

Appendix I

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**Supplementary Reports**

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- I1 Supplementary Reports
  - I1.1 WaterSecure -Gold Coast Desalination Facility- 45, 135 and 270 Megalitre per Day Expansion Study
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## I1 Supplementary Reports

### I1.1 WaterSecure -Gold Coast Desalination Facility- 45, 135 and 270 Megalitre per Day Expansion Study

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**Gold Coast Desalination Facility**  
**45, 135 and 270 Megalitre per Day Expansion Study**  
**19 February 2009**

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## Glossary

<i>GCCC</i>	Gold Coast City Council
<i>GCDA</i>	Gold Coast Desalination Alliance.
<i>GCDF</i>	Gold Coast Desalination Facility.
<i>ML/day</i>	Megalitres per day.
<i>OLS</i>	Obstacle Limitation Surface
<i>QAL</i>	Queensland Airport Limited
<i>QR</i>	Queensland Rail
<i>QWC</i>	Queensland Water Commission.
<i>SEQ</i>	South East Queensland
<i>SEQ Water Grid</i>	South East Queensland Water Grid
<i>SSW</i>	Sure Smart Water
<i>Strategy</i>	South East Queensland Water Strategy

## Definitions

<i>Airport</i>	Means the Gold Coast Airport, Coolangatta, Australia.
<i>Desalination Train</i>	Means an arrangement of mechanical/electrical plant capable of being run as a single unit. For GCDF the Desalination Trains have a Rated Capacity of 45 ML/day.
<i>Energex</i>	Means the bulk power supply authority for this location.
<i>Gold Coast Desalination Alliance</i>	Means the construction alliance responsible for the delivery of the GCDF.
<i>Gold Coast Desalination Facility</i>	Means the desalination plant located on Lot 30 of SP197355.
<i>Government</i>	Means the Government of the State of Queensland.
<i>Location Factor</i>	Means a cost multiplier applied to allow for the remoteness of the construction area from supply of labour and materials. For South East Queensland this factor is 1.0.

<i>Lot 30</i>	Means such land as described by Lot 30 on SP197355, being a registered survey plan in the State of Queensland. Refer to Appendix 3.
<i>Lot 31</i>	Means such land as described by Lot 30 on SP197355, being a registered survey plan in the State of Queensland. Refer to Appendix 4.
<i>Operational Capacity</i>	Means 94% of the Rated Capacity and allows for maintenance and cleaning of the plant. This is the long term capacity of the GCDF. Refer also to Rated Capacity.
<i>Preserved Site</i>	A site preserved for future consideration as a site for a desalination plant supplying the SEQ Water Grid.
<i>Priority Site</i>	A site prioritised for consideration as a site for a desalination plant supplying the SEQ Water Grid.
<i>Queensland Airport Limited</i>	Means the Airport Leasing Company, leasing the Gold Coast Airport from the Commonwealth of Australia, holding ABN 91 077 200 821.
<i>Queensland Water Commission</i>	Means the statutory authority responsible for achieving safe, secure and sustainable water supplies in South East Queensland and other designated regions.
<i>Rated Capacity</i>	Means the maximum volume of potable water per day produced at 100% efficiency. This is the instantaneous capacity of the GCDF. Refer also to Operational Capacity.
<i>South East Queensland Water Grid</i>	Means infrastructure as defined by the South East Queensland Water (Restructuring) Act 2007, No. 58.
<i>South East Queensland Water Grid Manager</i>	Means the State owned entity that operates and manages the SEQ Water Grid.
<i>South East Queensland Water Strategy</i>	Means the strategy released by QWC in March 2008 which identified six potential new sites for future desalination facilities at Marcoola, Kawana, Bribie Island, North Stradbroke Island, South Stradbroke Island and Lytton.

*Sure Smart Water*

Means the, *South East Queensland (Gold Coast) Desalination Company Pty Ltd (ABN 77122413316)*.

*Water Secure*

Means the Manufactured Water Authority, a State owned entity responsible for the manufacture of desalinated and purified recycled water.

## 1. Executive Summary

### **Preamble**

The purpose of this Pre-feasibility Study enable the Queensland Water Commission to inform Government as to the requirement to set aside a site for a future desalination plant as either a Priority, Reserved or Excluded Site supplying the South East Queensland Water Grid. This Study has assessed three optional expansion scenarios, being:

- Option 1: 45 Megalitres per day Augmentation;
- Option 2: 135 Megalitres per day Duplication, or;
- Option 3: 270 Megalitres per day Triplication.

This will allow the Queensland Water Commission to compare the Tugun site with eight (8) other sites under consideration as part of the *South East Queensland Water Strategy – 2008*. While this report has been compiled separately to the study of the eight other sites, QWC has been informed by the methodology used in that study in order to consistently address issues in both studies.

### **Conclusions**

The Study has concluded that:

1. Based on non-cost criteria this site is considered to be ideally suited to a 45 ML/day Augmentation.
2. Based on non-cost criteria this site is considered to be highly suited to a 135 ML/day Duplication or 270 ML/day Triplication.
3. A footprint enlarged outside the boundary of Lot 30 on SP 197355 is required to enable development of all expansion options.
4. Such an enlarged site at this location is generally suited to use for an expanded desalination facility.
5. Close and detailed consultation with the Gold Coast City Council, Queensland Airport Limited, Energex and Queensland Rail would be required to determine expansion land availability.
6. Careful consideration of the landfill strategy would be needed for all expansion options to achieve a viable outcome for all stakeholders.
7. The site feed water, discharge water and marine environmental characteristics are highly suited for an expansion.
8. The geotechnical, environmental, flora and fauna, cultural heritage characteristics of the site are highly suited for expansion.
9. Native Title is extinguished.
10. The site has well developed site access and constructability.
11. Power infrastructure does not cause a long term constraint noting to present Energex supply network planning considerations.
12. All expansion options considered are feasible.

***Potential Increase to Existing Plant's Rated Capacity***

During the course of this investigation it became obvious that increasing the capacity of the existing facility should be considered.

This opportunity would increase the Rated Capacity of the Gold Coast Desalination Facility by 15 ML/day. This opportunity will be developed by Water Secure and reported separately to this Pre-feasibility Study.

***Discussion***

The major consideration for all expanded plant options is the availability of sufficient and suitable land to contain the relevant footprint and the impact of any competing land use requirements, including the requirement to contain the existing landfill volumes within a reconfigured landfill site allocation.

Should the site be nominated as either Priority or Reserved, it is imperative that Water Secure undertake a strategic land use strategy at the earliest practical convenience.

***Recommendation***

Subject to the Tugun site being classified as either a Preserved Site or Priority Site, it is recommended that Water Secure develop a strategic land use study relating to the expansion options as soon as practical. This would include consultation with the Sure Smart Water site personnel, Gold Coast Desalination Alliance, Gold Coast City Council, Queensland Airport Limited, Energex, Queensland Rail and other relevant stakeholders to investigate and progress and potential landfill and / or land use issues.

## **2. Overview**

### **2.1. Purpose of this Study**

The purpose of this Pre-feasibility Study is to investigate the implications and feasibility of expanding the Rated Capacity of the Gold Coast Desalination Facility (GCDF) by 45, 135 or 270 Megalitres per Day (ML/day) and to provide recommendations consequential to this study.

