Prepared for:
Blue Dolphin Development Joint Venture

THE DOLPHIN BLUE DEVELOPMENT, YAMBA ROAD, YAMBA

Report on Sustainable Water Management

Prepared by:
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Project No:
SY060137

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Executive Summary

This document provides an engineering and environmental assessment of water management at the proposed Dolphin Blue Development, Yamba Road, Yamba.

The purpose of this document is to identify and assess the environmental and operational impacts in managing natural and man-made water flow on site, including:

- Storm water runoff
- Potable water supply
- Non-potable water harvest for reuse
- Groundwater
- Swimming pool aquatics

Each water source is considered in an integrated approach to sustainable use of water on the site, considering water quality, quantity and reuse potential.

Reporting on building hydraulic services is being carried out under a separate report prepared by Norman Disney and Young Consulting Engineers.

All proposed works shall conform to the intent and relevant requirements set by Clarence Valley Council's 'Sustainable Water Development Control Plan' (2004). This DCP requires that developments must promote water efficiency measures that will cumulatively contribute to:

- Efficient use of potable water
- Reduced storm water runoff and peaks
- Reduced demand on upstream water treatment and supply infrastructure, downstream drainage infrastructure and wastewater
- Minimising pollutants leaving the site, both during and after construction
- Reducing the impact of the development on the adjoining Clarence River Estuary environment

The development will adopt best practise design in the handling of all aspects of the water cycle system within the development to achieve these sustainable water goals as per the Stormwater Management Re-use Plan.

1 Introduction

The proposed development of the Dolphin Blue site seeks to incorporate the sustainable management of water resources, in providing recreational facilities, non-potable water for reuse, storm water management and landscape amenity.

The design team is committed to the ecologically sustainable development (ESD) of Dolphin Blue, where feasible and appropriate. In complying with the ESD principles and the aims of ESD at Dolphin Blue as set out by Sustainable Futures Australia in their 'ESD Project Framework' and associated documents, all water sources on the site will be managed with a view to environmental protection and resource conservation.

This report will describe the works proposed and consider opportunities to limit potable water use, including water efficient practices and non-potable water use, to safeguard necessary supplies in times of restrictions and to manage water supply costs. A separate report prepared by the Building Services Engineer deals with building Hydraulic Services.

This report addresses the design of the following facilities:

- Site wide non-potable water harvest and reuse
- Site storm water management
- Swimming pool aquatics

The purpose of this report is to explain the proposed design concepts in handling of water in the facilities described above.

The development will consist of both tourist facilities and residential accommodation, catering for up to 1500 guests and residents, to suit a variety of holiday needs and budgets, with associated restaurants, sporting and recreational facilities. The development is more fully described in the main body of the Statement of Environmental Effects prepared by the project planning team.

This document is based on the concept plan for the entire development, with detailed information presented for Stage 1. The information relating to Stages 2 and 3 will be subject to additional approvals and detail at a later date. At this stage, details for Stage 2 and 3 are only included to demonstrate that the desired environmental outcomes and compliance with relevant standards can be achieved.

2 Existing Site Conditions

The subject site is approx 5.8 Ha and located on Yamba Road, Yamba. The site is bound by the Clarence River Estuary to the north east, Yamba Road to the south west, bush land to the north west and the Moby Dick Tourist site to the south east.

The existing site is generally flat with a slight undulation varying in level from approximate RL 1.9 to RL 1.4. The site is founded on deep sands. The water table is approximately 1m below natural surface level and is

affected by tide and antecedent moisture conditions due to recent weather events.

3 The Proposed Water Management System

3.1 Sustainable Water Design

The sustainable design of water resources requires an integrated approach to water quality, quantity and conservation, in accordance with the principles of Water Sensitive Urban Design (WSUD). At Dolphin Blue the following issues are considered in the design and management of all the water resources:

Water Quantity

- Hard stand areas have the potential to increase overland flow during peak rainfall events, causing flooding downstream. The design minimises the use of hard stand areas and maximises the area of landscaping.
- All rainwater will be harvested from the roof areas for reuse within the site. Water harvesting and storage for reuse reduces peak flow events and aids in flood management.
- Storm water falling on hard surfaces will be diverted to the drainage system, which mimics the natural flow of the site.
- Water storage will be designed so as not to disrupt environmental flows which are essential to riparian habitats and groundwater recharge.

Water Quality

- Storm water will be treated in a Gross Pollutant Trap (GPT) to improve water quality prior to release to the environment.
- Sedimentation and erosion control during construction and ongoing operations will be designed to protect the surrounding water bodies.

Water Conservation

- Building design will incorporate water efficient design to reduce potable water demand.
- Water is to be harvested from all building roofs and stored in underground rainwater tanks. This water will be reused for toilet flushing throughout the residential properties and tourist facilities and for irrigation of site landscaping.
- Swimming pool plant and equipment will be designed in line with current best practice in pool filtration, to reduce the potable water consumption associated with backwashing of pool water.
- Allowance has been made for potential future connection to a dual reticulation (treated wastewater) supply from Clarence Valley Council should it become available.

3.2 Proposed Water Cycle Management System

The general arrangement for the storm water and water reuse cycle is described in the drawing titled the Concept Storm Water Management and Reuse Plan which is included in Appendix A.

The proposal is to harvest roof water and store in rainwater tanks for reticulating recycled rain water through the units for reuse in cisterns and for site irrigation requirements. The demand is topped up with potable water if and when required.

All storm water systems will be designed in accordance with best practice WSUD principles, i.e. maximise groundwater recharge, minimise pollutants and sediment loads, slow response.

4 Storm Water

4.1 General

The existing site generally flat and varies in level between 1.9 and 1.4m AHD. The site is drained via a series of storm water pits, pipes and open drains. Generally storm water flows to the north west towards a formed drain along the north west boundary with adjacent bush land. One small diameter Upvc pipe drains directly to the estuary. The open drain along the north west boundary runs to the Clarence Estuary and falls on both private and public owned property.

This drain appears to have been constructed to drain Yamba road to the Clarence River Estuary, as it drains the roadway only and the adjacent bush land. Yamba Road forms a high point. Storm water runs away from Yamba Road on both sides. To the lake on the south west and to the Clarence Estuary to the north east.

The existing storm water Services survey plan is included in Appendix B which illustrates the existing storm water system.

4.2 Proposed Stormwater Drainage System

Included in Appendix A is the Concept Storm Water Management and Reuse Plan which illustrates the water reuse and storm water systems proposed for the site.

Generally, storm water runoff from all landscaped areas and road ways will be drained to the proposed piped storm water drainage system. The system will include gross pollutant traps prior to all outlets. It is proposed to discharge to the estuary via the existing water stormwater outlet locations with appropriate scour protection and landscape treatments added to improve the functionality and amenity of each outlet.

