Water Cycle Management Study

For Proposed Rezoning of Part Lot 4 DP 834254, 510 Beach Road, Berry

Prepared by: Mark Passfield

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8th October 2015

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Document Certification

This report has been developed based on agreed requirements as understood by SEEC at the time of investigation. It applies only to a specific task on the nominated lands. Other interpretations should not be made, including changes in scale or application to other projects.
Any recommendations contained in this report are based on an honest appraisal of the opportunities and constraints that existed at the site at the time of investigation, subject to the limited scope and resources available. Within the confines of the above statements and to the best of my knowledge, this report does not contain any incomplete or misleading information.

Mark Passfield
SEEC

8th October 2015

Document Table

Issue Number	By	Reviewed by	Date
DRAFT1	MP	NL	29th June 2015
DRAFT 2	MP	Client	13th July 13, 2015
DRAFT 3	MP	Client	25th September 2015
FINAL	MP	Client	8th October 2015

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1 INTRODUCTION

SEEC have been commissioned by Mr. and Mrs. Hall owners of Lot 4 DP 834254 (Figure 1) to prepare this Water Cycle Management Study. It is required to accompany an application to re-zone part of their property from RU1 (Primary Production) to RU5 (Large Lot (rural) Residential).

This WCMS includes:

(i) An investigation into the existing water cycle;

(ii) An assessment of how the proposed development might affect the management of the water cycle;

(iii) A conceptual plan for managing the water cycle to achieve a neutral or beneficial effect (NorBE) on the quality of water leaving the site.

SEEC staff inspected the site on 5th May 2015. Weather on that day was cool and dry but the ground was wet following significant recent rainfall.

Figure 1 - Site Location

2 PROJECT DESCRIPTION

It is proposed to re-zone part of Lot 4 DP 834254 from RU1 (Primary Production) to RU5 (Large Lot Residential). A conceptual subdivision plan has been prepared by JMD Development Consultants and is shown in **Figure 2**. Conceptually there would be 46 residential lots between 0.3 ha and 5 ha. All those lots would be rural residential in nature, similar to neighbouring land to the west and the east (**Figure 1**). All the residential lots would require onsite wastewater management and rainwater tanks to supply potable water.

A road network would provide access to all residential lots. It would have an 8 to 9 m wide sealed pavement within an 18 m wide corridor and it would have a total length of about 1,800 m. The road would drain to grassed table drains (swales), similar to neighbouring land to the east and west.

The conservation zone would be provided for a distance of about 110 m from Coomenderry Swamp. It would be contained on conceptual Lot 47. The conservation zone would be excluded from livestock and might be planted with native vegetation.

Figure 2 - Conceptual Subdivision

3 THE SITE

3.1 General Conditions

Lot 4 is a large rural property almost entirely covered with pasture grass. At the time of inspection it was used to graze cattle but in the past it has been used as a dairy farm. Minor remnant native vegetation occurs in parts but generally the land has been cleared. Aerial photography from 1945 shows the site has been in a similar condition since that time.

A farm house and associated sheds are located in the northwest part of the site, on Conceptual Lot 40. The house is serviced by a septic tank to absorption bed located to the northwest and by a greywater trench located just to the east. **Figure 3** shows the typical conditions across the site.

Figure 3 - Conceptual Lot 46 looking south approximately along the alignment of the depression

3.2 Topography and Drainage

Total relief is about 20 m and much of the land slopes at about 10 – 15%. A ridge divides the site into those lands that drain to Coomenderry Swamp and those lands that don't. To the southwest lies Coomenderry Swamp which is a SEPP14 Wetland. Approximately 21.6 ha of the lot is Coomenderry Swamp itself but that will not be changed. Approximately 24.7 ha of the site drains to the swamp (including Lot 47 which is 5.7ha), the remaining 28.5 ha drains towards Beach Road.

Drainage on the main southwest-facing slope is by sheet flow, there are no defined drainage depressions there. Drainage on most of the northeast-facing slope is via a broad depression which feeds two existing farm dams. A contour bank also feeds the northern-most of these dams. Although the depression is shown as a blue line on the Gerroa 1:25,000 topographic map, it does not have defined bed and banks (**Figure 3**) and so is not a watercourse requiring a controlled activity permit. On the map it is shown to discontinue north of Beach Road. A third small dam is located in the far northwest. It is by-passed by the depression which drains just to its east and then along the site boundary with Beach Road. Finally, the depression drains under Beach Road through a culvert. A small portion of the far northeast of the site drains under Beach Road by another culvert, which drains into a dam on a separate property.

3.3 Climate

The area has a warm temperate climate with summer-dominated rainfall. Nearby Berry has a mean annual rainfall of 1,423 mm and nearby Kiama has a mean 97 wet days a year. Pan evaporation is relatively high (approximately 1,671 mm/year measured at Nowra RAN station).

3.4 Soils

According to mapping by The Department of Conservation and Land Management (Hazleton P.A., 1992) the site has three soil landscapes (**Figure 4**):

- The Coolangatta Soil Landscape which is a residual soil landscape and occupies most of that part of the site to be developed;
- The Shoalhaven Soil Landscape which is an alluvial soil landscape in the far northwest of the site; and
- The Seven Mile Soil Landscape which is an estuarine soil landscape and occurs in the south.

