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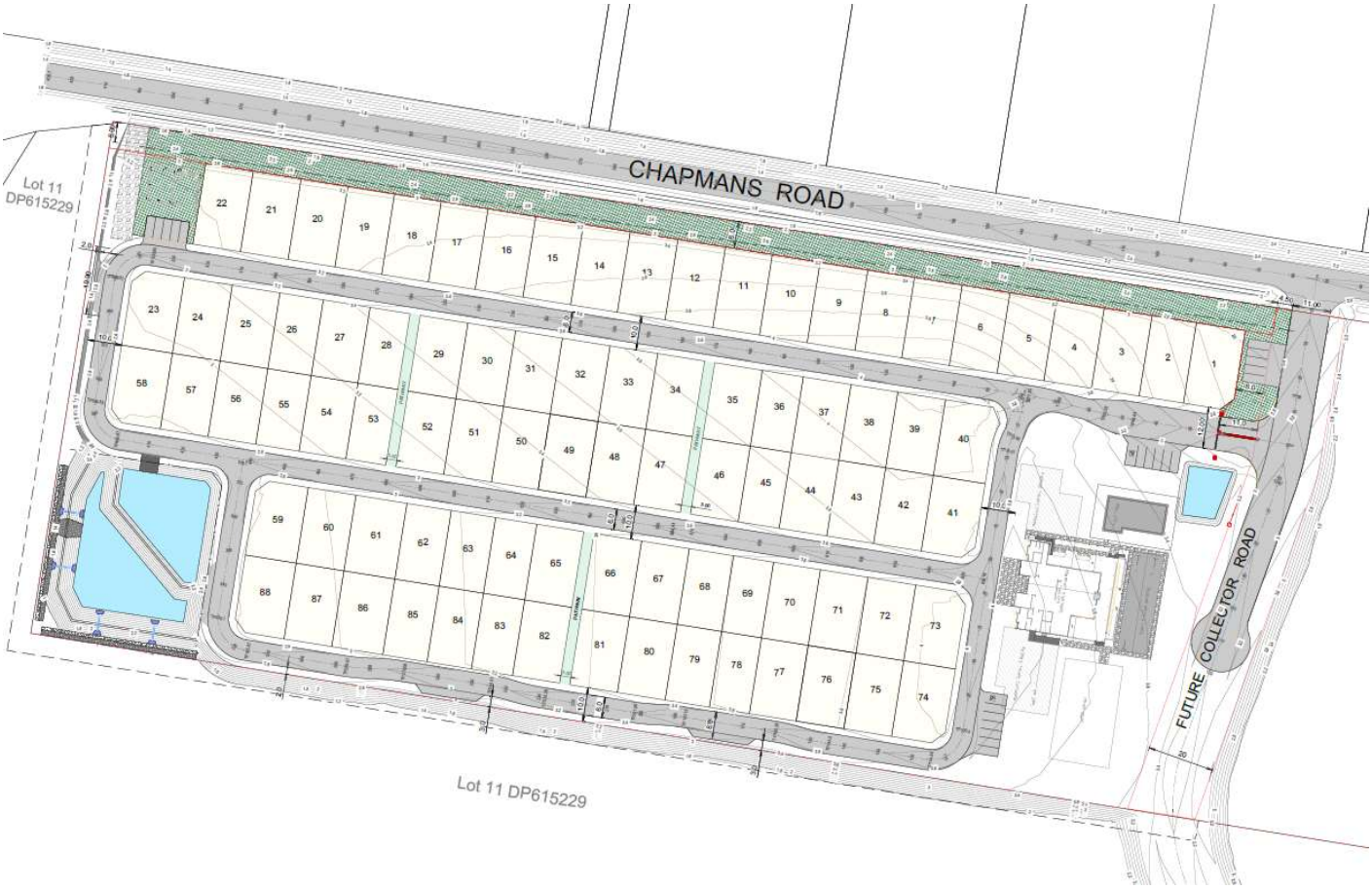


# STORMWATER MANAGEMENT PLAN

# 40 – 80 Chapmans Road, Tuncurry

# Manufactured Home Estate

**On Behalf of**
**Allam Group Pty Ltd**

Land Dynamics Australia

July 2023

Document No. 5445 SWMP Rev C

# Document History

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# 1.0 EXECUTIVE SUMMARY

Land Dynamics has been engaged by Allam Group to prepare a Stormwater Management Plan (SWMP) for a proposed Manufactured Home Estate located at Lot 100 DP1286524, Chapmans Road, Tuncurry.

The proposed development intended for the site involves construction of an 88-lot manufactured home estate plus community building, with appropriate roads and infrastructure to service the development.

The purpose of this SWMP is to analyse the site in its proposed developed and undeveloped states then identify preliminary locations and size for stormwater management features and appropriately assess the need for detention and bioretention basins that will be required to control runoff and treat stormwater before discharging to local receiving waterways.

This report demonstrates the development will be constructed and operated generally in accordance with the Water Sensitive Urban Design (WSUD), requirements of MidCoast Council and best management practices.

In this document are assessments for two primary areas:

- Stormwater Quantity (Hydrology & Detention Sizing)
- Stormwater Quality (Water Sensitive Urban Design)

A hydrologic analysis was undertaken to assess rainfall runoff generated within the pre-developed area and the post developed area. Results show that the overall development will increase flows from pre-developed state as elaborated in Section 5. The flow difference will be managed by a single detention/bioretention basin to ensure non-worsening will be maintained downstream.

Proposed detention basin has been sized to mitigate flows for both the major and minor storm events (20% and 1% AEP respectively).

Stormwater quality assessment was undertaken to design the preliminary treatment train to meet the Water Quality objectives and MidCoast Council quality requirements. Refer to Section 6.0 for details.

The proposed treatment train consists of an end-of-line detention/bioretention basin that allow for treated stormwater discharge.

# 2.0 INTRODUCTION

This Stormwater Management Plan outlines the stormwater quantity and quality management measures required for the proposed development of an 88-lot manufactured home estate plus community building located at Lot 100 DP1286524, Chapmans Road, Tuncurry, which is within the MidCoast Council Local Government Area.

# 3.0 EXISTING SITE CHARACTERISTICS

## 3.1 Site Description

The proposed development is located at the northern end of Tuncurry. The land is predominately cleared but has some vegetation along the eastern boundary. Vegetation on the western side of the site will be cleared for the proposed development.

The site is sandy, low lying and flat.

The site is within 500m of the Wallamba River and is subject to flooding.

A site locality map and an aerial photo is provided in Figure 3-1 and Figure 3-2 below.

