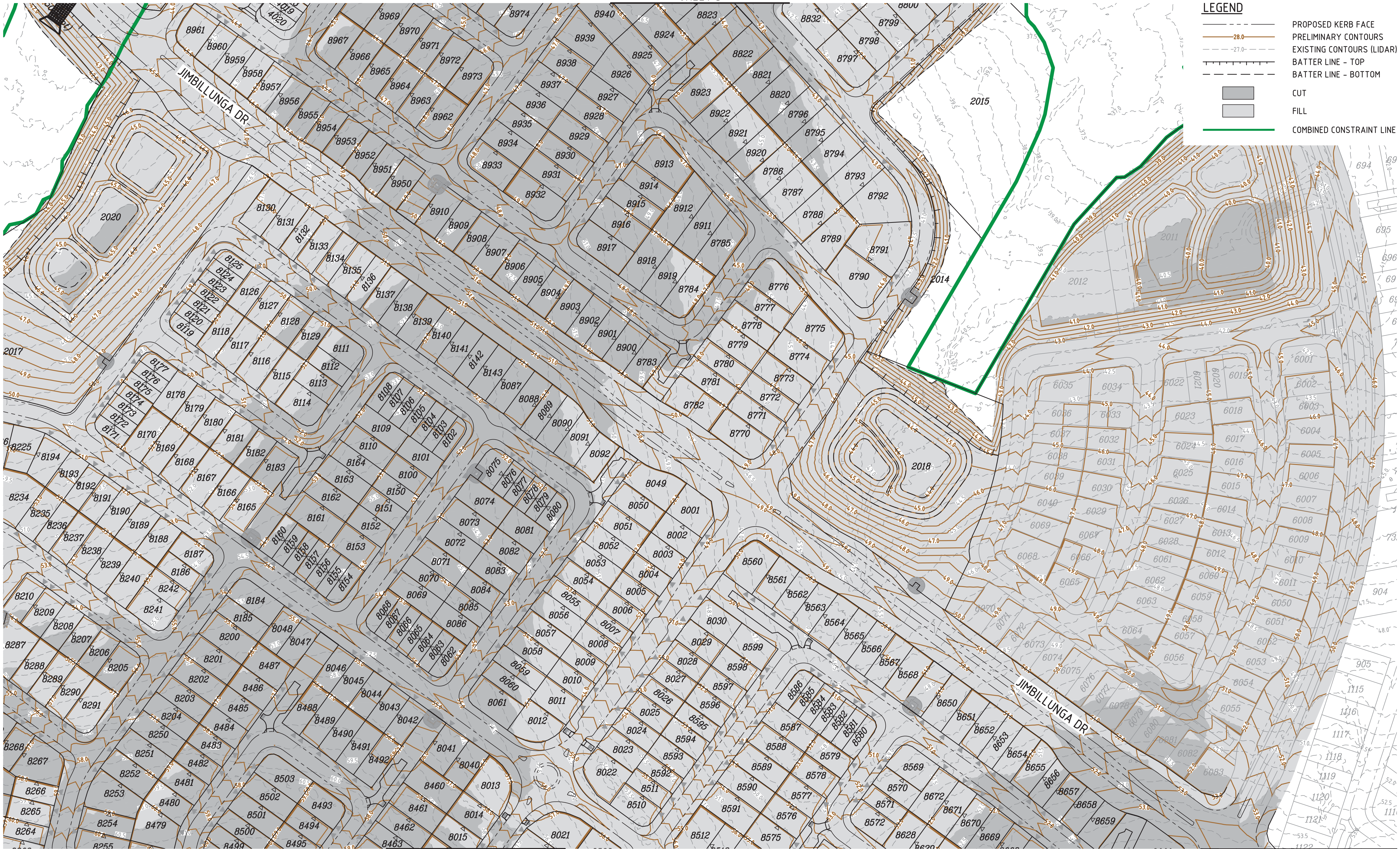
Application No.

kn group
L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title
FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 1

Scale: AS SHOWN
Sheet: 27 of 34
A1
Drawing No: 24-153-SK027
Revision: B

SHEET 3



SHEET 1

EARTHWORKS CONTOUR PLAN

SCALE 1:1000

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

FOR APPROVAL

REVISIONS

No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project

YARRABILBA

PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:45+10'00'

