

SHOALHAVEN CITY COUNCIL
Environmental Planning & Assessment Act, 1979

DEVELOPMENT CONSENT NO: SF10851 Dated: 19/06/2023

These are the plans referred to in the above Development Consent

Note: Approval of the works shown on this plan is subject to compliance with the conditions of the Development Consent.

Integrated Water Cycle Management Strategy

Proposed six (6) Lot subdivision

Prepared for
Southern Cross Housing

Site address
Lot 1 DP 520502
Lot 129 DP 3060
Lot 110 DP131219

25 Moss Vale Road, Bomaderry, NSW 2541

Date
1st August 2022

allen price & scarratts pty ltd
land and development consultants

Surveying



Town Planning



Civil Engineering



Project Management





allen price & scarratts pty ltd
land and development consultants

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Contents

1.0 Introduction	3
2.0 Site & Locality	4
2.1 Proposed Development	4
3.0 Water Quality Modelling	5
3.1 Data Inputs / Methodology	5
3.1.1 Rainfall Data	5
3.1.2 Source Nodes	5
3.1.3 Rainwater Tanks	6
3.1.4 Gross Pollutant Trap Nodes	7
3.1.5 Bioretention Basin	7
3.1.6 Bio Basin Vegetation	8
3.1.7 Treatment Train	9
3.2 Water Quality Results	10
4.0 Stormwater Quantity Modelling	10
4.1 Site Model	11
4.1.1 Model Hydrology	11
4.1.2 Catchment Details	11
4.1.3 Pit Blockage and Loss Coefficients	12
4.1.4 Tailwater Levels	12
4.1.5 Regional OSD Details	13
4.1.6 Results	13
4.1.7 Climate Change	13
5.0 DCP2014 Compliance Tables	15
6.0 Conclusion	24

Appendix A – APS Engineering Plans ref N27790-401 to 406

Appendix B – ROCLA CDS Product Details

Table of Revisions

Rev	Date	Details
0	June 2020	ISSUED FOR DEVELOPMENT APPLICATION
1	July 2022	AMENDED FOR REVISED WATER QUALITY AREA
2	August 2022	AMENDED FOR REVISED WATER QUALITY AREA

1.0 Introduction

Our clients seek development approval for six (6) lot Torrens Title Subdivision from Lot 1 DP 520502, Lot 129 DP 3060 and Lot 110 DP 131219 (25 Moss Vale Road), Bomaderry.

Allen Price and Scarratts (APS) has been engaged by Southern Cross Housing to detail design suitable detention and water quality measures for the development. These are to be consistent with the parameters in Shoalhaven City Councils DCP's or other acceptable standard or guidelines, for the purpose of gaining a Development Approval.

With reference to Table 5 in section 6.1 of Chapter G2 of DCP2014; as the proposal is subdivision of land greater than 3,500m², footprint greater than 2,500m² and increases the impervious area by more than 1,000m² for a commercial/residential development it is therefore determined that this is large scale development.

The development is not within the Sydney Water drinking supply catchment area. Discharge is to an existing open drainage system, which is considered a riparian corridor. A Controlled Activity approval will be required for any works required within the riparian corridor, including re-vegetation of the riparian lands.

This report references the following Shoalhaven City Council's (SCC) standards and technical advice:

- D5 Engineering Standards document and DCP2014 for storm events from the 10% AEP to 1% AEP for stormwater quantities,
- G2 of DCP2014
- Supporting document *Sustainable Stormwater Technical Guidelines*.

Under SCC DCP2014 Chapter G2; Section 5.2.4; Performance Criteria P10 table 3, the following are the pollutant load reductions:

Pollutant	post developed average Annual load reduction
Total suspended solids	80%
Total Phosphorus	45%
Total Nitrogen	45%
Gross Pollutants as per the table 3 in G2	

In compliance with Shoalhaven City Councils DCP100 the proposal's objective is to ensure:

“existing downstream environments are not adversely affected and no net increase in pollution levels discharging from the development”

The method considered acceptable for demonstrating that the objective has been met is that the treatment train effectiveness is able to achieve the DCP2014 for pollutant reduction as summarised above

2.0 Site & Locality

The subject land (site) is Lot 1 DP 520502, Lot 129 DP 3060 and Lot 110 DP 131219 (25 Moss Vale Road), Bomaderry which is approximately 8.6 hectares in area. The site is currently occupied by "Nowra Saleyards".

The site has a single site frontage to Moss Vale Road to the north. The site has existing vehicular access from Moss Vale Road via a two-way driveway to Nowra Saleyards provided opposite Elvin Drive.

The site is currently zoned B4 – Mixed Use under the SLEP 2014.

The site is generally surrounded by low-density residential development to the north, agricultural land to the west, environmental sensitive land to the south and public recreation land to the east.

The site is an extension of the existing Bomaderry urban area westward towards the future residential growth areas that are located both north and south of Moss Vale Road. These future residential areas take advantage of developable land which is not flood affected or impacted by future Princes Highway bypass land.

The site is largely vacant and has been used for grazing. The site has a relatively gentle slope towards the west and the adjacent Bomaderry Creek and is serviced by adjacent reticulated water and sewer lines.

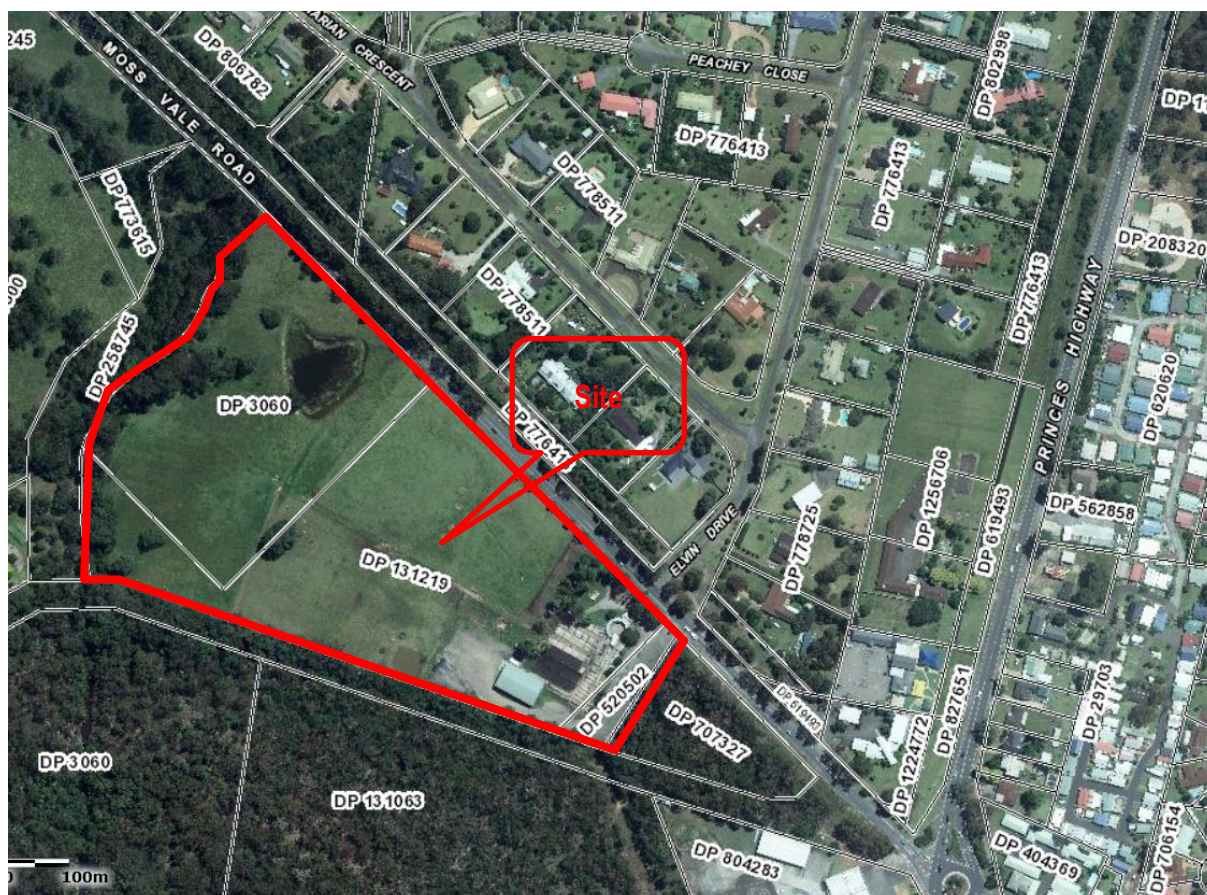


Figure One – Locality Plan, Source: SixMaps.

2.1 Proposed Development

The proposed development is to create a six (6) lot Torrens Title Subdivision from Lot 1 DP 520502, Lot 129 DP 3060 and Lot 110 DP 131219 2 DP 1093337 (as shown in supporting plans)

The proposal involves the construction of roads, drainage (and associated water quality devices), sewer, water, electrical and telecommunications to service the proposed development. Additionally it is proposed that all existing buildings be demolished, and existing hardstand areas be removed and restored.

3.0 Water Quality Modelling

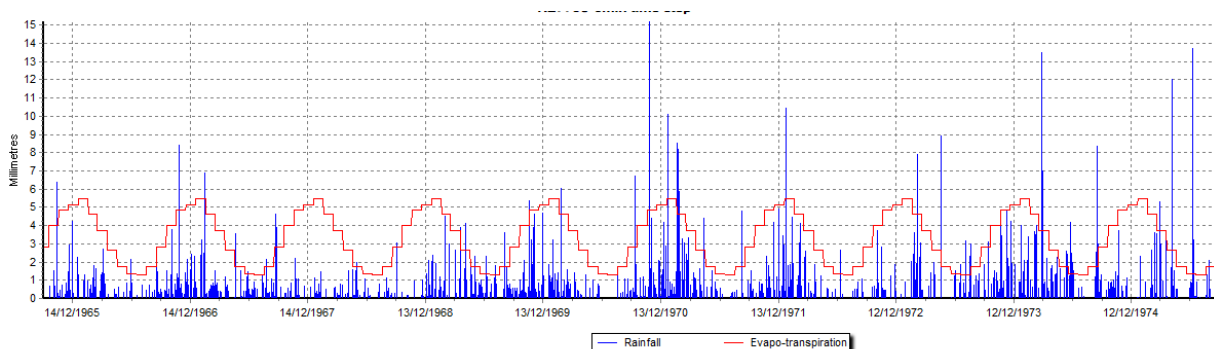
Water quality modelling has been undertaken using MUSIC version 6.3 by a qualified practicing engineer and qualified Environmental Scientist (Pollution Control) to confirm that the acceptable solutions for water quality objectives as outlined in the introduction are met by use of WSUD measures as detailed in the concept designs by Allen Price & Scarratts (not included in this report).

MUSIC modelling was used to predict the average annual pollutant loads for the post-development conditions using the sub-catchments for the proposed development. Area specific daily rainfall data for a time period over 10 years of continuous data and monthly average evapotranspiration was input into the model.

3.1 Data Inputs / Methodology

3.1.1 Rainfall Data

Rainfall data taken from the Royal Australian Navy (RAN) Air Station, HMAS Albatross (station number 68076), for the time period from 1965 to 1975 has been used for the basis of this model. This location has 100% data coverage at a 6min time step over time period of 10 years, providing stability and confidence to the resulting calculations. The monthly average evapo-transpiration data input was adopted from data available within the software from Port Kembla. It is deemed by the software creator that there is no significant change in evapotranspiration figures between Port Kembla and Nowra. See below for graph showing daily rainfall and evapo-transpiration data



3.1.2 Source Nodes

The source nodes have been broken into five main catchments all ultimately discharging to Bomaderry Creek. The system considers possible future development within the catchments for the purpose of confirming the total water quality measures for a fully developed site.

As the site is zone B4 (mixed use) the worst-case proportion of up to 90% impervious areas on the lots for commercial sites and 95% for public roads has been adopted in accordance with DCP2014. Excluded from these is the possible future road widening and the proposed Public Reserve as both of these are considered non-

development areas and will either be improved (with riparian plantings) or remain unchanged. See below the summary of lot catchments to achieve the 90% impervious fraction:

Table 1 – MUSIC Impervious fractions on lots

Node	roof (all 100% imp)	Remainder of lot			total site imp	Comment
	area	tot. area	% imp	area		
Lots 1, 2, 3, 4	18,000m ²	17,127m ² @	80%-	13,702m ²	31,702m ²	Min 31,614m ² required
Lot 5	3,000m ²	2,881m ² @	80%=	2,305m ²	5,305m ²	Min 5,293m ² required
Lot 6	3,900m ²	2,107m ² @	72%=	1,517m ²	5,417m ²	Min 5,406m ² required

All roof water from future buildings have been modelled as “Roof” urban areas and are to discharge to tanks (to be installed with future buildings), see stormwater quantity modelling for details of these future tanks. It is assumed that a minimum of the future impervious area of the site is able to drain to the proposed tanks, the remaining future pervious and impervious areas of each site have been modelled as “mixed” Urban areas and are to discharge to the proposed future at-source water quality areas. Detailed guide (including maintenance) to be developed and accepted by Shoalhaven City Council prior to the issue of the Subdivision Certificate and will generally follow the concept shown on the preliminary Engineering plans.

Roads and other related areas are modelled as “Sealed Road” urban areas and discharge to the proposed street stormwater system.

