

Stormwater Management Strategy

Briody Drive - West Torquay

Prepared for St Quentin Consulting

December 5, 2017
(Version 5)

PLANNING & ENVIRONMENT ACT 1987
SURF COAST PLANNING SCHEME

This Stormwater Management Plan complies with the requirements of Clause 43.04 of the Surf Coast Planning Scheme

Approval Number: 15/0446
Date: 7/12/2017 Sheet No: 1 of 17

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STORMWATER MANAGEMENT STRATEGY

Briody Drive West - Torquay

1. Introduction

This stormwater management strategy is prepared in response to the relevant provisions contained within Schedule 10 to the Development Plan Overlay (DPO), which identifies two distinct catchments and the drainage intentions for both viz.,

- An integrated stormwater management system for the properties discharging directly to Deep Creek (170 Grossmans Road and 150 and 170 Briody Drive) that ensures the peak discharge rate, and pollutant load of stormwater leaving the subject land within this DPO is no greater than pre-development levels, meets current best practice and is discharged to the existing drainage system.
- An integrated stormwater management system for the remainder of the land that ensures the pollutant load of stormwater leaving the land is no greater than predevelopment levels, meets current best practice and the stormwater is discharged to Deep Creek via the Council walkway and designed to cater for the 1 in 100 year (1% AEP) storm to the existing drainage system.
- Any interim stormwater management arrangements that could provide for out of sequence residential development.
- Input from the Corangamite Catchment Management Authority for works in, on or over Deep Creek, which is a designated waterway.
- Where required, a description of the methodology and apportionment of costs for the provision of the integrated stormwater management system including how its costs will be equalised across all landowners. This may be implemented via a condition on a planning permit that approves a residential subdivision, for a Section 173 Agreement that requires a cash contribution to equalise the costs associated with providing land for and the construction of the system or any other mechanism to the satisfaction of the responsible authority.

The last bullet point relates to the cost of certain works and how these are to be apportioned to each of the landholders.

This report will establish the components and costs which will be incorporated into a more expansive Developer Contributions Plan by others.

2. Proposed Development Plan

Appendix 1 is a plan prepared by St Quantin Consulting (Ref: 15027 Version 129), which provides a general road layout for the subject land including Deep Creek as well as two stormwater treatment areas, one of which also acts as a detention basin.

This Briody Drive West Development Plan complies with the requirements of Clause

43.04 of the Surf Coast Planning Scheme

There is one parcel of land shown in brown which is not part of this RIZ process, nevertheless it has been included in all computations and treatments in this report.

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The plan represents the basis for the drainage network and how it is to operate.

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3. Pre-development / Prescribed Drainage Catchments

We have taken the development plan, superimposed the contours, marked the naturally occurring ridgelines and the general direction of flow stormwater runoff currently takes.

To this we have added the location and footprints of the two Water Sensitive Urban Design (WSUD) wetlands previously referred to.

This plan, Appendix 2, indicates the pre-development catchment areas, herein after known as the west catchment shown in green, the east catchment shown in blue and a portion of the property abutting Grossmans Road shown in red that drains to the south west which will be known as the south catchment.

There is a dashed line encompassing the west catchment and parts of the south and east catchments.

These areas are described earlier as 170 Grossmans Road and 150 -170 Briody Drive and it is these areas that are required to be retarded back to pre-development flows.

In determining the west catchment detention storage, that portion of the east catchment enclosed by the dashed line has been used to calculate the allowable detention basin outlet volume, as this area, had it gone directly to the east outfall, would have been allowed to discharge as unretarded fully developed runoff into Deep Creek.

That portion of the southern catchment within 170 Grossmans Road has also been included but for a different reason and that is, that the rural runoff volume attributable in this area balances the nett discharge to Deep Creek outlined in the preceding paragraph.

4. Drainage Intentions

4.1 West Catchment

Appendix 3 indicates a pipe layout and flow arrows, the network by which stormwater is to be transferred to the detention basin/WSUD wetland identified in the DPO.

In fact due to the intervention of Briody Drive and the need to ensure the developed stormwater volume crosses over it, it is likely that the pipe network will cater for the entire 1 in 100 year runoff.

The flow arrows would then act as a further factor in directing water in an intended direction as well as providing overflow protection to properties.

The total runoff volume from the catchment is then directed into the detention basin shown and released into Deep Creek at a rate equivalent to the pre-development values.

Within the base of the detention basin will be a wetland and it will treat the stormwater to achieve water quality targets prior to release into Deep Creek.

This Briody Drive West Development Plan complies with the requirements of Clause 43.04 of the Surf Coast Planning Scheme

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The actual parameters for connecting to Deep Creek will be the subject of an application to the CCMA, but at this stage we have allowed for an endwall angled downstream into Deep Creek with rock beaching to help dissipate velocity and protect against erosion.

4.2 East Catchment

The drainage from this catchment is able to be transferred to Deep Creek directly without detention.

In this instance the pipe network conveys the 1 in 10 year stormwater runoff and the directional arrows indicate the route for the balance of the 1 in 100 year stormwater volume.

As the network shows, stormwater runoff will ultimately be transferred to Briody Drive and from there to Deep Creek via a Council owned "walkway" between Lots 80 & 90 Grossmans Road.

It is generally intended that the majority of the stormwater will be transferred via the pipe system in the road running parallel to Briody Drive to the low point adjacent to the WSUD wetland.

At this location the 1 in 3 month stormwater volume can be directed into the wetland, while the main flows pass beneath to connect with the balance of the Briody Drive drainage.

The low point in Briody Drive is opposite the abovementioned walkway and the catchment runoff will be taken by pipe and open drain to Deep Creek.

The process of discharging into Deep Creek, at both locations, will require the preparation of a proposal and subsequent approval from the Corangamite Catchment Authority (CCMA), with the primary consideration likely to be velocity into the Creek and measures to mitigate against downstream damage.

At this stage we have allowed for a similar treatment as was previously required by the Surfcoast Shire at Jetty Lane, presuming that they will want similar connectivity to the north side of Deep Creek at this location.

This comprised a 1500mm diameter pipe including endwalls and rock beaching to protect against erosion as previously described.

4.3 South West Catchment

The contours on this plan indicate that it will not be possible to command the southern catchment to the north, as it lies two metres below the internal road.

Should Council insist that the difference in pre and post developed flows be dealt with, it is proposed to convey this volume east along and within the allotments parallel to Grossmans Road.

Once it reaches a point just east of the Duffields Road intersection with Grossmans Road, this drainage will be incorporated into the network draining south into the east catchment and into its outfall.

This Briody Drive West Development Plan complies with the requirements of Clause 43.04 of the Surf Coast Planning Scheme

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5. **Detention Basin/Wetland**

5.1 **West Catchment**

Appendix 4 provides a detail of the retarding basin, its footprint and 1 in 100 year pre-development runoff calculations.

The calculations for detention, was based on an outlet allowance of 658 l/sec determined using the Vicroads method.

Intensities derived from the polynomial table specific to this area and downloaded from the Bureau of Meteorology, were used in the basin computations to determine the storage volume required and each is shown below.

The volume required to be stored equates to 1,735 cubic metres.