NORTH

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group

L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title

FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 2

Scale AS SHOWN

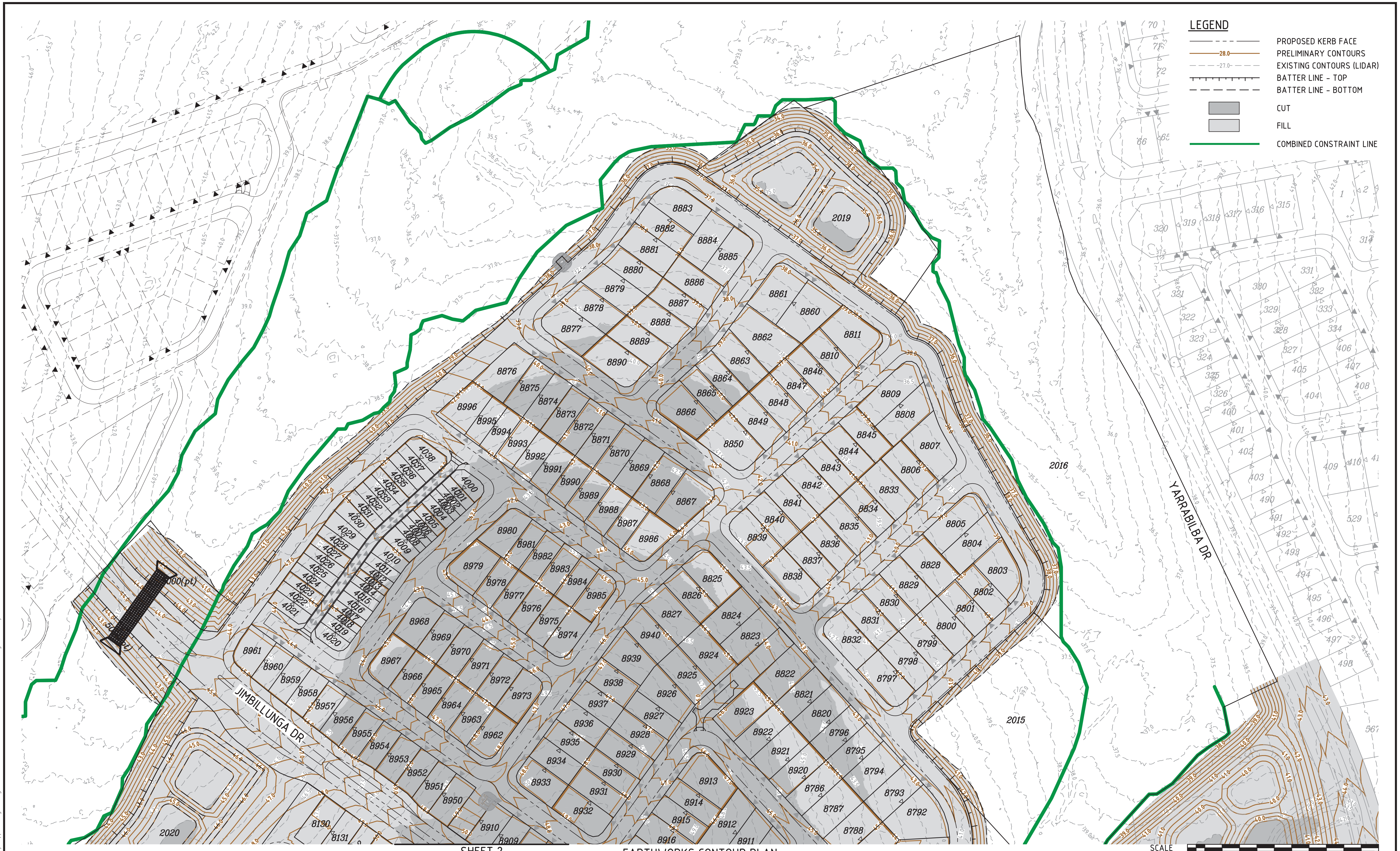
Sheet 28 of 34

A1

Drawing No 24-153-SK028

Revision B

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK027-SK030-P08ROL1-FUNC-EWKS.dwg Plotted by: JS on 8/04/2026 1:35:55 PM



