

WYONG SHIRE COUNCIL

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To Council

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**Wyong Temporary Desalination Plant - Tuggerah Beach**

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**SUMMARY**

An application has been received for a temporary desalination plant with a capacity of 2ML/day to be located within a coastal reserve off Wilfred Barrett Drive at Tuggerah Beach, Magenta. The application has been examined having regard to the matters for consideration detailed in Section 79C of the *Environmental Planning and Assessment Act 1979* and other statutory requirements with the issues requiring attention and consideration being addressed in the report.

<b>Applicant:</b>	Wyong Shire Council
<b>Owner</b>	Crown Land (NSW Department of Lands)
<b>Application No</b>	1668/06
<b>Description of Land</b>	Lot 623 DP 822104
<b>Proposed Development</b>	Temporary Desalination Plant
<b>Site Area</b>	Compound area 800m <sup>2</sup>
<b>Zoning</b>	7(a) Conservation Zone
<b>Existing Use</b>	Coastal reserve adjacent to beach car park

**PRECIS**

As part of the Central Coast Drought Initiatives, Wyong Shire Council proposes to install temporary desalination plants at three sites within the Wyong Shire, which are:

- Budgewoi Beach
- Lakes Beach SLSC car park
- Tuggerah Beach, Magenta.

This Planning Report has been prepared by Maunsell Australia Pty Ltd on behalf of Wyong Shire Council to independently assess the development application for the proposed **Tuggerah Beach Temporary Desalination Plant**. This assessment has been prepared in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The matters for consideration are discussed in the following planning report.

## RECOMMENDATION

- 1. That consent for DA/1668/2006 be granted subject to the conditions attached to the report.*
- 2. That those residents and interest groups that made submissions be advised of Council's decision.*
- 3. That the General Manager be authorised to determine any application for minor modifications to the approved development plans and/or consent conditions.*

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## 1 EXECUTIVE SUMMARY

### 1.1 Project Description

Wyong Shire Council proposes a series of three temporary desalination plants to meet short term water needs as part of the Gosford Wyong Water Authority's drought contingency plan. The three temporary desalination plants are situated within compounds proposed at Lakes Beach (SLSC car park), Budgewoi Beach and Tuggerah Beach. This report considers the proposed **2ML/day Temporary Desalination Plant at Tuggerah Beach**.

The proposed temporary desalination plant is a seawater reverse osmosis (SWRO), which involves the process of forcing seawater through a semi-permeable membrane under high pressure. The membrane allows fresh water to pass through and retains salt and other impurities, which are discharged back into the ocean in the form of seawater discharge.

The proposed desalination plant will take water from the ocean via a series of up to 16 beach wells (or bores) underneath the beach and will return the seawater discharge via a seawater concentrate (brine) return pipeline. The potable water will be pumped to the existing trunk water main on Wilfred Barrett Drive.

### 1.2 Key matters for consideration

The following table provides a summary of the key issues and recommendations discussed in this report.

Key matter	Response	Recommended Condition
Further analysis is required to ensure the proposal will not have significant impacts on the coastal environment.	Detailed monitoring of the proposed plant is required and if adverse impacts are evident desalination operations will cease until such impacts can be mitigated or reversed to an acceptable level.	Monitoring conditions proposed in relation to: <ul style="list-style-type: none"> <li>• groundwater</li> <li>• dune stability</li> <li>• ecological communities</li> <li>• water quality</li> <li>• coastal erosion</li> <li>• acid sulfate soils.</li> </ul>
The proposed development adequately mitigates impacts arising from the development with regard to greenhouse gas emissions.	With implementation of recommended offsets provided by the applicant in the <i>Greenhouse Gas Emissions and Mitigation</i> report (dated 15 December 2006) the development can better achieve the principles of Ecologically Sustainable Development.	The conditions of consent require the mitigation of greenhouse gas emissions from the plant's energy use, and the monitoring and documenting of other emission sources.
Proposed infrastructure in the beach has a high potential for exposure through erosion in light of the proposal to retain infrastructure indefinitely.	Along with the desalination plant, all beach infrastructure must be temporary.	All infrastructure is to be removed upon cessation of the temporary desalination operations.
Proposed infrastructure in the beach pose a potential risk to public safety	Risk and Safety of infrastructure in the beach needs to be assessed in	A Risk and Safety Management Plan is required that is developed through a

Key matter	Response	Recommended Condition
	greater detail with respect to the risks it poses to public safety.	formal risk workshop process that involves all key stakeholders.
Insufficient justification of the temporary nature of the desalination plants	The proponent is strongly encouraged to do everything cost effective to establish a more sustainable supply of water during the two year life of the temporary desalination plant.	The proponent is encouraged to investigate all options for improving water efficiencies and water supplies. Investigations should be publicised through an action plan and regular community updates.

### 1.3 Secondary matters for consideration

In addition to the key matters described above, this report discusses the following secondary matters:

- consistency with planning framework
- terrestrial ecology
- marine ecology
- noise and vibration
- air quality
- visual amenity
- traffic and access.

### 1.4 Recommended Management Measures

Additional studies and environmental management plans that are recommended to be prepared by the applicant are described in the table below.

Recommended study / management plan	Timing
Construction Environmental Management Plan, including (but not limited to): <ul style="list-style-type: none"> <li>• Erosion and Sediment Control Management Plan (including detailed monitoring strategy for dune stability and erosion of beach)</li> <li>• Construction Traffic Management Plan (including Community Liaison Plan)</li> <li>• Construction Air Quality Management Plan</li> <li>• Risk and Safety Management Plan</li> <li>• Spill Control Plan</li> <li>• Waste Management Plan</li> </ul>	Prior to commencement of construction
Operational Environmental Management Plan, including (but not limited to): <ul style="list-style-type: none"> <li>• Supplementary Water Quality Analysis Report</li> <li>• Groundwater draw down monitoring</li> <li>• Seasonal monitoring of ecological communities</li> <li>• Contaminated groundwater monitoring</li> <li>• Management of chemicals</li> <li>• Spill Control Plan</li> <li>• Emergency Response Management Plan</li> <li>• Waste Management Plan</li> </ul>	Prior to commencement of operations

Acid Sulphate Soils Management Plan	Prior to issue of Construction Certificate
Monitor and mitigate greenhouse gas emissions.	Prior to commencement of operations
Pilot testing for fine tuning of beach wells.	Prior to commencement of construction
Discussion paper – water supply and efficiency options.	Prior to commencement of operations
Aquatic Ecology Pilot Study	Prior to commencement of construction
Detailed Aquatic Ecology Monitoring Programme	During plant operation
Pre-construction Shorebird Survey	Prior to commencement of construction
Landscape and Rehabilitation Management Plan	Prior to commencement of operations
Cultural Heritage Management Plan	Prior to commencement of construction

### 1.5 Summary

As the potential impacts of the proposed development can be adequately mitigated through recommended management measures, and further analysis is likely to demonstrate impacts are either not significant or can be mitigated to a reasonable level considering the temporary nature of the development, this report recommends Council grant consent subject to those conditions.

## 2 INTRODUCTION

Wyong Shire Council proposes a series of three temporary desalination plants to meet short term water needs as part of the Gosford Wyong Water Authority's drought contingency plan. The three temporary desalination plants are situated within compounds proposed at Lakes Beach (SLSC car park), Budgewoi Beach and Tuggerah Beach. This report considers the proposed **2ML/day Temporary Desalination Plant at Tuggerah Beach**.

### 2.1 The site

The proposed Tuggerah Beach Temporary Desalination Plant is located within a coastal reserve adjacent to an existing informal car park with access to Wilfred Barrett Drive, Magenta. The desalination plant is proposed to be located on flat open space immediately north of the existing Tuggerah Beach car park. The existing car park is sealed and provides informal parking for beach users.

The subject site is within the coastal dunes which have been previously cleared and compacted, which is currently used as a helipad or for an annual carnival. Vegetation around the site comprises low level scarce vegetation consisting of a mix of native and exotic species. Topography of the subject site is relatively flat, but rises sharply towards the dune and the site is raised above the level of Wilfred Barrett Drive.

The site would be accessed from the existing car park accessed from Wilfred Barrett Drive, which is a main road owned and maintained by the RTA. The road is one lane in each direction and links The Entrance with Norah Head. The route forms part of a scenic tourist drive.

Vehicular access to the car park is provided through a priority T-intersection with Type B (Austroads) treatment. This provides sufficient pavement width to allow through vehicles to pass when a vehicle is waiting to turn right into the car park.

Direct access for pedestrians between the beach and the car park is provided from the edge of the car park.

The site is Crown Land and appropriate owner's consent is provided by the NSW Department of Lands (letter dated 9 August 2006).

### 2.2 The proposal

#### 2.2.1 Project description

The project description and development application details are described in:

- *Wyong Shire Council Temporary Desalination Plant – Tuggerah Beach – Statement of Environmental Effects*, reference 22931 / R01, revision 1; prepared by Connell Wagner Pty Ltd, dated 27 September 2006.



The Statement of Environmental Effects is supported by the following assessment documents:

- *Test Drilling, Bore Construction and Aquifer Testing Temporary Desalination Plants Gosford and Wyong Local Government Areas*, for Department of Commerce, prepared by Hydroilex, 5 July 2006
- *Groundwater Flow and Potential for Groundwater Contamination - Southern Part of Magenta Shores Development Site, The Entrance North*, Letter to Department of Commerce, prepared by Hydroilex, 5 August 2006
- Detailed Conceptual Design of Beach Bore Intakes and Brine Discharge to Ocean – Temporary Desalination Plants, Wyong Area, prepared by Water Research Laboratory, August 2006.
- *Dilution of Seawater Concentrate and Groundwater Level Drawdown Associated with a 4ML/day Temporary Desalination Plant*, Letter to Department of Commerce, prepared by Hydroilex, 11 September 2006.

Amendments received during consideration of this development application, which form part of this development application, are described in the following table.

Plan / Assessment	Superseded by
<p><i>Typical 2 ML/D Temporary Desalination Plant Layout</i> Drawing No. CPA110864-3 (reference: REVISION).</p>	<p>Superseded by: Revised 2 ML/D desalination compound layout prepared by NSW Department of Commerce, dated 8/11/2006, titled "<i>Typical 2 ML/D Temporary Desalination Plant Layout</i>" (reference: REVISION). Note: Drawing adds the typical location of waste container.</p>
<p>Plan entitled: <i>Wyong Temporary Desalination Units – Typical Beach Well Pipework</i> Drawing No. WYONG 510, Revision 0, 25/09/2006</p>	<p>Plan entitled: Wyong Temporary Desalination Units – Budgewoi South (Site 2) Typical Beach Well Pipework Drawing No. WYONG 550, Revision 1, 31/10/2006. Note: all references in the documentation and other plans to Drawing No. WYONG 510 should be replaced with Drawing No. WYONG 550. Although this plan relates to Budgewoi South, it is taken to apply to Lakes Beach also.</p>
	<p><i>Detailed Conceptual Design of Beach Well Intakes – 4 ML/Day Intake Model Scenario</i>, prepared by Water Research Laboratory, dated 7 November 2006. Note: letter provides additional assessment of groundwater impacts for the Budgewoi site (i.e. not Tuggerah Beach).</p>
	<p><i>Suggested Monitoring Programme for Temporary Desalination Plants (Finished Water)</i>, supplied by applicant 6 November 2006</p>
	<p>Clarification received regarding vehicle numbers during construction and construction timeframe via email from applicant dated 10 November 2006.</p>

Plan / Assessment	Superseded by
<i>Typical Pipe and Conduit Trench Details</i> , Drawing Reference: WYONG 512, Revision 0, dated 22/09/2006	Superseded by: <i>Typical Pipe and Conduit Trench Details Across Sand Dunes</i> , Drawing Reference: WYONG 603, Revision 0, dated 13/12/2006
	Wyong Desalination Plants – Supplementary Information Figure 3 – Design Tuggerah Beach. Reference: DESAL\22931\AMc\DESIGN_MAG\15-12-06\R1
	<i>Draft Shore Bird Census – Proposed Temporary Desalination Plants Wyong Shire Council</i> , Revision 0, dated 15 December 2006. Prepared by Connell Wagner
	<i>Utility Services Investigation Desalination Site #5 Magenta</i> , Barry Hunt Associates, Drawing Reference: 3270SERVICES
	<i>Greenhouse Gas Emissions and Mitigation – Temporary Desalination Plants Wyong Shire Council</i> , Revision 1, Reference 22931.02, dated 15 December 2006. Prepared by Connell Wagner.

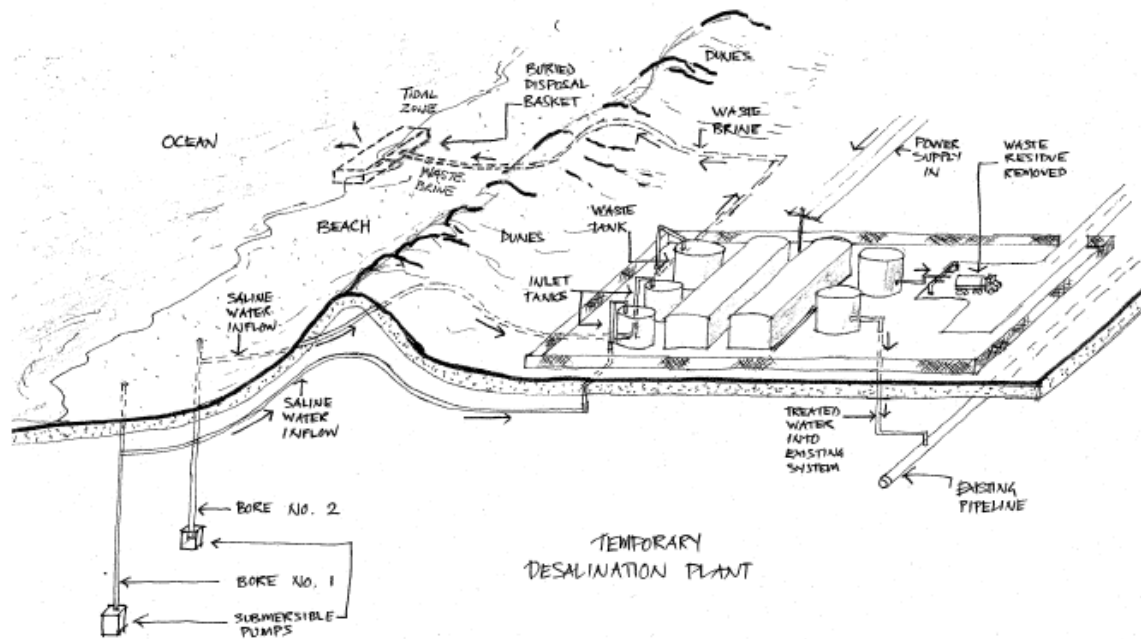
The proposed Tuggerah Beach temporary desalination plant consists of the following components:

- Seawater intake system, comprising:
  - up to 16 vertical beach wells to extract up to 5ML/day of saline groundwater (required to generate 2ML/day of desalinated water). Each well is up to 11m deep and spaced approximately 15m apart (centre to centre).
  - a groundwater bore pump for each bore.
  - rising main (200mm diameter) a minimum depth of 600mm below beach level.
- Temporary SWRO treatment plant, contained within a compound with a “man proof” fence 2.3m in height with two 8m wide gates, and comprising the following plant:
  - raw seawater tank – 6m in diameter, height of 2.5m
  - two RO treatment plant containers – each container being 22.2m in length, 2.44m wide and 2.44m in height
  - two pre-treatment plant containers – proposed to be “similar” in dimensions to the RO treatment containers
  - two containers comprising the fluoride and disinfection plants – 6m in length, 2.44m wide and 2.44m in height
  - one treated water tank – 5m diameter, height of 2.5m
  - switchboard container
  - electrical substation
  - treated water pump station.

*Note: each container proposed will be situated on concrete blocks to raise them 300mm off the ground.*

- Pre-treatment, comprising the following processes:
  - Anti-scalant chemicals – added to feed seawater (prevents significant scaling of calcium, barium, strontium and silica compounds, which in turn prevents the fouling of the RO membranes). Such chemicals are biodegradable and have proprietary composition. Chemicals are returned to the sea with seawater concentrate (brine).
  - Up to six filters of 2m in diameter – for screening of the extracted seawater, which will utilise sand filtration, microfiltration or filter cartridges
  - Each filter will undergo backwash every 12 hours (lasting up to 5 minutes), Totalling 12 backwash events per day, which will be discharged to sewer (Note: amended details were submitted during consideration of the application that state the backwash will be discharged to sewer as opposed to discharging to the ocean through the seawater concentrate return).
- Seawater concentrate return:
  - Concrete seawater discharge outlet located in the swash zone between the high and low tide marks – 1 m length x 1 m width and 900mm in height.
  - 300mm diameter “buried” pipe will be constructed from the desalination plant to the outlet
  - 3ML/day of seawater concentrate (brine) will be returned from the 2ML/day desalination plant, which will be of two types being normal discharge and discharge when backwash is occurring.
- Clean in place chemicals – approximately 500kg of each CIP chemical (comprising; caustic soda, sulphuric acid and other proprietary chemicals) will be used each 6 months to clean microfiltration or RO membranes. These chemicals are not stored on site, but instead will be transported to the site by cleaning contractors and removed within 24 hours of cleaning completion.
- Post chemical treatment of water supplies:
  - chemicals stored in the containers containing the disinfection and fluoride plants.
  - lime added to the RO via a limestone filter
  - chlorine added in the form of sodium hypochlorite (471 litres per month)
  - fluoride dosing in accordance Wyong Council's existing practices (128 kg per month)
- Power supply demand of 10MWh/day (mega watt hours per day), based on a typical plant power demand (sourced from the NSW Department of Commerce, 2003).
- Fresh water delivery – water stored in concrete tank and continuously monitored to confirm compliance with Australian Drinking Water

A typical schematic diagram of the proposed plant is provided in the SEE, which is reproduced as the figure below. Although this schematic represents the layout for a typical 1ML/d temporary desalination plant, which is of less capacity than the proposed plant, the drawing provides useful description of the overall layout.



### Construction

The applicant states that “*construction of the proposed temporary desalination plant is estimated to take 12 to 14 weeks to complete*”. However, in the Traffic and Transport section of the SEE, the applicant states that “*construction of the proposed temporary desalination plant is expected to require up to two months to complete*”. Clarification was subsequently received from the applicant (10 November 2006) that states:

- Temporary Desalination Plant installation: estimated to take 8 to 10 weeks
- Bore and Pipeline Construction: estimated to take 6 weeks.

Accordingly, the total construction timeframe is estimated by the applicant to be 8 to 10 weeks, being the longer of the two timeframes above.

Advice was received from the applicant (via email dated 31 October 2006) that estimates construction is proposed to commence February/March 2007.

Amendments to the Development Application (received 15 December 2006) provide for construction of pipelines from the beach to the desalination compound using trench boxes or sheet pile methods.

The SEE states that the majority of construction for the RO plants would involve pre-assembly off site and delivery using large trucks. Refer to Section 9.10 of this report for discussion of the forecast traffic generation of the proposal.

Sand removed from the installation of bores and associated pipelines will be re-graded across the beach using a track bladed vehicle. A drilling rig will access the beach to install the bores.

*Operation*

The RO unit and post chemical treatment facilities are designed to provide unattended automatic operation of the plant. A manual override switch will also be incorporated into each unit.

*Rehabilitation*

The proposed desalination plant is proposed to have a maximum operational life of two years. The applicant states that removal of the plant will involve removal of:

- SWRO and pre-treatment process units
- all aboveground pipe work and holding tanks
- all fencing.

The applicant also commits to “*site cleanup*” so as to restore the site to pre-development conditions, including re-establishment of all car parking and access provisions.

The applicant does not proposed to remove any below ground components (including bores and pipe work).

**3 REQUESTS FOR FURTHER INFORMATION**

During the consideration of this application, a number of requests were made to the applicant for further assessment or information for this assessment. The table below provides a description of key information requested that was not provided or not fully addressed by the applicant.

<b>Information requested</b>	<b>Response</b>
Requested detailed analysis of greenhouse gas emissions and proposed abatement/mitigation measures.	A Greenhouse Gas Emissions and Mitigation Report submitted for consideration as an addendum to the SEE, dated 15 December 2006.
Confirmation required regarding the vehicle movements during construction.	Additional information provided by applicant. However, the numbers of movements and vehicles were ambiguous. Assumptions have therefore been made according to exact wording provided by applicant.
An assessment is required of any shortfall in parking based on existing usage of the car parks, and how these shortfalls would be managed/catered for.	No assessment provided. Amended layout submitted reducing number of spaces occupied by proposal from approximately 110 to approximately 60. Conditions of consent recommended to quantify impact and implement appropriate management measures.
Swept path analyses for construction vehicles	Not provided. Condition recommended for applicant to demonstrate accessibility of the site during construction for all vehicles and to implement measures to provide access where access is not appropriate.

## 4 HISTORY

Notable previous land uses at and surrounding the site include sandmining and landfill, in addition to recreational uses associated with the unmanned beach, including occasional use of the clearing as a helipad which is ongoing.

Information provided by the Department of Primary Industries shows that the area between North Entrance and Budgewoi has been previously disturbed and modified as a result of heavy mineral sand mining which occurred in the area between 1960 and 2003. The area in the vicinity of the proposed beach bores and associated pipelines at Tuggerah Beach was mined by Associated Minerals Consolidated in the 1970's, with much topography disturbed by sand mining and some reformation of dunes occurring.

The decommissioned domestic landfill is situated approximately 600m to 700m to the north of the subject site (Connell Wagner, 2006) and was operated by Wyong Shire Council between 1971 and 1990.