The majority of the site will drain via the proposed new pit and pipe system to the water quality measures proposed to be constructed with the road and drainage works. The existing pipe outlet from Moss Vale Road is proposed to be conveyed through the site and will discharge into the re-vegetated riparian area.

The defaults for the source nodes have been adopted.

3.1.3 Rainwater Tanks

As there is no known footprint for the development (i.e. number of units, informing number of tanks etc) an estimate must be made to determine a reasonably conservative tank volume available. A standard residential dwelling will typically have 3-5kL rainwater tanks for 200-300sqm of roof area. As mixed units tend to be denser and provide less reuse tanks a rate of 1kL per 500sqm of roof area is assumed.

In accordance with the NSW MUSIC Modelling Guidelines, high flow bypass for rainwater tanks is set as 5L/s per tank. This is extremely conservative as in reality there will be numerous rainwater tanks applied over each of these source nodes.

The individual “Rainwater Tank” treatment nodes are modelled as (roof area / 500)kL volume, with an initial assumption of 50% volume filled to be reflective of DCP2014 recommendations. It is noted that MUSICX calculates in 6-minute time steps, so once factoring in reuse the initial volume level has little impact on the end result. The outlet from rainwater tanks is a 90mm diameter orifice at the top of the tank.

To establish rainwater reuse we must reduce typical potable water demands to a fraction representative of greywater reuse. The Sydney Water ‘Average Daily Water Use - By property Development Type’ lists a single Torrens lot as having an average potable water demand of 623L/day based on the Water Supply Code of Australia. This is reduced to 44% based on the ‘NSW Guidelines for Greywater Reuse in sewered, single household residential premises’ March 2007. This results in a reuse demand of 100kL/dwelling/year. As use of toilets and washing machines will be basically uniform across the study period this is applied as a uniform daily reuse demand multiplied

by the number of tanks in each catchment (approx. 274L/day/Lot). As this is a mixed development, we again approximate this reuse as applying per 500sqm of roof area.

3.1.4 Gross Pollutant Trap Nodes

A Rocla CDS treatment node is adopted as the GPT for the site upstream of an additional sediment forebay. The sediment forebay is not modelled in music as its intended use is as a backup for if the GPT becomes overfull. It is intended that the forebay will include weepholes through the edge kerb to drain any ponded water within 24hours. Weephole orifice diameter/details to be provided at SWC stage once forebay geometry and inlet geometry is finalised. Balustrading mounted to the downstream edge of the sediment forebay may also be considered at SWC stage to further reduce the chance of trash re-suspension.

The concentration-based capture efficiencies of the Rocla CDS device are supplied by Rocla as:

- 98% Capture Efficiency for Gross Pollutants
- 70% Capture Efficiency for Total Suspended Solids (TSS)
- 30% Capture Efficiency for Total Phosphorus (TP)
- 0% Capture Efficiency for Total Nitrogen (TN)

along with high flow bypass rates. Specific models of CDS unit are selected to minimise bypass to achieve the required target pollutant removal.

Access for maintenance will be made from the road reserve and fire trail adjacent to the WQ measures. CDS unit proposed to be unobstructed for vacuum truck emptying. Open grassed area surrounding forebay also proposed as traversable for an excavator from the public road / fire trail. As the forebay is relatively small, it is also possible for this to be scraped by manual excavation utilising wheelbarrows or similar to convey any waste to an MRV parked on the fire trail.

3.1.5 Bioretention Basin

The Bioretention Basin (Bio-Basin) is modelled as a “Bioretention” treatment node. Running adjacent to the fire trail off the Road 1 cul-de-sac, this basin is approximately 31m in length and 15m width in the base at the widest point – however the main flow path maintains the approximate 3:1 desirable ratio. A Rocla CDS unit and additional forebay is provided upstream to remove the majority of gross pollutants and coarse sediment.

The basin extended detention depth is 300mm in accordance with Melbourne Water/FAWB guidelines. This depth is achieved using 1:4 batters compliant with SCC standard practice and typical road reserve batters. As this water body is ephemeral, the increased batter grades from Melbourne Water Guidelines recommendations area acceptable. Similarly, a filter depth of 500mm is also adopted per these guidelines. The filter media Saturated Hydraulic Conductivity (k_{sat}) is set to 100mm/h for compliance with DCP2014 Chapter G2. It is noted that Soilco has indicated an available 250mm/h k_{sat} mix – applying the 50% reduction recommended by NSW Music Modelling Guidelines and eWater software this would reduce the applicable k_{sat} to 125mm/h, as such the DCP guidelines are considered conservative.

This basin is designed as a ‘contained’ bioretention basin (per Melbourne Water Guidelines) including:

- A filter area of 460m²
- A total area of 666m²
- A filter depth of 500mm

- Filter media Saturated Hydraulic Conductivity is set at 100mm/h as discussed for the above.
- A 100mm transition layer.
- A 150mm drainage layer with 100mm slotted subsoil under-drains at 3m centres.

It is noted that a submerged zone was trialled (with corresponding increased transition layer depth) to improve nitrogen removal, however the phosphate leaching was found to be detrimental to the performance of the basin. As such no saturated zone is proposed. This also results in an overall shallower Bio-Basin enabling the drainage layer to discharge by gravity.

It is noted that flows into the Bio-Basin at the headwall inlet are at approx. 1.5m/s velocity in an ARI 1:100 event. This is higher than acceptable for a Bio-Basin and as such the headwall is proposed to be fitted with energy dissipators. In addition the base and side batters of the basin may be reinforced with jute mat (or approved equivalent) that will biodegrade over 10-18 months while vegetation becomes established.

Once flows enter the basin area the flow velocity will greatly disperse across the large water volume. By addition of inflow hydrographs the peak inlet discharge for 1:100 ARI flow is 2.36m³/s, while the peak discharge is controlled by the headwall outlet as 1.03 m³/s Using a Q=VA approximation across the wetted area of the Bio-Basin/OSD in the direction of flow gives a velocity range of 0.16 – 0.07m/s across the basin (from inlet to outlet). It is noted that this is a depth-averaged velocity and is generally accepted to occur at 60% the channel depth, with the fastest flows generally occurring at the surface. Simplifying to a linear relationship this results in a surface flow velocity of $V_{max} = 0.27\text{m/s}$. As such, it is considered that flows across the Bio-Basin are <0.5m/s in the 1:100 ARI event and are therefore acceptable in combination with dispersal of inlet flows by energy dissipators.

The outlet structure is designed as a concrete pit with lid elevated above the EDD. The outlet structure provides sump pits for maintenance with the drainage layer able to drain by gravity. The final pit will discharge to the surface by PVC outlet pipe leading under the fire trail to the low point on the site. It is noted by the flood certificate for the site that the outlet point will be inundated in >10% AEP events, however given the site topography it is considered the outlet will be freely draining in the 4EY water quality events.

Subsoil drains are provided at max 3m centres in accordance with Blacktown City Council guidelines. All subsoil drains are 100mm diameter socked and slotted pvc and laid at 0% grade with upstream flushing points. The terminating low flow outlet structure provides sump pit to create a maintenance point for any trapped sediments.

It is noted the fire trail creates separating bank between the Bio-Basin and downstream flood levels. As such the Basin/OSD are not considered to be submerged in any flood events. Sump pits in the outlet structures will also limit any sedimentation in reverse flow due to outlet inundation.

Access to the Bio-Basin is via the public road and fire trail. Clear open area surrounds the basin to a typical width of 5m. Access to the bioretention for maintenance will generally be on-foot (for any weeding etc), as it is not appropriate to drive machinery into the filter media area unless full excavation/replacement is underway. It is proposed that in the event of these major maintenance works any dump truck etc would be parked on the fire trail with an excavator removing any material and transporting to the parked truck.

Details of this basin can be found on drawing sheet N27790-401 and 406.

3.1.6 Bio Basin Vegetation

It is noted that the vegetation selected for the bio basins:

- 1) Must be effective for nutrient removal;
- 2) Must be suitable regularly wet soils;
- 3) Must be suitable for periodic inundation in larger storm events as combined in OSD basin.

Below are some species considered appropriate for this purpose from similar developments. Final species may be selected subject to Ecologist review at Subdivision Works Certificate stage.

Scientific Name	Common Name
<i>Acacia falcata</i>	Sickle Wattle
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney Golden Wattle
<i>Acacia stricta</i>	Straight Wattle
<i>Allocasuarina littoralis</i>	Black Sheoak
<i>Banksia spinulosa</i>	Hairpin Banksia
<i>Callistemon citrinus</i>	Common Red Bottlebrush
<i>Cassytha pubescens</i>	Devil's Twine
<i>Casuarina cunninghamiana</i>	River Sheoak
<i>Cynodon dactylon</i>	Couch Grass
<i>Cyperus difformis</i>	Variable Flatsedge
<i>Cyperus eragrostis</i>	Umbrella Sedge
<i>Eucalyptus longifolia</i>	Woollybutt
<i>Ficus coronata</i>	Sandpaper Fig
<i>Gahnia clarkei</i>	Red-fruit Saw-sedge
<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese Tree
<i>Hakea salicifolia</i>	Willow-leaved Hakea
<i>Hakea sericea</i>	Needlebush
<i>Hakea teretifolia</i>	Dagger Hakea
<i>Imperata cylindrica</i>	Blady Grass
<i>Isolepis inundata</i>	Swamp Club-rush
<i>Juncus usitatis</i>	Common Juncus
<i>Kunzea ambigua</i>	Tick Bush
<i>Kunzea capitata</i>	
<i>Lomandra longifolia</i>	Spiny-head Mat-rush
<i>Lomandra obliqua</i>	Fish Bones
<i>Melaleuca ericifolia</i>	Swamp Paperbark
<i>Microlaena stipoides</i>	Weeping Grass
<i>Persoonia linearis</i>	Narrow-leaved Geebung
<i>Pittosporum undulatum</i>	Sweet Pittosporum
<i>Themeda australis</i>	Kangaroo Grass

3.1.7 Treatment Train

Detailed guides (including maintenance) are to be developed for Shoalhaven City Council prior to the issue of the Subdivision Certificate and will generally follow the concept shown on the preliminary engineering plans. The default pollutant generation for the source nodes have been adopted.

The post development treatment train can be seen below. On-Site Detention (OSD) is omitted from this model and is discussed in Section 4.

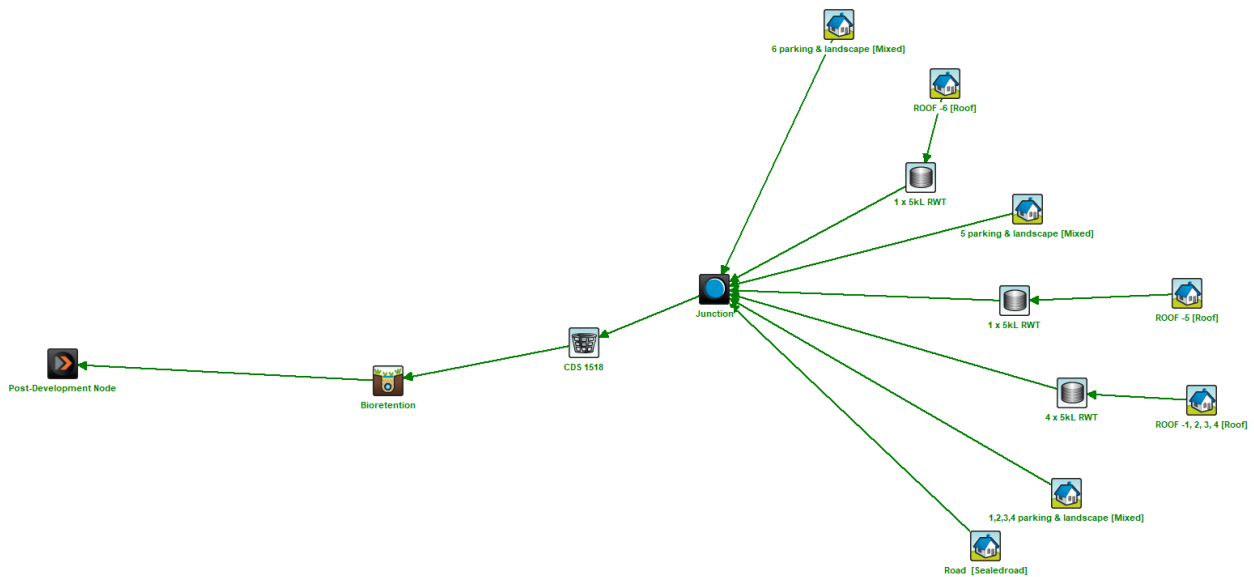


Diagram I – MUSIC Post-development treatment train

3.2 Water Quality Results

Below is a table showing both the target post development average annual pollutant load reduction and the designed post-development average annual pollutant load reduction. As can be seen, with the proposed treatment train the targets are all met for the site and thus generally satisfy the acceptable solutions from chapter G2 of DCP2014.

Table 1 – MUSIC Post-development reductions of annual pollutant load

Pollutant	Target post-developed av. Annual load reduction	Design post-developed av. Annual load reduction	Comment
Total suspended solids	80%	90.0%	Acceptable reduction
Total Phosphorus	45%	58.2%	Acceptable reduction
Total Nitrogen	45%	48.8%	Acceptable reduction

It is noted that as this development is not within Sydney Water’s water supply catchments” therefore it is not a requirement that NorBE must be met under DCP2014 G2.

Gross pollutants are not readily quantifiable within MUSIC as related to the DCP2014 requirements, however as there is a 100% reduction of gross pollutants this is deemed compliant with DCP2014.