EARTHWORKS CONTOUR PLAN

SCALE 1:1000

FOR APPROVAL

REVISIONS

No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project

YARRABILBA

PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:45+10'00'

NORTH

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group

L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title

FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 3

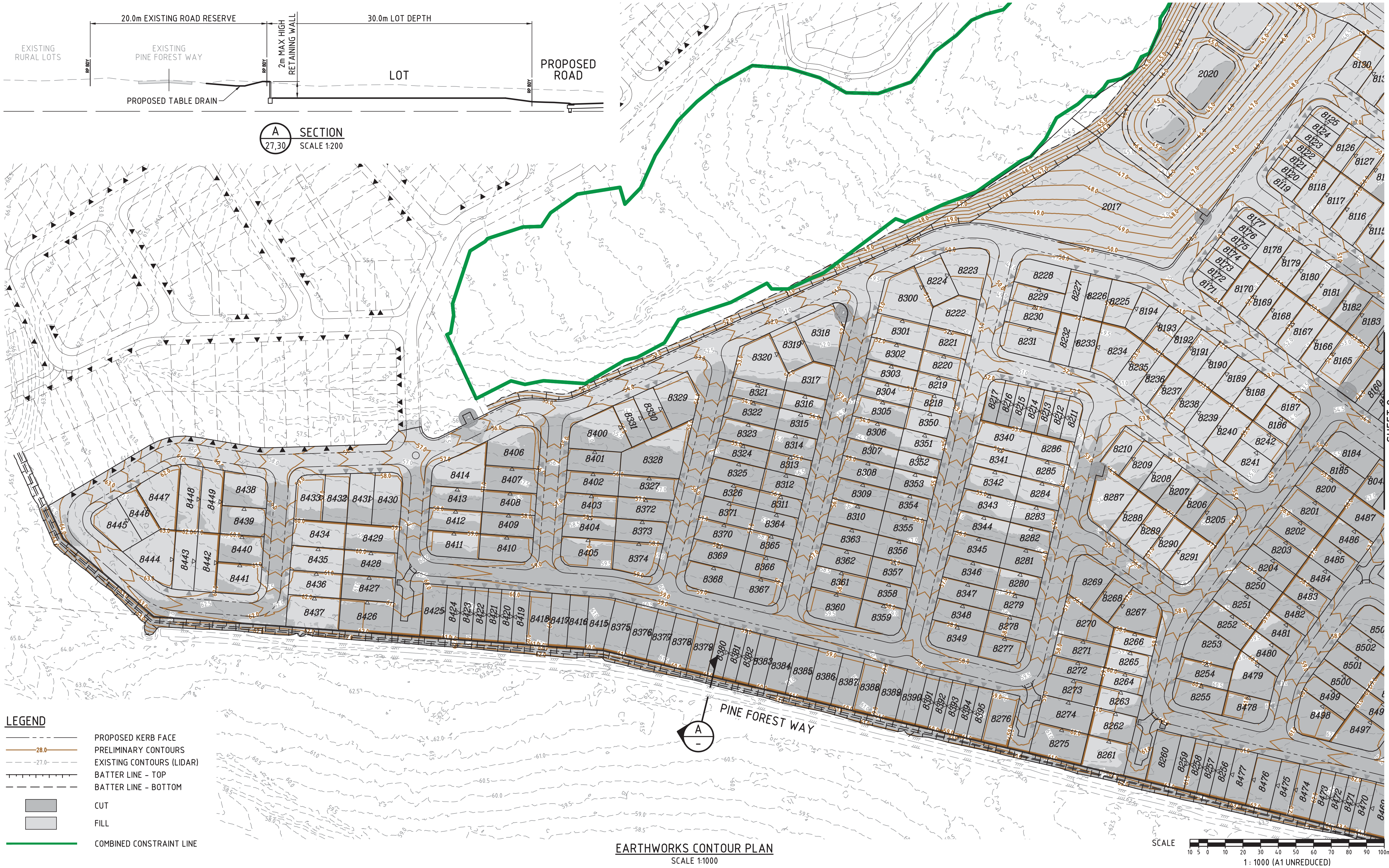
Scale: AS SHOWN

Sheet: 29 of 34

A1

Drawing No: 24-153-SK029

Revision: B



LEGEND

- PROPOSED KERB FACE
- PRELIMINARY CONTOURS
- EXISTING CONTOURS (LIDAR)
- BATTER LINE - TOP
- BATTER LINE - BOTTOM
- CUT
- FILL
- COMBINED CONSTRAINT LINE

