Whitehead & Associates
Environmental Consultants Pty Ltd
2/13 Industrial Drive, North Boambee Valley NSW 2450
PO Box 23 Bellingen NSW 2454 Australia
Telephone +61 2 6651 1512
Email mnc@whiteheadenvironmental.com.au

Mat Morris

Byron Venue Management Pty Ltd

PO Box 517

Bangalow NSW 2479

Date: 23 October 2018

Ref: 1912 RTC 231018sd

Re: Wastewater Assessment for North Byron Parklands

1. Introduction

At the request of Byron Venue Management Pty Ltd (the Client), Whitehead & Associates (W&A) prepared a Wastewater Assessment (WWA) for the proposed continuation and expansion of the North Byron Parklands (NBP) cultural events site. The WWA (Ref: 1912 WWA 081217 Rev, dated 8 December 2017), was included as Appendix R in the Environmental Impact Statement for the proposed development. A number of comments were received on the WWA by the Department of Planning & Environment (DP&E) appointed third party reviewer, GHD[1]. The WWA was revised and reissued on 9 July 2018, and final comments were received by GHD[2] in late September 2018. Following a meeting between NBP, DP&E and GHD on Friday 20 October, it was agreed that supplementary information was to be provided on the treatment train proposed, particularly in nitrogen removal.

It is acknowledged by DP&E and GHD that the WMA incorporated a concept design only as proof of concept, and that further engineering design was required. Following further technical review and input by WetSystems in September 2018[3], the current concept design includes:

- A series of pumpwells to lift festival wastewater from the source zones up to a flow distribution tank;
- Flow distribution into 4 parallel treatment trains, including:
    - Holding tanks. Aeration in the holding tanks for partial nitrification of the wastewater;

[1] North Byron Parklands Development Application Wastewater Review. April 2018. 2316318
[2] North Byron Parklands Wastewater management Review of additional information. September 2018. 2316318
[3] WetSystems Technical Memorandum 180921-2 and Case Studies, 28 September 2018

  - Gravity throttled flow into a septic tank for anaerobic digestion and partial denitrification;
  - Direct input of conference centre wastewater into each of the septic tanks for fresh carbon input to aid in the denitrification process;
  - Flow through a submerged woodchip bioreactor for additional carbon input and denitrification; and
  - Flow through a subsurface flow horizontal reed bed for further polishing and nitrification/denitrification, with up to 50% recirculation back into the distribution tank for denitrification;
- Resumed combined flow to the final clarification and disinfection tank, with optional zeolite/slag filtration for residue nutrient removal.

The holdings tanks wastewater derived from the festivals is relatively high in nitrogen, which will lead to ammonification. The introduction of air into the holding tanks will aid in the pre-processing of the wastewater, including partial nitrification.

Currently wastewater is generally derived from the amenities blocks consisting of showers, compost toilet seep and urinals, and analytical results of wastewater chemistry has monitored wastewater from these sources. But in the future with the addition of the conference centre, additional wastewater derived from flushing toilets, kitchens, day spa and overnight accommodation (including compost toilets) will generate wastewater of a more balanced chemistry including higher C:N ratios.

The addition of the conference centre wastewater directly to the septic tanks will provide fresh carbon inputs in an anaerobic environment for digestion of the wastewater and partial denitrification.

Modelling has confirmed the ability of reed beds for nitrification and dentrification through the combination of aeration zones and carbon sources within media pore spaces. WetSystems provided confirmation that the addition of recirculation to the process can increase nitrogen removal to >83%.