Polynomial Coefficients Table

Location: 38.300S 144.325E NEAR.. Torquay Issued: 1/9/2014

List of coefficients to equations of the form

$$\log_e(I) = A + B \times (\log_e(T)) + C \times (\log_e(T))^2 + D \times (\log_e(T))^3 + E \times (\log_e(T))^4 + F \times (\log_e(T))^5 + G \times (\log_e(T))^6$$

T = Time in hours and I = Intensity in millimetres per hour

YEARS	A	B	C	D	E	F	G
1	2.5892763138	-6.2105197E-1	-4.3898504E-2	9.0241572E-3	1.2564363E-3	-3.9736641E-4	-1.4507250E-5
2	2.8541719913	-6.2889689E-1	-4.0817116E-2	9.8839710E-3	6.8665090E-4	-4.9060781E-4	2.4853676E-5
5	3.1116268635	-6.4544249E-1	-3.8224310E-2	9.1040023E-3	8.2370160E-4	-3.2245665E-4	-9.2582080E-6
10	3.2515068054	-6.5502048E-1	-3.6497098E-2	8.7949075E-3	8.3519610E-4	-2.4504788E-4	-2.356295E-5
20	3.4160957336	-6.6213983E-1	-3.4803916E-2	7.7339504E-3	8.7476970E-4	-9.2314600E-5	-4.8159818E-5
50	3.6105115414	-6.7156112E-1	-3.3162531E-2	7.0784609E-3	9.5945180E-4	3.0510360E-5	-7.2739531E-5
100	3.7458896637	-6.7825311E-1	-3.1885102E-2	6.7072609E-3	9.8017460E-4	1.0302090E-4	-8.5743937E-5

(Raw data: 17.97, 3.33, 0.9, 34.01, 5.97, 1.69, skew=0.43, F2=4.28, F50=14.82) © Australian Government, Bureau of Meteorology

BASIN DESIGN COMPUTATIONS – POERTNER METHOD

Area (sm)	98800	Coefficient of Runoff	0.70
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Time of Concentration (mins)	Q (In) [l/sec]	Q (Out) [l/sec]	Intensity (mm/hr)	Poertner Method	Storm Frequency (Yr)	
					Torquay	100 yr
2	4134	658	215.20	417	2	215.20
4	3551	658	184.85	734	4	184.85
6	3042	658	158.35	937	6	158.35
8	2672	658	139.10	1085	8	139.10
10	2395	658	124.66	1200	10	124.66
12	2179	658	113.40	1292	12	113.40
14	2005	658	104.34	1368	14	104.34
16	1861	658	96.87	1431	16	96.87
18	1740	658	90.57	1484	18	90.57
20	1636	658	85.18	1529	20	85.18
22	1547	658	80.51	1568	22	80.51
24	1468	658	76.40	1600	24	76.40
26	1396	658	72.77	1626	26	72.77
28	1336	658	69.52	1647	28	69.52
30	1279	658	66.60	1671	30	66.60
32	1229	658	63.95	1688	32	63.95
34	1182	658	61.54	1701	34	61.54
36	1138	658	59.33	1709	36	59.33
38	1101	658	57.31	1721	38	57.31
40	1065	658	55.47	1728	40	55.47
42	1032	658	53.70	1731	42	53.70
44	1001	658	52.09	1734	44	52.09
46	972	658	50.59	1735	46	50.59
47	945	658	49.19	1735	47	49.19
48	920	658	47.87	1662	48	49.19
49	896	658	46.63	1662	50	47.87
50	873	658	45.47	1594	52	46.63
51	852	658	44.37	1562	54	45.47
					56	44.37

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The basin is set adjacent to Deep Creek while providing for the 25 metre linear open space reserve.

This basin is also to act as a wetland for water quality purposes and the components for this purpose are set in the base below the storage volume requirement.

The details determining the size of the wetland are arrived at via a MUSIC (Model for Urban Stormwater Improvement Conceptualization) model, the objectives of which are outlined in the "Urban Stormwater, Best Practice Environmental Management Guidelines" and relate to a reduction in pollutants compared to typical urban area with no stormwater treatment.

These targets are a reduction in annual loads of –

- 80% reduction in the typical urban annual load for total suspended solids (TSS)
- 45% reduction in the typical urban annual load for total phosphorus (TP), and
- 45% reduction in the typical urban annual load for nitrogen (TN)
- 70% reduction gross pollutants (litter).

This catchment including the south west area to Grossmans Road have been modelled and the achieved targets noted on this plan.

The outlet details to Deep Creek are to be established through consultation with CCMA in due course.

Allowances made can be seen on the attached plans and in the schedules in Appendix 7.

6. Wetland

6.1 East Catchment

Appendix 5 provides a detail of the wetland, its footprint and components required as a result of MUSIC modelling.

The catchment modelled includes that portion of the south west Catchment falling to Grossmans Road, but excludes the yellow area in Appendix 1 being PUZ1.

The plan indicates the following –

- a) A 1 in 10 year pipe system which will pass below the wetland before interconnecting with other drainage to discharge to Deep Creek via the Council owned walkway.
- b) The diversion of the 1 in 3 month storm event runoff into a sediment pond and wetland.

c) A second diversion from Briody Drive for the same event, and

d) An overland flow path diversion of the difference between the 1 in 100 and

3 in 10 year rainfall event through the wetland on the north side of
This Briody Drive (West Development) Plan complies with the requirements of Clause
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7. **Environmental Management Plan**

We submit as part of this stormwater strategy, an Environmental Management Plan (EMP) that deals generally with the site as a whole.

It is intended that individual EMP's will form part of the detailed engineering plans for each stage.

This plan can be found in Appendix 6.

8. **Components / Cost**

From a purely engineering perspective, development would proceed from the location of existing assets, that is downstream end, to the most upstream point of the catchment extending services with each stage.

Services such as electricity, gas and telecommunication are generally available wherever development wished to commence in this instance.

This leaves only drainage and sewer as the two controlling factors in development staging and while we will be dealing particularly with the former, extraordinary sewer costs are applicable and affect what might be considered straight forward.

In brief this relates to 150-170 Briody Drive where a sewer pumping station and rising main will be required and previous advice affecting the balance from Barwon Water regarding catchment outfall locations.

As matters stand, the general direction of development would logically proceed from east to west.

While it is true to say that pipe sizes become less in diameter as we proceed in this direction, or south to north in the west catchment case, these sizes and costs cannot be determined at this point and so are deemed to be a cost borne by the developer of that particular stage.

Indeed any "out of sequence" development will incur and bear outfall costs that will be of benefit to any downstream landowner.

As such, we have confined ourselves to the basin/wetland costs and have prepared itemized schedules for each found in Appendix 7.

The first of two schedules relates to the western area defined as 170 Grossmans Road and 150-170 Briody Drive, and the second relates to the eastern catchment.

The apportionment of these costs will be dealt with by others as part of a Developer Contributions Plan (DCP) or a 173 Agreement identified in the DPO.

9. **Out of Sequence Development**

9.1 **East Catchment**

Apart from the earlier referred to "subdivisional drainage" the outfall works down to Deep Creek together with the wetland will be covered by a DCP or a 173 Agreement.

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Quite often start up money doesn't exist and so interim measures and offsets come into play.

Not all of the measures surrounding the outfall and wetland construction need to be carried out initially (development size depending), and so part of the wetland may be constructed with some pipe work towards Deep Creek plus overland the flow path.

The CCMA will have some input into this proposal as bullet point four (4) in the introduction points out.

However this is at Council's discretion and would be subject to the preparation of evidence that for any initial area under consideration, the proposal achieves the targets outlined.

That said, the DPO wording suggests, at least in the 173 Agreement situation, that a cash contribution be made for the construction of the system.

Generally speaking it would be likely that Council would want to see the Wetlands and the outfall to Deep Creek constructed early in the piece and any "out of sequence" developer would need to factor this into his thinking.

9.2 West Catchment

Much the same is to be said of this catchment as for the east, except that the basin will certainly be required first up as the DPO stipulates detention rather than just water quality.

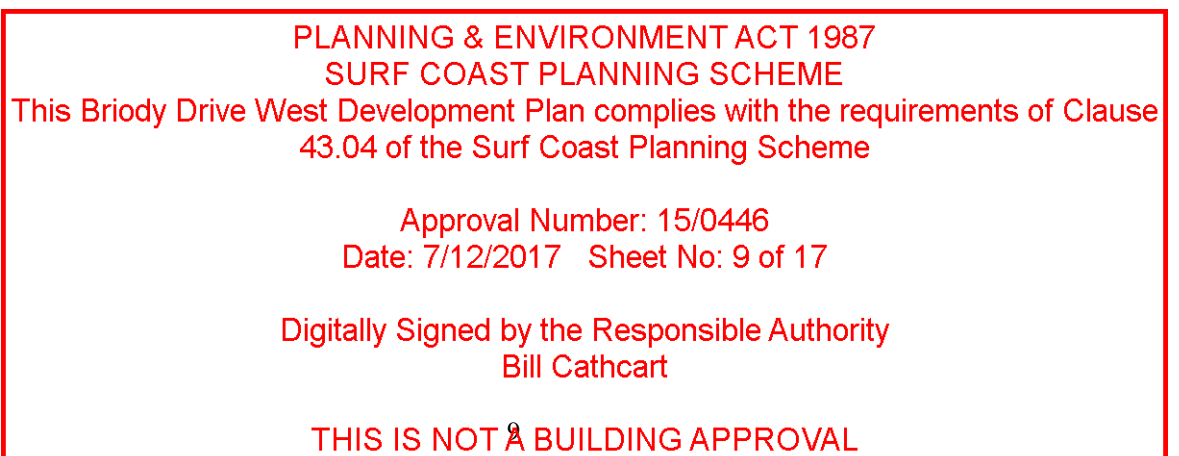
Added to this is our earlier comment relating to a sewer pumping station and rising main which would add an approximate \$600k expenditure to the first stage development.