EARTHWORKS CONTOUR PLAN

SCALE 1:1000

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\24-153-SK027-SK030-P08ROL1-FUNC-EWKS.dwg Plotted by: JS on 8/04/2026 1:36:05 PM

FOR APPROVAL

REVISIONS					
No	Description	DR	DES	CHK	Date
A	FOR APPROVAL	SLK	JAS	RWM	30.05.25
B	LOT LAYOUT AMENDED	JAS	JAS	RWM	08.04.26

Project
YARRABILBA
PRECINCT 8 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client
Stockland

Approved - RPEQ 12805
Digitally signed by Robert William Mander BEng (Civil), CPEng, RPEQ 12805
Date: 2026.04.09 11:00:46+10'00'

NORTH
DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

Application No.

kn group
L1, 62 Astor Terrace, Spring Hill, QLD 4000
www.kngroup.com.au | 07 3017 1900

Drawing Title
FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 4

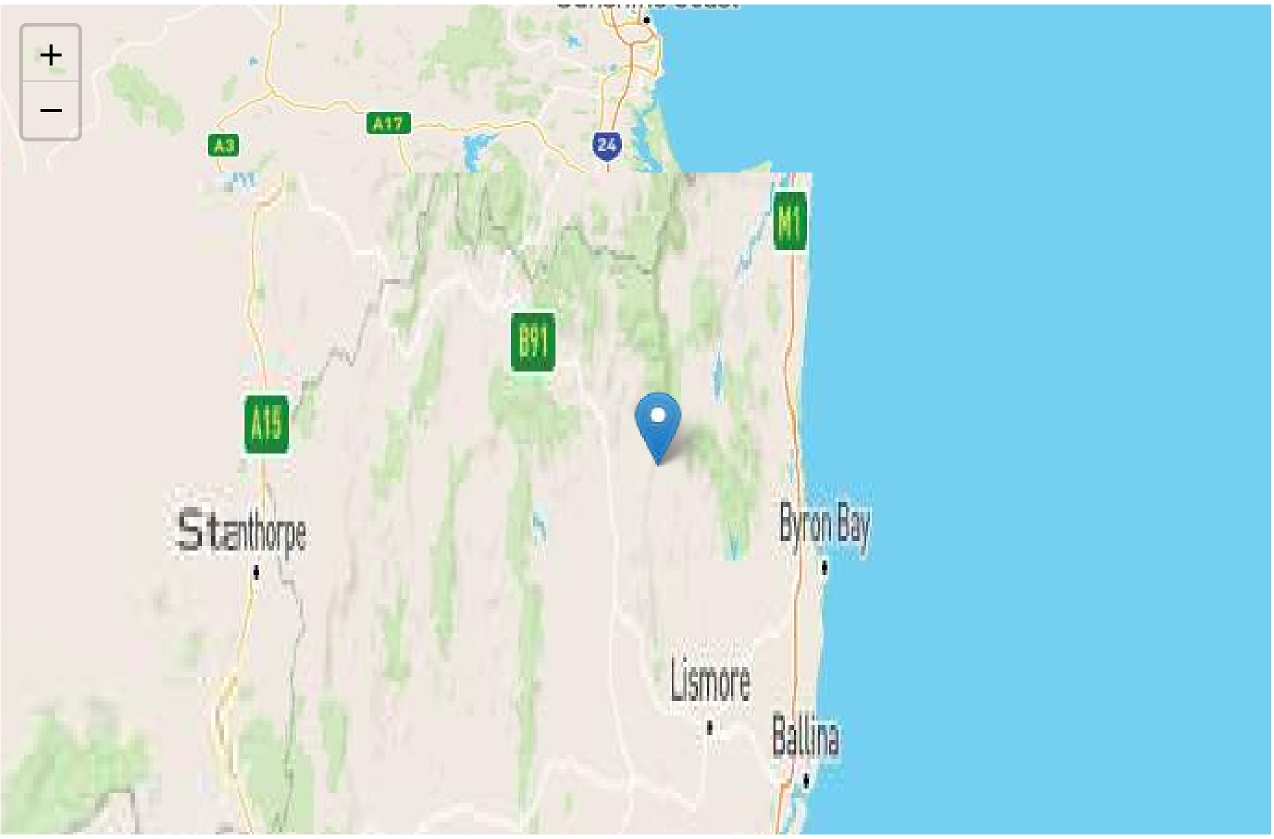
Scale	Sheet
AS SHOWN	30 of 34
A1	Drawing No 24-153-SK030	Revision B