All results demonstrated pollutant reductions compliant with DCP2014 Chapter G2 requirements. This is considered an acceptable outcome and is recommended for approval.

4.0 Stormwater Quantity Modelling

The Stormwater Hydraulic calculations have been prepared by a qualified practicing engineer using DRAINS version 2021.031. As the proposed development has B4 zoning, a high-level approach to stormwater modelling at greenfield stage is required – as the final proposal for on-lot development is unknown. As such, catchments are developed to reflect DCP compliant overall impervious areas and estimate peak discharges to Basin/OSD devices.

4.1 Site Model

4.1.1 Model Hydrology

The adjoining site (Moss Vale Road – being channelled to bypass OSD basin) is modelled with an extended rational method in accordance with SCC Engineering Guidelines adopting C10 values as 0.9 and 0.7 for impervious and pervious areas respectively (per Table 5.1 in D5.06). This is recommended by watercom as ILSAX is intended only for urban catchments.

An ILSAX model is used to simulate post-development site conditions with impervious, supplementary and pervious surface storages of 1mm, 1mm and 5mm respectively. Rainfall is imported in accordance with ARR2019 from BOM and ARR data hub.

Overland Flows are calculated using the Kinematic wave equation.

Soil Type and Antecedent Moisture Condition are set to the watercom recommendation of 3.

4.1.2 Catchment Details

A summary of the catchment details is seen below:

	Sub-catchment	Area (m ²)	%Impervious	%Supplementary	%Pervious
Pre-Development	Cat-pre-gravel areas	7,019	0	50	50
	Cat-pre-roof	2,338	100	0	0
	Cat-pre-remainder	55,615	0	0	100
	Totals	64,972	3.6	5.4	91.0
Post-Development	Cat-post-road-imperv	12,990	95	0	5
	Cat-lots	51,982	50	40	10
	Totals	64,972	59.0	32.0	9.0
	CatMVR	116,600	40	0	60

It can be seen from the above table that the post-development road areas are all considered 95% impervious in accordance with SCC DCP 2014. The lot areas are also considered to be 90% impervious (with a 50/40 split between assumed impervious and supplementary areas to consider directly vs indirectly connected impervious areas). The adjoining MVR catchment is considered solely for pipe size / bypass capacity considerations and does not form part of the pre/post modelling considerations.

The CatMVR catchment is modelled using the 'extended rational method' approach with time of concentration (ToC) determined using the ARR method of $t_c = 0.76A^{0.38} = 14.2$ and 20.1 minutes for impervious and pervious catchments respectively.

All remaining catchments are modelled with ILSAX hydrology and calculating the ToC via the kinematic wave method. Distances are reflective o measurements taken from plans, while a range of retardance coefficients (n*) have been used as listed below:

Material	Retardance Coefficient (n*)	Comments
Gravel	0.02	Adopted in accordance with SCC D5 and Watercom guidelines
Predev-Grassed	0.1	Adopted in accordance with Watercom guidelines for sparse/low vegetation areas
Roads	0.013	Adopted as typical balance between asphalt pavement and concrete gutters. In accordance with SCC D5
Road Verge	0.17	Adopted as flow across well maintained grassed areas
Lot-Paved DCIA	0.012	Adopted as typical value for concrete
Lot-Supplementary-RIA	0.04	Adopted for commercial areas in accordance with SCC D5
Lot-Grassed	0.35	Adopted per Watercom range of values to consider well maintained garden/landscaping on lots etc

4.1.3 Pit Blockage and Loss Coefficients

Blockage Factors are assumed per ARR2019 and SCC Engineering Guidelines as 50% for sag pits and 20% for on-grade pits. However as no pits are included in this high-level OSD model these blockage factors do not come into play.

4.1.4 Tailwater Levels

Tailwater levels are set at the post-development outlets using the Flood Certificate provided for the site based on the *Bomaderry Creek Floodplain Risk Management Study* (2016). These levels are adopted for storm events ranging from 10% to 1% AEP as seen below.

FLOOD INFORMATION

Year	Existing	Projected 2050	Projected 2100
Flood Planning Level	32.7m AHD		
Hazard Category	High		
Hydraulic Category	Floodway		
Probable Maximum Flood Level	37.0m AHD		
1% AEP Flood Level	32.2m AHD		
2% AEP Flood Level	31.8m AHD		
5% AEP Flood Level	31.4m AHD		
10% AEP Flood Level	31.1m AHD		
Velocity (1% AEP flood event)	3.9m/s		

Note: The above levels and velocity refer to the highest flood level/velocity across the 3 properties.

4.1.5 Regional OSD Details

Individual lot level tanks are not modelled at this stage due to the high-level nature of the model. There are too many unknowns regarding number of tanks and possible configurations to accurately assume any particular contribution to OSD. As such all OSD burden is placed on the regional device – it is noted that this *may* be revised to a smaller volume with a future SWC if lot-level development proposals are further progressed to inform rainwater tank contributions

The regional OSD area is the volume above the Extended Detention Depth combined with the Bio-Basin. For minor storms it is assumed that the basin is empty at the commencement of the storm, as the basin will have emptied through the drainage in trickle flows prior to the minor storm. In the major storms (>10% AEP) it is assumed the basin commences at RL31.9 (i.e. the EDD is full).

The minor storm outlet is located at invert level RL31.9 with twin 525 diameter pipes. The OSD basin above RL31.9 continues battering up at 1:4 grade to a maximum RL33.5 – any flows greater than this would then sheet over the fire trail, however the maximum water level in the 1% AEP event is RL32.99. This complies with the SCC DCP2014 requirement for maximum ponding depth of 1.2m in landscaped areas (i.e. 32.99 – 31.9). It is noted this is measured to the EDD and as such an additional 300mm of ponding is present in the form of the bioretention (for a total ephemeral depth of 1.39m). This is considered to be a minor increase over 1.2m and considering the consistent 1:4 batters is not considered to be of detriment to the design. However, it is noted that the ponding depth in the minor storm (including EDD) is only 0.87m – and as such it would be possible for additional outlets to be provided above this height to reduce 1% AEP depths further. This may be considered at SWC stage when pit & pipe conveyance is further detailed.

4.1.6 Results

The DRAINS file will be made available on request, with a summary of final pre vs post development flow results tabulated below.

	Pre-Development	Post Development (without detention)	Post Development (with detention)
<i>1:10 ARI Peak Flow (m³/s)</i>	0.687	1.26	0.682
<i>1:20 ARI Peak Flow (m³/s)</i>	0.975	1.52	0.772
<i>1:50 ARI Peak Flow (m³/s)</i>	1.41	2.01	0.896
<i>1:100 ARI Peak Flow (m³/s)</i>	1.79	2.36	1.03

It can be seen then that the post development peak flows are less than predevelopment for all storm events up to and including the 1:100 ARI in compliance with DCP2014.

4.1.7 Climate Change

Climate change factors were also assessed from the ARR data hub with the below table being produced:

Interim Climate Change Factors

	RCP 4.5	RCP6	RCP 8.5
2030	0.648 (3.2%)	0.687 (3.4%)	0.811 (4.0%)
2040	0.878 (4.4%)	0.827 (4.1%)	1.084 (5.4%)
2050	1.081 (5.4%)	1.013 (5.1%)	1.446 (7.3%)
2060	1.251 (6.3%)	1.229 (6.2%)	1.862 (9.5%)
2070	1.381 (7.0%)	1.460 (7.4%)	2.298 (11.9%)
2080	1.465 (7.4%)	1.691 (8.6%)	2.719 (14.2%)
2090	1.496 (7.6%)	1.906 (9.7%)	3.090 (16.3%)

Previously it has been common practice to adopt RCP6 factors as the best middle ground for predicting future climate impacts on rainfall intensity, however CSIRO have recently updated figures for RCP4.5 and 8.5 and as such ARR recommends their use. It can be seen from the above table that a T_m factor of 3.09 can be adopted as the most conservative climate change estimate for the year 2090. This subtends a climate change multiplying factor of 1.163 (16.3%) which is adopted for use in DRAINS.

The site is not considered to be impacted by sea level rise.

Climate change factors are applied to the design storms (1:10 ARI and 1:100 respectively). It is found for the minor storm that as per the pattern established in the results table, the greater the inflow the more effective the OSD treatment becomes. Pre and Post peak flows are established as 0.898m³/s and 0.748m³/s respectively. As this is a high-level model there is no further pit/pipe performance to assess at this stage and will be further reviewed at SWC stage.

For the major storm it is similarly found that the OSD basin remains functional with Pre and Post peak flows are established as 2.19m³/s and 1.14m³/s respectively. Overflow routes included in this high-level model are not reflective of final design overflow routes from pit-to-pit etc and as such must again be further reviewed at SWC stage.

It is confirmed then that the worst case RCP8.5 Climate Change multiplier of 16.3% for 2090 does not exceed the OSD design capacity.

5.0 DCP2014 Compliance Tables

The following table is prepared to demonstrate compliance with DCP2014 Chapter G2 – Sustainable Stormwater Management.

DCP2014 Chapter G2 – Sustainable Stormwater Management – 5 Controls	
5.1 Stormwater	
5.1.1 Minor and Major Systems Design	
Acceptable Solutions	Compliance
A1.1 Runoff from impervious areas must not be concentrated or directed onto neighbouring properties	Complies. Drainage run off from all proposed and future impervious areas is to be captured in pit/pipe infrastructure. Minor pervious areas may sheet flow off site through other properties as per existing conditions
A1.2 For residential and rural residential areas, the drainage must be designed to cater for a 5-year ARI event.	Not applicable, site is zoned B4 mixed use as such the higher level is adopted.
A1.3 For mixed residential/commercial and industrial development, the drainage must be designed to cater for a 10-year ARI event.	Complies. Minor system drainage to be designed at Subdivision Works Certificate stage to be designed to contain the ARI 1:10 storm event
A1.4 Kerb and gutters are required if soil permeability is not sufficient to allow natural infiltration of stormwater runoff without causing adverse impacts onsite or to neighbouring properties.	Complies. Kerb and gutters are proposed throughout the development.
A1.5 Runoff from roof gutters and downpipes can be directed to an existing or proposed stormwater system, when it can be proved that the systems design capacity is not exceeded.	Complies. New stormwater infrastructure is proposed to cater for design flows and be detail designed at Subdivision Works Certificate stage.
A1.6 Where onsite infiltration/absorption is proposed for stormwater disposal, supporting geotechnical reports are submitted with a development application to assess the suitability of the proposal	Not applicable. Absorption is not proposed

<p>A1.7 Stormwater inlet structures must be designed with a blockage factor provision in accordance with the latest version of Australian Rainfall and Runoff (ARR) guidelines</p>	<p>Complies. New stormwater infrastructure is proposed to have appropriate blockage factors applied and be detail designed at Subdivision Works Certificate stage</p>
<p>A1.8 Major system drainage must be designed for a 1:100 year ARI event</p>	<p>Complies. Major system drainage to be designed at Subdivision Works Certificate stage to be designed to contain the ARI 1:100 storm event.</p>
<p>A1.9 Trunk stormwater systems, which include open channels, large conduits and overland flow paths are designed for storms up to 100-year ARI event.</p>	<p>Complies. Trunk system drainage to be designed at Subdivision Works Certificate stage to be designed to contain the ARI 1:100 storm event</p>
<p>A1.10 The following overland flow paths shall be utilised as Major system flow routes;</p> <ul style="list-style-type: none"> ● Roadways including footpath; ● Pathways; and ● Parkland or open space. 	<p>Complies. All new overland flow paths are proposed to be within road reserves, pathways and parkland/open spaces. Where existing pipes discharge into the site, they will be piped through the site and sized so that the flow is contained within the pipework for all events up to and including the ARI 1:100 storm event.</p>
<p>A1.11 Flow paths must be designed to ensure a velocity depth product of less than 0.3m²/s for a 100-year ARI storm event.</p>	<p>Complies, for proposed infrastructure. All overland flow paths are to have a velocity x depth product of less than 0.3m²/s for a 100-year ARI storm event to be designed at Subdivision Works Certificate stage.</p>
<p>A1.12 The continuity of the overland flow paths must not be obstructed by fences, walls, footpaths and the like.</p>	<p>Complies. New overflow paths from roads discharge through 'reserves' to waterways.</p>
<p>5.1.2 Disposal of Stormwater from Development sites</p>	<p>This section is not applicable to this development, it would apply to any subsequent development of the vacant lots created from this development. Provision is to be made with this development to ensure future compliance with this section is possible.</p>
<p>5.1.3 Climate Change Controls</p>	
<p>A3.1 Climate change impacts, such as changes to rainfall intensity, shall be considered in system design as per relevant policies and/or Australian Rainfall & Runoff (ARR) Guidelines.</p>	<p>Complies.</p>