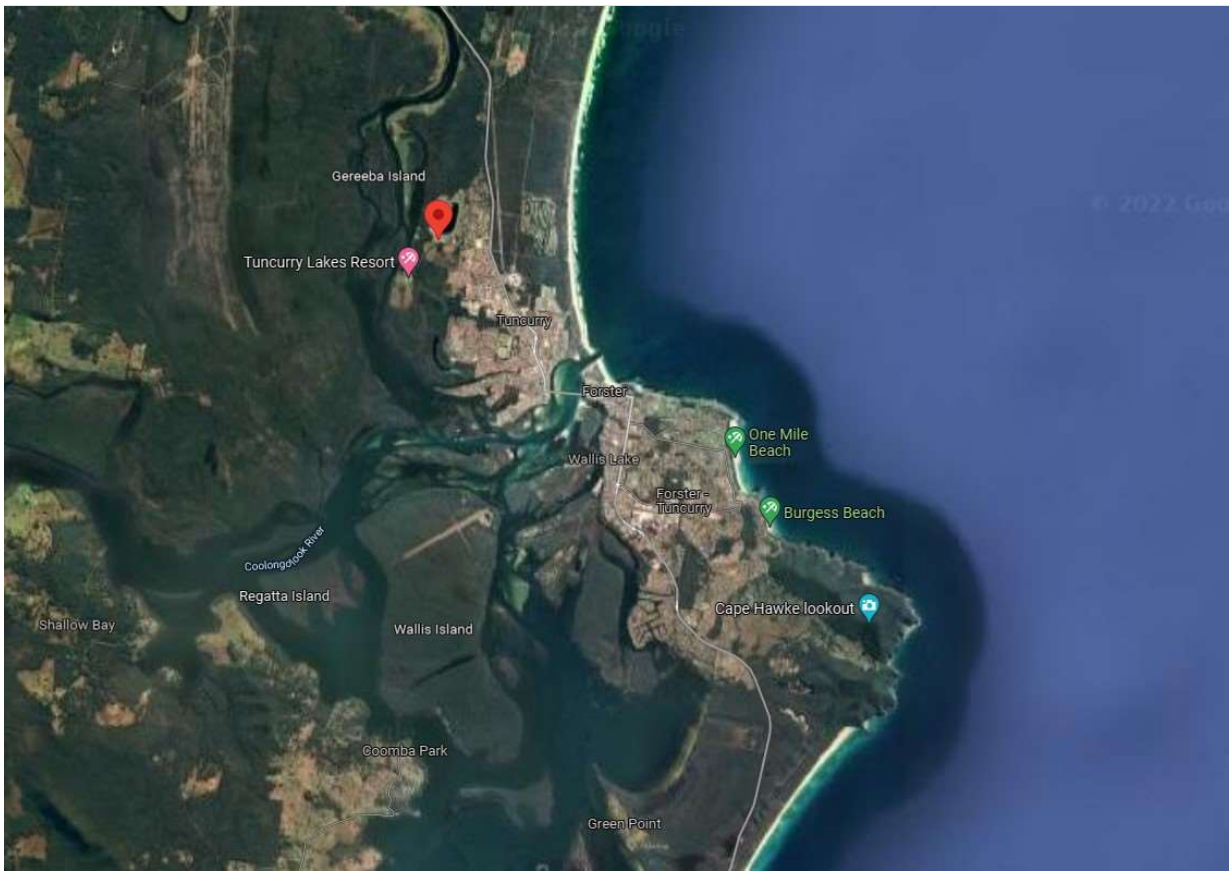


*Figure 3-1 Locality Map (source: Google) (Red Marker indicates site)*


*Figure 3-2 Site Aerial Photo (source: SIX Maps) – Existing Condition*

## 3.2 Property Description and Area

The development is proposed to be undertaken within the parcel of land designated as Lot 100 DP1286524 (40-80 Chapmans Road, Tuncurry) with a total area of 6.07 Ha.

## 3.3 Existing Land Use

The land is predominately cleared but has a pocket of vegetation along the eastern boundary. The land is undeveloped currently except for one dilapidated structure near the current entrance off Chapmans Road. There is also an existing unsealed site access and stockpiling area.

## 3.4 Existing Topography and Site Drainage

In its existing condition, the site generally grades toward the southwest with a gradual slope of approximately 0.5% - 1.0%. There is no nominated site discharge location for this property; it currently discharges overland and via infiltration given the sandy geology of the site.

Whilst the site is unlikely to discharge overland for frequent rainfall events due to infiltration, rare events may discharge overland into the adjacent property (Lot 11 DP615229) heading towards Wallamba River.

The infiltration effectiveness of the site will be affected by groundwater levels.

# 4.0 PROPOSED DEVELOPMENT

The proposed development incorporates an 88-lot manufactured home estate plus community building, car parking areas and a stormwater detention basin. There is a future collector road passing through the development on the eastern portion of the site.

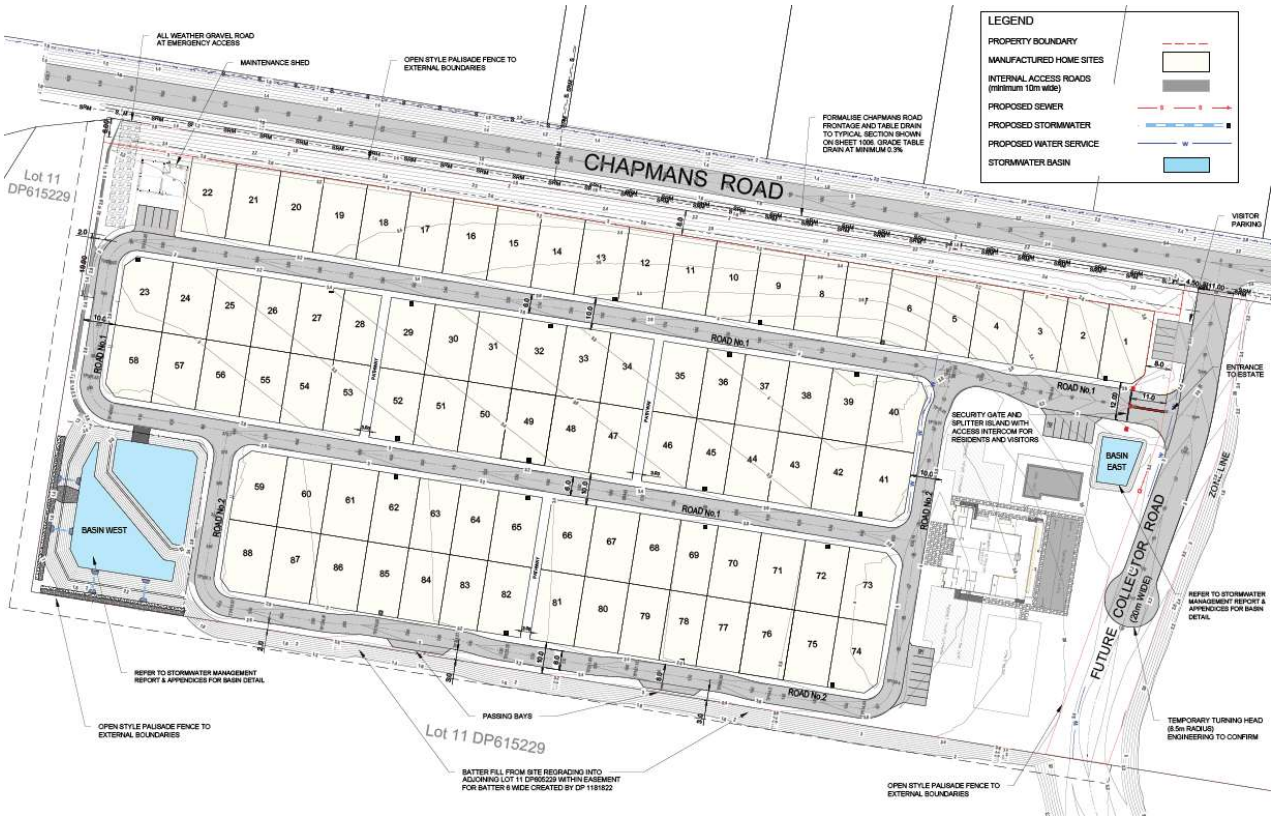


*Figure 4-1 Proposed Development Layout*

# 5.0 STORMWATER QUANTITY MANAGEMENT

## 5.1 Existing Topography and External Catchments

The site drains in a south-westerly direction towards the adjacent property (Lot 11 DP615229).

Upstream stormwater from the north is cut-off by Chapmans Road leaving a small parcel of land to the east of the proposed development site.

Based on LiDAR, existing catchments to the east appear directed to the adjacent property (Lot 11 DP615229), with fill material (assumed placed) evident in the vegetated eastern section of the site. It is difficult to determine exact overland flow path directions on site with the vegetation being overgrown, and the site being predominately flat.

However, it is envisaged that the majority of stormwater would infiltrate into the groundwater table (even if taking an extended period to do so) in pockets of low-lying areas. It is unlikely that significant overland flows occur from this adjacent land parcel. Any significant overland flows would only occur in very rare events and are unlikely to discharge beyond the vegetated area of the proposed development site, which is to remain as per the proposed development plan.

There is a fill deposit adjacent to the vegetation, this would prevent overland flow entering the rest of the development site, however it is not envisaged that this would play a role in stormwater management currently due to the other site conditions.

Figure 5-1 shows the adjacent upstream catchment and the expected stormwater response. As such, there is no allowance for external catchments within the proposed development site.