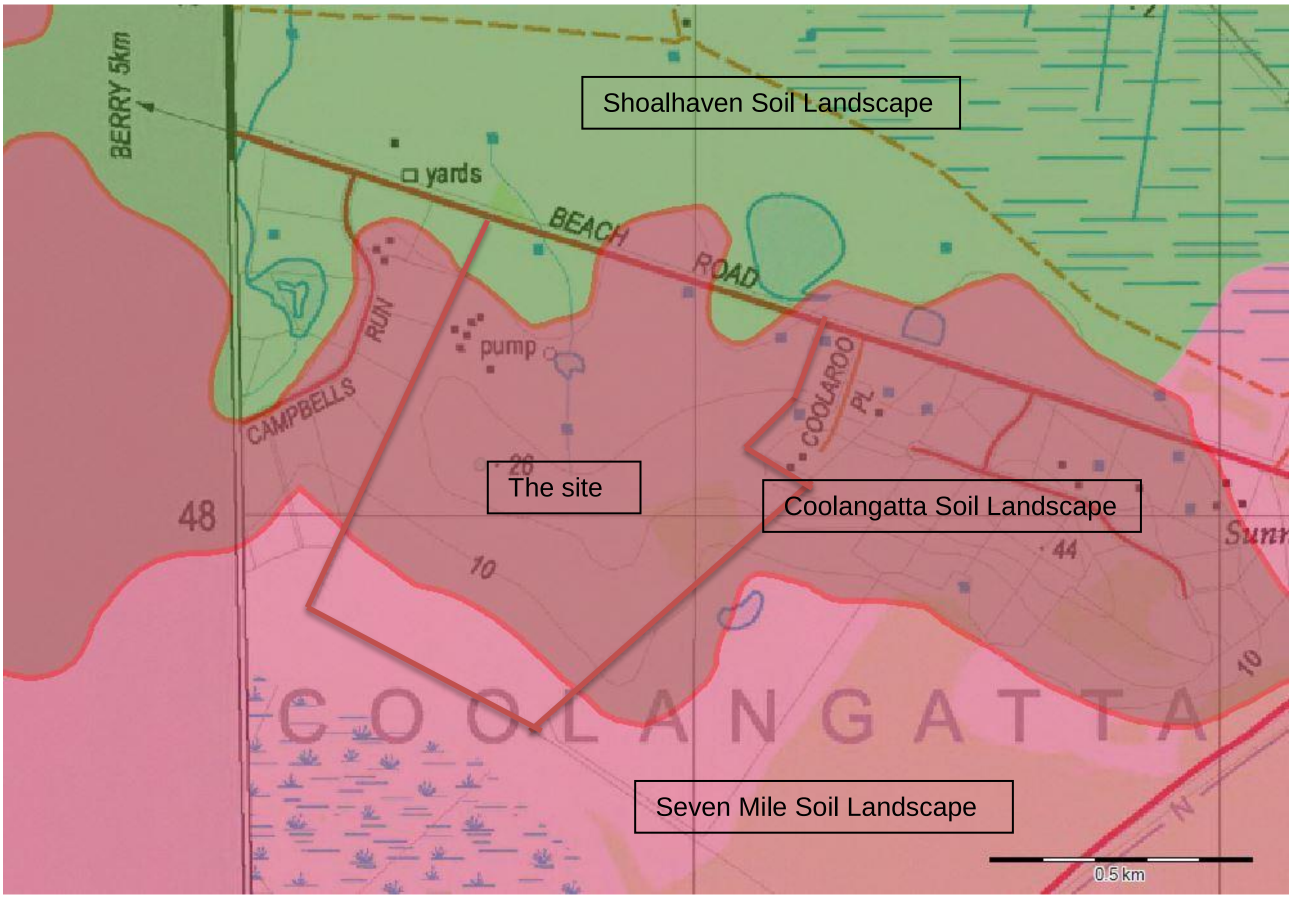

Figure 4 - Soil Landscape Mapping

A site specific soil investigation was undertaken by SEEC. A series of soil bores were taken where shown in **Figure 5.** The results of that investigation suggest the extent of the Shoalhaven Soil Landscape in the far northwest is smaller than mapped; the Coolongatta Soil Landscape was present in this area too. Lands in the far south will not be developed and so were not investigated. All soil cores were taken on the Coolongatta Soil Landscape. The following soil profiles were observed:

Borehole 1:

0-200	Dark brown strongly pedal loam
200-400	Dark brown moderately pedal clay loam, sandy
400-900+	Light brown sandy clay loam with 10% fragments

Borehole 2:

0-150	Dark brown strongly pedal loam, saturated
150-600	Grey, weakly pedal, fine sandy clay loam to light clay
600-800	Mottled grey and orange brown sandy clay loam to light clay
800+	Bedrock (sandstone)

Borehole 3:

0-300	Dark brown strongly pedal loam
300-800	Dark brown moderately pedal clay loam to light clay, sandy
800-1,000	Dark brown moderately pedal clay loam, sandy with fragments
1,000+	Shale

Borehole 4:

0-200	Grey-brown loam
200-500	Brown light clay, moderately pedal
500-900	Mottled grey and orange medium clay, weakly pedal
900+	Shale

Borehole 5

0-100	Grey clay loam, weakly pedal
100-450	Grey mottled orange clay loam, moderately pedal
450-900	Grey mottled orange light to medium clay
900+	Shale

Figure 5 - Soil Core Locations

Soils were sent to NSW Department of Lands' Scone Research Laboratory and tested for a suite of effluent-disposal related tests. Topsoil and subsoil from BH2 and BH3 were composited separately and tested to give an indication of the average results. The results are given in **Table 1**. In summary, the boreholes and soil testing showed the soils at this site:

(i) Are consistently about 800 mm to 1,000 mm deep;

(ii) Are moderately drained on the crest and higher side slopes but less well drained on footslopes where grey mottling occurs in the clay subsoil (*Minor to Moderate Limitation*[1]);

(iii) Are slightly acidic, although this doesn't seem to affect grass growth (*Moderate Limitation*);

(iv) Are not saline (*Minor Limitation*);

(v) Are not sodic (*Minor Limitation*);

(vi) Are not significantly dispersive in the subsoil (EAT Class 2(1) *(Moderate Limitation);*

(vii) Have moderate potential to sorb phosphorous *(Moderate Limitation);*

(viii) Have a moderate cation exchange capacity (about 20 cmol(+)/kg) *(Minor Limitation)*.

