Appendix I – Stormwater Assessment

Technical Advice Note

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Subject	Belmont Drought Response Desalination Plant - Stormwater Assessment	Job no.	2219573

1 Introduction

Hunter Water Corporation (Hunter Water) is seeking approval to construct a drought response desalination plant, adjacent to the Belmont Wastewater Treatment Works (WWTW) in Belmont South. The desalination plant was originally designed for 15 ML/d capacity, the EIS was exhibited from 21 November to 19 December 2019. In response to submissions received during this process Hunter Water is providing additional details of the stormwater management for the concept design and amended design to 30 ML/d capacity.

This brief report provides an assessment of potential impacts to stormwater drainage as a result of building this desalination plant. This assessment also includes comparison between the concept designs of a desalination plant with 15 ML/d capacity and 30 ML/d capacity.

The concept design of desalination plant includes directing the stormwater into a swale in the south and east side of the desalination plant which finally drains into a sedimentation basin in the north-east of the site. This swale has been sized to accommodate the 1 in 100 year Average Recurrence interval (ARI) peak discharge from the site of 0.7 m^3/s, with a base width of 1.0 metres, side slopes of 1H in 4H, depth of 0.5 metres and a longitudinal slope for 1 in 200. Flows in excess of the basin capacity are directed to an overflow swale, which drains to the beach. The layout of the stormwater management for the desalination plant is presented in Figure 1.

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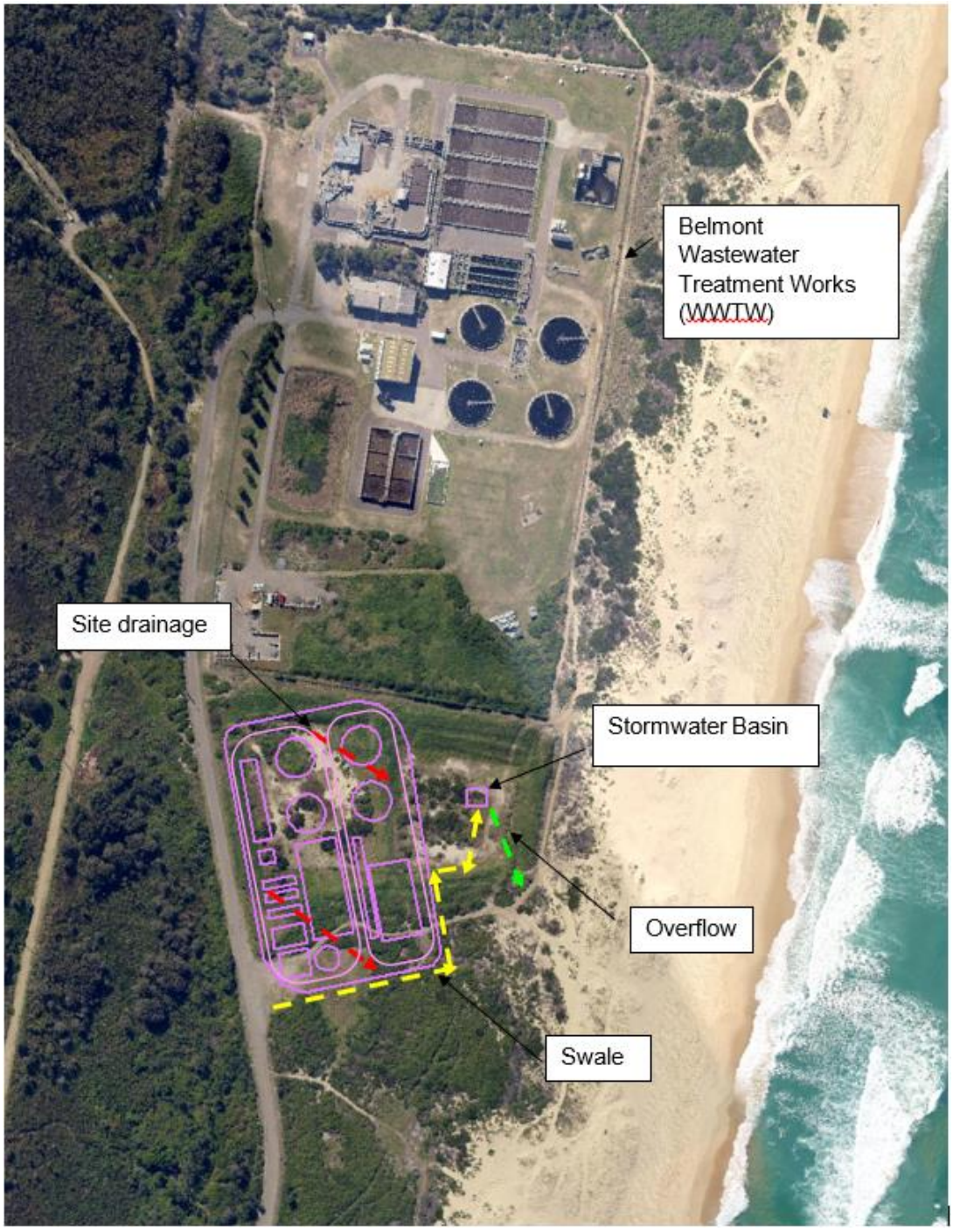

