# YARRABILBA

# PRECINCT 9 ROL1

# STORMWATER MANAGEMENT PLAN

VERSION 2

DesignFlow

Prepared for Stockland

April 2026

PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

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## Document Control Sheet

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### 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

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# 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 9 ROL1 (subject site) covers an area of approximately 107 ha which includes residential lots, roads (and road resumption areas), local and neighbourhood centres, school, recreational open space, major sports park and 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 9 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 9 ROL1 (P9 ROL1) lies in the central west portion of the Stockland Yarrabilba site and is located west of Precinct 8 and east of Waterford Tamborine Road as shown in Figure 1. The subject development area covers a total area of approximately 130 hectares and 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 9 exhibits reasonably consistent grades in the order of 4-5% falling generally north and south off two central ridgelines with lower gradients along the waterways draining in an east to northeast direction. Waterway corridors define the north eastern and southern edge of development with a third waterway corridor through the central part of the precinct. Elevation varies from 30mAHD to 77mAHD within the P9 ROL1 site. The site topography is shown in Figure 2.

Precinct 9 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 9 ROL1 is to the existing waterways within the precinct, which confluence at the eastern extent of the precinct and drain 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 9 ROL1.

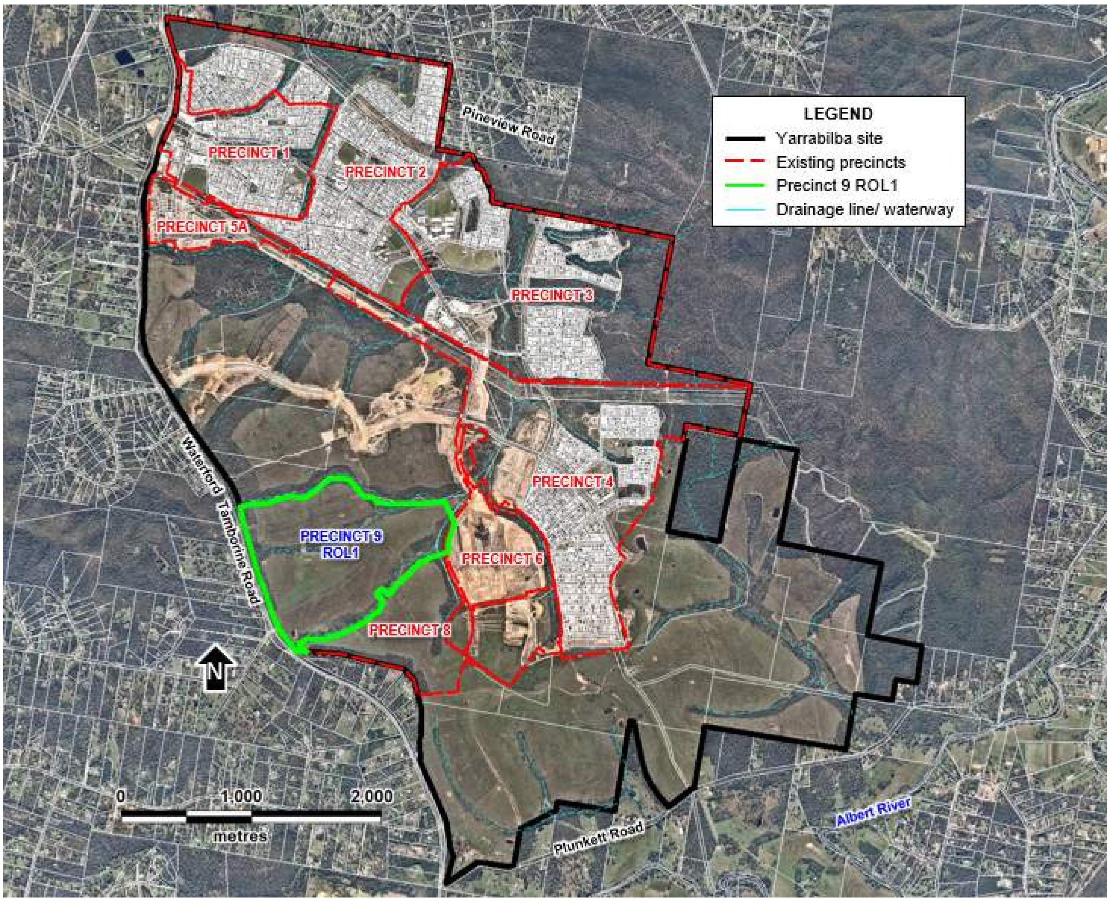



Figure 1: Yarrabilba Precinct 9 ROL1 locality

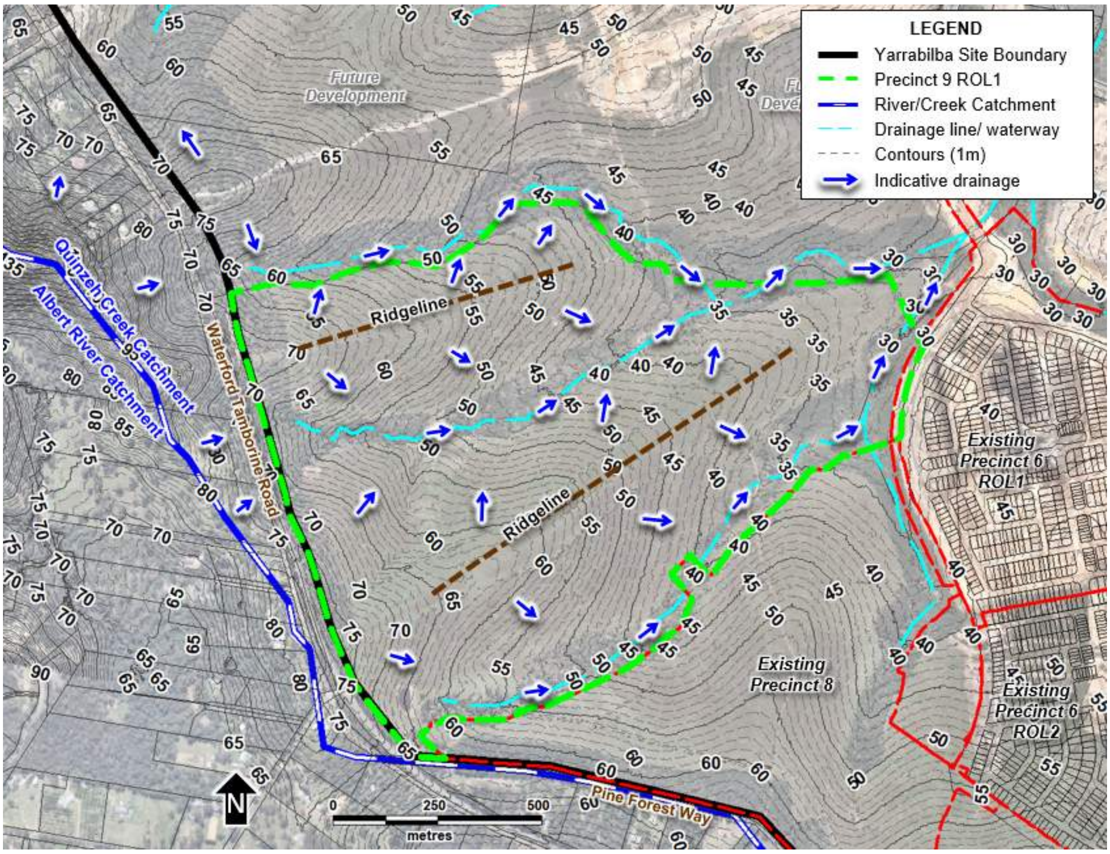



Figure 2: Existing topography, catchments and drainage

## 2.3 GEOLOGY AND SOILS

Geological mapping indicates Precinct 9 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 9 ROL1 are not expected to vary significantly from those encountered in the balance of Precinct 4 to 8 previously (i.e. those within the lower slope development zones). The alluvium zones (eastern portion of P9 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 9 ROL1 to confirm soil conditions for civil engineering design.

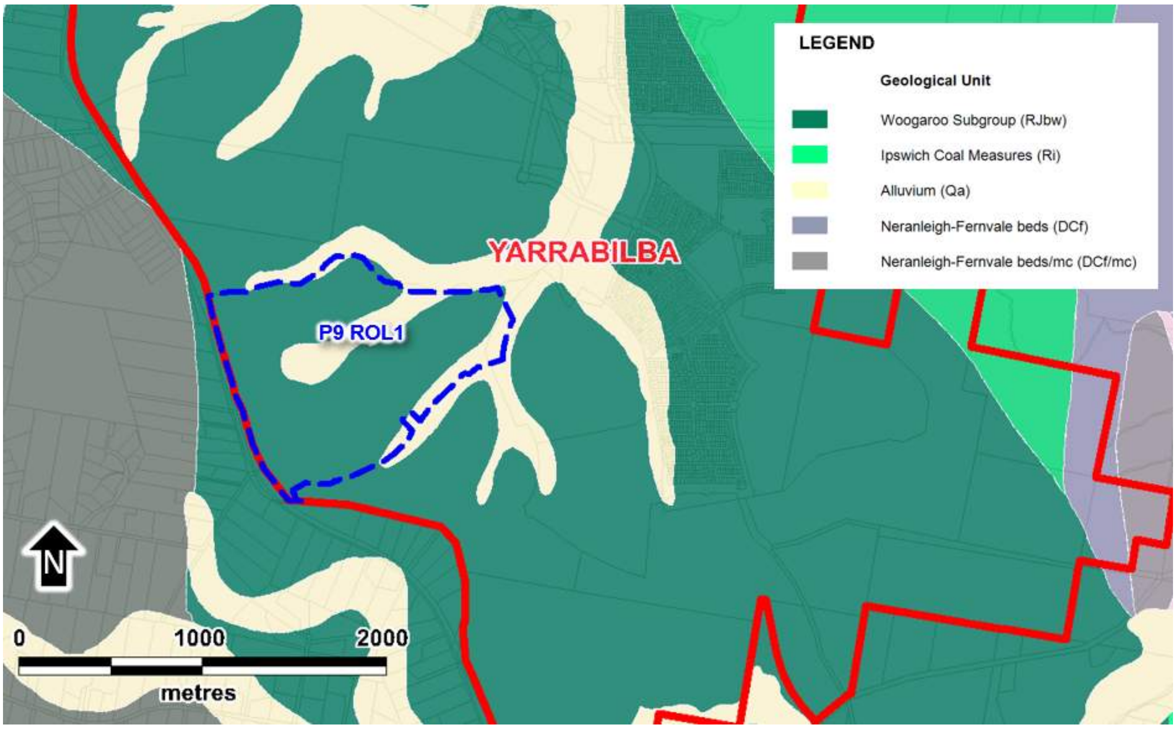



Figure 3: Geology and soils

## 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 9 ROL1 development.

## 2.5 WATERWAYS

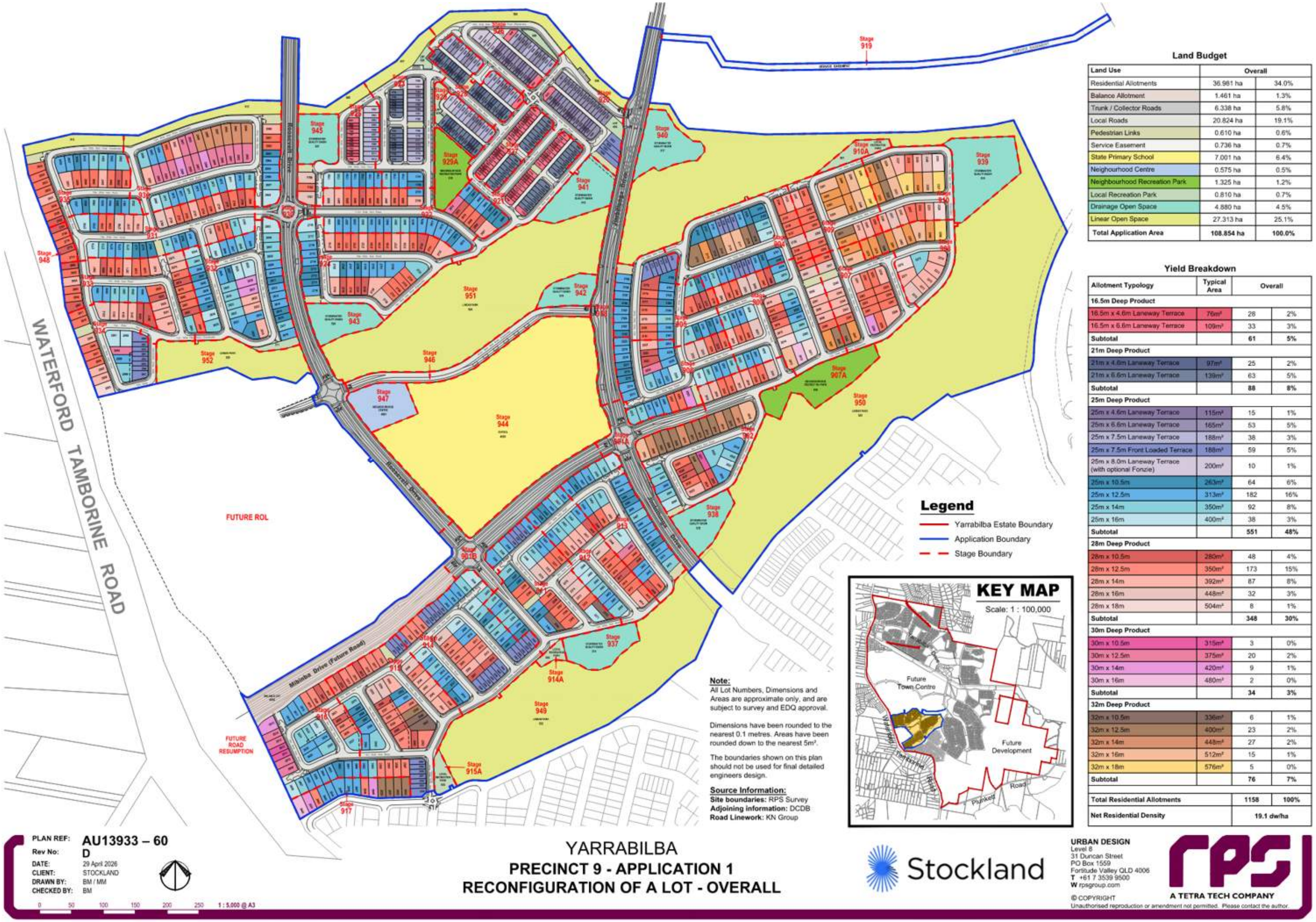
The precinct is delineated by three ephemeral waterways, one each defining the northern and southern extents of the precinct and the third through the central portion of the development zone. These waterways create two distinct ridgelines of development running in a northeast direction.

The southern and central waterways are broadly classified as in average to good conditions based on the *Yarrabilba Waterway Condition Assessment* (DesignFlow, 2023) with very good waterway stability scores and good riparian habitat. The northern waterway also exhibits good riparian habitat but has areas of poor stability in the upper reaches. The northern waterway also lies within the 100m ecological corridor that extends east and north through the balance of the site. All waterways flow generally east and northeast towards the existing Precinct 6 confluence.

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 9 ROL1 (subject site) covers an area of approximately 107 ha which includes residential lots, roads (and resumption areas), local and neighbourhood centres, school, recreational open space, major sports park and drainage open space. The precinct layout is shown in Figure 4.