Outlet 1 drains to the estuary adjacent to the existing jetty structure. It is proposed to demolish and reconstruct this outlet to incorporate it into the abutment of the existing jetty structure.

All roof water will be directed to rainwater reuse tanks adjacent to the basements from where the water will be reticulated for use within the building. During wet periods excess run-off will surcharge from the reuse tanks and into the site storm water drainage system. All storm water systems discharging to the river will incorporate a gross pollutant trap to capture sediment, oils and litter.

All proposed storm water works shall conform to the requirements set in the Maclean Storm water Drainage Design Handbook and by the Clarence Valley Council Sustainable Water DCP. This DCP requires that building design and site management must adopt practises that are complementary to the operation of the natural water cycle and water sustainability.

The development is proposed to be staged. The detailed stormwater system for Stage 1 is provided separately.

4.3 Water Quality

The water quality targets set by Clarence Valley Council are set out in section 2.4 of the Sustainable Water DCP. These targets will be met by designing all site storm water works in accordance with the principles of water sensitive urban design. In particular this will include:

- Limit impermeable areas where possible,
- Adopt gross pollutant traps to provide water quality improvement where storm water is leaving the site.

During detail design storm water quality will be modelled using the computer program MUSIC to ensure all post development water quality targets are achieved.

5 Flooding

The existing site is subject to flooding due to the effects of the Clarence River peak flows coinciding with a tidal surge. The site does not experience flooding due to local catchment flows. A flood information enquiry has been lodged with Clarence Valley Flood Plain Services for the site to establish the flood height and velocity predicted for the site. A copy of response received is included in Appendix C.

A report titled "The Lower Clarence River Council Flood Study Review" was prepared for Clarence River Council by WBM Oceanics. This report reviews the original study prepared in 1988 and incorporates new modelling and floodplain management recommendations. Additional modelling of the Clarence Valley River flooding characteristics and the cumulative effects of other development within the catchment has also been carried out by WBM Oceanics to demonstrate that this site in particular will not worsen flood levels.

The current computer simulated models prepared by WBM Oceanics were overlaid over the site and maps produced for the 1:5, 1:20, 1:100 and PMF floods. This letter was accompanied by a disclaimer stating that

the results can be exceeded and that an exact future flood level cannot be predicted.

Existing floor levels are vary between RL 2.4 and 2.7m approximately. The minimum floor level set for the proposed development is RL 2.7m AHD and generally all apartments with below ground parking are set a further 900mm above this level.

Flood levels have been provided by council for the site for the different average recurrence intervals as follows:

Recurrence Interval	**Flood Height AHD**	**Flood Velocity m/s**
1 in 5 year ARI	0.9 – 1.0 m AHD	<1.0m/s
1 in 20 year ARI	1.8 – 1.9m AHD	<1.0m/s
1 in 100 year ARI	2.3 – 2.4 m AHD	<1.0m/s
PMF Flood	3.3 – 3.6 m AHD	0.1 – 0.2 m/s

A copy of a letter regarding the development sent from the Department of Natural Resources (DNR) to The Planning Department, has been received. This letter refers to the fact that the site is flood prone and should take into account the following:

1. The provisions of the Floodplain Development Manual.
2. The full extent of the flood hazard in this area.
3. The impact of flooding on the proposed redevelopment.
4. The impact of the proposed development including the cumulative effect of development in Yamba including the Yamba bypass on flooding.
5. The consequences of floods greater than the 1% AEP flood event up to the probably Maximum Flood; and
6. Clarence Valley Council's LEP and DCP.

ACOR Consultants P/L have liaised with council in regard to the above items and comment as follows:

1. The provisions of the Floodplain Development Manual: –

   During a flood event water will rise and fall from the estuary. The development will not impede flood flows but will reduce available flood storage volumes. Due to the significant area of the extent of flooding within the flood plain and the proximity to the ocean the effect of reduced flood storage will be insignificant. As such loss of flood plain storage due to the development is not a concern.

   Council have in place a flood warning plan for the Clarence Valley that warns Yamba residents of the ensuing flood as it travels from the upper reaches of the Clarence towards the site. It is recommended that a site evacuation plan in the event of flooding is incorporated into the Community Management Statement that coordinates with

councils flood warning plan to ensure residents of this development are fully warned of ensuing rising of flood waters.

2. The full extent of the flood hazard in this area.

As per the WBM Oceanics report, the development is located within an area designated as low velocity. Velocity has been predicted as 0.1m/s. Depths of flooding will vary from 0 to 800 maximum. As such the velocity depth product will be in the range of 0 to 0.1m.m.s and hence the flood hazard is considered to be classified as low.

3. The impact of flooding on the proposed redevelopment.

The development has been designed to set all floor levels at or above the flood planning level provided by council, i.e. 2.7m AHD. Building basements are to be effectively "flood proofed" by raising entry levels to at least RL 2.7m AHD around all building entries.

The development will effectively act as a levee along the Clarence Rover estuary boundary which will reduce the negative effects of flooding on the development itself and the surrounding residential areas immediately to the south of the development by slowing the inundation of flood waters to these areas.

4. The impact of the proposed development including the cumulative effect of development in Yamba including the Yamba bypass on flooding.

Additional modelling of the Clarence Valley River flooding characteristics and the cumulative effects of other development within the catchment has been carried out at the request of the DNR and is included in appendix D. The report prepared by WBM concluded that the filling of the Blue Dolphin Caravan Park Site independently had a non worsening effect of flood levels, based on the 100 year and 20 year ARI modelling results. Similarly, results show the combined filling of the Blue Dolphin Caravan Park with the neighbouring development in West Yamba reduces the minor impacts resulting from West Yamba development.

5. The consequences of floods greater than the 1% AEP flood event up to the probably Maximum Flood;

Flood levels received from council indicate predicted levels for the 1in 100 and the PMF flood events. The flood planning level has a freeboard to reduce the likelihood of flood inundation of the buildings in very large events in excess of the 1 in 100 year AEP event. The WMB report indicates predicts that the 1 in 500 year AEP event is approximately 60mm higher than the 1 in 100 year event

The WBM report predicts a PMF level for Yamba of 3.39m AHD and councils flood information level predicts in the range of 3.3 to 3.6m AHD. Only two buildings within the tourist facility and one apartment building have a ground floor level below this RL and the villa dwellings within the residential stages. Should the Clarence Valley receive a

PMF event a large majority of the first floor dwellings will be above the predicted RL.

The WBM report is included in Appendix D.

5.1 Minimum Floor Levels

Minimum floor levels have been set at Councils Flood Planning Level (FPL) as advised by council as RL 2.7m. This allows for a freeboard of 360mm above the 1 in 100 year ARI flood level. The 1 in 100 year AEP flood event level for the site is in the range of 2.3 to 2.4m AHD. The WBM Oceanics report predicts a level of 2.34m for Yamba.