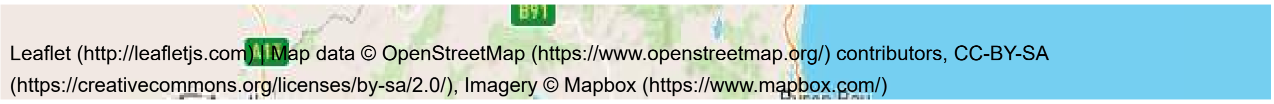
APPENDIX B ARR DATA HUB

Australian Rainfall & Runoff Data Hub - Results

Input Data

Longitude	153.122
Latitude	-27.835
Selected Regions (clear)	
River Region	show
ARF Parameters	show
Storm Losses	show
Temporal Patterns	show
Areal Temporal Patterns	show
BOM IFDs	show
Median Preburst Depths and Ratios	show
10% Preburst Depths	show
25% Preburst Depths	show
75% Preburst Depths	show
90% Preburst Depths	show
Climate Change Factors	show





Data

River Region

Division	North East Coast
River Number	45
River Name	Logan-Albert Rivers

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2016_v1

ARF Parameters

$$ARF = Min\left\{1, \left[1 - a\left(Area^{b} - c\log_{10}Duration\right)Duration^{-d} + eArea^{f}Duration^{g}\left(0.3 + \log_{10}AEP\right) + h10^{iArea\frac{Duration}{1440}}\left(0.3 + \log_{10}AEP\right)\right]\right\}$$

Zone	a	b	c	d	e	f	g	h	i
East Coast North	0.327	0.241	0.448	0.36	0.00096	0.48	-0.21	0.012	-0.0013

Short Duration ARF

$$ARF = Min\left[1, 1 - 0.287\left(Area^{0.265} - 0.439\log_{10}(Duration)\right).Duration^{-0.36} + 2.26 \text{ x } 10^{-3} \text{ x } Area^{0.226}.Duration^{0.125}\left(0.3 + \log_{10}(AEP)\right) + 0.0141 \text{ x } Area^{0.213} \text{ x } 10^{-0.021\frac{(Duration-180)^{2}}{1440}}\left(0.3 + \log_{10}(AEP)\right)\right]$$

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2016_v1

Storm Losses

Note: Burst Loss = Storm Loss - Preburst

Note: These losses are only for rural use and are **NOT FOR DIRECT USE** in urban areas

ID	5092.0
Storm Initial Losses (mm)	26.0
Storm Continuing Losses (mm/h)	1.9

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2016_v1

Temporal Patterns | Download (.zip) (static/temporal_patterns/TP/ECnorth.zip)

code	ECnorth
Label	East Coast North

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2016_v2

Areal Temporal Patterns | Download (.zip) (./static/temporal_patterns/Areal/Areal_ECnorth.zip)

code	ECnorth
arealabel	East Coast North

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2016_v2

BOM IFDs

Click here (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-27.835&longitude=153.122&sdmin=true&sdhr=true&sdday=true&user_label=) to obtain the IFD depths for catchment centroid from the BoM website