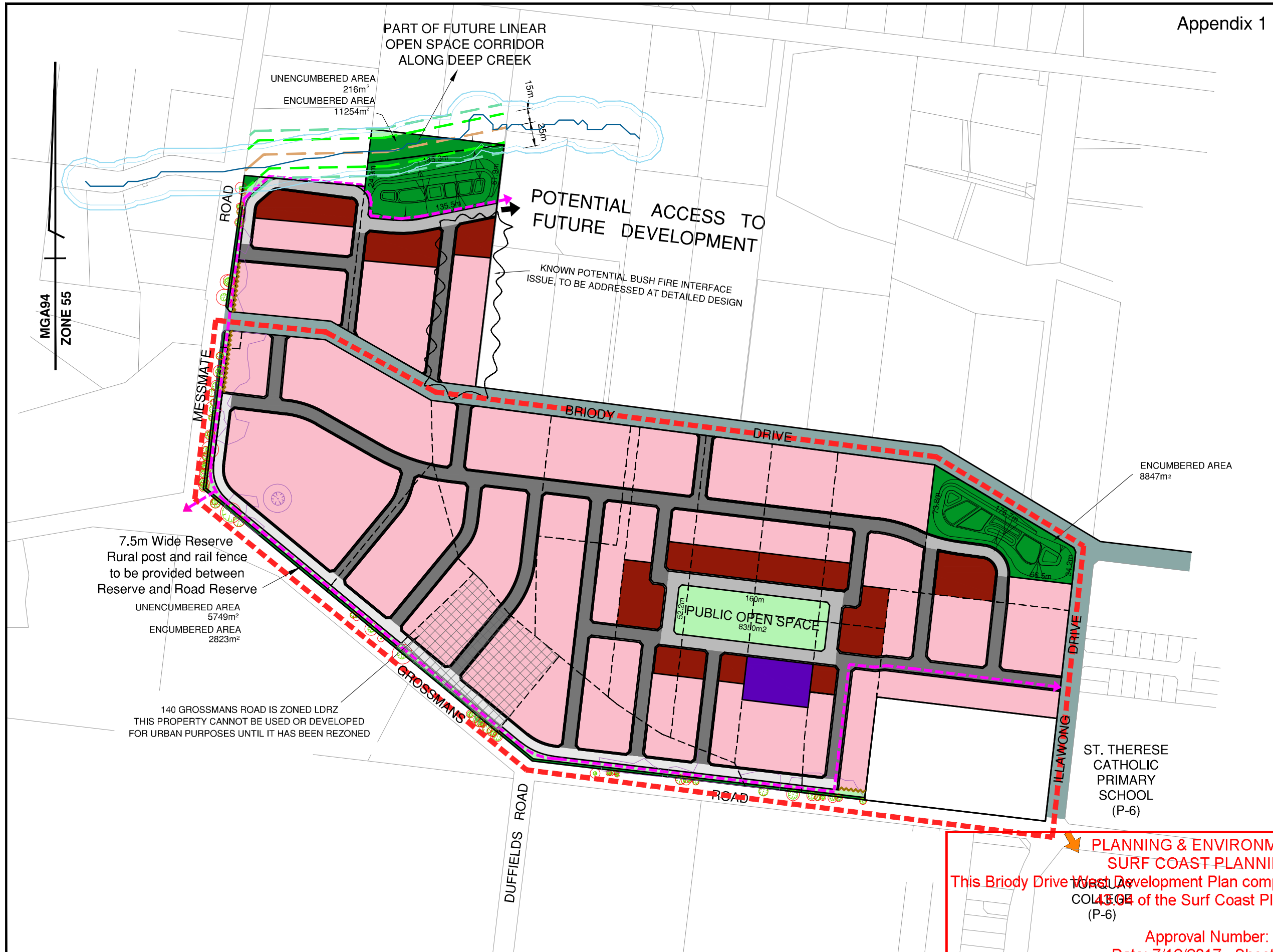
This would also rely on gravity sewer being brought along Briody Drive from Illawong Drive for the rising main to connect into.

10. Conclusion

This strategy and the implementation of the proposals it contains, addresses all of the stormwater and water quality treatment issues as well as the remaining items in the DPO.

We recommend its adoption for this area.





LEGEND	
RESIDENTIAL DENSITIES	
	HIGHER DENSITY (350m ²) 2.45Ha / 28.5 Lots per Ha / 70 lots
	STANDARD DENSITY (450m ²) 18.23 Ha / 22.2 Lots per Ha / 404 lots
	MULTI-UNIT SITE
NOTE: SECTION 1 & 2 USES THAT ARE PERMISSIBLE WITHIN THE ZONE WILL BE CONSIDERED ON THEIR MERITS.	
ROAD NETWORK	
	ACCESS STREET LEVEL 2
	16m WIDE ROAD RESERVE
	14.5m WIDE ROAD RESERVE
	11.5m WIDE ROAD RESERVE
OPEN SPACE / DRAINAGE	
	ENCUMBERED OPEN SPACE
	UNENCUMBERED OPEN SPACE
	CENTRELINE OF CREEK
	TREES IN LARGE PATCHES
	TREE WITH TREE PROTECTION ZONE
NOTE: WHERE THE TREE PROTECTION ZONE ENCROACHES IN TO RESIDENTIAL LOTS A BUILDING RESTRICTION SHALL BE APPLIED.	
OTHER	
	POTENTIAL FUTURE BUS ROUTE
	2.5m WIDE SHARED PATH
	DIRECTION TO SCHOOLS & COMMUNITY FACILITIES
	EXISTING TITLE BOUNDARIES
	FOOTPATH
	FENCE PROVISIONS

7.5m Wide Reserve
Rural post and rail fence
to be provided between
Reserve and Road Reserve
UNENCUMBERED AREA
5749m²
ENCUMBERED AREA
2823m²