6 Non-Potable Water

6.1 Non-Potable Water Supply

All potable water will be supplied to the site from town mains (Refer Norman Disney and Young services report).

Providing a non-potable cold water supply to the site assists in reducing the potable (mains) water demand of the development and forms part of the storm water management system proposed for the site.

The following non-potable water supplies are available to the site:

Rainwater
Rainwater will be harvested from the roofs of all buildings via gutter down pipes, with a first flush water treatment system to remove debris and pollutants from the roof.

Storm Water
Due to the high permeability of the sandy soils, it is expected that overland flow is only likely to occur during peak rainfall events, therefore it is not likely to be able to contribute to the water reuse volume. Stormwater during peak event will flow to the stormwater drainage system as described in Section 4. At other times, rainfall will infiltrate through the soils, recharging the groundwater supply.

Bore Water
At present, groundwater quality available from a bore is uncertain. Until geotechnical results are available for groundwater quality, it is assumed that the water will be brackish to saline and therefore is not suitable for reuse without high treatment levels and cost.

Treated Wastewater
Clarence Valley Council is currently considering the provision of a treated wastewater supply via dual reticulation to the area. The development will be designed such that If a treated wastewater supply becomes available in the future then a connection to the existing systems can be retro fitted.

6.1.1 Non-Potable Water Strategy

It is proposed that rainwater is only harvested from the building roofs. This allows storm water falling on the ground to infiltrate to recharge groundwater to maintain natural flows. Additionally, rainwater from roof areas is of high quality, requiring minimal treatment prior to reuse.

The roof areas, based on the Concept Plan are as follows:

Table 6.1: Approximate Roof and Landscaped Areas

Development Stage	Roof Area (m^2)	Landscaped Area (m^2)
Stage 1 Residential	2,800	1,000
Stage 2 Tourist facility	8,000	4,000
Stage 3 Residential	10,000	4,000

6.2 Non-Potable Water Demand

6.2.1 Development Description

The development will compromise both residential and tourist accommodation, associated restaurants and sporting facilities.

For the purposes of this report, it is assumed that the development experiences near full capacity (90%) during the summer months from October – April, dropping to around 60% occupancy in the winter months.

The following table provides a summary of the development accommodation and expected occupancy of each type of accommodation:

Table 6.2: Development Occupancy

Residential Accommodation					
Rooms	**Number**	**Max. No Occupants**	**Occupancy**		
			100%	**Winter**	**Summer**
				60%	**90%**
1 bed	28	2	56	33.6	50.4
2 bed	134	4	536	321.6	482.4
3 bed	31	6	186	111.6	167.4
Penthouse	31	6	186	111.6	167.4
TOTAL	**224**		**964**	**578.4**	**867.6**

Tourist Facility Accommodation					
Rooms	**Number**	**Max. No Occupants**	**Occupancy**		
			100%	**Winter**	**Summer**
				60%	**90%**
2 bed	80	4	320	192	288
3 bed	19	6	114	68	103
Penthouse	18	6	108	65	97
TOTAL	**117**		**542**	**325**	**488**

6.2.2 Residential Accommodation Water Demand

It is proposed that rainwater harvested from the roof is used to meet the toilet flushing demand of the individual residential properties. Based on the occupancy rates in Table 3.1, the following water volumes are required to meet this demand:

Table 6.3: Residential Non-Potable Demand

Non-Potable Water Demand					
Season	**Total Predicted Occupancy**	**Dual Flush Toilet (6/3L flush)**	**No. of flushes/ person/day**	**Total (L/day)**	**Total (m^3/month)**
Summer	868	4.5	5	19521	594
Winter	578	4.5	5	13014	396

6.2.3 Tourist Facility Water Demand

Rainwater may also be used to supply the toilet flushing demand within the tourist development, to meet the following predicted demand:

Table 6.4: Tourist Facility Non-Potable Demand

Non-Potable Water Demand					
Season	**Total Predicted Occupancy**	**Dual Flush Toilet (6/3L flush)**	**No. of flushes/ person/day**	**Total (L/day)**	**Total (m^3/month)**
Summer	488	4.5	5	10975.5	334
Winter	325	4.5	5	7317	223

6.2.4 Site Non-Potable Water Demand

The residential areas require irrigation of all landscaped areas, over an area of approximately 5,000m^2 surrounding the residential areas and 4,000m^2 within the Tourist Facilities. The landscape architect has selected vegetation types that have a low water demand, assumed to be a combination of turfed areas, native planting and lush feature landscaping. The irrigation system contains moisture sensors, to ensure that water is only provided when required, further reducing water demand.

It is assumed all landscaping areas do not require irrigation during periods of rainfall and for several days after each rain period, dependant on plant type. For the purpose of modelling the irrigation requirement, it is assumed that each rain period lasts for 2-3 days and that no irrigation is required for 3-4 days after each rain period.

6.3 Water Balance

Detailed water balance calculations have been carried out to ascertain the most appropriate rainwater storage volume to meet the demand for internal residential water demand and landscaping requirements and the demand of the Tourist Facilities (refer to Water Balance model in Appendix E).

Weather data was obtained from the Bureau of Meteorology for Yamba Pilot weather station to calculate the available runoff and the effect of evaporation on water storage.

6.3.1 Model Considerations

The water balance model was developed to consider the effects of the environment on the storage and vice versa. The major impacts are:

Evaporation

Evaporation rates are relatively high in the region and therefore underground rainwater tanks are recommended to ensure that stored water is not subject to high evaporation rates.

It is recommended that irrigation is only carried out at night when required, to prevent evaporative losses during application.

Environmental Flows

The detention of natural runoff for reuse on site can have a deleterious effect on downstream environmental flows if undertaken on a large scale. In consideration of this, the annual average water detention is limited to rainfall on building roofs.

6.3.2 Water Reuse Storage Volume

The following storage tank volumes are optimal for reuse, based on average weather data. In times of extreme weather events, irrigation water may be topped up from the potable supply as necessary:

Residential: 100m^3
Tourist Facilities: 70m^3

For Stage 1 alone, an underground tank of 60m^3 will provide all toilet flushing and irrigation demands. However, the exact uses of this non-potable water (i.e. potential to use water for laundry, car washing, showering, etc.) would result in variations of this tank size and is subject to the requirements of the project BASIX report. The BASIX report prepared for Stage 1 will detail the minimum storage volume required to enable the development to meet the required potable water reduction targets.

6.3.3 Non-Potable Water Storage

Harvested rainwater may be stored in purpose built below ground tanks. The water storage and reuse strategy is illustrated diagrammatically in Appendix A.