## 5 STATUTORY REQUIREMENTS

### 5.1 Approvals process

The proposal is to be assessed under Part 4 of the *Environmental Planning & Assessment Act 1979* as development consent is required for the works. The proposal is not classified as designated development under Schedule 3 of the *Environmental Planning & Assessment Regulation 2000*, and therefore an Environmental Impact Statement is not required to be prepared. A Statement of Environmental Effects has been prepared in accordance with the provisions of Section 79C of the *Environmental Planning & Assessment Act 1979*.

A number of licences and approvals are required under the provisions of a number of different acts and are documented under 'Other licenses and approvals', below. The proposed development constitutes integrated development, as it requires consent from one or more of the approvals listed within section 91 of the *Environmental Planning & Assessment Act 1979*.

### 5.2 Wyong Local Environmental Plan 1991

#### *Clause 10 zone objectives and development control table*

The proposed temporary desalination plant is to be located in Zone No 7 (a) (Conservation Zone). Objectives of the zone are to restrict the type and scale of development which will be carried out on land possessing special aesthetic, ecological or conservation values, to development that is compatible with such environments.

Where it can be demonstrated that development can be carried out in a manner that minimises risks from natural hazards, functions efficiently, does not prejudice other economic development and does not detract from the scenic quality of the land, 'compatible' development can be allowed. These criteria for assessment are summarised below.

Zone criteria	Assessment
minimises risks from natural hazards	<p>An assessment of risks associated with the proposed plant has been conducted (refer Section 9.18 of this report), which determines that the proposal, subject to preparation of a Risk and Safety Management Plan, satisfactorily minimises risks from natural hazards considering:</p> <ul style="list-style-type: none"> <li>• the proposed mitigation measures (including those that are the subject of recommended conditions)</li> <li>• the temporary nature of the plant.</li> </ul>
functions efficiently	<p>The proposed desalination plant provides indicative details only. However, sufficient information has been provided that, in conjunction with the recommended conditions of consent, demonstrate the proposed desalination plant can function efficiently for the specified two year period.</p>
does not prejudice other economic development	<p>The proposed desalination plants will have a positive impact on the economic activity through providing guaranteed water supplies in the short term. The potential for impact on tourism is considered to be manageable, considering the two year operational life of the proposed development. Accordingly, signage is required to clearly communicate the temporary nature of the facility.</p>
does not detract from the scenic quality of the land	<p>The proposal is industrial in visual appearance, which would detract from the aesthetic quality of the area. However, in light of the following considerations the visual impacts are considered to be reasonable compared to the benefit of guaranteed short term water supplies:</p> <ul style="list-style-type: none"> <li>• operational life of the desalination plants is two years</li> <li>• restoration measures are proposed</li> <li>• screening with fences and vegetation.</li> </ul>

Under the provisions of the *Wyang Local Environmental Plan 1991*, the proposed works would constitute a utility installation for the supply of water. Within Zone No 7 (a) (Conservation Zone), utility installations are permissible with consent from Wyong Shire Council.

The proposal is compatible with the objectives of the zone, considering the criteria described above and the following:

- high quality finishes are required to be used
- stringent environmental measures (particularly to minimise impacts to the scenic value of the subject site) are to be applied
- the development is temporary in nature (maximum operational life of two years)
- community benefits are generated from short term augmentation of water supplies.

*Clause 15 Development on land containing acid sulfate soils*

The Statement of Environmental Effects states that the Acid Sulfate Soil Risk Map for Wyong indicates that the site has a probability of Acid Sulfate Soils (ASS) occurring, however does not state the class of ASS (1 to 5). Due to the works occurring over 11m below the ground, it is assumed the provisions of Clause 15 apply to the proposal and an ASS management plan is required.

Pursuant to clause 15, Council must not grant consent required by this clause unless it has considered:

- *the adequacy of an acid sulfate soils management plan developed in accordance with the Acid Sulfate Soils Assessment Guidelines*
- *the likelihood of the proposed development resulting in the discharge of acid water, and*
- *any comments received from the Department of Infrastructure, Planning and Natural Resources within 21 days of the Council having sent that Department a copy of the development application and the related acid sulfate soils management plan.*

The proposed works are situated on a cleared and compacted site and is in an area where soils comprise well-drained beach sand that is aerated and sorted by the actions of wind and waves. It is not likely that any acid generating material remains would be present near the surface in the beach area. It is recommended that initial screening tests are required for acid sulphate soils testing within the dunes.

Given that the majority of the excavation for the project will be confined to the dunes, it seems unlikely that an Acid Sulfate Soils Management Plan will be required for the excavation or trenching of the pipelines. However, should ASS be discovered as a result of the screening tests, the Acid Sulfate Soils Management Plan should deal with this issue.

As the proposal involves drawing down groundwater there is potential for off site impacts that may generate ASS. Groundwater modelling carried out by the proponent demonstrates the area of influence of the proposed groundwater drawdown. This shows there is potential for impact on estuarine areas near the site, which may lower the water table and result in ASS.

Although the project is not located on land that is likely to contain surface ASS, it is a requirement of this consent that the proponent carries out investigations in accordance with the *Acid Sulfate Soils Assessment Guidelines* and prepares a commensurately detailed Acid Sulfate Soils Management Plan (ASSMP). The investigations and ASSMP shall be undertaken in accordance with the *Acid Sulfate Soil Manual* (Acid Sulfate Soils Management Advisory Committee, 1998). The ASSMP shall be submitted to Council and the Department of Natural Resources for approval prior to commencing construction.

Particular matters that should be addressed in the investigations and management plan include:

- Confirmation, or otherwise, of the presence of Potential ASS at depth under the beach and any required mitigation
- Confirmation, or otherwise, of the presence of Actual ASS or Potential ASS in areas affected by the groundwater drawdown (as shown in the groundwater modelling provided as part of this application and any required mitigation).



*Clause 35 Development in the vicinity of heritage items, archaeological sites or potential archaeological sites*

Clause 35 requires Council to consider likely effects of a proposal on an archaeological site and its setting, when determining an application for consent to carry out a development in its vicinity. As there is the potential to impact on a known archaeological site, and there is a possibility of encountering residual Aboriginal objects during the proposed construction activities, and because of the need to consult more fully with the Darkinjung Local Aboriginal Land Council, a Cultural Heritage Management Plan should be developed for the proposal. A condition of consent is recommended to this effect (refer to Section 9.15 of this report).

*State Environmental Planning Policy No. 71 – Coastal Protection*

The aims of SEPP 71 include to:

- *“Protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast,*
- *Protect and preserve beach environments and beach amenity, and*
- *Protect and preserve the marine environment of New South Wales”.*

The SEPP applies to land within the coastal zone and is intended to work with the NSW *Coastal Policy 1997* to strive toward uniform decision-making processes with respect to planning and development in the coastal zone. A key way in which the SEPP undertakes to achieve this is by requiring consent authorities to consider additional matters for consideration are taken into account when determining a development application.

The following table provides an overview of the proposal's consistency with the matters for consideration contained under clause 8 of SEPP 71.

**Tuggerah Beach SEPP 71 matters for consideration**

<b>Clause 8 matter for consideration</b>	<b>Result of consideration</b>
<i>(a) the aims of this Policy set out in clause 2</i>	The aims of the Policy are represented in the matters for consideration below.
<i>(b) existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved</i>	During the construction period users of the car park may experience an increase in traffic movements in the car park, however the car park will still remain open for public use. There is currently no provision for disabled access to the beach, and this will remain unchanged during construction and following the temporary installation of the plant.
<i>(c) opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability</i>	As above.
<i>(d) the suitability of development given its type, location and design and its relationship with the surrounding area</i>	As the proposed plant relies on adequate supply of seawater, suitable sites are limited. By locating the plant within an already cleared area, environmental impacts are minimised when compared to other sites near the ocean. The presence of an unvegetated sand track allows piping to be laid without clearing of native

Clause 8 matter for consideration	Result of consideration
	vegetation. With rehabilitation it will be possible to return the site to its original condition after two years of operation of the plant.
<i>(e) any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore</i>	The proposed plant will not exceed 2.5m in height and would not exceed the height of the surrounding sand dunes system. It is not considered that the plant would cause significant overshadowing of the foreshore or loss of views from a public place.
<i>(f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities</i>	All works to the dune and beach (apart from seawater return pit and pipeline) would remain below the surface. Due to vegetative screening, the location within a previously cleared area, and the temporary nature of the works, it is considered that the scenic qualities of the coast are not unreasonably compromised. Landscaping to be established during construction and maintained for the duration of the development, with semi-mature stock, would screen the plant while providing opportunity for casual surveillance.
<i>(g) measures to conserve animals (within the meaning of the Threatened Species Conservation Act 1995) and plants (within the meaning of that Act), and their habitats</i>	An assessment of potential impacts to aquatic and terrestrial animals and plants (flora and fauna) was undertaken. Seven part tests under the EP&A Act have concluded that a significant impact is unlikely to occur. A pre-construction survey for the Little Tern is to be conducted to ensure requirements of the <i>Threatened Species Conservation Act 1995</i> are met. No clearing of trees or vegetation is proposed by the applicant.
<i>(h) measures to conserve fish (within the meaning of Part 7A of the Fisheries Management Act 1994) and marine vegetation (within the meaning of that Part), and their habitat</i>	The SEE considers impacts on beach ecology would be fairly small scale in nature however it recommends a monitoring programme be put in place to detect effects on beach fauna and surrounding water quality.
<i>(i) existing wildlife corridors and the impact of development on these corridors</i>	As the works are either to be located in a cleared area or beneath the dunes and beach, no wildlife corridors would be impacted.
<i>(j) the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards</i>	Specialist studies were undertaken by the applicant to examine the potential changes to the beach profile as a result of high wave events. Design modifications submitted during consideration of this application show the beach wells and pipe work would remain below the estimated 1 in 100 year storm event (eroded) beach profile. This report recommends the beach wells be located greater than 1m below the 1 in 100 year event beach profile to minimise risk of exposure of works.

Clause 8 matter for consideration	Result of consideration
<i>(k) measures to reduce the potential for conflict between land-based and water-based coastal activities</i>	<p>Some conflict may occur during construction, however this would be short term and managed via the Construction Environmental Management Plan.</p> <p>Potential conflict as a result of exposure of the subsurface infrastructure is considered in Section 9.4.1 of this report, which recommends implementation of appropriate management measures to minimise conflicts. Surface infrastructure poses a potential conflict with public use of the beach. Section 9.18 of this report provides a discussion regarding the potential public safety impacts of proposed beach infrastructure.</p> <p>Conditions of consent are recommended that require minimisation and management of risk in accordance with best practice principles.</p>
<i>(l) measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals</i>	<p>An Aboriginal archaeological site is located within the vicinity of the study area, and there is the possibility of disturbing Aboriginal objects during construction, and there is also a requirement to consult further with the Darkinjung Local Aboriginal Land Council. A condition of consent is recommended to require a Cultural Heritage Management Plan (CHMP) be prepared for the proposal in consultation with the Darkinjung Local Aboriginal Land Council.</p>
<i>(m) likely impacts of development on the water quality of coastal waterbodies</i>	<p>A condition of consent will require demonstration that the proposed management methodology does not result in harmful traces of the chemicals being introduced into the ocean via the brine stream.</p>
<i>(n) the conservation and preservation of items of heritage, archaeological or historic significance</i>	<p>There are no issues relating to non-Indigenous heritage arising from this proposal.</p>
<i>(o) only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities</i>	<p>Not applicable.</p>
<p><i>(p) only in cases in which a development application in relation to proposed development is determined:</i></p> <p><i>(i) the cumulative impacts of the proposed development on the environment, and</i></p> <p><i>(ii) measures to ensure that water and energy usage by the proposed development is efficient</i></p>	<p>Cumulative impacts, water efficiency and energy efficiency are considered in section 9.22 of this report.</p> <p>Mitigation measures are required to ensure cumulative impacts and efficiency levels are satisfactory in the circumstances.</p>

Additional matters for consideration from Department of Planning are described in the following table.

Clause 8 matter for consideration	Result of consideration
<i>dissipation pit and wells/rising mains shall not be exposed - maintaining safe access along the waterfront and not creating a hazard to the public (both wading along the beach and swimming)</i>	Safety and security are addressed in Section 9.18 of this report. The risk of exposure of beach infrastructure is considered in Section 9.4 of this report.

### 5.3 Other licences and approvals required

Other licences and approvals required are described as follows.

- A licence from the Department of Lands under Section 45 of the *Crown Lands Act 1989* would be required for the siting and operation of the proposed plant on Crown land. Correspondence from the Department of Lands states that they consent to the lodgement of the development applications and are currently processing the occupation licence under Section 45 of the *Crown Lands Act 1989*.
- Correspondence from the Department of Environment and Conservation states that as the activity is not scheduled under the *Protection of the Environment Operation Act 1997*. Accordingly an environment protection licence is not required. The Department of Environment and Conservation acknowledge that the works will be assessed by the Department of Natural Resources under the *Coastal Protection Act 1979*. Department of Environment and Conservation state that should consent be granted to Council, Department of Environment and Conservation would be the appropriate regulatory authority under the *Protection of the Environment Operation Act 1997* and would expect that reasonable and feasible controls would be implemented and maintained.
- This application has been referred to the Department of Natural Resources, which has issued general terms of approval under Section 112 of the *Water Act 1912*. Subject to these conditions, a licence under Part 5 of the *Water Act 1912* will be granted by the Department of Natural Resources for the sinking of bores.
- The application has been referred to the Department of Primary Industries (Fisheries), which has issued general terms of approval under Part 7 *Protection of Aquatic Habitats* of the *Fisheries Management Act 1994* for dredging and reclamation works at the desalination plant at Tuggerah Beach.
- If contamination is encountered at the site, investigations and remediation would be undertaken in accordance with the requirements of the *Contaminated Land Management Act 1997*.
- The application was referred to the Mine Subsidence Board, which issued general terms of approval under section 15 of the *Mine Subsidence Compensation Act 1961*, to alter or erect improvements within a mine subsidence district or to subdivide land. The Mine Subsidence Board granted approval for the erection of improvements and services in relation to the desalination plants on the following conditions:
  - All improvements being temporary in nature, sited at the locations for a two year period ending in January 2009.

- Any permanent structures/services or the retention of the temporary structures/services after January 2009, would be the subject of a separate application. Approval would be considered at the time of submission and may be subject to design requirements.

Note: current general terms of approval issued by the Mine Subsidence Board limits the life of the structure proposed until January 2009. Due to delays in lodgement of the development application the applicant may need to submit an amendment to the Mine Subsidence Board to extend the life of the temporary desalination plant beyond January 2009, if required.

- Appropriate requirements of the *Waste Avoidance and Recovery Act 2001* should be met during construction and operation.
- Under the provisions of Section 40 of the *Coastal Protection Act 1979*, Wyong Shire Council notified the Minister in writing of the proposed desalination plant development. A response from the Department of Natural Resources was received (dated 21 November 2006) which states:

*“The Department of Natural Resources advised the Minister for [Natural] Resources of his concurrence role under the Coastal Protection Act 1979. In this instance a review of the proposed works as set out in the concept drawing provided with the relevant development application shows that the Minister for Natural Resources has no role in determining concurrence for the activities as proposed. This is best explained as follows;*

*The regulation applies to the offshore marine water of the state below the open coast mean high water mark. However, the provisions of a regulation made pursuant to section 39(2) Coastal Protection Act, 1979 do not apply in respect of an area that is subject to an environmental planning instrument within the meaning of the Environmental Planning and Assessment Act 1979. Of relevance here is that the Wyong LEP (1991) applies to all land within the local government area of Wyong, which pursuant to clause 205, Local Government Act 1993, extends to the low water mark.*

*Therefore this project if it remains consistent with the conceptual drawings submitted for review, do not trigger the need for Ministers concurrence.”*

Refer below for consideration of the matters for consideration under *State Environmental Planning Policy No 71 – Coastal Protection*.

- Under provisions of *State Environmental Planning Policy No 71 – Coastal Protection*, development below the mean high water mark requires referral to the Director-General of the Department of Planning. A referral was made to the Department of Planning, who have advised that along with the matters for consideration under Clause 8 of the SEPP, the impact of seawater return pit must be considered. It is considered that the matters for consideration in accordance with the SEPP have been adequately considered.
- A shorebird survey, documenting species composition and abundance at each site is to be conducted prior to construction activities to target threatened and migratory species listed under the *Threatened Species Conservation Act 1995* and the *Environmental Protection and Biodiversity Conservation Act 1999*. The applicant was notified of this requirement, via email dated 12 October 2005, to enable surveys to be conducted during the appropriate season and prior to commencement of construction.

- Requirements with respect to Part 6 Relics and Aboriginal Places of the *National Parks and Wildlife Act 1974* are currently uncertain. Ground truthing of the results of inventory searches carried out by the applicant is recommended.
- Although *State Environmental Policy No 26 – Littoral Rainforests* does not currently apply to the proposal, should any clearing be proposed along the northern boundary of the currently cleared area, further investigations will be required to ensure the requirements of *State Environmental Policy No 26 – Littoral Rainforests* are met, including maintenance of a 100 metre buffer adjoining the Magenta Shores remnant littoral rainforest.

General terms of approval received from the above Government agencies are incorporated into the conditions attached to this report.

The NSW Department of Environment and Conservation are the appropriate regulatory authority under the *Protection of the Environment Operations Act 1997*. Reasonable and feasible controls in accordance with this Act would need to be implemented and maintained.

#### 5.4 Wyong Council Referrals

Internal Council referrals were made to the Environmental Health and Development Engineering Sections of Council. The responses have been incorporated into the conditions of consent and the assessment provided in this report.

## 6 COUNCIL POLICY AND STRATEGIC IMPLICATIONS

### 6.1 Council policy

*Development Controls for Wyong Shire Development Control Plan 2005 – Chapter No 13 Interim Conservation Areas for Wyong Shire*

The aim of this chapter is to conserve remaining natural areas and wildlife opportunities until such time as detailed ecological investigations can be undertaken to inform land use decisions. The site for the proposed works is within an interim conservation area. Section 1.5 of the Plan identifies the approvals process for development applications on land where this Plan applies, namely that a Conservation Assessment be submitted with the development application. Although the SEE is not in the format of the Conservation Assessment that the plan describes, it is considered that the Statement of Environmental Effects and supporting specialist studies contain sufficient information to satisfy the requirements for information included within this Plan.

*Development Controls for Wyong Shire Development Control Plan 2005 Chapter No 14*

No clearing of trees or native vegetation is proposed as part of the temporary desalination plant.

#### *Landscape Policy and Guidelines*

The Statement of Environmental Effects states that: 'The landscape impacts of the proposed desalination plant will generally be minimal and can be mitigated through the submission and implementation of a landscape plan. This landscape plan should be prepared in accordance with the *Landscape Policy and Guidelines*.

### *Plan of management*

Council does not have a Plan of Management that covers the subject site, but the site is covered under the *Plan of Management No. 10 For Natural Areas* (as amended).

The core objectives for management of community land categorised as foreshore are:

- *To maintain the foreshore as a transition area between the aquatic and the terrestrial environment and to protect and enhance all functions associated with the foreshores role as a transition area.*
- *To facilitate the ecologically sustainable use of the foreshore and to mitigate impact on the foreshore by community use.*

These objectives are discussed in the assessment sections of this report. Generally, it is considered that the proposal can meet the intent of these objectives considering the temporary nature and subject to conditions that require detailed monitoring and measures to mitigate impacts.

## **6.2 Strategic implications**

### *The NSW Greenhouse Plan*

The proposed desalination plant will contribute to the emission of greenhouse gases through any use of fossil fuel energy to power the plant along with:

- vehicle emissions associated with construction, operation and decommissioning of the plant
- emissions from waste sent to landfill
- SF<sub>6</sub> (Sulphur Hexafluoride) emissions
- network losses from continuous electrical load of the plant (discussed under Utilities).

The supplementary Greenhouse Gas Emissions and Mitigation report (dated 15 December 2006) concludes that "*In light of the short term, small scale nature of the project, it is recommended that Council pursue Option B above [which is to] increase the percentage of green energy purchased to offset the energy requirements for the plant*". This report recommends that the energy requirements of the desalination plant be offset by an equivalent amount of green energy and the other sources of emissions be monitored and reported.

In terms of the *NSW Greenhouse Plan*, the applicant's proposed mitigation of greenhouse gas emissions through the use of green energy to offset the energy requirements of the desalination plant meets several of its broader objectives. The applicant will assist in:

- raising community awareness of the greenhouse impact of supplying water
- addressing water security while reducing greenhouse impacts and encouraging green energy
- avoidance of greenhouse gas emissions.

The proposal applies a number of the key action themes focussed on reducing greenhouse emissions such as leading by example, using emissions trading (offsets), and encouraging low emission energy supply.

Refer to **Section 9.12** of this report for further discussion of the greenhouse gas and energy impacts associated with the proposed desalination plants.