**Land Budget**

| Land Use | Overall | |
|---|---|---|
| Residential Allotments | 36.981 ha | 34.0% |
| Balance Allotment | 1.461 ha | 1.3% |
| Trunk / Collector Roads | 6.338 ha | 5.8% |
| Local Roads | 20.824 ha | 19.1% |
| Pedestrian Links | 0.610 ha | 0.6% |
| Service Easement | 0.736 ha | 0.7% |
| State Primary School | 7.001 ha | 6.4% |
| Neighourhood Centre | 0.575 ha | 0.5% |
| Neighbourhood Recreation Park | 1.325 ha | 1.2% |
| Local Recreation Park | 0.810 ha | 0.7% |
| Drainage Open Space | 4.880 ha | 4.5% |
| Linear Open Space | 27.313 ha | 25.1% |
| **Total Application Area** | **108.854 ha** | **100.0%** |

**Yield Breakdown**

| Allotment Typology | Typical Area | Overall | |
|---|---|---|---|
| **16.5m Deep Product** | | | |
| 16.5m x 4.6m Laneway Terrace | 76m² | 28 | 2% |
| 16.5m x 6.6m Laneway Terrace | 109m² | 33 | 3% |
| **Subtotal** | | **61** | **5%** |
| **21m Deep Product** | | | |
| 21m x 4.6m Laneway Terrace | 97m² | 25 | 2% |
| 21m x 6.6m Laneway Terrace | 139m² | 63 | 5% |
| **Subtotal** | | **88** | **8%** |
| **25m Deep Product** | | | |
| 25m x 4.6m Laneway Terrace | 115m² | 15 | 1% |
| 25m x 6.6m Laneway Terrace | 165m² | 53 | 5% |
| 25m x 7.5m Laneway Terrace | 188m² | 38 | 3% |
| 25m x 7.5m Front Loaded Terrace | 188m² | 59 | 5% |
| 25m x 8.0m Laneway Terrace (with optional Fonzie) | 200m² | 10 | 1% |
| 25m x 10.5m | 263m² | 64 | 6% |
| 25m x 12.5m | 313m² | 182 | 16% |
| 25m x 14m | 350m² | 92 | 8% |
| 25m x 16m | 400m² | 38 | 3% |
| **Subtotal** | | **551** | **48%** |
| **28m Deep Product** | | | |
| 28m x 10.5m | 280m² | 48 | 4% |
| 28m x 12.5m | 350m² | 173 | 15% |
| 28m x 14m | 392m² | 87 | 8% |
| 28m x 16m | 448m² | 32 | 3% |
| 28m x 18m | 504m² | 8 | 1% |
| **Subtotal** | | **348** | **30%** |
| **30m Deep Product** | | | |
| 30m x 10.5m | 315m² | 3 | 0% |
| 30m x 12.5m | 375m² | 20 | 2% |
| 30m x 14m | 420m² | 9 | 1% |
| 30m x 16m | 480m² | 2 | 0% |
| **Subtotal** | | **34** | **3%** |
| **32m Deep Product** | | | |
| 32m x 10.5m | 336m² | 6 | 1% |
| 32m x 12.5m | 400m² | 23 | 2% |
| 32m x 14m | 448m² | 27 | 2% |
| 32m x 16m | 512m² | 15 | 1% |
| 32m x 18m | 576m² | 5 | 0% |
| **Subtotal** | | **76** | **7%** |
| | | | |
| **Total Residential Allotments** | | **1158** | **100%** |
| **Net Residential Density** | | **19.1 dw/ha** | |

Figure 4: Precinct 9 ROL1 proposed layout

# 3 STORMWATER QUALITY

## 3.1 DESIGN OBJECTIVES

The stormwater quality management objectives that apply to the operational phase of Yarrabilba Precinct 9 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 9 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 8 development areas to maintain successful integration of treatment with development outcomes
- Minimise the impact on existing vegetation and ecosystems
- Ensure future development/catchments are allowed for in precinct scale treatment systems.
- School site and sports park manage stormwater onsite separately from this strategy (to meet the same objectives).

Figure 5 shows the overall proposed treatment strategy for Precinct 9 with details of treatment systems provided in Table 2

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 3.4.

Table 2: Stormwater treatment elements

| Treatment Type and Basin ID | Size | Catchments | Comment |
|---|---|---|---|
| Sediment Pond 9A1<br>Bioretention 9A2/9A3 | 300 $m^2$<br>2 x 700 $m^2$ | 9A | Sediment pond pre-treatment to dual bios |
| Bioretention 9B | 650 $m^2$ | 9B | |
| Sediment Pond 9C1<br>Bioretention 9C2 | 300$m^2$<br>600 $m^2$ | 9C | Sediment pond pre-treatment to single bio |
| Bioretention 9D | 480 $m^2$ | 9D | |
| Sediment Pond 9E1<br>Bioretention 9E2 | 300 $m^2$<br>800 $m^2$ | 9E | Sediment pond pre-treatment to single bio |
| Bioretention 9F | 700 $m^2$ | 9F | |
| Bioretention 9G | 700 $m^2$ | 9G | |
| Bioretention 9K | 350 $m^2$ | 9H, 9I, 9J, 9K | |

Note:

1. All basins in Precinct 9 combine 63.2% AEP minor storm detention above the treatment areas for waterway stability protection. Refer to Section 5.2 for the hydraulic assessment of this basin.

The concept layout and preliminary earthworks for the proposed stormwater quality management basins have been documented in the functional design plans by KN Group (Appendix A). Key design parameters are summarised in Table 3. Further concept design and layout detail is also provided in Section 5.3.5 as it relates to the hydraulic structures and dual functioning of the basins as minor detention storage for waterway stability. 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 concept design levels summary

| Basin | Surface Level (typ. Bio basin) | External Bund Level (min.) | 1% AEP flood (waterway) |
|---|---|---|---|
| Basin 9A | RL 33.1 | RL 34.6 | RL 31.5 |
| Basin 9B | RL 41.6 | RL 43.1 | RL 40.1 |
| Basin 9C | RL 46.6 | RL 48.1 | RL 45.3 |
| Basin 9D | RL 38.6 | RL 40.1 | RL 37.9 |
| Basin 9E | RL 42.1 | RL 43.6 | RL 41.8 |
| Basin 9F | RL 50.6 | RL 52.1 | RL 49.0 |
| Basin 9G | RL 54.6 | RL 56.1 | RL 51.1 |
| Basin 9K | RL 43.0 | RL 44.5 | RL 43.7 |

Notes:

1. Internal bunds between multi-basin systems will be lower than the design external bund level
2. Minor level variations are possible as part of detailed design to ensure detailed pipe drainage network and basin hydraulics are suitable.

These levels ensure there is sufficient volume within the basin for water quality function, minor detention volume and immunity to bunds from adjacent waterway flood levels.

## 3.3 EXTERNAL CATCHMENT INFLOW

As discussed further in Section 5.2, there are several external catchment areas interfacing with Precinct 9 from the west. These are proposed to be directed to upper reaches of nearby waterways or through the local P9 piped (and overland) drainage network. Where pipe drainage use used, flow diversion (splitting) structures will be used to divert the external flows towards the P9 waterways such that these flows do not discharge to the treatment basins. Hence these external catchments are not included in the stormwater quality assessment below.

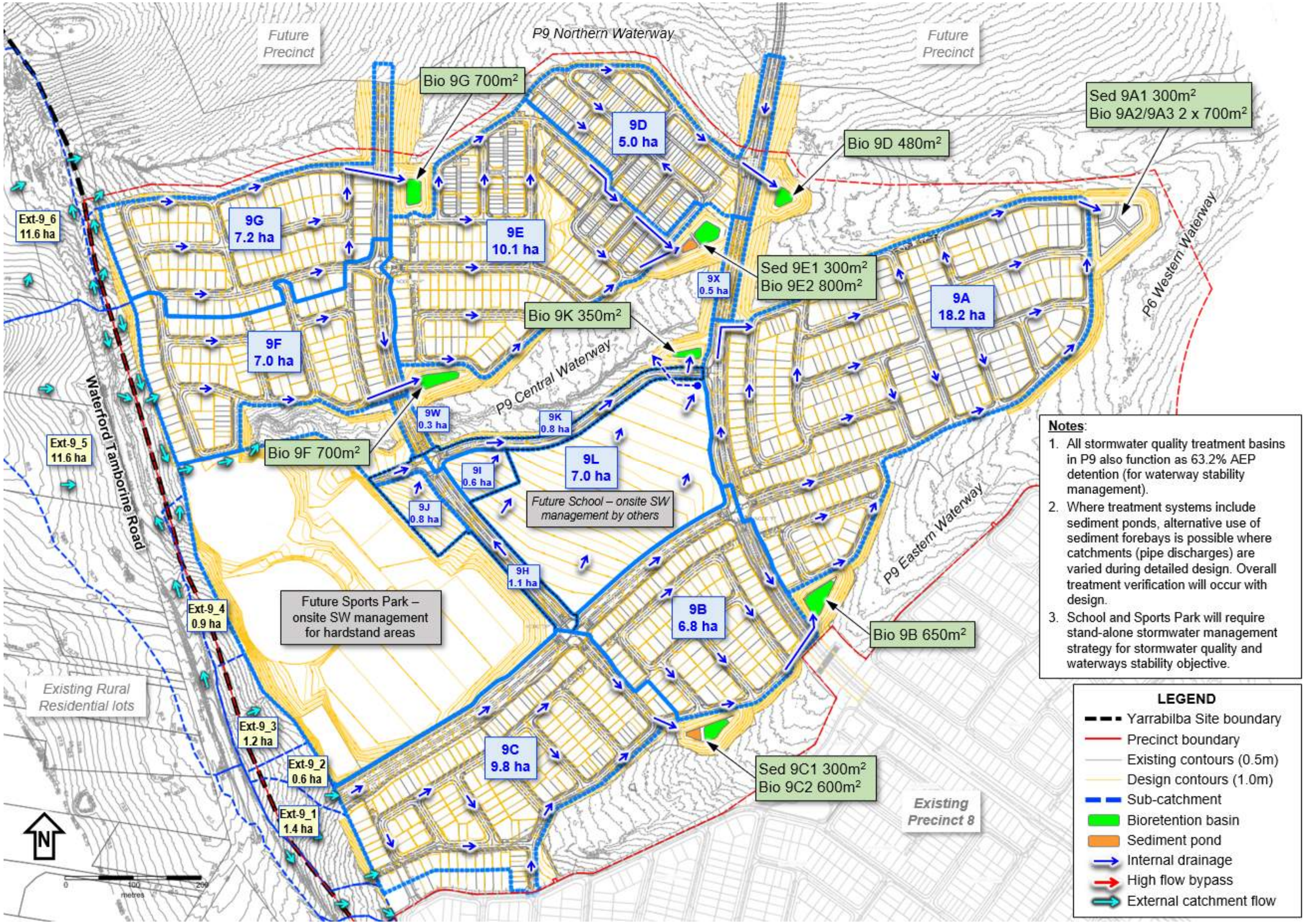



Figure 5: Precinct 9 ROL1 stormwater quality management strategy

## 3.4 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.

### 3.4.1 Model Structure

The structure of the MUSIC model is shown in Figure 6 with the general data provided in Table 4. 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.

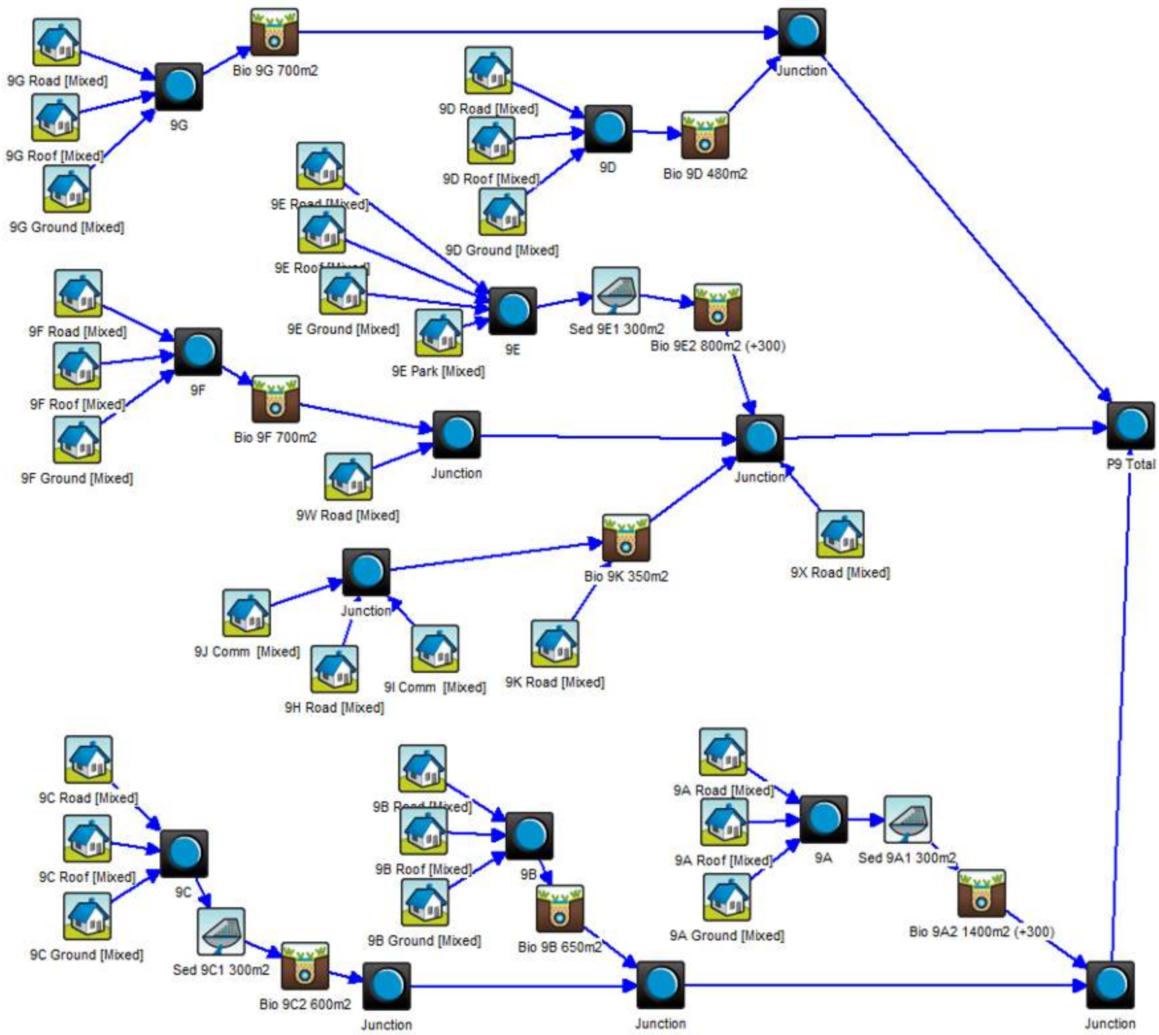



Figure 6: MUSIC model layout

Table 4: 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<br>Extended detention depth = 0.3 m<br>Extended detention area = Bio area (when stand-alone) or Bio + wetland + sed pond (when in combined system)<br>Seepage = 0 mm/hr<br>TN content 400 mg/kg<br>Orthophosphate content 30 mg/kg<br>Overflow weir width = bio area/10 |
| Sediment Basin | Extended detention depth (EDD) = 0.01 m (detention depth over 0.01m is included in bio basin where linked)<br>Evaporative loss 75% of PET<br>Notional detention time = <0.1hr (upstream of wetland or bioretention basin)<br>Overflow weir width = sediment pond area/10 |

### 3.4.2 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 9A2/9A3 are modelled as combined total surface area (actual design will split into multiple cells for 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 <u>and</u> 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.
6. The school site (by others) and major sports park are excluded from this assessment as they will be subject to onsite treatment strategies as part of separate development applications.

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.

### 3.4.3 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 5 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 except catchments 9D and 9E which adopt higher impervious fractions for terrace lots.

Table 5: MUSIC model catchment split data

| Catchment ID (refer to Figure 5) | Total Area (ha) | % Impervious | Surface Type | Sub-Area (ha) | Impervious % |
|---|---|---|---|---|---|
| 9A | 18.2 | 60% | Road | 4.55 | 60% |
| | | | Roof | 6.83 | 100% |
| | | | Ground | 6.83 | 20% |
| 9B | 6.8 | 60% | Road | 1.70 | 60% |
| | | | Roof | 2.55 | 100% |
| | | | Ground | 2.55 | 20% |
| 9C | 9.8 | 60% | Road | 2.45 | 60% |
| | | | Roof | 3.68 | 100% |
| | | | Ground | 3.68 | 20% |
| 9D | 5.0 | 67% | Road | 1.50 | 70% |
| | | | Roof | 1.75 | 100% |
| | | | Ground | 1.75 | 30% |
| 9E | 10.1 | 64% | Road | 2.88 | 70% |
| | | | Roof | 3.36 | 100% |
| | | | Ground | 3.36 | 30% |
| | | | Park | 0.51 | 20% |

*Table 5 continued over page*

*Table 5 continued*

| Catchment ID (refer to Figure 5) | Total Area (ha) | % Impervious | Surface Type | Sub-Area (ha) | Impervious % |
|---|---|---|---|---|---|
| 9F | 7.0 | 60% | Road | 1.75 | 60% |
| | | | Roof | 2.63 | 100% |
| | | | Ground | 2.63 | 20% |
| 9G | 7.2 | 60% | Road | 1.80 | 60% |
| | | | Roof | 2.70 | 100% |
| | | | Ground | 2.70 | 20% |
| 9H | 1.1 | 60% | Road | 0.28 | 60% |
| | | | Roof | 0.41 | 100% |
| | | | Ground | 0.41 | 20% |
| 9I | 0.6 | 90% | lumped | 0.60 | 90% |
| 9J | 0.8 | 90% | lumped | 0.80 | 90% |
| 9K | 0.8 | 60% | Road | 0.20 | 60% |
| | | | Roof | 0.30 | 100% |
| | | | Ground | 0.30 | 20% |
| 9W | 0.26 | 60% | Road | 0.26 | 60% |
| 9X | 0.42 | 60% | Road | 0.42 | 60% |
| Total | 90.98 | 61% | | 90.98 | 61% |

Notes:

1. School site excluded from MUSIC as this is a stand-alone treatment system by others.
2. Major Sports Park (MSP) excluded as this is subject to a separate DA with onsite treatment strategy for hardstand areas.
3. Catchments 9D and 9E account for higher impervious fractions from terrace lots.