The developed understanding of these implications, feasibility and recommendations will be provided by Water Secure to the Queensland Water Commission (QWC) to assist in informing Government in relation to the potential future desalination facility sites to supply the South East Queensland Water Grid (SEQ Grid).

QWC are also giving separate and concurrent consideration to eight other potential sites.

### **2.2. Existing GCDF Plant**

The GCDF is located at Tugun, Queensland. It has a Rated Capacity of 135 Megalitres per day (ML/day); refer also to the Definitions at page iv.

Potable water manufactured at GCDF will be supplied into the SEQ Grid, effectively at the site boundary.

The existing GCDF is an arrangement of three (3) Desalination Trains each of which has a Rated Capacity of 45 ML/day providing a Rated Capacity of 135 ML/day.

### **2.3. Study Background**

In December 2008 QWC requested Water Secure to undertake a Pre-feasibility Study to investigate options relating to expansion of the GCDF. The GCDF is currently entering the last stages of construction and commissioning and will be operational in early 2009.

### **2.4. Other QWC Considerations – Potential New Desalination Sites**

The draft *South East Queensland Water Strategy (Strategy)* was released by the QWC in March 2008. This strategy identified six potential new sites for future desalination facilities at Marcoola, Kawana, Bribie Island, North Stradbroke Island, South Stradbroke Island and Lytton.

Two additional sites at Fisherman Islands (Port of Brisbane) and Brisbane Airport have been nominated as potential locations for desalination facilities as part of ongoing investigation and development of the Strategy.

## 2.5. GCDF Expansion Options

In consultation with the QWC the following options for the GCDF expansion have been developed for consideration.

### ***Option 1: An Additional 45 Megalitres per day (Augmentation)***

This option is to increase the capacity of the plant by one (1) Desalination Train. The expanded plant Rated Capacity would be 180 ML/day in total. Limited alterations to the existing marine and network integration works would be required.

### ***Option 2: An Additional 135 Megalitres per day (Duplication)***

This option is to increase the capacity of the plant by three (3) Desalination Trains. The expanded Rated Capacity would be 270 ML/day in total. It would require a duplication of the GCDF plant. Extensive new marine and network integration works would be required.

### ***Option 3: An Additional 270 Megalitres per day (Triplication)***

This option is to increase the capacity of the plant by six (6) Desalination Trains. The expanded Rated Capacity would be 405 ML/day in total. It would require a triplication of the GCDF plant. Extensive new marine and network integration works would be required.

Option	Existing Rated Capacity. (ML/day) (January 2009) (a)	Expansion (ML/day) (b)	Rated Capacity by Option. (a)+(b)
Augmentation	135	45	180
Duplication		135	270
Triplication		270	405

**Table 1: Rated Capacities by Option (Existing and Expanded)**

## 2.6. Potential Increase to Existing Plant's Rated Capacity

During the course of this investigation it became apparent that opportunities to increase the Rated Capacity of the existing plant by 15 ML/day exist by installing additional reverse osmosis desalination cells and supporting infrastructure into the existing built plant area.

No significant network integration and marine works would be required.

While requiring some investment, this opportunity would be a least cost option, due to the ability to access previous capital investment, however, it is not necessary to develop this option for the purposes of this Pre-feasibility Study. There would be no increase in the plant footprint. No environmental or planning approvals would be anticipated.

This opportunity would be developed separately to this Pre-feasibility Study.

## **2.7. Study Deliverables**

The key information to be gained from this study for a range of options will be:

- key infrastructure;
- network integration requirements;
- cost;
- stakeholder consultation process; and
- feasibility assessment.

## **2.8. Study Team**

The study team was lead by Water Secure with project leadership by The Peron Group. The study team acknowledges the valuable and knowledgeable support of the Sure Smart Water and Gold Coast Desalination Alliance technical team members, without whom the timely completion of this study would not have been possible.

### 3. Option 1: 45 ML/day Augmentation

#### **Description of Option**

This option is to increase the Rated Capacity of the plant by one third of its existing capacity to 180 ML/day.

<b>Option</b>	<b>Existing Rated Capacity. (ML/day) (January 2009)</b> <b>(a)</b>	<b>Expansion (ML/day)</b> <b>(b)</b>	<b>Rated Capacity by Option.</b> <b>(a)+(b)</b>
Augmentation	135	45	180

**Table 2: Rated Capacity Option 1 – Augmentation (Existing and Expanded)**

#### **Scope**

The following bulk scope has been used to develop the expansion options.

<b>Requirement</b>	<b>Assumed Scope Response</b>
Sea Water Intake	The existing intake tunnel is capable of the increased duty requirement without modification.
Saline Water Discharge	The existing discharge tunnel is capable of meeting the requirement with minor increases to the discharge heads being necessary. The equipment has been previously procured and a minor capital allowance has been made for fitting of the discharge heads.
New Desalination Trains	One new Desalination Train with a Rated Capacity of 45 ML/day inclusive of pre-treatment has been assumed.

Requirement	Assumed Scope Response
New Potable Water Storage Tanks	One new potable water storage tank has been allowed. This may be required to be constructed either on site or potentially some minor distance from site. No attempt has been made to assess suitable off-sites at this stage.
Network Integration	The existing pipeline is capable of meeting the requirement with minor increases to the mechanical and electrical equipment. Corridor works are not required.

**Table 3: Requirement and Scope Response (Augmentation)**

### ***Footprint***

An indicative footprint is shown at Figure 1: Option 1 (Augmentation) Site Layout.

### ***Cost***

Reference is made to Appendix 1.

Unit rates are based on the existing known international costs and are comparable to recent projects in Australia. Direct comparison has been made to the Tugun facility however changes in technology costs, international pricing and exchange rate have been broadly assessed.

A Location Factor of 1.0 has been adopted for the purposes of comparison. Factors influencing the costs include:

- established site;
- existing infrastructure;
- existing approvals;
- international supply costs trends;
- domestic market slowdown; and,
- reduced tunneling requirements.

The capital cost for Augmentation is estimated at \$AUD 262.5 million which is \$AUD 5.83 per megalitre of installed capacity.

### **Operational Cost**

Reference is made to Appendix 2.

Operational costs have been assumed in accordance with other similar plants in Australia.

The operational cost for Augmentation is estimated at \$AUD 15.0 million which is \$AUD 0.97 per megalitre of manufactured water.

### **Non-Cost Criteria**

Non-Cost Criteria are at Table 4.

Although the 45 ML/day Augmentation has a requirement to be constructed within the 500 metre zone relating to, *Distance from desalination plant to nearest sensitive land uses*, it has been considered that the existing plant will completely and effectively shield the sensitive land use area from all impacts. Consequently this measure is determined to be very low.

A weighted score of 5.000 is shown.

### **Conclusion**

**Conclusion 1: Based on non-cost criteria this site is considered to be ideally suited<sup>1</sup> to a 45 ML/day Augmentation.**

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<sup>1</sup> Ideally Suited - refers to there being no identified environmental or social issues at Table 4.