## 7 SUBMISSIONS RECEIVED

In accordance with Council Notification Policy, the development application was notified for a period of 28 days, from 16 October until 10 November 2006. During this time 68 submissions were received in objection to/support of the proposal. The submissions included three petitions objecting to the proposal, which contained 6,000, 1,138 and 309 names respectively. A breakdown of the submissions received is below:

- Total submissions: 165
- During Exhibition: 80
- Post Exhibition: 85
- In support: 3
- In support of plant but in a different location: 2
- In objection: 160

Issues raised in submissions are summarised as follows:

- The area is a high energy ocean foreshore and development application documentation recognises the lack of accurate profile measurements below high tide and offshore. The results do not cover the localised erosion that will occur around the bores and potential for exposure.
- Redirecting investment into bigger rebates on tanks.
- Request for independent assessment on the impact these plants will have on the surrounding areas, marine life and sand dunes.
- The visual impact of industrial sites on our beaches.
- Impact on tourism.
- Technology has never been trialed before.
- Spending ratepayer's money on something that is temporary, expensive to operate.
- The fact that the water will be fed back into the closest water supply hence consumed mostly by the people that live nearest.
- The impact on property values.
- Pollution generated.
- Noise impacts.
- Potential for vandalism.
- Potential for locating desalination plant nearer power station(s).
- Need to investigate alternative forms of water supply (dams, recycling, rainwater harvesting and the like).
- Zoning is inappropriate.
- Impacts upon character of site (Budgewoi Beach).
- In favour of desalination plants but in a different location such as electricity/power station or national parks.
- Impact on beach.
- Environmental concerns generally.
- Impact on property values.
- Failure of governing bodies to "plan" in the past.
- What happened to proposed permanent plant at Norah Head.
- Increased greenhouse gases.
- No guarantee that temporary won't become permanent.
- Effect of storm surges.
- Effect of discharge of seawater concentrate on marine life.
- Chemical waste.
- Will the proposal affect domestic power supply?



- Lack of transparency in site evaluation.
- Rehabilitation of dunes.
- Inadequate time frame for submissions.
- Support desalination plants in short term although long term alternative solutions must be found.

It is considered that this report and attached conditions address the relevant environmental impacts and matters for consideration under Part 4 of the *Environmental Planning and Assessment Act 1979* that are raised above.

## 8 ECOLOGICALLY SUSTAINABLE PRINCIPLES

The following section summarises the assessment of the proposed plant in terms of Ecologically Sustainable Development (ESD) principles.

### 8.1 Precautionary principle (*i.e. threat of serious irreversible environmental damage*)

The proposal has been assessed in a precautionary manner in accordance with Council's requirements, incorporating satisfactory stormwater, drainage and erosion control and the retention of vegetation where possible, and is deemed to be consistent with Council objectives in this regard.

The impacts of the proposed temporary desalination plant in relation to coastal processes, seawater concentrate return and groundwater draw down are addressed by the SEE and this independent assessment report. With the recommended conditions of consent (including monitoring of impacts, removal of infrastructure and stop work provisions) and assuming the development is limited to two years operations, sufficient confidence that the impacts would not be significant is achieved.

On the basis of the Precautionary Principle, the potential risk to public safety as a result of locating infrastructure on a public beach warrants the preparation of a Risk and Safety Management Plan to minimise risks associated with the works for the period of construction and operation (refer to Section 9.18 of this report for further discussion of risk and safety).

### 8.2 Intergenerational equity (*i.e. ensuring the environment is maintained for future generations*)

The proposed development is temporary and the subject site will be returned to equal or better than its current state. Monitoring will be conducted to confirm the claims that the proposal will not have significant impacts on the local environment.

The proposal suggests that developing a temporary desalination plant now, as opposed to a later date, addresses the issue of inter-generational equity. For a temporary plant lasting two years it is difficult to identify how inter-generational equity is achieved. From a greenhouse perspective, the plant's use of green energy significantly reduces its impact on inter-generational equity due to the avoidance of releases of greenhouse emissions.

In light of the supplementary *Greenhouse Gas Emissions and Mitigation* report (dated 15 December 2006) and the commitment of the applicant to abate 100% of the greenhouse gas emissions through use of green power, the application adequately addresses inter-generational equity in terms of greenhouse gas emissions.

### 8.3 Conservation of biological diversity and ecological equity

The proposed development does not result in the disturbance of any endangered flora or fauna habitats and is unlikely to significantly affect fluvial environments.

### 8.4 Improved valuation, pricing and incentive mechanisms

This goal requires polluters to pay for containment, avoidance or abatement of the effect of pollution, as well as requiring the users of goods and services to pay for costs of these services.

There is a need to undertake greenhouse mitigation in order to provide improved valuation, pricing and incentive mechanisms with regard to the use of desalinated water. Greenhouse mitigation accords with these ecologically sustainable development principles as it internalises the cost of emitting CO<sub>2</sub>, providing a price signal as to the cost of releasing greenhouse gases.

To meet the intent of this principle, drinking water produced by this desalination plant should be priced to reflect the true cost associated with the supply of water including projected greenhouse emission abatement costs associated with electricity supply. A condition of consent is recommended that requires the applicant to purchase green energy to offset the energy requirements of the desalination plant and levy those costs to the sale of water. Water pricing needs to accord with the Independent Pricing And Regulatory Tribunal (IPART) requirements. Note that IPART also administers the NSW Greenhouse Gas Abatement Scheme.

## 9 RELEVANT ISSUES

Having regard to Section 79C of the *Environmental Planning and Assessment Act 1979*, it is considered that the following matters require further consideration and are addressed in the following sections.

### 9.1 Context and Setting

The Wyong Gosford Water Authority proposes the temporary desalination plants to supplement the region's water supply in a time of extremely low water supplies.

The proposed plants necessitate locations near to the coast in order to obtain a guaranteed supply of ocean water with minimal pumping. The subject site provides a cleared area that can cater for the proposed development without the need for clearing of coastal vegetation.

### 9.2 Geology and Soils

#### 9.2.1 Issue – dune stability

##### *Issue description*

Construction of the pipeline and conduit trench across the dune has the potential to impact upon stability of the dune, through disturbance of the highly erodible dune sands and removal of dune vegetation and the thin layer of humic vegetative matter that helps hold the loose sand in place.

The application indicates that no *significant* vegetation clearance will be required. However, the second paragraph in the same section recommends that no vegetation, particularly dunal vegetation be removed. Discrepancies in relation to this issue need to be clarified and appropriate management strategies implemented through the preparation of the Construction Environmental Management Plan. The discrepancy is also present within the section on Construction Impacts (4.8.2) and in the Summary and Conclusions (Section 6).

Further information was received from the applicant (Drawing Reference: WYONG 603, dated 13/12/2006) that demonstrates the conduits and pipes across the sand dune will be constructed using temporary sheet piling (or using trench boxes). This construction method avoids the need for a wide excavation trench and subsequently minimises vegetation clearance.



*Recommended action*

A condition of consent has been attached to this report that requires that no vegetation clearance shall occur without prior approval of Council's Development Assessment Unit.

Where vegetation clearance is necessary and approved by Council's Development Assessment Unit, revegetation with appropriate native species should be undertaken and these should be maintained during the operational phase of the project. Consideration of access requirements during construction and maintenance should be incorporated into the Construction Environmental Management Plan and should minimise disturbance to the dune vegetation.

Any beach stabilisation works (including steps and fencing) that are removed must be replaced immediately upon completion of works. In addition, a suitable board and chain arrangement shall be installed along the full length of the accessway across the dune used for laying the pipeline, in order to provide additional protection of the pipeline infrastructure buried below the dune against the effects of wind and storm erosion. Design should be in

accordance with the recommendations of the publication *Coastal Dune Management*, 2001, prepared by the Department of Land and Water Conservation.

Furthermore, the ground levels across the dune shall be monitored by regular (at least weekly) visual inspections. Ground levels along the accessway should also be surveyed at intervals no greater than eight weeks. Additional inspections and surveys are to be undertaken immediately following coastal storms. Ground survey data and digital photographs from the inspections shall be stored securely and compared against previous data to ensure that the risk for infrastructure exposure is minimised.

### 9.3 Water Quality

#### 9.3.1 Issue – use of beach bores to extract water

##### *Issue description*

The use of beach wells as a source of raw feed water for desalination has been well established internationally. The proposed wells for the temporary desalination plant in this instance are within an area that is susceptible to erosion, and mitigation measures are required.

##### *Recommended action*

As part of the Environmental Management Plan, the beach well area should be inspected regularly to ensure that erosion has not exposed the well heads and pipelines. In addition, particular inspections should be made after coastal storm events.

#### 9.3.2 Issue – potential for bio-fouling of the beach well intake screens

##### *Issue description*

The design report (UNSW Water Research Laboratory, 2006) notes that “*proactive management of iron bio-fouling may be required*” and this is further indicated on Figure 3.2 of the same report. The way in which bio-fouling would be managed, particularly considering the fact that there is no contingency built into the designed number of bores present on the beach (meaning that ‘proactive management’ will need to be regular), has not been addressed in the SEE document.

It is not possible to determine whether the management regime proposed, which may introduce additional chemicals into the overall process and that will ultimately be discharged with the seawater return during normal operating conditions, is likely to have a harmful effect on the marine environment.

##### *Recommended action*

An appropriate condition of consent will require demonstration that the proposed management methodology does not result in harmful traces of the chemicals being introduced into the ocean via the brine stream.

### 9.3.3 Issue – products of pre-treatment process

#### *Issue description*

The pre-treatment process is required to prevent blockage of the Reverse Osmosis membrane by salt precipitation and microbial growth. Treatment typically involves the addition of an anti-scalant chemical to the raw seawater. Paragraph 1 under Section 2.3.4 of the SEE states that:

*“Modern anti-scalants are typically bio-degradable and have proprietary composition. These chemicals would be returned to the sea together with the seawater concentrate”.*

It is apparent that the actual anti-scalant that would be used is not known at present and therefore the potential for adverse environmental impacts cannot be assessed on the basis of information provided within the SEE.

#### *Recommended action*

Clear indication shall be provided regarding the anti-scalant to be used to dose the raw seawater and the likely environmental impact when it is discharged with the brine (seawater concentrate). An appropriate condition of consent will require approval, by Council, of the proposed anti-scalant and demonstration that its discharge to the ocean would have minimal effect on the environment, either during construction or during the commissioning phase.

To obtain this approval, a Supplementary Anti-scalant Analysis Report is to be submitted to Council by the applicant.

### 9.3.4 Issue – products from membrane cleaning

#### *Issue description*

Section 2.3.6 of the SEE notes that clean in place (CIP) chemicals would be used to clean membranes used during the Reverse Osmosis and microfiltration process. These chemicals would include sulphuric acid, caustic soda and other chemicals, with *“approximately one tonne of each.....required each six months”*. The way in which these chemicals would be used and the potential for residues of these to remain on the reverse osmosis membrane during operation and traces of them to be discharged to the ocean has not been discussed. The SEE implies that details of the cleaning operation will be contingent upon the membranes used, and that this is not yet known.

#### *Recommended action*

An appropriate condition of consent will require details to be submitted, to the satisfaction of Council, that the proposed cleaning methodology does not result in harmful traces of the chemicals being introduced into the ocean via the seawater (brine) stream.

### 9.3.5 Issue – discharge salt concentrations and dilution

#### *Background to potential impact*

As part of this assessment, a brief and limited literature review was conducted, which failed to identify any national or international examples of a brine discharge directly to the wash zone. Discharging the concentrated brine directly to the coastline does not appear to be the

favoured option in most cases, with discharge to the bed of the ocean some distance offshore or mixing with the cooling water of a co-located power plant being more common. Indeed, evidence found discourages the use of discharge directly to the coast (Einav et al., 2002), including:

*“The alternative of discharging concentrated salt solutions directly at the coastline is not recommended by the authors of this paper, although under certain conditions (small plants, insensitive shore) it should be given some consideration because of economical factors. Brine water, which is continuously returned to the sea, will form a plume of high salinity seawater, depending on the marine conditions and other factors. The effect will be noticeable at distances of hundreds of metres from the outlet (depending on the amounts of the brines). Even if the brines would be mostly diluted at a short distance from the outlet, during the many days in which the sea is calm ... the secondary dilution would be negligible. On those days, the damage to the coastal habitats would be high. This method is not recommended for seas with high sensitivity or for large desalination plants, or for areas with population of high environmental awareness”*

Although this quotation relates directly to conditions along the Mediterranean coastline of Israel, it still summarises the key issues governing the shortcomings of the proposed outlet. Nevertheless, we note that:

- the plant is small (the proposed beach infrastructure cannot be considered temporary as it is not proposed to be removed under the present proposal)
- the same paper classifies a High-energy sandy oceanic coast (such as at the proposed site) as one of the least sensitive in terms of marine habitat
- it appears that economic and expediency concerns have dictated the selection of this option over the other preferred option in the design report (deep water ocean discharge).

Selection of discharge within the swash zone has resulted in uncertainty regarding the potential for damage and/or burial of the infrastructure, the potential visual impact of the outlet, the potential impact on public amenity and safety on the beach, and the mixing behaviour of the discharge within the ocean.

#### *Issue description*

Section 4.2 of the SEE notes that:

*“under worst case mixing conditions (i.e. calm wind and wave conditions) the estimated dilutions for the seawater concentrate discharge could result in concentrations over 8 ppt above background salinity levels (i.e. up to 35 ppt) in a zone of approximately 15 m around the discharge point”*

It seems a fair assumption that the discharge will be well mixed within a short distance from the outlet. Nevertheless, a letter from the Water Research Laboratory to the Department of Commerce (Miller, 2006) indicates that a pilot field test using an introduced tracer would be required to have more confidence.

It cannot be stated with certainty that there will be insignificant impact from the concentrated salt brine discharge being pumped into the swash zone.

#### *Recommended action*

Undertaking comprehensive field testing prior to construction may result in delays to the project. However, to provide more certainty regarding the impacts of discharge into the

swash zone, a programme of testing brine dispersion over a range of wave and wind conditions, immediately following commissioning, is recommended. Of particular concern is the potential for dense brine to settle within beach parallel gutters during calm conditions. The programme of field testing should confirm whether or not this actually happens. If it does, relevant mitigative strategies will need to be developed and incorporated into the environmental management plan. An appropriate condition of consent is recommended.

#### 9.3.6 Issue – subsurface pipe leakage

##### *Issue description*

The potential for leakage of either the intake or outlet pipelines, causing ingress of saline water into the freshwater regions of the aquifer has not been addressed by the applicant. Furthermore, the location of the Aquifer is not clear. The design report (UNSW Water Research Laboratory, 2006) indicates that there was insufficient data to develop a site specific model for Tuggerah Beach.

##### *Recommended action*

An appropriate monitoring programme and mitigative management strategies for pipe leakage needs to be established for the operational phase of the project.

### 9.4 Coastal Processes

#### 9.4.1 Issue – coastal erosion and beach level fluctuations

##### *Issue description*

Coastal storms have the potential to erode significant quantities of sand from a beach, potentially exposing any items originally buried below the beach surface. During calm wave conditions, which occur for most of the time at the proposed site, beaches tend to accrete to a stable 'full' or 'accreted' profile. The occurrence of a storm removes sand from the beach, depositing it offshore of the beach. Subsequent calmer conditions then rework this sand back onto the beach, rebuilding it to an accreted profile.

Due to the potential for large seas to remove sand from the beach, the depth of the beach well infrastructure was amended post-lodgement of the development application, to locate the infrastructure immediately below the 1 in 100 year ARI event beach profile. However, the background information used to derive storm erosion profiles is scarce and the methods used to calculate storm profiles are indicative at best.

Manly Hydraulics Laboratory, in their report accompanying the development application (Appendix B to the SEE), recommends burying infrastructure 1m below the 1 in 100 year ARI event beach profile to provide a factor of safety. On the basis of the MHL advice, the infrastructure should be relocated to this level.

The Manly Hydraulics Laboratory Report describes a general warning regarding exposed infrastructure on the beach, which states:

*“It is recommended that the proposed design should aim to minimise the risk of exposure of the pipe/bore infrastructure. ... The end client should be made aware of all the risks associated with buried/exposed structures on the beach and in the swash zone, including public liability risk”*

The beach well heads are located within a region where exposure would seem unlikely on the basis of figures shown in Manly Hydraulic Laboratory (2006) report. However, there are a number of reasons presented by Manly Hydraulics Laboratory that urge caution when interpreting the provided results, which are described below.

- There was no data available for the beach profile within the most active beach zone and the beach level in this area has been linearly interpolated. MHL indicate that the S-Beach model may therefore underestimate the scour.
- S-Beach does not include predictions of the impact of infrastructure on the beach profile (i.e. localised erosion) and does not take into account longshore transport.
- Robust calibration (validation) was not achievable due to the absence of adequate pre and post storm beach profiles.

Furthermore, the following issues also highlight that there may be substantial uncertainty in the results.

- Modelling with S-Beach has had limited application in New South Wales to date, with most coastal erosion assessments being based upon photogrammetric analyses. While it has been applied extensively internationally the results can only be as reliable as the data that is entered. The required data, particularly bed levels in the nearshore zone are typically unavailable.
- The offshore data (below -3 m AHD) are based on survey from 1986, and depths would have been substantially modified since that time. Similarly, this data would not have been directly applicable to the verification event used (1974 storm).
- S-Beach is not a process based model for dune erosion, being based on theoretical equilibrium beach profiles, and the predicted profile is most likely derived from applying smoothing filters over the upper part of the beach.
- The MHL study did not consider the swash zone outlet discharge that has been adopted for the final design, instead assuming a subsurface injection bore discharge at around -6.0 m AHD.
- The beach profiles are predicted to pivot around the lower inter-tidal zone, at approximately mean sea level, which is the actual proposed location of the discharge pit. From the results, it would seem that the beach elevation would change very little in this location. However, a much more complex pattern could actually be expected. A small shift in the pivot location would leave the discharge pits either buried or undercut.

Figures illustrating verification of the model were not available with the report. Although the MHL report indicates that verification was achieved and that the model “predicted the end of storm results within reasonable limits of the observed profiles” these would have still been useful for further interpreting model reliability, particularly in the vicinity of the proposed infrastructure.

Given these shortcomings, MHL place a number of caveats on the results:

- *“it is possible that events smaller than those tested could still expose and impact on the bores*
- *“It is recommended that the proposed design should aim to minimise the risk of exposure of the pipe/bore infrastructure.....[and that] infrastructure be buried below the expected beach storm scour levels*
- *“It is recommended that in the design process a further 1 m below these levels should be adopted as a factor of safety*
- *“The end client should be made aware of all the risks associated with buried/exposed structures on the beach and in the swash zone, including public liability risk”*

However, it appears that these concerns may not have been adequately communicated. Indeed, review of the design report (UNSW Water Research Laboratory, 2006, Figure 4.2), it



seems that designers did not have access to Manly Hydraulics Laboratory's (MHL) results and they have adopted a storm erosion profile derived by Neilsen, 2004.

In the design report (UNSW Water Research Laboratory, 2006, p12) it is noted:

*“Council have recognised that beach installations may be affected by extreme weather events, and therefore replacement of the infrastructure may be required.....Their report stated that the risk of damage was considered “low and acceptable””*

Furthermore, the design report notes that:

*“The [outlet] pipeline would be exposed to beach erosion in the active zone.....it must be accepted that the pipeline would be exposed for a number of weeks while sand is naturally transported onshore [following a storm] .....During this period the pipeline would present a risk to beach and surf users”*

The development application plans show that the geobags and the outlet pit will be above the existing beach profile for a distance of over 15m. The degree of exposure will vary with the tide and wave conditions

*Note: visual and public safety impacts associated with the seawater concentrate return line under normal conditions are discussed later in this report.*

There is a significant chance that the outlet will be subject to severe damage as a result of either erosion or accretion.

In storm events, there is a risk that scouring will occur around the seawater outlet pit, further exposing the geobags and the outlet itself. Following erosion, the geobags may be exposed and present both a visual and physical barrier across the beach.

There is potential for the outlet to be buried, under the right wave conditions, particularly if the structure settles during the period of erosion. The potential for burial is dependant upon whether the infrastructure is installed while the beach is in an eroded or accreted state. When burial occurs, the problem of sand liquefaction (quicksand) and a potential public safety risk could arise.

It is noted that the beach infrastructure is not proposed to be removed after decommissioning. This increases the risk that the infrastructure will be exposed over time and is highly undesirable.

The construction and indefinite retention of infrastructure that may be exposed on the beach face is inconsistent with the aims of SEPP 71, or recent amendments to the *Coastal Protection Act 1979* given the potential for loss of public amenity risks to the public.

#### *Inconsistencies within application documentation*

Similarly to the inconsistencies between the MHL report and the final design of the brine outlet described above, Section 4.1 of the SEE refers to “*deep injection locations*”. This is clearly incorrect and should be modified as part of the preparation of environmental management plans.

### *Recommended action*

On the basis of the limited information available, there is a risk that the bores will become exposed during a storm event. Accordingly, a more definite specification for the reduced level at the top of the well head is appropriate. A condition of consent is recommended that requires the beach wells to be constructed at least 1m below the 1 in 100 year ARI storm event (eroded) beach profile.

Furthermore, a condition of consent is recommended to require all surface and sub-surface beach infrastructure to be completely removed from the area of the beach within a specified timeframe following decommissioning. As the life of the development is proposed to be two years, the specified period is two years.

A condition of consent is recommended that requires an Erosion and Sediment Control Management Plan to be prepared that addresses the guidelines (where appropriate) for construction, operation and rehabilitation contained in:

- Landcom, 2004, *Managing Urban Stormwater: Soils and Construction* ("The Blue Book") revised fourth edition, reprinted July 2006.
- NSW Department of Land and Water Conservation, 2001, *Coastal Dune Management: A Manual of Coastal Dune Management and Rehabilitation Techniques*, Coastal Unit, DLWC, Newcastle.

The Erosion and Sediment Control Management Plan shall specify (but not limited to) the following:

- details of how the outlet would be constructed, with consideration of the erosion/accretion status of the beach
- a monitoring plan including regular inspections of the beach infrastructure.