6.4 Water Efficient Internal Building Design

In accordance with Clarence Valley Council's 'Sustainable Water Development Control Plan' (2004), the internal design of the residential and Tourist Facility units include the following water efficient hydraulic fixtures and fittings:

- 3/6L dual flush toilets
- 3 star rated showerheads
- 3 star rated flow regulators on all kitchen, bathroom and laundry taps

The additional water savings which are achievable by installing 4 star rated fixtures will be assessed during detailed design, to ascertain the financial viability of this upgrade.

6.5 Summary of Water Conservation

The design of the non-potable water harvest, storage and supply system and specification of water efficient landscaping and hydraulic fixtures and fittings greatly reduces the water consumption of the residential properties compared to average dwelling design.

The following table presents the expected water demand per person for an average dwelling, with estimations of the potential water savings by introducing water efficient design (Adapted from NSW BASIX Model):

Table 6.5: Water Efficient Devices

Domestic Water Use	**Typical Usage (L/person/day)**	**Potential savings (%)**		
Drinking/ Cooking	10	-	-	-
		Flow Regulator		
Dishwashing	20	50%		
		2 star	3 star	4 star
Laundry	40	19%	40%	61%
Shower and Bath	65	22%	39%	50%
		Flush Arrester	3/6 L Flush	2/4 L Flush
Toilet	50	42%	35%	55%
Other internal	15	-	-	-
Total	**200**	**152**	**132**	**107**

All residential buildings incorporate 3 star rated appliances at a minimum and the toilet flushing demand is supplied by non-potable water. Therefore the average water usage/person/day is reduced to 100L, a 50% reduction on average dwelling design.

Additional to this, 100% irrigation demand reduction is achievable.

By considering these savings, the residential potable water reduction which may be achieved from the water efficiency measures presented in this section of the report is summarised as follows:

Table 6.6: Dolphin Blue Water Efficiency

Season	No. of People	Typical Usage (L/person / day)	Total Demand (L/day)	Demand with Efficient Fixtures (L/day)	Total Demand with Efficient Fixtures (L/day)	Total Annual Water Saving (m^3/year)
Summer	868	200	173,600	100	86,800	144,600
Winter	578		115,600		57,800	

Total Residential Water Savings/year = 144,600m^3
Total Irrigation Water Savings/year = 1,346m^3

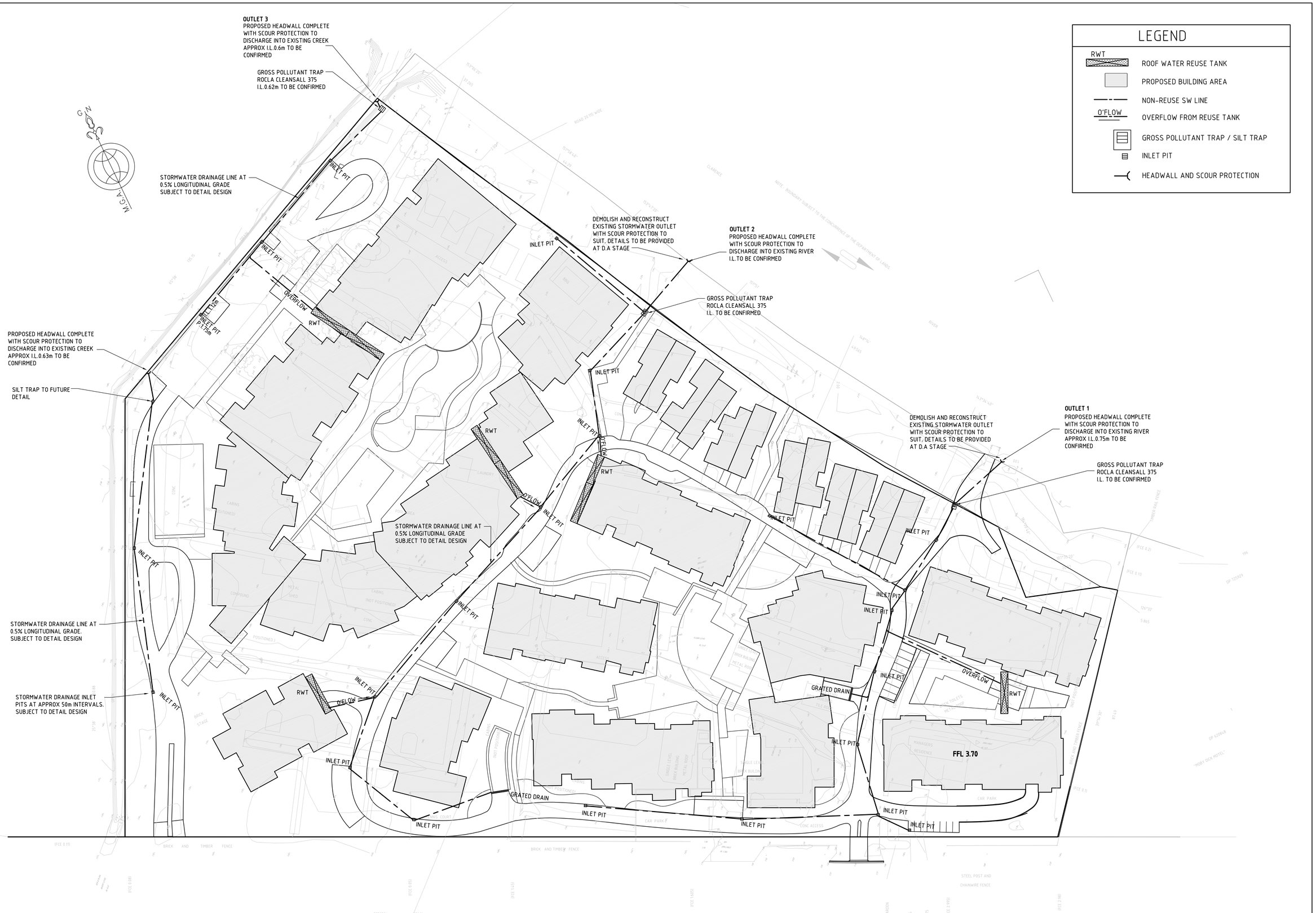
6.6 BASIX Requirements

A BASIX Consultant has been engaged as part of the design team for this project, to ensure that the residential development complies with the BASIX tool requirements for water and energy conservation.

As shown in the previous section, the water conservation measures presented in this section of the report allow the development to exceed the required 40% reduction in potable water consumption. Refer to the BASIX report for details of compliance and performance under this tool, as well as minimum rainwater tank sizes.