**LEGEND**

ASSUMED AUGMENTATION FOOTPRINT



Figure 1: Option 1 (Augmentation) Site Layout

Weighted Score: 5.000

Principle	Principle Weight	Objective	Criteria Impact Weight	Criteria	Unit	Measure	CONSTRAINT					Score	Weighted Score
							Very Low 5	Low 4	Medium 3	High 2	Very High 1		
Environmental	0.686	Minimise impact on terrestrial and intertidal environment	0.271	Protected area	ha	Protected area affected	0 - 5	>5 - 10	>10 - 20	>20 - 40	> 40	5	0.678
					km	Length of new edge created	0 - 1	>1 - 2.5	>2.5 - 5.0	>5.0 - 10.0	> 10	5	0.678
			0.035	Remnant vegetation clearance	ha	Hectares removed	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	5	0.173
					ha	Hectares removed	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	5	0.739
					ha	Area of RAMSAR wetlands affected	0 - 5	>5 - 10	>10 - 20	>20 - 40	> 40	5	0.771
		0.154	Significant wetland	ha	Area of RAMSAR wetlands affected	0 - 5	>5 - 10	>10 - 20	>20 - 40	> 40	5	0.771	
0.079	Fish habitat	ha	Area affected	0 - 1	>1 - 2.5	>2.5 - 5.0	>5.0 - 10.0	> 10	5	0.393			
Social	0.314	Maximise compatibility with other uses	0.067	Existing sensitive land uses <sup>1</sup>	m	Distance from desalination plant to nearest sensitive land use.	>5000	>2000 - 5000	>1000 - 2000	>500 - 1000	0 - 500	5	0.166
					km	Length of corridor within 1 km of existing sensitive land uses.	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	5	0.166
		0.032	Minimise land related issues that have the potential to affect securing the site for use for a desalination plant.	Minimise land related issues <sup>2</sup>		Assessment with supporting commentary	No issues	Minimal issues	Moderate issues	Complex issues	Extremely complex issues	5	0.162
							5						
		0.091	Minimise impact on native title	Native title		Land Type	Freehold tenure	No claim, non-freehold land	Not registered Native Title claim over non-freehold land	Registered Native Title claim over non-freehold land	Determined Native Title	5	0.453
							5						
0.124	Minimise visual impact	Visual impact		Assessment with supporting commentary	Very low impact	Low impact	Moderate impact	High impact	Very high impact	5	0.621		
					5								
<b>Total</b>											<b>5.000</b>		

<sup>1</sup> A sensitive land use is a land use that could be detrimentally affected by the operation of the proposed desalination plant (eg. Noise, odour, visual amenity).

<sup>2</sup> Land related issues refers to issues such as mining leases, infrastructure agreements between multiple parties, etc.

Table 4: Non-Cost Key Evaluation Criteria for SEQ Regional Desalination Plant – Tugun – Option 1 Augmentation

## 4. Option 2: 135 ML/day Duplication

### *Description of Option*

This option is to double (duplicate) the Rated Capacity of the plant to 270 ML/day.

Option	Existing Rated Capacity. (ML/day) (January 2009) (a)	Expansion (ML/day) (b)	Rated Capacity by Option. (a)+(b)
Duplication	135	135	270

**Table 5: Rated Capacity Option 2 – Duplication (Existing and Expanded)**

### *Scope*

The following bulk scope has been used to develop the expansion options.

Requirement	Assumed Scope Response
Sea Water Intake	<p>The existing intake tunnel is incapable of the increased duty requirement without modification.</p> <p>The solution assumed is to construct a new intake tunnel of approximately 4.0 metre internal diameter. This would allow the existing inlet tunnel to be reverse directed to discharge, thereby yielding cost savings. (i.e. Only one new pipeline is required to supply to plant with seawater. Brine discharge would be via both of the existing inlet/outfall pipelines).</p>
Saline Water Discharge	<p>The existing discharge tunnel is incapable of meeting the requirement.</p> <p>The solution assumed is as described for the sea water intake with the existing intake tunnel being reverse directed.</p>

Requirement	Assumed Scope Response
New Desalination Trains	Three new Desalination Trains each with a Rated Capacity of 45 ML/day inclusive of pre-treatment has been assumed, giving a total new desalination Rated Capacity of 135 ML/day.
New Potable Water Storage Tanks	<p>Two new potable water storage tanks have been allowed. This may be required to be constructed either on site or potentially some minor distance from site. No attempt has been made to assess suitable off-sites at this stage.</p> <p>Other bulk water storage water reservoirs would be required to be constructed within the reticulation network(s) and the location and storage volume of these reservoirs will determine the on site potable water storage requirements.</p>
Network Integration	<p>The existing pipeline is incapable of meeting the requirement. A new purpose built 1100 mm steel pipeline has been assumed.</p> <p>Corridor works are required by others and at this time the non-cost criteria have assumed that additional pipes will be able to be contained within the existing GCCC corridor.</p> <p>An alternative and potentially more appropriate corridor is a parallel co-use corridor within the Pacific Motorway easement.</p> <p>Network integration and corridor requirements will need to consider the consumption demographics.</p>

**Table 6: Requirement and Scope Response (Duplication)**

### ***Footprint***

An indicative footprint is shown at Figure 2: Option 2 (Duplication) Site Layout.

### ***Cost***

Reference is made to Appendix 1.

Unit rates are based on the existing known international costs and are comparable to recent projects in Australia. Direct comparison has been made to the Tugun facility however changes in technology costs, international pricing and exchange rate have been broadly assessed.

A Location Factor of 1.0 has been adopted for the purposes of comparison. Factors influencing the costs include:

- established site;
- existing infrastructure;
- existing approvals;
- international supply costs trends;
- domestic market slowdown; and,
- reduced tunneling requirements.

The capital cost for Duplication is estimated at \$AUD 748.4 million which is \$AUD 5.54 per megalitre of installed capacity.

### ***Operational Cost***

Reference is made to Appendix 2.

Operational costs have been assumed in accordance with other similar plants in Australia.

The operational cost for Augmentation is estimated at \$AUD 41.8 million which is \$AUD 0.90 per megalitre of manufactured water.

**Non-Cost Criteria**

A Non-Cost Criteria are at Table 8.

A weighted score of 4.644 is shown. The following facts were used to determine the constraint levels other than very low.

<b>Measure</b>	<b>Value Adopted</b>	<b>Narrative</b>
Distance from desalination plant to sensitive land use.	Very High	Located within 500 metres visible to the local community.
Length of corridor within 1 km of existing sensitive land uses.	Medium	Corridor located within GCCC existing corridor and is 23km in length.
Land related issues.	Low	The land has the potential for various parties (principally GCCC, QR and QAL) to have an interest and the assumed requirement to contain the landfill volume currently on site when remediated.
Visual Impact	Medium	Similar construction is assumed. Visual amenity would be impacted at some 300 metres distance.

**Table 7: Non-Cost Criteria Narrative - Duplication**

**Conclusion**

<p><b>Conclusion 2: Based on non-cost criteria this site is considered to be highly suited<sup>2</sup> to a 135 ML/day Duplication.</b></p>
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<sup>2</sup> Highly Suited - refers to there being limited identified environmental or social issues at Table 8.