As part of an overall Risk and Safety Management Plan, a Contingency Plan must be prepared as part of the Erosion and Sediment Control Management Plan and approved by Council that identifies measures to regularly monitor erosion conditions at the beach, and protect public safety in the event of further exposure of beach infrastructure, including seawater outlet infrastructure and sand bags. The contingency plan should also include measures to protect public safety in the event of seawater outlet burial, which may result in beach liquefaction in the vicinity of the outlet.

The Contingency Plan should include pro-active monitoring of predicted ocean storm conditions to ensure timely response to events where infrastructure is exposed on the beach.

## **9.5 Groundwater**

### *9.5.1 Issue – fine tune spacing of beach wells*

#### *Issue description*

Supporting documentation provided with the development application recommends that piezometer testing be undertaken prior to construction to refine the spacing of beach wells (WRL, 2006). The report suggests that pilot tests may be required to fine tune the spacing and yield of bores.

*Recommended action*

A condition of consent is recommended to reinforce the requirement for pilot testing in accordance with the WRL report, which would fine tune spacing and yield of beach wells, and investigate whether the resulting draw down of the water table is equivalent to that estimated in the development application documentation. In the event that the beach wells are modified significantly, in terms of spacing, configuration, depth or number, additional impact assessment will be required as part of an application to modify to the development consent. Minor amendments may be considered as part of the Environmental Management Plan.

9.5.2 *Issue – groundwater impacts on sensitive receptors*

*Description of issue*

The extraction of saline water at the borefield will draw down groundwater levels in the surrounding area. Drawing down groundwater levels may potentially impact:

- ecological communities in the vicinity of the borefield, which are dependent on groundwater levels
- the geotechnical properties of the aquifer due to reduced water levels, which may lead to settlement that may cause structural damage to roads, structures and services.

Detailed groundwater modelling has not been carried out for the Tuggerah Beach site.

The WRL report on the conceptual design of beach bore intakes (August 2006) submitted with the development application states that no detailed information is available on subsurface conditions at Tuggerah Beach. However, given the site's geomorphic setting as a barrier between the ocean and a coastal lake, it is expected that the groundwater characteristics of the Tuggerah Beach site would be similar to Lakes Beach and Budgewoi Beach. The WRL report states that although the dune is much higher and bigger at Tuggerah Beach, the beach profile appears similar to Budgewoi Beach and may have a similar history.

The similarities between Tuggerah Beach and Budgewoi Beach are important, because to assess the impacts of groundwater drawdowns the applicant (WRL, 2006 and amended via email on 7 November 2006) established a groundwater model for the Budgewoi Beach site rather than the Tuggerah Beach site. The Budgewoi Beach model uses the lower values of hydraulic conductivities estimated by WRL and therefore drawdown estimates are considered to be conservative. A hydraulic conductivity of 35 m/d was used (as opposed to the conductivity of 130 m/d calculated by Hydroilex in the *Test Drilling, Bore Construction and Aquifer Testing* report submitted with the SEE), which is consistent with values measured on similar high energy beaches on the NSW coast.

The groundwater model for the Budgewoi Beach site is based on borehole data and calibrated to observed levels, and is considered adequate for the purposes of identifying potential impacts resulting from a temporary desalination plant in a coastal environment. Although Tuggerah Beach has similar geomorphic characteristics to Budgewoi Beach, a recent borehole taken by WRL intersected a layer of organic rich quartz sand between 7.5m and 11.5m below ground level. In this instance, drawdowns may be higher at Tuggerah Beach compared to Budgewoi Beach due to the presence of this layer, which results in reduced hydraulic conductivity. The borehole also shows that the permeable aquifer thickness is limited to 3.9m.

The potential impact on groundwater dependent ecological communities in the vicinity of the Tuggerah Beach site is based on mapping of ecological communities by Connell Wagner, which uses data provided by the *Lower Hunter and Central Coast Regional Environmental Management Strategy* (LHCCREMS) (2003). Swamp Oak Rushland Forest is present at a distance of approximately 250m from the subject site, at which the estimated draw down is up to 0.2m at the eastern extent of the community. The Swamp Oak Rushland Forest is likely to be resilient to the small declines in groundwater level predicted.

Based on available information, the potential impact of groundwater draw down is not likely to be significant. However, it should be noted that no long duration test pumping has been carried out for Tuggerah Beach. Therefore it is not possible to categorically state the draw down that will occur at the road, other structures and in the vicinity of groundwater dependent ecological communities as a result of ongoing extraction.

#### *Recommended action*

A condition of consent is recommended that requires monitoring of groundwater levels in the vicinity of the borefield and at sensitive location at appropriate intervals. This monitoring should be of sufficient duration to establish the steady state draw down during ongoing operation of the plant. The monitoring strategy shall also establish acceptable draw down limits at sensitive structural and ecological sites.

A condition of consent is recommended to install a monitoring network in the vicinity of the site to monitor groundwater levels and compare these to the draw down limits on an ongoing basis.

To monitor the ongoing impacts on sensitive ecological communities, seasonal monitoring (four times per year) of the extent and health of these ecological communities is to be conducted and, if die off is reported, works will cease until measures to halt the decline in vegetation are implemented.

The results of all monitoring shall be made available to the wider community so that future projects can benefit from the knowledge gained.

#### *9.5.3 Issue – contaminated groundwater (beach well contamination)*

##### *Issue description*

There is a potential for contaminated groundwater to leach from a former landfill located approximately 600 to 700m north of the proposed temporary desalination plant. Elevated levels of ammonia and total dissolved solids (TDS) in this groundwater has the potential to contaminate water in the beach wells. If present in the intake feedwater, these contaminants may also be discharged to the ocean, either during normal operation or backwash activity.

Draw down of groundwater associated with the temporary desalination plant has the potential to increase the risk of drawing contaminated groundwater to the subject site.

The SEE states the following key points in relation to the risk of contamination.

- Studies indicate that contaminants from the former landfill have not migrated either north or south from the site.
- Monitoring data from two wells located on the eastern and western boundaries of the former landfill indicated ammonia at elevated levels is probably migrating off site in the direction of Tuggerah Lakes and the ocean.

- The contamination investigations included a monitoring well located at the south western boundary of the cleared area to the south of the former landfill which would represent the south western corner of the proposed desalination plant at the Tuggerah Beach car park. This monitoring well was used by SKM for background groundwater monitoring with no evidence of groundwater contamination being found.

Hydroilex also reviewed the previous investigations in 2006 and undertook limited hydrogeological modelling in relation to a test bore installed at Tuggerah Beach in June 2006. Based on the information available, Hydroilex identified that most concentrations of potential contaminants in groundwater samples collected in the vicinity of the former landfill were less than detectable limits or well within the relevant environmental guidelines. The exceptions to this were ammonia and TDS.

There may be no evidence of contaminants from the former landfill migrating to the south to date, but such migration may be induced under the proposed desalination plant pumping regime. Based on the review carried out by Hydroilex, there is potential for migration of groundwater with elevated ammonia and TDS levels.

#### *Recommended action*

A condition of consent is recommended that requires regular monitoring of ammonia, TDS and other potential landfill leachate contaminants within the intake feed water at least on a weekly basis throughout the operation of the proposed temporary desalination plant. Appropriate mitigative strategies should be implemented if elevated levels of contaminants are evident.

A condition of consent is recommended that requires monitoring wells to be installed between the former landfill and the proposed extraction boreholes (including a location close to the southern boundary of the landfill site). Monitoring wells should be sampled for the standard suite of analytes for monitoring of landfills of this type. Sampling should be carried out, analysed and reported on a weekly basis.

To establish the ongoing impacts on sensitive ecological communities, seasonal monitoring (four times per year) of the extent and health of these ecological communities is to be conducted and, if die off is reported, works will cease until measures to halt the decline in vegetation are implemented.

The results of all monitoring shall be made available to the wider community so that future projects can benefit from the knowledge gained.

## **9.6 Flooding**

The site is located within a coastal reserve, elevated above Wilfred Barrett Drive at Tuggerah Beach. The site is located adjacent to the northern boundary of the existing car park on a high point where any surface water runoff would drain away from the site.

Based on the site topography and the permeable nature of the soils the potential flooding impact is expected to be negligible.

## 9.7 Water supply

### 9.7.1 Issue – supplies of water

#### *Issue description*

The purpose of the temporary desalination plant is to augment short term water supplies to the community and provide sufficient time for the Water Authority to investigate more sustainable forms of water supply. To provide certainty that the water supplies in Wyong after two years will be sufficient to enable the proposed temporary desalination plant to be removed, the application must demonstrate that the proponent has done, or will do, everything that is cost effective to:

- improve water use efficiencies (household, Shire and regional levels)
- investigate more sustainable forms of water supply.

Such options are discussed in the development application, which includes:

- working with drought-affected industries to help manage the impact of new water restrictions
- reducing demand through restrictions
- providing recycled water for commercial usage
- detecting leaks and pressure problems in water pipes
- rebates for fitting household tanks and efficient washing machines
- subsidising the REFIT programme to reduce water usage in homes
- providing tanks to childcare centres and schools
- conducting education and awareness programs
- helping organisations apply for community water grants and businesses to audit water use
- providing groundwater for Rural Fire Service training
- hosting a water expo and seminars.

Wyong Council's operational water initiatives described by the SEE include:

- water tanks and water saving devices fitted in Council facilities
- groundwater or recycled water used on road works and sports fields
- disconnecting beach showers and outdoor taps
- ensuring water efficiency while cleaning and repairing water mains
- using waterless car wash products on council fleet vehicles and rainwater to clean trucks.

It is understood the Water Authority is also investigating hard engineering solutions to improve the supply of water to the region.

As discussed earlier in this report, it is essential for the long term sustainability of water supplies to Wyong and Gosford that the temporary desalination plant be treated as an opportunity to implement meaningful water efficiencies measures for the local community.

In this regard, the proposal does not provide sufficient certainty to justify the claim that the desalination plant will only be required as a temporary measure.

#### *Recommended action*

A condition of consent is recommended that limits the operational lifetime of the desalination plant to a maximum of two years. Upon which time all infrastructure must be removed and the site rehabilitated (refer to Flora and Fauna section for further description of rehabilitation).

During this two year period of desalination, it is strongly recommended that the applicant actively investigate alternative forms of water supply and measures to improve efficiencies of water use. It is also recommended that the applicant consider preparing, and exhibiting for public comment, a discussion paper into the potential options for long term water supply. The discussion paper should contain an action plan for assessing and implementing water supply and efficiency measures in the medium to long term.

9.7.2 Issue - water testing

*Issue description*

Testing of freshwater produced by the desalination process is proposed to ensure compliance with Australian Drinking Water Guidelines Health and Aesthetic Guideline Values. A manual water sampling programme will also be undertaken in accordance with Wyong Shire Council potable water quality monitoring programme. The applicant has stated the key characteristics of the water monitoring programme to be adopted include:

- *“Microbial indicator organisms*
- *Disinfectant residuals and any disinfection by-products*
- *Any health-related characteristic that can be reasonably expected to exceed the guideline value, even if occasionally*
- *Potential contaminants identified in analysis of the water supply system and hazard identification.”*

Additional information was provided by the applicant on 6 November 2006 that provided a monitoring programme, as described below .

*Suggested Monitoring Programme for Temporary Desalination Plants (Finished Water)*

<b>Parameter</b>	<b>Initial Frequency</b>	<b>Normal Frequency</b>	<b>Comments</b>
pH	Daily	Daily	
Alkalinity	Daily	Daily	
TDS	Daily	Daily	
Turbidity	Daily	Daily	
Fluoride	Daily	Daily	
Chlorine	Daily	Daily	<i>If used as disinfectant</i>
True Colour	Daily	Monthly	
Hardness	Daily	Quarterly	<i>React to TDS changes</i>
Thermotolerant Coliforms	Weekly	Weekly	
THMs	<i>Initial discharge to system</i>	Monthly*	<i>* In system nearby</i>
Sodium	<i>Initial discharge to system</i>	Quarterly	<i>React to TDS changes</i>
Sulphate	<i>Initial discharge to system</i>	Quarterly	<i>React to TDS changes</i>
Chloride	<i>Initial discharge to system</i>	Quarterly	<i>React to TDS changes</i>
Boron	<i>Initial discharge to system</i>	Quarterly	<i>React to TDS changes</i>
As, Ba, Hg, Mo, Se	<i>Initial discharge to system</i>	Quarterly	

	<i>system</i>		
<i>Cr, Cu, Pb, Zn</i>	<i>Initial discharge to system</i>	<i>Monthly*</i>	<i>* In system nearby</i>
<i>Iron, Manganese</i>	<i>Initial discharge to system</i>	<i>Weekly</i>	
<i>Acrylamide</i>	<i>Initial discharge to system</i>	<i>Quarterly</i>	

*Initial frequencies to continue until satisfactory results obtained. Additional safeguards: In line telemetric alarms for pH, Fluoride, TDS and Chlorine residual (if Chlorine used for disinfection).*

This level of monitoring is considered to be appropriate.

## 9.8 Aquatic ecology

### 9.8.1 Issue – taking up of marine organisms

#### *Issue description*

Take up of marine organisms can occur via impingement and entrainment. There is expected to be negligible impact on aquatic ecology due to the low abundance and diversity of marine organisms occurring at depths greater than 11m below the beach surface where the intake pipes will be situated.

### 9.8.2 Issue – discharge of hyper saline seawater concentrate

#### *Issue description*

As discussed in section 9.3.5 of this report, discharging hyper saline seawater concentrate after passing through the desalination process may also impact upon aquatic ecology. The WRL report (dated 11 September 2006) provided with the development application states that this concentrate (60 parts per thousand [ppt] salt) will be 1.7 times as saline as seawater at the point of discharge. WRL state also that even under worst case mixing conditions (no wind and calm wave conditions), there would only be an increase in salt concentration of 8 ppt above normal salinity (i.e. 35 ppt) in an area 15m around the discharge point. More likely wind and wave conditions in the swash discharge zone will reduce this impacted area even further. Thus, the SEE states that any impacts in salinity on the ecology of the surrounding waters from the discharge of seawater concentrate are considered to be small scale and minor (Connell Wagner, 2006).

#### *Recommended action*

Very little scientific information is known about the impacts of seawater concentrate discharge on aquatic ecology. Consequently, a BACI-designed monitoring programme will be conducted by suitably qualified experts to confirm the impact of the discharge on the aquatic environment. This must be published in a peer-reviewed journal to ensure knowledge gained from this study is available to the wider community.

Note: The Applicant was advised of the appropriate conditions recommended in the attached schedule (via email dated 12 October 2006) in relation to aquatic ecology monitoring.



### 9.8.3 Issue – commercial and recreational fisheries

There are no impacts anticipated from the construction or operation of the desalination plants on commercial and recreational fisheries because the mobility of fish enables them to migrate away from the disturbance zone (refer to Section 9.3.5 of this report for discussion on the dissipation of seawater return).

### 9.8.4 Issue – threatened marine species

There are no impacts envisaged on threatened fish, marine vegetation, endangered populations of marine organisms or endangered aquatic ecological communities because either none were detected in the area or those that may occur will be able to avoid the disturbance zone.

## 9.9 Terrestrial ecology

### 9.9.1 Issue – protection of threatened species

#### *Issue description*

No threatened flora or ecological communities were recorded in the study area and the applicant states that no vegetation will be cleared. However, the site has the potential to be foraging and nesting habitat for threatened shorebirds, including pied oystercatchers, lesser sand plovers, greater sand plovers, and little terns.

A supplementary Shore Bird Census report was submitted by the applicant (dated 15 December 2006), which concludes that:

*“Provided the mitigation measures listed in Connell Wagner [Temporary Desalination Plants Statements of Environmental Effects] are implemented, the proposed temporary desalination plants are unlikely to have a significant impact on threatened or migratory shore birds listed under TSC Act and EPBC Act. In particular, pre-construction site inspection by a suitably qualified ecologist immediately prior to construction should be carried out to prevent impacts on shore birds.*

*“It is also recommended that construction take place between March and August, outside of the known breeding season of Little Tern, Sooty and Pied Oystercatcher. The remaining shorebird species considered likely to occur in the study are non-breeding migrants to Australia and thus the proposal will not affect the breeding for these species.”*

The high visitation rates of the study area by humans and by dogs further limit the potential of the site for threatened fauna. Seven part tests provided with the supplementary *Shore Bird Census* report indicate there would be no significant impact on threatened species and there was no requirement for a Species Impact Statement for threatened species. Similarly, there was no need for referrals to the Commonwealth Minister for the Environment for species listed on the *Environment Protection and Biodiversity Conservation Act 1999*.

The applicant has identified the need to conduct targeted shore bird surveys immediately prior to the commencement of construction, in order to determine whether any are present in areas that may be affected by the proposed works.

*Recommended action*

A condition of consent is recommended that requires a pre-construction shore bird survey to be conducted immediately prior to commencement of construction. If threatened bird species are identified on site, construction works should cease until eggs have hatched and young have fledged.

*9.9.2 Issue – restoration to preserve integrity of dune system*

*Issue description*

At the cessation of desalination the plant is to be removed, which would result in any unprotected areas becoming susceptible to erosion and sedimentation.

*Recommended action*

A Habitat Restoration Plan is required to provide a strategy for planting to stabilise the soil of the decommissioned site and assist with habitat creation for fauna and connectivity. Restoration should be carried out to replace and enhance the existing vegetation conditions of the site.

*9.9.3 Bushfire*

*Description of issue*

The proposed desalination plant is situated near dense coastal vegetation, which poses a risk of bushfire.

*Recommended action*

The applicant has provided further information stating that during periods of bush fire risk to the site a water tanker will be stationed on site to protect the plant. This is considered appropriate considering the temporary nature of the proposed development and the aim of minimising vegetation clearance on the dune system. An appropriate condition of consent is recommended.

**9.10 Access, Transport and Traffic**

*9.10.1 Issue – loss of car parking during operation*

*Description of issue*

During operation there will be minimal impact on the existing parking area as the plant compound is located outside the parking area. Occasional maintenance vehicles are unlikely to impact on existing uses as the car park is an informal parking area.

The loss of parking during operation is considered to be minimal and no specific actions are recommended.

### 9.10.2 Issue – traffic generation during construction

#### *Issue description*

The SEE provides an assessment of the number of vehicles that will access the site during construction and operation. However, there are discrepancies between different sections of the report and inconsistencies in the use of wording (particularly the use of 'a vehicle movement' which is a one-way vehicle trip). In addition, the traffic information presented in the SEE for each of the three proposed sites was the same, despite the differing plant sizes.

Revised forecast traffic generation and construction periods for each of the three sites were subsequently provided by the applicant, although these revisions refer only to Section 4.13.2 of the SEE and not Sections 2.4.1 and 2.4.2 which provide a breakdown of the vehicle movements associated with the construction programme. The revised traffic movements provided by the applicant for Section 4.13.2 state that 'up to 5 semi-trailer movements and 15 small truck movements' will be required over the two month period.

However, according to Sections 2.4.1 and 2.4.2 of the SEE, construction of the plants will involve four elements (the number of vehicles and movements associated with each of the elements is outlined below):

- Construction of the pre-assembled containers - 3 semi-trailers over 8-10 weeks (6 vehicle movements);
- Delivery of smaller items of plant and equipment and removal of construction wastes - 20 small trucks over 8-10 weeks (assume 40 truck movements);
- Site personnel for equipment construction - 4-5 light vehicles per day (10 movements per day);
- Construction of the bore and pipelines – 3 semi-trailers over 6 weeks (6 vehicle movements);
- Site personnel for bore and pipeline construction – 5 light vehicles per day (10 movements per day).

This equates to a total of 12 semi-trailer movements, 40 truck movements and 800 light vehicle movements over the total construction period.

During construction, heavy vehicles (semi-trailers and trucks) would access the site through the existing car park. Manoeuvring and circulation space would need to be provided to allow for plant and equipment to be unloaded and to facilitate the safe movement of vehicles into and out of the site and car park.

#### *Recommended actions*

The number of vehicle movements generated by the proposed plant during construction is considered to be minimal. The impacts of the generated construction traffic (including loss of further spaces for circulation purposes) can be addressed through implementation of a Construction Traffic Management Plan (CTMP). The CTMP should include the following details.

- Details of the additional number of parking spaces that will be unavailable to the public during construction. This will be based on the circulation and manoeuvring requirements of heavy vehicles visiting the site.

- Details of any temporary works that may be required within the car park and/or at the car park access intersection to facilitate access by the largest design vehicle accessing the development.
- Temporary traffic management measures that would be required to allow safe access and egress of heavy vehicles at the car park access intersection.
- Measures to address issues of pedestrian access and safety during the construction period.

The CTMP should also include a proposal to implement a community liaison strategy prior to the commencement of construction activities. This would address matters such as notification of noisy activities, temporary disruptions to access, alternative parking arrangements, and complaints monitoring and management.

#### *9.10.3 Issue – Traffic generation during operation*

##### *Issue description*

During operation, the plant would generate two light vehicle movements per day (one inbound, one outbound) as well as two small truck movements per month (one inbound, one outbound).

The traffic generated during operation is considered to be minimal and no specific mitigation measures are proposed.

#### *9.10.4 Issue – removal of plant*

##### *Issue description*

Traffic associated with the removal of the plant at the end of the two year period is not discussed in the SEE. It is considered that a similar level of heavy and light vehicle activity as the construction phase would result during removal of the plant.

##### *Recommended actions*

A Traffic Management Plan shall be prepared for the decommissioning phase of the development to appropriately manage vehicle movements during this time. The car park surface should be reinstated if necessary and any landscaping removed during the construction phase should be replaced. A condition of consent is recommended that limits the amount of heavy and light vehicle activity during decommissioning to a level similar to the construction phase. Further, decommissioning / restoration works shall not take place during the peak summer months when the car park is heavily utilised.

