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Addendum to Concept Water Cycle Management Strategy

MP06_0034

Preferred Project Report

Department of Planning issue no.6

Proposed Tourist and Commercial Development
Goodnight Island and Greenwell Point

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P0601331JC11_v1
June 2009

1.0 INTRODUCTION

Martens & Associates Pty Ltd (Martens) were briefed to respond to key issue number 6, in the Department of Planning (DoP) report (dated 17 December, 2008) for the proposed Tourist and Commercial Development at Goodnight Island and Greenwell Point.

This report will form part of the Preferred Project Report (PPR) and is an addendum to the Water Cycle Management Strategy (P0601331JR01_v1, April 2008) prepared by Martens.

A review was conducted by Whitehead and Associates (W&A) on behalf of DoP, of Martens report (April, 2008). In light of that review, the information request from DoP (Dec, 2008) requested the following additional information in relation to wastewater management on Goodnight Island:

1. *'Provide clarification on effluent disposal area and wet weather storage size based on W&A amended hydraulic loading.*
2. *Prepare and operation and Maintenance Management Plan for the wastewater treatment plant and its disposal area.*
3. *Prepare a Wastewater Management Emergency Response Plan in respect to failure or accidental discharges to the waterway, taking into consideration the requirements of NSW Shellfish Program.*
4. *Clarify the term 'storage dams' listed in Martens report.*
5. *Clarify the term 'pump out' listed in Martens report and seek clarififcation on how this procedure could be implemented on Goodnight Island.*
6. *Provide details on the pool filters and if backwashing is required an amended water and nutrient balance must be prepared to accommodate additional backwash water.*
7. *Provide detailed treatment plant design and engineering details to achieve the desired effluent quality as detailed in Martens report.'*

Our response to the above points is provided in the following sections.

2.0 CHANGES TO THE ORIGINAL PROPOSAL

The following changes to the development impacting on wastewater management are noted:

- Number of pavilions on the island reduced from 17 to 15.
- Pavilions now all one bedroom.
- Managers residence removed from proposal.
- Day spa is proposed for Island patrons only (i.e. no general public access).
- Only 25% capacity of the restaurant will be available to the general public.
- Wet weather storage has been increased from 100 KL to 300 KL.

3.0 SUMMARY OF RECLAIMED WATER SYSTEM

For clarification purposes, the following is a summary of the proposed reclaimed water system for the development:

Table 1: Summary of wastewater treatment system:

Item	Description
Tertiary Sewage Treatment Plant (STP)	A Membrane Bioreactor (MBR) proposed for the site to provide tertiary treatment of all wastewater. All membrane bioreactor technology is existing and readily available.
Wet weather storage (WWS) facility	300 KL facility proposed. WWS to be provided by either concrete / core filled block work tanks or appropriately lined dam with 300mm freeboard.
Reclaimed water header tank	Reclaimed water to be trickle fed via a pump to 5 KL header tank to provide 15m head pressure for internal non potable re-use (i.e. toilet flushing) in all buildings.
Irrigation Area	Excess wastewater to be delivered to the sub-surface irrigation area. Treated wastewater to be retained in the wet weather storage facility when field capacity is >95%.
Sewage Pump Stations	A number of small sewage pump stations (approximately 1.5 KL with macerating pump) will collect wastewater and deliver to STP via a low pressure main.

4.0 COMMENTS ON MATTERS RAISED BY THE DEPARTMENT OF PLANNING

POINT 1:

A) Amended Wastewater Generation Figure

Discussions were conducted with W&A regarding the wastewater generation rate at the site. Table 2 provides the amended peak daily wastewater generation rate for the development.

Table 2: Summary of wastewater generation figures.

Item	# Units	# Bedrooms	Persons/ Unit	Total Persons	Flow/ Person (L/d)	Total (L/d)
Hotel Suites	10	1	2	20	80	1600
Hotel Suites	5	2	4	20	80	1600
Hotel Pavilions	15	1	2	30	80	2400
5 bedroom Villa	1	5	10	10	80	800
Day Spa	1	n/a	24	24	10	240
Day Visitors	20	n/a	1	20	30	600
Non-resident staff	12	n/a	1	30	40	480
Restaurant (75% for GI patrons)	120	n/a	1	120	15	1800
Restaurant (25% public access)	39	n/a	1	39	30	1170
Pool Backwash	2	n/a	0	0	0	0
Reception Pool	50	n/a	0	0	0	0
Pavilion Pool	50	n/a	0	0	0	0
TOTAL						**10,690**

It is noted that this figure assumes 100% occupancy of the island (which is not likely to occur) and does not take into account proposed water recycling measures on the island. Recycling of treated wastewater for toilet flushing is proposed, which will equate to a minimum 30% reduction of the wastewater required to be irrigated.