**LEGEND**

NEW 4000 mm DIA SEAWATER INTAKE TUNNEL



NEW 1100mm DIA MSCL NETWORK PIPELINE



ASSUMED DUPLICATION FOOTPRINT



**Figure 2: Option 2 Site Layout (Duplication)**

Weighted Score: 4.644

Principle	Principle Weight	Objective	Criteria Impact Weight	Criteria	Unit	Measure	CONSTRAINT					Score	Weighted Score	
							Very Low 5	Low 4	Medium 3	High 2	Very High 1			
Environmental	0.686	Minimise impact on terrestrial and intertidal environment	0.271	Protected area	ha	Protected area affected	0 - 5	>5 - 10	>10 - 20	>20 - 40	> 40	5	0.678	
					km	Length of new edge created	5							
			0.035	Remnant vegetation clearance	ha	Hectares removed	0 - 1	>1 - 2.5	>2.5 - 5.0	>5.0 - 10.0	> 10	5	0.678	
			0.148	Essential Habitat	ha	Hectares removed	5						5	0.173
			0.154	Significant wetland	ha	Area of RAMSAR wetlands affected	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	5	0.739	
		0.079	Fish habitat	ha	Area affected	5						5	0.393	
Social	0.314	Maximise compatibility with other uses	0.067	Existing sensitive land uses <sup>1</sup>	m	Distance from desalination plant to nearest sensitive land use.	>5000	>2000 - 5000	>1000 - 2000	>500 - 1000	0 - 500	1	0.033	
					km	Length of corridor within 1 km of existing sensitive land uses.	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	3	0.100	
		Minimise land related issues that have the potential to affect securing the site for use for a desalination plant.	0.032	Minimise land related issues <sup>2</sup>		Assessment with supporting commentary	No issues	Minimal issues	Moderate issues	Complex issues	Extremely complex issues	4	0.130	
							4							
		Minimise impact on native title	0.091	Native title		Land Type	Freehold tenure	No claim, non-freehold land	Not registered Native Title claim over non-freehold land	Registered Native Title claim over non-freehold land	Determined Native Title	5	0.453	
							5							
Minimise visual impact	0.124	Visual impact		Assessment with supporting commentary	Very low impact	Low impact	Moderate impact	High impact	Very high impact	4	0.497			
					4									
<b>Total</b>											<b>4.644</b>			

<sup>1</sup> A sensitive land use is a land use that could be detrimentally affected by the operation of the proposed desalination plant (eg. Noise, odour, visual amenity).

<sup>2</sup> Land related issues refers to issues such as mining leases, infrastructure agreements between multiple parties, etc.

Table 8: Non-Cost Key Evaluation Criteria for SEQ Regional Desalination Plant – Tugun – Option 2 Duplication

## 5. Option 3: 270ML/day Triplication

### *Description of Option*

This option is to triple (triplicate) the Rated Capacity of the plant to 405 ML/day.

Option	Existing Rated Capacity. (ML/day) (January 2009) (a)	Expansion (ML/day) (b)	Rated Capacity by Option. (a)+(b)
Triplication	135	270	405

**Table 9: Rated Capacity Option 3 (Triplication)**

### *Scope*

The following bulk scope has been used to develop the expansion options.

Requirement	Assumed Scope Response
Sea Water Intake	<p>The existing intake tunnel is incapable of the increased duty requirement without modification.</p> <p>The solution assumed is to construct a new intake tunnel of approximately 4.0 metre internal diameter. This would allow the existing inlet tunnel to be reverse directed to discharge, thereby yielding cost savings. (i.e. Only one new pipeline is required to supply to plant with seawater. Brine discharge would be via both of the existing inlet/outfall pipelines).</p>
Saline Water Discharge	<p>The existing discharge tunnel is incapable of meeting the requirement.</p> <p>The solution assumed is as described at sea water intake with the existing intake tunnel being reverse directed.</p>

Requirement	Assumed Scope Response
	This solution is configured in a similar manner to the Duplication.
New Desalination Trains	Six new Desalination Trains each with a Rated Capacity of 45 ML/day inclusive of pre-treatment has been assumed, giving a total new desalination Rated Capacity of 270 ML/day.
New Potable Water Storage Tanks	<p>Two new potable water storage tanks have been allowed. This may be required to be constructed either on site or potentially some minor distance from site. No attempt has been made to assess suitable off-sites at this stage.</p> <p>Other bulk water storage water reservoirs would be required to be constructed within the reticulation network(s) and the location and storage volume of these reservoirs will determine the on site potable water storage requirements.</p>
Network Integration	<p>The existing pipeline is incapable of meeting the requirement. A new purpose built 1500 mm steel pipeline has been assumed.</p> <p>Corridor works are required by others and at this time the non-cost criteria have assumed that additional pipes will be able to be contained within the existing GCCC corridor.</p> <p>An alternative and potentially more appropriate corridor is a parallel co-use corridor within the Pacific Motorway easement.</p> <p>Network integration and corridor requirements will need to consider the consumption demographics.</p>

Table 10: Requirement and Scope Response (TriPLICATION)

### ***Footprint***

An indicative footprint is shown at Figure 3: Option 3 (Triplication) Site Layout. This footprint is conservative and is based on existing technology solutions and an assumption that all of the facilities will be housed on site.

### ***Cost***

Reference is made to Appendix 1.

Unit rates are based on the existing known international costs and are comparable to recent projects in Australia. Direct comparison has been made to the Tugun facility however changes in technology costs, international pricing and exchange rate have been broadly assessed.

A Location Factor of 1.0 has been adopted for the purposes of comparison. Factors influencing the costs include:

- established site;
- existing infrastructure;
- existing approvals;
- international supply costs trends;
- domestic market slowdown; and,
- reduced tunneling requirements.

The capital cost for Augmentation is estimated at \$AUD 1261.9 million which is \$AUD 4.67 per megalitre of installed capacity.

### ***Operational Cost***

Reference is made to Appendix 2.

Operational costs have been assumed in accordance with other similar plants in Australia.

The operational cost for Augmentation is estimated at \$AUD 81.0 million which is \$AUD 0.87 per megalitre of manufactured water.

**Non-Cost Criteria**

Non-Cost Criteria narrative is at Table 12.

A weighted score of 4.487 is shown. The following facts were used to determine the constraint levels other than very low.

Measure	Value Adopted	Narrative
Distance from desalination plant to sensitive land use.	Very High	Located within 500 metres and facing local community.
Length of corridor within 1 km of existing sensitive land uses.	Medium	Corridor located within GCCC existing corridor and is 23km in length, however, options exist that utilise the Pacific Motorway corridor.
Land related issues.	Medium	The land has the potential for various parties (principally GCCC, QR and QAL) to have an interest and the assumed requirement to contain the landfill volume currently on site when remediated. A medium constraint has been assumed due to the higher level of footprint demand required by Triplication.
Visual Impact	Medium	Similar construction is assumed. Visual amenity would be impacted at some 100 metres distance.

**Table 11: Non-cost criteria narrative - Triplication**

**Conclusion**

<p><b>Conclusion 3: Based on non-cost criteria this site is considered to be highly suited<sup>3</sup> to a 135 ML/day Duplication.</b></p>
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<sup>3</sup> Highly Suited - refers to there being limited identified environmental or social issues at Table 12.