140 GROSSMANS ROAD IS ZONED LDRZ
THIS PROPERTY CANNOT BE USED OR DEVELOPED
FOR URBAN PURPOSES UNTIL IT HAS BEEN REZONED

PART OF FUTURE LINEAR
OPEN SPACE CORRIDOR
ALONG DEEP CREEK

POTENTIAL ACCESS TO
FUTURE DEVELOPMENT

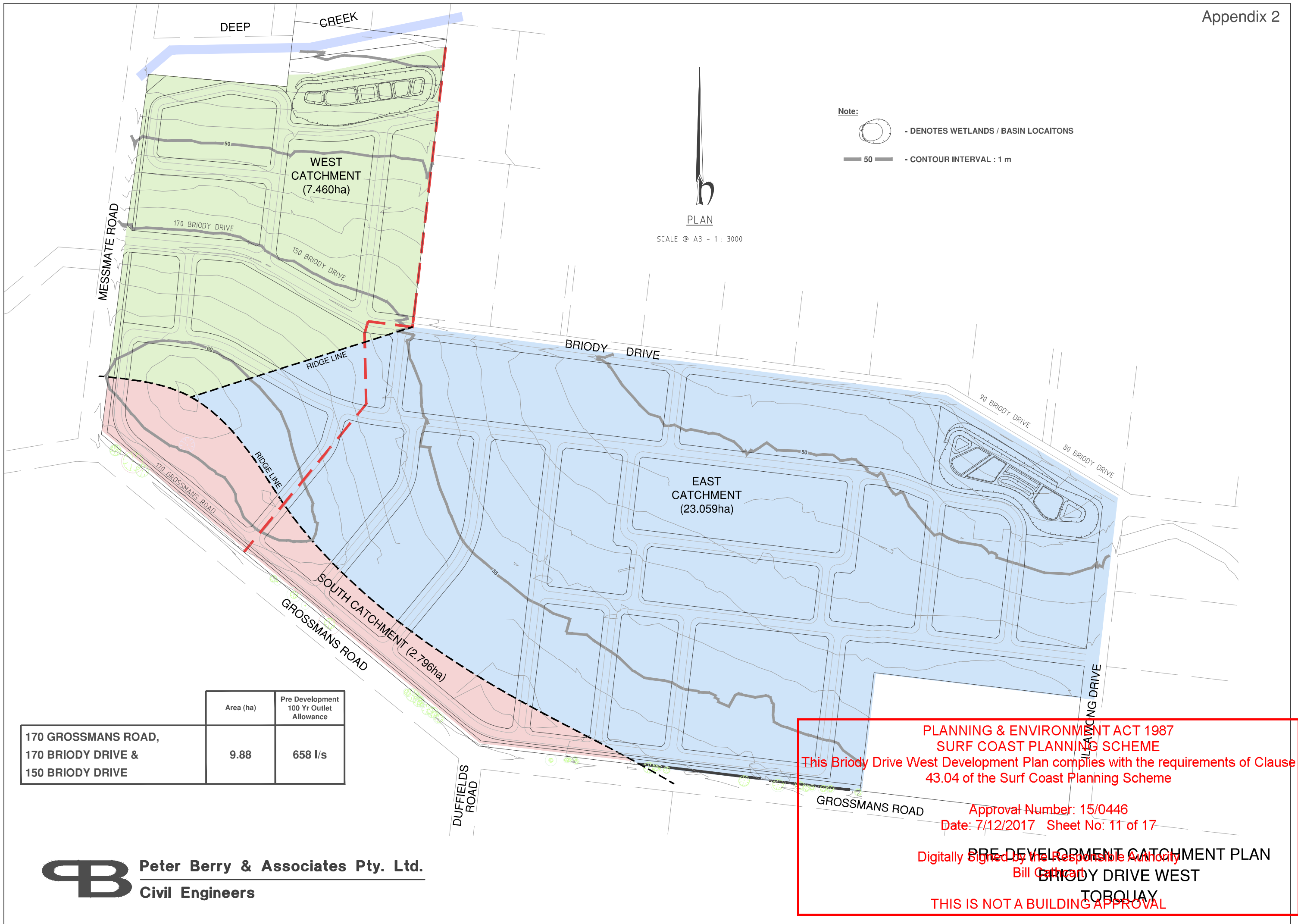
KNOWN POTENTIAL BUSH FIRE INTERFACE
ISSUE, TO BE ADDRESSED AT DETAILED DESIGN

PUBLIC OPEN SPACE
160m
92.2m
8330m²

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DRAWN CM	LEVEL DATUM -
DRAWING REF 9827	DWG DATE 30/11/2017
VERSION 23	SCALE 1:4000
	A3



	Area (ha)	Pre Development 100 Yr Outlet Allowance
170 GROSSMANS ROAD, 170 BRIODY DRIVE & 150 BRIODY DRIVE	9.88	658 l/s

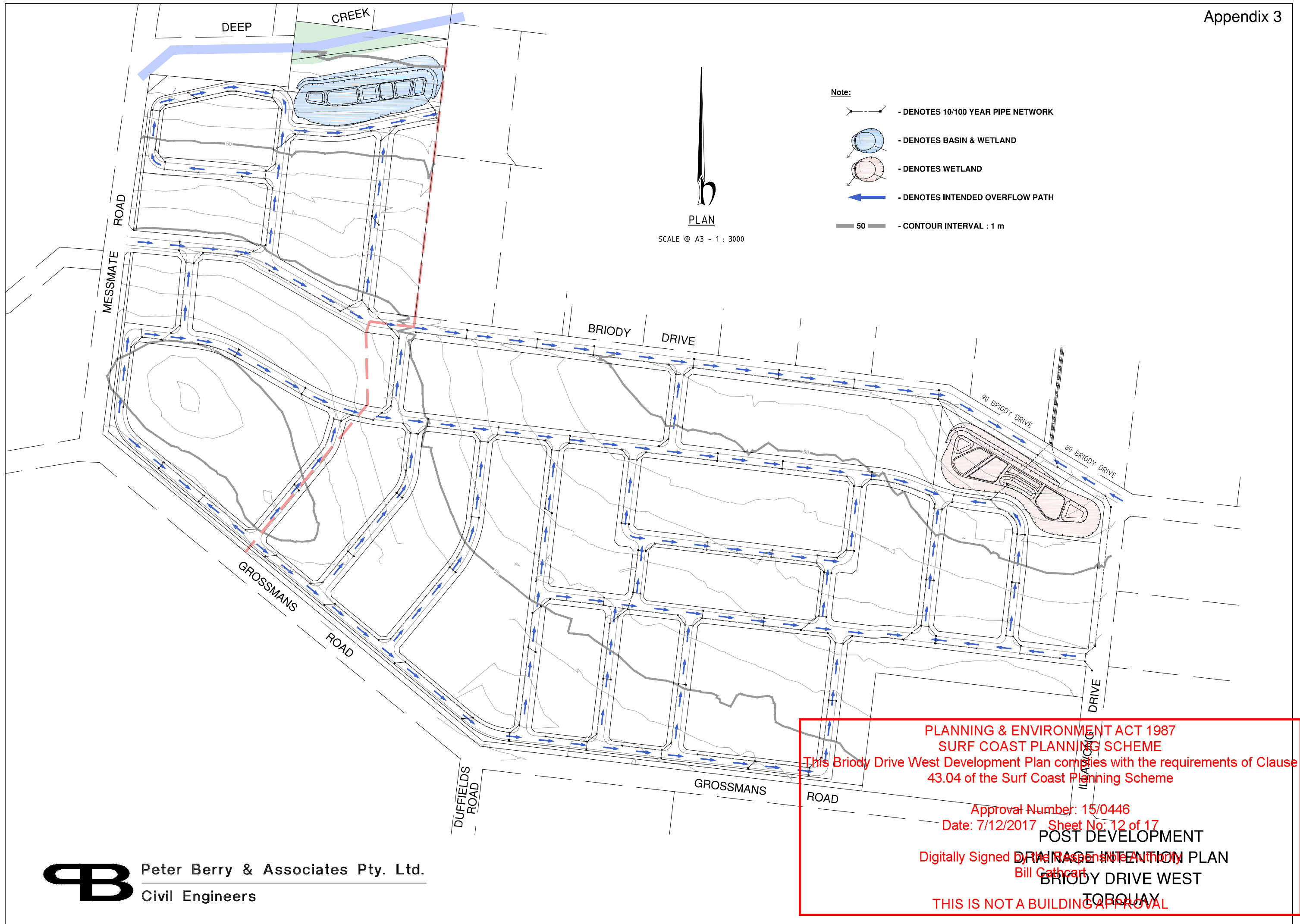
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PRE-DEVELOPMENT CATCHMENT PLAN
BRIODY DRIVE WEST
TOBOUQUAY

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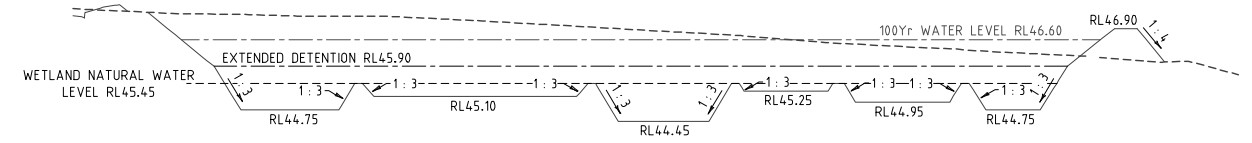
POST DEVELOPMENT
 DRAINAGE INTENTION PLAN
 BRIODY DRIVE WEST
 TORQUAY

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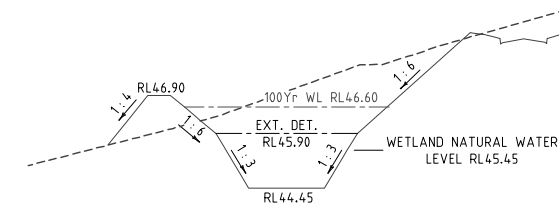
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MUSIC MODELLING RESULTS