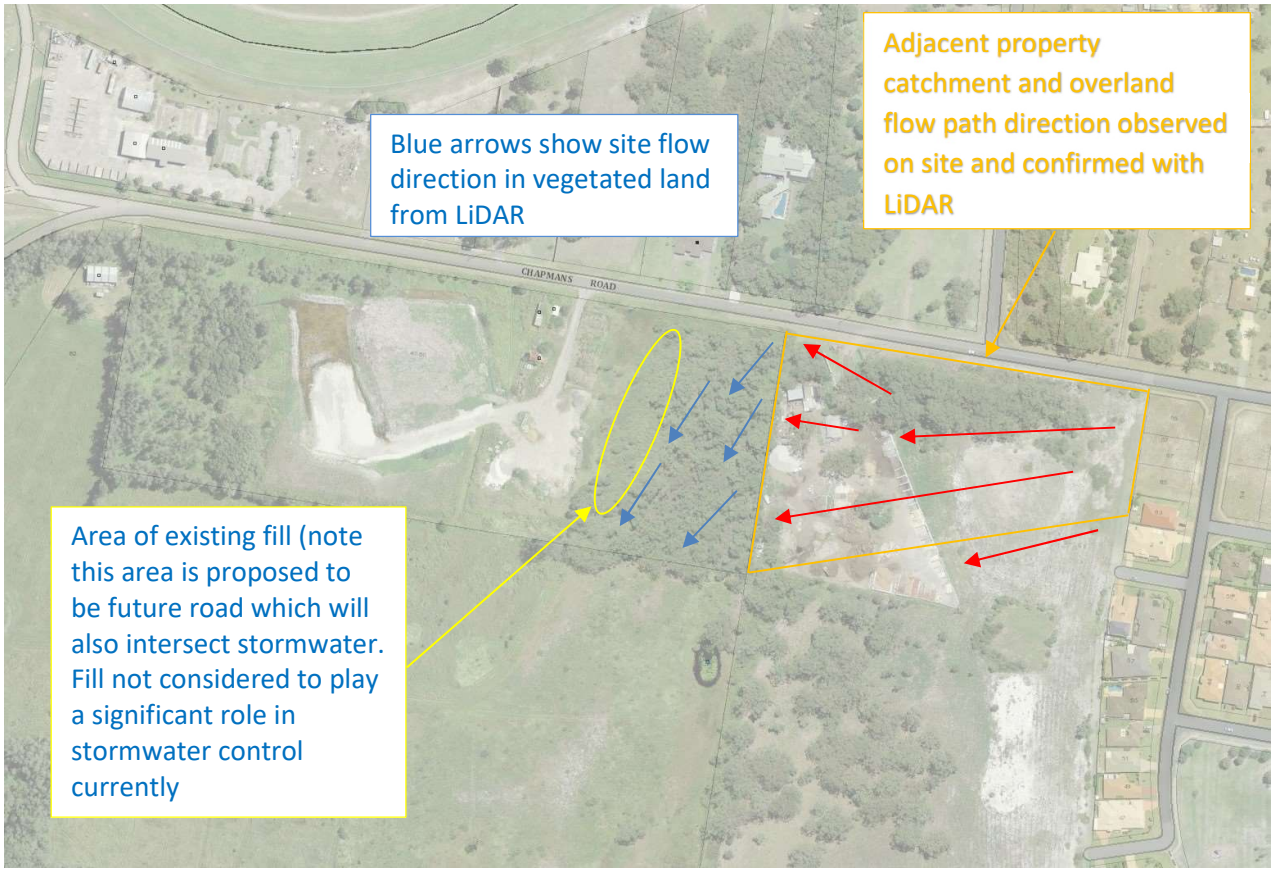


*Figure 5-1 Existing Stormwater flow and Catchment boundaries*

## 5.2 Proposed Discharge Characteristics

For the proposed development, the site will retain its existing discharge location at the southwest corner of the lot onto the adjacent property (Lot 11 DP615229).

The existing site discharge is via infiltration and overland sheet flow, whereas the post-development condition may see a more concentrated site discharge in the southwest corner of the site for rare events. This is proposed to be managed with a level spreader device to ensure there will be no erosion or impact upon the existing property.

As the existing site has no underground stormwater connection, the existing natural surface level has been utilised as the controlling level for stormwater infrastructure on the development site. Lot filling will occur to provide flood controls, site grading and cover for underground services.

The upstream catchment to the east of the proposed development will bypass the proposed development site.

The area of the development site to the east of the future collector road has not been included in hydraulic assessment as it will discharge to the adjacent property in its current capacity without modification.

Note that the native aeolian sands have been reported by Regional Geotechnical Solutions as having a high infiltration rate of $5.0x10^{-3}$ m/s. Refer to Section 5.7 for further details.

## 5.3 Flooding

The subject site is subjected to flooding based on the flood map information from MidCoast Council online mapping system and considered flood prone land.

A review of the Wallis Lake Foreshore (flood plain) Risk Management Study – Flood Study Review (WMA Water January 2014) does not clearly show the flood planning level for the proposed development site as it is on the fringe of the model used within the report.

As such further clarification has been sought from MidCoast Council with confirmation of the following flood levels supplied:

- Flood Planning Level RL 2.7m AHD
- Habitable Floor Level RL 3.2m AHD

As such the proposed development is to be filled to at least RL2.7m AHD to comply with MidCoast Council requirements for flood prone land.

## 5.4 Hydrology

A hydrological assessment was undertaken using rainfall data in accordance with ARR2019 which was derived specifically for the proposed development site from ARR Hub and from Bureau of Meteorology respectively.

Catchment hydrological analysis was undertaken using the DRAINS software package, which also assessed the hydraulics of the proposed detention facility.

Given the sandy soil type, and proposed filling of the development site, an ILSAX hydrological model was developed for the site. Pre-development allowable site discharges for critical storm events were determined using a high infiltration value within the ILSAX hydrological model due

to the sandy soil type, with a conservatively reduced infiltration ILSAX model used for the post-development scenario to effectively model the reduced infiltration effect that imported fill material may have on the catchment hydrology.

*Table 5-1 Loss Model Parameters*

| Parameter | Pre-developed Value | Post-developed Value |
|---|---|---|
| Impervious Area Depression Storage (mm) | 1 | 1 |
| Supplementary Area Depression Storage (mm) | 1 | 1 |
| Pervious Area Depression Storage (mm) | 5 | 5 |
| Soil Type | 1 | 3 |

This results in a high runoff result for the post-development scenario with a low allowable site discharge due to the current site conditions (high infiltration). This will result in a larger than standard detention facility, however is a more accurate means of proving compliance to MidCoast requirements.

The DRAINS model was used to determine discharge flow rates of each catchment for standard Annual Exceedance Probabilities (AEP's) of 20% and 1%, (corresponding the minor and major storms respectively) from 5-min to 6-hour durations.

## 5.5 DRAINS Catchment Modelling

The existing and developed site was modelled as a lumped catchment.

The DRAINS ILSAX hydrology model requires impervious area and pervious area loss data which has been derived from ARR data hub. In this method, catchment areas are generally divided into impervious area, supplementary impervious area, and pervious areas.

At this concept stage, for the post developed lumped catchments, it is assumed that effective impervious area within the future lots is equal to 70%, of which 80% of the impervious area being directly connected. Road catchments have been calculated on the layout presented in Appendix A, accounting for future driveway crossings.

A full catchment breakdown is shown in Appendix B.

## 5.6 DRAINS Results

In order to ensure post-developed peak flows were attenuated to a level less than or equal to that of the pre-developed scenario, an end of line stormwater detention basin was modelled as part of the mitigated scenario to detain and manage discharge flows from the site. A summary of the results is provided in Table 5-2 below.

*Table 5-2 Discharge Summary from DRAINS Analysis*

| Scenario | Peak Flow Rate for Average Recurrence Interval ($m^3/s$) | |
|---|---|---|
| | 20% AEP | 1% AEP |
| Pre-Developed | 0.32 | 1.57 |
| Post-Developed | 0.25 | 1.56 |

The proposed basin will have an outlet to the adjacent property, dispersing flows as a level spreader generally in accordance with the detail shown in Appendix C - Engineering Concept Drawings. This will ensure flows are not concentrated at the point of discharge.

The infiltration to groundwater has conservatively not been modelled for peak flow calculations, despite it being expected to further reduce the flows exiting the site. The infiltration rate is expected to be in the region of $5.0x10^{-3}$ m/s, as provided by Regional Geotechnical Services (RGS) Report RGS02673.1-AB.

See mitigated scenario DRAINS model configuration in Figure 5-2.

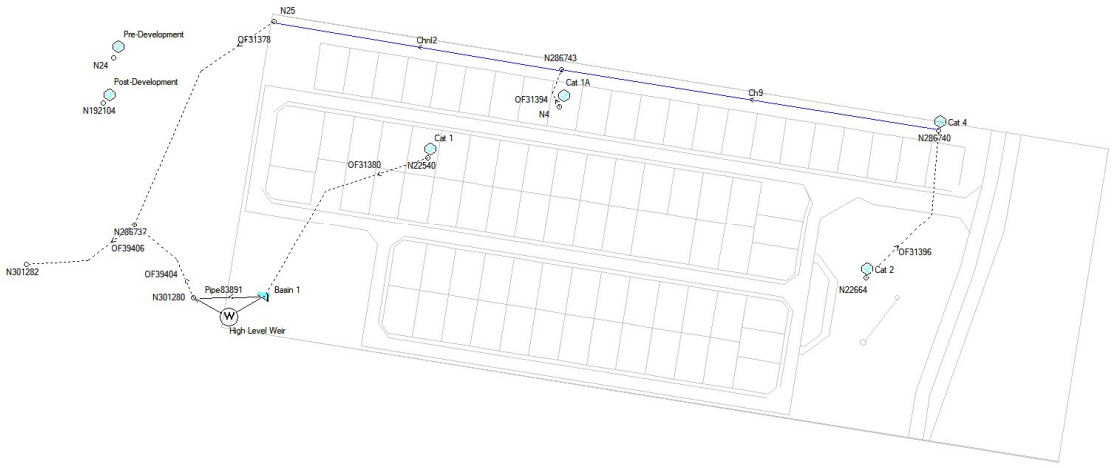


*Figure 5-2 DRAINS Model (Mitigated Developed Scenario)*

The results seen in Table 5-2 above are from the DRAINS model which summarizes the peak discharge rates for each identified critical storm across the assessed Annual Exceedance Probability (AEP) range at the assessment point for the catchments, in a mitigated scenario.