**LEGEND**

NEW 5000 mm DIA SEAWATER INTAKE TUNNEL



NEW 1600mm DIA MSCL NETWORK PIPELINE



ASSUMED TRIPLICATION FOOTPRINT



**Figure 3: Option 2 Site Layout (Triplication)**

Weighted Score: 4.487

Principle	Principle Weight	Objective	Criteria Impact Weight	Criteria	Unit	Measure	CONSTRAINT					Score	Weighted Score
							Very Low 5	Low 4	Medium 3	High 2	Very High 1		
Environmental	0.686	Minimise impact on terrestrial and intertidal environment	0.271	Protected area	ha	Protected area affected	0 - 5	>5 - 10	>10 - 20	>20 - 40	> 40	5	0.678
					km	Length of new edge created	5						
			0.035	Remnant vegetation clearance	ha	Hectares removed	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	5	0.173
			0.148	Essential Habitat	ha	Hectares removed	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	5	0.739
			0.154	Significant wetland	ha	Area of RAMSAR wetlands affected	0 - 5	>5 - 10	>10 - 20	>20 - 40	> 40	5	0.771
		0.079	Fish habitat	ha	Area affected	0 - 1	>1 - 2.5	>2.5 - 5.0	>5.0 - 10.0	> 10	5	0.393	
Social	0.314	Maximise compatibility with other uses	0.067	Existing sensitive land uses <sup>1</sup>	m	Distance from desalination plant to nearest sensitive land use.	>5000	>2000 - 5000	>1000 - 2000	>500 - 1000	0 - 500	1	0.033
					km	Length of corridor within 1 km of existing sensitive land uses.	0 - 10	>10 - 20	>20 - 40	>40 - 80	> 80	3	0.100
		Minimise land related issues that have the potential to affect securing the site for use for a desalination plant.	0.032	Minimise land related issues <sup>2</sup>		Assessment with supporting commentary	No issues	Minimal issues	Moderate issues	Complex issues	Extremely complex issues	3	0.097
		Minimise impact on native title	0.091	Native title		Land Type	Freehold tenure	No claim, non-freehold land	Not registered Native Title claim over non-freehold land	Registered Native Title claim over non-freehold land	Determined Native Title	5	0.453
							5						
Minimise visual impact	0.124	Visual impact		Assessment with supporting commentary	Very low impact	Low impact	Moderate impact	High impact	Very high impact	3	0.372		
<b>Total</b>											<b>4.487</b>		

<sup>1</sup> A sensitive land use is a land use that could be detrimentally affected by the operation of the proposed desalination plant (eg. Noise, odour, visual amenity).

<sup>2</sup> Land related issues refers to issues such as mining leases, infrastructure agreements between multiple parties, etc.

Table 12: Non-Cost Key Evaluation Criteria for SEQ Regional Desalination Plant – Tugun – Option 3 Triplication

## 6. Site

### 6.1. Footprint

The site is located at Tugun in Queensland on Lot 30 of SP197355 (Lot 30). A copy of the Plan is at Appendix 3 – Registered Plan.

The site is immediately west of the northern end of the Gold Coast Airport (Airport) runway 14-32 and is bounded by Gold Coast City Council (GCCC) owned property. Appendix 4 demonstrates that the existing GCDF has a footprint that largely consumes the practical construction area of Lot 30. Consequently, for all options it will be necessary for additional suitable land area to be acquired for expansion.

**Conclusion 4: A footprint enlarged outside the boundary of Lot 30 on SP 197355 is required to enable development of all expansion options.**

### 6.2. Suitability for Site Enlargement

The site is generally constrained by the Airport, existing landfill, sporting facilities and other GCCC infrastructure, as well as potential future Queensland Rail and Energex requirements.

Queensland Rail has identified the need for a rail corridor on Lot 31. This is referenced at Reference 8 and 9, Appendix 7.

Suresmartwater are corresponding with Energex with respect to a high voltage power easement required within Lots 30 and/or 31. As this correspondence is commercial-in-confidence it is not included in this report, however it clearly indicates the need to consult with Energex should the sites be either Prioritised or Reserved.

Notwithstanding these constraints, an expanded site would have significant advantages of economies of scale and collocation, proximity to population growth centres, use of existing approvals, unsuitability of land for tourism/residential use due to airport noise and the potential for acquisition of adjacent freehold land controlled by GCCC.

It is concluded that the site is constrained, however, this is considered manageable in the context that an expanded site provides significant advantages not readily available on the South East Queensland coastline.

**Conclusion 5: An enlarged site at this location is generally suited to use for an expanded desalination facility.**

### **6.3. Land Availability**

Reference is made to Appendix 1 – Registered Plan.

Airport land is not considered practical due to the extant airspace requirements and is not given further consideration. The GCCC controls all other land generally surrounding the site, namely, Lot 31 on SP197355 (Lot 31). This land has a variety of existing uses including sports and recreation, sewerage infrastructure and landfill. Further easements are proposed for an airport access road and power infrastructure. In the event of Tugun being adopted as a Preserved Site or Priority Site, careful planning and consultation with the GCCC will be necessary to coordinate and validate the availability of any expansion land.

**Conclusion 6: Close and detailed consultation with the GCCC will be required to determine expansion land availability.**

### **6.4. Airport Issues**

#### ***Airport Leasing Arrangements and Operations Responsibility***

The properties upon which the Airport is located is Commonwealth land, located partly in Queensland and partly in New South Wales. Queensland Airports Limited (QAL) has long term lease arrangements and is responsible for technical matters associated with the operations.

#### ***Airspace Preservation***

The airspace of the Airport is preserved by Commonwealth legislation which restricts the construction of obstacles which penetrate an inclined surface, referred to as the Obstacle Limitation Surface (OLS). The OLS requirement is considered to be non-negotiable and is not considered further.

As it applies to Lot 31 this surface is parallel to the centreline of the main (14/32) runway. The constructed facilities at the GCDF reflect the requirement. The offset and roof heights of the existing GCDF have been adopted as the construction envelope limitation with respect to the airport boundary.

Close consultation with the Gold Coast Airport and Civil Aviation Safety Authority has resulted in the achievement of all aviation requirement being achieved in the current phase of development.

### ***Airport Master Plan***

The purpose of the Airport Master Plan is to summarise the planning framework for the development of Gold Coast Airport over a planning period of 20 years, within the context of the airport's ultimate development potential.

The *Gold Coast Airport Master Plan – 2006*<sup>4</sup> does not identify any land use requirements associated with Lot 31. The Master Plan foresees the lengthening of the main runway from 2042 metres to 2858 metres, the upgrade of taxiways located generally east of the main runway and other built facilities. No requirement for a parallel runway is identified.

These works are within the Airport property boundary and do not appear to have increased the constraints on either Lot 30 or Lot 31.

### ***Airport Access Road***

A requirement for a secure access road connecting the northern end of the Airport to Boyd Street has been identified. The operational requirements of this carriageway have not been developed and consultation with QAL is required for resolution of any issues.