Figure 1 Schematic of the stormwater management for the Desalination Plant

2 Guidelines

This assessment has considered the following guidelines:

1. Development adjoining land and water management by DECCW, OEH 2013 (https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Development-guidelines/guidelines-for-developments-adjoining-land-managed-by-OEH-130122). This guideline was specified by OEH in the guidance material documents and includes the following recommendations to be addressed in the design process, discussed in the Section 6:
   - Development proposals for areas adjacent to OEH land should incorporate stormwater detention and water quality systems (with appropriately managed buffer areas) within the development site.
   - Stormwater should be diverted to council stormwater systems or to infiltration and subsurface discharge systems within the development site.
   - The discharge of stormwater to OEH land, where the quantity and quality of stormwater differs from natural levels, must be avoided.
2. Lake Macquarie City Council (LMCC), Water Cycle Management Guideline – (revision 2, June 2013) (https://www.lakemac.com.au/files/assets/public/hptrim/land-use-and-planning-planning-development-control-plans-dcp-lake-macquarie-control-plan-dcp-2014-original-dcp-2014-and-revision-4-warners-bay-review/dcp-2012-adopted-11-june-2013/dcp-2014-guideline-water-cycle-management-revision-2-adopted-11-june-2013.pdf).

The LMCC stormwater management targets has been reported in the Water Cycle Management Guideline and is shown in Table 1.

Table 1 LMCC stormwater management targets

Development area	Stormwater pollutant	Reduction target
Urban areas (residential, commercial, industrial)	total suspended solids reduction	80%
	total phosphorus reduction	45%
	total nitrogen reduction	45%

These pollutant removal targets have been used in the design process, with the basin sized to address these targets, calculated using the MUSIC modelling, discussed in Section 4.

3 Incremental change

This assessment has compared the concept designs of a desalination plant with 15 ML/d capacity and with 30 ML/d capacity. The upgraded design shows a 10% increase in the impervious area in the 30 ML/d design compared to the 15 ML/d design. This change in the footprint resulting from the increase in the capacity of the plant has been incorporated in the design of stormwater measures.

4 Stormwater assessment

The stormwater assessment has been done with MUSIC model (Version 6.3.0), using the MUSIC-link feature to incorporate Lake Macquarie City Council model parameters and requirements. The model is used to assess the effectiveness of a stormwater treatment measure on the stormwater quality in terms of percentage removal of the key stormwater pollutants specified in Table 1.