The results show the proposed development can be satisfactorily attenuated to meet non-worsening criteria.

## 5.7 Detention Basin Details

The properties of the detention basin are summarized in Table 5-3.

*Table 5-3 Stormwater Detention Basin Details*

| Basin No. | Base Area ($m^2$) | Nom. Total Depth (m) | Nom. Storage Volume ($m^3$) | Discharge Pipe Configuration | Overflow Weir Details |
|---|---|---|---|---|---|
| West | 614 (Base RL.1.0) | Max. Depth 1.44m (Modelled TWL = RL2.44) | 1418 (to Weir at RL2.30) | 4 x 150dia uPVC's Discharging into Level Spreader | Weir level 10m wide at RL 2.30m |

The hydraulic investigation and runoff-routing exercise has demonstrated that the proposed development increases stormwater discharge off site. The incorporation of an end-of-line detention basin in the mitigated scenario demonstrates that flows can be controlled and managed to ensure non-worsening of the proposed development.

By utilising multiple piped outlets into an adjacent level spreader, stormwater will be discharged as broad sheet flows, replicating the predeveloped scenario. The level spreader will assist in the energy dissipation and scour protection of these flows prior to reaching the downstream property. The final configuration will be developed during the detailed design phase.

The top water level (TWL) achieved in the Western Basin within the 1% AEP event is RL.2.44. As mentioned previously, the minimum proposed road level within the development in RL2.7, with all habitable spaces to be a minimum RL3.2.

Refer to Appendix A for the Stormwater Treatment Measures Plan.

It should be noted that the proposed Eastern Bioretention Basin was not modelled for detention purposes. Due to its relatively small size is expected to only provide very minor peak flow attenuation.

Note that further optimization of the detention basin during the detailed design phase is proposed to best utilize the allowable discharge for each design event. This may result in a minor modification to the proposed outlet structure; however, the intent of the basin will not be changed.

# 6.0 STORMWATER QUALITY MANAGEMENT

## 6.1 MUSIC Modelling

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been utilised as the key water quality modelling tool for this project. MUSIC is a continuous simulation water quality model used to evaluate the short and long-term performance of stormwater improvement devices that are configured in series or in parallel to form a 'treatment train'.

MUSIC consists of control measures at source and end-of-line measures to manage the discharge of nutrients and pollutants leaving the site to be reduced to meet the objectives outlined in future sections. The MUSIC modelling considers suspended solids, total nitrogen and total phosphorus, which are typical components and key pollutants within stormwater runoff.

To undertake the water quality assessment, a MUSIC model was established for the subject site in order to compare pollutant loading reductions with and without water quality treatment measures.

## 6.2 Water Quality Objectives

To prevent degradation of MidCoast waterways, ecologically sustainable development principles have been embraced and regulated by MidCoast Council.

*Guidelines for Water Sensitive Design Strategies - Mid-Coast Council October 2019* includes following general objectives of Water Sensitive Design (WSUD) are to:

- To safeguard the environment by maintaining or improving the quality of stormwater run-off.
- To protect and restore aquatic, estuarine, or riparian ecosystems and bushland areas.
- To harvest rainwater and urban stormwater runoff for use where appropriate.
- To control the hydrological impacts of development on receiving surface and
- ground water systems by controlling the frequency, magnitude, and duration of flows to preserve, as far as practicable, pre-development groundwater and surface water regimes and interactions.
- To control the impacts of development on channel bed and bank erosion by controlling the magnitude, nature, and duration of sediment-transporting flows.
- To promote disconnection of impervious areas to the drainage system by introducing appropriate measures to minimise the rate, frequency, and volume of urban runoff events to improve WSD performance.

MidCoast Council DCP states that all developments must provide measures to address treatment of pollutants as shown in Table 6-1. For the purpose of this assessment of the stormwater system for the 40-80 Chapman's Road development, it was assumed treatment in the form of two end of line bioretention basins will be adopted.

It is to be noted the end of line basins may require a coarse sediment forebay to prevent coarse sediment entering the bioretention zone. The basin has sufficient surplus floor area to accommodate sediment control zones. The final design of the sediment forebay will be confirmed in the detailed design as it is subject to final pipe velocities from the proposed stormwater network.

Stormwater quality for the proposed development has been analysed using MUSIC software and is based on the following specified water quality objectives as provided by MidCoast Council.

*Table 6-1 MidCoast Council Water Quality Targets*

| Pollutant | Reduction percentage |
|---|---|
| Total Suspended Solids (TSS) | NorBE |
| Total Phosphorus (TP) | NorBE |
| Total Nitrogen (TN) | NorBE |
| Gross Pollutants (GP) | 90% |

## 6.3 Rainfall and Evapotranspiration Data

Rainfall and evapotranspiration data was provided from MidCoast Council. A 9-year consecutive period of data was recorded which included both wet and dry years with an average annual rainfall over the period being close to the historic average. The rainfall template to be adopted exhibits an average annual rainfall of 1234mm.

A 6-minute rainfall time step was considered necessary to accurately model the performance of rainwater tanks and biofiltration devices.

Areal potential evapotranspiration values have also been provided in the template to be adopted within the LGA.

## 6.4 MUSIC Modelling Parameters

The model was calibrated in accordance with the *Guidelines for Water Sensitive Design Strategies - Mid-Coast Council October 2019* for a Soil Hydrologic Group 'D', which broadly corresponds to a Sand soil.

All input parameters to the MUSIC model were derived from the NSW MUSIC Modelling Guidelines (2015).

*Table 6-2 MUSIC Rainfall Runoff Parameters*

| Rainfall Runoff Parameter | Value |
|---|---|
| **Impervious** | |
| Rainfall Threshold | 1mm (Roads & Impervious Areas = 1.5mm) |
| **Pervious** | |
| Soil Storage Capacity | 155mm |
| Initial Storage | 25% |
| Field Capacity | 75mm |
| Infiltration Capacity Coefficient - A | 360.0 |

| | |
|---|---|
| Infiltration Capacity Coefficient - B | 0.50 |
| **Groundwater Properties** | |
| Initial Depth | 10mm |
| Daily Recharge Rate | 100% |
| Daily Baseflow Rate | 50% |
| Daily Deep Seepage Rate | 0% |

## 6.5 MUSIC Pollutant Concentrations

The pollutant concentrations adopted for modelling are shown below in Table 6-3. The event mean concentrations (EMC's) for each of these land uses were derived from *Fletcher et al (2004)* and *NSW MUSIC Modelling Guidelines (2015).*

*Table 6-3 MUSIC Pollutant Concentrations*

| Land use/ Surface Type | Storm Flow Concentration $Log_{10}$ mg/l | Standard Deviation $Log_{10}$ mg/l | Base Flow Concentration $Log_{10}$ mg/l | Standard Deviation $Log_{10}$ mg/l |
|---|---|---|---|---|
| **Roofs** | | | | |
| Suspended Solids | 1.30 | 0.32 | - | - |
| Total Phosphorous | -0.89 | 0.25 | - | - |
| Total Nitrogen | 0.30 | 0.19 | - | - |
| **Urban Residential** | | | | |
| Suspended Solids | 2.15 | 0.32 | 1.20 | 0.17 |
| Total Phosphorous | -0.60 | 0.25 | -0.85 | 0.19 |
| Total Nitrogen | 0.30 | 0.19 | 0.11 | 0.12 |
| **Sealed Roads** | | | | |
| Suspended Solids | 2.43 | 0.32 | 1.20 | 0.17 |
| Total Phosphorous | -0.30 | 0.25 | -0.85 | 0.19 |
| Total Nitrogen | 0.34 | 0.19 | 0.11 | 0.12 |
| **Rural** | | | | |
| Suspended Solids | 1.95 | 0.32 | 1.15 | 0.17 |
| Total Phosphorous | -0.66 | 0.25 | -1.22 | 0.19 |
| Total Nitrogen | 0.30 | 0.19 | -0.05 | 0.12 |
| **Forest** | | | | |
| Suspended Solids | 1.60 | 0.20 | 0.78 | 0.13 |
| Total Phosphorous | -1.10 | 0.22 | -1.22 | 0.13 |
| Total Nitrogen | -0.05 | 0.24 | -0.52 | 0.13 |

| | | | | |
|---|---|---|---|---|
| **Unsealed Roads** | | | | |
| Suspended Solids | 3.00 | 0.32 | 1.20 | 0.17 |
| Total Phosphorous | -0.30 | 0.25 | -0.85 | 0.19 |
| Total Nitrogen | 0.34 | 0.19 | 0.11 | 0.12 |

## 6.6 Contributing Catchments

The pre-developed scenario was modelled as a mixture of both rural and forested land-uses. Additionally, an existing unsealed site access and stockpiling area was modelled as 'unsealed road'. The trafficable and stockpiling areas were modelled as 50% and 0% imperviousness respectively.