### ***Tunneling Corridor***

It may be beneficial to negotiate a sea water intake tunnelling corridor in the event of the Duplication and Triplication options being adopted. Access to cross the Airport property is likely and beneficial and consequently should be investigated.

**Conclusion 7: Consultation with the QAL will be required to be progressed to determine the access road configuration and validate land availability.**

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<sup>4</sup> Reference 4.

## 6.5. Land Fill Management

### *Previous Remediation of Lot 30*

Lot 30 has been previously remediated, involving relocation of some in-situ landfill onto Lot 31 to facilitate the construction of the GCDF.

### *Landfill Management for Proposed Rail Corridor*

Queensland Rail has determined a rail corridor aligned east of the Tugun Bypass (Pacific Motorway) This corridor contains an unknown quantity of landfill which will require relocation. Non-rail corridor areas of Lot 31 are suited to this use. By placing more demand on the available site area, this has the potential to further constrain the use of Lot 31 for any expanded desalination option.

### *Lot 31*

Lot 31 contains unknown quantity of land fill in areas suitable for the establishment of the desalination plant, including the existing sports and recreation areas. Options exist to pile through the landfill or to adopt the previous strategy of relocating and to further concentrate the landfill within Lot 31. Removal of the landfill from the site is not considered practical due to the volume of material.

### *Landfill Strategy*

Given the variety of competing land use requirements any expanded desalination option will need to carefully develop a landfill strategy that will maximise long term site utilisation.

**Conclusion 8: Careful consideration of the landfill strategy would be needed for all expansion options to achieve a viable outcome for all stakeholders.**

## 6.6. Ocean Water / Seabed Characteristics

The ocean intake at Tugun provides very high consistency feed water suitable for the desalination process. Extensive testing has been carried out and the feed water characteristics are well understood.

In addition, the strong coastal currents facilitate rapid dispersion of the saline discharge.

The area surrounding the existing marine structures is sandy sea bottom and is naturally devoid of marine flora and fauna.

**Conclusion 9: The site feed water, discharge water and marine environmental characteristics are highly suited for expanded desalination development.**

## 6.7. Geology and Terrain

The site has a subsurface profile comprised of variable amounts of sand fill overlying natural sand and silty sand materials. Surface fill has been moved around the site, filling in gullies and removing sand ridges. This is inconsequential for the scale of development required to achieve the proposed options.

**Conclusion 10: The geotechnical characteristics of the site are highly suited for expanded desalination development.**

## 6.8. Environmental, Flora and Fauna Assessment

Stormwater discharge from the site is now controlled at levels not above pre-existing conditions using retention basins. There are minor flora and fauna considerations on the site(s) however all options avoid there sensitive areas.

**Conclusion 11: The environmental, flora and fauna characteristics of the site are highly suited for expanded desalination development.**

## 6.9. Cultural Heritage

A high level of interaction has occurred during the development of the GCDF and cultural heritage is considered to be manageable using close consultation and relying on the existing good relationships.

**Conclusion 12: The cultural heritage characteristics of the site are highly suited for expanded desalination development.**

## 6.10. Native Title Assessment

Lot 30 and Lot 31 are freehold.

**Conclusion 13: Native Title is extinguished.**

## 6.11. Energy Infrastructure Required

Planned energy infrastructure is being developed by Energex and a new redundant supply is proposed. Consultation with Energex is required to establish the footprint requirements of this supply.

**Conclusion 14: Energy infrastructure does not cause a long term constraint due to present Energex supply network planning.**

## **6.12. Constructability and Site Access**

The site is currently a construction site with a well developed site access corridor.

**Conclusion 15: The site has well developed site access and constructability.**

## **6.13. Likely Approvals**

Reference is made to the Approvals Assessment at Appendix 5.

## **6.14. Stakeholders**

Reference is made to the Stakeholder Assessment at Appendix 6.

## **6.15. Option Feasibility Assessment**

### ***Option 1: Augmentation***

Acquisition of part of Lot 31 is necessary.

There are no significant constraints to the development of the Augmentation option. The relocation of the GCCC sewerage infrastructure is necessary however it is anticipated that the GCCC would readily accept this approach on a cost neutral basis. Relocation of landfill would need to be interrogated immediately in the event of the GCDF expansion site being Preserved or Prioritised. Land use planning consultation is necessary to confirm the site requirements.

**Conclusion 16: A 45 ML/day Augmentation of the GCDF is feasible.**

### ***Option 2: Duplication***

Acquisition of part of Lot 31 is necessary.

There are no significant constraints to the development of the Duplication option. The relocation of the GCCC sewerage infrastructure is necessary. Relocation of landfill would need to be interrogated in the event of the GCDF expansion site being Preserved or Prioritised. Land use planning consultation is necessary to confirm the site requirements.

**Conclusion 17: A 135 ML/day Duplication of the GCDF is feasible.**

***Option 3: Triplication***

Acquisition of part of or all of Lot 31 is necessary.

There are no significant constraints to the development of the Triplication option. The relocation of the GCCC sewerage infrastructure is necessary.

Relocation of landfill would need to be interrogated in the event of the GCDF expansion site being Preserved or Prioritised. Land use planning consultation is necessary to confirm the site requirements.

The overall footprint is conservative and technology improvements and innovative use of the available are anticipated to provide significant reductions in the footprint after more rigorous investigation.

<b>Conclusion 18: A 270 ML/day Triplication of the GCDF is feasible.</b>
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Appendix 1: Estimated Capex Costs

	45 AUGMENTATION	135 DUPLICATION	270 TRIPLICATION
<b>Direct Costs</b>			
Tunnel	\$ 1,000,000	\$ 100,000,000	\$ 120,000,000
Seawater Intake and Outfall (Excluding Tunnel)	\$ 12,640,650	\$ 30,862,768	\$ 54,625,230
Pretreatment System	\$ 58,146,992	\$ 141,968,731	\$ 251,276,057
2 Pass RO System	\$ 72,051,707	\$ 175,917,776	\$ 311,363,810
Potabilisation Plant	\$ 8,090,016	\$ 19,752,171	\$ 34,960,147
Drinking Water Storage Tank and Pumping System	\$ 7,303,545	\$ 17,831,964	\$ 31,561,496
Auxiliary Systems	\$ 8,090,016	\$ 19,752,171	\$ 34,960,147
Residuals Collection/ Treatment System	\$ 9,831,675	\$ 24,004,518	\$ 42,486,542
Onshore site preparation	\$ 2,528,130	\$ 6,172,554	\$ 10,925,046
Infrastructure Works	\$ 1,825,886	\$ 4,457,991	\$ 7,890,374
Pre-Commissioning and Testing	\$ 3,651,773	\$ 8,915,982	\$ 15,780,748
Electrical Supply and Installation	\$ 10,955,318	\$ 26,747,946	\$ 47,342,245
Instrumentation Supply and Install	\$ 1,825,886	\$ 4,457,991	\$ 7,890,374
Freight Costs	\$ 3,651,773	\$ 8,915,982	\$ 15,780,748
Duty	\$ 1,825,886	\$ 4,457,991	\$ 7,890,374
<i>Subtotal Direct Costs</i>	<b>\$ 203,419,255</b>	<b>\$ 594,216,535</b>	<b>\$ 994,733,338</b>
<b>Non Direct Costs</b>			
Project Management	\$ 12,640,650	\$ 30,862,768	\$ 54,625,230
Engineering and Design	\$ 12,640,650	\$ 30,862,768	\$ 54,625,230
Site Establishment and Running Costs	\$ 5,561,886	\$ 13,579,618	\$ 24,035,101
Commissioning and Handover	\$ 1,896,098	\$ 4,629,415	\$ 8,193,784
Other	\$ 2,528,130	\$ 6,172,554	\$ 10,925,046
<i>Subtotal Indirect Costs</i>	<b>\$ 35,267,415</b>	<b>\$ 86,107,122</b>	<b>\$ 152,404,391</b>
<b>Contingency (10%)</b>	<b>\$ 23,868,667</b>	<b>\$ 68,032,366</b>	<b>\$ 114,713,773</b>
<b>CAPEX</b>	<b>\$ 262,555,337</b>	<b>\$ 748,356,022</b>	<b>\$ 1,261,851,502</b>
<b>OPEX / YEAR</b>	<b>\$ 14,994,552</b>	<b>\$ 41,831,171</b>	<b>\$ 81,010,953</b>
<b>CAPEX (M-AUD\$) PER MEGALITRE INSTALLED CAPACITY</b>	<b>5.83</b>	<b>5.54</b>	<b>4.67</b>
<b>OPEX (\$AUD) PER KILOLITRE</b>	<b>0.97</b>	<b>0.90</b>	<b>0.87</b>