Table 1 - Laboratory Soil Test results

Lab No	Method	C1A/5	C2A/4	C2B/4	C5A/4 CEC & exchangeable cations (cmol (+)/ kg)						C8B/1	P9B/2	
	Sample Id	EC (dS/m)	pH	pH ($CaCl_2$)	CEC	Na	K	Ca	Mg	Al	P sorp (mg/kg)	EAT	Texture
1	15000106 BH 2 100 cm & 15000106 BH 3 100 cm	0.05	6.5	5.1	18.8	0.3	1.8	5.4	4.6	<0.5	290	8	Loam
2	15000106 BH 2 600 cm & 15000106 BH 3 500 cm	0.01	6.0	4.6	20.3	0.9	0.2	3.3	8.4	1.1	450	2(1)	Light clay

END OF TEST REPORT

[1] Limitations are those described in DLG (1998)

4 Land Surface Changes

4.1 Subdivision Stage

4.1.1 Introduction

For the purpose of stormwater modelling (Section 6) the site is divided into lands that drain to Coomenderry Swamp and lands that drain to Beach Road. The following land surface changes would occur when the subdivision works are done.

4.1.2 Lands that drain to Coomenderry Swamp

- Approximately 18.1 ha of land that is currently agricultural lands would become rural residential land (Part of Lot 14, Lot 15 and Lots 30 to 36).
- Approximately 5.7 ha of land that is currently agricultural lands would become a conservation zone (Lot 47).
- A perimeter fire trail is required but it would be formed of a compacted gravel base covered with a thin veneer of vegetation. Therefore, it would not represent an impervious surface.

4.1.3 Lands that don't drain to Beach Road

- Approximately 29.7 ha of land that is currently agricultural lands would become rural residential land, including the roads.
- A new sealed road network would be built to provide access to each new lot. It would have an 8 to 9 m wide sealed pavement in an 18 m wide corridor. The total area of the road corridors would be approximately 3.24 ha. It would be entirely built to drain east, towards Beach Road, and so away from Coomenderry Swamp. It would drain to grassed swale drains, similar to the development just to the north.
- The two dams on the north-facing slope would be removed.

4.2 Dwelling Stage (Future DAs)

Once the lots are developed there would be a slight increase in impervious surfaces (roofs, paving and driveways) on each lot. However, as the lots are large, and it would be permissible to manage stormwater in absorption trenches, the connectivity of these impervious surfaces to the stormwater drainage system would be minimal. CMA (2010) recommends the *effective* imperviousness[2] of these lots be taken as 5% for modelling purposes (Section 6).

[2] i.e. the percentage of impervious surfaces that would be directly connected to the stormwater drainage system

5 Onsite Wastewater

5.1 Introduction

The site will not be connected to sewer and so wastewater generated in each new home would be managed on each lot. Many of the lots would be unconstrained for wastewater management and the soils across the site are reasonably well suited to disposal of secondary treated effluent by either irrigation or absorption. However, required buffers to various drainage features would constrain some lots:

- Some lots would be located adjacent to a north-south orientated access road which would follow the alignment of the former depression. Here a 40 m buffer would be required between any future Effluent Management Area and the new table drains;
- Some lots would be constrained by the east-west access roads' upslope table drains. A 40 m buffer would be required;
- Conceptual Lots 45 and 46 would be constrained by low lying, periodically saturated land and the presence of a drainage line which passes under Beach Road via a culvert. A 100 m buffer is recommended between any future Effluent Management Area and that culvert.

These constraints are shown on **Figure 6**.

5.2 Conceptual Design

5.2.1 Introduction

For the purpose of this early assessment, it is assumed irrigation would be adopted for wastewater disposal. Slope gradients and the reasonably wet climate both dictate that subsurface irrigation must be adopted on all lots. In addition it is assumed wet weather storage is not desired as it is difficult to manage. Assuming a five-bedroom home on tank water supply, the design load is approximately 900 L/day.

5.2.2 Nutrient Balances

Assuming irrigation occurs under poorly managed lawns[3], to balance the input and uptake of nutrients an EMA of 830 m^2 would be required for a design life of 50 years (**Table 2**).

5.2.3 Hydraulic Balance

Council's Chapter 8 in their DCP requires a monthly water balance to be done. The hydraulic inputs are retained median rainfall (i.e. median rainfall less an allowance for

[3] The estimated plant nutrient uptakes would be 32.5 mg/m^2 and 3.25 mg/m^2 for nitrogen and phosphorous respectively (SCA, 2012). The insitu soil phosphorous sorption is estimated at 1861 kg/ha.

run-off) and applied effluent. Outputs are evapotranspiration (taken as pan evaporation multiplied by a crop factor which varies through the year) and percolation (the ability of the soil to absorb water). Median rainfall and pan evaporation values are taken from Council's DCP No. 78.

The balance is given in **Table 3**. If 900 liters is applied over 830 m^2 the calculated required percolation rate so that wet weather storage is not required is 1.8 mm/day. This is far lower than the percolation rate for moderately structured light clay which is 10 mm/day (AS/NZS1547:2012)[4].

Therefore, for the purpose of this assessment **Figure 6** shows an 830 m^2 EMA located on the constrained lots after considering required buffer distances (measured in the direction of overland flow) to drainage lines (including road drainage) and boundaries. The other lots would be unconstrained for wastewater management and so no specific effluent management area needs to be identified on them.

[4] Note that the percolation rate is the same as the Design Loading Rate (DLR) for trenches and beds. It is NOT the same as the Design Irrigation Rate (DIR).

Table 2- Nutrient Balances

Wastewater Volume 900 (L/day)

NOTE: The area required to uptake nutrients varies on what vegetation is adopted in the EMA.