For the purposes of post-developed MUSIC modelling, the proposed development was separated into Roofs, Pavement Areas and other adjacent hardstand and pervious curtilage.

It was assumed that a residential lot (approximately 310m$^2$ average) would exhibit a developed fraction impervious of 70%, consisting of 180m² roof area, and 40m² impervious curtilage.

It should be noted that external catchments are proposed to divert the development footprint. Hence these catchments will not be assessed within the MUSIC modelling.

A contributing catchment breakdown for the MUSIC modelling is shown below for the pre-developed scenario in Table 6-4, and the post-developed scenario in Table 6-5.

*Table 6-4 Pre-developed MUSIC Contributing Catchments*

| Subcatchment | Area (ha) | % Imperviousness |
|---|---|---|
| Existing Shed Roofs | 0.020 | 100% |
| Unsealed Accessway | 0.602 | 50% |
| Rural (inc. Stockpiling Areas) | 4.196 | 0% |
| Forested | 1.253 | 0% |
| **Σ** | **6.071** | |

*Table 6-5 Post-developed MUSIC Contributing Catchments*

| Subcatchment | Area (ha) | % Imperviousness |
|---|---|---|
| **To Bioretention West** | | |
| Roofs (82) | 1.476 | 100% |
| Lot Impervious | 0.264 | 100% |
| Lot Pervious | 0.612 | 0% |
| Sealed Roads | 0.566 | 100% |
| Driveways within Verge | 0.049 | 100% |
| General Pervious | 0.584 | 0% |
| Managers Building | 0.023 | 100% |

| | | |
|---|---|---|
| Managers Building Hardstand | 0.015 | 100% |
| **To Bioretention East** | | |
| Roofs (6) | 0.108 | 100% |
| Sealed Roads | 0.227 | 100% |
| General Pervious | 0.505 | 0% |
| Community Building Roof | 0.120 | 100% |
| Community Building Impervious | 0.062 | 100% |
| **To Northern Swale** | | |
| Lot Impervious | 0.088 | 100% |
| Lot Pervious | 0.243 | 0% |
| Sealed Roads | 0.044 | 100% |
| Vegetated Setback to Chapmans Road | 0.270 | 0% |
| **Bypassing Treatment** | | |
| Development Batter to Natural | 0.091 | 0% |
| Undisturbed Forest | 0.724 | 0% |
| **Σ** | **6.071** | |

It should be noted that roof drainage from lots 1 – 6 will be directed back to the internal drainage network and treated within the eastern bioretention basin. Similarly roof drainage from lots 7 -22 will be treated internally by the western bioretention basin. Surface flows from these lots will be captured and treated by the roadside table drain adjacent to Chapmans Road.

## 6.7 Proposed Stormwater Treatment Devices

For the purpose of this water quality assessment, it is proposed to incorporate at source control measures and two end-of-line Bioretention Basins in order to control pollutant loadings from the site.

Roofwater will be captured by a 1kL Rainwater Tank for the purpose of indoor and outdoor re-use. Any overtopping of this captured roofwater will discharge to the underground stormwater system, and directed to the respective end-of-line bioretention basin. Flows generated from the Eastern Catchments will then be directed West via the aforementioned table drain running adjacent to Chapmans Road.

### 6.7.1 Bioretention System

Water Quality Bioretention Basins are shallow, extensively vegetated water bodies that use enhanced sedimentation, fine filtration and pollutant uptake processes to remove pollutants from stormwater. These processes are engaged by slowly passing runoff through vegetated areas. Plants filter sediments and pollutants from the water, while bio-films that grow on the plants can absorb nutrients and other associated contaminants.

A typical section is also presented in Figure 6-1 showing a typical Bioretention Basin within an urban setting.

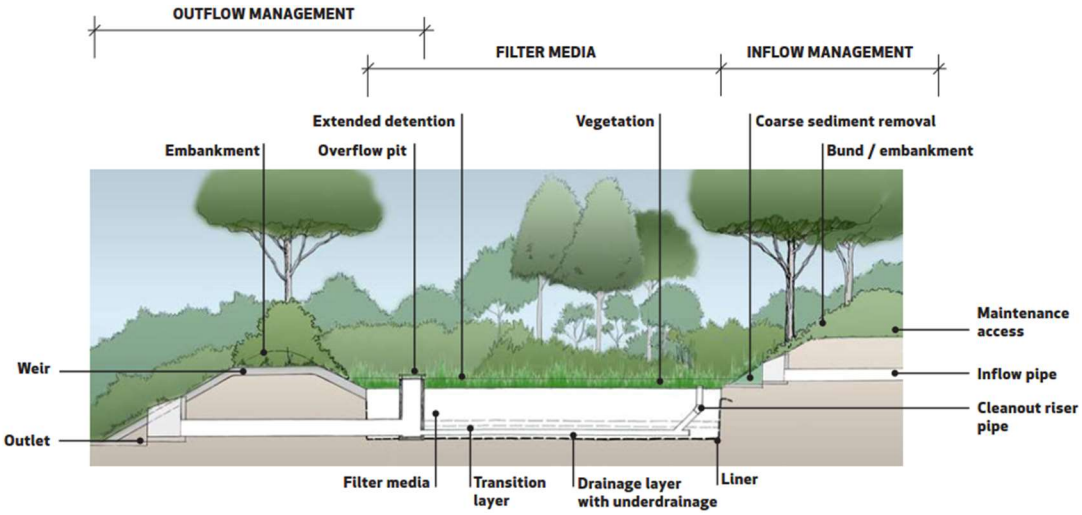


*Figure 6-1 Example of Urban Bioretention Basin*

A preliminary stormwater layout plan showing indicative treatment location has been included in the Stormwater Treatment Measures Plan included in Appendix A. This layout assumes a conventional piped drainage network within the urban footprint areas, discharging into the bioretention/detention basins. It is noted temporary treatment measures will likely be required to facilitate the staging of the development.

Sizing was performed for the overall treatment of the site and a MUSIC model was constructed to verify the treatment objectives.

Parameters used for the bioretention basin modelling have been summarised in Table 6-6 below:

*Table 6-6 Summary of Proposed Bioretention Basin Properties*

| Parameter | Bioretention West | Bioretention East |
|---|---|---|
| Minimum Filter Area (m²) | 550 | 160 |
| Extended Detention Depth (m) | 0.4 | 0.4 |
| Minimum Filter Media Depth (m) | 0.4 | 0.4 |
| Saturated Hydraulic Conductivity (mm/hour) | 140* | 140* |
| TN Content of Filter Media (mg/kg) | 400 | 400 |
| Orthophosphate Content of Filter Media (mg/kg) | 40 | 40 |

** Whilst Guidelines for Water Sensitive Design Strategies - Mid-Coast Council October 2019 suggest the use of 100mm/hr as the saturated hydraulic conductivity of the filter media, the guidelines also infer that the biofilter shall be modelled with a saturated hydraulic conductivity equivalent to 50% of the design saturated hydraulic conductivity to allow for potential blockage over the lifecycle of the measure. Therefore, provisions will be implemented within the detailed design phase to ensure filter media with a saturated hydraulic conductivity of 280mm/hr be placed, to be confirmed by geotechnical testing.*

### 6.7.2 Rainwater Tanks

On a typical residential lot, roofwater will be captured by a minimum 1kL Rainwater Tank (100% of roof area, for the purpose of indoor (plumbed to toilets and cold water laundry) and outdoor re-use. Any overtopping of this captured roofwater will discharge to the underground stormwater system.