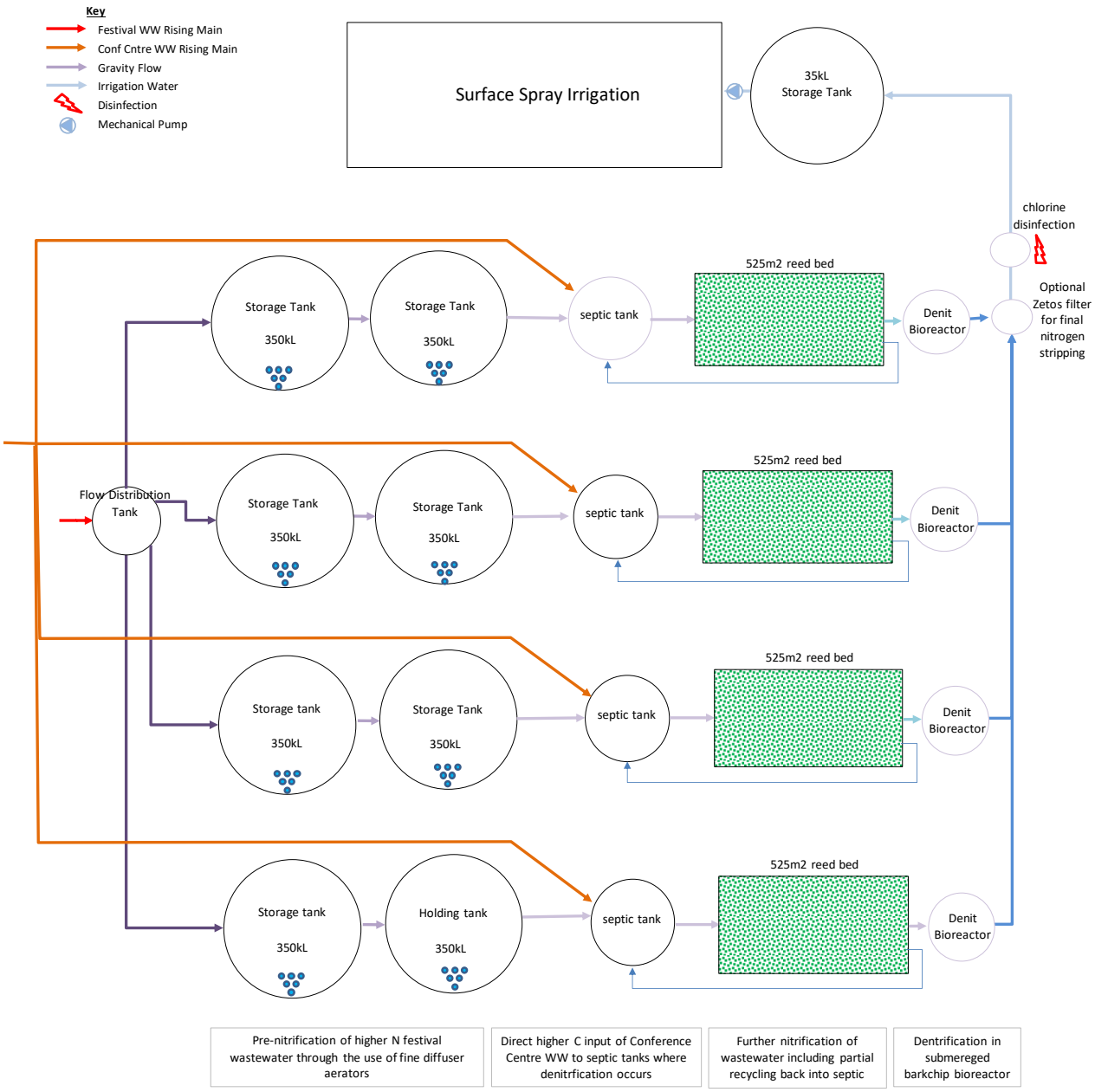
On top of this, a denitrifying bioreactor, containing a wood substrate plus activated carbon will further strip nutrients from the wastewater. WetSystems provided an example of the efficacy of bioreactors for denitrification[4] (Tanner etal 2012). Studies on agricultural runoff have shown that even simple bioreactors can result in nitrogen mass removal of 14-36%[5].

Subject to detailed design the inclusion of a zeolite filter will be considered for final nutrient stripping and polishing prior to disinfection. Volcanic scoria, zeolite or industrial slag in layers provide effective stripping of nutrients (both nitrogen and phosphorus).

The current, concept treatment train is shown in Graph 1 below.

[4] Tanner, C.C., Sukias, J.P.S., Headley, T.R., Yates, C.R., Stott, R. 2012. Constructed wetlands and denitrifying bioreactors for on-site and decentralized wastewater treatment: comparison of five alternative configurations. *Ecol. Eng.* **42**, 112-123.

[5] Laura, E.C., Hanley J.A., Hedley, M. J. 2011. Optimized denitrification bioreactor treatment through simulated drainage containment. *Ag Water management*, **99**, Issue 1, Nov



Graph 1 (From Graph 6 of WWA): Revised Schematic of NBP OSMS Treatment System

For and on behalf of

Whitehead & Associates

Strider Duerinckx

Office Manager

Final quality of the treated wastewater

That the final quality of the treated wastewater for disposal shall be:

a. BOD < 20 mg/L,
b. SS < 30 mg/L,
c. TN = <50 mg/L,
d. P = <20mg/L, and
e. E.coli (or, thermotolerant coliforms) < 30 cfu/100 mL.