Vegetation in EMA **Lawn - Unmanaged**

Nitrogen Balances
A = (C x Q) / Lx
Where:
A = Land Area (m2)

C = Concentration of Nutrient =	30	mg/L
Q = Wastewater Flow =	900	L/day
Lx = Critical Loading Rate =	32.5	(mg/m^2/day)

A = 831 m^2 of subsurface irrigation under Lawn - Unmanaged

Phosphorus Balances
Step 1: P Sorption Calculation

Psorb (topsoil)	loam	290	mg/kg
Psorb (subsoil)	clay	450	mg/kg
Bulk Density (topsoil)	loam	1500	kg/m3
Thickness (topsoil)		200	mm
Coarse Frags (topsoil)		0	%
Bulk Density (subsoil)	clay	1300	kg/m3
Thickness (subsoil)		800	mm
Coarse Frags (subsoil)		5	%
Calculated Psorb (topsoil)		870	kg/ha
Calculated Psorb (subsoil)		4446	kg/ha
Assumed P-sorb		1861	kg/ha (insitu P-sorb is 35% calculated P-sorb)

Step 2: Determine the required area to sorb phorphorus (50 year design life) :

P absorbed	= 5316	x 0.35
	= 1861	kg/ha
	= 0.19	kg/m2
P uptake	= 3.25	mg/m2/day

Determine the amount of phosphorus generated over that time:

Concentration of phosphorus =	12	mg/L
Phosphorus generated = Concentration x volume of wastewater =	197.1	kg

Area Required:
P generated / (P sorbed + P uptake) = 803 m^2 of Lawn - Unmanaged

Figure 6 – Constraints to Effluent Management

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Table 3- Monthly Water Balance

Hydraulic Balance (DCP No.78)

Rainfall Station	Berry	
Evaporation Zone	Nowra	
Wastewater Load	900	**L/day**
Percolation Rate	1.8	**mm/day**
Land Area	830	**m^2**
Storage Required	0	**m^3**

Month	Days in month	Median Precipitation (mm)	Evaporation (mm)	Crop Factor
Jan	31	99.8	194.4	0.8
Feb	28	108.7	161.1	0.8
Mar	31	116.2	144.6	0.8
Apr	30	98.1	118.7	0.7
May	31	79.8	95	0.7
Jun	30	90.2	85.8	0.6
Jul	31	60	94.7	0.6
Aug	31	46.2	127.6	0.7
Sep	30	59.1	148.1	0.7
Oct	31	70.3	194.4	0.8
Nov	30	77.6	161.1	0.8
Dec	31	87.4	144.6	0.8

INPUTS

	Retained Rainfall (mm)	Effluent Irrigation (mm)	Total Inputs (mm)
Jan	79.84	33.61	113.45
Feb	86.96	30.36	117.32
Mar	92.96	33.61	126.57
Apr	78.48	32.53	111.01
May	63.84	33.61	97.45
Jun	72.16	32.53	104.69
Jul	48	33.61	81.61
Aug	36.96	33.61	70.57
Sep	47.28	32.53	79.81
Oct	56.24	33.61	89.85
Nov	62.08	32.53	94.61
Dec	69.92	33.61	103.53

OUTPUTS

	Evapotranspiration (mm)	Percolation (mm)	Outputs (mm)	Storage (mm)
Jan	155.52	55.80	211.32	-97.87
Feb	128.88	50.40	179.28	-61.96
Mar	115.68	55.80	171.48	-44.91
Apr	83.09	54.00	137.09	-26.08
May	66.5	55.80	122.30	-24.85
Jun	51.48	54.00	105.48	-0.79
Jul	56.82	55.80	112.62	-31.01
Aug	89.32	55.80	145.12	-74.55
Sep	103.67	54.00	157.67	-77.86
Oct	155.52	55.80	211.32	-121.47
Nov	128.88	54.00	182.88	-88.27
Dec	115.68	55.80	171.48	-67.95

6 Stormwater Quality Modelling

6.1 Introduction

The estimated Pre and post development sediment and pollutant loads are modelled using MUSIC (Model for Urban Stormwater Improvement Conceptualisation), developed by eWater. The model is appropriately calibrated as in **Tables 4, 5 and 6** and quantifies:

- The levels of the principal pollutants before and after development; and
- Changes in export levels because the development is there.

Statistics are produced in MUSIC for the following pollutants:

- TSS - Total Suspended Solids (kg/yr)
- TP - Total Phosphorus (kg/yr)
- TN - Total Nitrogen (kg/yr)
- Gross Pollutants (kg/yr)

Note however, that MUSIC's capability to model gross pollutants in semi-urban areas such as this is not good as their concentrations cannot be adjusted. Therefore, results for gross pollutants are not discussed.

6.2 Climate Calibration

Creation of a MUSIC catchment file requires an associated meteorological data file. CMA (2010) recommends using data obtained from the Bureau of Meteorology's pluviougraph rainfall station at Nowra for the period 1964 to 1970. However, that data has a mean annual rainfall value of just 874 mm (**Table 4**) and so is not suitable. Therefore, Nowra data from 1970 to 1975 was used as that has a higher mean annual rainfall (1,179 mm). This is considered close enough to be able to be calibrated to reflect the site's higher rainfall. Basic rainfall and evapotranspiration statistics are in **Table 5** and the time-series graph is in **Figure 7**.

Table 4 - Rainfall and PET statistics recommended by CMA (2010)

Meteorological Data Statistics

	Rainfall/6 Minutes	Evapo-Transpiration
mean	0.010	3.253
median	0.000	3.661
maximum	15.180	5.339
minimum	0.000	1.310
10 percentile	0.000	1.443
90 percentile	0.001	4.910

	Rainfall	Evapo-Transpiration
mean annual	874	1188

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Table 5 - Rainfall and PET statistics adopted

Meteorological Data Statistics

	Rainfall/6 Minutes	Evapo-Transpiration
mean	0.014	3.491
median	0.000	2.820
maximum	15.180	6.290
minimum	0.000	1.110
10 percentile	0.000	1.190
90 percentile	0.001	6.100