### 3.4.4 Results

The results of the MUSIC modelling are presented in Table 6. All water quality objectives can be readily achieved with the proposed treatment strategy (including offset of untreated catchments 9W and 9X in overall p9 combined results). Target reductions from Table 1 are TSS = 80%, TP = 60%, TN = 45%, GP = 90%

Table 6: MUSIC results

| Catchments | Treatment ID | Pollutant | Inflows (kg/yr) | Outflows (kg/yr) | Reduction (%) |
|---|---|---|---|---|---|
| 9A | Basin 9A | TSS | 16100 | 2570 | 84.0 ✓ |
| | | TP | 34.3 | 8.73 | 74.5 ✓ |
| | | TN | 222 | 108 | 51.1 ✓ |
| | | GP | 2740 | 0 | 100 ✓ |
| 9B | Basin 9B | TSS | 5930 | 986 | 83.4 ✓ |
| | | TP | 12.9 | 3.21 | 75.2 ✓ |
| | | TN | 81.8 | 38.6 | 52.9 ✓ |
| | | GP | 1020 | 0 | 100 ✓ |

*Table 6 continued over page*

*Table 6 continued*

| Catchments | Treatment ID | Pollutant | Inflows (kg/yr) | Outflows (kg/yr) | Reduction (%) | |
|---|---|---|---|---|---|---|
| 9C | Basin 9C | TSS | 8880 | 1710 | 80.7 | ✓ |
| | | TP | 18.5 | 5.44 | 70.6 | ✓ |
| | | TN | 118 | 62.7 | 46.7 | ✓ |
| | | GP | 1480 | 0 | 100 | ✓ |
| 9D | Basin 9D | TSS | 5690 | 964 | 83.1 | ✓ |
| | | TP | 11.2 | 2.76 | 75.4 | ✓ |
| | | TN | 64 | 30.7 | 52.0 | ✓ |
| | | GP | 827 | 0 | 100 | ✓ |
| 9E | Basin 9E | TSS | 11200 | 1520 | 86.5 | ✓ |
| | | TP | 22.4 | 5.06 | 77.4 | ✓ |
| | | TN | 128 | 61.4 | 51.9 | ✓ |
| | | GP | 1630 | 0 | 100 | ✓ |
| 9F | Basin 9F | TSS | 6580 | 1160 | 82.4 | ✓ |
| | | TP | 14.1 | 3.53 | 75.0 | ✓ |
| | | TN | 89.2 | 42.3 | 52.6 | ✓ |
| | | GP | 1120 | 0 | 100 | ✓ |
| 9G | Basin 9G | TSS | 6680 | 1200 | 82.1 | ✓ |
| | | TP | 14.2 | 3.64 | 74.3 | ✓ |
| | | TN | 92.6 | 44.3 | 52.2 | ✓ |
| | | GP | 1150 | 0 | 100 | ✓ |
| 9H-9K | Basin 9K | TSS | 7830 | 1260 | 83.9 | ✓ |
| | | TP | 15.1 | 3.38 | 77.6 | ✓ |
| | | TN | 66.2 | 30.3 | 54.2 | ✓ |
| | | GP | 651 | 0 | 100 | ✓ |
| 9W | Untreated (offset) | TSS | 928 | 928 | 0 | - |
| | | TP | 1.52 | 1.52 | 0 | - |
| | | TN | 4.92 | 4.92 | 0 | - |
| | | GP | 61 | 61 | 0 | - |
| 9X | Untreated (offset) | TSS | 1310 | 1310 | 0 | - |
| | | TP | 2.13 | 2.13 | 0 | - |
| | | TN | 6.84 | 6.84 | 0 | - |
| | | GP | 85.3 | 85.3 | 0 | - |
| Overall P9 combined | | TSS | 70600 | 13500 | 80.9 | ✓ |
| | | TP | 146 | 39.3 | 73.1 | ✓ |
| | | TN | 869 | 429 | 50.6 | ✓ |
| | | GP | 10800 | 146 | 98.6 | ✓ |

Target reductions: TSS = 80%, TP = 60%, TN = 45%, GP = 90%

These results indicate conservative outcomes which enables the detailed design of the basins, 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.

## 3.5 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, P9 ROL1 discharges to three waterway tributaries, the southern of which also receive inflows from existing Precinct 8 and 6 to the east. The northern waterway lies within the ecological corridor and therefore has a 100m wide overlay applied.

### 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 7. These objectives are consistent with *Yarrabilba Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and *State Planning Policy* (DSDIP, 2017).

Table 7: 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><br>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 REVIEW

A review of the waterways was undertaken to assess the conditions within the three tributaries in P9 ROL1. This assessment was more rapid that previous precincts where minor storm detention was not included in the precinct strategy and the receiving waterways were lower gradient, poorer condition and were to be rehabilitated to manage the developed hydrology.

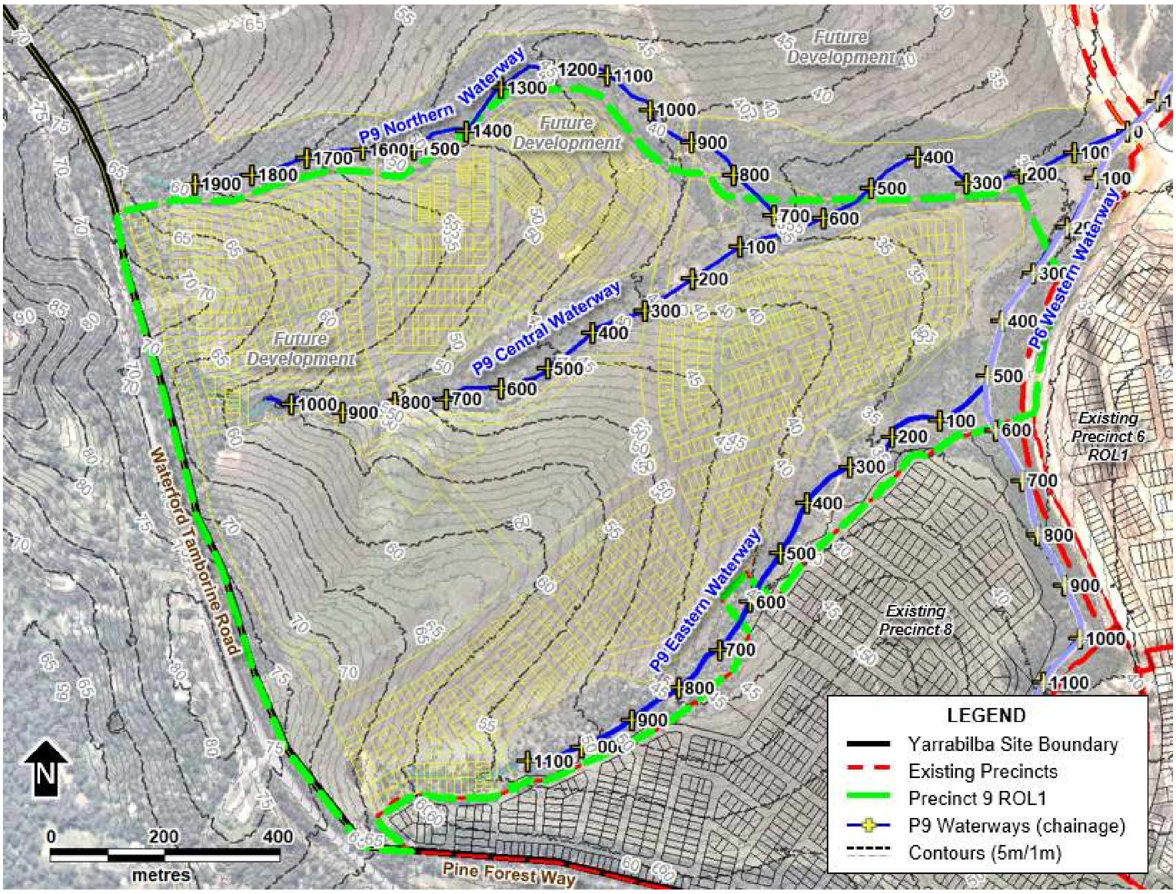



Figure 7: Precinct 9 ROL1 waterway layout

### 4.2.1 Characteristics

The overall waterway condition ratings for these waterway tributaries provided in the *Yarrabilba Waterway Condition Assessment* (DesignFlow, 2023) indicates generally good overall condition based on riparian habitat and stability considerations, with the exception of the northern waterway which showed poorer waterway stability. A review of waterway characteristics from more recent site visits is provided below. The latest site inspections were undertaken on 17th and 18th September 2025 following a relatively wet Autumn and Winter. Groundwater and baseflow was therefore observed in most waterways.

*P9 Eastern Waterway*

The P9 eastern waterway grades at around 1.5% from the confluence with the mid-point of the P6 western waterway to around CH700 increasing to 2.5% in the mid-upper reaches to a maximum of around 4.5% between ch800-ch900and back to around 2.1% in the upper 200m. Localised areas of steeper channel exist where incision or change to bed level has resulted from vehicle or livestock crossings.

The lower half of the waterway was dominated by broad wet grassland zones and localised wetlands and ponds linked by shallow low flow channel (iron rich groundwater observed). Ground vegetation was reasonably dense throughout with tree cover variable.

The upper reach had some minor localised scour and head-cut but not extensive. Low flow channel was small with broad profile and light groundcover and scattered canopy trees. Pockets of dense grassland meadows exist where canopy was open. Minor groundwater seepage in parts but typically drier overall conditions than lower reaches.

*P9 Central Waterway*

The P9 Central waterway grades up fairly consistently at around 1.9% from the confluence with the northern waterway. From around Ch300, the channel begins to incise which extends upstream in a defined and in parts deep narrow channel. This opens out between CH800-CH900 then transitions back into deep channel.

The lower reach is characterised by broad, multi-flowpath grasslands with wet/boggy soils and melaleuca dominated canopy. At around CH100-CH300 the tree density reduces, and open grassland dominates with livestock damage evident.

Middle reaches between CH300-CH600 showed poor soils with local areas of head cut, defined channel, bank erosion and tunnelling, likely from dispersive soils. Deep incised channel defined the low flow path with vertical and undercut banks in parts. Fringing vegetation throughout these reaches is maintaining some erosion control with minimal lateral gully erosion occurring. At CH800, a cleared zone has significant sand deposition and livestock damage.

Upper reaches transition back into shallow channel and canopy trees with light groundcover. Head of waterway at CH1000 exhibits multiple head cut steps with isolated pools observed in scour holes.

Due to the presence of good riparian vegetation along this waterway, flow management from development is adopted as the preferred method of protection from future hydrological changes on stability. Discharging stormwater networks downstream to stabilised culvert crossings will also be a priority.

*P9 Northern Waterway*

The P9 Northern waterway grades at around 1.0% from the confluence with the lower reaches of the P6 western waterway and gradually increases to around 2.4% in the upper reaches. Localised areas of incised channel linked with localised head cut exist along the length interspersed with broad areas of boggy undefined flow and pockets of wetland and open pond.

Lower reaches include open water ponded areas with good diversity of macrophyte and fringing vegetation with tree canopy cover. Localised areas of defined channel linking broader wet zones and very localised grass meadows with little tree cover.

Middle reaches had wetland zones formed upstream of vehicle tracks mixed with channelised zones. Mid reaches included broad wet open meadow zone with little canopy species. Localised head cut evident where channelised flows occur. Baseflow and ponding evident throughout.

Upper reach increased in gradient and characterised by incised channel with evidence of historical disturbance from tree felling around CH1800 (with logs pushed into/adjacent to channel). Some undermining of trees has occurred. Further upstream varied in depth of scour cut channel, localised bank undercutting with pockets of standing water, but typically drier vegetation types surrounding.

Ecological corridor overlay and generally good riparian vegetation limits instream stabilisation works and will need to rely on revegetation and piped stormwater to downstream stabilised road crossings and lower gradient waterways in the bottom of the catchment.

### 4.2.2 Modelling

The latest 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 (8m 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 8 provides a broad scale analysis of the flow characteristics at the lower ends of each waterway for pre and post-development (unmitigated) catchment conditions. This data is based on the fully developed site conditions.

Table 8: 63.2% AEP discharge and velocity in P9 receiving waterways (unmitigated)

| Waterway Chainage | Tuflow PO Location | Flow ($m^3/s$) | | Peak Velocity (m/s) | |
|---|---|---|---|---|---|
| | | Existing | Developed | Existing | Developed |
| P9 Eastern CH400 | L_41 | 2.0 | 4.0 | 0.5 | 0.6 |
| P9 Central CH200 | L_285 (& L_38) | 2.4 | 7.3 | 1.2 | 1.4 |
| P9 northern CH300 | L_39 | 5.0 | 8.2 | 0.8 | 0.8 |

Notes:

1. Data extracted from Tuflow models QC3_B02e and QC3_P01c at the respective plot output reporting locations (most downstream available within subject waterways)
2. Peak velocity is highest point velocity within cross section (typically near invert) and not an average velocity over total cross section.

This data indicates that while the unmitigated peak discharge within the waterways drainage line increases significantly because of urbanisation (unmitigated results presented), the actual peak 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 once breakout of any low flow channel occurs) with only very minor increase in flow depth and velocity.

Bed shear stress modelling provided in Figure 8 has been derived from of the *Yarrabilba (Quinzeh Creek) Flood Study – Version 2* (DesignFlow, 2025) at a 8m 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 considerations of waterway stability management (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.

*P9 Eastern Waterway*

P9 eastern waterway shows comparatively low bed shear stress mapping under pre-development conditions with localised increases under unmitigated post development conditions over the central (deepest) parts of the channel due to the increased discharge and greater slope in the upper reach (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.

*P9 Central Waterway*

The lower reaches of P9 Central Waterway show broad flow over a wide channel zone into the confluence with the P9 Northern waterway. Pre-development bed shear stress is low with appreciable increases within the central channel under post-development conditions including some overbank flow break out from CH600 down to CH300.

*P9 Northern Waterway*

The P9 Northern waterway shows localised increases in bed sheer stress under developed conditions, mainly where there is a defined (incised) low flow channel. Other areas where the flow is broad and shallow (lack of defined channel) indicate minimal changes from pre-development.

The targeted waterway management strategy for all three waterways therefore aims to mitigate the increase in local 63.2% AEP discharge to minimise the increases in scour potential for the channelised reaches 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 and reflects the approach adopted within the adjacent Precinct 8 area.

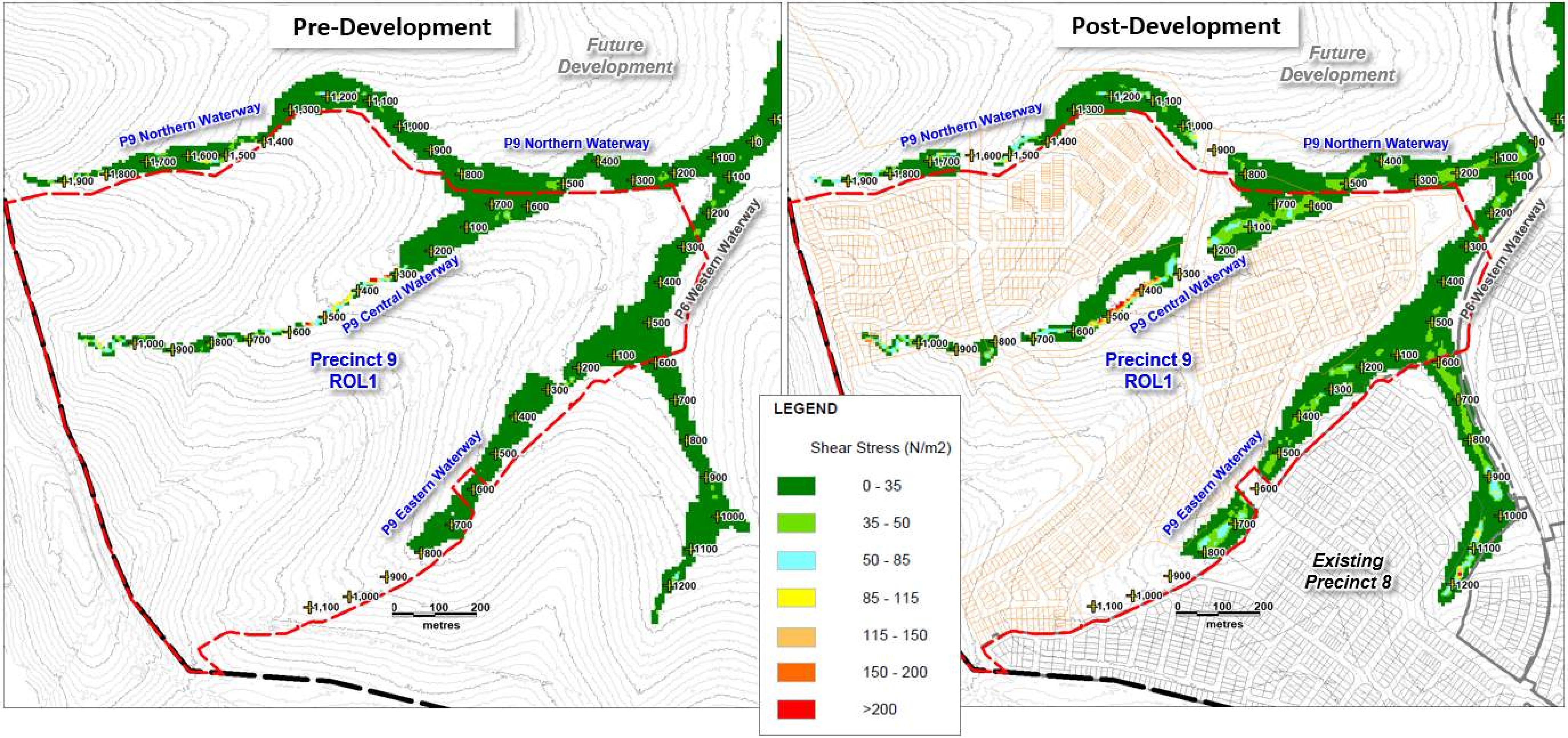



Figure 8: 63.2% AEP bed shear stress comparison (no local mitigation)

## 4.3 WATERWAY STABILITY MANAGEMENT STRATEGY

As described in Section 4.2.1, the waterways adjacent to and downstream of Precinct 9 ROL1 are considered to be in reasonably good condition (ecologically) while being variably stable with intermittent incised channels, predominantly in the lid to upper reaches. 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 minor instability should be monitored to assess the success of natural regeneration of groundcover vegetation following the removal of livestock from waterways.
- 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 9 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 1-8 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 9 ROL1 is generally in accordance with the *Yarrabilba Masterplan Flood Risk Management Strategy – Version 1.2* (DesignFlow, 2024). No major 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 P9 ROL1 is well above the 1% AEP defined flood level being conveyed through the adjacent waterways and ultimately downstream to the southern tributary of Quinzeh Creek.