Wastewater Management Plan

The Proponent shall prepare a Wastewater Management Plan (WMP) to manage the operation of the planned On-Site Sewage Management System (OSMS). The WMP must be approved by DPE prior to lodgment to lodgment of a S.68 application under the *Local Government Act 1993* with Byron Shire Council. The WMP shall be prepared with reference *to NSW Guidelines for Private Recycled Management Systems (DPI, 2015)* to include the following:

a. wastewater treatment system and irrigation system description;
b. environmental policy and organisational roles, responsibilities and authorities;
c. environmental and health risk assessment;
d. compliance obligations;
e. competence and awareness;
f. internal and external communications;
g. control of documented information;
h. operational planning and controls including regular harvesting of the reed bed plants to ensure reliability in N reduction;
i. emergency preparedness and response;
j. evaluation of performance (monitoring and measurement, inspections, evaluations of compliance); and
k. audit and management review.

Irrigation Management

The Proponent must prepare an Irrigation Management Plan (IMP) for the site, as part of the WMP. The IMP must address:

a. methods of irrigation application (i.e., spray or drip) and approach to irrigation scheduling;
b. design controls (i.e. to prevent irrigation in high winds or following rainfall, and protect human health);
c. soil moisture monitoring methods water and nutrient balances and nominated deficits or leaching to be applied. Monitoring shall be initially undertaken as determined by the hydrogeologist and, may be decreased over time as specified by the IMP;
d. required soil, groundwater and recycled water testing and limits based on guideline values;
e. scheduled testing and maintenance of the system;
f. mitigation measures to protect the soil, groundwater and public health based on relevant guidelines; and
g. contingency measures to be applied if triggers are reached including alternative methods for wastewater disposal if the site is saturated and onsite storages are near capacity.

MEDLI modelling shall be used to determine the area required to dispose of recycled water.

The Proponent shall size the irrigation area based on:

a. selection of an area where depth to groundwater is typically 0.6 m or greater below ground level, and
b. is sufficient to accommodate water and nutrient loads.

The final method of irrigation (i.e., drip or high or low volume spray) must be selected to protect human health adopting a risk-based approach.

Irrigation scheduling to occur in response to soil moisture levels to meet the requirements stated in IMP and records shall be maintained and made available to the Council, DPE, EPA on request.

Irrigation must not occur within 48 hours of forecasted significant rainfall (i.e., rainfall > 10 mm) or when soil moisture monitoring determines that the soil is saturated, or the site is flooded.

No irrigation of public access areas within 48 hours of a scheduled event at the site, or, longer if soil moisture monitoring indicates that the soils will be saturated at the time of the event if irrigated (potentially exposing patrons to pooled recycled water).

Groundwater and surface water monitoring

A groundwater monitoring network shall be established and be operational, prior to irrigation commencing at the site. The groundwater monitoring network shall be designed and be sufficient to:

a. establish baseline groundwater quality in the shallow aquifers beneath the site;
b. permit the development of a hydrogeological conceptual model with contours to determine groundwater flow direction; and
c. provide for regular groundwater level and chemistry monitoring with level results reported in mAHD and depth below ground level, and chemistry assessed by a NATA accredited laboratory.

Compost management

The following requirements apply to compost management:

a. no burying of compost to occur in areas prone to 1% flooding or with shallow groundwater;
b. no irrigation with recycled water in or near areas where composting is occurring; and
c. development and approval of a Management Plan for composting and management of biosolids at the site, as part of the WMP.

Annual Report

The Proponent shall prepare an annual report for the Council and DPE relating to the operation of the OSMS. The annual report must detail irrigation volumes, findings of any soil, water or groundwater monitoring, incidents and complaints and mitigation measures applied and an assessment of compliance against the requirements of plans or programs required by this approval.

First year of operation report

After the completion of the first year of operation of the recycled water irrigation scheme, the Proponent shall commission and pay the full cost of an Independent Audit of the operation of the OSMS. This audit must:

a. be conducted by a suitably qualified, experienced and independent auditor whose appointment has been mutually agreed to by the proponent and DPE;
b. assess the environmental performance of the project and assess whether it is complying with the requirements of this approval (and any plans or programs required under this approval);

c. recommend appropriate measures or actions to improve the environmental performance of the project and/any assessment, plan or program required under this approval; and

d. recommend the frequency of any future audits for approval by DPE.

Within six weeks of completing the audit, the Proponent shall submit a copy of the audit report to the Council and DPE, with its response to any recommendations contained in the audit report.