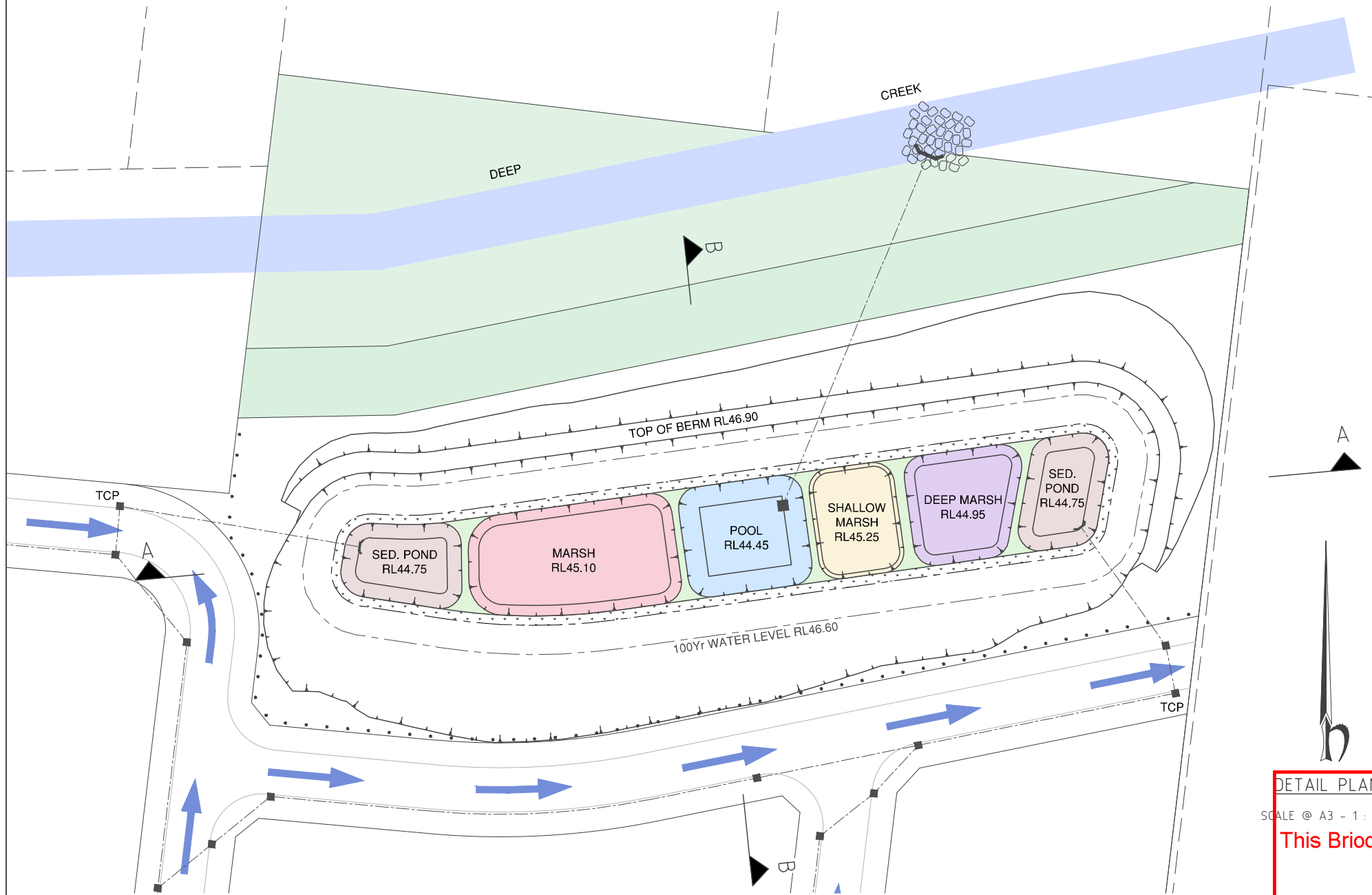
	Sources	Residual Load	% Reduction
Flow (ML/yr)	27.1	25.8	4.6
Peak Flow (m3/s)	1.29	0.428	66.9
Total Suspended Solids (kg/yr)	5.08E3	1.20E3	76.3
Total Phosphorus (kg/yr)	10.8	3.84	64.5
Total Nitrogen (kg/yr)	78.2	44.7	42.9
Gross Pollutants (kg/yr)	1.18E3	0.00	100.0



WETLAND SECTION A-A
 SCALES - HORIZ. 1 : 1000 @ A3
 VERT. 1 : 200 @ A3



WETLAND SECTION B-B
 SCALES - HORIZ. 1 : 1000 @ A3
 VERT. 1 : 200 @ A3



WETLAND LEGEND

ALL PLANTS SPECIES TO BE APPROVED BY SURFCOAST SHIRE.

ZONE	DEPTH
LITTORAL	+0.50 - 0.00m
EPHEMERAL MARSH	+0.20 - 0.00m
SHALLOW MARSH	0.00 - 0.20m
MARSH	0.20 - 0.35m
DEEP MARSH	0.35 - 0.50m
POOL	0.50 - 1.00m

DETAIL PLAN
 SCALE @ A3 - 1 : 750

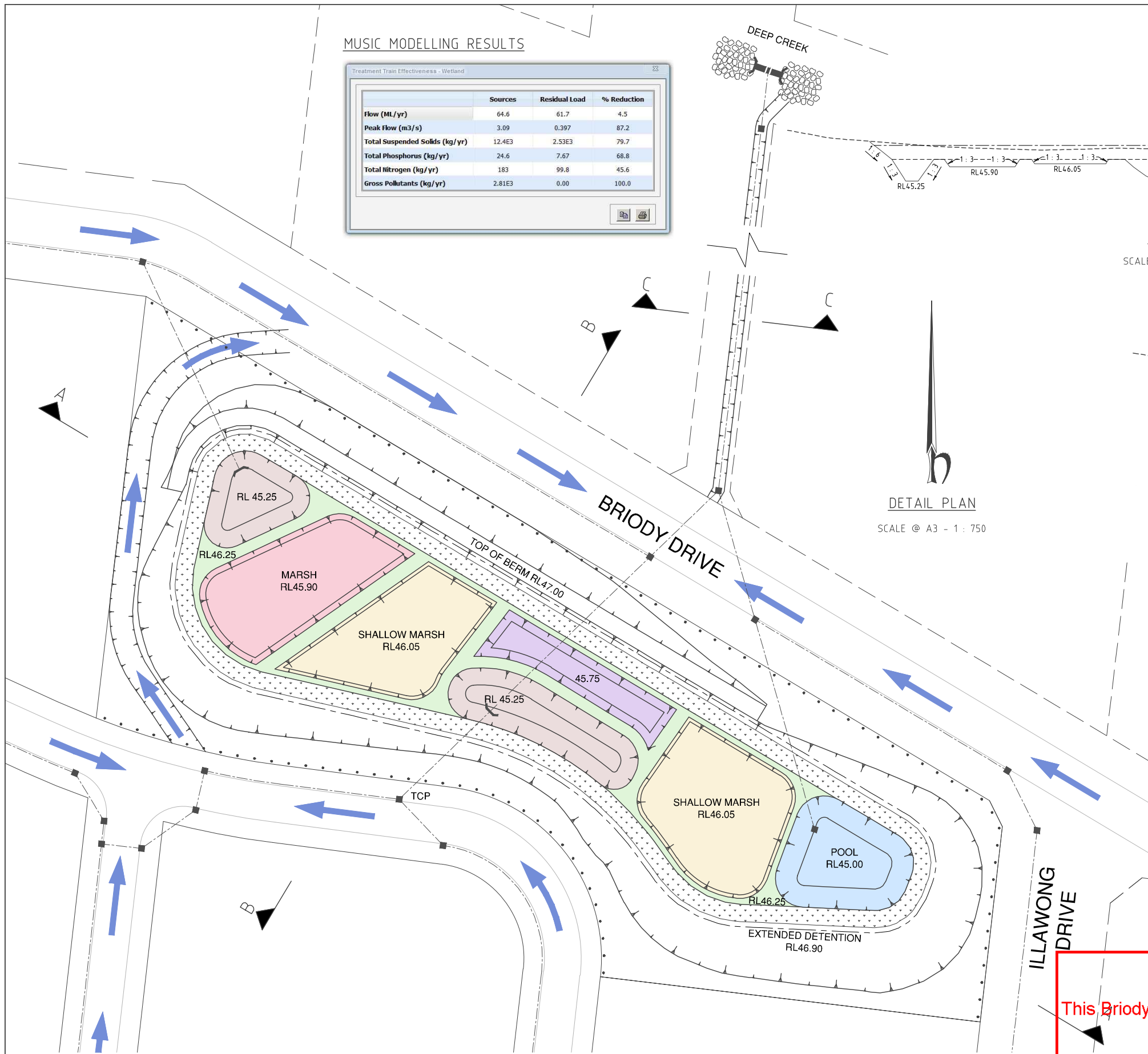
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PROPOSED DETENTION BASIN & WETLAND - WEST CATCHMENT
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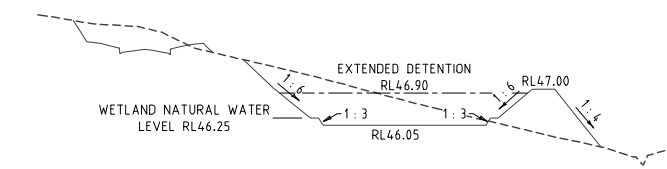
MUSIC MODELLING RESULTS