<p>A4.1 Where relevant major and minor system design must consider the impact of sea level rise.</p>	<p>Not Applicable. The Flood Certificate indicates this is not relevant to this site due to elevation relative to sea level</p>
<p>5.1.4 Onsite Stormwater Detention (OSD)</p>	
<p>A5.1 OSD is to be sized to match pre-development peak flow rates for the 5, 20 and 100 year ARI rain events for the site</p>	<p>Complies. End of line detention proposed, no additional at-source detention required.</p>
<p>A5.2 For development other than subdivision, pre- and post-development peak flow calculations must be based on the impervious percentages (as outlined below) or the actual impervious surface area (whichever is greater) as detailed on development plans.</p>	<p>Not applicable. Development is subdivision only</p>
<p>A5.3 For subdivisions, pre- and post-development peak flow calculations must be based on the impervious percentages as outlined below. Area impervious:</p> <ul style="list-style-type: none"> • Open Space – 25% • Low and Med density residential – 80% • Industrial areas – 80% • Commercial areas – 90% • Half width road reserve – 95% 	<p>Complies. All impervious fractions are to be adopted in accordance with these values at detailed design stage for the Subdivision Works Certificate.</p>
<p>A5.4 OSD design must consider downstream boundary conditions for the 100-year ARI level of the receiving water.</p>	<p>Complies. Tailwater levels adopted as appropriate per Flood Certificate.</p>
<p>A5.5 Detention storage must be located at a level above the 5-year ARI flood level</p>	<p>Complies.</p>
<p>A5.6 If OSD is provided in landscaped areas, the desirable maximum depth of ponding under design conditions is 300mm.</p>	<p>Ponding exceeds 300mm and is to be managed by 1:4 grassed batters. Plantings to deter entry around the perimeter may also be detailed at SWC stage.</p>

<p>A5.7 Despite A5.6 the desirable maximum depth of ponding can be increased to 1200mm provided that site slopes of the basin are $\geq 1:6$, or the provided storage is fenced off.</p>	<p>Alternative solution proposed in consultation with SCC. 1:4 grassed batters maintained per SCC standard practice. Plantings may be provided at perimeter to dissuade entry. Maximum ephemeral ponding in 1% AEP = 1.39m inclusive of bioretention EDD = 0.3m.</p>
<p>A5.8 For subdivisions OSD shall be:</p> <ul style="list-style-type: none"> • Designed at the subdivision stage • Constructed at the individual dwelling stage where OSD is proposed on each lot • Constructed at the subdivision stage where OSD is proposed to be provided through dedicated detention storage 	<p>Complies. End of line detention proposed, no additional at-source detention required.</p>
<p>A5.9 50% of any retention volume can contribute towards the OSD volume required for the development, provided the systems are interconnected.</p>	<p>Not Applicable. End of line detention proposed, no additional at-source detention required.</p>
<p>5.2 Stormwater Quality and Waterway Protection</p>	
<p>5.2.1 Erosion and Sediment Control</p>	
<p>A6.1 Where vegetation exists on the site, buffer zones of vegetation shall be retained along the boundaries of the site where practicable, particularly those adjacent to creeks and street gutters</p>	<p>Complies. To be indicated thus upon the detailed designs for Subdivision Works Certificate.</p>
<p>A6.2 Sediment and erosion control measures shall not adversely impact on stormwater management measures of the site or any existing public drainage structures of systems</p>	<p>Complies. To be indicated thus upon the detailed designs for Subdivision Works Certificate.</p>
<p>5.2.2 Stormwater Retention and re-use</p>	

<p>A7.1 The volume of retention storage provided is to be equal to or greater than: [storage depth*] X [increase in impervious surfaces compared to pre-development] *as outlined below (refer to Sustainable Stormwater Technical Guidelines for further details).</p> <ul style="list-style-type: none"> • Alterations, additions, auxiliary structures & second storey additions (10mm) • Single dwelling & dual occupancy (10mm) • Medium Density (9mm) • High Density (8mm) • Industrial (6mm) 	<p>Not Applicable. The development is subdivision only without future dwellings as part of this application.</p>
<p>A8.1 Residential development shall install rainwater tanks to meet a portion of supply such as outdoor use, toilets, laundry</p>	<p>Not Applicable. This is applicable at building construction stage, not proposed as part of this application</p>
<p>A8.2 Any overflow from rainwater tanks shall be directed into an existing stormwater system where possible, alternatively the overflow will be managed so that it does not cause nuisance to neighbouring properties</p>	<p>Not Applicable. This is applicable at building construction stage, not proposed as part of this application</p>
<p>5.2.3 Small/medium scale development – Not Applicable (Assessed as Large scale development)</p>	
<p>5.2.4 Large Scale Development</p>	
<p>A10.1 For development within Sydney's drinking water supply catchments, a neutral or beneficial effect must be demonstrated in accordance with the State Environmental Planning Policy (Sydney Drinking Water Catchment) 2011.</p>	<p>Not Applicable. Development is not within Sydney Water's drinking water supply catchments.</p>
<p>A10.2 For development outside Sydney's drinking water supply catchments, pollutant load reduction must be a minimum reduction of the load of the post development average annual load of pollutants in accordance with Table 3 and the following as relevant:</p>	

<ul style="list-style-type: none"> • For greenfield sites or sites draining to a natural stream of 3rd order or lower, the 1.5-year ARI predevelopment peak discharge must be maintained. • For development discharging to a natural stream, the post development duration of stream forming flows must be no greater than a stream erosion index of 2 • For development discharging to a tidal area or natural watercourse, outlets must be designed to limit erosion and sedimentation at the discharge point • For development discharging to St Georges Basin, Swam Lake, Lake Conjola, Burrill Lake, Lake Tabourie, Willinga Lake and Wollumboola Lake a higher Total Phosphorus reduction target of 65% must be achieved • For a development discharging into an area of significant biodiversity value, the post development residual pollutant concentrations must not exceed the ecological trigger values listed in the A & NZ guidelines for fresh and Marine Water Quality • Un coated metal roofs, facades and/or downpipes are not supported 	<p>Complies. 1.5year ARI event flows are maintained</p> <p>Complies. Preliminary calculations indicate a predeveloped flow period of approx. 131min and a post developed flow period of 143min for the 1.5 YR event, indicating stream erosion index of 17/9 or 1.1, which is below 2</p> <p>Complies. All outlets to be stabilised at detailed design stage</p> <p>Not applicable, development not in any of these areas</p> <p>Complies, the stormwater is compliant with target reductions as stipulated within DCP2014 in lieu of site-specific Default Guideline values being available</p>
<p>5.2.5 Design and Maintenance of Stormwater Treatment Measures</p>	
<p>A11.1 Where practicable, trunk drainage is to be provided as a natural vegetated stable channel; and</p>	<p>Not Applicable, no trunk drainage is proposed for the proposed development.</p>
<p>A11.2 Where practical due to adequate catchment area, constructed wetlands are preferred over the use of bio-retention basins and water quality ponds. The preference between a water quality pond and bioretention device will depend on site specific constraints</p>	<p>Wetlands not practical due to flooding, biofiltration adjacent to the public road and within proposed public land with forebays and GPT at the outlet point for ease of maintenance are consistent with performance criteria P11.</p>
<p>A11.3 An Operation and Maintenance Plan is submitted to Council for all stormwater treatment measures proposed, whether remain in private ownership or to be handed over to Council; and</p>	<p>Complies. Maintenance details as per Appendix B.</p>

<p>A11.4 System design allows for maintenance (i.e. access and room to operate safely) at all times; and</p>	<p>Complies. All water treatment measures are accessible from the public road/fire trail.</p>
<p>A11.5 Stormwater treatment measures must not be connected until the majority of catchment infrastructure is completed and landforms stabilised with impervious or fully established grassed surfaces. Bioretention devices and constructed wetlands must be established offline from inflows until they are fully established</p>	<p>Complies. Treatment measures to be brought on-line only once upstream road and disturbed lot areas are stabilised prior to erosion control measures being removed.</p>
<p>A11.6 Where the development is staged, sacrificial zones must be included in the design of the stormwater treatment measures. Sacrificial zones are to be rectified upon completion of development at the developer's cost; and</p>	<p>Not applicable. Staging is not proposed</p>
<p>A11.7 Structural stormwater treatment measures must be able to bypass flows in excess of the design discharge with negligible afflux resulting from over topping or blockage of the device; and</p>	<p>Not applicable. No structural stormwater treatment measures are proposed.</p>
<p>A11.8 Trash racks are generally preferred over proprietary GPT's by Council</p>	<p>Not applicable. Concurrence previously granted to permit a GPT. Forebay provided in addition to this at the request of Council.</p>
<p>A11.9 In the event of a stormwater discharge, structure stormwater treatment measures must not allow the release of any previously trapped material.</p>	<p>Complies. Sediment & gross pollutant treatment measures are offline (through the GPT) and sediment and the like are to be trapped within the GPT.</p>
<p>A11.10 Stormwater treatment measures must consider mosquito control in their design. Designs should consider:</p> <ul style="list-style-type: none"> • Permanent water ponding; • Water depth; • Exposure to sunlight and wind; and • Proximity to residential development 	<p>Complies. No permanent ponding is proposed, water depth is nominal, the treatment areas are to be exposed to wind and sun rather than enclosed.</p>
<p>A11.11 All filter media used in bioretention stormwater treatment measures must meet the current specifications of the Guidelines for filter media in adoption</p>	<p>Complies. To be managed during construction. Material to be sourced from an acceptable supplier and adequacy demonstrated prior to placement.</p>

guidelines for biofiltration systems or a demonstrated equivalent, verified by a soil laboratory registered by the National Association of Testing Authorities; and	
A11.12 Design of stormwater treatment measures is in accordance with Sustainable Stormwater Technical Guidelines.	Complies. Calculations provided through Section 3 of this report.
A11.13 Development adjacent to a watercourse or stormwater drain addresses environmental impact upon the water body.	Complies. Calculations provided through Section 3 of this report.
A11.14 Constructed wetlands and bio-retentions basins must be located in a treatment train approach immediately downstream of a sediment basin/forebay.	Complies. Biofiltration areas downstream of GPT which functions as a sediment basin. Forebay is in addition to this.
A11.15 Bioretention devices must be designed in accordance with the latest version of the Adoption Guidelines for stormwater systems (CRC for water sensitive cities) and Facility for advancing water biofiltration (FAWB) Guidelines	Complies. To be detail designed at Subdivision works Certificate stage incorporating these measures, general guide indicated on concept engineering plans and in this report
5.3 Waterfront Land	
5.3.1 Development on Waterfront land	
A12.1 The minimum width of the core riparian zone is in accordance with Table 4 or as specified by the Water Management Act 2000	Complies. Riparian buffer is provided in excess of the required minimum amount
A12.2 The core riparian zone must be maintained or restored or rehabilitated using appropriate local species with a range of canopy, understorey and ground cover species to enable a healthy and diverse ecosystem	Complies. Core riparian buffer is and proposed for re-vegetation, details to be provided with subdivision works certificate application
A12.3 Topsoil shall be reused from the development site where it contains known or potential seedbank on the development site	Not applicable due to the extensive nature of the disturbance of the existing site and land use over a long period of time for agricultural purposes.

<p>A12.4 Transport infrastructure and services (i.e. sewer, electricity, gas and communications) shall be located outside the core riparian zone</p>	<p>Complies. See Concept Engineering indicating all civil works are outside the core riparian zone with the exception of minor encroachment of batters which are proposed to be revegetated as part of the riparian works for areas currently utilised as agricultural grazing.</p>
<p>A12.5 Despite A12.4, where services must traverse the core riparian zone, the development application must demonstrate that there will be minimal impact on the function and integrity of the core riparian zone</p>	<p>Not applicable. See concept Engineering indicating all civil works are outside the core riparian zone</p>
<p>A12.6 Pathways, cycleways and pervious recreational area shall be located outside core riparian zone unless all of the following is satisfied:</p> <ul style="list-style-type: none"> • An opportunity exists for the community to connect with and explore the watercourse in a strategic location • There will be minimal impact on the riparian function • The integrity of the riparian land is maintained 	<p>Not applicable. See concept Engineering indicating all civil works are outside the core riparian zone</p>
<p>A12.7 Bushfire asset protection zones shall be located outside the core riparian zone or vegetated buffer and should be incorporated into the development footprint</p>	<p>Complies, refer to the bushfire report</p>
<p>A12.8 Crossings of waterways or other activities must have regard to the minimum structure requirements for fish passage in accordance with relevant NSW state government guidelines</p>	<p>Not applicable. No waterway crossings are proposed</p>
<p>A12.9 Works carried out on waterfront land comply with the Water Management Act 2000</p>	<p>Noted, works to comply with Controlled Activity Approval</p>
<p>A12.10 Stormwater disposal over/across/through public waterfront reserves should be avoided to prevent erosion and need for remedial actions</p>	<p>The discharge is all proposed within the site, which is in private ownership</p>
<p>5.3.2 Coastal areas – Section Not applicable, development not discharging to coastal cliffs or coastal dunes</p>	

6.0 Conclusion

This report provides an assessment of the proposed subdivision for stormwater runoff as a result of the development for the purpose of a Development Approval. Pollutant loads for a fully developed site have been assessed.

This assessment concludes that the proposal has an acceptable impact on stormwater management with no adverse impacts on stormwater water peak flows or water quality.

These conclusions are based upon the works being completed generally in accordance with the designs by APS concept engineering plans.