	Rainfall	Evapo-Transpiration
mean annual	1191	1275

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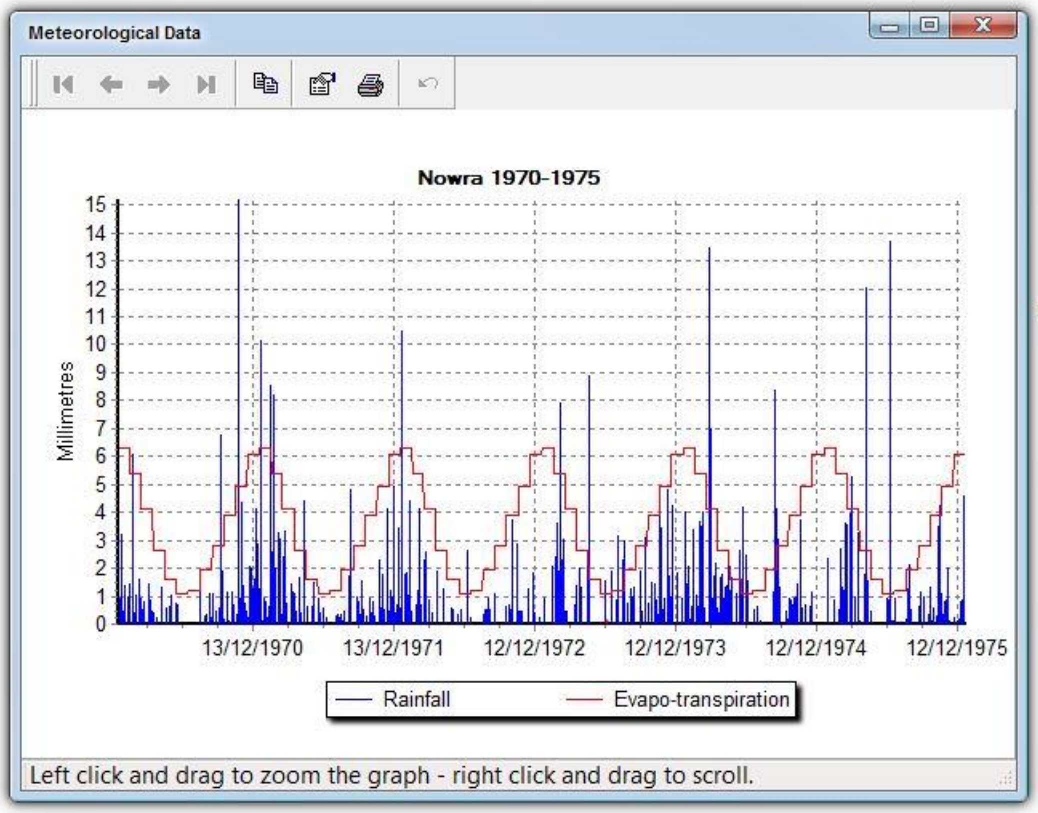

Figure 7 - Rainfall and PET Statistics

6.2.1 Node Calibration

Table 6 presents the storm flow concentration calibrations for the MUSIC model. They are derived from CMA (2010).

Table 6 - Storm flow concentration calibrations used in MUSIC

	TSS mean (log mean)	TSS std dev (log std dev)	TP mean (log mean)	TP std dev (log std dev)	TN mean (log mean)	TN std dev (log std dev)
Existing land (agricultural)	141 (2.15)	2 (0.31)	0.6 (-0.22)	2 (0.3)	6.31 (0.48)	1.82 (0.26)
Rural residential land	89 (1.95)	2.1 (0.32)	0.22 (-0.66)	1.8 (0.25)	2 (0.3)	1.55 (0.19)
Sealed road	269 (2.43)	2.1 (0.32)	0.5 (-0.30)	1.8 (0.25)	2.19 (0.34)	1.55 (0.19)
Conservation Zone	89 (1.95)	2.1 (0.32)	0.22 (-0.66)	1.8 (0.25)	2 (0.3)	1.55 (0.19)

The pervious area characteristics for both pre and post modelling are calibrated as in **Table 7**. They are based on the method described in Section 3.6.3 of CMA (2010), see also Section 6.2.2.

Table 7 - Pervious area calibrations used in MUSIC

Parameter	Value
Soil storage capacity	210
Initial storage	30
Field capacity	66
Infiltration capacity coefficient	215
Infiltration capacity exponent	2.4
Groundwater initial depth	10
Daily recharge rate	55
Daily base flow rate	10[5]
Daily deep seepage rate	0

[5] Baseflow is specified as at least part of the site drains to the wetland and baseflow would enter it (CMA, 2010)

6.2.2 Catchment Hydrology Check

To check the model's hydrological calibration, the outflow from a pre-development, 100% pervious, node was checked against the Annual Runoff Fraction (**Figure 8**). The site's mean annual rainfall is 1,423 mm so the annual runoff fraction should be about 0.35 which equals 4.98 ML/ha/yr. The soil storage capacity and the soil field capacity were adjusted until this fraction was reached (+/- 10%); the model's value was 5.34 ML/ha/yr.

A similar check was made of the post development model, assumed to be 5% effective impervious (excluding the road). The annual runoff fraction should be about 0.38 which equals 5.41 ML/ha/ year. The model's value was 5.62 ML/ha/yr.