	Sources	Residual Load	% Reduction
Flow (ML/yr)	64.6	61.7	4.5
Peak Flow (m3/s)	3.09	0.397	87.2
Total Suspended Solids (kg/yr)	12.4E3	2.53E3	79.7
Total Phosphorus (kg/yr)	24.6	7.67	68.8
Total Nitrogen (kg/yr)	183	99.8	45.6
Gross Pollutants (kg/yr)	2.81E3	0.00	100.0

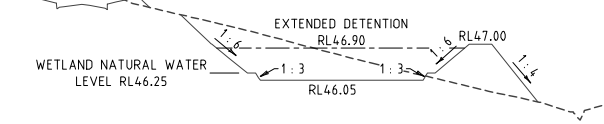


DEEP CREEK

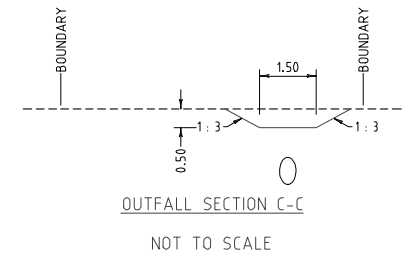
WETLAND SECTION A-A
 SCALES - HORIZ. 1 : 1000 @ A3
 VERT. 1 : 200 @ A3



WETLAND SECTION B-B
 SCALES - HORIZ. 1 : 1000 @ A3
 VERT. 1 : 200 @ A3



DETAIL PLAN
 SCALE @ A3 - 1 : 750



WETLAND LEGEND

ALL PLANTS SPECIES TO BE APPROVED BY SURFCOAST SHIRE.

ZONE	DEPTH
LITTORAL	+0.50 - 0.00m
EPHEMERAL MARSH	+0.20 - 0.00m
SHALLOW MARSH	0.00 - 0.20m
MARSH	0.20 - 0.35m
DEEP MARSH	0.35 - 0.50m
POOL	0.50 - 1.00m

PLANNING & ENVIRONMENT ACT 1987
 SURF COAST PLANNING SCHEME
 This Briody Drive West Development Plan complies with the requirements of Clause 43.04 of the Surf Coast Planning Scheme

Approval Number: 15/0446
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PROPOSED WETLAND TREATMENT
 EAST CATCHMENT
 BRIODY DRIVE WEST
 TOBOUQUAY

Digitally Signed by the Responsible Authority
 Bill Callaghan

THIS IS NOT A BUILDING APPROVAL

THE FOLLOWING HEADINGS HAVE BEEN IDENTIFIED AS SIGNIFICANT FOR THIS SITE AND THEIR MANAGEMENT HAS BEEN DERIVED FROM -

**GUIDELINE FOR ENVIRONMENTAL MANAGEMENT
DOING IT RIGHT ON SUBDIVISIONS
TEMPORARY ENVIRONMENTAL PROTECTION MEASURES
FOR SUBDIVISION CONSTRUCTION SITES
PUBLICATION 960 - SEPTEMBER 2004**

THE ENTIRE PUBLICATION CAN BE FOUND AT www.epa.vic.gov.au/publications/

THE FOLLOWING HAVE BEEN IDENTIFIED AS SIGNIFICANT ASPECTS FOR THE SITE:

1. NOISE	4. WASTE	7. SIGNIFICANT FLORA AND FAUNA	10. SERVICES
2. DUST	5. CHEMICALS	8. ARCHAEOLOGICAL/HERITAGE	
3. EROSION AND SEDIMENT	6. TRAFFIC	9. ACCESS	

THESE ASPECTS SHALL BE MANAGED WITH THE ENVIRONMENTAL PROTECTION MEASURES OUTLINED ON THIS PLAN.

MANAGEMENT

1. RESPONSIBILITIES: CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTATION OF THIS PLAN. EMERGENCY CONTACTS - - TO BE ADVISED - PETER BERRY (03 5223 2799)	4. STAGING OF WORKS: WORKS WILL BE STAGED IN ACCORDANCE WITH THE SEPERATE PLANS OF SUBDIVISION AND RESPECTIVE ENGINEERING PLANS. EACH STAGE SHALL HAVE A SPECIFIC EMP WITH OVERALL PROTECTION MEASURES TO BE IN ACCORDANCE WITH THIS PLAN.
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2. COMMUNICATION ON EMP REQUIREMENTS: CONTRACTOR TO HAVE COPY OF PLAN ON SITE AT ALL TIMES. CONTRACTOR TO ADVISE ALL PERSONAL OF SITE EMP AT INDUCTION AND TOOLBOX MEETINGS.	5. INFORMING RESIDENTS: CONTRACTOR TO NOTIFY ADJOINING RESIDENTS PRIOR TO COMMENCING WORKS. - SIGNAGE - DOOR KNOCK
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3. INSPECTIONS AND MAINTENANCE: CONTRACTOR TO INSPECT ENVIRONMENTAL PROTECTION MEASURES ONCE A WEEK, INCLUDING PRIOR TO AND AFTER A HEAVY RAINFALL EVENT, WITH AN OBSERVED FAILURES TO BE RECTIFY IMMEDIATELY. THE CONTRACTOR IS TO MAINTAIN ALL ENVIRONMENTAL PROTECTION MEASURES UNTIL THE END OF THE MAINTENANCE PERIOD.	6. ASSOCIATED DOCUMENTS: - BRIODY DRIVE WEST: STORMWATER MANAGEMENT STRATEGY. - CONSTRUCTION PLANS: BRIODY DRIVE WEST - RELEVANT STAGE - CHMP No.12805 PREPARED BY OCHREIMPRINTS - VEGETATION REPORT PREPARED BY MARK TRENGOVE ECOLOGICAL SERVICES
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NOISE RISK: SIGNIFICANT/MED/LOW

REQUIREMENTS: EPA VICTORIA AND COUNCIL REQUIREMENTS MUST BE ADHERED TO IN RELATION TO THE LEVEL OF NOISE AND WORKING HOURS, TO ENSURE THAT RESIDENTS AND OTHER APPLICABLE NEIGHBOURS TO THE SITE ARE NOT DISTURBED UNREASONABLY. THE GENERATION OF NOISE MUST BE MINIMIZED.

7. WORKING HOURS: 7am TO 5pm MONDAY - FRIDAY 7am TO 2pm SATURDAY	8. NOISE MINIMIZATION METHODS: - WELL MAINTAINED EQUIPMENT	9. OTHER:
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DUST RISK: SIGNIFICANT/MED/LOW

REQUIREMENTS: DUST GENERATION MUST BE MINIMIZED TO ENSURE THERE IS NO HEALTH RISK OR LOSS OF AMENITY.

10. MINIMIZING DUST GENERATION: - STOCKPILE PROTECTION - RESTRICTED VEHICLE MOVEMENTS	12. CONTINGENCIES: - NOT REQUIRED
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11. DUST SUPPRESSION - WATER CART TO BE LOCATED ON SITE	13. OTHER: - HAVE REGARD TO WIND DIRECTION AND STRENGTH.
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EROSION AND SEDIMENT RISK: SIGNIFICANT/MED/LOW

REQUIREMENTS: EROSION AND SEDIMENT MUST BE MANAGED IN ACCORDANCE WITH CURRENT BEST PRACTICE ENVIRONMENTAL MANAGEMENT PRACTICES, TO PREVENT SEDIMENT-LADEN WATER FROM ENTERING ANY DRAINAGE SYSTEM OR NATURAL WATERWAY.