Appendix A

Concept Storm Water Management and Reuse Plan



Issue	Description	Date	Drawn	Chkd
B	REVISED ISSUE FOR APPROVAL	19.10.06	RBS	MG
A	ISSUE FOR APPROVAL	11.07.06	SE	MG

1cm at full size

North

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Project

DOLPHIN BLUE DEVELOPMENT
YAMBA ROAD, YAMBA NSW

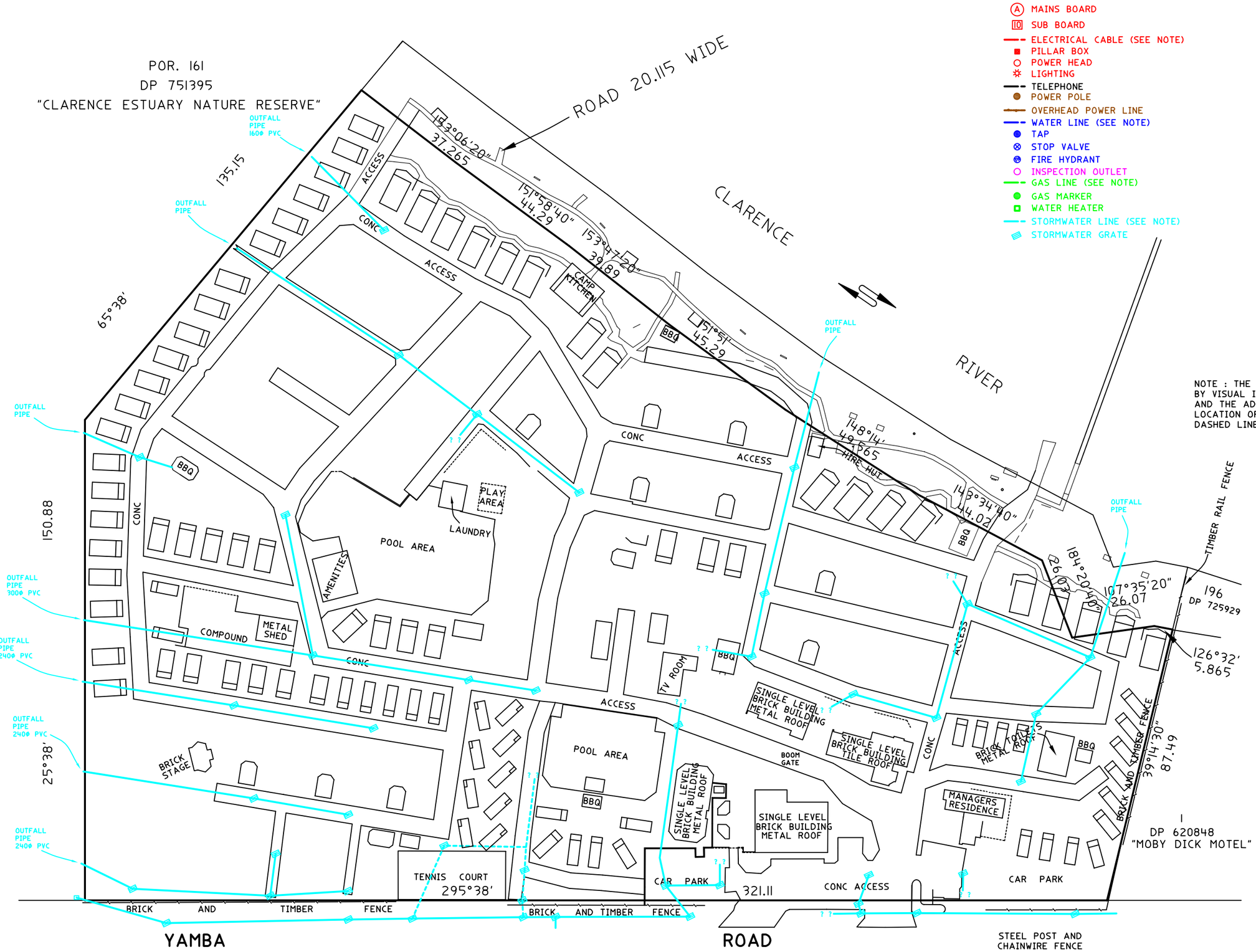
Drawing Title

CONCEPT STORMWATER MANAGEMENT & REUSE PLAN

Drawn	Date	Scale	B1	Q.A. Check	Date
RBS	OCT 2006	1:500			
Checked	Project No.	Dwg. No.	Issue
MG	SY06.0137	SKC01	B

Appendix B

Existing Stormwater Services



- MAINS BOARD
- SUB BOARD
- ELECTRICAL CABLE (SEE NOTE)
- PILLAR BOX
- POWER HEAD
- LIGHTING
- TELEPHONE
- POWER POLE
- OVERHEAD POWER LINE
- WATER LINE (SEE NOTE)
- TAP
- STOP VALVE
- FIRE HYDRANT
- INSPECTION OUTLET
- GAS LINE (SEE NOTE)
- GAS MARKER
- WATER HEATER
- STORMWATER LINE (SEE NOTE)
- STORMWATER GRATE

NOTES:

THE INFORMATION CONTAINED HEREON HAS BEEN DERIVED FOR A SPECIFIC PURPOSE AND SHOULD NOT BE USED FOR OTHER APPLICATIONS.

SHOULD THERE BE ANY DOUBT AS TO THE SUITABILITY OF THE INFORMATION FOR AN APPLICATION PLEASE CONTACT GULAPTIS & SMITH FOR CLARIFICATION.

THIS DOCUMENT SHOULD NOT BE REPRODUCED IN PART. GULAPTIS & SMITH WILL NOT BE RESPONSIBLE FOR THE INFORMATION SHOWN HEREON UNLESS THIS DOCUMENT (INCLUDING ANY ACCOMPANYING CORRESPONDENCE) IS USED IN ITS ENTIRETY.

THE POSITION OF ALL SERVICES SHOULD BE CHECKED WITH ALL AUTHORITIES AND LOCATED ON SITE PRIOR TO THE COMMENCEMENT OF ANY WORK.

THE POSITION OF THE LANDWARD BOUNDARY OF THE ROAD ALONG THE CLARENCE RIVER HAS BEEN CALCULATED FROM PLANS AND FIELD NOTES FROM WHICH THE TITLE DIAGRAM HAS BEEN DERIVED AND IS SUBJECT TO THE CONCURRENCE OF THE DEPARTMENT OF LANDS.

G N M.G.A.

NOTE : THE LOCATION OF SERVICES HAS BEEN INTERPOLATED BY VISUAL INSPECTION OF MARKS AVAILABLE ON THE SURFACE AND THE ADVICE OF RELEVANT TRADESMEN. THE UNDERGROUND LOCATION OF THESE SERVICES HAS NOT BEEN DETERMINED. DASHED LINES ARE AN INDICATATION OF MORE UNCERTAINTY

CAUTION : MORE SERVICES THAN SHOWN HEREON MAY EXIST

SURVEYOR REGISTERED UNDER THE SURVEYING ACT, 2002.