These tanks will require a council approved first flush stormwater filter device, prior to water entering the unit. The rainwater tank is to have re-use capabilities in accordance with BASIX requirements. All taps connected to the rainwater tanks are to be identified as *'Rainwater'* with a sign complying with AS1319.

Re-use of the collected stormwater runoff is to be used for non-potable indoor and outdoor purposes only including toilet flushing and cold water laundry, and outdoor garden irrigation.

For MUSIC modelling, the following parameters were used:

- 1kL tank per dwelling for re-use capturing all roof area (100% capture)
- Constant Internal Re-use of 87L/day/dwelling (based on *NSW MUSIC Modelling Guidelines, 2015)* with 1.5 persons/dwelling and re-use for toilet and laundry
- Seasonal Outdoor Re-use of 49L/day/dwelling conservatively based on **half** of the typical external usage per *Guidelines for Water Sensitive Design Strategies - Mid-Coast Council October 2019*
- The conservative PET – Rain option was chosen for re-use modelling (i.e. outdoor re-use demand is zero when the rainfall exceeds the PET).

## 6.8 MUSIC Modelling Results

The developed site has been modelled in accordance with a detailed sub-catchment regime to ensure the entire site meets pollutant reduction objectives. Refer to Figure 6-2 below for the modelled MUSIC layout.

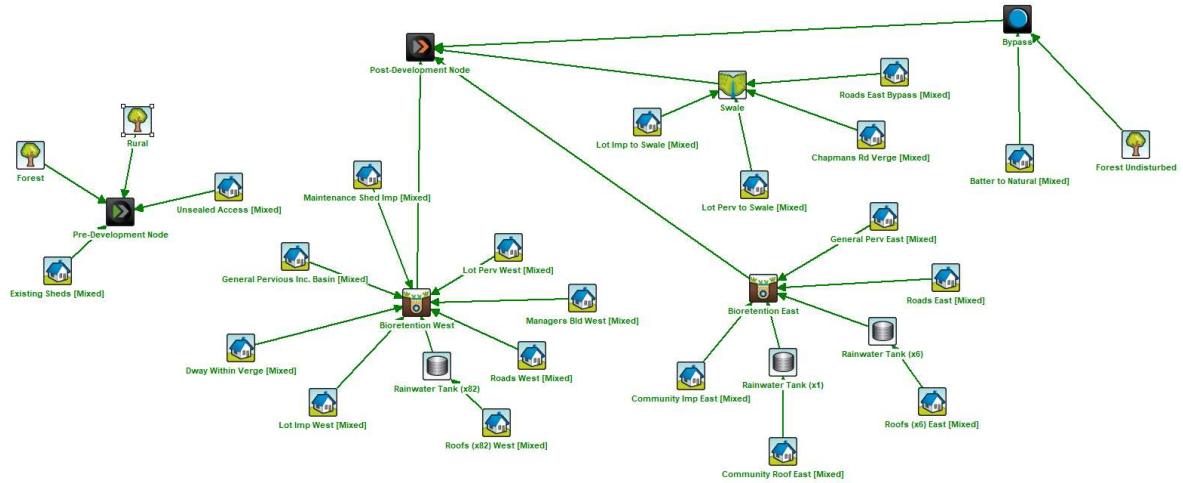


*Figure 6-2 MUSIC model layout*

Table 6-7 presents the average annual pollutant export loads at the downstream extent of the entire subject site as a percentage reduction of post developed conditions (with and without treatment).

*Table 6-7 Summary of Results V MCC Requirements*

| Pollutant | Proposed Development Catchment | | | |
|---|---|---|---|---|
| | **Existing Site Load (kg/yr)** | **Developed Site Load (Without Treatment) (kg/yr)** | **Developed Site Load (With Treatment) (kg/yr)** | **% Reduction** |
| Gross Pollutants | 123 | 858 | 0.5 | **99.9** |
| TSS | 5320 | 5190 | 362 | **93.0** |
| TP | 4.60 | 12.2 | 3.44 | **71.8** |
| TN | 34.7 | 94.8 | 34.6 | **63.5** |

The results in Table 6-7 indicate that the proposed treatment measures would meet or exceed the water quality objectives for the site, which were:

- Gross Pollutants are to be reduced to 90%, TSS, TN and TP are to be Neutral or Beneficial Effect (NorBE) from the pre-developed scenario.

Details of the location and preliminary design of the proposed bioretention basin are presented in the Stormwater Treatment Measures Plan in Appendix A of this report.

# 7.0 CONCLUSION

This Stormwater Management Plan (SWMP) has been prepared to provide a design proposal and guide to the stormwater quantity and quality management techniques for the site.

The two primary objectives of this SWMP have been to ensure that:

- Suitable measures are incorporated in the development to ensure that there are no adverse impacts to downstream receiving waterways, property or infrastructure resulting from any increase to peak discharging stormwater flow rates.

- Details of a proposed stormwater quality treatment train are provided to ensure discharge of stormwater from the site is of adequate quality standards to comply with the requirements of MidCoast Council.

The analysis presented in this report shows that the development overall will increase flows from the undeveloped state. However, this increase will be managed by diverting overland runoff into a specifically designed stormwater detention / infiltration basin. The proposed measures will ensure no adverse impacts to downstream receiving waterways, properties or infrastructure is achieved.

The site will maintain its existing site discharge via infiltration (primarily) and overland flow to the adjacent property via a level spreader device to prevent scour and erosion.

A stormwater quality assessment is provided which demonstrates that a specially tailored treatment system will be required to meet the pollutant removal targets of MidCoast Council during the operational phase of the proposed development. The proposed treatment system comprises of two end-of-line bioretention basins.

Based on the proposed Stormwater Assessment presented in this report the proposed Stormwater system for 40-80 Chapmans Road, Tuncurry will treat the stormwater generated onsite to a sufficient level that is compliant with MidCoast Council's Water Quality and Quantity objectives.

# Appendix A – Stormwater Treatment Measures Plan

100mm AT ORIGINAL SIZE

## LEGEND

- PROPERTY BOUNDARY
- MANUFACTURED HOME SITES
- INTERNAL ACCESS ROADS (minimum 10m wide)
- CARPARK SPACES
- PROPOSED GREEN AREA
- EXISTING LAND ZONING LINE
- STORMWATER BASIN
- PATHWAYS

CHAPMANS ROAD

ROOF FLOWS FROM LOTS 1 - 22 TO BE DIRECTED TO INTERNAL STORMWATER NETWORK. ALL SURFACE FLOWS TO DRAIN TO ADJACENT ROADSIDE TABLE DRAIN

CONSTRUCT GRASSED ROADSIDE TABLE DRAIN GRADED AT 0.30% CONVEYING FLOWS WEST

BIORETENTION BASIN EAST TO DISCHARGE TO ROADSIDE TABLE DRAIN

Lot 11 DP615229

CONSTRUCT ALL-WEATHER MAINTENANCE ACCESS TO BASIN

BASIN SYSTEM TO BE FENCED

BIORETENTION BASIN WEST

DETENTION BASIN WEST

BASIN EAST

BIORETENTION BASIN EAST. MINIMUM FILTER 160m² FILTER MEDIA

FUTURE COLLECTOR ROAD

PATHWAY

DISCHARGE BASIN OULET INTO PERIMETER (APPROXIMATELY 100m) LEVEL SPREADER WHOLLY WITHIN DEVELOPMENT LOT. REFER TO SHEET 2003 FOR FURTHER DETAILS

BASIN WEST - MINIMUM STORAGE VOLUME = 1418m³. BIORETENTION COMPONENT TO BE A MINIMUM 550m² FILTER MEDIA.
BASE RL. = 1.00
WEIR RL. = 2.30
REFER TO SHEET 2003 FOR FURTHER DETAILS

Lot 11 DP615229

| REV | DESCRIPTION | DATE | DRAWN | SURVEY | CHECK | APPROVED |
|---|---|---|---|---|---|---|
| A | DA LODGEMENT | 23.02.22 | RKS | RS | MS | MS |
| B | DA LODGEMENT | 31.08.22 | RS | | SB | MS |
| C | COUNCIL COMMENT AMENDMENTS | 14.10.22 | SH | | SH | MS |
| D | DA LODGEMENT WITH AMENDMENTS | 07.07.23 | SH | | SH | MS |
| | | | | | | |
| | | | | | | |
| | | | | | | |

SCALES: 0 5 10 20 30
Full Size 1:500 ; Half Size 1:1000
Scale (m)

DO NOT SCALE FROM DRAWING



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NOTE:
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**PRELIMINARY ISSUE**
**NOT FOR CONSTRUCTION**