#### *9.10.5 Issue – Pedestrian and vehicular access during operation*

The design of the desalination compound is such that access would still be available to the beach during operation. The compound is proposed to be located directly adjacent to a pedestrian access route to the beach, which pedestrians would continue to use during operation.

## 9.11 Energy

### *Issue Description*

The development's energy efficiency can only be assessed at a generalised level due to a lack of plant specific information (only typical plant details can be provided at this stage as the applicant has not 'ordered' the units). The development proposal does not provide the actual energy consumption per ML for the desalination plant as an actual plant has not been chosen for the development.

A preliminary estimate of the power supply requirement is 250 kW to produce 1 ML of fresh water per day, or 6 MWh per ML. For the 2 ML per day proposed development at Tuggerah Beach, the preliminary estimate results in 12 MWh per day. The continuous load for the development is 0.5 MW.

The applicant's SEE states that Salt Water Reverse Osmosis (SWRO) desalination technology's energy requirements have reduced by over 60% in the last decade due to the development of better membranes and new energy recovery devices. The report also states that the significant difference between the energy requirements of new and old SWRO plants means an undertaking to utilise the newest technology plant available would maximise energy efficiency.

### *Recommended action*

A condition of consent is recommended to require the desalination plant to pursue energy recovery technologies to identify the most energy efficient units which can be provided to maximise the energy efficiency of the plant, even if there is a higher cost.

## 9.12 Greenhouse gas emissions

Greenhouse impacts are a major component of the environmental considerations of the development. The development's stated level of greenhouse emissions relates to the electricity use of the desalination plant without determination of the greenhouse impact arising from other sources associated with the proposal. Other sources will include:

- vehicle emissions associated with construction, operation and decommissioning of the plant
- emissions from waste sent to landfill
- emissions arising through the water treatment processes used
- SF<sub>6</sub> (Sulphur Hexafluoride) emissions
- network losses from continuous electrical load of the plant (discussed under Utilities).

Given the level of mitigation to be undertaken to offset the greenhouse gas emissions from the energy use of the desalination plant, these other sources of emissions are to be monitored and reported annually.

### 9.12.1 Issue – electricity use

#### *Issue description*

Using an estimated electricity consumption of 12 MWh per day, the plant will indirectly produce 11.82 tCO<sub>2</sub>e (tonnes of CO<sub>2</sub> equivalent)<sup>1</sup> per day to provide 2 ML of water product. Therefore, over the two year life of the temporary desalination plant, 8,640 tCO<sub>2</sub>e will be released. Daily emissions from the plant equate to 595 two person all electric houses. The water produced will have a greenhouse intensity of 5.91 tCO<sub>2</sub>e/ ML.

The supplementary *Greenhouse Gas Emissions and Mitigation* report concludes, “it is recommended that the Council....increase the percentage of green energy purchased to offset the energy requirements for the plant”.

In calculating greenhouse gas emissions from electricity use, the applicant assumes a rate of 5 MWh/ML (megawatt hours of electricity used per mega litre of water produced), which is the estimated energy consumption for a 20 ML per day plant. A 20 ML per day plant would benefit from economies of scale and the use of energy recovery equipment, which may or may not be achievable for a temporary desalination plant as proposed. If the stated value of electricity use of 5 MWh/ML is accepted, then the applicant’s calculations of greenhouse gas emissions from electricity are correct.

The applicant’s assessment assumes that the energy consumption per unit of water produced is transferable between larger systems and the temporary plant to be installed. Given the applicant’s recommendation to purchase 100% GreenPower to offset actual greenhouse gas emissions from electricity use, no detailed assessment of the accuracy of assumptions is necessary. A condition of consent is recommended below to ensure measurement of actual greenhouse gas emissions from electricity.

No information is provided on other sources of emissions, so the GHG offset proposed by the applicant relates primarily to electricity. In light of this, it is recommended that the applicant purchase 100% GreenPower accredited renewable energy.

The greenhouse footprint of the plant has been reduced to an almost carbon neutral position through the purchase of GreenPower accredited renewable energy. This is a positive outcome and demonstrates the applicant’s commitment to reducing the greenhouse impacts associated with desalination.

#### *Recommended action*

A condition of consent is recommended that requires the development to purchase enough GreenPower accredited renewable energy to offset the desalination plant’s actual energy use. Further, monitoring and documentation of actual energy use shall be undertaken and the offsetting of each year’s energy use through the purchase of GreenPower accredited renewable energy will be independently verified.

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<sup>1</sup> Refers to the emissions of all greenhouse gases (in this case generated by electricity generation) converted, using the Global Warming Potential of each gas emitted, to the equivalent amount of CO<sub>2</sub>.

### 9.12.2 Issue – SF<sub>6</sub> (Sulphur Hexafluoride)

#### *Issue description*

An electricity substation is identified for the development which may contain SF<sub>6</sub> within the switch gear. The Global Warming Potential of SF<sub>6</sub> is 23,900 times that of CO<sub>2</sub>.

#### *Recommended action*

A condition of consent is recommended to require regular monitoring of SF<sub>6</sub> gas levels in switchgear, if used, in order to identify any leakage of this gas. Further, action shall be taken to minimise loss of gas and the monitoring results be documented.

### 9.12.3 Issue – monitoring and reporting of other emission sources

#### *Issue description*

The fuel types to be used and their consumption during construction, operation and decommissioning must be documented.

The issue of emissions from waste is mainly focussed on construction and decommissioning when the majority of waste will be generated. Certain wastes sent to landfill will generate greenhouse emissions. The amount of each type of waste, or total co-mingled amount, expected to be produced during construction, operation and decommissioning requires documenting.

Emissions potentially arising from the water treatment processes are not documented as part of the development application.

Due to the lack of discussion surrounding other sources of greenhouse gas emissions (apart from electricity use) the applicant should be required to collect data in order for the purpose of improving awareness of emission sources and potentially offsetting of total greenhouse gas emissions.

#### *Recommended action*

A condition of consent is recommended to require the monitoring and reporting of other sources of greenhouse gas emissions arising from the construction, operation and decommissioning of the desalination plant.

In particular, the monitoring and reporting of vehicle fuel type and usage, the calculation and reporting of the greenhouse impact of treatment processes used to convert the desalinated water to drinking water standard and documentation of the waste generated annually is required, all of which is to be disclosed publicly.

## **9.13 Noise and Vibration**

The assessment of noise has been addressed by the applicant in a report prepared by Hunter Acoustics for the temporary desalination plants. Vibration has not been assessed and is not considered to be a significant feature of this development. The applicant has also not assessed the noise generated by construction activities or traffic generated by the development. Neither of these issues is considered to be significant and their omission is not considered to be a weakness in the assessment.

This section provides a discussion of the relevant noise criteria (first issue below) and then provides an assessment of the proposal in light of the established noise criteria (second issue below).

#### *Issue – Noise Criteria*

This section provides a description of relevant noise criteria used to establish the basis for the noise assessments and is included because some of the criterion provided by the applicant are incorrect.

Noise emission is regulated by the *Protection of the Environment Operations Act 1997* (POEO Act) which was promulgated on 1 July 1999. The regulation to this Act that specifically details how noise emission should be assessed is the *Protection of the Environment Operations (Noise Control) Regulation 2000*. The POEO Act updated and replaced, amongst others, the *Noise Control Act 1975*. The POEO Act and Regulation provide the legal framework and basis for managing unacceptable noise in New South Wales.

The Department of Environment and Conservation (DEC) provides guidelines for assessing noise in its “Industrial Noise Policy” (INP) and in the “Noise Guide for Local Government”.

#### Intrusiveness Criterion

Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (represented by the  $L_{Aeq}$  descriptor), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is termed the intrusiveness criterion.

The background noise level is defined by the DEC as “the underlying level of noise present in ambient noise when all unusual extraneous noise is removed”. It can include sounds that are normal features of a location and may include birds, traffic, insects, waves on a beach etc. The background noise level is considered to be represented by the  $L_{A90,15\text{ min}}$  descriptor. The  $L_{A90}$  noise level is the level exceeded for 90% of the sample period and represents the average minimum noise level in the local acoustic environment over the measurement period. The Assessment Background Level (ABL) is established by determining the low est ten-percentile level of the  $L_{A90}$  noise data acquired over each period of interest (i.e. day, evening and night) for each 24hours of monitoring.

The Rating Background Level (RBL) is the overall single figure background noise level representing the day, evening and night assessment periods. It is based on the median of individual ABLs determined over the entire monitoring period.

#### Noise Amenity Criteria

To limit continuing increases in noise levels, the maximum ambient noise level within an area from industrial noise sources should not normally exceed the acceptable noise levels specified in Table 2.1 of the INP. That is, the ambient noise level should not exceed the level appropriate for the particular locality and land use. This is often termed the “Background Creep” or Amenity criterion. The Amenity Criterion is based upon the measured equivalent continuous noise level of the area (denoted as the  $L_{Aeq}$  noise level). For a residential receiver in a suburban area and a passive recreation area, the recommended amenity criteria are shown in the table below.



*Recommended  $L_{Aeq}$  noise levels from Industrial Noise Sources*

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended $L_{Aeq}$ Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55

Notes:

1. Days defined as 7:00am to 6:00pm, Monday to Saturday and 8:00am to 6:00pm Sundays & Public Holidays.
2. Evening is defined as 6:00pm to 10:00pm, Monday to Sunday & Public Holidays.
3. Night is defined as 10:00pm to 7:00am, Monday to Saturday and 10:00pm to 8:00am Sundays & Public Holidays.

When the existing background noise level from all existing industrial sources is close to the “acceptable” level given above, noise from the new source must be controlled to preserve the amenity of the area. Since the existing noise environment at the site is not affected by existing industrial noise, the Amenity Criterion at the nearest residential receiver will be given by the acceptable nighttime  $L_{Aeq}$  limit of 40 dB(A) since the proposed desalination plants will operate 24 hours a day. The amenity criterion for the beach, where this is used for passive recreation, is 50 dB(A).

*Description of Issue*

The criteria for the assessment of noise, as indicated above, is determined by both the intrusiveness and amenity criteria. As the intrusiveness criteria is determined against a “background + 5 dB(A)” criteria, it is necessary to determine the existing background noise level at the nearest affected residential location. The nearest affected residences are those located in the Magenta Shore site to the north and in Curtis Parade to the south. The background noise level at either of these two locations has not been measured by the applicant.

Although it is usual to perform long term noise logging at the nearest affected residences over a one week period to determine the Rating Background Noise level, the proponent’s consultant has determined the background noise level at night from one spot measurement made between 10pm and 11pm at night in Wyrabalong National Park. The location of the measurement is identified as being approximately 200m from Wilfred Barrett Drive and 400m from the beach. The measured background noise level is given in the assessment report as 32 dB(A) and the intrusiveness criterion as 37 dB(A) at the nearest residence. The measured background noise level appears surprisingly low. Since the residents located in Curtis Parade and the Magenta Shore site are located approximately 100-200m from the ocean, it could be expected that the background noise level at these locations would be higher (measurements made over a one week period at other beachside locations have resulted in background noise levels of approximately 50-55 dB(A) at 100m from the ocean). Due to the very low background noise level measurements, the nominated residential criteria is quite stringent and will more than adequately protect the amenity of the nearest residents.

The proponent’s consultant has incorrectly applied the intrusiveness criterion to users of the car parks and beach. The intrusiveness criterion is only applied to residential receivers. The users of the beach should however not be exposed to noise levels above the amenity criteria specified for passive recreation areas, given above as 50 dB(A). The proponent’s

assessment location nominated as being 50m from the plant is reasonable and should be adopted. This distance is the approximate distance of the plant from the recreational areas of the beach.

The proponent's consultant has also incorrectly nominated an amenity criterion of 42 dB(A) at night for the nearest residents. Presumably the measured ambient  $L_{Aeq}$  noise level was 52 dB(A) and the consultant has subtracted 10 dB(A) from this measurement on the basis that the background noise level is unlikely to fall in the future. This approach can only be taken when this high background noise level is caused by existing levels of industry or in areas of high traffic noise. Both of these situations appear unlikely given the measurement location. The correct amenity criterion for the nearest residences is given in the table above as 40 dB(A). Since the amenity criterion is greater than the nominated intrusiveness criterion, the assessment of noise would be made against the intrusiveness criterion of 37 dB(A), provided the background noise level is relevant.

#### *Recommended Action*

The noise criteria should ideally be set at individual residential receivers and be based upon noise measurements made at that individual location. Given the generally large distances between the desalination and the nearest residence (approximately 600m), additional noise monitoring is not recommended. Indeed, monitoring at the nearest residence would result in higher background noise levels due to the closer proximity to the ocean. Due to the lack of noise measurements at the nearest residents, the following criteria are nominated for the operation of the desalination plant at Tuggerah Beach:

*The noise from the operation of the desalination plant should not exceed 40 dB(A) at the nearest residence and 50 dB(A) at a distance of 50m from the plant site boundary.*

#### *9.13.1 Issue – Noise Measurement and Assessment*

##### *Description of Issue*

The proponent's consultant has measured noise levels of an operating desalination plant at Austar Colliery. The equipment at Austar Colliery has also been measured by Bassett Acoustics on the 31<sup>st</sup> October, 2006. The primary source of noise from the desalination plant will be the supply pumps (2), the product pump (1) and the brine pump (1). These are likely to be powered by 75 kW motors similar to those at the Austar Colliery. These pumps were measured by Bassett Acoustics to have a sound power level of 95 dB(A) each.

The proponent's consultant has prepared a table of power levels and predicted noise levels at the nearest residential receiver which is nominated in the report as being approximately 750m to the north of the site. The residents to the south in Curtis Parade may in fact be slightly closer at a distance of approximately 600m.

Table 2c of the proponent's acoustic assessment list equipment numbers and sound power levels in terms of linear levels rather than the usual A-weighted levels, which makes the calculation difficult to follow. The number of supply, product and brine pumps are incorrectly nominated although somehow the resultant overall sound power level for all the equipment is assessed as being correctly indicated at 85 dB(A) after the implementation of noise control treatment. The calculated noise level at the nearest residence is 21 dB(A) which clearly satisfies the established noise criterion. The calculation assumes that 16 dB(A) attenuation can be achieved through the implementation of noise control treatment. This treatment consists of constructing a roof and end walls of internally insulated Colorbond steel between two adjacent containerised RO plants to enclose the supply, product and brine pumps. This

level of reduction is reasonable provided the 300mm gap under the containers is also blocked off and the end walls and roof are relatively free from gaps in the construction.

The calculated noise level at 50m from the plant site boundary with the proposed level of noise treatment is 44 dB(A). The real level of noise reduction is probably greater than this level and will satisfy the noise criteria nominated here of 50 dB(A) for passive recreational areas.

#### *Recommended Action*

It is recommended that the proposed noise control treatment recommended in the proponent's acoustic assessment be adopted. This treatment will ensure compliance with the criteria nominated.

### **9.14 Air quality**

#### *9.14.1 Issue – management of dust*

##### *Description of issue*

Dust will be generated during construction. As such, there is potential for impacts on recreational areas (such as Tuggerah Beach and Tuggerah Lake) and residential areas to the south. However, with controls as outlined below (and required under a condition of consent), the potential impacts are predicted to be minimal.

##### *Recommended action*

A Construction Environmental Management Plan (CEMP) must be prepared that includes appropriate management measures to minimise the impacts of air borne emissions, including the following.

- Minimising the area of clearing and exposed material during construction activities.
- Stabilisation and revegetation of exposed areas including stockpiles quickly.
- Implementation of dust suppression measures as required eg. water carts or cessation of dust generating activities during windy periods.
- Regular checking of emissions from equipment and plant during construction activities to ensure compliance with Protection of the Environment Operations Act.
- No burning of waste material on-site.
- Construction vehicles transporting potentially dust generating material are to be covered.
- Where practicable, access tracks are to be stabilised using crushed concrete aggregate or equivalent to minimise dust and reduce potential for sediment to be tracked onto local roads.
- Any material tracked onto local roads is to be removed immediately to prevent the generation of dust
- Install rumble grids, wheel wash or equivalent to minimise sediment tracking offsite.
- If required, stockpile heights are to be minimised as far as practicable.
- Operation of water cart to suppress dust, where practicable.
- Dust monitoring.
- A complaints handling procedure
- A schedule of site inspections and monitoring of controls for effectiveness.

#### 9.14.2 Issue – desalinisation plant operations

The temporary desalination unit proposed for the Tuggerah Beach site does not include the use of a degassifier. Accordingly, no operational air quality impacts are expected. A condition of consent is recommended to make certain a degassifier is not used.

### 9.15 Heritage

#### 9.15.1 Issue – identification of archaeological sites

##### *Issue description*

Background information in the SEE and an Indigenous archaeological heritage assessment of the proposed Tuggerah Beach location identified an Aboriginal archaeological site—a shell midden (Tuggerah Beach AHIMS-45-7-0122)—in proximity to the proposal. The proposed development area is identified as having been subject to extensive disturbance from sand dredging, destroying Aboriginal cultural materials.

Whilst this is the case, no detailed supporting documentation providing a compelling demonstration of the invoked disturbance processes is presented with the SEE. There is the potential to impact on the known archaeological site, and there is a possibility of encountering Aboriginal objects (albeit previously disturbed) during the proposed construction activities. Preliminary consultation was undertaken with the Darkinjung LALC who raised concerns regarding the proposal.

The proposed development location has been subject to extensive ground disturbance. However, as there is an archaeological site in the vicinity of the proposal, and there is the possibility of disturbing Aboriginal objects during the proposed construction. Preliminary consultation was undertaken with the Darkinjung LALC who raised concerns regarding the proposal. A recommendation is described below to address this matter and to formulate mitigation measures where necessary.

##### *Recommended action*

As there is an archaeological site in the vicinity of the proposal and there is the possibility of disturbing Aboriginal objects during the proposed construction, a Cultural Heritage Management Plan (CHMP) must be developed for the proposal. The CHMP must be developed in consultation with the Darkinjung Local Aboriginal Land Council and should ground truth the assessment findings. A condition of consent is attached to this effect.

#### 9.15.2 Non-Indigenous heritage

##### *Issue – impacts to non-Indigenous heritage items during construction*

Searches of the relevant heritage registers, and a general site history contained in the SEE indicate that the area has seen no significant historical development and there is no identified risk of impact to non-indigenous heritage values from the proposal.

## 9.16 Visual impact

### 9.16.1 Issue – desalination infrastructure on beach

#### *Description of issue*

The impacts relating to visual and public amenity as a result of beach infrastructure are potentially significant, particularly considering that below ground beach infrastructure is not proposed to be removed following decommissioning. There is a risk of beach infrastructure being exposed through storm events and creating visual and physical barriers on the beach. Note that this report recommends removal of all beach infrastructure in accordance with erosion and exposure considerations.

Proposed beach infrastructure comprises the intake infrastructure (beach wells and associated pipelines) and the outfall infrastructure (seawater discharge pipeline and outlet pit).

With future sea level rise, it is foreshadowed that any infrastructure constructed on the beach today would become more susceptible to exposure and have increasing effects on coastal processes in the future.

The development application plans show that the geobags and the outlet pit are above the beach profile (2006 profile) for a distance of over 15m. At high tide (RL 1.042m AHD) the outlet pit and geobags in the swash zone will be covered by the ocean. During low tides (approximately RL -1.0m AHD) the outlet pit and geobags will be fully exposed above the beach profile.

The SEE states that:

*“The bores and brine dissipater will be located between the high and low tide levels, however a portion of the sand filled geobags surrounding the outlet pipe will be visible above the high tide level”*

Establishing a seawater outfall above the beach profile will generate a negative impact on the visual landscape by interrupting what is now a continuous beach foreshore. However, due to the temporary nature of the proposal and the community benefit from augmenting water supplies, the detrimental impact generated by the proposed outfall infrastructure is considered reasonable. This assumes that the seawater discharge infrastructure is to be completely removed upon cessation of operations.

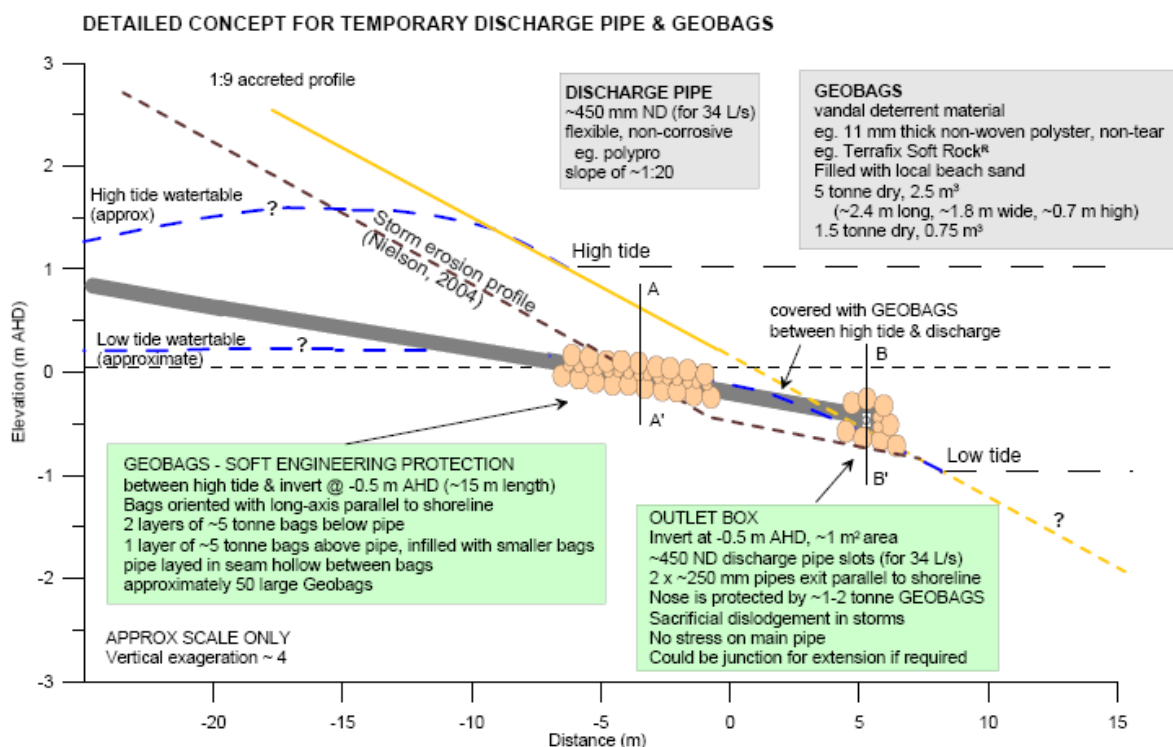
In extreme storm events, there is potential for the seawater outfall infrastructure to be further exposed. Reference is made to Figure 4.1 (reproduced below) of the design report (UNSW Water Research Laboratory, 2006), which demonstrates the extent to which the geobags may be exposed if a severe storm causes significant erosion.