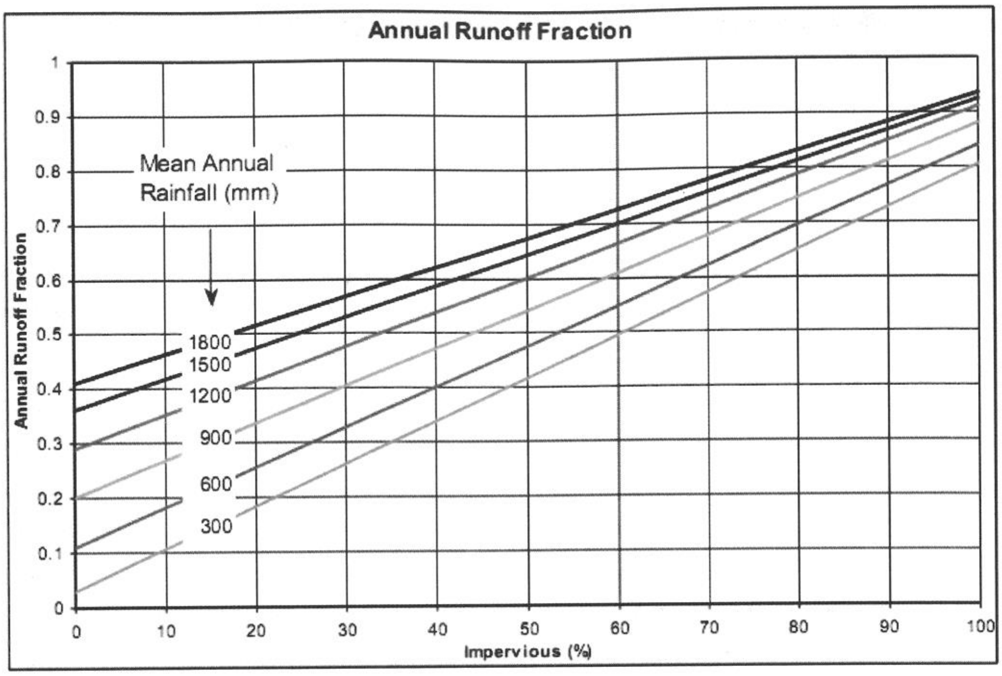

Figure 8 - Annual Runoff Fraction

6.3 Pre Development Modelling Assumptions

The pre-development model is comprised of a two agricultural source nodes, both 100% pervious and both calibrated as in **Table 6**:

- 23.8 ha that drains to Coomenderry Swamp
- 29.7 ha that drains to Beach Road.

6.4 Post Development Modelling Assumptions

The post-development model is comprised of the following source nodes:

Lands that drain to Coomenderry Swamp:

- A rural residential node, 17.7 ha in area, conservatively set to 5% effective impervious and calibrated as in **Table 6**.
- A conservation area node, 5.7 ha in area, 100% pervious and calibrated as in **Table 6**. This node drains offsite.

Lands that drain to Beach Road:

- A Road node, 3.24 ha in area, 50% effective impervious and calibrated as in **Table 6**. This node drains to road table drains modelled with a swale treatment node. Note that only the proposed table drains on the east-west roads are modelled as the ones on the north-south roads would grade at more than 5%.
- A rural residential node, 7.3 ha in area, 5% effective impervious and calibrated as in **Table 6**. This node drains to road table drains modelled with a swale treatment node.
- A rural residential node, 19.16 ha in area, 5% effective impervious and calibrated as in **Table 6**. This node doesn't drains to road table drains modelled with a swale treatment node.

The MUSIC model is shown diagrammatically in **Figure 9**.

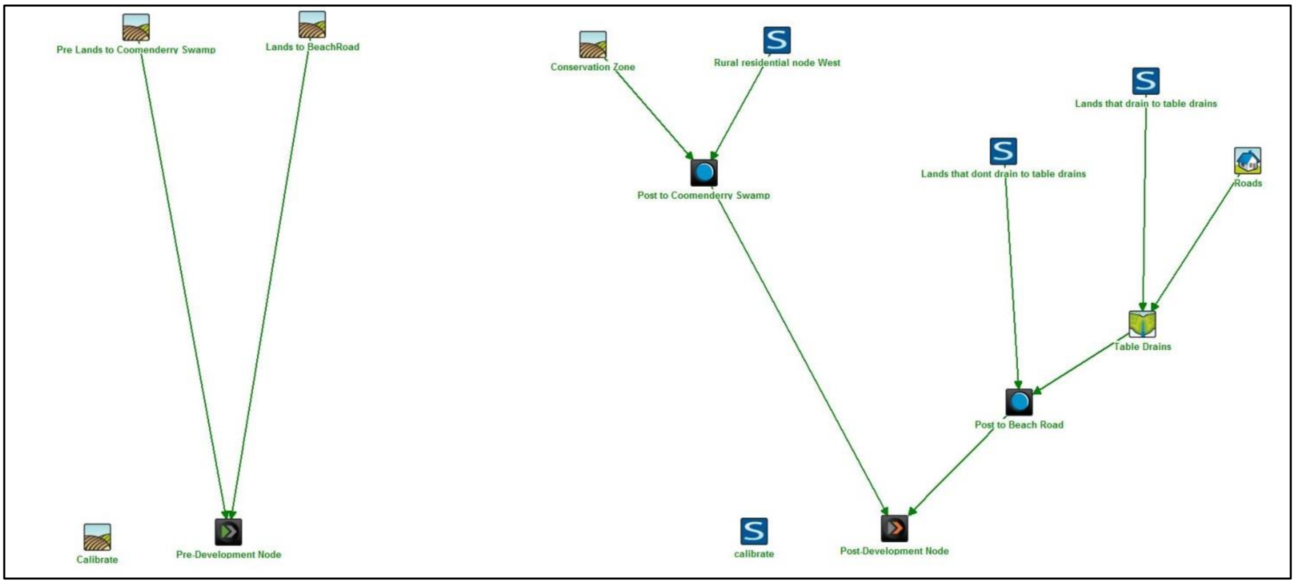

Figure 9 - MUSIC Model Schematic

6.5 Modelling Results

6.5.1 Mean Annual Loads

Two models were run to represent pre and post development. The models were both split into those lands that drain to Coomenderry Swamp and lands that drain to Beach Road. **Tables 8 and 9** contain the results of the modelling respectively. They show the proposed development would improve the existing mean annual loads of sediment and nutrients in water draining in both directions. The improvement is particularly good on lands that drain to Coomenderry Swamp.

Table 8 - MUSIC Results for Lands That Drain to Coomenderry Swamp. Mean Annual Loads[6]

Parameter	Pre	Post	Change%
TSS (kg)	5.67×10^3	4.95×10^3	-13
TP (kg)	25.8	14	-46
TN (kg)	187	158	-16

Table 9 - MUSIC Results for Lands That Drain to Beach Road. Mean Annual Loads

Parameter	Pre	Post	Change%
TSS	7.33×10^3	5.59×10^3	-24
TP	31.8	20.9	-34
TN	245	232	-5

6.5.2 Pollutant Concentrations

To fully demonstrate a neutral or beneficial effect (NorBE), the post-development pollutant concentrations for total suspended solids, phosphorous and nitrogen should be less than or equal to the pre-development concentrations for between 98 percent and 50 percent of the time (SCA, 2012).