Table 13: Capital Cost (\$AUD) Breakdown for existing and new Desalination Plants based on GCDF

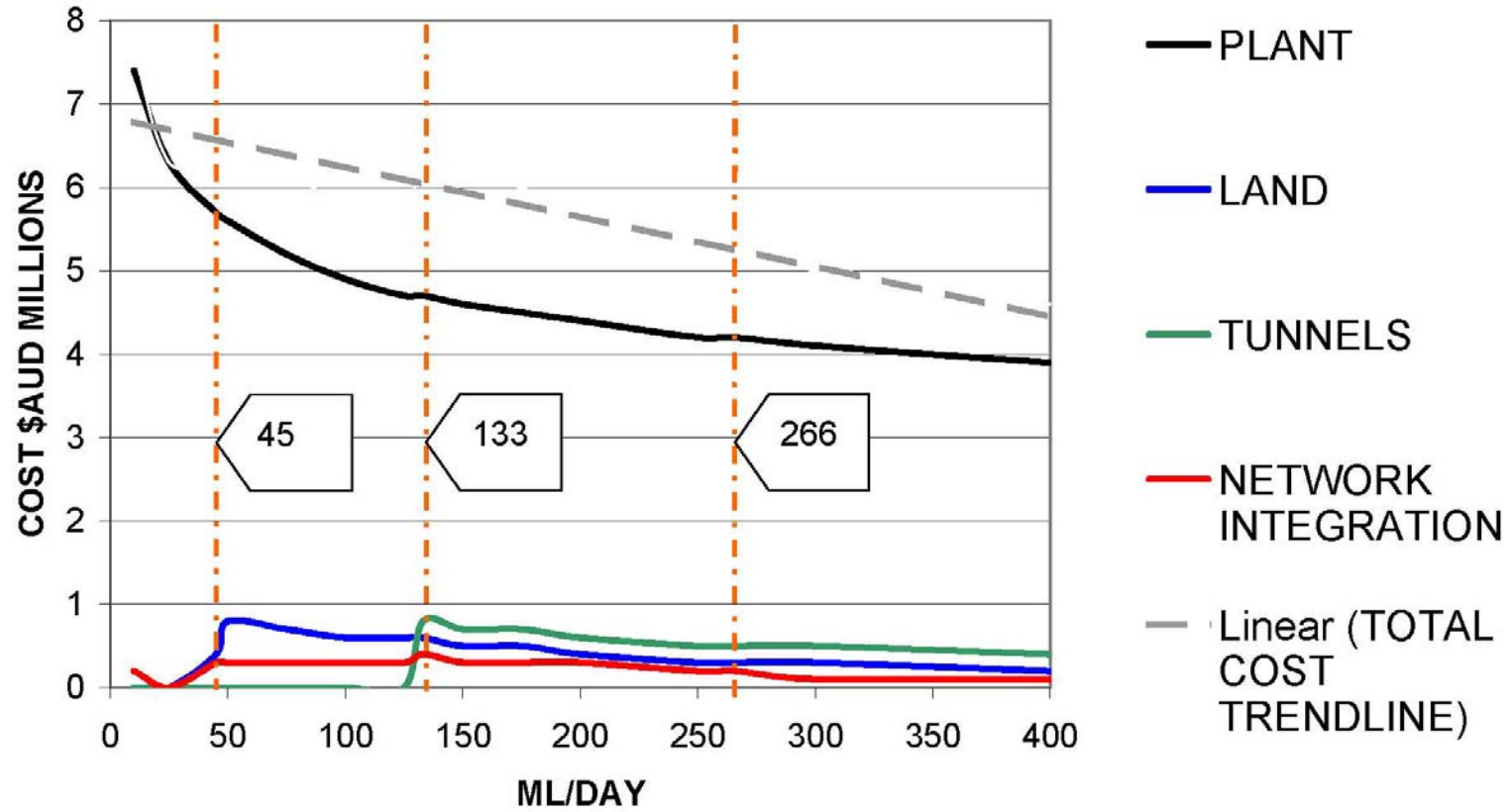


Figure 4: Capital Cost (\$AUD) per Cubic Metre of Installed Capacity

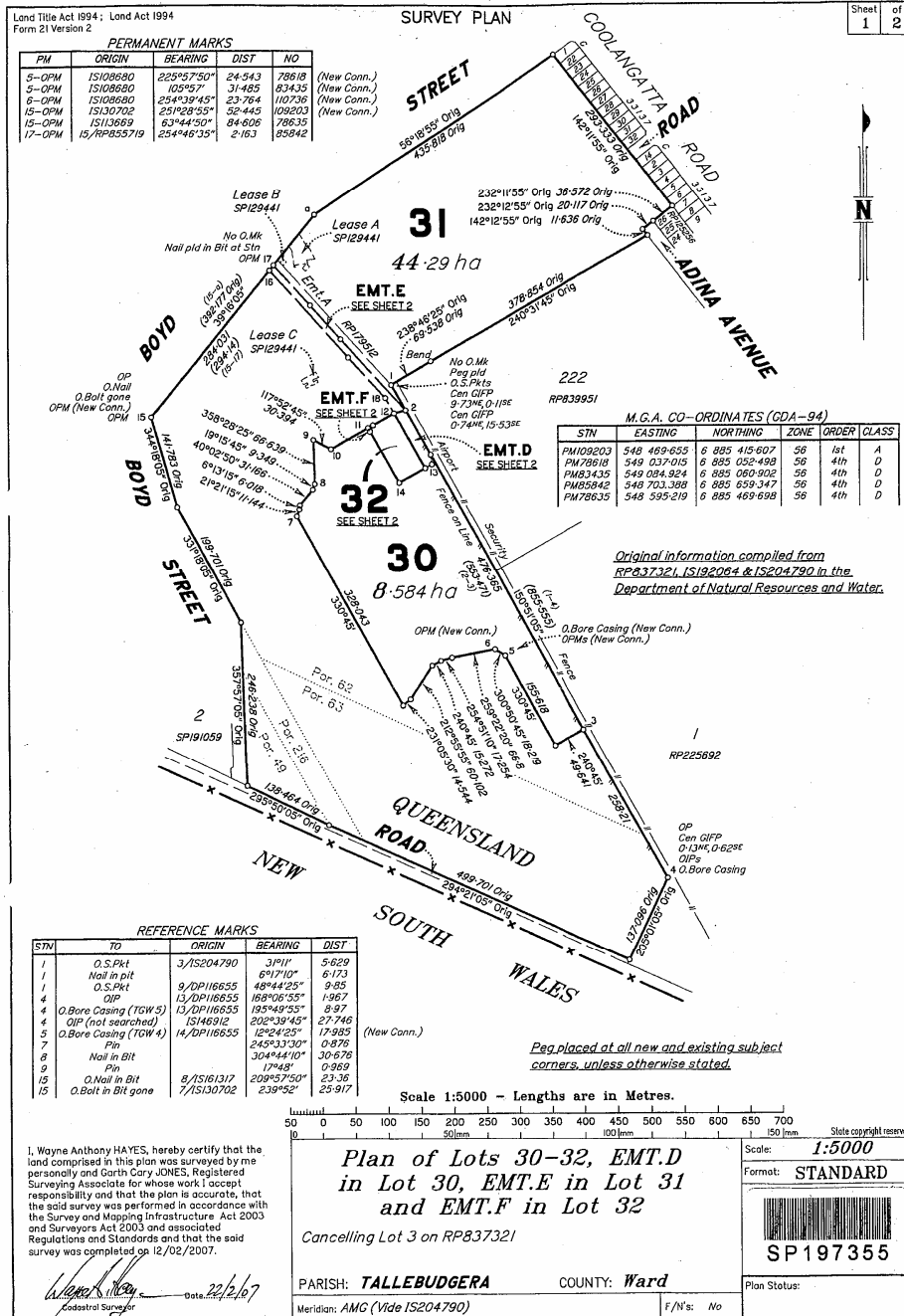
**Appendix 2: Estimated Opex Costs**

<b>PLANT SIZE</b>	<b>ESTIMATED OPEX (\$AUD MILLIONS)</b>
45	14.99
133	39.44
266	81.10

**Figure 5: Opex Cost for Options (M\$AUD)**

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Appendix 3: Registered Plan



**Appendix 4: Site Aerial Photograph**



**Appendix 5: Gold Coast Desalination Plant - Approvals Required**

<b>Approvals/ Permit Requirements</b>	<b>Legislation</b>	<b>Approving Authority</b>	<b>Comments</b>
Authorised Works Application	State Development and Public Works Organisation Act 1971	Co-ordinator General	-
Prescribed Project	State Development and Public Works Organisation Act 1971	Co-ordinator General	-
Development Application for Building works	Standard Building Regulations	Private Certification	-
Development Application for a Major Hazard Facility or possible Major Hazard Facility	Dangerous Goods Safety Management Act 2001.	Department of Emergency Services	-
Operational Work – Prescribed Tidal Works (GCCC Assessment Managers)	Integrated Planning Act 1997  Coastal Management and Protection Act 1995	Gold Coast City Council	Not required - Exempt from the Coastal Management and Protection Act 1995 under the Authorised works designation.
Allocation of Quarry Material	Coastal Management and Protection Act 1995	Environmental Protection Agency	Not required - Exempt from the Coastal Management and Protection Act 1995 under the Authorised works designation.

<b>Approvals/ Permit Requirements</b>	<b>Legislation</b>	<b>Approving Authority</b>	<b>Comments</b>
Operational Work - Disposal of dredge spoil or other solid waste material in tidal waters	Integrated Planning Act 1997  Coastal Management and Protection Act 1995	Environmental Protection Agency	Not required - Exempt from the Coastal Management and Protection Act 1995 under the Authorised works designation.
Operational Work – Removing or interfering with coastal dunes on land, other than State coastal land, that is in an erosion prone area and above high water mark	Integrated Planning Act 1997  Coastal Management and Protection Act 1995	Environmental Protection Agency	Not required - Exempt from the Coastal Management and Protection Act 1995 under the Authorised works designation.