*Soft Engineered Geobags protecting a discharge pipe at Maroochy, Queensland*



Source: *Detailed Conceptual Design of Beach Bore Intakes and Brine Discharge to Ocean – Temporary Desalination Plants, Wyong Area, WRL, 2006*

Reference to Figure 4.2 of the same report (reproduced below) shows an outfall structure height of around 0.5 m. In reality, if Terrafix Soft Rock products are used (0.75 m<sup>3</sup> bags are 400 mm high, 2.5 m<sup>3</sup> bags are 650 mm high) an overall structure height of around 2.3 m could be expected. After a significant erosion event, this structure would represent a significant physical and visual barrier on the beach. The 5T bags (using Terrafix “Soft Rock” dimensions are 1.8 m \* 2.4 m \* 0.65 m high – around 2.5 m<sup>3</sup>, accounting for curvature on edges).



Source: *Detailed Conceptual Design of Beach Bore Intakes and Brine Discharge to Ocean – Temporary Desalination Plants, Wyong Area, WRL, 2006*

In such events, there is also potential for the beach wells to be exposed, thereby generating negative visual impacts. The risks of exposure of beach infrastructure in terms of public safety and beach stability are considered in separate sections of this report.

Overall, the visual impact of the beach infrastructure needs to be balanced against the inferred urgency of installing the temporary desalination plant.

*Recommended action*

Prior to construction, more consideration of the potential for exposure of the infrastructure needs to be made, including potential impacts on the visual and recreational amenity of the beach. Appropriate mitigative strategies are required as part of the erosion and sediment control plan.

*9.16.2 Issue – desalination plant compound*

*Issue description*

The proposed plant infrastructure is located in an area of high scenic landscape values, which necessitates effective mitigation of any adverse visual impacts. This visual assessment is tempered by the temporary nature of the proposed development, however, minimising adverse visual impact depends on the effective removal and restoration of the visual landscape once the operation life of the plant is ceased.

Views of the proposed desalination plant compound would occur from:

- the adjacent golf course
- car park
- pedestrian access track.

The compound site is elevated above Wilfred Barrett Drive yet remains mostly screened by roadside vegetation. This site is in an area classified as having a high scenic rating (Andrews Neil, 2006) and is important to protect the integrity of broader scenic qualities of the coast.

The proposed development, untreated, will generate some adverse impacts on the visual qualities of the subject site, due primarily to the industrial nature of the plant. The primary method to minimise visual impact in this location would be to screen the development using landscaping. However, screening the plant to minimise visual impact must be balanced with the need to maintain opportunities for casual surveillance to discourage crime.

The visual impacts of the facility are not consistent with purpose of the zoning, which is to restrict the type and scale of development on land with special aesthetic, ecological or conservation values. However, as the proposed development is temporary, the visual impacts can be mitigated to an acceptable level.

#### *Recommended action*

Mitigation measures required to minimise the adverse visual impacts are:

- A Landscape Plan shall be prepared by a suitably qualified person, to the satisfaction of Council, that describes a strategy for suitable plantings (which are endemic to the local area) to minimise visual impact and for restoration of the site upon cessation of desalination operations. This Landscape Plan must be submitted to Council for approval prior to commencement of operations. The key requirements for the Tuggerah Landscape Plan are:
  - provide landscaping along the Wilfred Barrett Drive (west) elevation to screen the compound from view from the roadway.
- All finishes are to be non-reflective and of recessive colouring to minimise impacts on the surrounding visual landscape.
- Chain wire mesh fencing shall be coloured black.
- All signage should be of simple design, avoid clutter and should reflect the character of the site.

Appropriate conditions of consent are recommended in this regard.

## **9.17 Social Impact in the Locality**

### *9.17.1 Issue – management of community expectations*

#### *Issue*

Due to the prominent nature of this proposal, the community will need to be regularly informed of key aspects of the desalination process, including:

- construction (including construction management measures – parking, access and safety information to the public)
- operation and monitoring
- restoration
- investigations into more sustainable forms of water supply.



*Recommended action*

It is recommended that a dedicated website or webpage be established as soon as practical after approval of this application and prior to issue of a construction certificate, which provides publicly available information to the community. The contents of the web page should also be available in hard copy newsletter format at Council's offices and public library.

The web page should also contain reference to a free call number for the community. A member of Council staff is to be responsible for responding to such telephone enquiries. This staff member should be suitably qualified in dealing with public consultation matters. If appropriate, this free call number can be used for the public to report incidents or damage to the desalination plant (as required by the EMP).

## **9.18 Safety, Security and Crime Prevention**

### *9.18.1 Issue – minimise impacts of damage to plant and infrastructure*

*Issue description*

There is potential for deliberate and unintentional damage to plant infrastructure during both construction and operation.

*Recommended action*

A 24 hour free call telephone number shall be maintained for the duration of the project (combined for all three sites) that allows the public to report damage or incidents directly to the desalination plant operator.

The web page established for this project should include a description of the risks to the wider community associated with tampering or damaging the desalination infrastructure.

The application proposes “manproof” fencing around the perimeter of the temporary desalination plant compound in order to protect infrastructure from vandalism. It is recommended that security patrols be considered to provide additional security against vandalism.

### *9.18.2 Issue – safety of beachgoers*

*Issue description*

The proposed seawater discharge outfall will be located between the mean high water and mean low water marks, which has the potential for generating risks to personal safety of beachgoers, particularly swimmers and surfers.

There are many examples in New South Wales where exposure of infrastructure on beaches has resulted in public injury, community anger and legal proceedings.

The proposed seawater outlet pit and pipeline will be covered with 5 tonne geobags, which will ‘soften’ the edge to the pipelines and outlet pit infrastructure. However, as the outlet pit is located in the swash zone, which is exposed during low tides and covered during high tides, mitigation is required to minimise potential public safety impacts.

Alternative options for the proposed outlets were considered as part of this assessment, which are described below .

- Shifting the proposed infrastructure (outlet pit) into the ocean to a depth that would minimise risk of injury to swimmers. However, we note that moving the infrastructure further into the surf could potentially result in a less visible and hence more dangerous structure.
- Altering the technology to an outlet pipeline with dissipators, which would be typically located in deep water. The cost implications of this option are such that it may negate the viability of the project, particularly given its temporary nature.
- Using sub surface injection back into the groundwater at significant depth below the beach. This option was technically ruled out during the design phase. We consider that liquefaction of the sand resulting from such an option is a possibility, leading to an alternative public hazard.

#### *Recommended action*

Prior to commencement of construction in or near the swash zone, a Risk and Safety Management Plan (RSMP) shall be prepared, to the satisfaction of Council that demonstrates adequate consideration of these issues and implementation of measures to minimise risks associated with the proposed beach infrastructure. Visibility of infrastructure and potential for injury are important considerations to be managed by the Risk and Safety Management Plan.

The RSMP should be prepared by persons who have suitable experience in assessing risk of the nature presented by this proposal. The process for formulating the RSMP must include a safety and risk workshop, which shall include participation by:

- the applicant / proponent
- Council
- person(s) suitably qualified in assessing risk
- key stakeholders
- construction groups
- a suitably experienced facilitator (can be the risk specialist if appropriate).

The findings of this workshop (including risk identification and suitable mitigation measures) shall be incorporated into the RSMP. As only typical details are provided with the application, a preliminary workshop using typical details would necessitate a follow-up workshop to clarify risks identified once detailed engineering and construction issues are more highly understood.

The CEMP must also provide for the safety of beachgoers during the construction period through clear demarcation of work sites and clear warning signage.

#### *9.18.3 Issue – accessibility of beach during construction*

##### *Issue description*

The construction of beach wells will severely restrict the availability of beach space, including the flagged areas. The construction period has the potential to generate risks to public safety as a result of heavy machinery, infrastructure and large excavations in a recreation area.

##### *Recommended action*

A condition of consent is recommended that requires progressive drilling and restoration of the beach areas. Construction should initiate from the northernmost well and move south, progressively drilling, constructing and restoring the beach profile.

It is expected that work sites would be fenced off during the two month well construction programme. The CEMP shall consider public safety and implement appropriate measures to secure worksites during construction and after hours.

## **9.19 Economic Impact in the Locality**

### *9.19.1 Issue – economic impacts*

#### *Issue description*

The proposed desalination plant will augment the supplies of water to the Wyong community, including the business community. Ongoing water supplies are critical to protecting investment and economic growth and the proposal will ensure that during the short term, drought conditions do not unreasonably restrict economic activity in the shire.

Due to the increased price associated with generating desalination water, compared to the current supplies via rainfall, there will be a short term impact on the cost of water to the community. On the basis that Council will actively investigate more sustainable forms of water supply and conservation, it is considered that the benefit of a guaranteed water supply outweighs the increase in costs for the two year period of operation.

## **9.20 Utilities**

### *9.20.1 Issue – services on Wilfred Barrett Drive*

Any services that are required to connect to the western side of Budgewoi Rd will need to be bored / jacked under Wilfred Barrett Drive to avoid disturbing the road surface.

### *9.20.2 Issue – electricity network losses*

#### *Issue description*

The plant will require a continuous load of 0.5 MW likely necessitating an upgrade of the existing power supply infrastructure. The impact of this load on the electricity network's losses in the area is not identified. This continuous load will place additional demand onto a possibly already constrained section of the network, increasing network losses, while an upgrade to improve the network in the area would have potentially positive impacts from reduced line losses locally. The impact the plant will have on peak demand on the network during summer is not identified.

#### *Recommended action*

A condition of consent is recommended that requires the impact on the local electricity network of the additional load from the plant and cumulatively across all three sites to be determined and, where feasible, actions implemented to minimise adverse impacts on network losses.

### 9.20.3 Issue – discharge of backwash to sewer

#### *Issue description*

Amendments to the proposal received from the applicant during consideration of the development application state that backwash will be discharged to sewer. No design details are provided, but it is understood that measures would need to be implemented to divert the waste water during backwash events to sewer, rather than to the seawater concentrate return pipeline. Under normal operating conditions (i.e. not during backwash events) the seawater concentrate will continue to be discharged to the ocean via the seawater concentrate return pipeline.

Discharging backwash wastewater to sewer will avoid impacts on water quality in the ocean that may otherwise result from total suspended solids (TSS) and the potential presence of other constituents in backwash water.

#### *Recommended action*

Conditions are recommended that require:

- the development not to discharge backwash to ocean
- the proponent obtain a trade waste agreement prior to commissioning of the plants
- contingency measures to be identified within the Trade Waste application in the event that the discharge to sewer exceeds the approved Trade Waste Agreement limits.

## **9.21 Hazardous materials and waste**

### 9.21.1 Issue – storage of hazardous chemicals

#### *Issue Description*

Hazardous materials used in the pre-treatment and cleaning processes will need to be safely stored. Potential hazards could include leakage and spillage into the surrounding environment, potential for reaction, corrosion of equipment, explosion and fire.

#### *Recommended action*

Quantities and storage of hazardous materials appear to have been adequately addressed in the SEE, although only conceptual design details have been provided. Recommended consent conditions to cater for design of the chemicals storage are described below.

- To ensure that appropriate separation distances, bunding and spill containment systems are in place prior to commencement of operation of the plant.
- Storage of chemicals on site will be required to meet the following requirements:
  - EPA Guideline on Bunding and Spill Management (EPA, 2001);
  - Occupational Health and Safety Regulation 2001 (as amended) (OHS Regulation);
  - WorkCover NSW Code of Practice for the Storage and Handling of Dangerous Goods 2005; and
  - Appropriate Australian Standards, in particular AS 3780 – The Storage and Handling of Corrosive Substances, and AS/NZS 4452 The Storage and Handling of Toxic Substances.
- A spill control plan should be developed and implemented as part of the Environmental Management Plan for both the construction and operational phases of the project.

9.21.2 *Issue - waste management*

*Issue Description*

Any waste generated during construction or operation of the desalination plant should be stored and disposed of in a responsible and legal manner. Potential impacts are litter, odour and pests. Waste Management issues appear to have been adequately addressed by the application, however these details need to be confirmed as part of the detailed design process.

*Recommended action*

A consent condition is recommended that requires a Waste Management Plan to be prepared as part of the Environmental Management Plan as relevant for the construction, operational and decommissioning phases of the project.

**9.22 Cumulative Impacts**

9.22.1 *Issue – energy use and Greenhouse gas emissions*

*Issue description*

The development application recognises that cumulative impacts primarily relate to the energy usage and greenhouse gas emissions of the three plants. Cumulative impacts of the three plants, as determined from information contained in the SEE, are:

- electricity use will generate 43,200 tCO<sub>2</sub>e to produce 7,310 ML of water over 2 years
- network loss impacts of the additional three continuous loads of 1 MW each (Budgewoi Beach and Lakes Beach) and 0.5 MW at Tuggerah Beach inserted into the existing distribution network within close proximity to each other
- vehicle emissions during the construction, operation and decommissioning of the three plants
- emissions from waste generated by the three plants' construction, operation and decommissioning
- emissions from the treatment of 10 ML of desalinated water to drinking water standards.

The primary cumulative impact of increased greenhouse gases has been mitigated through the development's purchase of green energy to offset 100% of each plant's energy requirements each year.

Energy use and annual emissions of greenhouse gases will revert to pre-development levels once the plants are decommissioned. The greenhouse emissions avoided as a result of the two years of green energy purchases will continue to benefit the atmosphere for many years into the future due to the long lifespan of CO<sub>2</sub> in the atmosphere.

*Recommended action*

It is claimed that the development's provision of a temporary water supply for use by the community may assist to offset any environmental impact of the proposed activity which would ensure that the works result in a net gain to the local and regional community. The mitigation of the greenhouse impact of the desalination plant's energy use through the purchase of green energy enhances the social benefits generated by taking a leadership role, avoiding emissions and supporting renewable energy.

The public is aware of the issue of higher energy use and greenhouse gas emissions associated with desalination plants.

The greenhouse emissions associated with the development's energy use has been mitigated through the purchase of enough green energy to satisfy its energy requirements. A variety of other mechanisms and approaches which will accrue social and environmental benefits over short and long timeframes are potentially available to offset any additional greenhouse emissions from the development while acting as a driver for ongoing social, environmental and economic benefits.

Additional direct mitigation options include the following.

- Substituting vehicle fuels derived from the current carbon cycle such as Biodiesel or ethanol blends (E10) reduces greenhouse emissions and air quality impacts from vehicles.
- Switching to LPG for light petrol vehicles, lowering the emission intensity of fuel use.
- Membership of a carbon offset scheme to offset vehicle emissions (e.g. by the planting of enough trees sufficient to sequester their emissions).
- Purchasing NSW Greenhouse Gas Abatement Certificates (each NGAC is equivalent to 1 tCO<sub>2</sub>e of abatement), or Renewable Energy Certificates (each REC is equivalent to one MWh of renewable electricity), or accredited Greenhouse Friendly™ abatement.

Other approaches to mitigating emissions have additional benefits by acting to reduce water consumption and greenhouse emissions in both the short and long term. They increase the potential for the development to only be needed for a short time period and also have social and awareness raising benefits that add a non-monetary value to the approach.

Other approaches include the following.

- Implement a programme where high energy and water efficiency appliances are provided to customers to replace inefficient (often old) equipment amongst groups who are least able to afford upgrading.
- Water tanks or grey water recycling systems could be supplied at subsidised costs to high water consumption households or groups who are least able to afford upgrading.

The rationale behind these approaches is that water supply has emissions associated with it (e.g. pumping), so if these systems reduce the amount of water needed to be supplied to customers there is a saving in greenhouse emissions. The calculated savings in energy use and water use could be used to offset the emissions associated with the desalination process.

A condition of consent is recommended that requires the development to purchase enough green energy to offset 100% of the desalination plant's energy use. Further, monitoring and documentation of actual energy use shall be undertaken and the offsetting of each year's energy use through the purchase of green energy will be independently verified.

#### 9.22.2 Issue – cumulative impacts of three desalination plants on coastline

##### *Issue description*

Wyong Shire is dependent on incomes from tourism (both domestic and international), which is focussed on its location near to the coast. Establishing desalination plants along the coast could have an impact on the perception of Wyong as a natural coastline for tourists if they were to become a longer term feature.

Considering the temporary nature and the importance of the facility in augmenting the short term water supplies, the impact on the coastline in relation to perceptions of the coastline is reasonable.

#### 9.22.3 Issue – water quality

##### *Issue description*

Provided that the expected dilutions in the swash zone are achieved, the temporary desalination plants are not expected to result in measurable cumulative ocean water quality impacts arising due to the distance between the different sites.

Further, the plants could provide valuable monitoring data for use for other similar investigations throughout Australia.

#### 9.22.4 Issue – coastal processes impacts

##### *Issue description*

Any expected impact on coastal processes is likely to be localised. Accordingly, no cumulative interaction would be expected between the different temporary desalination sites proposed.

#### 9.22.5 Issue – groundwater drawdown

There are no cumulative impacts as a result of this proposal due to there being no major proposed or existing groundwater drawdown works, such as domestic bores or other desalination plants, in close proximity to the proposed Tuggerah Beach desalination plant.

#### 9.22.6 Issue – aquatic ecology

##### *Issue description*

The discharge of hyper saline water following the desalination process could have cumulative effects on aquatic ecology. However, the small area of impact (15m under worst mixing conditions) means that there will be very little cumulative impact on aquatic ecology arising from the desalination process.

##### *Recommendations*

The monitoring programme designed to determine the impact of individual hyper saline discharges (Section 6.8) will assist in determining the cumulative impact of such actions in this poorly researched area.

### **9.23 Suitability of the Site for the Development**

Due to the nature of the temporary desalination plant requiring a coastal location, suitable sites are restricted. By locating the plant within an existing cleared area, environmental impacts are minimised. The presence of a sand track allows piping to be laid and minimising the need for clearing of vegetation. Rehabilitation is likely to return the site to its original condition after two years of operation of the plant.

Provided a Risk and Safety Management Plan is prepared that identifies and avoids/manages potential risks to public safety, the site is suitable for the proposed temporary desalination plant.

#### 9.24 Public Interest

The proposed desalination plants are in the public interest to the extent that they provide an important short term solution for supplementing water supplies. Public interest is dependent on the proponent carrying out investigations into, and implementation of, more sustainable forms of water supply and improvements to water use efficiencies.

In accordance with Council Notification Policy, the development application was notified for a period of 28 days. During this time 68 submissions were received. As discussed in section 7 of this report, it is considered that this report adequately addresses these concerns and requires the implementation of appropriate management measures to mitigate environmental impacts identified.

### 10 CONCLUSION

Pursuant to the provisions of Section 79C(1) (b) of the *Environmental Planning and Assessment Act 1979*, the following key matters arise from the application for temporary desalination plant at Tuggerah Beach:

- Additional information provided by the applicant adequately addresses impacts arising from the development with regard to greenhouse gas emissions. The conditions of consent require the monitoring, documenting and offset of greenhouse emissions.
- Detailed monitoring of the proposed plant is required and if adverse impacts are evident, desalination operations will cease until such impacts can be mitigated or reversed to an acceptable level. This includes monitoring of:
  - groundwater
  - dune stability
  - ecological communities
  - water quality
  - coastal erosion
  - acid sulfate soils.
- Proposed infrastructure in the beach has a high potential for exposure through erosion in light of the proposal to retain infrastructure indefinitely. All beach infrastructure is to be removed upon cessation of the temporary desalination operations.
- Proposed infrastructure in the beach pose a potential risk to public safety. A Risk and Safety Management Plan is required that is developed through a formal risk workshop process involving all key stakeholders.
- Insufficient justification of the temporary nature of the desalination plants. The proponent is encouraged to do everything cost effective to establish a more sustainable supply of water during the two year life of the temporary desalination plant.

Additional studies and environmental management plans that are recommended to be prepared by the applicant are described in the table below .