14. DRAINAGE MANAGEMENT: - PROVIDE INLET FILTERS AROUND ALL DRAINAGE PITS. - PROVIDE A SILT FENCE DOWNSTREAM OF STOCKPILE. - PROVIDE TEMPORARY SURFACE DRAINS TO DIRECT WATER AWAY FROM EXISTING DWELLINGS AND SENSITIVE AREAS. - PROVIDE MESH AND GRAVEL (SAUSAGE) FILTERS AT EXISTING PITS. - HAY BALING.	17. SEDIMENTATION SYSTEM: - STORMWATER TREATMENT VIA TWO WETLANDS.
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15. SOIL STABILIZATION: - VEGETATION TO BE RETAINED WHERE POSSIBLE AND ENCOURAGED IN EXPOSED AREAS. - HYDROSEEDING IS TO BE UNDERTAKEN AT THE COMPLETION OF CONSTRUCTION WORKS.	18. MONITORING: - COMPLIANCE WITH EMP CAN BE EVALUATED BY COUNCIL DURING STAGE CONSTRUCTION AS PART OF ITS SUPERVISION.
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16. STOCKPILE PROTECTION: - STOCKPILE TO BE HYDROSEEDDED IF IN PLACE > 28 DAYS. - CONSTRUCTED TEMPORARY DRAIN AROUND STOCKPILE. - LIMIT HIGHT OF STOCKPILE TO A MAXIMUM OF 2 METRES. - PROVIDE SEDIMENTATION RETENTION STRUCTURES DOWNSTREAM FROM STOCKPILE.	19. VEHICLE AND ROAD MANAGEMENT: SITE ACCESS: TO BE FROM BRIODY DRIVE AND ILLAWONG DRIVE. CLEANING VEHICLES: NOT REQUIRED. STREET CLEANING: BY STREET CLEANING EQUIPMENT IF REQUIRED.
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20. OTHER: - WHERE DE-SILTING IS REQUIRED, MUST BE CARRIED OUT DURING DRY PERIOD.	21. MOVEMENT OF SOIL: OFF SITE CONTAMINANT STATUS: CLEAN
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WASTE RISK: SIGNIFICANT/MED/LOW

REQUIREMENTS: LITTER AND WASTE MUST BE CONTAINED ON SITE, BEFORE DISPOSAL IN A RESPONSIBLE MANNER. WASTE GENERATION MUST BE MINIMIZED.

22. WASTE MINIMIZATION METHODS: ALL WASTE MATERIALS TO BE STOCKPILED AND REMOVED FROM THE SITE.	23. WASTE STORAGE AND DISPOSAL: ALL WASTE MATERIALS TO BE STOCKPILED AND REMOVED FROM THE SITE.
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24. OTHER: - STOCKPILES AT NOMINATED LOCATIONS	25. STORAGE: - NO CHEMICALS/FUEL STORED ON SITE.
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CHEMICALS RISK: SIGNIFICANT/MED/LOW

REQUIREMENTS: STORAGE AND SPILL MANAGEMENT PRACTICES MUST BE IMPLEMENTED TO ENSURE THAT NO ENVIRONMENTAL DAMAGE CAN RESULT FROM ESCAPE OR SPILLAGE OF CHEMICALS OR FUELS.

26. SPILL MANAGEMENT: - SPILL KIT - CONTACT EPA - CONTAINMENT WALL/TRENCH	27. REFUELING PROCEDURE: - FROM FUEL TRUCKS - AT NOMINATED LOCATION
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28. OTHER: - ISOLATE AND REMOVE CONTAMINATED SOIL TO EPA DESIGNATED LOCATIONS.	29. LOCATION: CONTRACTOR TO PROVIDE TRAFFIC MANAGEMENT PLAN NOMINATING ACCESS POINTS PRIOR TO COMMENCING WORKS.
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TRAFFIC RISK: SIGNIFICANT/MED/LOW

REQUIREMENTS: TRAFFIC IS TO BE CONTROLLED TO ENSURE A SAFE WORKING ENVIRONMENT AND TO PROTECT THE GENERAL PUBLIC.

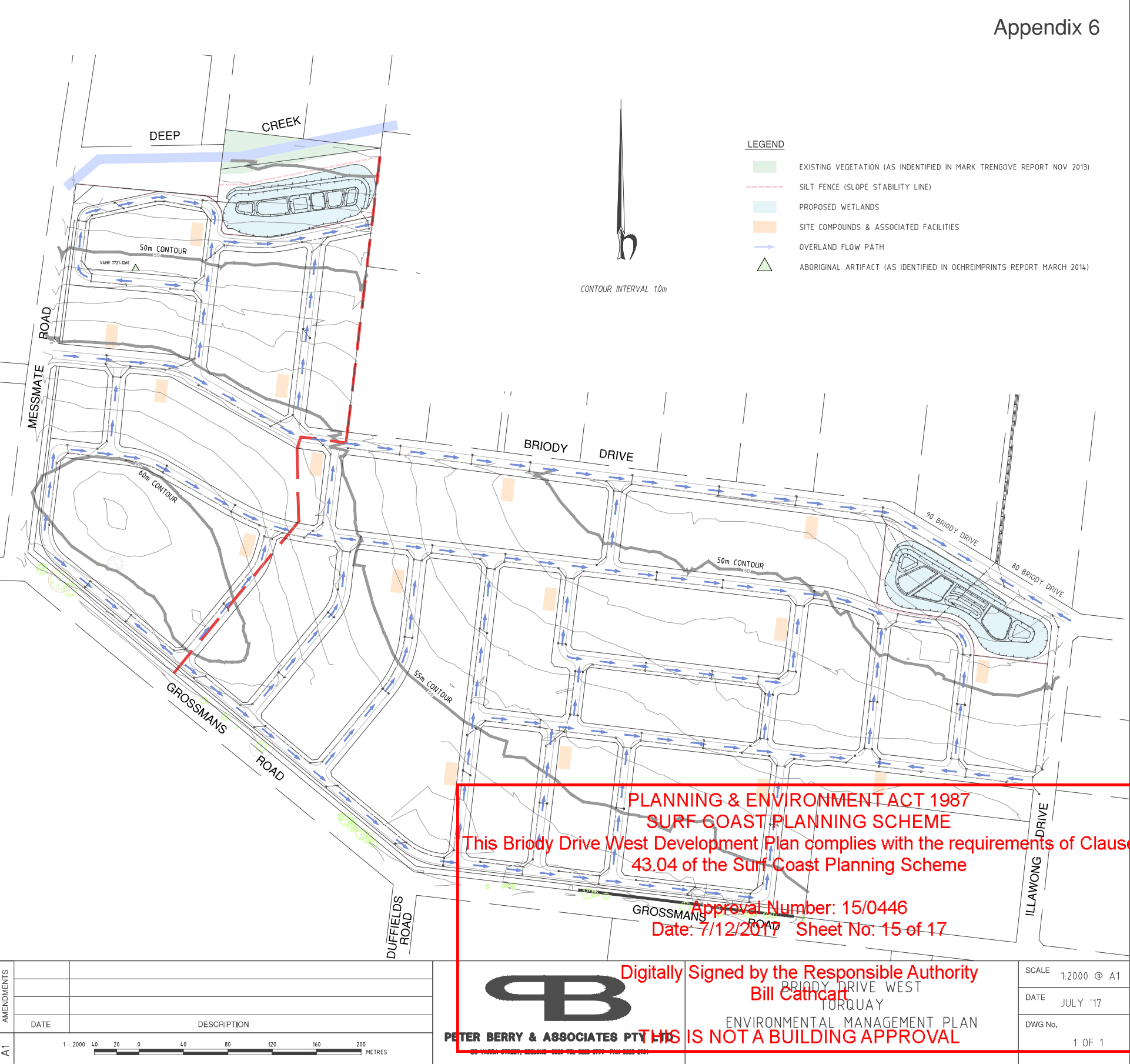
30. TRAFFIC MANAGEMENT: CONTRACTOR TO PROVIDE TRAFFIC MANAGEMENT PLAN DETAILING SIGNAGE AND OTHER APPARATUS REQUIRED TO ENSURE SAFETY PRIOR TO COMMENCING WORKS.	31. OTHER: - PERMITS, SIGNS, CONES, SIGNALMEN, ETC.
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I HAVE READ THIS ENVIRONMENTAL MANAGEMENT PLAN AND AGREE TO UNDERTAKE WORKS AND ENSURE SUB-CONTRACTORS UNDERTAKE WORKS IN ACCORDANCE WITH THIS PLAN.