4.1 Methodology

MUSIC is a conceptual water quality assessment model developed by the Cooperative Research Centre for Catchment Hydrology. MUSIC can be used to estimate the long-term annual average stormwater volume generated by a catchment as well as the expected pollutant loads. MUSIC is able to conceptually simulate the performance of a group of stormwater treatment measures (treatment train) to assess whether a proposed water quality strategy is able to meet specified water quality objectives. Development proposals for areas adjacent to OEH land should incorporate stormwater detention and water quality systems (with appropriately managed buffer areas) within the development site.

A MUSIC model was prepared to assess the impact of the desalination plant on the stormwater quality managed by a sedimentation (stormwater) basin, shown on Figure 2.

Figure 2 MUSIC model for the Desalination Plant

A stormwater basin has been conceptually modelled and sized to meet the LMCC stormwater quality targets. Figure 2 shows the desalination plant, the conceptual model of the desalination plant and the stormwater treatment measure (modelled as a sedimentation basin).

4.2 Data

The following data was used to perform the stormwater quality assessment:

- Catchment area of 1.72 ha (including 65% pervious and 35% impervious area) from the concept design drawings.
- Elevation data (https://elevation.fsdf.org.au/) for project location in Belmont south (with site elevation between 6 and 2 m AHD elevation).
- The rainfall and evaporation used Standard Lake Macquarie Council data was sourced from the Lake Macquarie City Council MUSIC-link.
- Pollutant generation removal parameters from the Lake Macquarie City Council MUSIC-link.

5 Stormwater Basin Design

Details of the proposed sizing of the stormwater basin with 100 year ARI peak discharge (calculated as 0.7 m^3/s) are presented in Table 2.

Table 2 Stormwater Basin size

Stormwater Basin surface area (m^2)	Permanent pool volume (m^3)	Extended detention depth (m)	Permanent pool volume (m^3)	Exfiltration rate (mm/hr)
130	0	0.2	0	360

The basin preliminary design details in Table 2 were used in the MUSIC modelling.

5.1 Results

The results of MUSIC modelling, in Table 3, shows that the proposed stormwater basin has been designed to achieve the pollutant removal targets outlined by LMCC, presented in Table 1

Table 3 Stormwater treatment train effectiveness

Stormwater pollutant	Treatment Reduction	Treatment Target	Addressing target
total suspended solids reduction	81.2%	80%	☑
total phosphorus reduction	77%	45%	☑
total nitrogen reduction	70%	45%	☑

The design avoids permanent water within the basin to avoid creating habitat for frogs or other wildlife, in order to avoid impacts on adjacent communities.

6 Discussion

Table 4 provides a description of the manner in which the stormwater treatment measure at the proposed desalination plant is in accordance to the guidelines for development adjoining land and water management by DECCW (OEH 2013).

Table 4 Guidelines for development adjoining land and water management by DECCW

Recommendation	How addressed
Development proposals for areas adjacent to OEH land should incorporate stormwater detention and water quality systems (with appropriately managed buffer areas) within the development site.	The stormwater treatment measures have been designed in accordance to the OEH guidelines and incorporate stormwater detention and water quality measures.
Stormwater should be diverted to council stormwater systems or to infiltration and subsurface discharge systems within the development site.	A stormwater basin has been designed and assessed using the MUSIC software to manage discharge from the site primarily through infiltration within the development site.
The discharge of stormwater to OEH land, where the quantity and quality of stormwater differs from natural levels, must be avoided.	The design has been prepared in accordance with OEH and LMCC guidelines and has been modelled to meet pollutant removal targets prior to discharge to OEH land.

7 Conclusions and recommendations

The potential impacts were assessed using the conceptual MUSIC model (Version 6.3.0) based on the LMCC parameters within MUSIC-link. The modelling result indicates that a stormwater basin with 130 m^2 surface area has been calculated to meet the stormwater pollution reduction targets set by Lake Macquarie City Council.

Regards

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