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REF. No. MC052964	ISSUE 1
DWG. No. MC052964-SV3	
CLIENT MITCHELL BROTHERS	DATE 22 MAR 2006

LOCALITY
LOTS 1 & 2 IN DP706628
YAMBA ROAD
YAMBA

SCALE
1 : 600 AT A1 SIZE

DATUM
AUSTRALIAN HEIGHT DATUM

SHEET 4 OF 5 SHEETS

LOCATION OF SERVICES
STORMWATER
"THE BLUE DOLPHIN HOLIDAY RESORT"

Appendix C

Flood Information Issued by Clarence Valley Floodplain Services – 21st June 2006

General Manager: Mr Stuart McPherson

CLARENCE VALLEY floodplain services
A Business Unit of the Clarence Valley Council

21 June 2006

ID:ka/126(f)/22-3A

Mr Michael Goodwin
ACOR Consultants Pty Ltd
PO Box 822
CROWS NEST NSW 2065

FLOOD INFORMATION ENQUIRY FOR BLUE DOLPHIN DEVELOPMENT
LOTS 1& 2 DP 706628

Dear Michael

I refer to your flood height and velocity enquiry for the 1:5, 1:20, 1:100 and PMF floods over the subject property.

The current computer simulated models for these floods were overlayed over the subject property and produced the maps as shown in figures 1 – 8.

It is also important to note the following information:

- It is not possible to accurately predict exact future flood levels for any location.
- The peak flood levels shown on the maps are only an approximate guide and have been derived to represent potential 1 in 100 year ARI (Average Recurrence Interval) peak flood levels.
- A qualified consultant and/or surveyor should be engaged to assess the likely 1 in 100 ARI peak flood level on the relevant ground and floor levels for the property before making any decision to purchase, sell or do anything on, at or to that property.
- Larger floods than the 1 in 100 year ARI flood are possible.
- Council retains copyright in all plans and details provided with your request and are not to be used for any unauthorised purpose.

Please acknowledge receipt of this information by signed printed copy and return by facsimile to (02)6642 3108. A hard copy of this information will also be forwarded by mail.

I hope this information will be of assistance to you and should you require further clarification of the information provided please contact Mr Frank Rasborsek during office hours on 66417350.