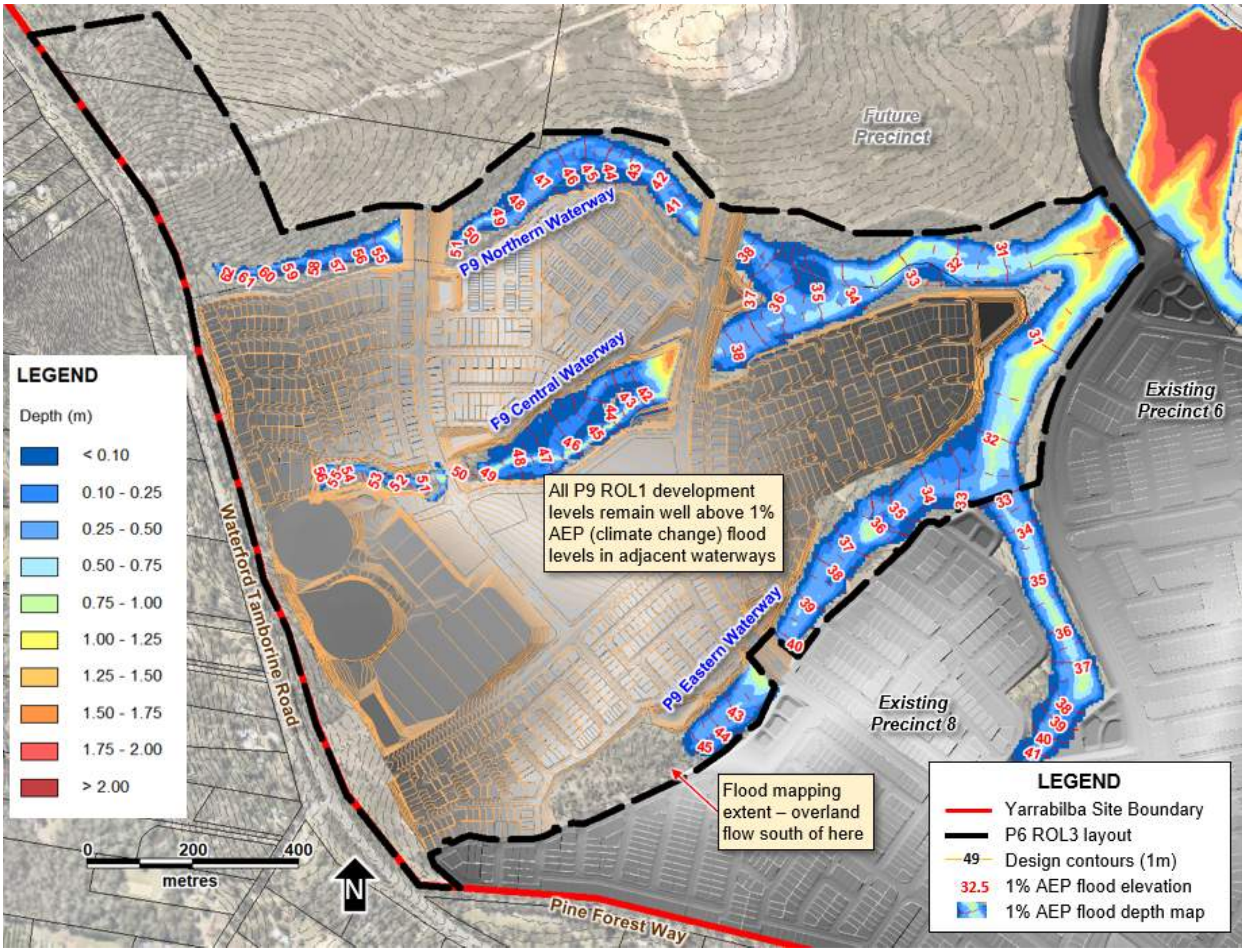



Figure 9: 1% AEP defined flood levels and preliminary earthworks

## 5.2 EXTERNAL DRAINAGE

External catchments west of Precinct 9 comprise rural residential lots and Waterford Tamborine Road. Preliminary allowances for drainage of these areas through or around development areas is shown in Figure 10. Where practical, these areas are drained overland to the nearest waterway or through proposed development areas via piped drainage network and overland flow path allowances to waterways. Where they drain to the local P9 pipe network, a flow bypass structure is typically installed downstream adjacent to waterways to limit the external flows draining to P9 stormwater quality basins. Refinement of these catchment and drainage interface with the western boundary and pipe network will be undertaken by KN Group as part of detailed design.

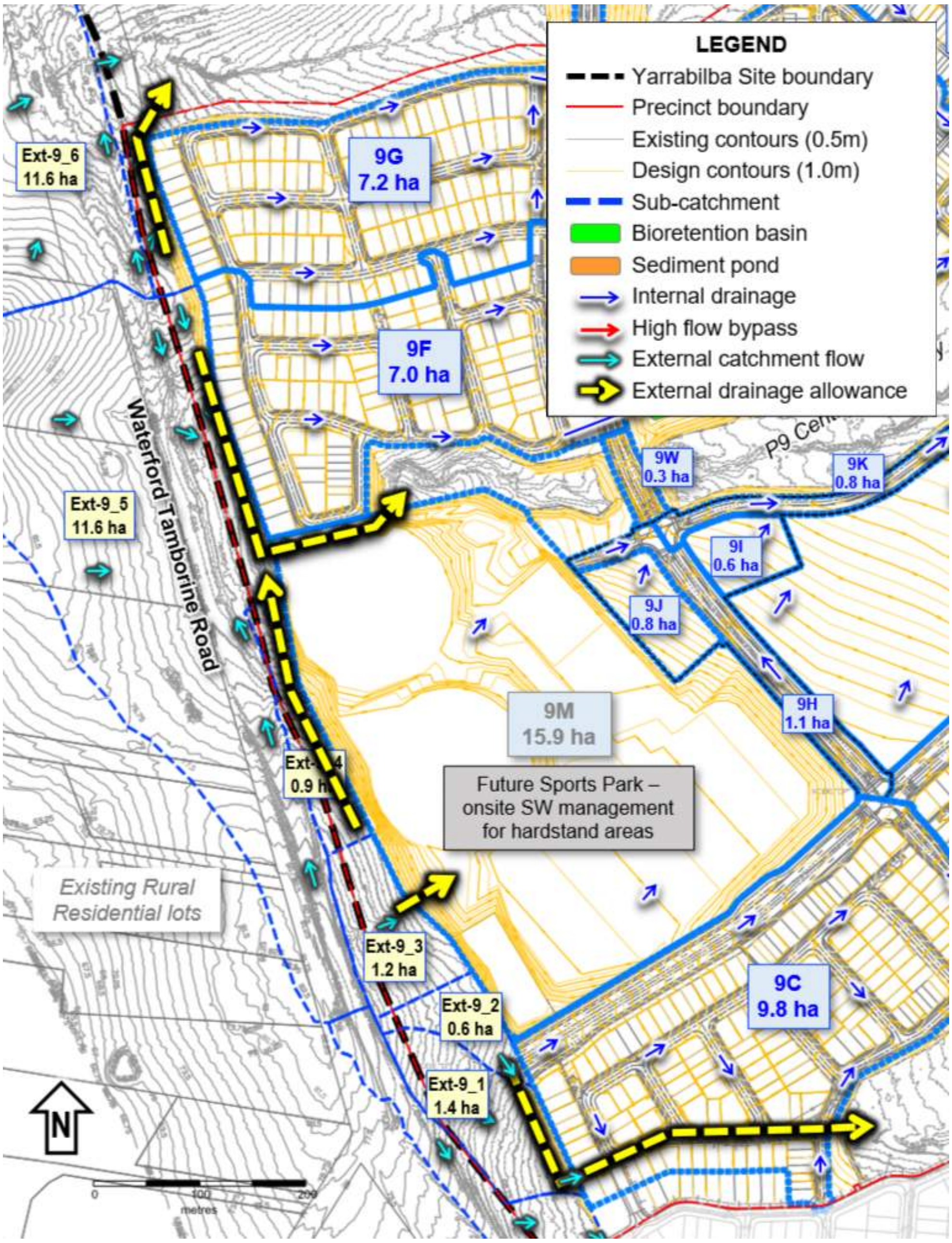



Figure 10: External drainage allowances (preliminary)

## 5.3 WATERWAY STABILTY FLOW ATTENUATION

As noted previously in Section 4.3, the P9 waterways require post-development minor flow attenuation to manage the potential waterway stability issues outlined in Section 4.2. While the northern and southern waterways will receive discharge from multiple development precincts, the proposed approach to minor flow management (63.2% AEP) is to maintain equivalent pre-development peak discharge from the respective development catchments at each location. The rapid assessment below applies to the eight (8x) stormwater treatment basins proposed as part of P9 ROL1 and draws from the previous Precinct 8 hydraulic assessment to define the preliminary design parameters for basins.

### 5.3.1 Waterway Stability Unit Detention Rates

The hydrologic/hydraulic modelling outcomes (in terms of unit rate detention storage per hectare of catchment) from the previous Precinct 8 assessment has been applied to the P9 catchments as they are hydrologically similar (i.e. the pre- and post-development area weighted average catchment slopes for P8 were 4.0% and 2.1% respectively while P9 slopes area 3.7% and 1.7% respectively).

- Precinct 8 63.2% AEP detention volume (average) = 111 $m^3$ /ha of development

This volume includes the initial 0.3m depth assumed full in the water quality component of the basin. For slightly conservative outcomes at this stage within P9, an initial allowance of:

- Precinct 9 63.2% AEP detention volume = <u>115 $m^3$/ha of development</u>

The increase for P9 ensures allowance for offset of minor road catchments 9W and 9X not draining to basins. These have been applied to catchments in Section 5.3.2 below. The school site and major sports park site will also require minor flow management to meet this objective as part of site base stormwater management and design (by others) and will vary based on imperviousness and design slope.

Verification modelling will then be undertaken as part of the detailed design to ensure the final basin earthworks is included in the stage-storage allowances for the P9 strategy.

### 5.3.2 Catchments

Catchment data used in the rapid assessment (Figure 11) is provided in Table 9 which is derived from the current layout and grading. The school and Major Sports Park catchments are excluded from the preliminary assessment as these catchments will address onsite stormwater management based on site design (and impervious fractions) and separate development applications.

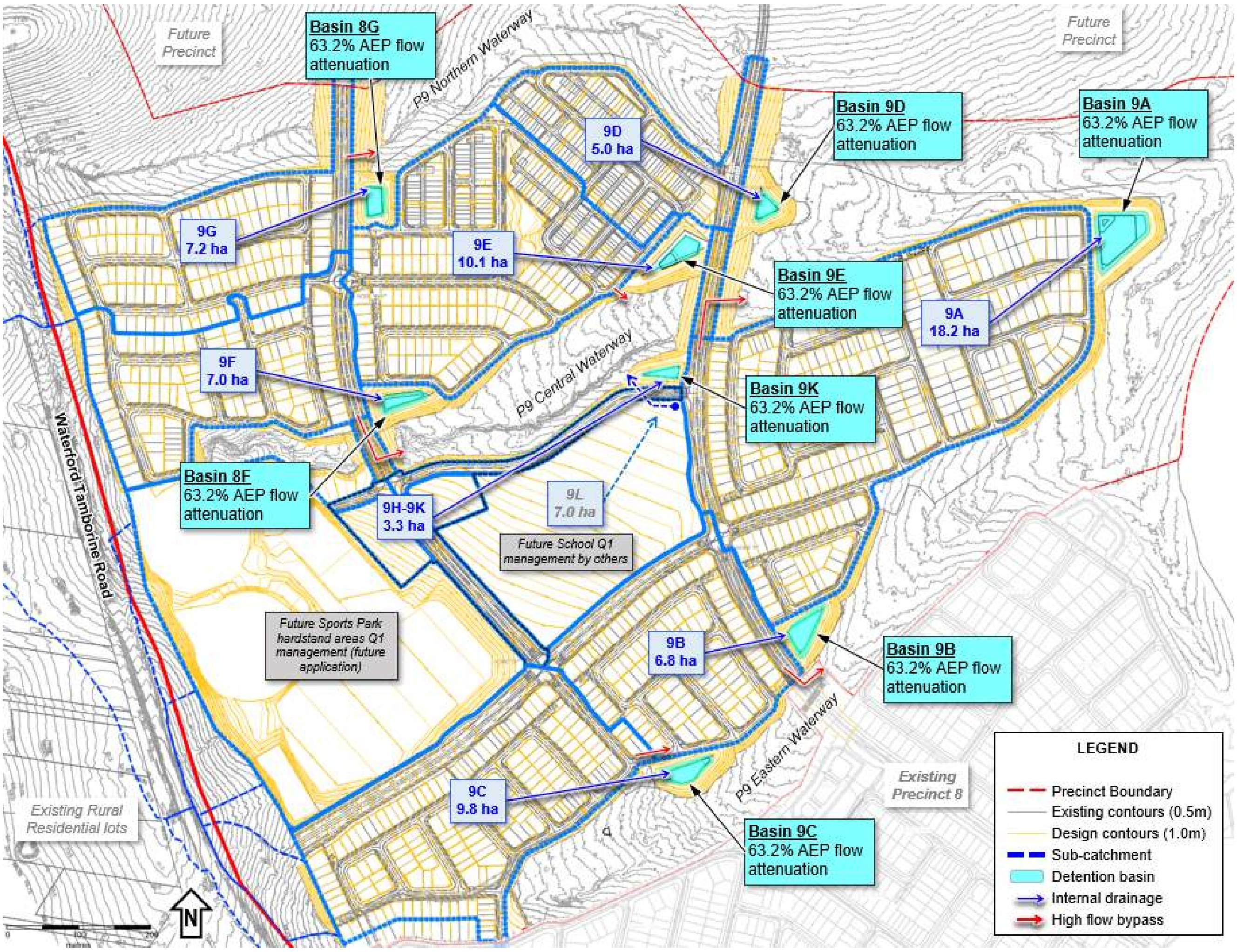


Figure 11: Catchment layout

Table 9: Catchment and target storage volumes (63.2% AEP)

| Catchment | Area | Slope % | Impervious % | Min. Detention Storage Required ($m^3$) |
|---|---|---|---|---|
| 9A | 18.2 | 0.9% | 65% | 1911 |
| 9B | 6.8 | 2.4% | 65% | 714 |
| 9C | 9.8 | 2.6% | 65% | 1029 |
| 9D | 5.0 | 1.2% | 70% [1] | 525 |
| 9E | 10.1 | 1.6% | 65% [2] | 1061 |
| 9F | 7.0 | 2.5% | 65% | 735 |
| 9G | 7.2 | 1.7% | 65% | 756 |
| 9H-9K | 3.3 | 1.8% | 90% [3] | 347 |
| *9W* | *0.3* | *1.0%* | *90%* | *offset* |
| *9X* | *0.5* | *0.9%* | *90%* | *offset* |

Table 9 Notes:

1. Catchment 9D includes smaller laneway terrace lot types with greater imperviousness.
2. A portion of Catchment 9E also includes the smaller lots described above, however the presence of the neighborhood rec park offsets the increase in imperviousness.
3. Catchment 9H-9K is primarily neighborhood centre and road catchment and assigned conservatively high imperviousness for concept design stage.
4. School and Major Sports Park catchments are excluded as these catchments will address onsite stormwater management (by others) based on site design and separate development applications.
5. All detention volumes reported above include the initial 0.3m depth assumed full for water quality.