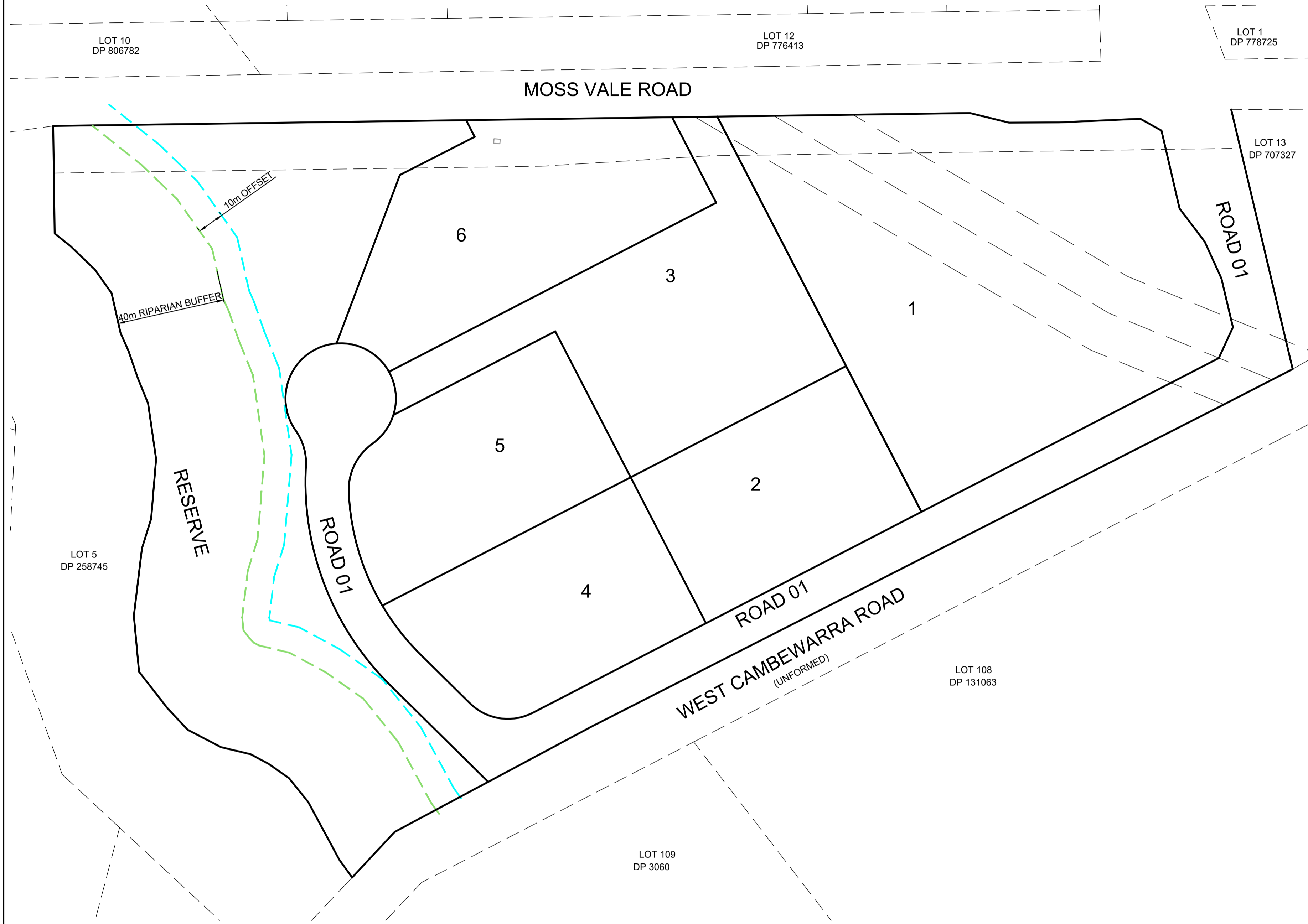
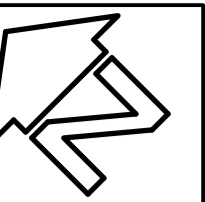
The proposal is considered adequate from a stormwater perspective and is recommended to be supported by Shoalhaven City Council

Caroline E Griffiths
B. Env. Sc.; Dip. Civ. Eng.
Allen, Price & Scarratts Pty Ltd
August 2022

Appendix A – APS Engineering Plans ref N27790-401 to 406

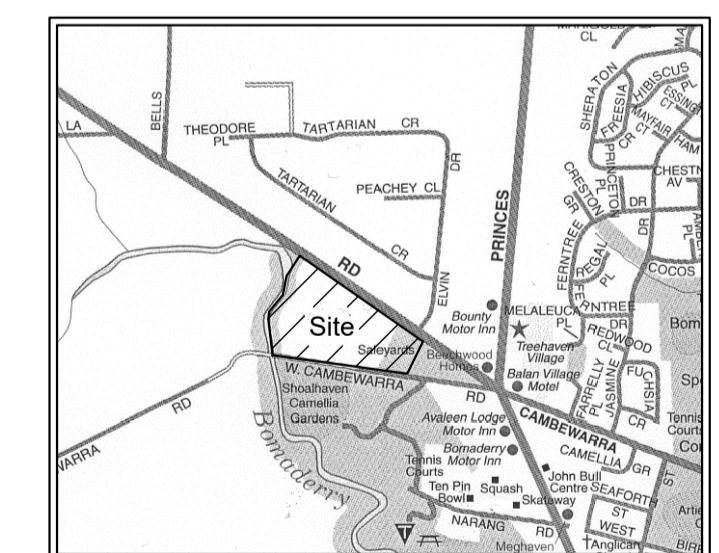


PROPOSED MIXED USE SUBDIVISION FOR SOUTHERN CROSS HOUSING



SITE LAYOUT PLAN
SCALE 1:1000

DRAWING SCHEDULE	
N27790-401	COVER SHEET
N27790-402	GENERAL ARRANGEMENT PLAN
N27790-403	CONCEPT INTERSECTION TREATMENT PLAN
N27790-404	ROAD 01 LONGITUDINAL SECTION
N27790-405	ROAD 01 SECTIONS & DETAILS
N27790-406	WATER QUALITY DETAILS



LOCALITY PLAN
MAP DRAWN & PUBLISHED BY CARTODRAFT AUST P/L

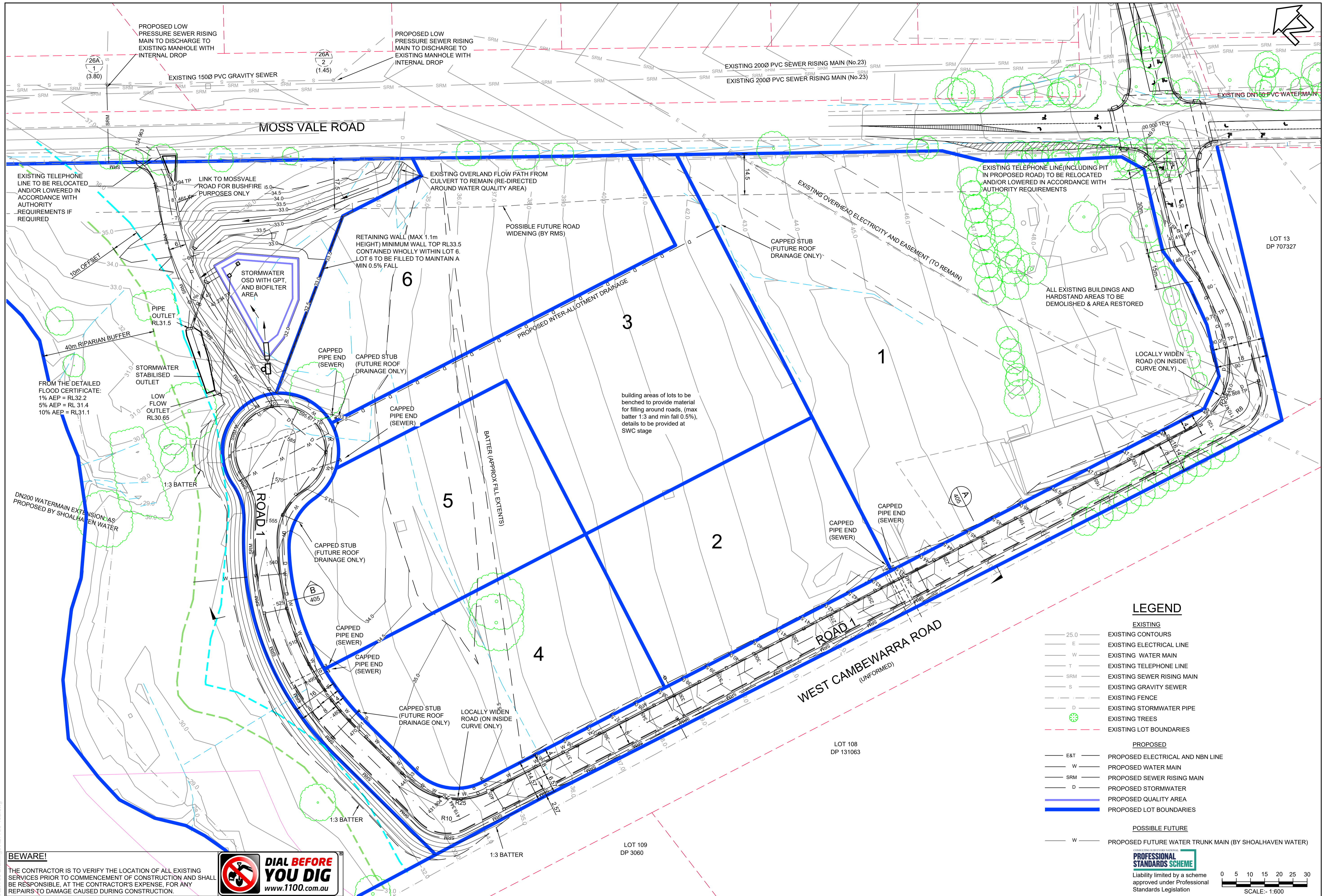
BEWARE!
THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.



PROFESSIONAL STANDARDS SCHEME
Liability limited by a scheme approved under Professional Standards Legislation



RATIO: 1 : 1000 (AT A1 ORIGINAL)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY	APS	REV	DESCRIPTION	BY	DATE	 allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone: (02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au	COVER SHEET PROPOSED SUBDIVISION OVER LOT129 DP3060 LOT110 DP131219 & LOT1 DP520502 AT 25 MOSS VALE ROAD, BOMADERRY FOR SOUTHERN CROSS HOUSING	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	ORIGIN: PM15204 RL52.718	DESIGN CEG	CHECK'D RH	P9 P2 P3 P4 P5 P6 P7 P8	LOT LAYOUT AMENDED LOT LAYOUT AMENDED CUL-DE-SAC ADDED + CURVES WIDENED INTERSECTION UPDATED INTERSECTION UPDATED INTERSECTION UPDATED INTERSECTION UPDATED	CEG CEG CJG CJG CJG CJG CJG	06.06.2022 03.11.2020 07.04.2021 26.07.2021 17.09.2021 05.11.2021 17.11.2021 29/03/2022			DRAWING NUMBER N27790-401



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RATIO:
1:600
(AT A1 ORIGINAL)

DATUM:
AUSTRALIAN HEIGHT DATUM
ORIGIN: PM15204
RL52.718
DATE OF PLAN: JUNE 2020

SURVEY	APS	REV	DESCRIPTION	BY	DATE
DESIGN	CEG	P9	INTERSECTION UPDATED	CJG	29.03.2022
DRAWN	CEG	P10	CULDESAC AMENDED	CEG	16.05.2022
CHECK'D	RH	P11	LOT LAYOUT AMENDED	CEG	06.06.2022
		P12	FUTURE ROAD WIDENING ADDED	CEG	22.06.2022
		P13	WATER QUALITY AMENDED	CEG	13.07.2022
		P14	WATER QUALITY AMENDED	CEG	27.07.2022
		P15	WATER QUALITY ADDITIONAL DETAILS	CEG	01.08.2022
		P8	INTERSECTION UPDATED	CJG	17/11/2021

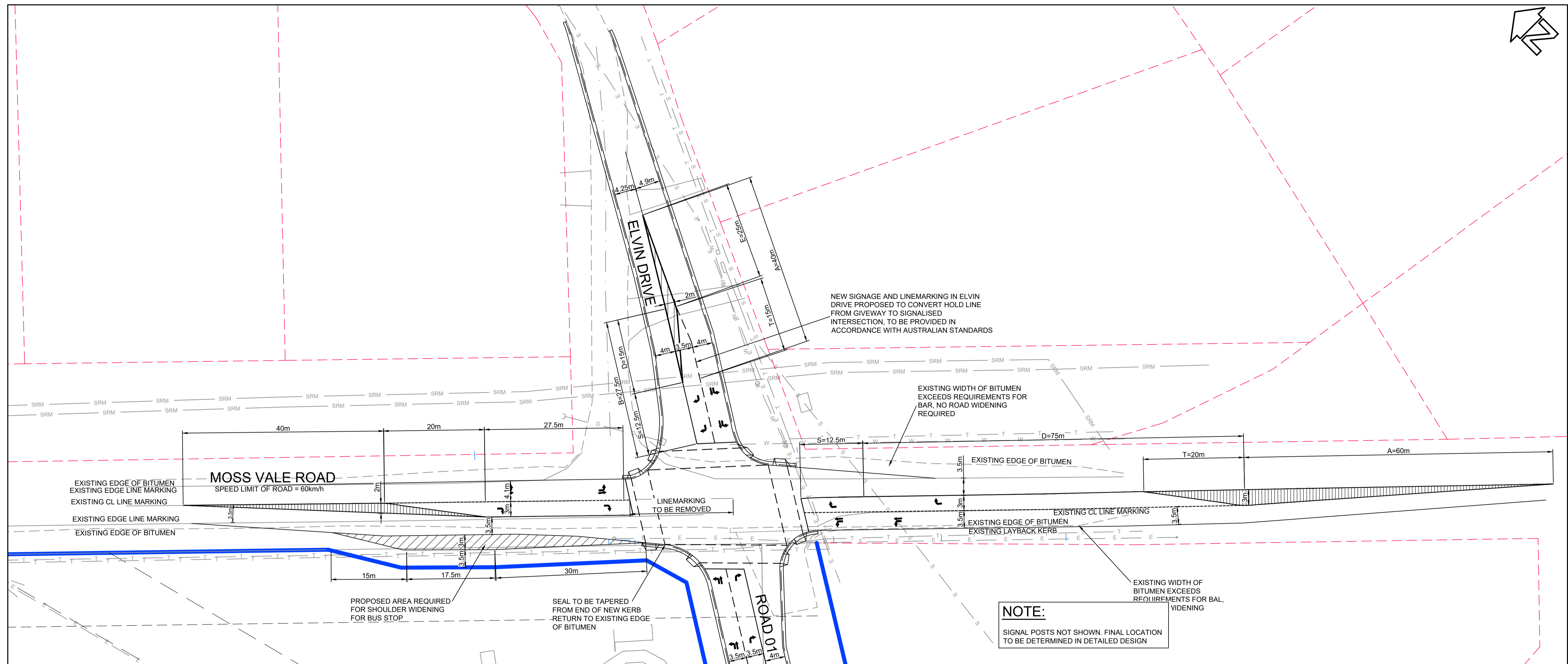
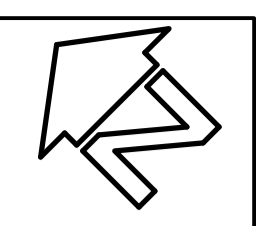
allen price & scarratts pty ltd
land and development consultants