B) Irrigation Area

Wastewater modelling conducted by MA was conducted utilising a daily time step model (as compared to a monthly model used by W&A), with daily evaporation and rainfall data sourced from the bureau of meteorology (BOM) Nowra RAN site. This model is useful as it provides a finer resolution than using a monthly model, in that it can account for day to day variations in weather and sewage generation. The approach allows for accurate modelling of dynamic storage values on a day to day basis.

We have revisited our previous modelling using the updated reclaimed water generation rate of 10,690/day and the same effluent and soil parameters as stipulated in Table 7 and Table 10 of our report (P0601331JR08_v2, April 2008). To be conservative, modelling was conducted with no allowance for reduced flow rates due to non-potable water re-use measures (i.e. recycled water used for toilet flushing was assumed to not occur). Modelling was undertaken assuming: 1) no wet-weather storage; and 2) with wet-weather storage and is summarised below in Table 3. We note, to increase the effectiveness of the scheme, WWS was increased from the original proposal from 100 KL to 300 KL.

Table 3: Summary of modelling results for the development:

Design Element	Criteria	Irrigation Area (m^2)	
		Without wet weather storage	**300 KL wet weather storage**
Total Phosphorous	> 50 years	850	850
Total Nitrogen	< 1kg / year leached below 0.25m	4,500	4,100
Water Balance	Drainage increase of <5mm / week	4,400	4,050
AS/NZS 1547 (2000)	DIR = 2.14 mm/day	4,995	4,995
ADOPTED MIN DESIGN		**na**	**7,000**

It is noted that in excess of 7,000 m^2 of irrigation area is available for effluent irrigation (see site plan attached). Also, there are significantly deeper soil profiles on Goodnight Island than those modelled, and modelling did not take into account water recycling measures proposed for the Island.

C) Wet Weather Storage

We note that the wet-weather storage facility has been increased from 100 to 300 KL. Wet-weather storage modelling was reviewed on the basis of a 7000 m^2 sub-surface irrigation field. Results for the 50 year daily simulation are provided in Figure 1 where no irrigation occurred when the tank was full. The analysis clearly indicates the following:

1. For a 300 KL storage, maximum capacity is reached briefly 15 times in the 50 year historical record. During these periods, effluent is applied to the irrigation field (ie. 'over irrigation').

2. If no 'over irrigation' is undertaken, then the maximum storage volume reached is 500 KL.

3. Increasing the storage volume from 300 KL to 500 KL is not considered useful as there will be no realised environmental benefit by removing the very small amount of 'over-irrigation' potential from the irrigation system.

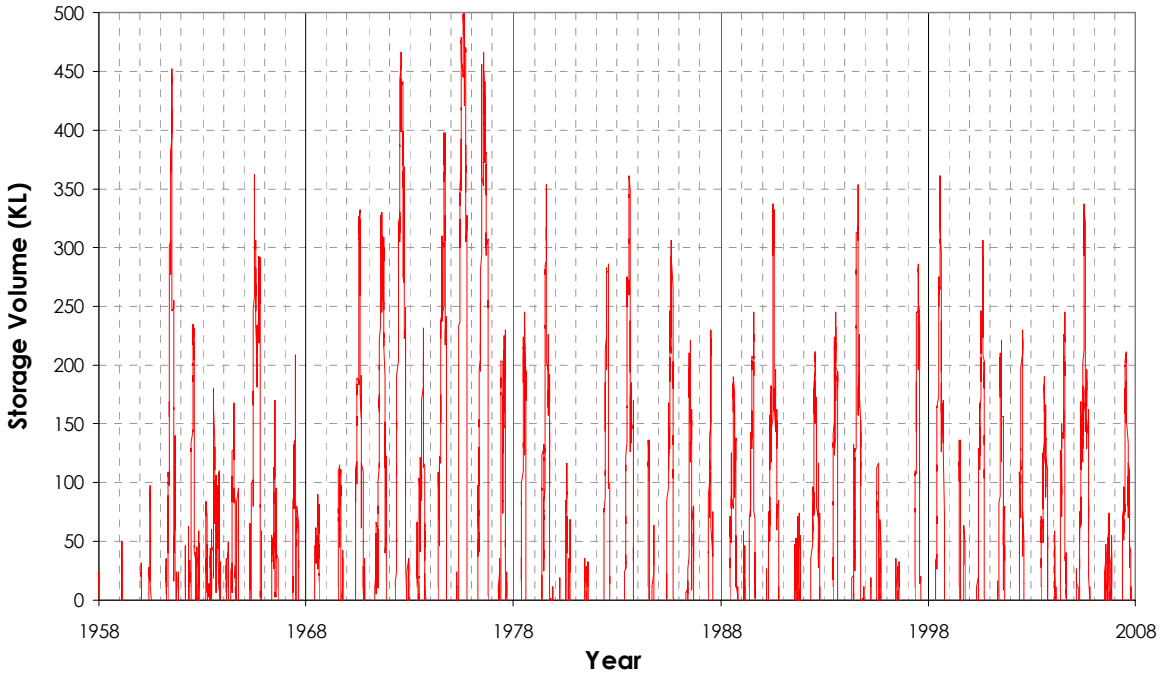

Figure 1: Dynamic wet-weather storage volumes over 50 year simulation period with no irrigation when storage tank is full.