For lands that drain to Coomenderry Swamp, **Figures 10 to 12** show the concentration graphs for suspended solids, total phosphorous and total nitrogen respectively and show this condition can be met. **Figures 13 to 15** show the same for lands that drain to Beach Road.

[6] SEEC internal reference = Run 4 Nowra 1970-1975

Figure 10 – Lands that drain to Coomenderry Swamp. Pre versus post for total suspended solids

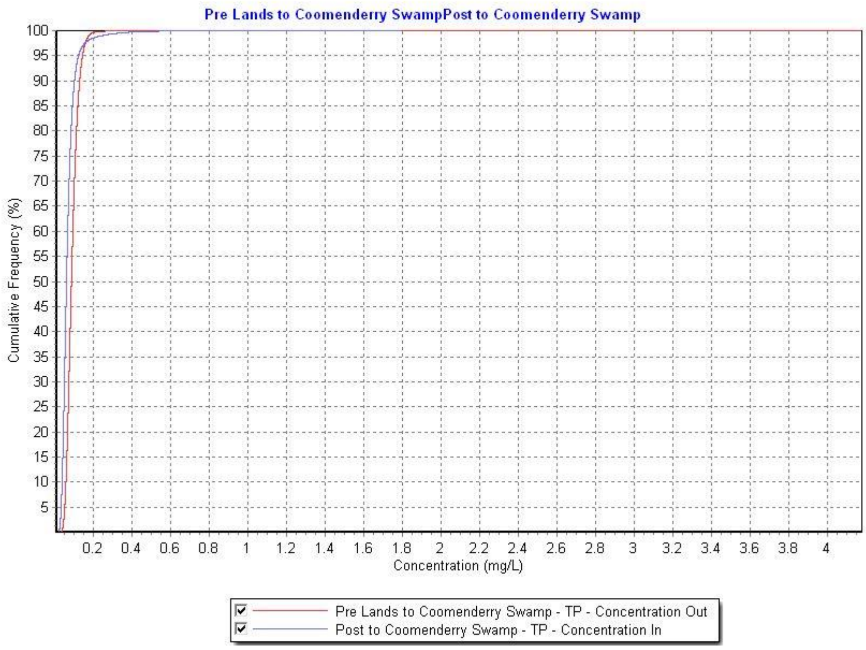

Figure 11 – Lands that drain to Coomenderry Swamp. Pre versus post for total phosphorous

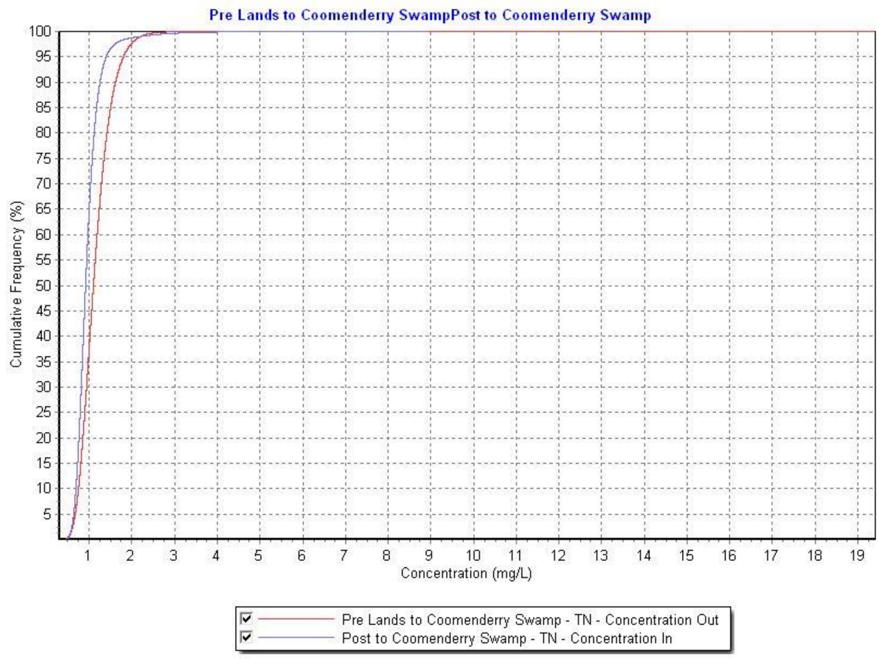

Figure 12 - Lands that drain to Coomenderry Swamp. Pre versus post for total nitrogen

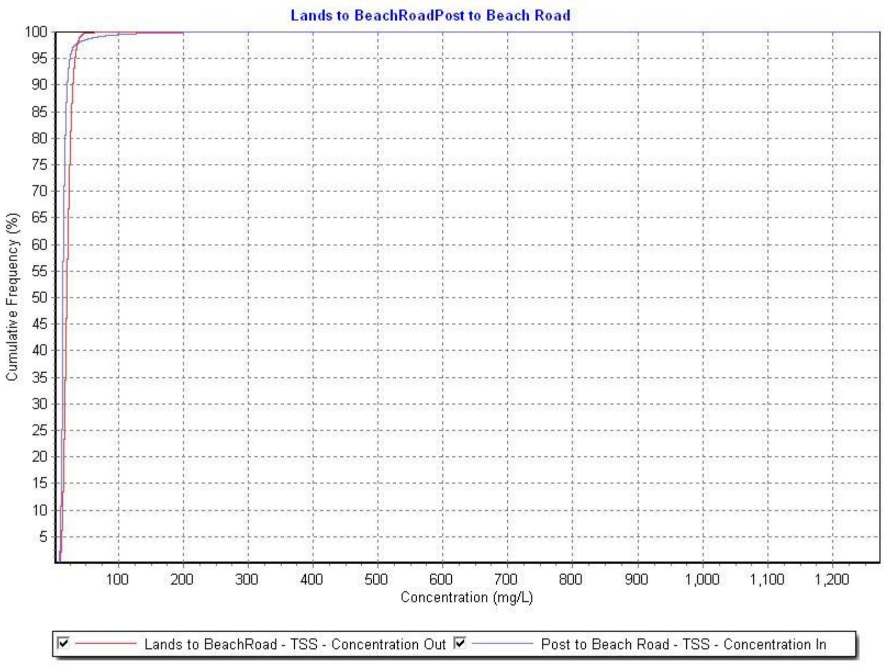

Figure 13 - Lands that drain to Beach Road. Pre versus post for total suspended solids