Yours faithfully

Ian Dinham
Executive Manager
Floodplain Services

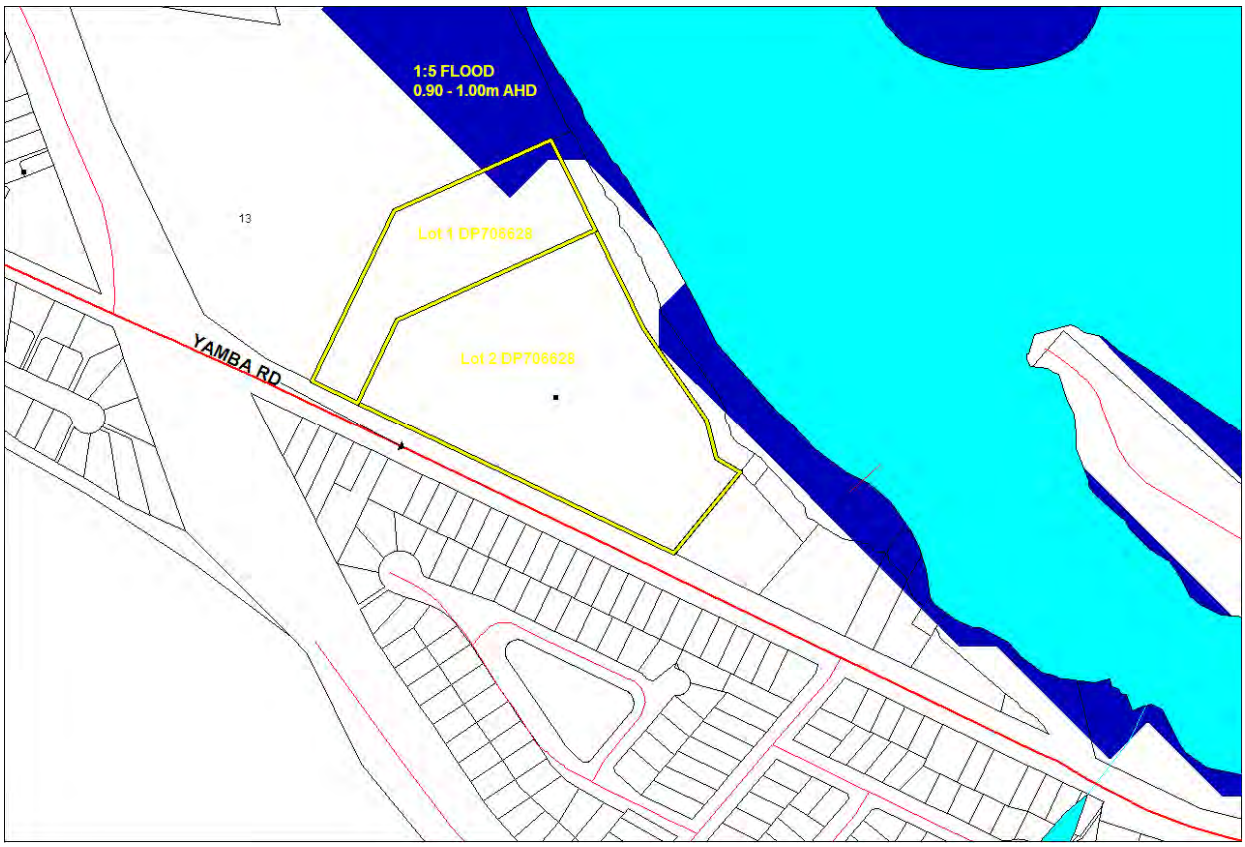

FIGURE 1 - 1:5 FLOOD – HEIGHT AHD

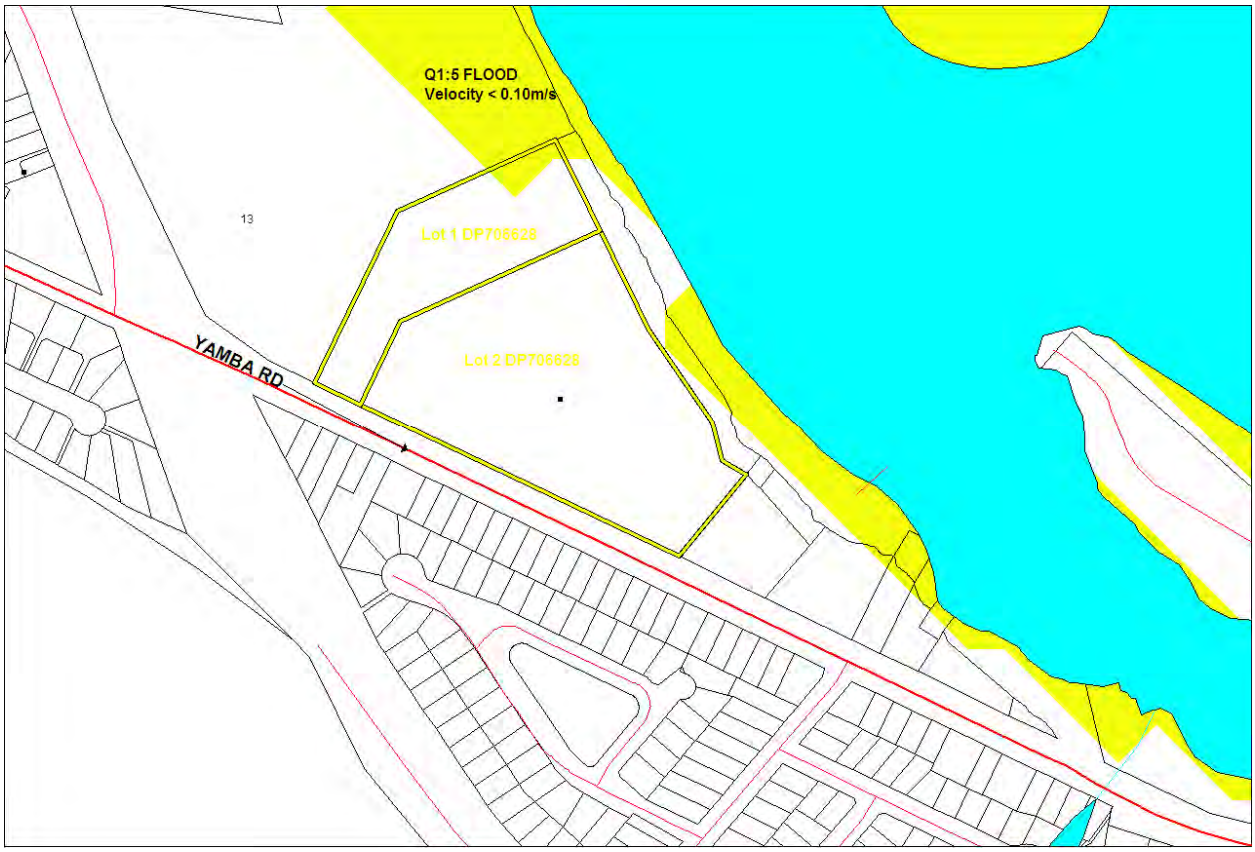

FIGURE 2 - 1:5 FLOOD – VELOCITY M/S

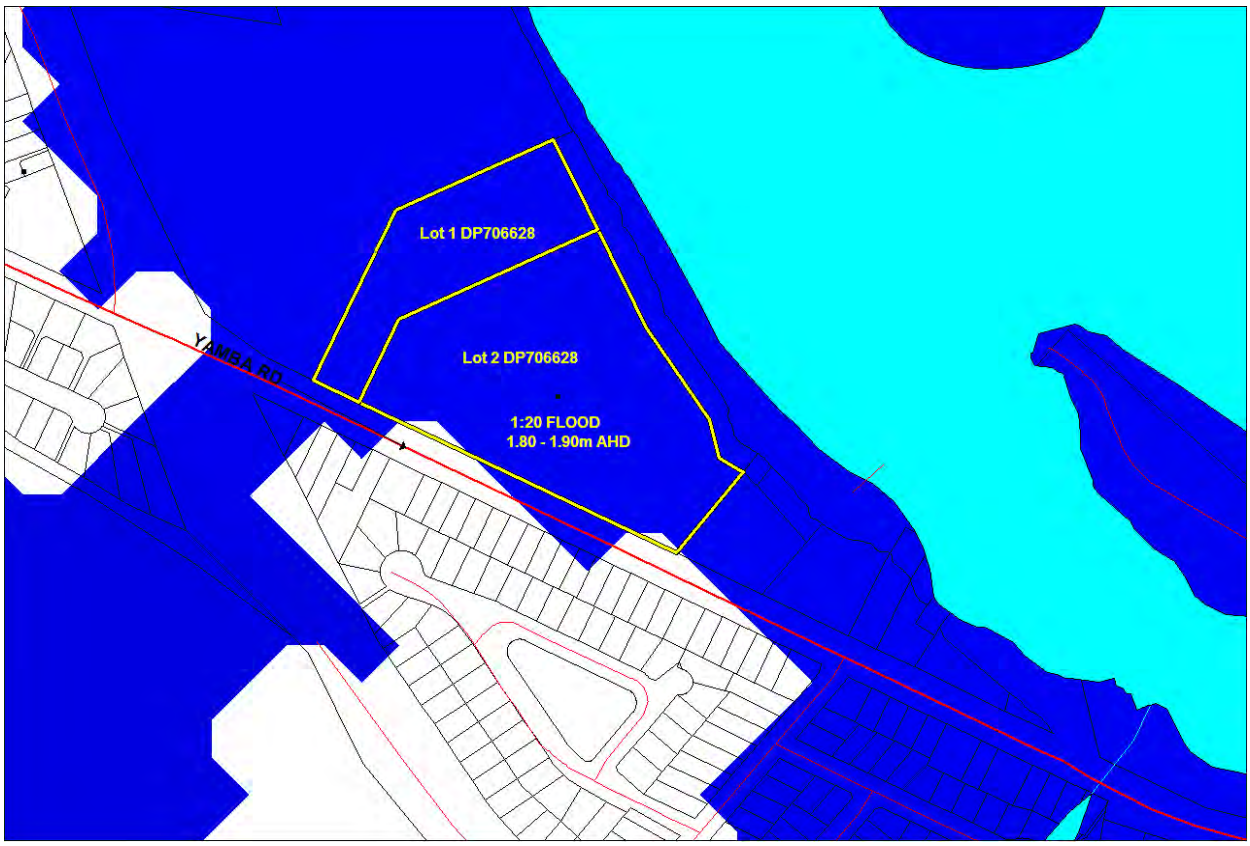