PROJECT:
40-80 CHAPMANS ROAD, TUNCURRY

DRAWING TITLE:
MANUFACTURED HOUSING ESTATE
LOT 100 DP1286524
STORMWATER TREATMENT MEASURES PLAN

| ORIGINAL SIZE: | LAND DYNAMICS JOB No.: | DRAWING No.: | REV: |
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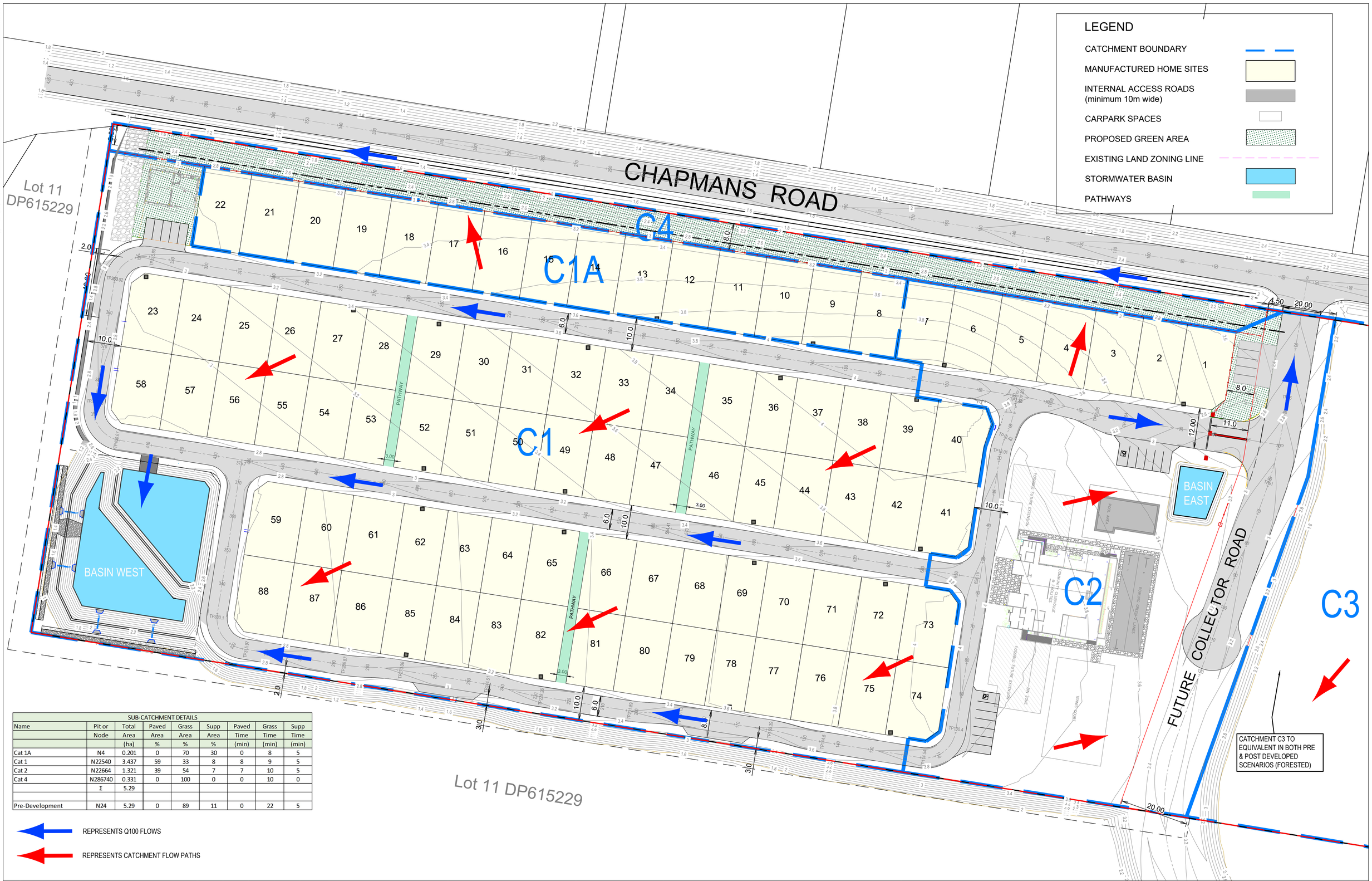
CAD FILE: W:\5445 - CHAPMANS ROAD TUNCURRY\8. ENGINEERING (WIP)\1. CIVIL DESIGN\2. DA & S96\20230706 DA RELODGEMENT\5445_MHE_DRAFTING SET\5445_MHE_DRAFTING SET.DWG PLOTTED BY: WINDOWS PC PLOT DATE: 10/07/2023 2:44:41 PM

# Appendix B – Post-developed Catchment Plan




| SUB-CATCHMENT DETAILS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Name | Pit or Node | Total Area (ha) | Paved Area % | Grass Area % | Supp Area % | Paved Time (min) | Grass Time (min) | Supp Time (min) |
| Cat 1A | N4 | 0.201 | 0 | 70 | 30 | 0 | 8 | 5 |
| Cat 1 | N22540 | 3.437 | 59 | 33 | 8 | 8 | 9 | 5 |
| Cat 2 | N22664 | 1.321 | 39 | 54 | 7 | 7 | 10 | 5 |
| Cat 4 | N286740 | 0.331 | 0 | 100 | 0 | 0 | 10 | 0 |
| | Σ | 5.29 | | | | | | |
| | | | | | | | | |
| Pre-Development | N24 | 5.29 | 0 | 89 | 11 | 0 | 22 | 5 |

REPRESENTS Q100 FLOWS

REPRESENTS CATCHMENT FLOW PATHS

| REV | DESCRIPTION | DATE | DRAWN | SURVEY | CHECK | APPROVED |
|---|---|---|---|---|---|---|
| A | DA LODGEMENT | 23.02.22 | RKS | RS | MS | MS |
| B | DA LODGEMENT | 31.08.22 | RS | | SB | MS |
| C | COUNCIL COMMENT AMENDMENTS | 14.10.22 | SH | | SH | MS |
| D | DA LODGEMENT WITH AMENDMENTS | 07.07.23 | SH | | SH | MS |

SCALES: 0 5 10 20 30
Full Size 1:500 ; Half Size 1:1000
Scale (m)

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**PRELIMINARY ISSUE**
**NOT FOR CONSTRUCTION**

PROJECT:
40-80 CHAPMANS ROAD, TUNCURRY

DRAWING TITLE:
MANUFACTURED HOUSING ESTATE
LOT 100 DP1286524
POSTDEVELOPED CATCHMENT PLAN

| ORIGINAL SIZE: | LAND DYNAMICS JOB No.: | DRAWING No.: | REV: |
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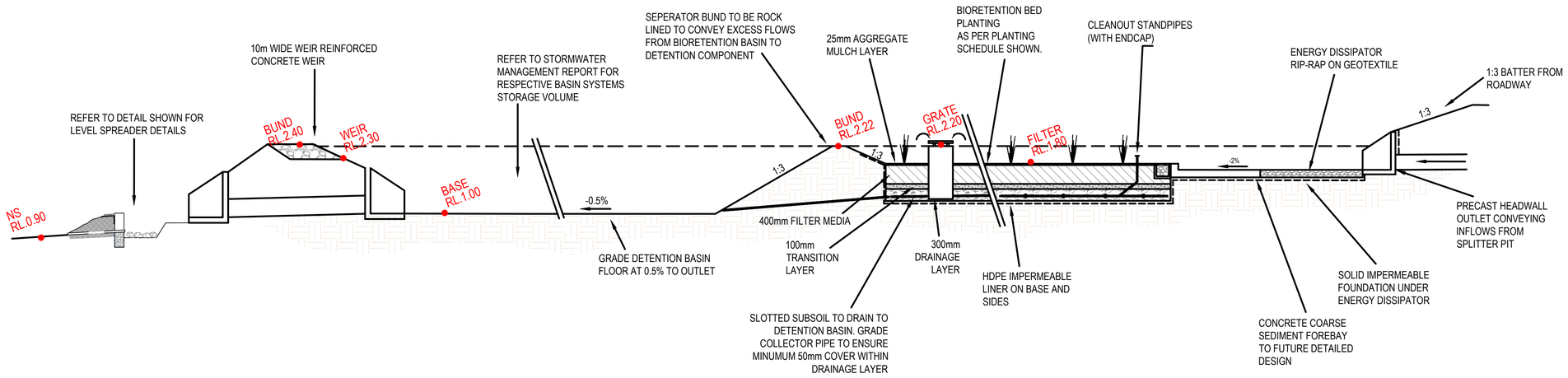
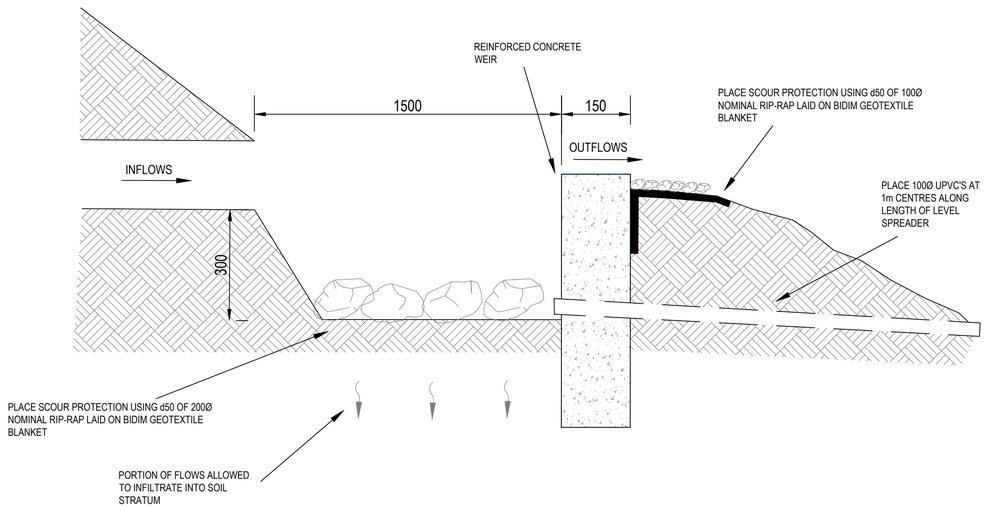
CAD FILE: W:\5445 - CHAPMANS ROAD TUNCURRY\8. ENGINEERING (WIP)\1. CIVIL DESIGN\2. DA & S96\20230706 DA RELODGEMENT\5445_MHE_DRAFTING SET\5445_MHE_DRAFTING SET.DWG PLOTTED BY: WINDOWS PC PLOT DATE: 10/07/2023 2:44:43 PM