### 5.3.3 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 11 and will be ultimately represented in detailed design modelling as surcharge from drainage in events larger than the nominal pipe capacity.

### 5.3.4 Detention storage volumes

The preliminary design for the storage volume requirements for the minor (63.2% AEP) detention basins is represented by the volume over the sediment pond and/or bioretention basins. Preliminary estimates in Table 10 are based on the volume over the basin floor area of the basins (conceptually vertical sided storage volume for rapid assessment). Final design volumes available will be greater than reported below once volume over batters is included. Refined modelling of the detailed earthworks will occur as part of detailed design with hydraulic model verification.

Concept design assumes 63.2% AEP detention occurs to approximately 1.0m deep, with the additional depth (up to 1.5m bund height) to enable pit and bypass weir overtopping in design events greater than 63.2% AEP detention events with sufficient freeboard. All required volumes reported below include the allowance for initial 0.3m depth for stormwater quality treatment extended detention (assumed full).

Table 10: Preliminary stage storage data

| Basin | Basin Floor Area ($m^2$) | Depth to Bund (m) | Volume at 1.0m deep ($m^3$) | Min. Storage Required (from Table 9) ($m^2$) | Meets Min. Storage Target? |
|---|---|---|---|---|---|
| 9A | 2200 | 1.5 | 2200 | 2093 | Y |
| 9B | 1130 | 1.5 | 1130 | 782 | Y |
| 9C | 1180 | 1.5 | 1180 | 1127 | Y |
| 9D | 590 | 1.5 | 590 | 575 | Y |
| 9E | 1280 | 1.5 | 1280 | 1162 | Y |
| 9F | 900 | 1.5 | 900 | 805 | Y |
| 9G | 880 | 1.5 | 880 | 828 | Y |
| 9K | 430 | 1.5 | 430 | 380 | Y |

Table 10 Notes:

1. Volume tabulated above are combined for area over sediment pond and/or bio basins. Actual design volumes will be greater (or conversely, depths will be reduced) once volume over batters is also accounted for.
2. A 0.3m initial depth has been applied to the basins for stormwater treatment volume being full prior to storm burst.

The preliminary earthworks design presented in KN Group functional drawings (Appendix A) provide sufficient volume above basins to provide minor flow attenuation to meet the waterway stability objective. The data presented above is a conservative estimate of volume available within each basin in the functional designs with detailed design and supporting modelling to confirm the design water levels and freeboard once detailed earthworks area available. Conceptual basin designs are provided below for preliminary water quality/detention basin integration.

### 5.3.5 Basin concept design

Preliminary design details for each basin are provided in Table 11 with concept layouts shown in Figure 12 to Figure 19.

Table 11: Precinct 9 basin preliminary design

| Parameter | Basin 9A | Basin 9B | Basin9C | Basin 9D | Basin 9E | Basin9F | Basin 9G | Basin 9K |
|---|---|---|---|---|---|---|---|---|
| Basin floor (bio filter surface) | RL33.1 | RL41.6 | RL46.6 | RL38.6 | RL42.1 | RL50.6 | RL54.6 | RL43.0 |
| Bund | RL34.6 (min.) | RL41.6 (min.) | RL48.1 (min.) | RL40.1 (min.) | RL43.6 (min.) | RL52.1 (min.) | RL56.1 (min.) | RL44.5(min.) |
| Stormwater quality | 300m² sediment pond, 2 x 700m² bioretention basin (with culvert or weir connection between). Batters/storage areas typically 1:6 or flatter. | 650m² bioretention basin with forebay. Batters/storage areas typically 1:6 or flatter. | 300m² sediment pond, 600m² bioretention basin (with culvert or weir connection between). Batters/storage areas typically 1:6 or flatter. | 480m² bioretention basin with forebay. Batters/storage areas typically 1:6 or flatter. | 300m² sediment pond, 800m² bioretention basin (with culvert or weir connection between). Batters/storage areas typically 1:6 or flatter. | 700m² bioretention basin with forebay. Batters/storage areas typically 1:6 or flatter. | 700m² bioretention basin with forebay. Batters/storage areas typically 1:6 or flatter. | 350m² bioretention basin with forebay. Batters/storage areas typically 1:6 or flatter. |
| Low level outlet [1] | 2 x 1.5m x 1.5m pits at RL33.4, 375mm dia pipe from pit [2] | 1.5m x 1.5m pit at RL41.9, 375mm dia pipe from pit [2] | 1 x1.5m x 1.5m pits at RL46.9, 375mm dia pipe from pit [2] | 1.5m x 1.5m pit at RL38.9, 375mm dia pipe from pit [2] | 1.5m x 1.5m pit at RL42.4, 375mm dia pipe from pit [2] | 1.5m x 1.5m pit at RL50.9, 375mm dia pipe from pit [2] | 1.5m x 1.5m pit at RL54.9, 375mm dia pipe from pit [2] | 1.5m x 1.5m pit at RL43.3, 375mm dia pipe from pit [2] |
| Secondary outlet (pit or grated manhole) | 1.5m x 1.5m pit opening (in manhole lid) at RL34.0, 900mm dia pipe to outlet. | 1.5m x 1.5m pit at RL42.5, 750mm dia pipe to outlet. | 1.5m x 1.5m pit opening (in manhole lid) at RL47.5, 825mm dia pipe to outlet. | 1.5m x 1.5m pit at RL39.5, 825mm dia pipe to outlet. | 1.5m x 1.5m pit at RL43.0, 825mm dia pipe to outlet. | 1.5m x 1.5m pit at RL51.5, 825mm dia pipe to outlet. | 1.5m x 1.5m pit at RL55.5, 825mm dia pipe to outlet. | 1.5m x 1.5m pit at RL43.9, 600mm dia pipe to outlet. |
| High flow weir | 15m at RL34.2 | 10m at RL42.7 | 15m at RL47.7 | 10m at RL39.7 | 15m at RL43.2 | 10m at RL51.7 | 10m at RL55.7 | 8m at RL44.1 |

Notes:

1. Low level outlets set bioretention basin extended detention depth required for treatment.
2. All 375mm dia pipes from low pits are to be fitted with an orifice plate in pit to reduce outlet area to restrict Q1 discharge to the respective target (as part of detailed design).
3. Final weir sizes to be determined basin on the overland flow locations for street network.