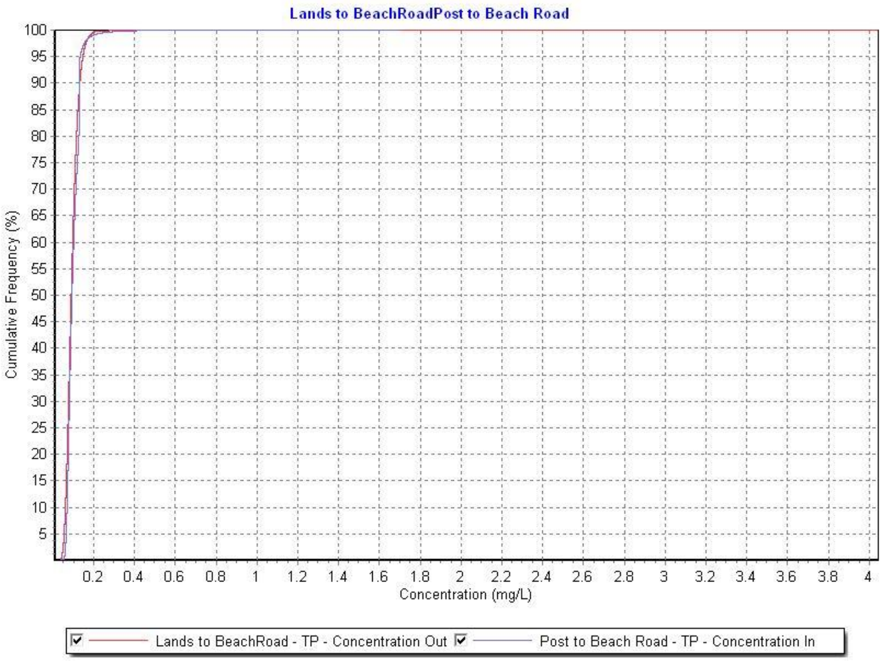

Figure 14 - Lands that drain to Beach Road. Pre versus post for Total Phosphorous

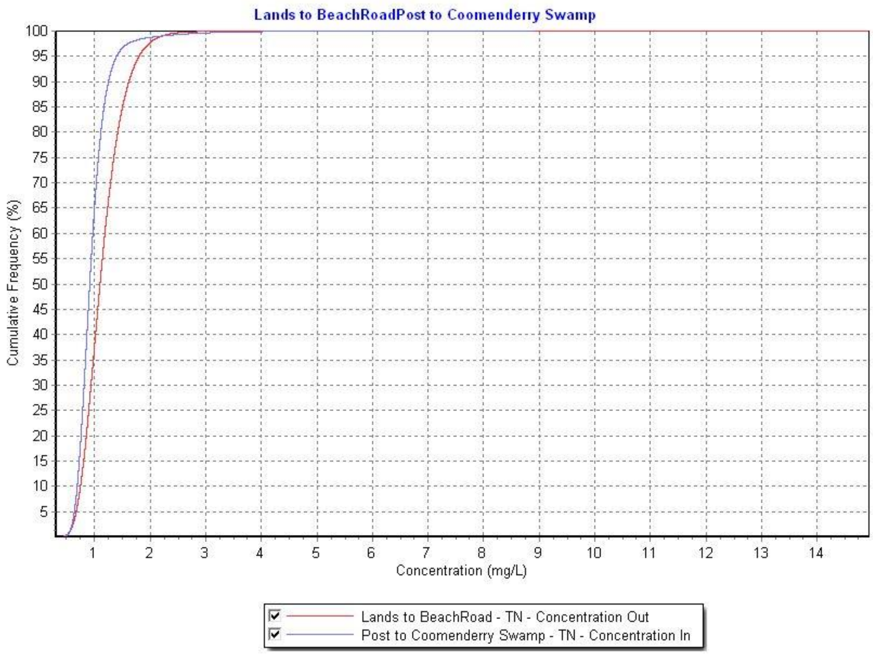

Figure 15 - Lands that drain to Beach Road. Pre versus post for Total Nitrogen

7 SUMMARY AND CONCLUSION

It is proposed to subdivide Lot 4 DP 713138 into 46 new rural-residential lots of between 0.3 ha and 5 ha. Lot 40 would contain the existing house and associated outbuildings.
Each new lot would be required to sustainably manage treated wastewater derived in each new home. It is calculated that 830 m² of subsurface irrigation would be required on each lot based on a five-bedroom home.

The northern part of the site contains lands that currently drain to the north via a drainage depression which feeds two farm dams. The two dams would be removed and one of the new north-south access roads would follow the alignment of the drainage depression. The function of the depression would be replaced by the table drains. The east-west access roads would also have table drains and the one on the upslope side would require a buffer from any effluent management area. This constrains some of the proposed lots but an area of at least 830 m² has been identified on them all. In addition, the northwest corner of the site (conceptual Lots 45 and 46) is characterised by an area of low lying land that is prone to periodic saturation. This low lying land would be avoided for the purpose of wastewater disposal and a 100 m buffer would be provided to the culvert under Beach Road. All other lots would be more or less unconstrained for the purpose of effluent management.

The MUSIC stormwater quality modelling shows the change in land use from agricultural to rural residential would be a benefit to water quality, even with the proposed road network. The large size of each lot (no less than 3,000 m²) means the effective imperviousness area on each would be low, estimated as 5%, CMA (2010). The new access road would be 50% effective impervious but would drain to grass-lined table drains in the same manner as in the similar adjoining subdivision.

The predicted improvement to water quality is particularly good on lands that drain to Coomenderry Swamp. Here an additional benefit would be a 5.7 ha, 110 m wide, conservation zone in which any domestic stock would be prohibited.

8 REFERENCES

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