DEVELOPER: BRIODY DRIVE WEST LANDOWNERS GROUP CONSULTANT: PETER BERRY & ASSOCIATES PTY LTD CONTRACTOR: TO BE ADVISED

OTHER SITE SPECIFIC ISSUES

SIGNIFICANT FLORA/ FAUNA	RISK: SIGNIFICANT/MED/LOW	ARCHAEOLOGICAL/ HERITAGE RISK: SIGNIFICANT/MED/LOW	ACCESS	RISK: SIGNIFICANT/MED/LOW	SERVICES	RISK: SIGNIFICANT/MED/LOW
REQUIREMENTS: ALL SIGNIFICANT FLORA AND FAUNA ON AND ADJACENT TO THE SITE MUST BE PROTECTED.		REQUIREMENTS: PLACES, SITES AND OBJECTS OF ARCHAEOLOGICAL OR HERITAGE SIGNIFICANCE MUST BE PRESERVED.	34. ACCESS TO THE WORK SITE IS TO BE AS OUTLINED IN 19. - ALL VISITORS TO THE SITE ARE TO REPORT TO THE SITE OFFICE BEFORE ENTERING THE SITE.		35. CONTRACTOR IS TO CONTACT 'DIAL BEFORE YOU DIG' PRIOR TO COMMENCING WORKS ON SITE. ALL SERVICES ARE TO BE ACCURATELY LOCATED PRIOR TO WORKING IN THE VICINITY. CONTRACTOR TO PROVIDE AN 'ELECTRICAL SPOTTER' WHEN WORKING IN THE VICINITY OF OVERHEAD POWER LINES.	
32. YES/ NO- DETAILS: - THE PARCEL OF LAND HAS SEVERAL AREAS OF EXISTING VEGETATION. AREAS TO BE FLAGGED OFF TO ENSURE THEY ARE NOT DISTURBED DURING CONSTRUCTION.		33. YES/ NO- DETAILS: - A CULTURAL HERITAGE INDUCTION IS TO BE UNDERTAKEN FOR ALL ON SITE PERSONNEL PRIOR TO THE COMMENCEMENT OF ANY ON SITE CONSTRUCTION ACTIVITY. A COPY OF THE CHMP IS TO BE KEEP ON SITE AT ALL TIMES.				



**The Construction of Detention & WSUD Basin Works
West Catchment - Briody Drive West, Torquay
Surfcoast Shire
Schedule of Quantities and Rates**

Appendix 7.1

Item	Description	Qty	Unit	Unit Rate	Amount
1	Retarding Basin/Wetland Cells -				
	(i) Strip topsoil & replace	5983	Sm	5.00	29915.00
	(ii) Excavate, shape including cut and fill	6327	Cm.	12.00	75924.00
	(iii) Remove excess material from site	3549	Cm.	21.00	74529.00
	Note: Cut and Fill volmes are solid.				
2	Outfall Drainage to Deep Creek-				
	(i) 525mm Diameter RRJ RCP - including Compacted Clay Backfill	55	Ln.M.	220.00	12100.00
	(ii) Precast Concrete Endwall for 525mm Diameter RCP	1	No	900.00	900.00
	(iii) 900mm x 900mm Grated Junction Pit - including galvanised grille cover as specified.	1	No.	6000.00	6000.00
	(iv) Connect to Deep Creek, rock stablisations of embankment and invert.		Item		9000.00
3	Wetland Planting - various zones with designated wetland tube stock species at a rate of 6 per Sm.				
	(i) Plants @ \$4.50 per plant	1348	Sm	27.00	36396.00
	(ii) Plant Maintenance @ \$400 / month	24	No.	500.00	12000.00
	(iii) Hydroseeding of basin footprint and surrounds with native grass mix excluding internal planting areas.	5174	Sm	7.00	36218.00
	(iv) Post and Rail Bollards	180	Ln.M.	90.00	16200.00
	(v) Mowing Basin footprint where applicable @ \$250 / month	24	No.	250.00	6000.00
4	Engineering Fees				31700.00
5	Council Fees				10300.00
6	Contingency Item				35818.00
				Total	\$ 393000.00

PLANNING & ENVIRONMENT ACT 1987
SURF COAST PLANNING SCHEME
 This Briody Drive West Development Plan complies with the requirements of Clause
 43.04 of the Surf Coast Planning Scheme

 Approval Number: 15/0446
 Date: 7/12/2017 Sheet No: 16 of 17

 Digitally Signed by the Responsible Authority
 Bill Cathcart

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The Construction of WSUD Basin Works
East Catchment - Briody Drive West, Torquay
Surfcoast Shire
Schedule of Quantities and Rates

Appendix 7.2

Item	Description	Qty	Unit	Unit Rate	Amount
1	Retarding Basin/Wetland Cells -				
	(i) Strip topsoil & replace	6907	Sm	5.00	34535.00
	(ii) Excavate, shape including cut and fill	6343	Cm.	12.00	76116.00
	(iii) Remove excess material from site	4665	Cm.	21.00	97965.00
	Note: Cut and Fill volmes are solid.				
2	Outfall Drainage to Deep Creek-				
	(i) 1500mm Diameter RRJ RCP - including - FCR Backfill	5	Ln.M.	1500.00	7500.00
	(ii) 975mm Diameter RRJ RCP - including - FCR Backfill	20	Ln.M.	850.00	17000.00
	- Compacted Clay Backfill	185	Ln.M.	520.00	96200.00
	(iii) 450mm RRJ RCP WSUD Offtake - FCR Backfill	10	Ln.M.	270.00	2700.00
	- Compacted Clay Backfill	12	Ln.M.	160.00	1920.00
	(iv) Drainage from Pool - 225mm UPVC - Compacted Clay Backfill	38	Ln.M.	115.00	4370.00
	(v) Precast Concrete Endwall - 1500mm RRJ RCP Pipe	2	No	5000.00	10000.00
	- 975mm RRJ RCP Pipe	1	No	3000.00	3000.00
	- 450mm RRJ RCP Pipe	1	No	800.00	800.00
	(vi) 900mm x 900mm Junction Pit with internal orifice pipe outlet from extended detention pool.	1	No	3500.00	3500.00
	(vii) 1050mm x 900mm Side Entry Pit - including cover as specified.	1	No.	2400.00	2400.00
	(viii) 1050mm x 1050mm Junction Pit - including cover as specified.	2	No.	3000.00	6000.00
	(ix) Overland Flow Path section around basin and down Coucil Reserve.	205	Ln.M.	35.00	7175.00
	(x) Connect to and construction within Deep Creek, rock stabilisations of embankment and invert, placement of clay over new pipe to create walkway.		Item		9000.00
3	Wetland Planting - various zones wiht designated wetland tube stock species at a rate of 6 per Sm.				
	(i) Plants @ \$4.50 per plant	3317	Sm	27.00	89559.00
	(ii) Plant Maintenance @ \$400 / month	24	No.	500.00	12000.00
	(iii) Hydroseeding of basin footprint and surrounds with native grass mix excluding internal planting areas.	4711	Sm	7.00	32977.00
	(iv) Post and Rail Bollards	320	Ln.M.	90.00	28800.00
	(v) Mowing Basin footprint where applicable @ \$250 / month	24	No.	250.00	6000.00
4	Engineering Fees				55000.00
5	Council Fees				17900.00
6	Contingency Item				62583.00
Total					\$ 685000.00

PLANNING & ENVIRONMENT ACT 1987
SURF COAST PLANNING SCHEME

This Briody Drive West Development Plan complies with the requirements of Clause 43.04 of the Surf Coast Planning Scheme

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Date: 7/12/2017 Sheet No: 17 of 17

Digitally Signed by the Responsible Authority
Bill Cathcart

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