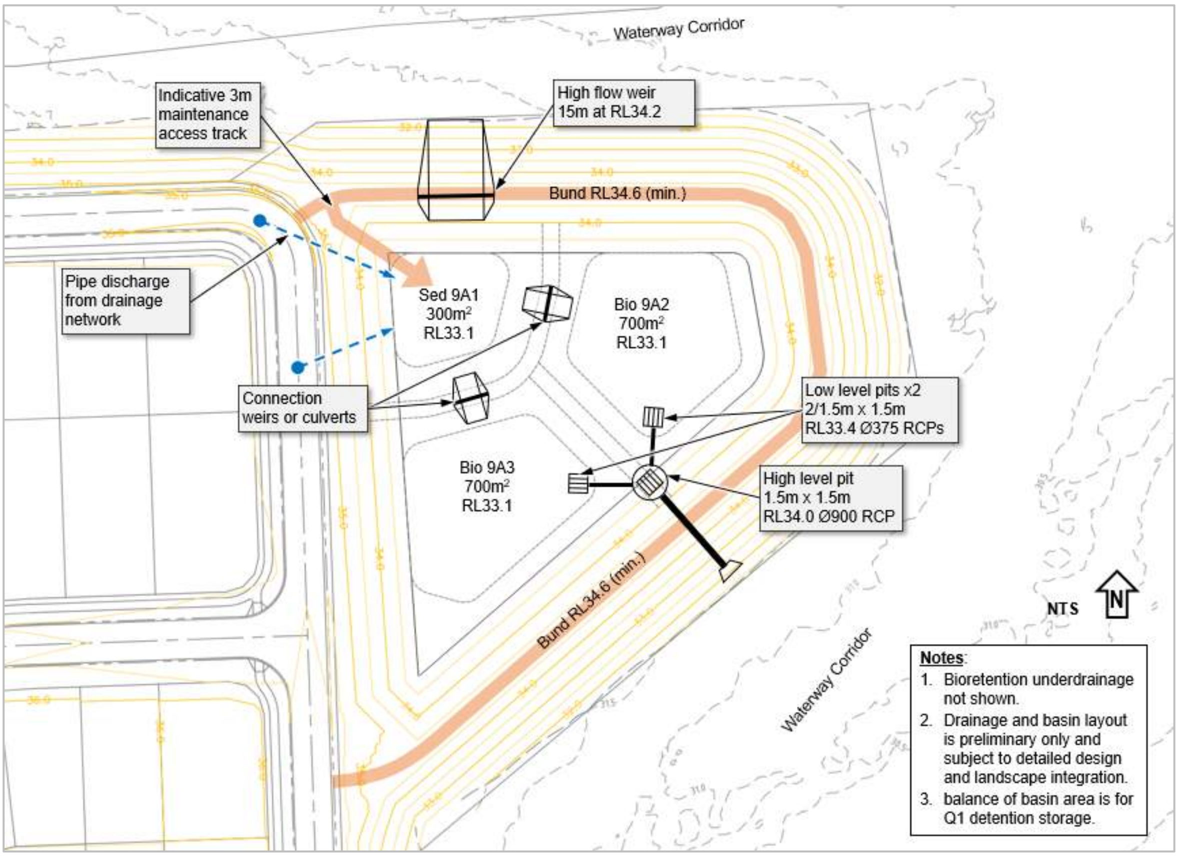



Figure 12: Basin 9A concept design

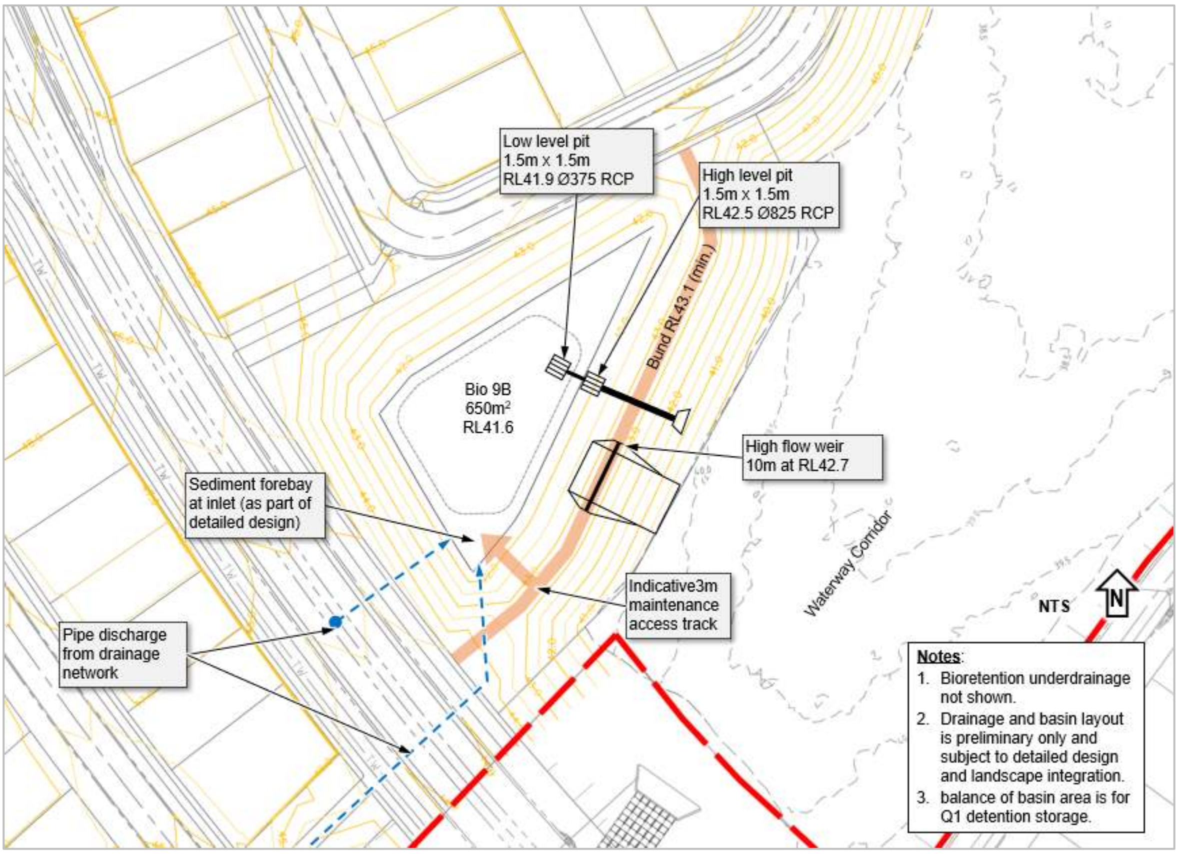



Figure 13: Basin 9B concept design

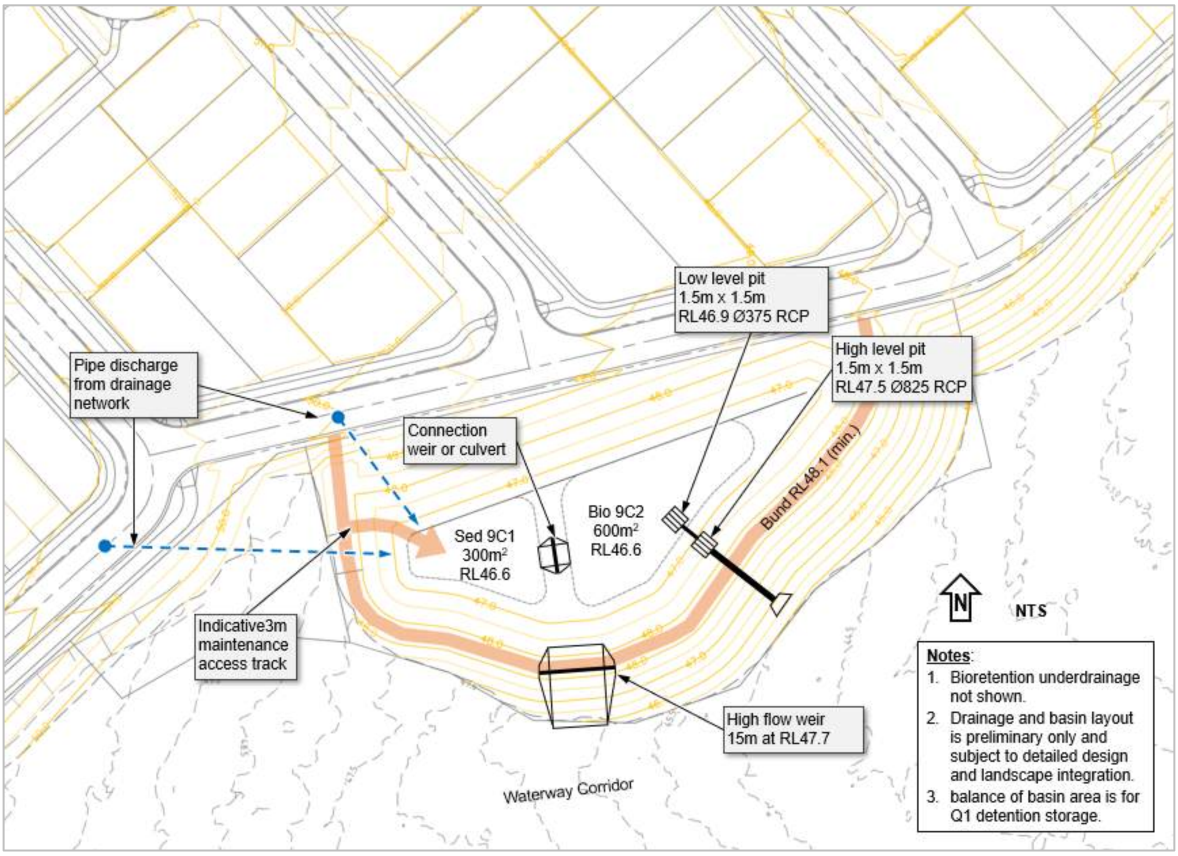



Figure 14: Basin 9C concept design

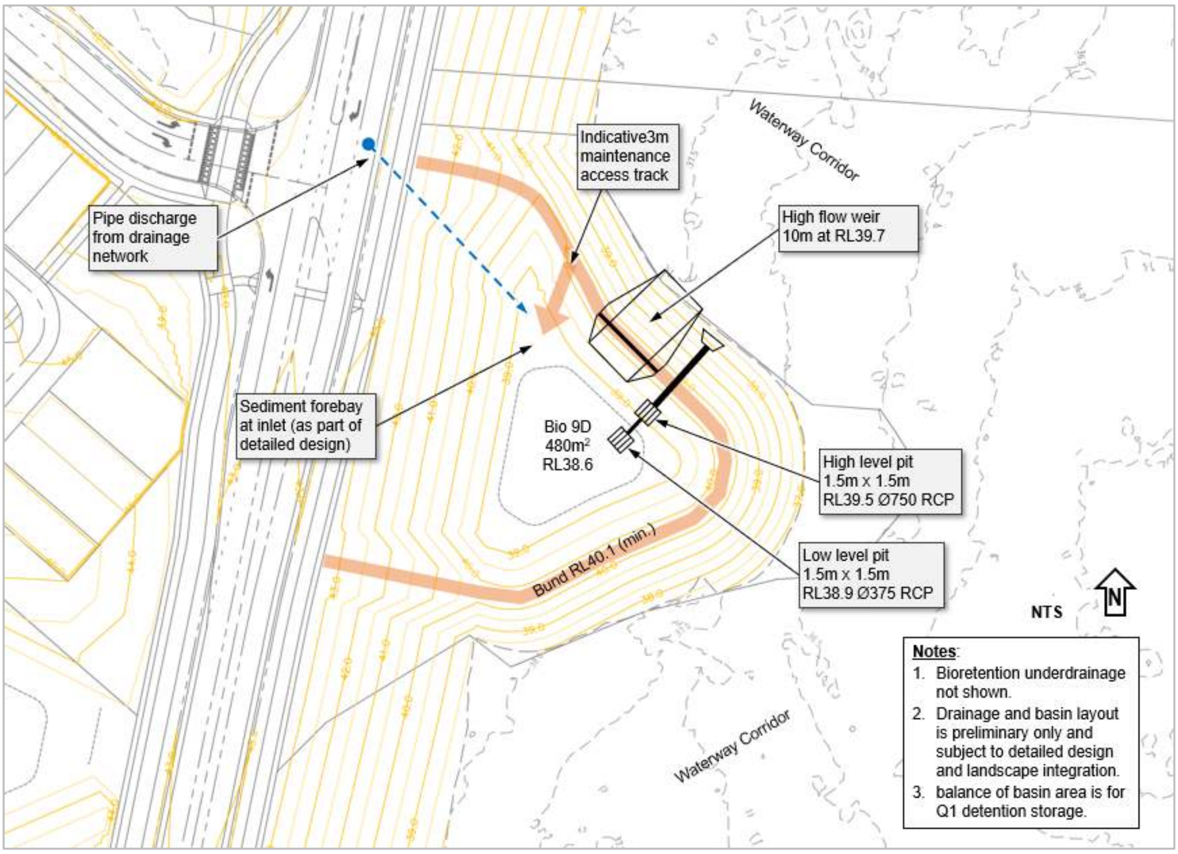



Figure 15: Basin 9D concept design

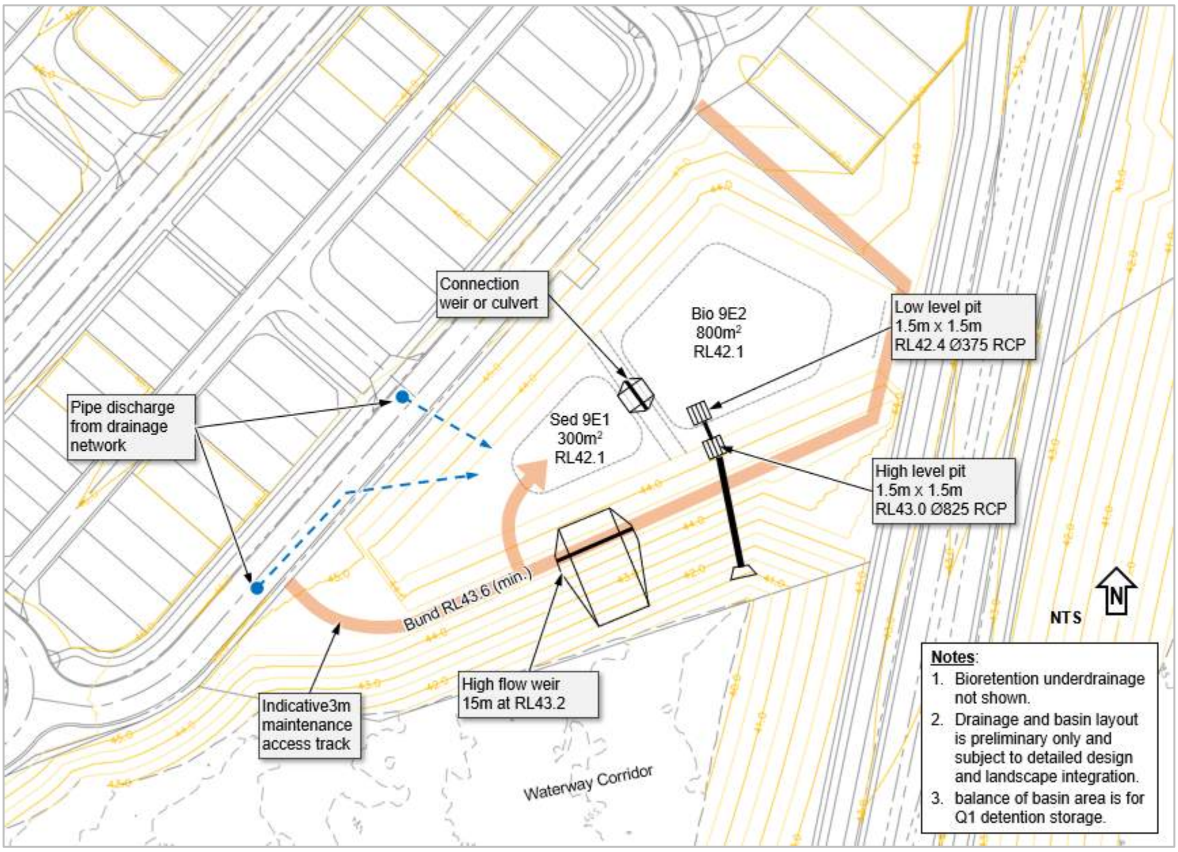



Figure 16: Basin 9E concept design

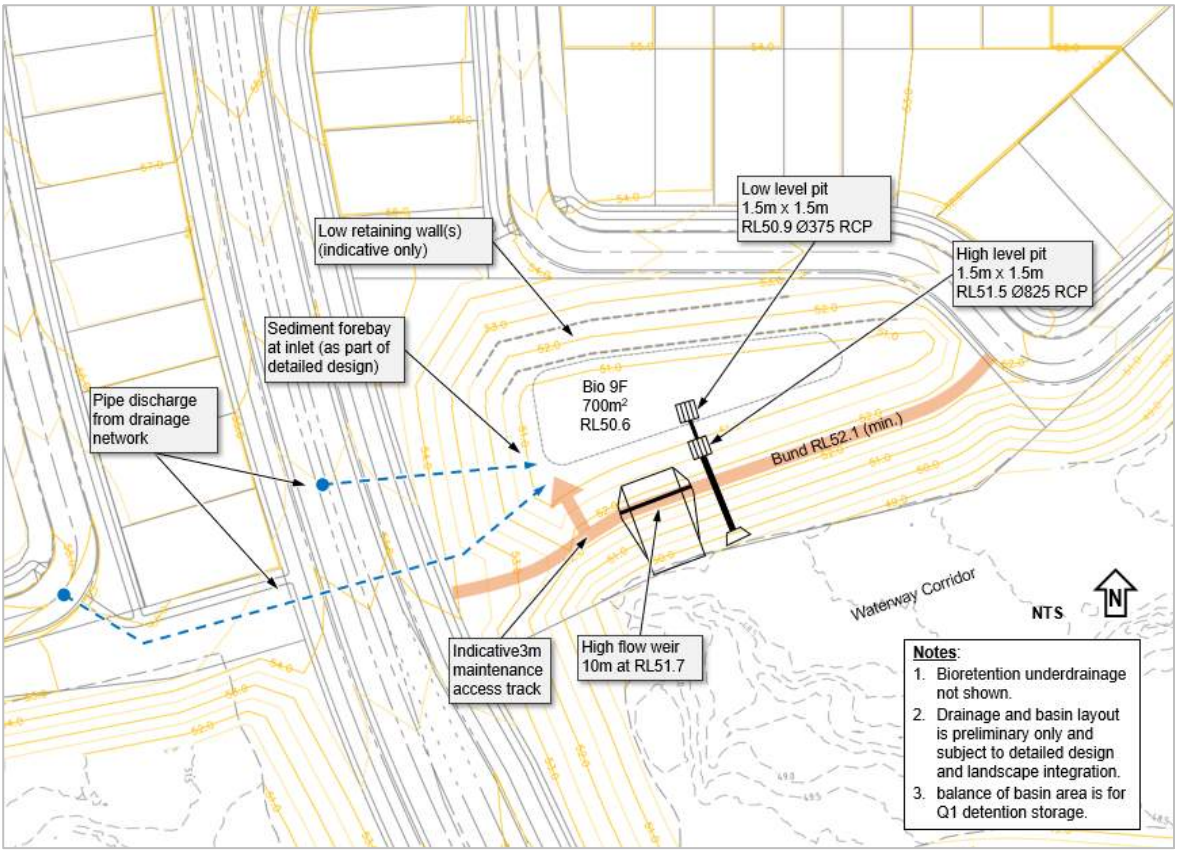



Figure 17: Basin 9F concept design

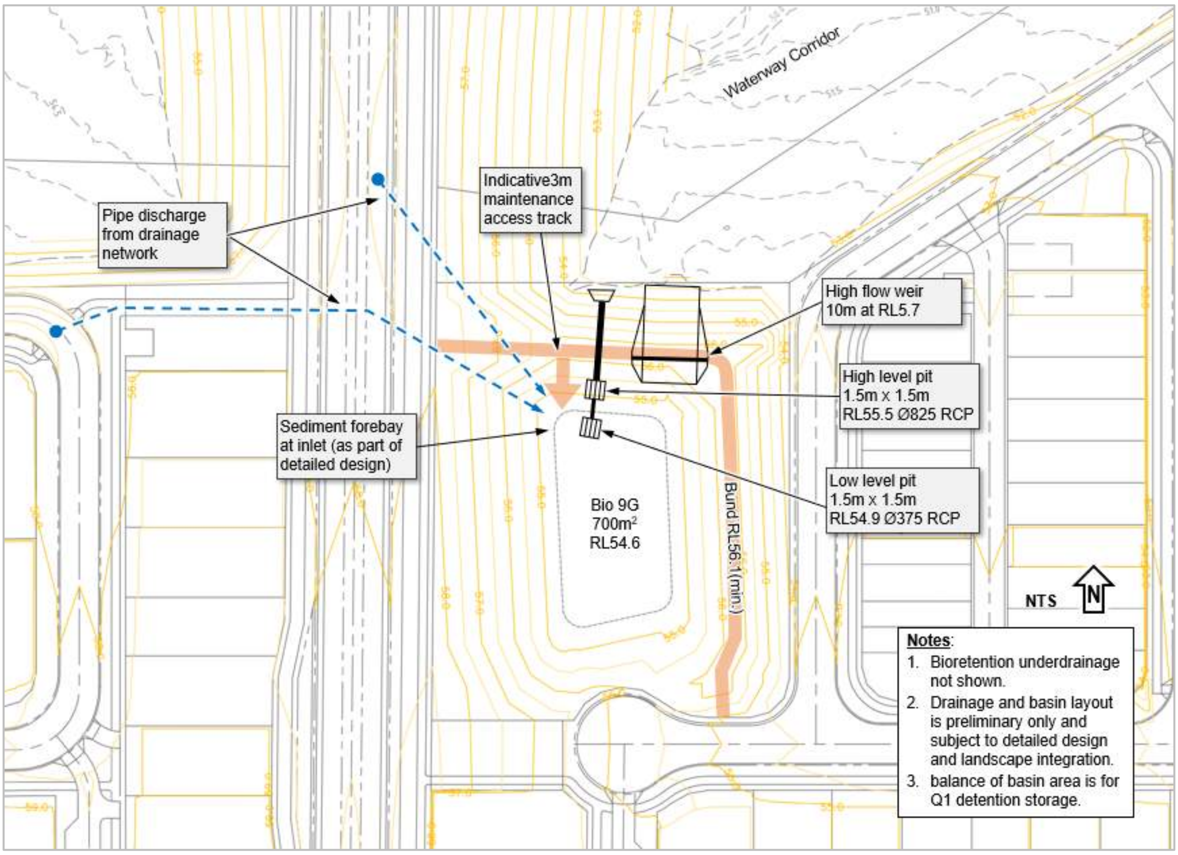



Figure 18: Basin 9G concept design

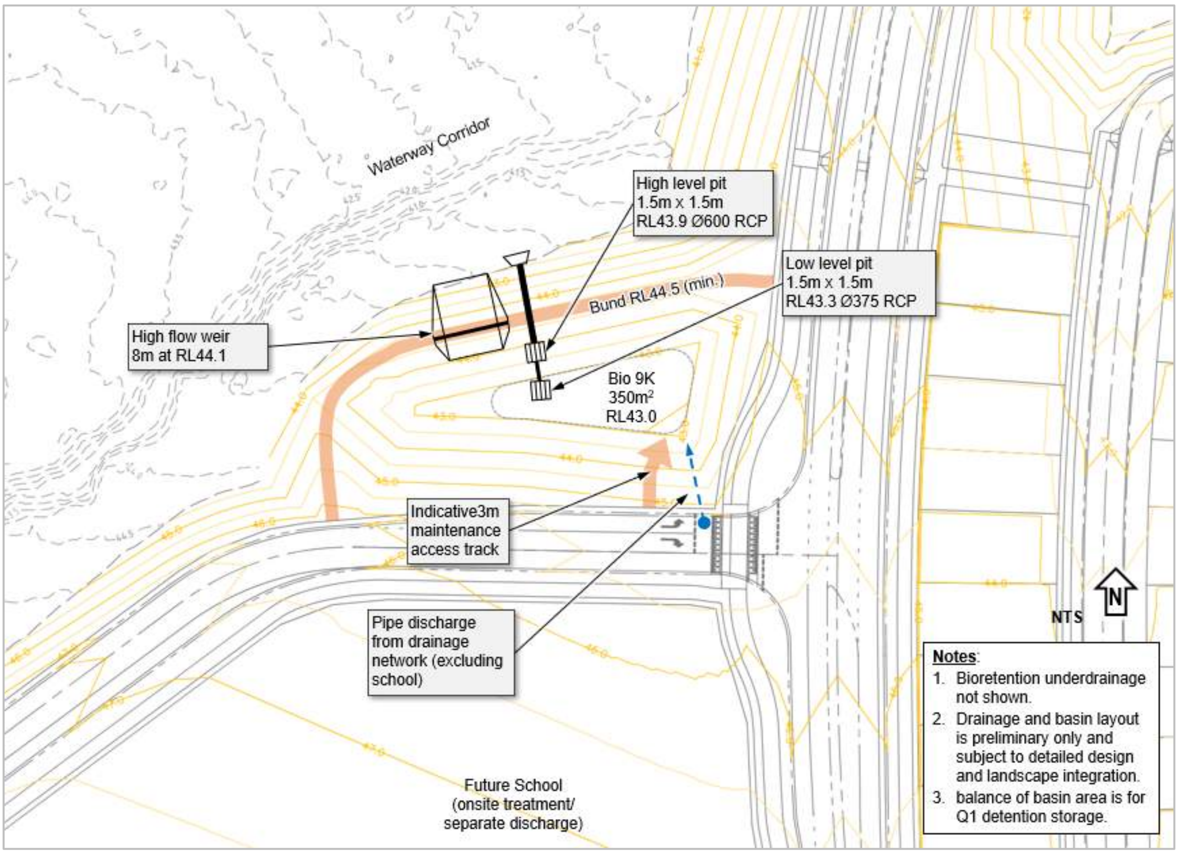



Figure 19: Basin 9K concept design

### 5.3.6 Discussion

The preliminary design of the stormwater quality and minor flow (63.2% AEP) detention basins provides adequate attenuation of local development runoff to mitigate discharge back to the equivalent pre-development 63.2% AEP discharge based in the rapid assessment of P9 from the hydrologically similar P8 unit rates of detention storage volume. This affords protection to downstream waterway stability in line with the objectives provided in Table 7 previously in Section 4.1.1.

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 once available from KN Group civil engineers. 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 9 ROL1 are provided in Table 12 which are generally in accordance with the *Yarrabilba – Stormwater Infrastructure Master Plan* (DesignFlow, 2024) and the State Planning Policy (DSDIP, 2017).

Table 12: Construction phase stormwater quality

| Issue | Desired outcomes |
|---|---|
| Drainage control | 1. Manage stormwater flows around or through areas of exposed soil to avoid contamination.<br>2. Manage sheet flows in order to avoid or minimise the generation of rill or gully erosion.<br>3. Provide stable concentrated flow paths to achieve the construction phase stormwater management design objectives for temporary drainage works (part 2).<br>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.<br>2. Effectively cover or stabilise exposed soils prior to predicted rainfall.<br>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.<br>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.<br>2. Avoid the release of oil or visible sheen to released waters.<br>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.<br>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 9 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 12.