Layer Info

Time Accessed	01 May 2025 10:44AM

Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.9 (0.027)	3.0 (0.063)	4.4 (0.077)	5.7 (0.086)	8.4 (0.107)	10.4 (0.118)
90 (1.5)	0.5 (0.014)	2.7 (0.050)	4.2 (0.064)	5.5 (0.073)	11.9 (0.131)	16.7 (0.162)
120 (2.0)	0.4 (0.009)	7.0 (0.118)	11.4 (0.159)	15.6 (0.185)	17.6 (0.174)	19.2 (0.166)
180 (3.0)	0.8 (0.017)	8.4 (0.125)	13.5 (0.165)	18.3 (0.190)	23.3 (0.199)	27.0 (0.201)
360 (6.0)	2.1 (0.034)	12.6 (0.145)	19.5 (0.185)	26.2 (0.208)	44.5 (0.289)	58.2 (0.329)
720 (12.0)	2.7 (0.034)	11.0 (0.095)	16.4 (0.116)	21.7 (0.128)	41.3 (0.200)	56.0 (0.235)
1080 (18.0)	2.3 (0.024)	11.9 (0.086)	18.3 (0.108)	24.4 (0.121)	36.4 (0.147)	45.4 (0.160)
1440 (24.0)	3.6 (0.034)	7.7 (0.049)	10.3 (0.054)	12.9 (0.056)	29.2 (0.104)	41.4 (0.129)
2160 (36.0)	0.0 (0.000)	4.6 (0.025)	7.6 (0.033)	10.5 (0.039)	22.7 (0.068)	31.8 (0.083)
2880 (48.0)	0.0 (0.000)	1.2 (0.006)	2.0 (0.008)	2.8 (0.009)	13.1 (0.035)	20.8 (0.049)
4320 (72.0)	0.0 (0.000)	0.1 (0.000)	0.2 (0.001)	0.3 (0.001)	4.7 (0.011)	8.1 (0.017)

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

10% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

25% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.2 (0.004)	0.4 (0.006)	0.5 (0.007)	0.5 (0.006)	0.5 (0.006)
90 (1.5)	0.0 (0.000)	0.2 (0.003)	0.3 (0.004)	0.4 (0.005)	1.0 (0.011)	1.5 (0.014)
120 (2.0)	0.0 (0.000)	0.8 (0.013)	1.3 (0.018)	1.7 (0.021)	1.3 (0.013)	1.0 (0.009)
180 (3.0)	0.0 (0.000)	0.2 (0.003)	0.4 (0.005)	0.5 (0.005)	0.8 (0.007)	1.0 (0.007)
360 (6.0)	0.0 (0.000)	0.6 (0.007)	1.0 (0.009)	1.4 (0.011)	4.0 (0.026)	6.0 (0.034)
720 (12.0)	0.0 (0.000)	2.1 (0.019)	3.6 (0.025)	4.9 (0.029)	8.6 (0.042)	11.4 (0.048)
1080 (18.0)	0.0 (0.000)	1.9 (0.014)	3.1 (0.019)	4.3 (0.021)	6.2 (0.025)	7.6 (0.027)
1440 (24.0)	0.0 (0.000)	0.1 (0.000)	0.1 (0.001)	0.2 (0.001)	4.2 (0.015)	7.2 (0.022)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.4 (0.001)	0.7 (0.002)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

75% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	16.8 (0.483)	28.4 (0.592)	36.2 (0.632)	43.6 (0.656)	39.8 (0.505)	37.0 (0.418)
90 (1.5)	14.6 (0.372)	23.0 (0.423)	28.6 (0.438)	33.9 (0.446)	65.5 (0.717)	89.2 (0.863)
120 (2.0)	10.6 (0.249)	29.6 (0.498)	42.3 (0.590)	54.4 (0.648)	93.7 (0.924)	123.1 (1.068)
180 (3.0)	30.2 (0.628)	49.4 (0.730)	62.1 (0.757)	74.2 (0.768)	112.9 (0.961)	141.9 (1.056)
360 (6.0)	32.4 (0.533)	51.6 (0.595)	64.3 (0.608)	76.4 (0.608)	117.9 (0.767)	149.0 (0.842)
720 (12.0)	37.7 (0.472)	59.1 (0.512)	73.2 (0.518)	86.8 (0.514)	112.1 (0.543)	131.1 (0.552)
1080 (18.0)	21.8 (0.229)	51.6 (0.375)	71.4 (0.422)	90.3 (0.446)	109.2 (0.441)	123.3 (0.434)
1440 (24.0)	28.9 (0.270)	47.5 (0.304)	59.7 (0.311)	71.5 (0.311)	84.8 (0.302)	94.7 (0.294)
2160 (36.0)	12.6 (0.100)	24.8 (0.134)	32.8 (0.144)	40.5 (0.149)	60.3 (0.181)	75.0 (0.197)
2880 (48.0)	12.9 (0.092)	27.2 (0.132)	36.7 (0.144)	45.8 (0.150)	62.4 (0.168)	74.9 (0.176)
4320 (72.0)	0.2 (0.001)	10.6 (0.045)	17.5 (0.060)	24.1 (0.070)	45.7 (0.108)	62.0 (0.128)