Recommended study / management plan	Timing
Construction Environmental Management Plan, including (but not limited to): <ul style="list-style-type: none"> <li>• Erosion and Sediment Control Management Plan (including detailed monitoring strategy for dune stability and erosion of beach)</li> <li>• Construction Traffic Management Plan (including Community Liaison Plan)</li> <li>• Construction Air Quality Management Plan</li> <li>• Risk and Safety Management Plan</li> <li>• Spill Control Plan</li> <li>• Waste Management Plan</li> </ul>	Prior to commencement of construction
Operational Environmental Management Plan, including (but not limited to): <ul style="list-style-type: none"> <li>• Supplementary Water Quality Analysis Report</li> <li>• Groundwater draw down monitoring</li> <li>• Seasonal monitoring of ecological communities</li> <li>• Contaminated groundwater monitoring</li> <li>• Management of chemicals</li> <li>• Spill Control Plan</li> <li>• Emergency Response Management Plan</li> <li>• Waste Management Plan</li> </ul>	Prior to commencement of operations
Acid Sulphate Soils Management Plan	Prior to issue of Construction Certificate
Monitor and mitigate greenhouse gas emissions.	Prior to commencement of operations
Pilot testing for fine tuning of beach wells.	Prior to commencement of construction
Discussion paper – water supply and efficiency options.	Prior to commencement of operations
Aquatic Ecology Pilot Study	Prior to commencement of construction
Detailed Aquatic Ecology Monitoring Programme	During plant operation
Pre-construction Shorebird Survey	Prior to commencement of construction
Landscape and Rehabilitation Management Plan	Prior to commencement of operations
Cultural Heritage Management Plan	Prior to commencement of construction

As the potential impacts of the proposed development can be adequately mitigated through recommended management measures, and further analysis is likely to demonstrate impacts are either not significant or can be mitigated to a reasonable level considering the temporary nature of the development, this report recommends Council grant consent subject to those conditions.

## ATTACHMENTS TO INDEPENDENT ASSESSMENT REPORT



# Department of Lands

Land Administration & Management  
Property & Spatial Information

Cnr New England Highway & Banks Street  
(PO Box 6) East Maitland NSW 2323  
Contact Officer: Allan Thorley  
Phone: (02) 49 379 344  
Fax: 49 348 417  
E-mail: [allan.thorley@lands.nsw.gov.au](mailto:allan.thorley@lands.nsw.gov.au)  
[www.lands.nsw.gov.au](http://www.lands.nsw.gov.au)

The General Manager  
Wyong Shire Council  
PO Box 20  
WYONG NSW 2259

Dear Sir

**Re: Owners Consent to Lodgement of DAs  
- Desalination Plants, Wyong LGA coastline**

I refer to previous correspondence and discussions regarding the consent of this Department, as landowner, to the temporary location of several desalination plants on three areas of Crown land in the Wyong Local Government Area.

Advice from consultants Andrews Neil is that Council proposes the location of these temporary plants at the following locations:

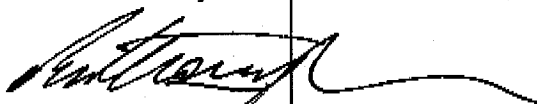
- Lot 7060 DP755266 at North Lakes Beach
- Lot 7060 DP755266 at South Lakes Beach
- Lot 623 DP 823104 at Tuggerah Beach (Magenta)

The Department recognises the urgency of this proposal as a temporary emergency measure to supplement local water supply. As such, I advise that the Department of Lands, as landowner, hereby consents to the lodgement of the necessary Development Applications in accordance with the above, to enable Council to formally consider this proposal.

The Department is currently processing a licence to authorise occupation of the Crown lands sites. This should be finalised shortly. Although the licence is not a prerequisite to lodgement of the DAs, obviously commencement of any operations other than investigative works will not be approved under the licence until the DA has been determined.

Should you require any further assistance in this regard, please feel free to contact me on 0413 745 496.

Yours sincerely



**Anthony Signor**  
Program Manager, Land Management  
Sydney Hunter Region.

9 AUG 2006

H:\Let Desal plants at Wyong.doc

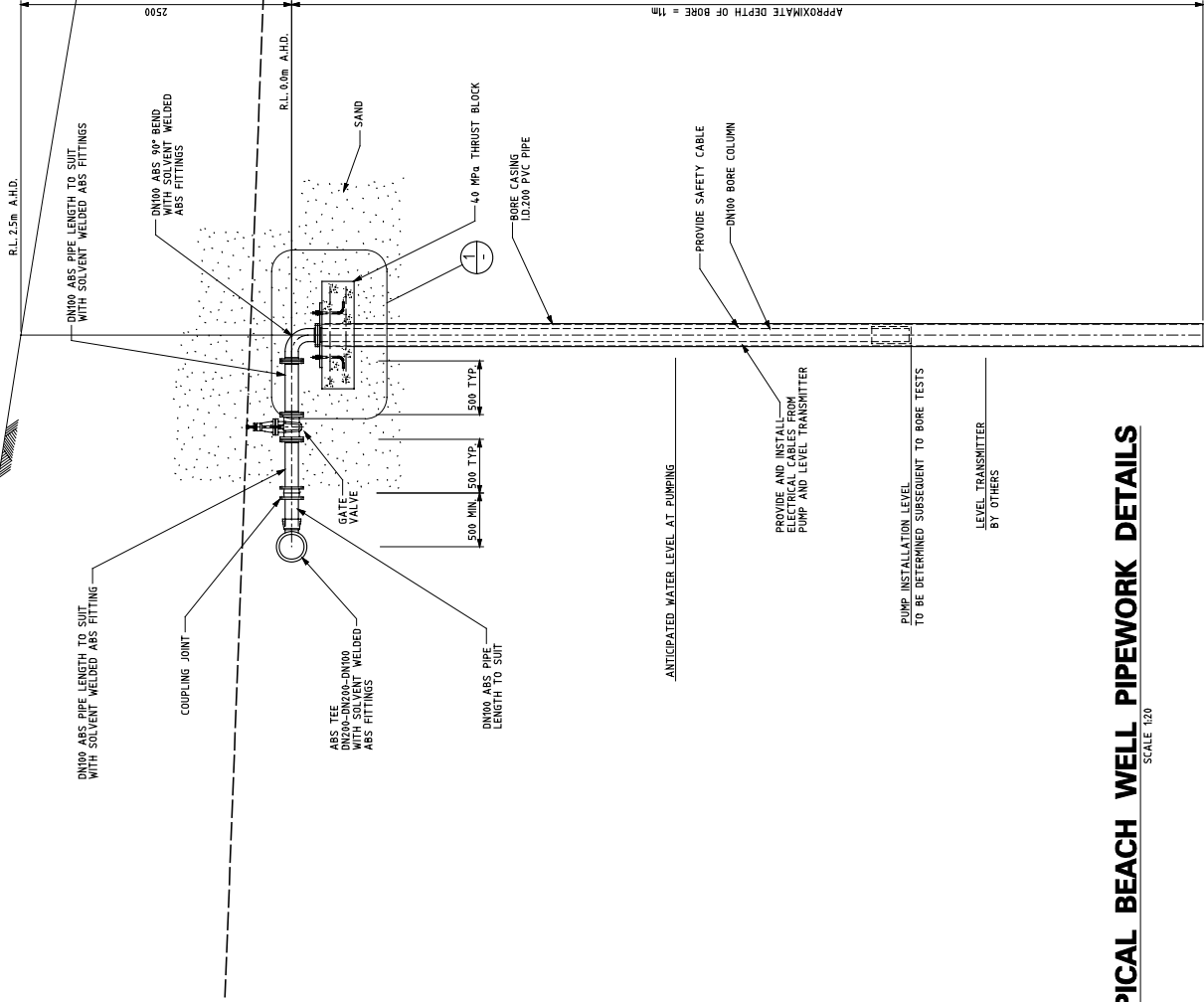


PROFILE AFTER 100 YEAR ARISTORM

INITIAL PROFILE 2006

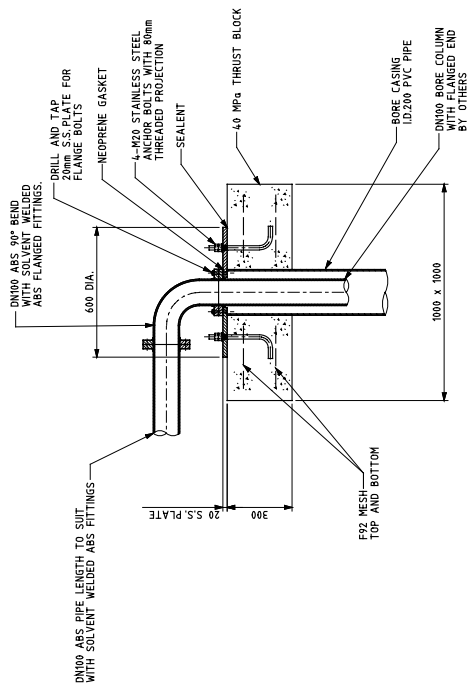
BEACH PROFILE 2006

HHW 1.042m (HIGH TIDE WATER LEVEL)



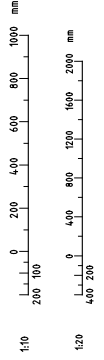
**TYPICAL BEACH WELL PIPEWORK DETAILS**

SCALE 1:20



**NOTES:-**

1. ALL FLANGED PLASTIC PIPEWORK TO BE ABS CLASS 12.
2. ALL FLANGES TO BE CLASS 16.
3. ALL CONCRETE TO BE 40MPa STRENGTH.
4. MINIMUM CONCRETE COVER TO BE 75mm.
5. LIMIT OF CONTRACT FOR BORE PUMP COLUMN IS AT FLANGED INTERCONNECTION BETWEEN DN100 FLANGED BEND AND FLANGED BORE COLUMN.



NO. R. ET	BY	DATE
1	WYONG	10/10/2006
<b>WYONG TEMPORARY DESALINATION UNITS</b>		
<b>BUDGEWOI SOUTH (SITE 2)</b>		
<b>TYPICAL BEACH WELL PIPEWORK</b>		
WYONG-550	REVISED BY	REVISION 1



NAME	ROLE
VADAO	ENGINEER
MUMAZAREMO	ENGINEER
MUKAPABES	ENGINEER

MICHAEL COITTS-TROTTER  
 Director General - NSW Department of Commerce  
 SUSTAINABLE WATER SOLUTIONS  
 LEVEL 13, MAXWELL BUILDING  
 2-24 PARKSON PLACE  
 PHONE (02) 93727888 FAX (02) 93727877

**CONCEPT DESIGN**

ISSUED FOR REVIEW	DATE
ISSUED FOR REVIEW	DATE
DETAILS OF AMENDMENTS	

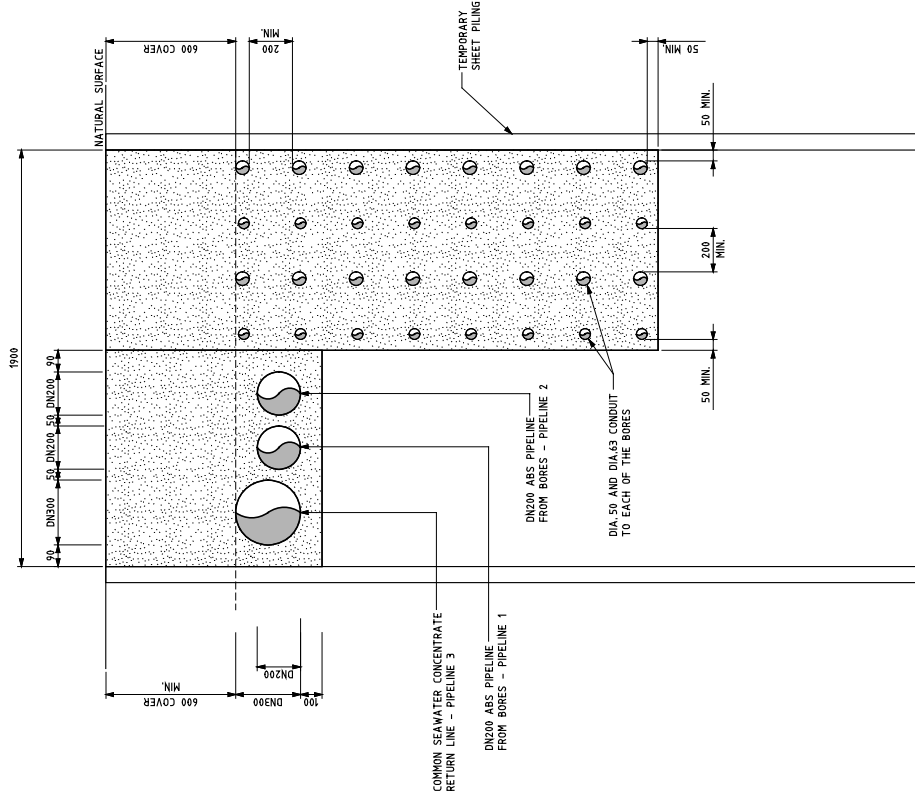


NOTE: Drawing is indicative only

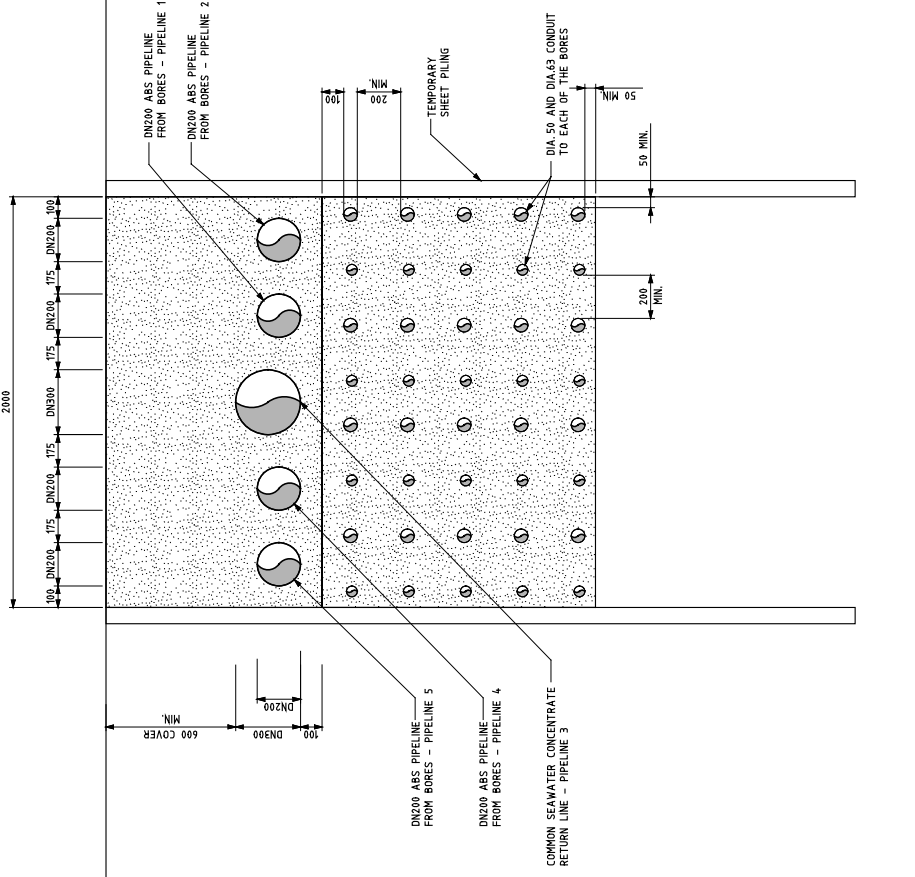
SOURCE: cadastre - Department of Lands  
Design - Department of Commerce



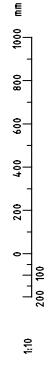
DRAFT ONLY



TYPICAL CONDUIT / PIPE BEDDING DETAILS FOR 2 ML/DAY PROPOSALS  
SCALE 1:10



TYPICAL CONDUIT / PIPE BEDDING DETAILS FOR 4 ML/DAY PROPOSALS  
SCALE 1:10



ISSUED FOR REVIEW	DATE	APPROVED	DATE
DETAILS OF AMENDMENTS			
PROJECT NO. 04301 CLIENT WATER SERVICES PROJECT NAME WYONG SHIRE COUNCIL PROJECT TITLE WYONG-603		PROJECT NO. 04301 CLIENT WATER SERVICES PROJECT NAME WYONG-603 PROJECT TITLE WYONG-603	
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PROJECT NO. 04301 CLIENT WATER SERVICES PROJECT NAME WYONG-603 PROJECT TITLE WYONG-603			



7th November 2006

Our Ref: WRL 06063 WAT L0611107

Nicholas Kaparos  
NSW Department of Commerce  
Level 13 McKell Building  
2-24 Rawson Place  
SYDNEY NSW 2000

WATER RESEARCH  
LABORATORY  
School of Civil and  
Environmental Engineering

Dear Nicholas,

### **DETAILED CONCEPTUAL DESIGN OF BEACH WELL INTAKES – 4 ML/DAY INTAKE MODEL SCENARIO**

The Water Research Laboratory (WRL) was requested by Department of Commerce (DOC) on 30/10/06 to complete an additional groundwater flow model scenario for 4 ML/day intakes.

These model results should be considered in conjunction with WRL Technical Report 2006/19 which provides relevant background and details on model setup (Appendix C). In brief, the groundwater flow model was developed on the basis of detailed field monitoring and hydraulic conductivity measurements, and calibrated using time-series data. The calibrated model was verified with data from a 24 hour pump test at 13.5 L/second (October 2004) that included monitoring of groundwater level drawdown on the beach in a watertable well, and a piezometer. Flow models are run in steady state with constant head boundaries on the lake and ocean sides and do not include density-dependent flow. The model results are consistent with the conceptual model and available data although predicted scenarios are subject to some uncertainty due to model assumptions and limitations.

The calibrated model is based on a hydraulic conductivity value of 35 m/day (transmissivity of 385 m<sup>2</sup>/day, assuming aquifer thickness of 11 m). It is noted that this value is significantly lower than transmissivity of 954 m<sup>2</sup>/day reported by Hydroilex (2006) for recent test pumping of a bore on the beach. Further discussion regarding this difference is provided in WRL Technical Report 2006/19 Appendix A.

The existing, calibrated model has been re-configured according to a plan of bore locations provided by DOC (Drawing No. Wyong-501) for the 4 ML/day scenario. The bores are located approximately 11-23 m from the shoreline (as defined prior to August 2006). The bore screen intakes are positioned between approximately -5 and -11 m AHD, so are not affected by changing beach surface profiles due to storm erosion, except in terms of the distance to the recharge boundary (ie. the shoreline).

Model results are presented in the following series of Figures that will be appended to WRL Technical Report 2006/19 as follows:

- Figure D8 Modelled drawdown for vertical bore intakes, 4 ML/day plant (16×7 L/second bores), 25 m spacing, Northern Site.
- Figure D9 Modelled drawdown for vertical bore intakes, 4 ML/day plant plant (16×7 L/second bores) compared with 1 ML/day plant (3×12 L/second), Northern Site.



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A B N 5 7 1 9 5 8 7 3 1 7 9

- Figure D10 Transect of drawdown (parallel to shoreline) for 1 ML/day and 4 ML/day intakes
- Figure D11 Transect of maximum drawdown (ocean to lake) for 4 ML/day intake.

It is noted that the bore plan provided by DOC (Drawing No. Wyong-501) shows the seawater concentrate discharge pit located in the centre of the borefield, with a minimum separation distance of 20 m. As shown in Figure D10, a groundwater level of -0.9 to -1.5 m AHD is anticipated in this area. The groundwater drawdown due to pumping would increase the possibility of infiltration of seawater concentrate into the aquifer. WRL Technical Report 2006/19 recommended in Section 3.3 that the seawater concentrate discharge pit be located 60-80 m from the nearest bore. The discharge point should be located outside the capture zone of the intake bores, as specified by 90% drawdown recovery.

Thank you for the opportunity to provide this additional groundwater modelling scenario. Please do not hesitate to contact Wendy Timms on ph. 9949 4488 ext. 253, or myself should you wish to discuss or clarify any matters.