### 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 9 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 should 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 9 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 ponds and bioretention basins that manage the Precinct 9 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 defined 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 P9 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*

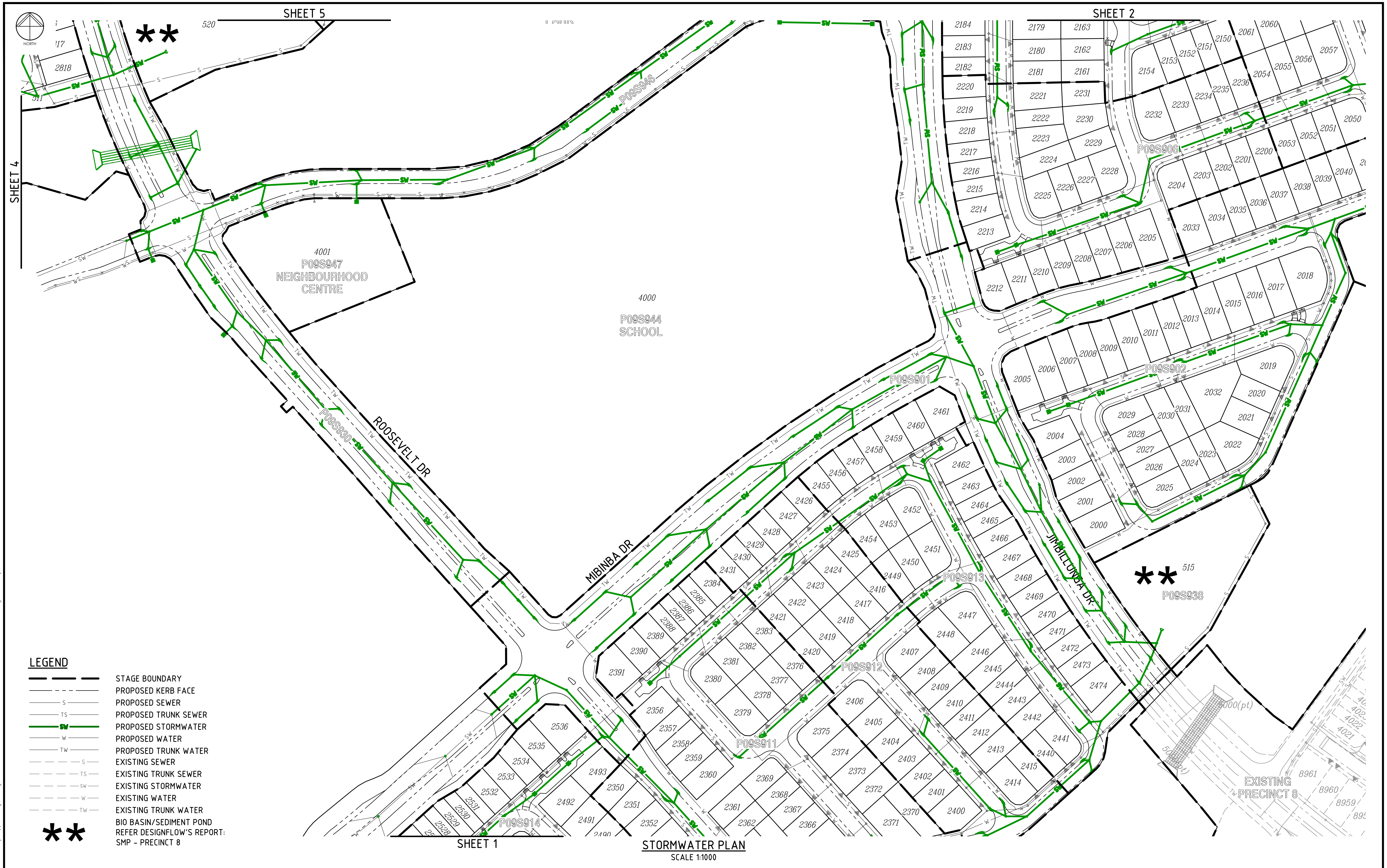
IECA (2008) *Best Practice Erosion and Sediment Control*

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
- 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

DRAFT

REVISIONS

| No | Description | DR | DES | CHK | Date |
|---|---|---|---|---|---|
| A | FOR APPROVAL | SLK | JAS | RWM | 10.12.25 |

Project

YARRABILBA

**PRECINCT 9 - ROL1**
**PRELIMINARY PLANNING**
**FUNCTIONAL DRAWINGS**

Client

Stockland

Approved - RPEQ 12805

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FUNCTIONAL LAYOUT
STORMWATER PLAN
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Application No.

A1

Drawing No
24-153-SK118

Revision
A

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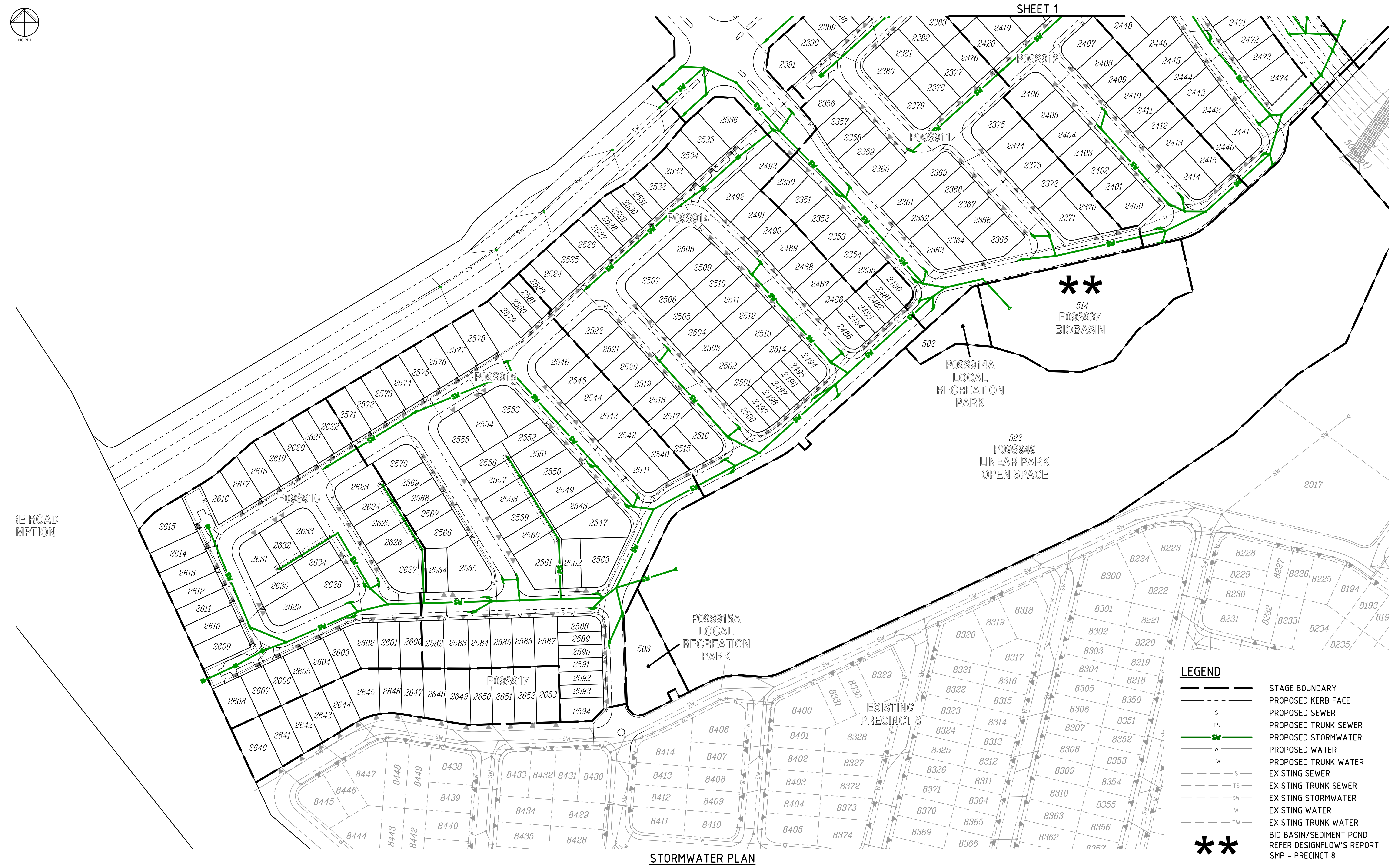


## LEGEND

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

STORMWATER PLAN
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**PRECINCT 9 - ROL1**
**PRELIMINARY PLANNING**
**FUNCTIONAL DRAWINGS**

Client
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PRECINCT 9 - ROL1
PRELIMINARY PLANNING
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Revision
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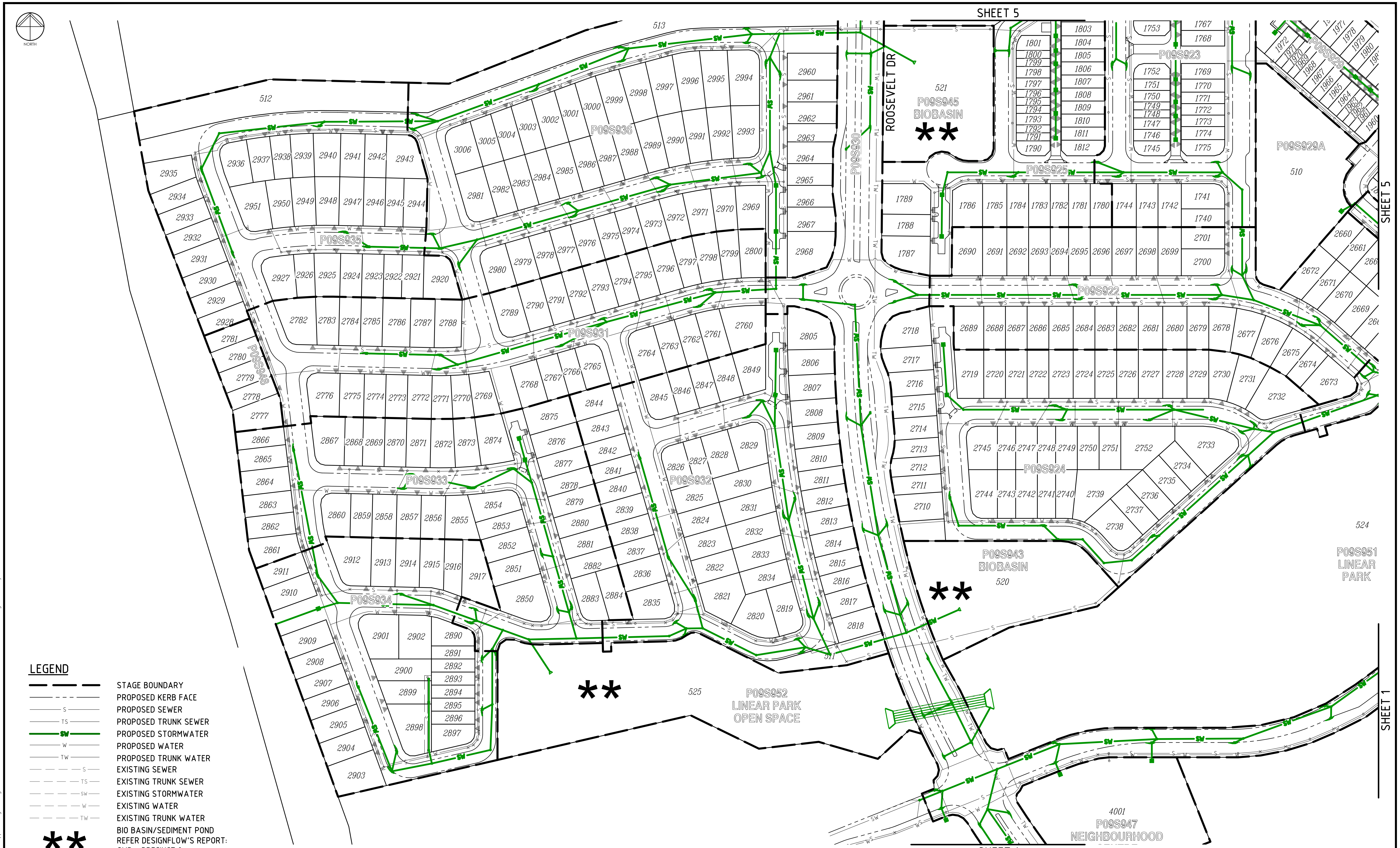


## LEGEND

- 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

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PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

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Drawing No

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Revision

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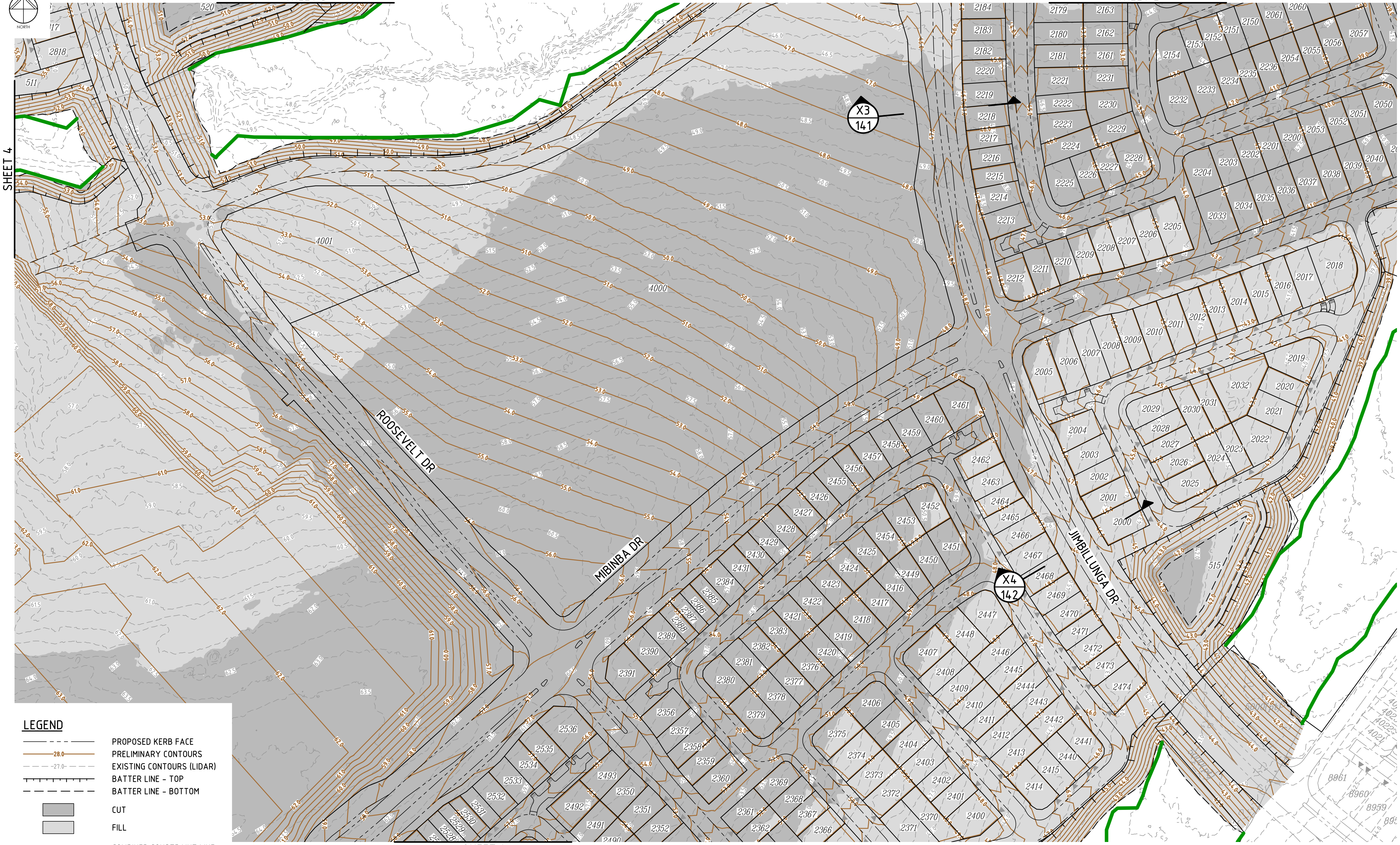


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- 28.0 PRELIMINARY CONTOURS
- 27.0 EXISTING CONTOURS (LIDAR)
- BATTER LINE - TOP
- BATTER LINE - BOTTOM
- CUT
- FILL
- COMBINED CONSTRAINT LINE

## EARTHWORKS CONTOUR PLAN

SCALE 1:1000

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PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

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FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 1

Application No.