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

90% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	62.6 (1.799)	98.4 (2.049)	122.1 (2.134)	144.8 (2.183)	135.1 (1.713)	127.7 (1.442)
90 (1.5)	51.1 (1.304)	76.1 (1.398)	92.7 (1.419)	108.5 (1.425)	190.8 (2.088)	252.5 (2.441)
120 (2.0)	37.0 (0.868)	76.9 (1.293)	103.4 (1.443)	128.7 (1.533)	190.3 (1.878)	236.4 (2.051)
180 (3.0)	70.6 (1.468)	108.2 (1.598)	133.0 (1.623)	156.9 (1.623)	241.6 (2.057)	305.2 (2.271)
360 (6.0)	59.6 (0.981)	106.5 (1.229)	137.6 (1.301)	167.3 (1.331)	245.1 (1.594)	303.4 (1.715)
720 (12.0)	88.8 (1.111)	125.2 (1.086)	149.3 (1.056)	172.4 (1.021)	220.3 (1.066)	256.2 (1.078)
1080 (18.0)	57.8 (0.609)	95.5 (0.693)	120.4 (0.711)	144.4 (0.714)	179.0 (0.724)	205.0 (0.722)
1440 (24.0)	77.7 (0.724)	103.3 (0.661)	120.3 (0.626)	136.6 (0.594)	166.3 (0.592)	188.6 (0.586)
2160 (36.0)	37.6 (0.297)	76.9 (0.415)	102.9 (0.451)	127.8 (0.469)	149.7 (0.449)	166.0 (0.435)
2880 (48.0)	44.2 (0.314)	75.2 (0.364)	95.7 (0.375)	115.4 (0.379)	147.8 (0.397)	172.1 (0.404)
4320 (72.0)	14.4 (0.090)	40.5 (0.172)	57.7 (0.199)	74.3 (0.215)	94.1 (0.222)	109.0 (0.224)

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

Climate Change Factors

Rainfall Factors

SSP1-2.6

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	**1.18**	**1.17**	**1.16**	**1.14**	**1.13**	**1.12**	**1.12**	**1.11**	**1.1**	**1.1**
2040	1.21	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.11
2050	**1.22**	**1.2**	**1.18**	**1.17**	**1.15**	**1.15**	**1.14**	**1.13**	**1.12**	**1.11**
2060	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2070	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2080	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2090	**1.23**	**1.21**	**1.2**	**1.18**	**1.17**	**1.16**	**1.15**	**1.14**	**1.13**	**1.12**
2100	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12

SSP2-4.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	**1.18**	**1.17**	**1.16**	**1.14**	**1.13**	**1.12**	**1.12**	**1.11**	**1.1**	**1.1**
2040	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12
2050	**1.27**	**1.24**	**1.23**	**1.21**	**1.19**	**1.18**	**1.17**	**1.16**	**1.15**	**1.14**
2060	1.3	1.27	1.25	1.23	1.21	1.2	1.19	1.18	1.16	1.16
2070	1.33	1.3	1.28	1.26	1.24	1.22	1.21	1.19	1.18	1.17
2080	1.37	1.33	1.31	1.28	1.26	1.24	1.22	1.21	1.2	1.19
2090	**1.4**	**1.36**	**1.34**	**1.31**	**1.28**	**1.26**	**1.24**	**1.23**	**1.21**	**1.2**
2100	1.41	1.37	1.35	1.32	1.29	1.27	1.25	1.24	1.22	1.21