Nowra Office: 75 Plunkett Street, Nowra NSW 2541
Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533
phone: (02) 4421 6544
consultants@allenprice.com.au www.allenprice.com.au

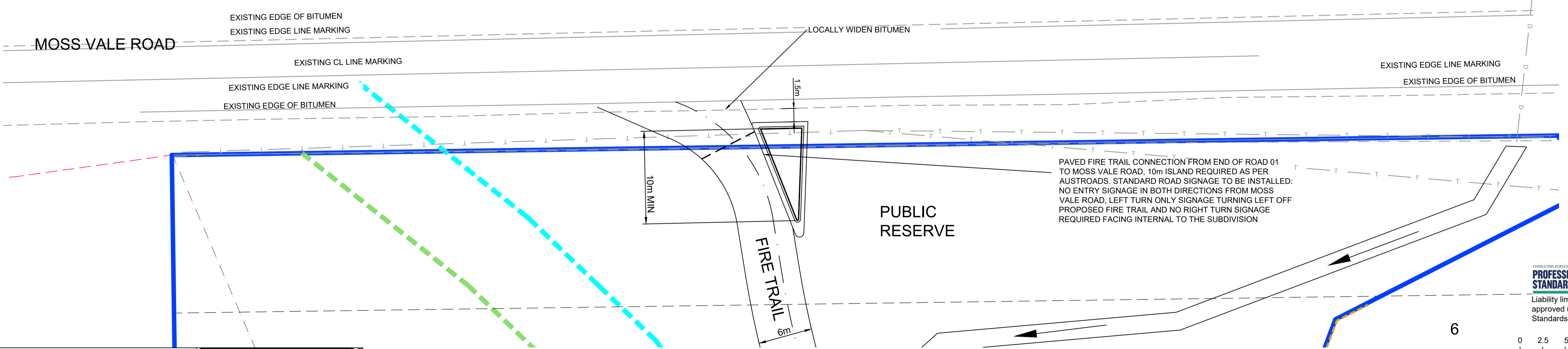
GENERAL ARRANGEMENT PLAN
PROPOSED SUBDIVISION
OVER LOT129 DP3060 LOT110 DP131219 & LOT1 DP520502
AT 25 MOSS VALE ROAD, BOMADERRY
FOR SOUTHERN CROSS HOUSING

DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES	
DRAWING NUMBER N27790-402	SHEET 2 REVISION P15
OF 6	

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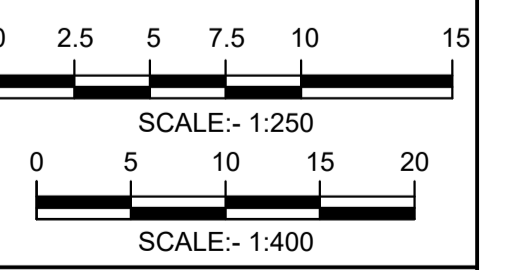
SIGNALISED INTERSECTION TREATMENT FOR EASTERN ENTRY/EXIST LAYOUT PLAN
SCALE 1:400



EMERGENCY VEHICLE ONLY ENTRY/EXIT LAYOUT PLAN
SCALE 1:250



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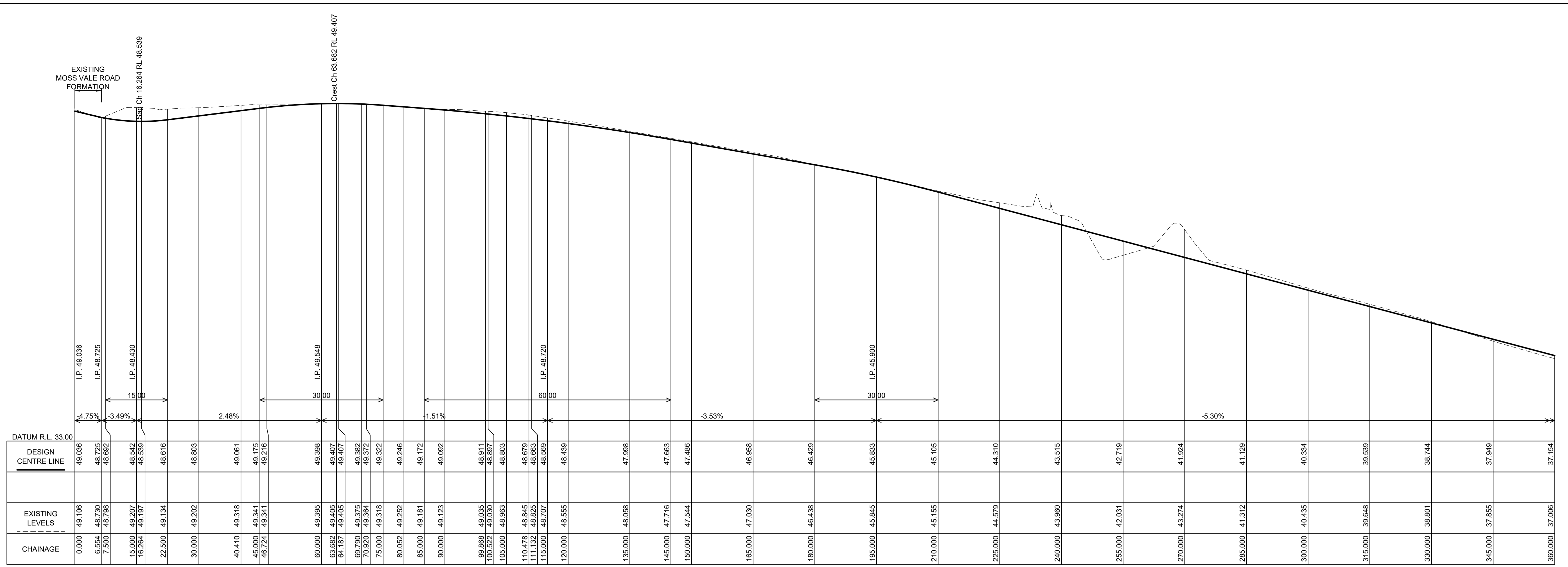


BEWARE!

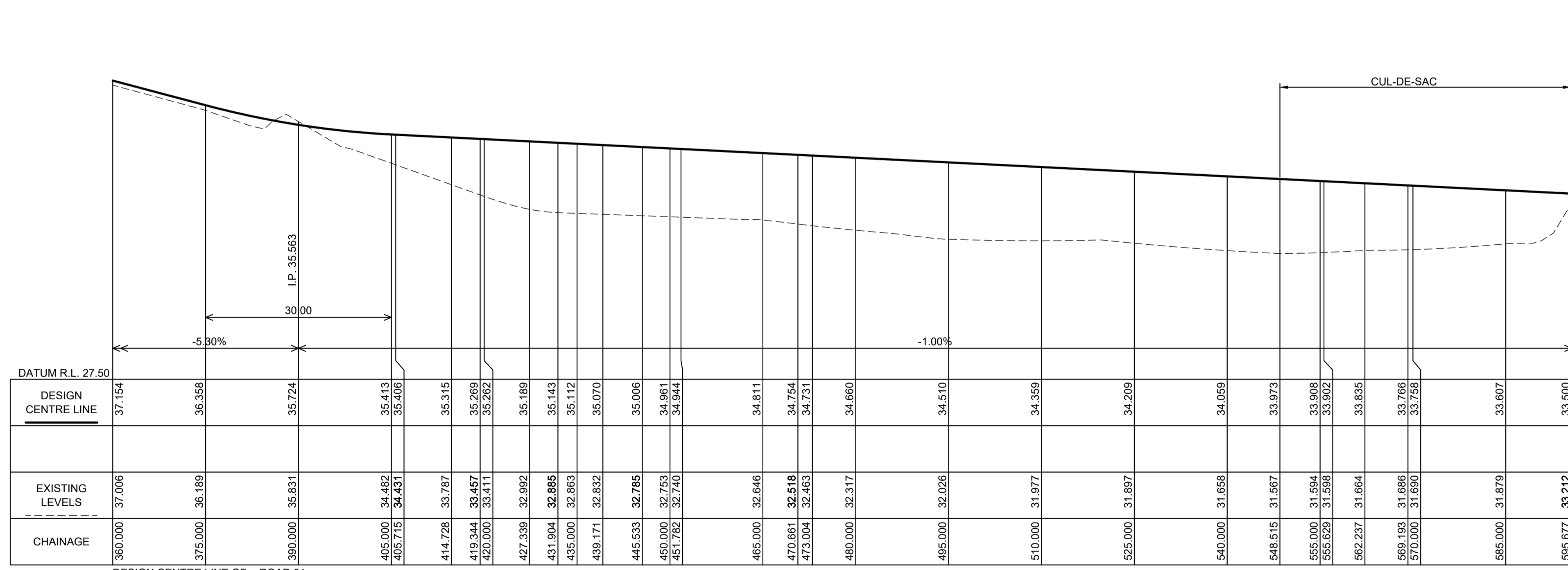
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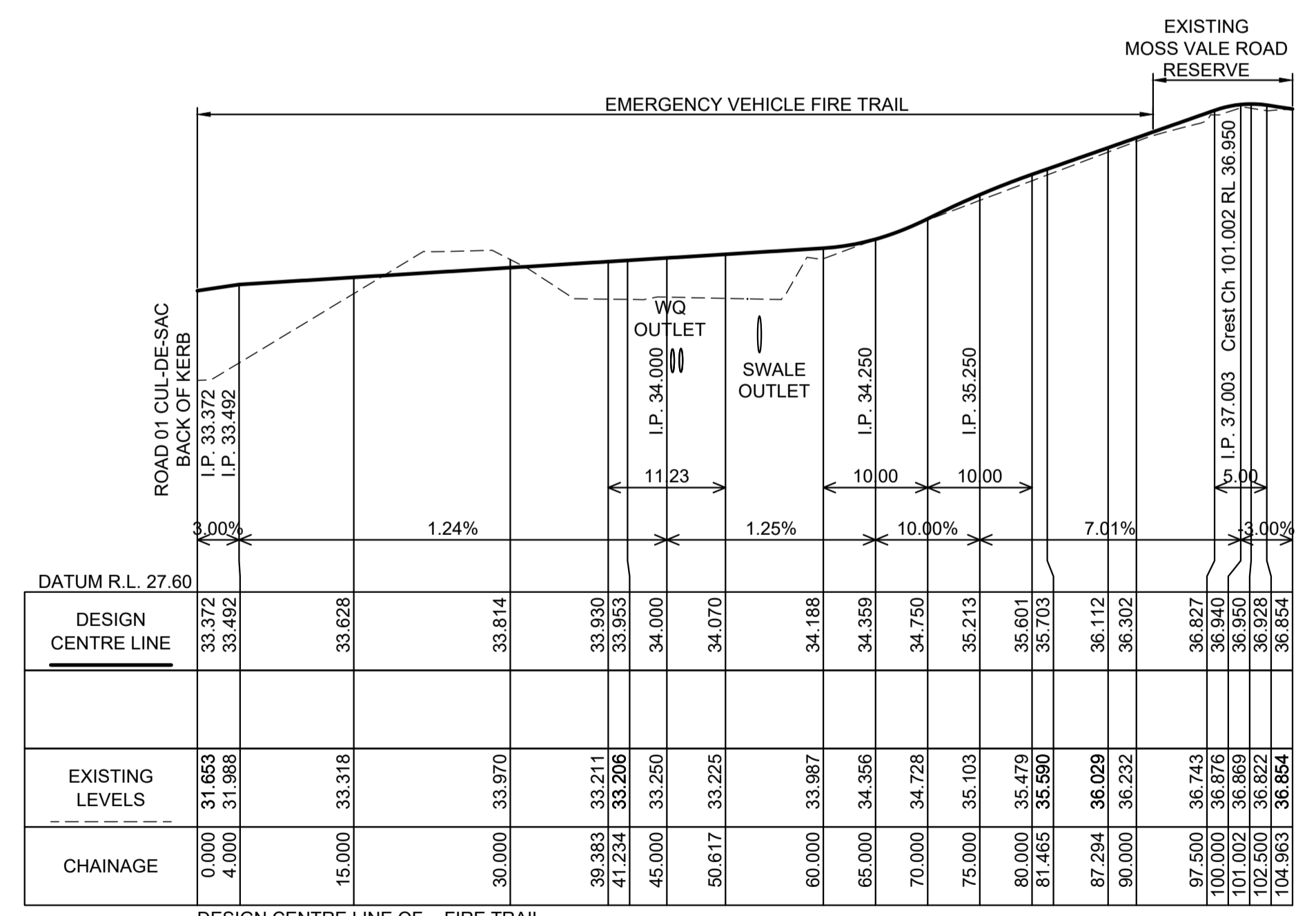
RATIO: AS NOTED (AT A1 ORIGINAL)	DATUM: AUSTRALIAN HEIGHT DATUM	SURVEY	APS	REV	DESCRIPTION	BY	DATE	<p>allen price & scarratts pty ltd land and development consultants Nowra Office: 75 Plunkett Street, Nowra NSW 2541 Kiama Office: 1/28 Bong Bong Street, Kiama NSW 2533 phone: (02) 4421 6544 consultants@allenprice.com.au www.allenprice.com.au</p>	CONCEPT INTERSECTION TREATMENT PLAN PROPOSED SUBDIVISION OVER LOT129 DP3060 LOT110 DP131219 & LOT1 DP520502 AT 25 MOSS VALE ROAD, BOMADERRY FOR SOUTHERN CROSS HOUSING	DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
	ORIGIN: PM15204 RL52.718	DESIGN CEG		P9 P10	LOT LAYOUT AMENDED WATER SWALE ADDED CUL-DE-SAC ADDED + CURVES WIDENED	CEG	06.06.2022 27.07.2022			DRAWING NUMBER N27790-403
DATE OF PLAN: JUNE 2020		DRAWN CEG		P3 P4	INTERSECTION UPDATED INTERSECTION UPDATED	CJG	07.04.2021 26.07.2021			
		CHECK'D RH		P5 P6 P7 P8	INTERSECTION UPDATED INTERSECTION UPDATED INTERSECTION UPDATED	CJG	17.09.2021 05.11.2021 17.11.2021 29.03.2022			