# Appendix C – Engineering Concept Typicals



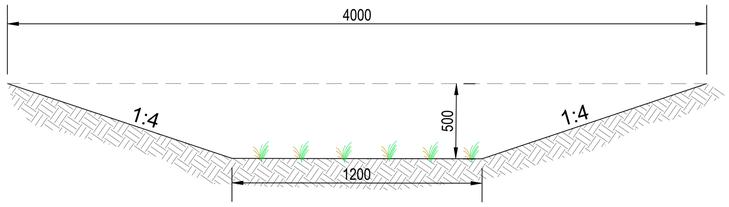

## TYPICAL BASIN SYSTEM DETAIL

NOT TO SCALE




## TYPICAL LEVEL SPREADER DETAIL - SK1

NOT TO SCALE




## TYPICAL GRASSED SWALE - SK2

NOT TO SCALE

| REV | DESCRIPTION | DATE | DRAWN | SURVEY | CHECK | APPROVED |
|---|---|---|---|---|---|---|
| A | DA LODGEMENT | 23.02.22 | RKS | RS | MS | MS |
| B | DA LODGEMENT | 31.08.22 | RS | | SB | MS |
| C | COUNCIL COMMENT AMENDMENTS | 14.10.22 | SH | | SH | MS |
| D | DA LODGEMENT WITH AMENDMENTS | 07.07.23 | SH | | SH | MS |
| | | | | | | |
| | | | | | | |
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SCALES: NOT TO SCALE

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PROJECT: 40-80 CHAPMANS ROAD, TUNCURRY

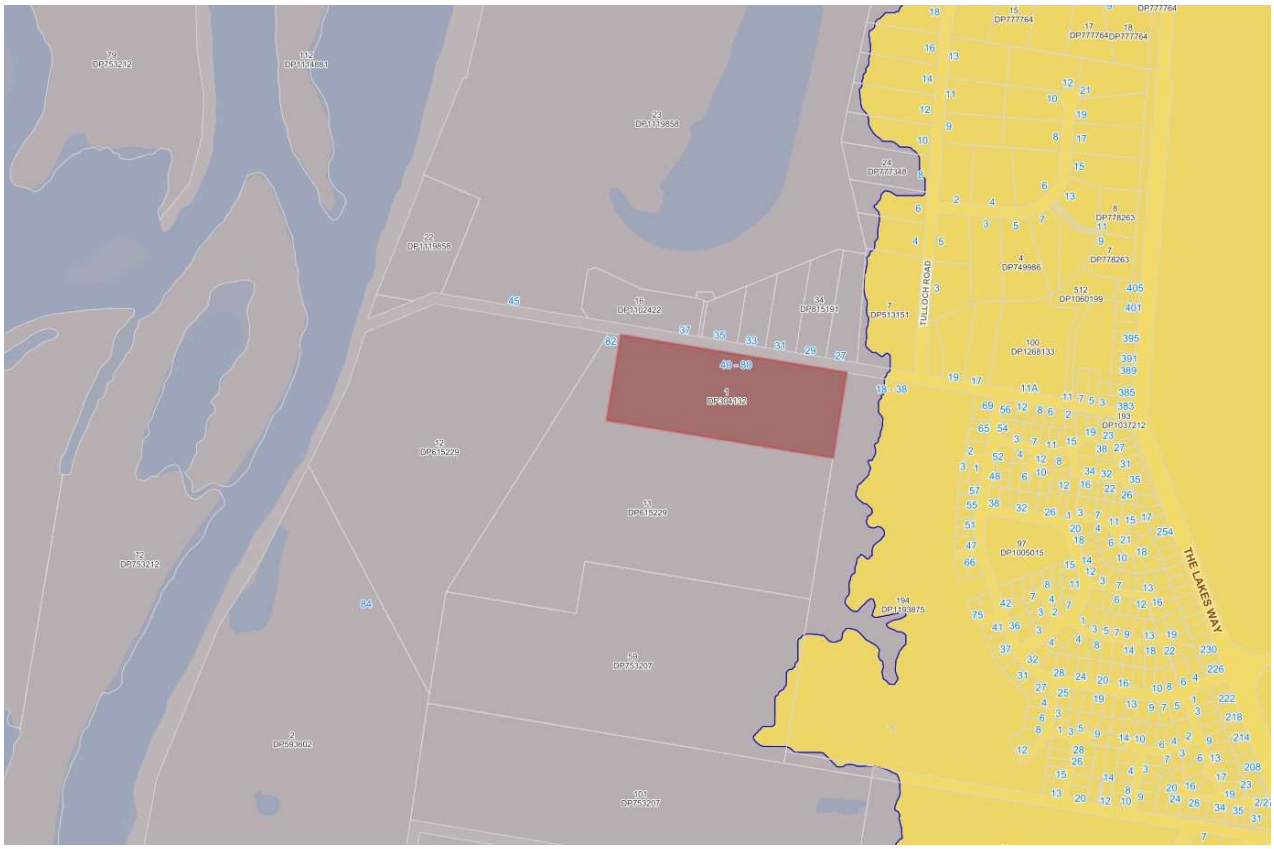
DRAWING TITLE:
MANUFACTURED HOUSING ESTATE
LOT 100 DP1286524
TYPICAL STORMWATER DETAILS

| ORIGINAL SIZE: | LAND DYNAMICS JOB No.: | DRAWING No.: | REV: |
|---|---|---|---|
| A1 | 5445 | 2003 | D |

CAD FILE: W:\5445 - CHAPMANS ROAD TUNCURRY\8. ENGINEERING (WIP)\1. CIVIL DESIGN\2. DA & S96\20230706 DA RELODGEMENT\5445_MHE_DRAFTING SET\5445_MHE_DRAFTING SET.DWG PLOTTED BY: WINDOWS PC PLOT DATE: 10/07/2023 2:44:44 PM

100mm AT ORIGINAL SIZE

# Appendix D – MidCoast Council Flood Map




**CADASTRE**

**LAND INFORMATION** 1 OF 1

| | |
|---|---|
| Parcel Identifier | 1//DP304132 |
| Land Area | 6.1 Ha |
| Land Zoning | C2 - Environmental Conservation, R2 - Low Density Residential |
| Min Lot Size | 40.0ha, 450.0m² |
| FSR | 0.4 :1, 0.5 :1 |
| Max Building Height | 8.5m |
| Acid Sulfate Soil Class | Class 2, Class 3 |
| Flood prone land | Yes, flood controls apply |
| Bushfire prone land | Is bushfire prone |

**PROPERTY DETAILS** 1 OF 1

| | |
|---|---|
| Property Address | 40-80 Chapmans Road TUNCURRY NSW 2428 |
| StreetView | Click here |