SSP3-7.0

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	**1.18**	**1.17**	**1.16**	**1.14**	**1.13**	**1.12**	**1.12**	**1.11**	**1.1**	**1.1**
2040	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2050	**1.29**	**1.26**	**1.24**	**1.22**	**1.2**	**1.19**	**1.18**	**1.17**	**1.16**	**1.15**
2060	1.35	1.32	1.3	1.27	1.25	1.23	1.22	1.2	1.19	1.18
2070	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2080	1.5	1.45	1.42	1.38	1.35	1.33	1.3	1.28	1.26	1.25
2090	**1.59**	**1.53**	**1.49**	**1.44**	**1.4**	**1.38**	**1.35**	**1.33**	**1.3**	**1.29**
2100	1.66	1.59	1.55	1.5	1.45	1.42	1.39	1.37	1.34	1.32

SSP5-8.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	**1.2**	**1.18**	**1.17**	**1.16**	**1.14**	**1.13**	**1.13**	**1.12**	**1.11**	**1.11**
2040	1.26	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.14
2050	**1.34**	**1.31**	**1.29**	**1.26**	**1.24**	**1.23**	**1.21**	**1.2**	**1.18**	**1.18**
2060	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2070	1.52	1.47	1.43	1.4	1.36	1.34	1.31	1.29	1.27	1.26
2080	1.63	1.57	1.52	1.48	1.43	1.4	1.37	1.35	1.33	1.31
2090	**1.77**	**1.69**	**1.64**	**1.58**	**1.52**	**1.49**	**1.45**	**1.42**	**1.39**	**1.37**
2100	1.86	1.77	1.71	1.64	1.58	1.54	1.5	1.47	1.43	1.41

Loss Factors

Initial Loss (Adjustment Factors)

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2030	**1.02**	**1.02**	**1.02**	**1.03**
2040	1.03	1.03	1.03	1.03
2050	**1.03**	**1.03**	**1.04**	**1.04**
2060	1.03	1.04	1.04	1.05
2070	1.03	1.04	1.05	1.06
2080	1.03	1.05	1.06	1.07
2090	**1.03**	**1.05**	**1.07**	**1.08**
2100	1.03	1.05	1.07	1.09

Continuing Loss (Adjustment Factors)

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2030	**1.04**	**1.05**	**1.05**	**1.05**
2040	1.05	1.05	1.06	1.06

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2050	**1.06**	**1.06**	**1.07**	**1.08**
2060	1.06	1.07	1.08	1.1
2070	1.06	1.08	1.1	1.12
2080	1.06	1.09	1.11	1.14
2090	**1.06**	**1.09**	**1.13**	**1.16**
2100	1.06	1.1	1.14	1.18

Temperature Changes (Degrees, Relative to 1961-1990 Baseline)

Year	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
2030	**1.2**	**1.2**	**1.2**	**1.3**
2040	1.3	1.4	1.5	1.6
2050	**1.4**	**1.7**	**1.8**	**2.1**
2060	1.5	1.9	2.2	2.5
2070	1.5	2.1	2.5	3
2080	1.5	2.2	2.9	3.5
2090	**1.5**	**2.4**	**3.3**	**4.1**
2100	1.4	2.5	3.6	4.5

Layer Info

Time Accessed	01 May 2025 10:44AM
Version	2024_v1
Note	Updated climate change factors for IFD Initial loss and continuing loss based on IPCC AR6 temperature increases from the updated Climate Change Considerations (Book 1: Chapter 6) in ARR (Version 4.2). ARR recomends the use of Current and near-term (2030 midpoint). Medium-term (2050 midpoint) and Long-term (2090 midpoint)

Download TXT (downloads/bd1b1226-bbfe-462d-8e3b-b7422f244233.txt)

Download JSON (downloads/6ec10340-1c2a-4948-a2c0-39a2045e9437.json)

Generating PDF... (downloads/4dc1d191-6132-4c1d-9a67-a7e7d2d7745a.pdf)