DESIGN CENTRE LINE OF - ROAD 01
 SCALES: H: 1 IN 500 V: 1 IN 100
 ROAD 01



DESIGN CENTRE LINE OF - ROAD 01
 SCALES: H: 1 IN 500 V: 1 IN 100
 ROAD 01



DESIGN CENTRE LINE OF - FIRE TRAIL
 SCALES: H: 1 IN 500 V: 1 IN 100
 BUSHFIRE ACCESS

BEWARE!
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RATIO:
AS SHOWN
 (AT A1 ORIGINAL)

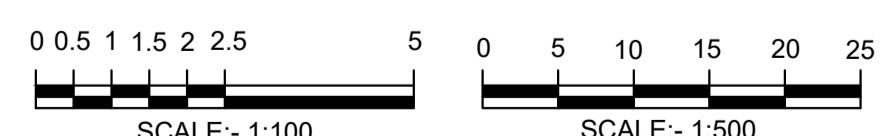
DATUM:
 AUSTRALIAN HEIGHT DATUM
 ORIGIN: PM15204
 RL52.718
 DATE OF PLAN: JUNE 2020

SURVEY	APS	REV	DESCRIPTION	BY	DATE
DESIGN	CEG	P1	FOR DA APPROVAL	CEG	29.06.2020
DRAWN	CEG	P2	LOT LAYOUT AMENDED	CEG	03.11.2020
CHECK'D	RH	P3	CUL-DE-SAC ADDED + CURVES WIDENED	CEG	07.04.2021
		P4	ROAD LOWERED TO REDUCE FILL	CEG	19.08.2021
		P5	MINOR LENGTH CHANGES TO LONG SECTION	CJG	17.09.2021
		P6	LOT LAYOUT AMENDED	CEG	06.06.2022
		P7	WATER QUALITY AMENDED	CEG	27.07.2022

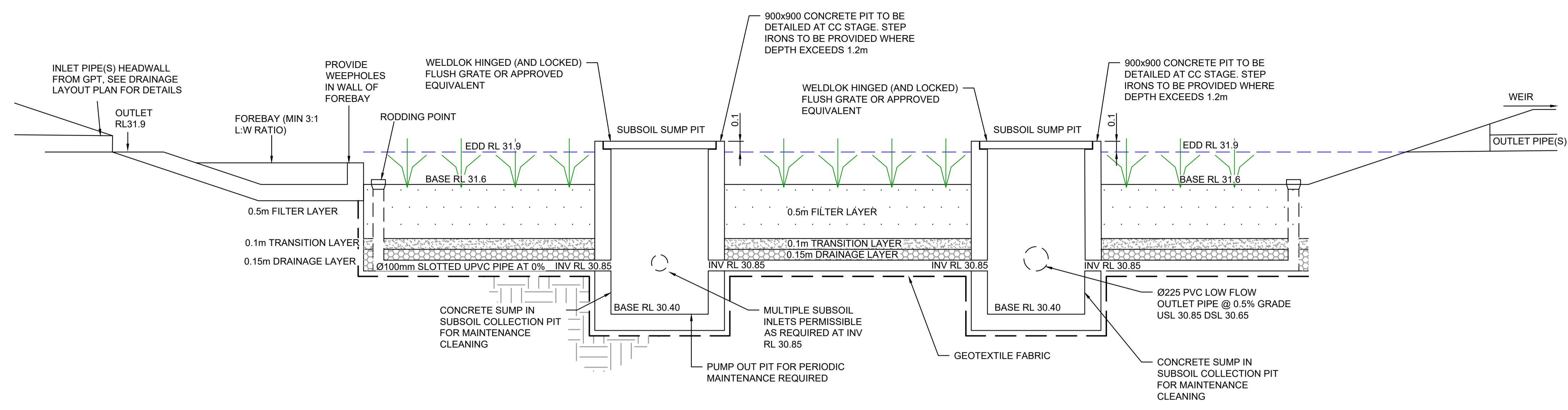
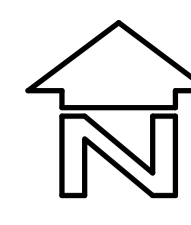
allen price & scarratts pty ltd
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 phone: (02) 4421 6544
 consultants@allenprice.com.au www.allenprice.com.au

ROAD 01 LONGITUDINAL SECTION
PROPOSED SUBDIVISION
OVER LOT129 DP3060 LOT110 DP131219 & LOT1 DP520502
AT 25 MOSS VALE ROAD, BOMADERRY
FOR SOUTHERN CROSS HOUSING

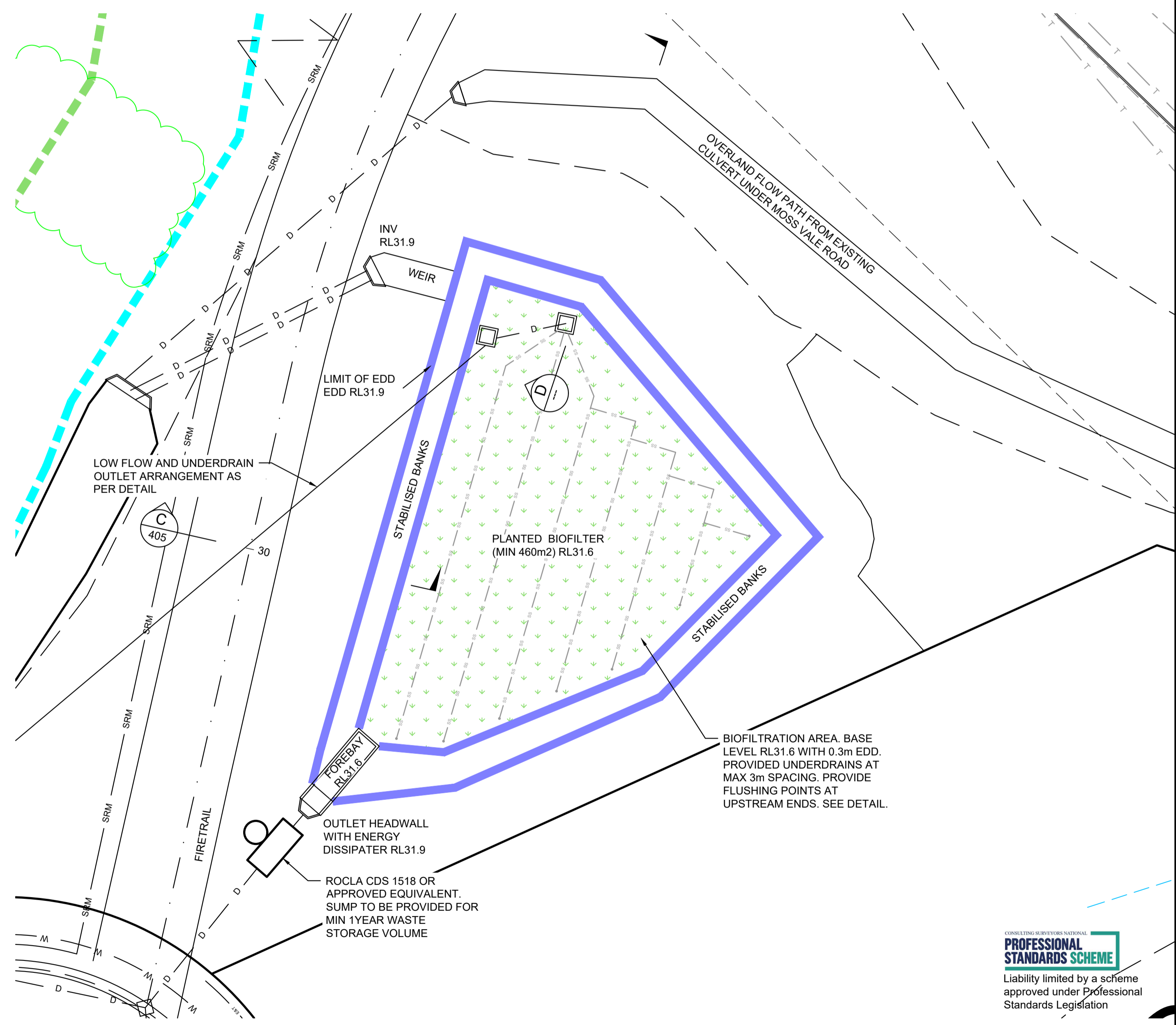
DRAWING STATUS
PRELIMINARY
 NOT TO BE USED FOR CONSTRUCTION PURPOSES
 DRAWING NUMBER
N27790-404
 SHEET **4** OF **6** REVISION **P7**



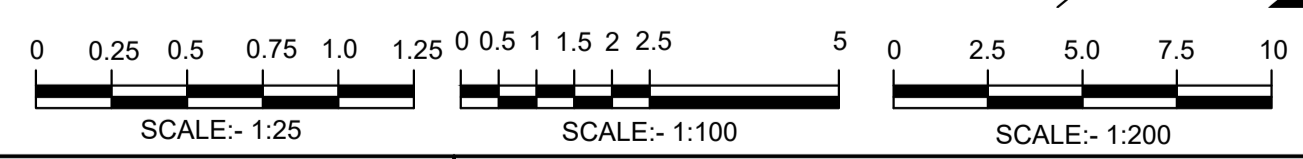
M:\Projects\2000\2700\06\N27790-Drawings\N27790-404.dwg



TYPICAL BIOFILTER DETAILS
SCALE 1:25



TYPICAL BIOFILTER LAYOUT PLAN
SCALE 1:200



- BIO-BASIN PARAMETERS:**
- extended detention depth 300mm
 - surface area 666m²
 - filter area 460m²
 - basin is lined
 - saturated hydraulic conductivity 100mm/hr for modelling - specify 250mm/hr for construction
 - filter depth 500mm
 - vegetated with effective nutrient removal plants
 - overflow weir 2m
 - has underdrain
 - no carbon