POINT 2:

A) General Wastewater Management Plan

In order for the sewage management system to operate efficiently and within its design criteria, on-going operation management and maintenance plan will be required. We recommend the preliminary measures provided in Table 4. This is to be reviewed and amended following detailed design of the treatment plant.

Table 4: Preliminary site wastewater management plan.

Item	Action	Daily[1]	Weekly[1]	Monthly[2]
Check for tank(s) / irrigation system leaks / overflows	Call plumber for immediate repair	X		
Check odours	Operator to call STP service contractor to identify fault and repair	X		
Record site rainfall	-	X		
Record influent volume	Repair flow meter as required	X		
Record reclaimed water use	Repair flow meter as required	X		
Record irrigation volume	Repair irrigation flow meter as required	X		
Check irrigation system operation and control valves	Call plumber for immediate repair as required		X	
Collect effluent pathogen sample	Call STP service if pathogen levels exceed design. Cease non-potable re-use until problem is rectified.		X	
Clean UV equipment	Replace UV lights as per manufacturers specifications			X
Routine irrigation field flush	Identify and repair leaks if detected			X
Check chlorination system dosing pump	Recalibrate / repair as required			X
Check and restock chlorine supply	Restock chlorine as required			X
Check operation of all pumps	Recalibrate / repair as required			X
Check air supply system	Recalibrate / repair as required			X
Check sludge levels in relevant compartment(s)	Remove excess sludge by pump-out tanker as required			X
Check grease traps on hotel / dwellings	Remove accumulated grease and dispose of in an appropriate receptacle			X
Collect routine effluent samples	Identify effluent compliance and rectify problem if evident			X
Check mixed liquor oxygen level	Adjust air supply as required			X

[1] Responsibility is site operator. [2] Responsibility is STP service agent engaged by site operator.

B) Irrigation Scheduling & Control

Irrigation will generally only be undertaken during periods when the soil is below 95% field capacity. This can be achieved through the implementation of soil moisture probes. Shallow sub-surface irrigation is to be utilised in the irrigation field

to prevent any surface runoff of reclaimed water. All sub-surface irrigation systems will be built in accordance with AS/NZS 1547 (2000).

Additionally, grassed irrigation areas should be mown regularly, with the grass clippings collected and disposed of into an appropriate waste receptacle or recycling area for composting/mulching.

C) Irrigation Records

Treated effluent being sent to the irrigation filed is to be monitored by an appropriate irrigation meter. All flow monitoring data to be recorded daily within a log book housed at the STP control building. Periods of extended rainfall are to be recorded together with repairs and maintenance undertaken on system and incidents such as component malfunctions or reasons why effluent has not been irrigated for extended periods.

D) Irrigation System Maintenance Requirements

In the event of system failure (e.g. blockage, broken pipes) the site operator is to immediately employ the services of a suitably qualified contractor to conduct the necessary repairs. Routine monthly maintenance of the irrigation system should include the following:

- Inspect and repair/service irrigation draw-off system.
- Inspect and repair/service irrigation pump-set.
- Inspect and repair/service filter system.
- Inspect and repair any breaks or faults in the effluent distribution system including flexible hoses and connections.
- Undertake any necessary irrigation system flushing (as required by manufacturer's settings).
- Inspect and repair/service air release valves where necessary.
- Routine landscape maintenance to ensure that grass blade length is < 75 mm within any irrigation area.
- Aeration of the dam is to be conducted by a single, central aerator to help maintain treated water quality during storage.

POINT 3:

A) Emergency Response Procedure

Full details of the design, construction and maintenance to minimise mechanical failure or treatment system will be provided with the detailed treatment plant design at the CC stage once a preferred sub-contractor is chosen. The following

general items will be integrated into the design to deal with emergency procedures:

- A visual alarm (red flashing light) shall be placed at the STP, in the managers residence and also in the hotel managers office in the event of either mechanical component failure, high water level breach or process failure (i.e. switches triggered out of order indicating failure of switch) or power failure.

- Site operator or manager is to keep on file contact details of the emergency maintenance contractor. Contractor to be notified immediately (or during working hours if non-critical) in order that any fault can be rectified.

- A generator is to be kept on site to allow the STP system to function during a mains power outage.