A1

Drawing No
24-153-SK134

Revision
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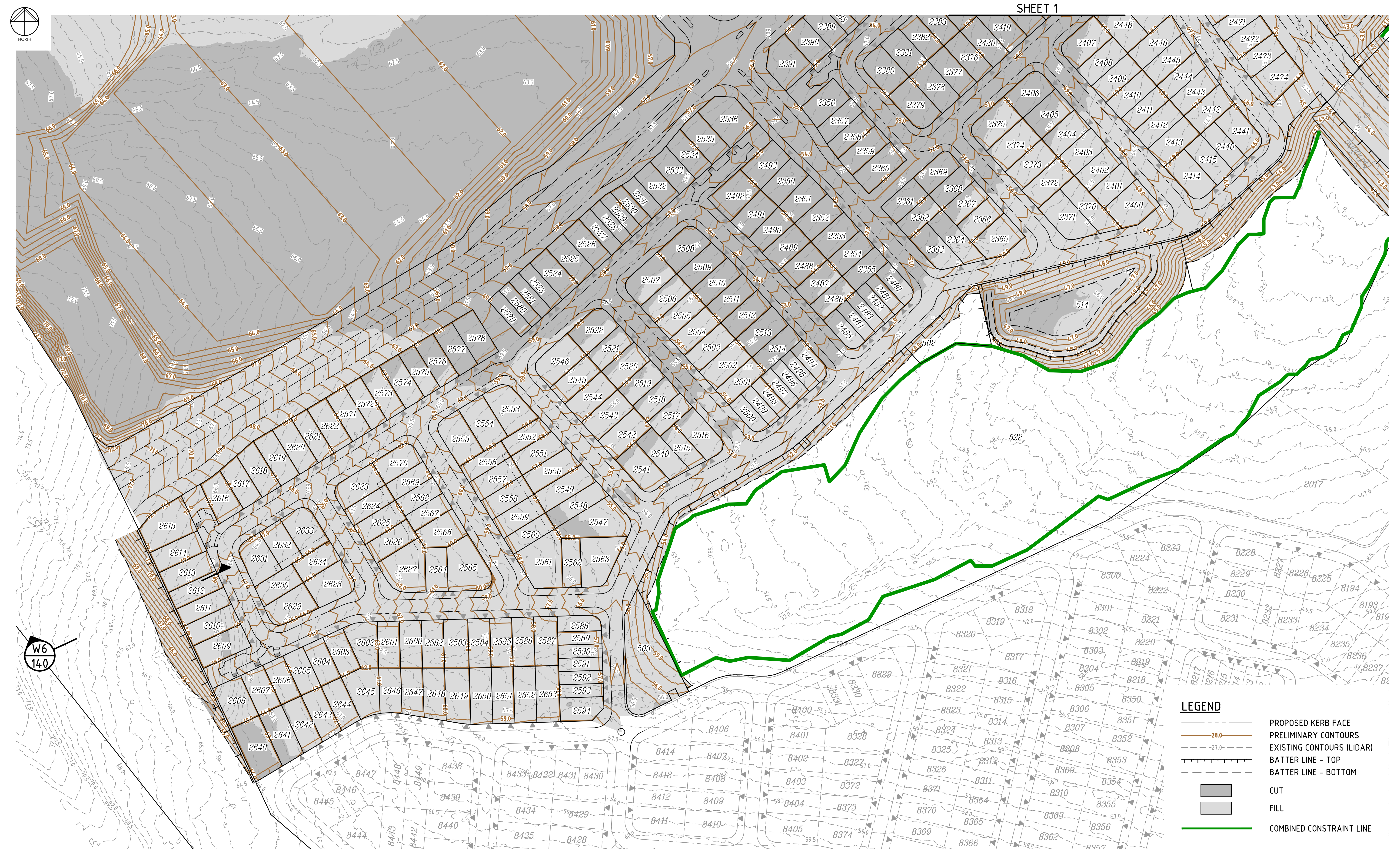


## EARTHWORKS CONTOUR PLAN

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Project

YARRABILBA

**PRECINCT 9 - ROL1**
**PRELIMINARY PLANNING**
**FUNCTIONAL DRAWINGS**

Client

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Drawing Title
FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 2

Application No.

A1

Drawing No
24-153-SK135

Revision
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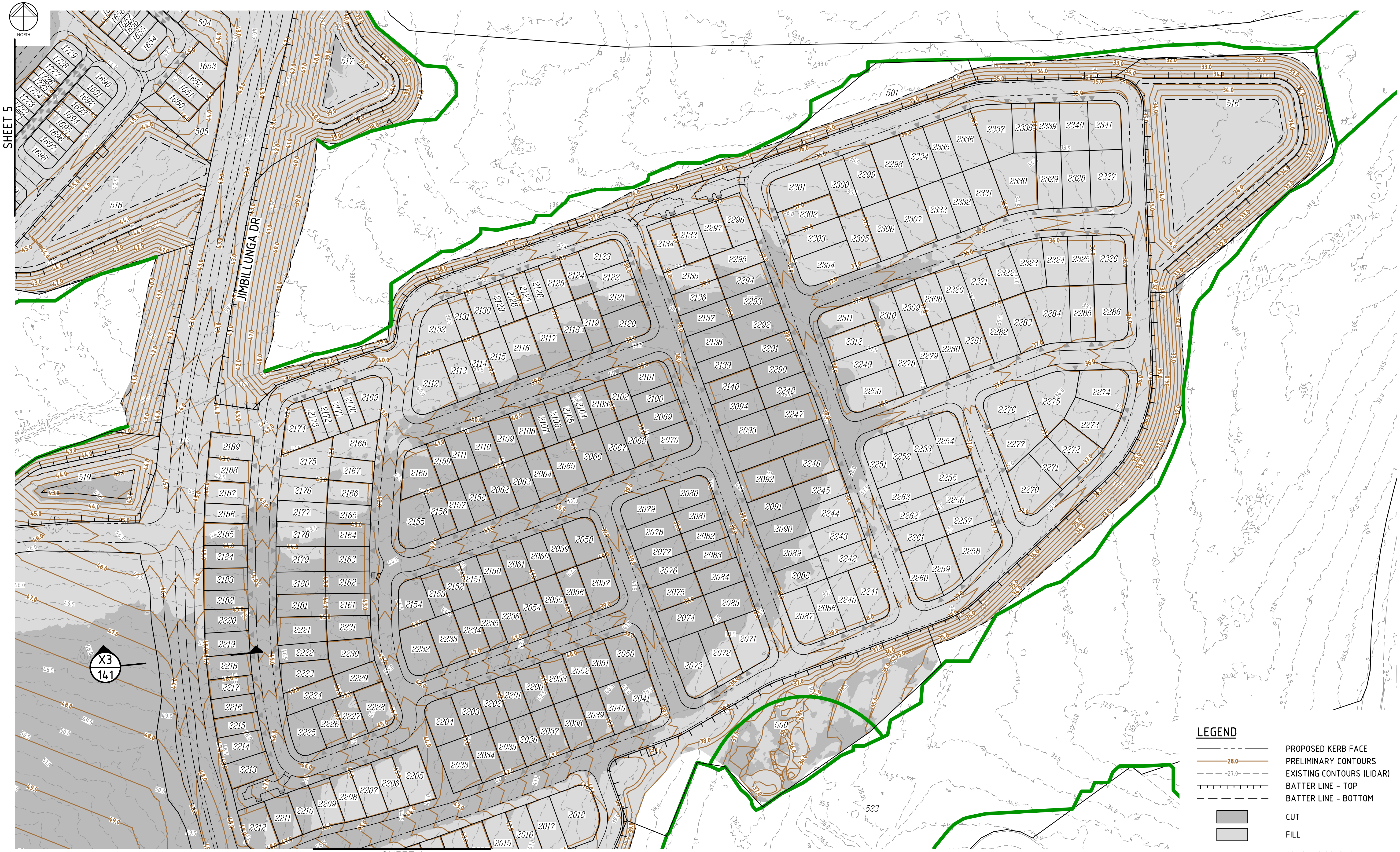


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SCALE 1:1000

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- EXISTING CONTOURS (LIDAR) (27.0)
- BATTER LINE - TOP
- BATTER LINE - BOTTOM
- CUT
- FILL
- COMBINED CONSTRAINT LINE

DRAFT

REVISIONS

| No | Description | DR | DES | CHK | Date |
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| A | FOR APPROVAL | SLK | JAS | RWM | 10.12.25 |

Project

YARRABILBA

**PRECINCT 9 - ROL1**
**PRELIMINARY PLANNING**
**FUNCTIONAL DRAWINGS**

Client

Stockland

Approved - RPEQ 12805

10 5 0 10 20 30 40 50m
1 : 1000 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING

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Drawing Title

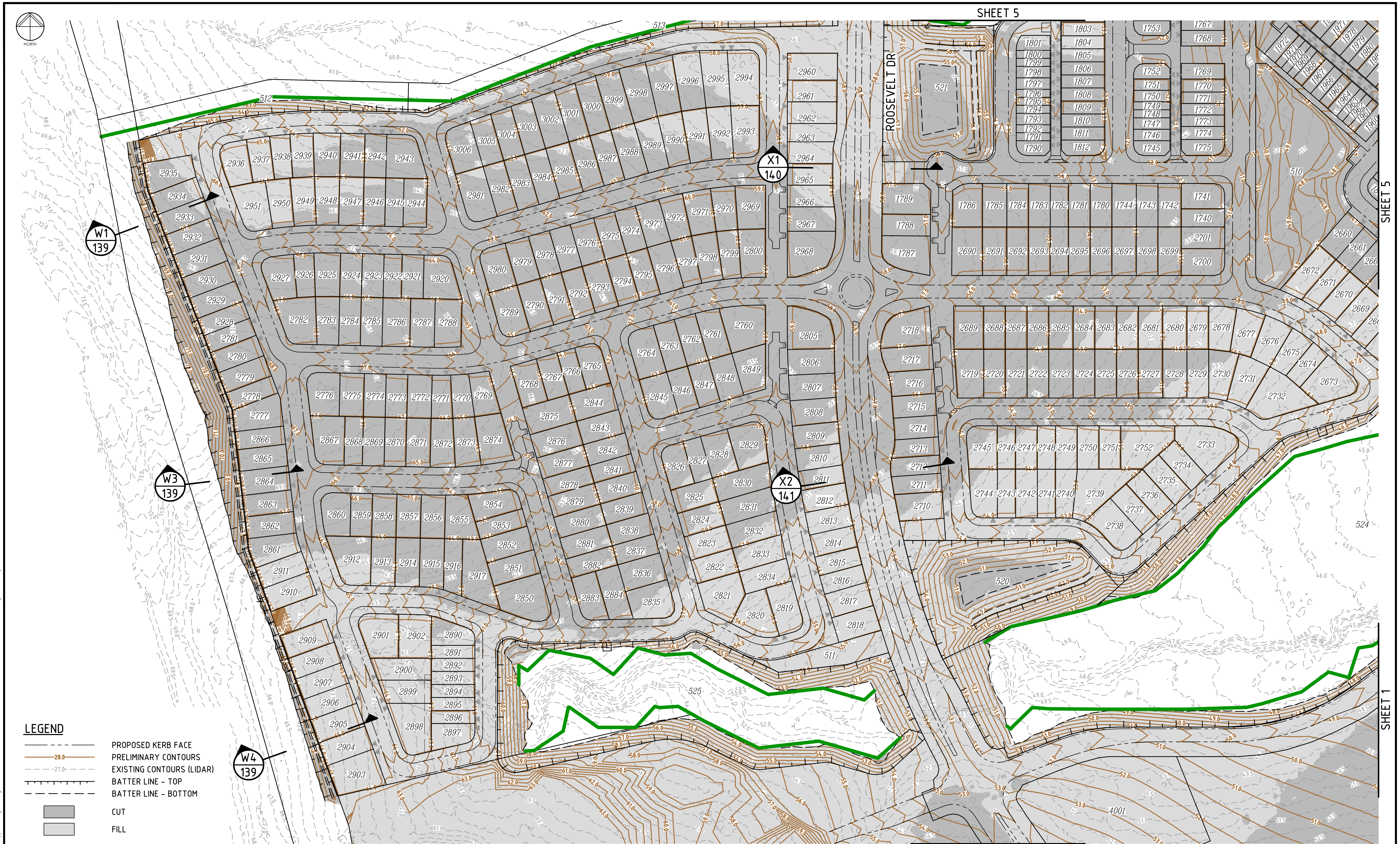
FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 3

Application No.

A1

Drawing No 24-153-SK136

Revision A




EARTHWORKS CONTOUR PLAN

SCALE 1:1000

DRAFT

REVISIONS

| No | Description | DR | DES | CHK | Date |
|---|---|---|---|---|---|
| A | FOR APPROVAL | SLK | JAS | RWM | 10.12.25 |

Project

YARRABILBA

PRECINCT 9 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client

Stockland

Approved - RPEQ 12805

10 5 0 10 20 30 40 50m
1 : 1000 (A1 UNREDUCED)

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Drawing Title

FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 4

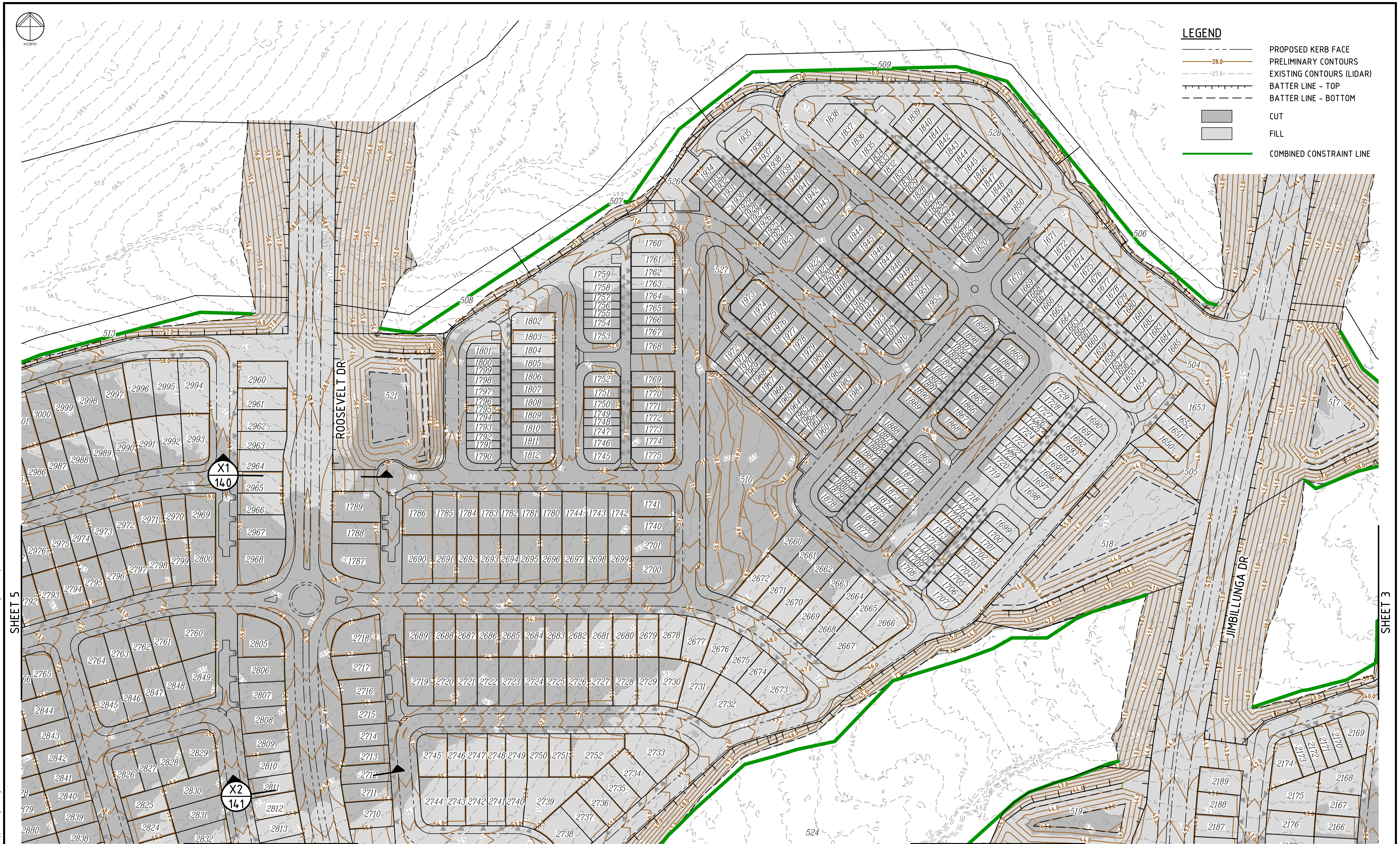
Application No.

A1

Drawing No 24-153-SK137

Revision A

M:\2024\24153 Yarrabilba Precinct 8-9 Preliminary Support\Engineering\Acad\P09 FUNCTIONALS\24-153-SK134-SK138-P09ROL1-FUNC-EWKS.dwg Plotted by: SLK on 17/04/2026 1:20:07 PM




SHEET 5 SHEET 3

EARTHWORKS CONTOUR PLAN
SCALE 1:1000

DRAFT

REVISIONS

| No | Description | DR | DES | CHK | Date |
|---|---|---|---|---|---|
| A | FOR APPROVAL | SLK | JAS | RWM | 10.12.25 |

Project
YARRABILBA
PRECINCT 9 - ROL1
PRELIMINARY PLANNING
FUNCTIONAL DRAWINGS

Client
Stockland
Approved - RPEQ 12805

10 5 0 10 20 30 40 50m
1 : 1000 (A1 UNREDUCED)
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Drawing Title
FUNCTIONAL LAYOUT
EARTHWORKS CONTOUR PLAN
SHEET 5

Application No.

A1
Drawing No
24-153-SK138
Revision
A

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