FIGURE 3 – 1:20 FLOOD – HEIGHT AHD

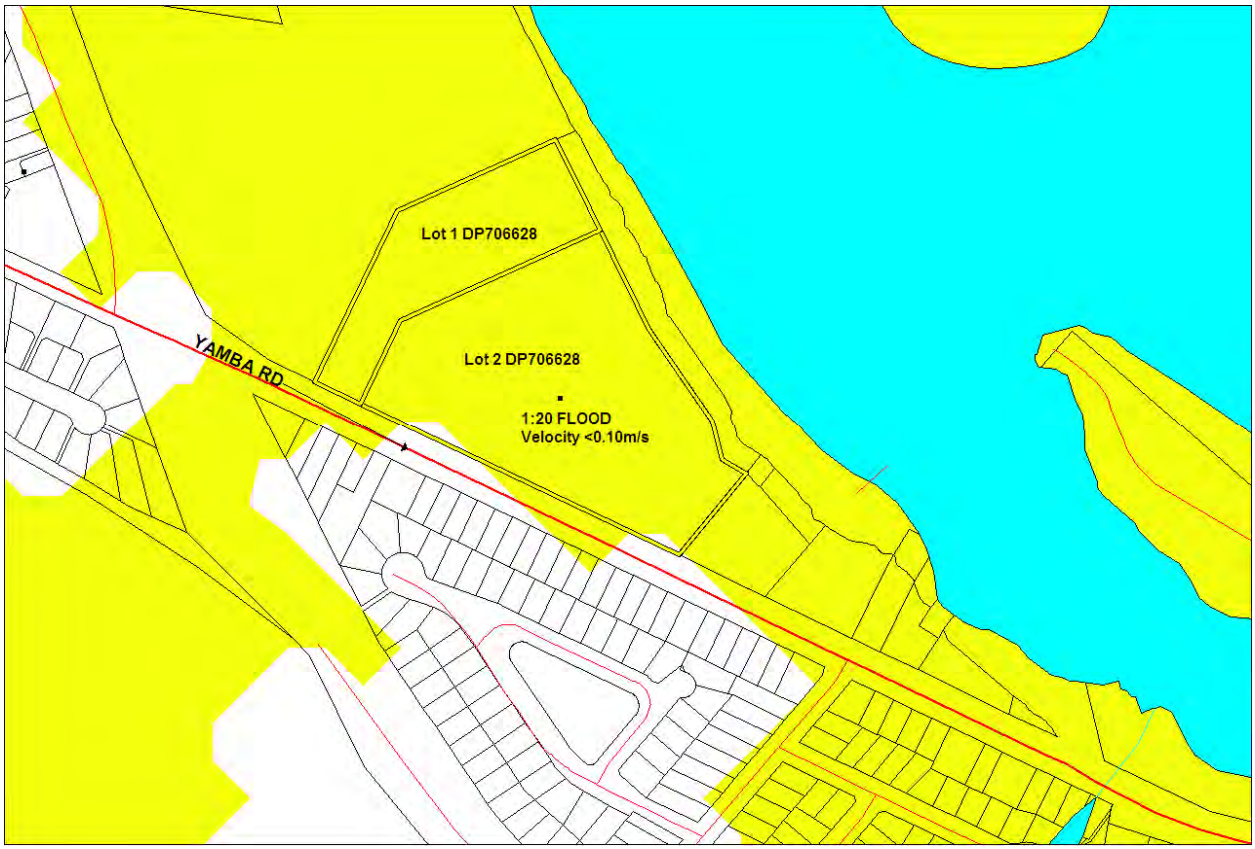

FIGURE 4 – 1:20 FLOOD – VELOCITY M/S

FIGURE 5 – 1:100 FLOOD – HEIGHT AHD

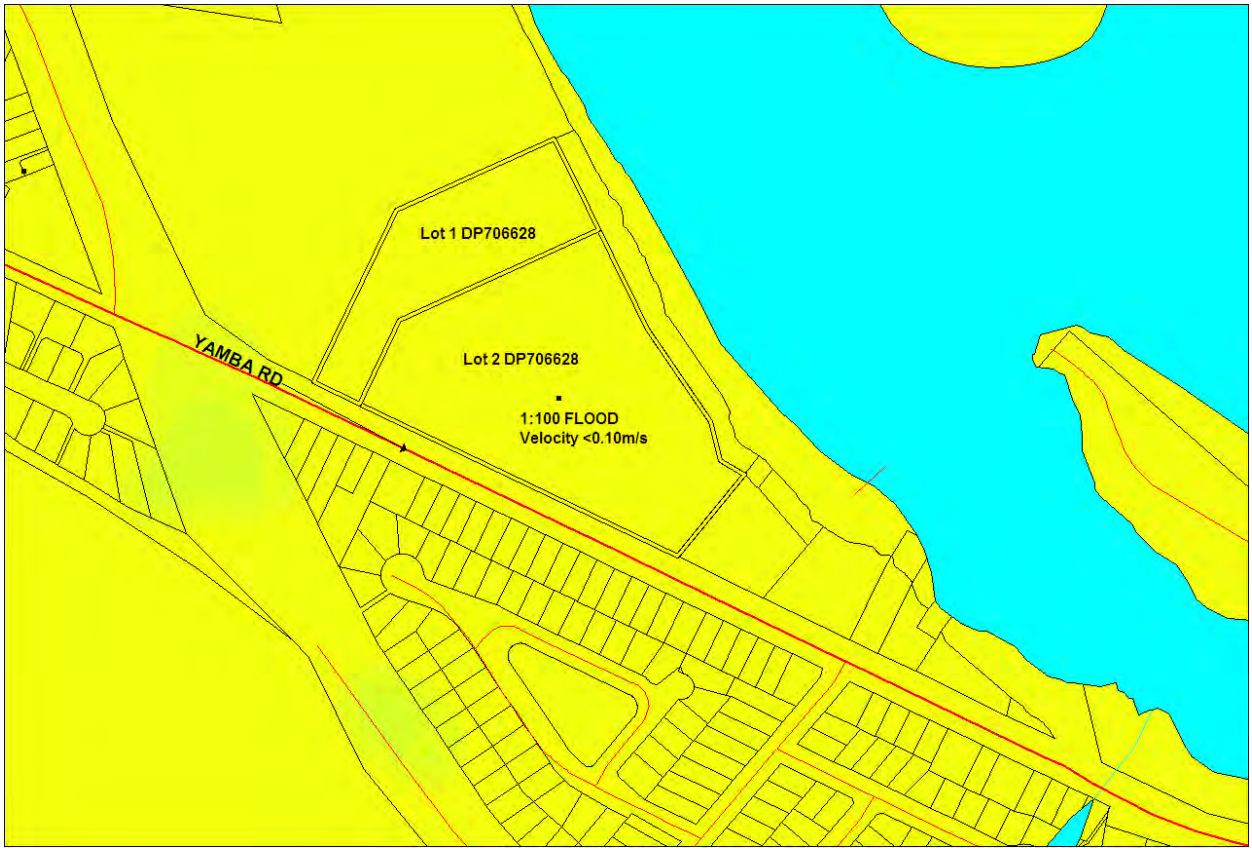

FIGURE 6 – 1:100 FLOOD – VELOCITY M/S