- All overflows from the STP to be directed to the wet weather storage facility via gravity drainage. In the event of an overflow to the wet-weather storage facility, non-potable re-use is to cease. Following rectification STP overflow, internal non-potable re-use cannot be recommenced until the all water in the wet weather storage facility is retreated. We note that STP outflows will still receive tertiary treatment even if full power failure and back up generator failure occurs. This is because all wastewater will have to pass through the tertiary membranes (which require 0.5m in gravity operating head only to pass water) to get to the wet-weather storage facility.

POINT 4:

Based on the required wet-weather storage capacity outlined in Point 1, a single wet-weather storage facility can be provided. This may take the form of either:

- An appropriately lined and constructed earth dam, with a minimum of 300mm freeboard above the top water level. Dam to be lined with either HDPE or geotextile with maximum permeability of 10^{-9} m/day.
- A concrete tank or tanks with a minimum capacity of 300 KL. Tanks to be constructed from poured *in-situ* concrete, or sealed core filled block work.

POINT 5:

The term 'pump out' refers to having effluent pumped out to a pump-out truck. Depending on the final design of the treatment system, this may be required for sludge and solids accumulation (small truck required). Such trucks can access to the site via the proposed barge. No effluent is proposed to be discharged to the waterway. It is noted that a pump out truck can access the island via the barge to remove wastewater if necessary (not likely).

POINT 6:

Pool filters are proposed to be activated carbon filters, which do not require back flushing. Subsequently, pool backwash is not required to be considered when assessing the wastewater generation rate for the site.

POINT 7:

Detailed treatment plant design and engineering details requested by DoP require significant engineering time and are costly to produce. It is recommended that such plans are produced at the CC stage of the development. This is standard procedure, and DoP should be assured that the proposed STP (membrane bioreactor) is existing and readily available technology.

ATTACHMENT A – SITE PLAN SHOWING IRRIGATION AREA

CROOKHAVEN RIVER

N
W E
S

POND

IRRIGATION AREA (APPROXIMATELY 7100 m2). NOTE 7000 m2 REQUIRED

SEWAGE TREATMENT PLANT AND CONTROL SHED

MAIN COMPLEX
FGL 10.5

UTILITY SHED
FGL 6.5

VILLA
FGL 16.5

HELIPAD
FGL 20.2

AMPITHEATRE
FGL 19.0

PAVILION B-7
FGL 16.0
FFL 16.85

PAVILION A-6
FGL 13.0
FFL 13.85

PAVILION B-6
FGL 16.0
FFL 16.85

PAVILION A-5
FGL 13.0
FFL 13.85

PAVILION A-4
FGL 12.5
FFL 13.35

PAVILION B-5
FGL 16.0
FFL 16.85

PAVILION A-3
FGL 12.5
FFL 13.35

PAVILION B-4
FGL 16.0
FFL 16.85

PAVILION A-2
FGL 12.5
FFL 13.35

PAVILION B-9
FGL 8.0
FFL 8.85

PAVILION B-8
FGL 8.0
FFL 8.85

PAVILION A-1
FGL 12.5
FFL 13.35

PAVILION B-3
FGL 16.0
FFL 16.85

PAVILION B-2
FGL 16.0
FFL 16.85

PAVILION B-1
FGL 16.0
FFL 16.85

HEADER TANKS
FGL 11.0

RECLAIMED WATER STORAGE RESERVOIR (300KL BELOW CONTROL SHED IF CONCRETE TANK USED)

NON-POTABLE WATER HEADER TANK TO SUPPLY NON-POTABLE RING MAIN TO SITE BUILDINGS. FINAL POSITION OF TANK TO BE DETERMINED AT CC STAGE OF DEVELOPMENT.

POTABLE WATER HEADER TANK TO SUPPLY POTABLE WATER RING MAIN TO SITE BUILDINGS. FINAL POSITION OF TANK TO BE DETERMINED AT CC STAGE OF DEVELOPMENT.

0 20 40 60 80 100

UNITS - METRES
SCALE - 1:1000 @ A1 1:2000 @ A3

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CLIENT/ PROJECT
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c / STUDIOINTERNATIONALE

THIS PLAN MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED BY PRINCIPAL CERTIFYING AUTHORITY
All measurements in mm unless otherwise specified.

TITLE
SITE PLAN: EFFLUENT MANAGEMENT PLAN GOODNIGHT ISLAND

PROJECT MANAGER: DANIEL MARTENS

DRAWING NUMBER: P0601331JD17_v1

DESIGNED: MGD
DRAWN: MGD/MLB
REVIEWED: DM
DATUM: mAHD
HORIZONTAL RATIO: 1:1000 @ A1 1:2000 @ A3
VERTICAL RATIO: 1:1000 @ A1 1:2000 @ A3
SHEET 1 OF 1 SHEETS
PAPER SIZE: A1 / A3

REV.	DESCRIPTION	DATE	ISSUED
1	WATER CYCLE MANAGEMENT PLAN ADDENDUM	18.06.2009	DM