BIOFILTER SPECIFICATION

MEDIA SPECIFICATION

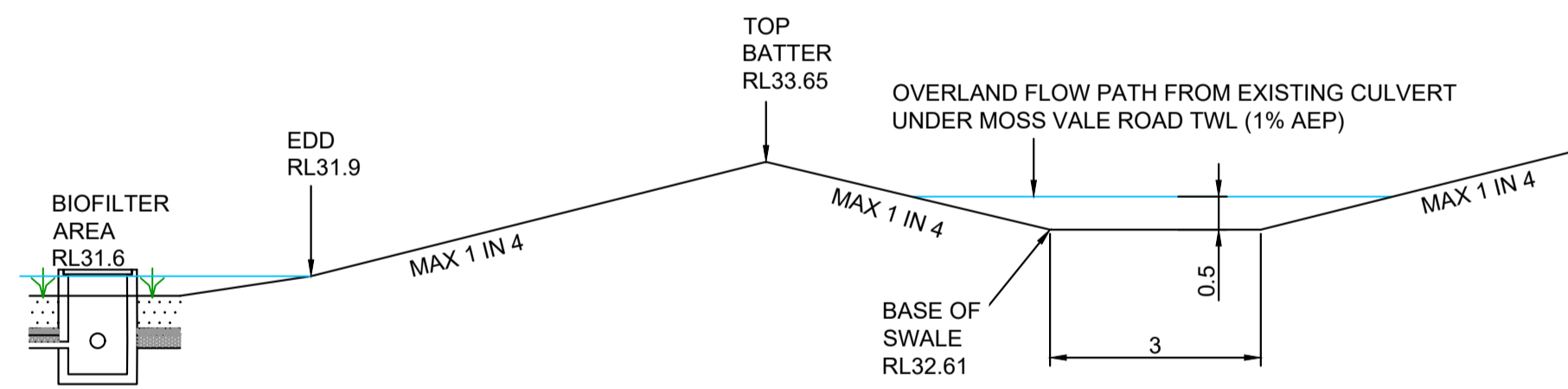
- THE BIOFILTRATION FILTER MEDIA IS TO BE A SANDY LOAM WITH THE FOLLOWING CRITERIA:
- SHALL HAVE A SATURATED HYDRAULIC CONDUCTIVITY 250mm/hr.
 - TYPICAL PARTICLES SIZE ANALYSIS:
 VERY COARSE +1mm MAX 60%
 MED SAND 0.25-1mm MIN 60%
 FINE SAND 0.106-0.25mm MAX 20%
 VERY FINE <0.053mm MAX 10%
 - SHALL BE BETWEEN 3-5% ORGANIC CONTENT, MEASURED IN ACCORDANCE WITH AS1289 4.1.1.
 - pH TO BE 7.0-7.2
 - MATERIAL IS TO BE NON-DISPERSIVE

PLANT SPECIFICATION

- 50% OF SPECIES TO BE EFFECTIVE NUTRIENT REMOVAL FROM FOLLOWING LIST (OR AS SPECIFIED ON THE LANDSCAPE PLAN, BY OTHERS):
 a. *Carex appressa*
 b. *Metelucis ericifolia*
 c. *Goodenia ovata*
 d. *Ficinia nodosa*
 e. *Juncus amabilis*
 f. *Juncus flavidus*
- MIN PLANTING DENSITY 10 PLANTS/m² FOR SEDGES AND RUSHES AND <1 PLANT/m² FOR SHRUBS AND TREES

MULCH

- JUTEMAT OR SIMILAR ON BED AND TURF OR JUTEMAT & ADDITIONAL PLANTINGS ON BANKS.
- LOOSE ORGANIC MULCH IS NOT TO BE USED



SECTION D
SCALE 1:100

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AS SHOWN
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AUSTRALIAN HEIGHT DATUM
ORIGIN: PM15204
RL52.718
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		P4	WATER QUALITY AMENDED	CEG	13.07.2022
		P5	WATER QUALITY AMENDED	CEG	27.07.2022
		P6	WATER QUALITY ADDITIONAL DETAILS	CEG	01.08.2022

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WATER QUALITY DETAILS
PROPOSED SUBDIVISION
OVER LOT129 DP3060 LOT110 DP131219 & LOT1 DP520502
AT 25 MOSS VALE ROAD, BOMADERRY
FOR SOUTHERN CROSS HOUSING

DRAWING STATUS PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES	
DRAWING NUMBER N27790-406	SHEET 6 OF 6 REVISION P6

Appendix B – ROCLA CDS Product Details



**CDS®
SEPARATOR**



CD 3030 SCO
14500 KG MAX

131 004
rocla.com.au

CDS® SEPARATOR

CDS® Separator are designed to capture and retain gross pollutants, litter, grit, sediments and associated oils, utilising patented CDS® indirect screening technology.

Rocla offers a complete design service for CDS® products that takes into account the catchment's characteristics, pollution load, hydraulic site constraints and opportunities, system capacities, velocity, backwater, as well as the location of services and access for cleaning.

Hydraulic reports are available on request and are automatically carried out for larger units.

CHARACTERISTICS

- Non-blocking functionality
- 95% capture of gross pollutants >1mm
- 95% sediment capture >200µm
- Captures organics and oils
- Captures adsorbed toxics and nutrients
- Can treat any pipe or multiple pipes
- Various sump sizes available
- Customised bypass requirements
- Underground - small footprint
- Easy installation
- No moving parts
- Lowest life cycle costs
- More water treated than comparable treatment designs
- Pollutants stored in the sump, not the screens

BENEFITS

- Subdivisions and roads
- Residential, commercial and industrial developments
- Car parks and shopping centres
- Pre-treatment for wetlands
- Pre-treatment for reuse applications
- Pipes, channels, culverts and creeks

Other CDS® models are available for non-stormwater applications involving high flow solids/ liquids separation, such as industrial processes and sewer overflows.



CDS® CONTINUOUS DEFLECTIVE SEPARATION

The CDS® Separator utilises the energy of the inflow to create a vortex flow regime within the CDS® screening chamber.

The CDS® Separator simply creates a whirlpool that draws all the deflected and settling pollutants to the centre of the screening chamber where they fall out into the storage sump below.

The pollutant storage sump located below the screening chamber allows pollutants to be removed from the flow path and away from the screens, thus maintaining a reliable treatment efficiency.

The unique CDS® technology is the most reliable way to effectively and efficiently treat gross pollutants in stormwater drainage systems.

One of the leading storm water traps

CDS® UNIT MODELS

The size and type of CDS® separator required depends on catchment area, flows, pollution loads, performance requirements, maintenance method, hydraulic limitations and site constraints.

Visit the Rocla website for a sizing request form. Details submitted with this form provide all the information needed to calculate the size of device most applicable for the site.

CDS® Separator Model No. ⁴	Overall Dia ¹ (mm)	Treatment ³ Flow (L/s)	Weir Height ² (mm)	Minimum DTI ⁵ (mm)
Nipper 0506	1300	20-22	300	1035
CDS 0708	1750	50-55	400	1105
CDS 0708Maxi	2600	50-55	400	1185
CDS 1009	1950	100-110	500	1610
CDS 1012	1950	140-150	600	1610
CDS 1015	1950	180-200	700	1610
CDS 1512	2600	220-250	650	1610
CDS 1518	2600	350-400	800	1610
CDS 2018	3400	500-600	900	1610
CDS 2028	3400	800-900	1100	1610
CDS 3018	5000	800-900	900	1610
CDS 3024	5000	1250-1400	1000	1610
CDS 3030	5000	1750-1900	1200	1800

1: Excludes Diversion Chamber except for models 0506, 0708 & 0708M

2: Measured from outlet invert with no tailwater

3: CDS treatment flows are indicative only

4: Model sizing is undertaken independently from the bypass hydraulics of the diversion chamber

5: In most cases minimum DTI is determined by diversion chamber depth

CDS® SEPARATOR PERFORMANCE

Gross Pollutant Removal	98% (>3mm)
Sediments Capture	>80% (>75µm)
TSS Removal	>70% (d ₅₀ = 106µm)
Total Phosphorous (TP) Removal	>30% (at 70% TSS removal)
Hydrocarbon Capture	80-90% 'at typical stormwater concentrations for free oil

MAINTAINING CDS® SEPARATOR

The CDS® Separator has the lowest life-cycle costs due to its non-blocking functionality, large off-line storage and multiple cleaning options. There are 3 methods of emptying CDS® Separators:

- Removable basket
- Material grab
- Suction method

With no requirement to unblock screens, confined space entry is minimised. Large off-line sump volumes (up to 10m³ available) also minimise cleaning frequency.

CDS® CONTINUOUS DEFLECTIVE SEPARATION

It has long been acknowledged that best management practice for stormwater pollutant traps involves locating the devices off-line.

- GPTs located on-line suffer badly from turbulence and eddies, often resulting in the re-suspension and loss of previously captured pollutants.
- GPTs which store pollution in the screening area suffer decreasing screen area and therefore decreasing flow rates, as they fill up.
- GPTs which function by direct filtration have a treatable flow rate decay that is proportional to the percentage of screen blockage.
- GPTs that utilise a vortex only, without a screen, cannot guarantee neutrally buoyant pollution removal.

Only CDS® Separators combine the advantages of being off-line, having non-blocking functionality, vortex forces and storing pollution outside the screening area. For these reasons, no other device is “equivalent” to a CDS® Separator.

DIVERSION CHAMBER

Precast diversion chambers can be manufactured to suit most typical installations, or chambers can be tailored to meet the hydraulic limitations of the site.

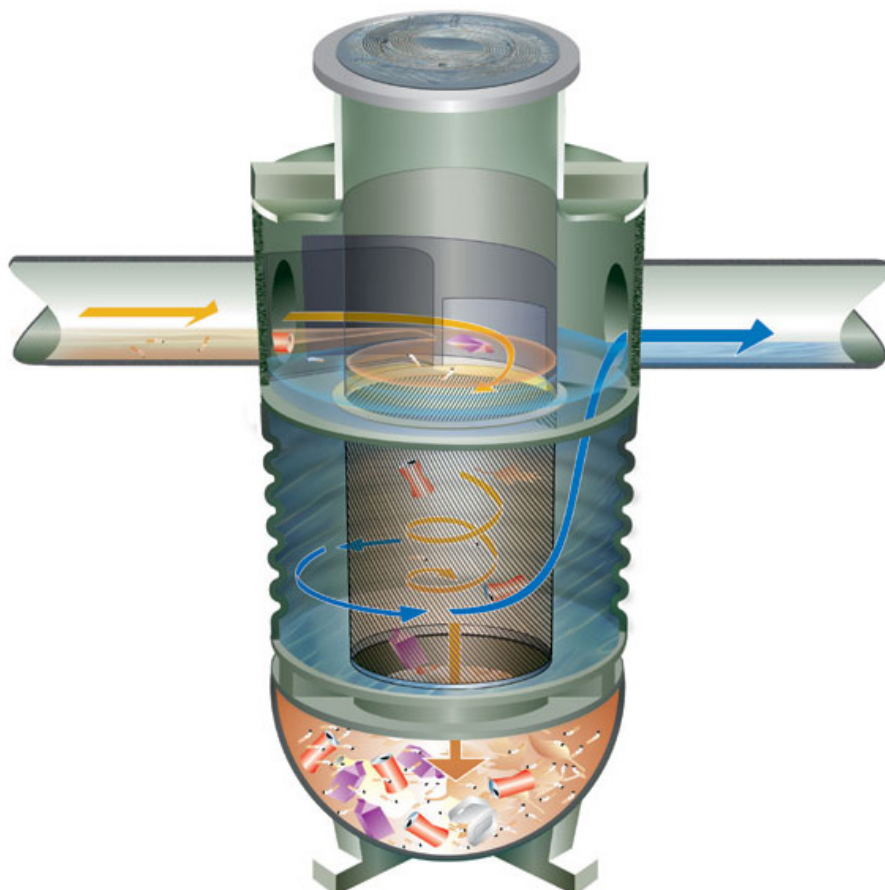
The diversion chamber has the capacity to cater for the highest possible flow in the stormwater system. The chamber is configured on the assumption that the CDS® Separator has not been maintained and there is no flow passing through the unit.

A weir is located within the diversion chamber to create a driving head and direct the majority of flows into the CDS® GPT.

CHAMBER OPTIONS

The CDS® Separator and diversion chamber design depends on the system capacity and site constraints. Rocla will design the most suitable CDS® Separator configuration to meet project requirements.

- Precast diversion chambers
- Semi-precaster diversion chambers
- Customised designs for multiple pipes, drops and bends
- In-situ channel designs
- Fixed or collapsible weirs
- Any flow capacity
- No flooding





CDS® 0506 Separator

The PL0506 in-line CDS® Unit, known as the Nipper, is the smallest in the CDS® range of gross pollutant traps. It provides the fully proven performance of CDS® Separators in a pint-sized polymer unit.

The Nipper is ideally suited for installation at the collection source in small catchment areas of less than a hectare and is designed to remove gross pollutants, organic waste, silt, sediment and oils.

Manufactured from strong, lightweight polymer material, the CDS® 0506 is delivered to site in one piece, making it easy to install and cost-effective.

CDS® 0506 PERFORMANCE

Pipe Flows	Treatment 25 L/s Max 150 L/S
Gross Pollutant Removal	98% (>3mm)
Sediments Capture	>80% (>75µm)
TSS Removal	>70% ($d_{50} = 106\mu\text{m}$)
Total Phosphorous (TP) Removal	>30% (at 70% TSS removal)
Hydrocarbon Capture	80-90% 'at typical stormwater concentrations for free oil
Free Oil Storage Capacity	150 litres

PRODUCT APPLICATION DESIGN (PAD) SERVICES

Rocla offers a full design and drafting service in support of its water quality products, including the CDS® separator.

These service are available to all customers. To see how Rocla can assist you with your water sensitive urban design (WSUD) solutions please visit the Rocla website or call your local sales representative on 131 004.

SPECIFICATIONS

Storage

- 0.72 cubic metres

Weight

- 140 kilograms

Footprint

- 1050mm diameter

Material

- High density polyethylene

Treatment

- Self-cleaning screens, vortex and gravity

Screens

- 2.4mm stainless steel

Inlet Size

- Up to 375mm diameter

APPLICATIONS

- Small subdivisions
- Bus and train stations
- Pre-screening bio- retention systems
- Pre-screening construction wetlands
- Packaging warehouses
- Roadside drains
- Car parks



For more
information
call Rocla on
131 004 or visit
rocла.com.au

CONCRETE PRODUCTS | PIPE | ENGINEERING CAPABILITY



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Before application in a particular situation, Rocla recommends that you obtain appropriate independent qualified expert advice confirming the suitability of product(s) and information in question for the application proposed.

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