Yours sincerely,

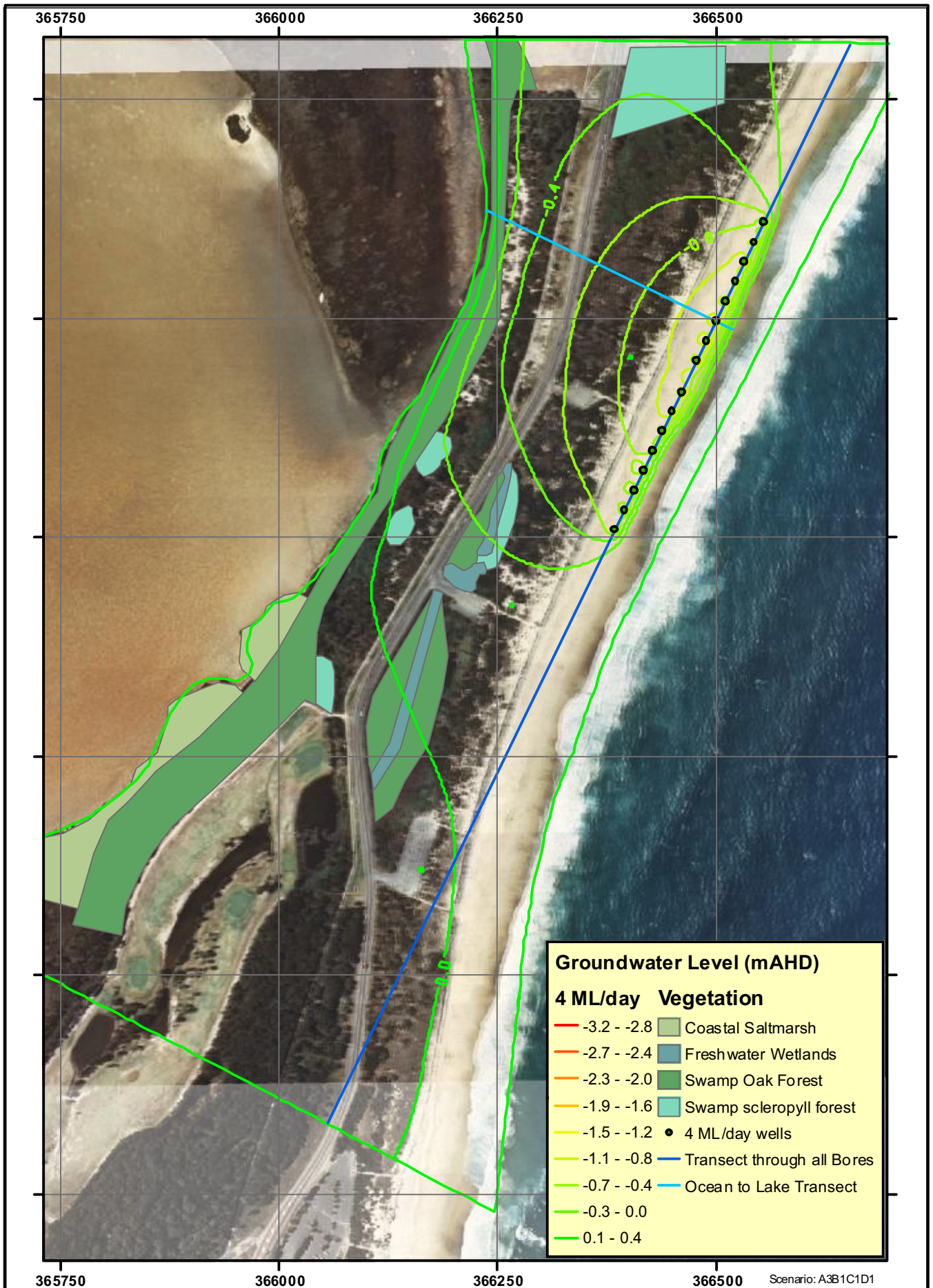


**Brett Miller**  
Manager

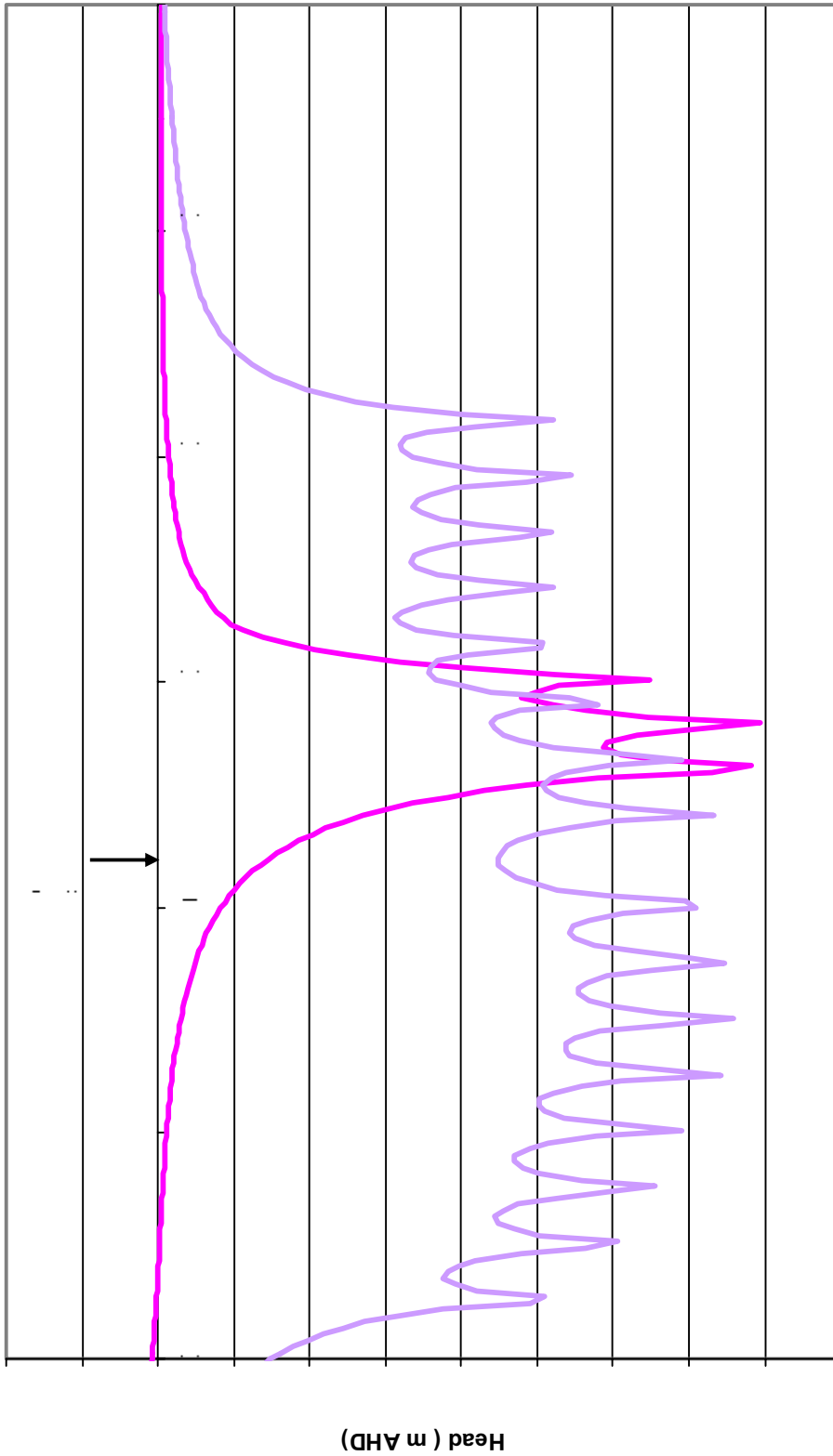
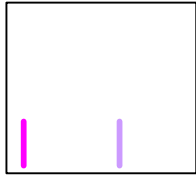
#### References

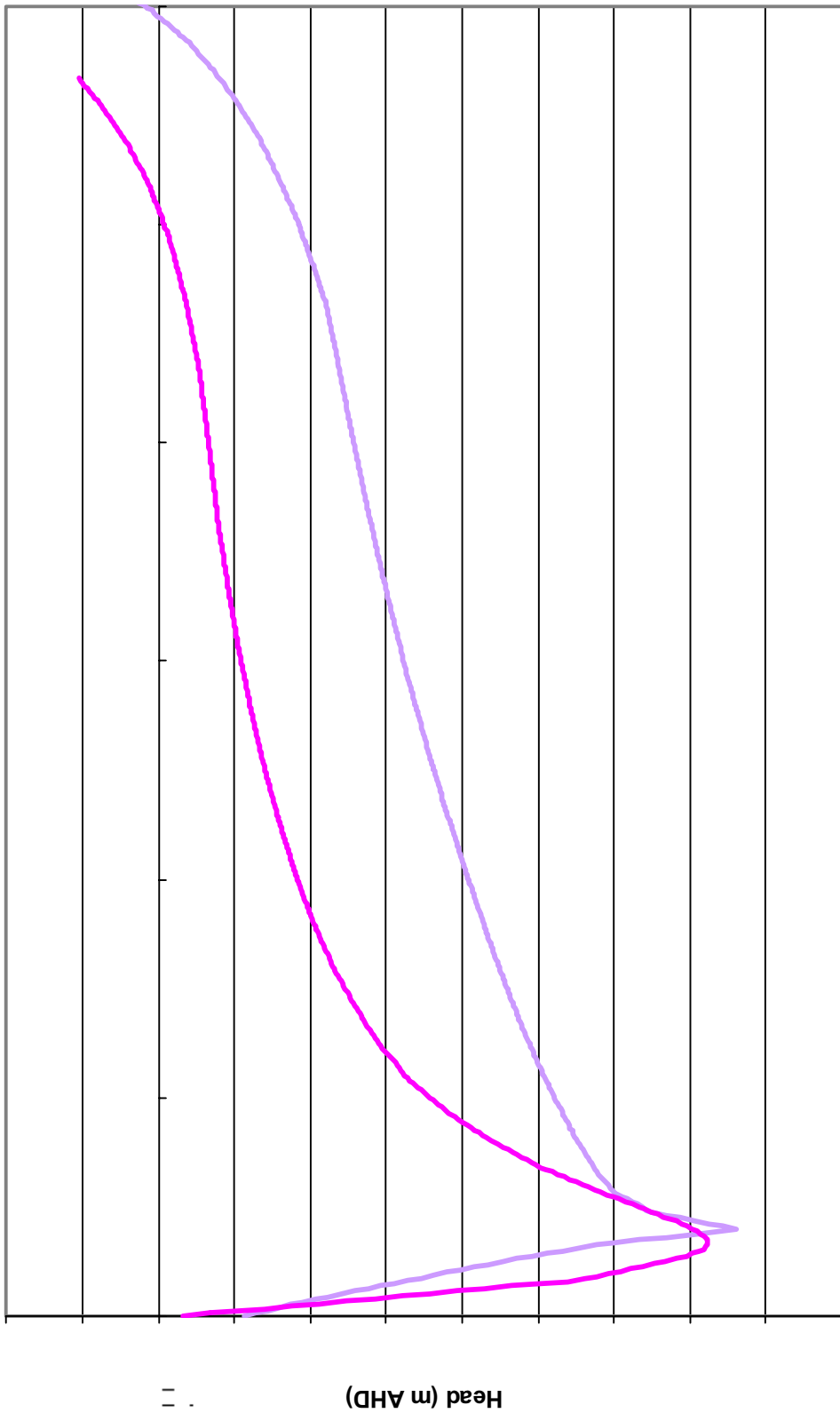
Timms, W., Miller, B.M., Wyllie, S.J., and Badenhop, A.M. (2006). Detailed Conceptual Design of Beach Bore Intakes and Brine Discharge to Ocean – Temporary Desalination Plants, Wyong Area. WRL Technical Report 2006/19 for Department of Commerce, August 2006.











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**Greenhouse Gas Emissions and  
Mitigation  
Temporary Desalination Plants  
Wyong Shire Council**

15 December 2006  
Reference 22931.02  
Revision 1

## Document Control

**Connell Wagner**

Document ID: O:\PROJECTS\URBAN\_DEVELOPMENT\22931 - DESALINATION\GREENHOUSE\GHG REPORT.DOC

Rev No	Date	Revision Details	Typist	Author	Verifier	Approver
0	13/12/06	First Draft	JE	JE	MM	
1	15/12/06	Incorporating DoC comments	JE	JE	MM	

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# 1. Introduction

## 1.1 Background

Connell Wagner prepared Statements of Environmental Effects on behalf of Wyong Council for the establishment of three temporary desalination plants at Budgewoi Beach, Lakes Beach and Tuggerah Beach (Connell Wagner 2006 a, b, c). As part of the Development Application assessment process, Council engaged independent consultant, Maunsells, to review the SEEs and provide a report to Council.

The review highlighted greenhouse gas emissions as a significant issue in the development of the plants. This report aims to provide supplementary information in relation to greenhouse gas emissions and possible mitigative measures to assist Council in the decision making process.

## 1.2 Government Greenhouse Policy

### 1.2.1 National Greenhouse Strategy

The National Greenhouse Strategy (NGS) was developed in 1998 and contains a broad set of actions to be implemented by governments, key stakeholders and the community. The key goals of the Strategy are:

- To limit net greenhouse emissions, in particular to meet our international commitments.
- To foster knowledge and understanding of greenhouse issues.
- To lay the foundations for adaptation to climate change.

The NGS focuses on cost-effective ways to reduce net greenhouse gas emissions which will deliver substantial non-greenhouse benefits to Australia in terms of reduced energy costs and the promotion of ecologically sustainable agricultural and forestry systems.

The NGS is of relevance to the proposed temporary desalination plants at Lakes Beach, Budgewoi Beach and Tuggerah Beach in relation to the energy usage and potential greenhouse gases that may be either directly or indirectly attributable to the project.

### 1.2.2 NSW Greenhouse Plan

The NSW Greenhouse Plan sets out actions for the NSW Government to reduce the emissions of its own activities and to work with other stakeholders to reduce the emissions from their activities. Two key aims of the Plan are:

- To limit the growth of greenhouse emissions and enhance the establishment of offsets such as trees.
- To place NSW on a long term pathway to reduce emissions to levels required to avoid dangerous climate change.

In reducing the emissions of greenhouse gases, the Plan identifies six key themes including emissions trading and strategic reform, and encouraging low emission energy supply and decreased demand.

The proposed temporary desalination plant will contribute to the emission of greenhouse gases indirectly through the use of energy to power the desalination process.



## 2. Greenhouse Gas Emissions

### 2.1 Emissions from Proposed Plant

Large amounts of greenhouse gases are typically produced by desalination plants due to the high energy requirements. Emission factors for use in greenhouse emissions reporting in Australia have been documented in the *AGO Factors and Methods Handbook* (DEH & AGO, 2005). The Handbook provides indirect emission factors for the consumption of purchased electricity and provides a methodology for estimating greenhouse gas emissions based on the electricity consumed in kilowatt hours (kWh).

$$GHG \text{ Emissions (t CO}_2\text{-e)} = Q \times EF / 1000$$

Where: Q is the electricity consumed expressed in kWh  
EF is the relevant emission factor from Table 5 of the Handbook

For a 4 ML/day plant with an energy consumption of 5 kWh/kL, the electricity consumed would equate to 20,000 kWh / day (which gives the value for Q above).

For a plant operating in NSW, the relevant emission factor (EF) based on a full fuel cycle is 0.985 kg CO<sub>2</sub>-e / kWh.

Using the equation above, the greenhouse emissions from the proposed temporary desalination plant would equate to 19.7 t CO<sub>2</sub> - e per day. Over the two year life of the temporary plant this would result in greenhouse emissions of 14,381 tonnes of CO<sub>2</sub> equivalents.

### 2.2 Emissions from Existing Plant

SKM (2005) calculated the greenhouse gas emissions from the existing Council water treatment plants at Mardi and Somersby as part of the assessment of a proposed 20 ML/day plant at Toukley. It was estimated that for 1 kL of water produced by the existing plants (sourced from rivers and dams), approximately 0.65 kg CO<sub>2</sub> equivalent greenhouse gases would be emitted from the electricity usage to treat and pump the water.

To produce 4 ML/day from the existing plants would therefore generate 2.6 tonnes CO<sub>2</sub> equivalents per day. Over a two year period, this would equate to 1898 tonnes of CO<sub>2</sub> equivalents.

### 2.3 Requirements for GHG Offsets and Mitigation

The draft conditions of consent for the proposed 20 ML/day desalination plant at Toukley required that the plant establish an operational performance criterion of no greater than 2.0 kg CO<sub>2</sub> emitted per kilolitre of desalinated water produced.

For the proposed temporary 4 ML/day plant at Budgewoi, greenhouse gas emissions would equate to 4.9 kg CO<sub>2</sub> per kilolitre of water produced. Therefore under this scenario, greenhouse offsets would be required equivalent to 2.9kg CO<sub>2</sub> per kilolitre or 11.7 tonnes per day for the 4 ML/day plant. This equates to 8541 tonnes over the two year life of the project.

The independent assessment of the Development Applications undertaken by Maunsells has indicated that the target for emission offsets should be such that the greenhouse gas emissions from the plant be no greater than that required to produce an equivalent amount of water from the existing treatment plants.

As calculated above, to produce 4 ML of water from the existing plants would generate 2.6 tonnes of CO<sub>2</sub> per day. Therefore the difference required to be offset under this scenario would be 17.1 tonnes CO<sub>2</sub> per day or 12,483 tonnes over the two year life of the project.

### 3. Mitigation Options

#### 3.1 Energy Efficiency of Desalination Process

A desalination plant using reverse osmosis technology requires less energy than other desalination technologies such as distillation. Analysis undertaken by GHD (2005) for the proposed Kurnell desalination plant showed that even the most efficient thermal desalination process requires more than three times the energy of a reverse osmosis plant and would accordingly produce three times the emissions of a reverse osmosis plant. GHD concluded that reverse osmosis was the preferred treatment technology for desalination from an energy and greenhouse perspective.

Energy requirements for SWRO desalination have reduced by 60% over the last decade due to the development of better membranes and new energy recovery devices (DoC, 2003). Energy recovery technologies for the reverse osmosis desalination process have been applied successfully elsewhere in the world. Such technologies include the use of energy recovery turbines, pressure and work exchangers, and hydraulic turbo booster systems.

Due to the small scale and temporary nature of the proposed desalination plants, the installation of energy recovery devices may not be an economic option. However, such technologies will be pursued with the desalination plant suppliers to identify the most energy efficient units which can be provided.

#### 3.2 Forestry for Carbon Sequestration

Forestry is a potential greenhouse gas mitigation measure through carbon sequestration in the forest system. Carbon is incorporated into forests and forest soils by trees and other plants. Through photosynthesis, plants absorb carbon dioxide from the atmosphere, store the carbon in sugars, starch and cellulose, and release the oxygen into the atmosphere.

To determine the size of a forestry plantation that would be required to offset the greenhouse emissions from a 4 ML/day plant, the FullCAM model v1.1 (AGO, 2005) was used to model the carbon stocks in a *Corymbia variegata* (Spotted Gum) plantation growing in the Wyong area over a 20 year timeframe. The simulation provided an indication of the amount of carbon storage in the system elements (Table 1) on a tonnes/hectare basis which enabled a calculation on the size of forest required.

**Table 1 Simulation Results: Carbon Stocks in a Spotted Gum Plantation**

	Tonnes carbon/hectare			
	On-site	Trees	Debris	Soil
Minimum	92.63	0	2.8	60.9
Maximum	223.23	115.23	54.76	93.65

Based on the results of the simulation, the size of forest required to offset the greenhouse gas emissions from the 4 ML/day plant is summarised in Table 2.

**Table 2 Forest Areas Required for Offsets**

Scenario	Offset Required (tonnes CO <sub>2</sub> )	Forest Size Minimum CO <sub>2</sub> (Hectares)	Forest Size Maximum CO <sub>2</sub> (Hectares)
Reduce to 2kg CO <sub>2</sub> /kL	8,541	92	38
Reduce to existing treatment	12,483	135	56

Given that forestry operations is not a key function of local government, a more effective method of using forestry for carbon sequestration and offset emissions would be for Council to invest in such operations through the purchase of Greenhouse Abatement Certificates from eligible forestry providers.

There are minimum requirements for the forest size under Greenhouse Gas Abatement Scheme:

- 0.2 hectare land mass
- 20 per cent crown cover of land mass
- 2m height capacity of tree species.

These minimum specifications are regarded as Kyoto-consistent. The number of abatement certificates that may be created from forestry activity can vary greatly on a per hectare basis. The rate at which carbon is sequestered through forestry is dependant upon many factors including tree species type, rainfall levels and soil condition.

### 3.3 Use of Renewable Energy

Although technically feasible, given the small scale and temporary nature of the proposed plants, it would not be economically feasible to directly invest in renewable energy supplies (eg wind or solar) as an alternate energy supply for the plant. Therefore, it is assumed that power will be sourced from the NSW electricity grid.

Council currently purchases 6% of its annual energy requirements as “green energy” (SKM, 2005) as required by the NSW Government Energy Management Policy. It would be feasible for the Council to increase the percentage of green energy purchased as a means of offsetting the greenhouse gas emissions from the temporary desalination plants.

Based on Energy Australia’s Pure Energy program, which ensures that an amount of electricity equal to 100% of the electricity supplied to a customer will be generated by GreenPower generators and delivered to the national electricity grid, a premium of 4.25 c/kWh would be payable on top of the normal electricity bill. Based on a 20 MWh power requirement per day for a 4 ML/day plant, this would cost Council an additional \$850/day or \$310,250 per annum to offset the energy requirements for the plant.

As an alternative to increasing the percentage of green power purchased by Council, purchase of Renewable Energy Certificates (RECs) may be preferred as a greenhouse gas mitigation mechanism. RECs are an electronic form of currency initiated by the *Renewable Energy (Electricity) Act 2000* which can be traded between parties. Each REC is equivalent to 1 MWh of power, therefore Council would need to purchase 20 RECs per day to offset the energy requirements of the plant. Given that RECs are market based, Council would need to negotiate a price for the required RECs from a registered holder. In 2005, an average price for RECs was \$36/REC (GHD, 2005). Based on this price, it would cost an average of \$262,800 per annum to purchase the required certificates to offset the energy requirements of the plant.

## 4. Conclusions

The temporary and small scale nature of the proposed desalination plants restricts the mitigation options which may be available to Council. The mitigation measures and offset options available to Council in relation to the emissions of the proposed plants could include any or a combination of the following measures:

- a) Investigation of measures to increase the energy efficiency of the reverse osmosis process
- b) Increase in the percentage of renewable energy purchased by Council
- c) Purchase of Renewable Energy Certificates to offset the energy requirements of the plant
- d) Investment in forestry for carbon sequestration through the purchase of Greenhouse Gas Abatement Certificates from eligible forestry operators.

In light of the short term, small scale nature of the project, it is recommended that Council pursue Option B above and increase the percentage of green energy purchased to offset the energy requirements for the plant.

## 5. References

AGO (2005) *National Carbon Accounting Toolbox and Data Viewer*. Department of Environment and Heritage, Canberra

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GHD, (2005) *Environmental Assessment of the Concept Plan for Sydney's Desalination Project*. Environmental assessment prepared by GHD Fichtner for Sydney Water.

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