Resource Entitlement	Land Act 1994  Integrated Planning Act 1997	Department of Natural Resource Management	-
ERA 16 – Municipal Water Treatment  ERA 7 – Chemical Storage  ERA 11 – Fuel Storage  ERA 19 – Dredging below high water mark.  ERA 62 – Concrete Batching on shore  ERA 62 – Concrete Batching Offshore	Integrated Planning Act 1997  Environmental Protection Act 1994	Environmental Protection Agency	-

<b>Approvals/ Permit Requirements</b>	<b>Legislation</b>	<b>Approving Authority</b>	<b>Comments</b>
Operational Works – Clearing of Remnant Vegetation	Vegetation Management Act 1999.	Department of Natural Resource Management	-
Operational Works – removal, damage or destruction of Marine Plants	Fisheries Act 1994	Department of Primary Industries and Fisheries	-
Waterway Barrier Works	Fisheries Act 1994	Department of Primary Industries and Fisheries	-
Approval to disturb, harm or destroy any species listed	Nature Conservation Act 1992	Queensland Parks and Wildlife Service	-
Riverine Protection Permit	Water Act 2000	Department of Natural Resource Management	Not required - Exempt from the under the Authorised works designation.
Referral to the Department of Environment and Heritage	Environment Protection and Biodiversity Conservation Act 1999	Department of Environment and Heritage	-
Approval under the Environment Protection and Biodiversity Conservation Act 1999	Environment Protection and Biodiversity Conservation Act 1999	Department of Environment and Heritage	-

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<b>Approvals/ Permit Requirements</b>	<b>Legislation</b>	<b>Approving Authority</b>	<b>Comments</b>
24 hour construction works approval  Network Pipeline  Tunnelling Works  Offshore Works  Site Building Works	Local Government Act	Gold Coast City Council	-

**Appendix 6: Principal Stakeholders (Preliminary)**

<b>Stakeholder</b>		<b>Stakeholder Interest</b>
Organisation:  Name:  Contact Details:	Energex  Gary Madigan, Asset Manager South Coast.  49 Hinde Street Southport Qld 4215 GPO Box 1461 Brisbane Qld 4001 P (07)55838608 F (07)55838555 M0417737639 garymadigan@energex.com.au	-Power supply to site.
Organisation:  Name:  Contact Details:	Gold Coast City Council  <name>  <tba>	-Land Use. -Landfill strategy. -Acquisition Lot 31. -Community Issues. -Impact on Sports Area.
Organisation:  Name:  Contact Details:	Gold Coast Airport Pty Ltd  Paul Donovan, Chief Operation Officer  Tel: (07) 5589 1100	-Land Use -Airspace Compliance.
Organisation:  Name:  Contact Details:	Queensland Rail  <name>  <tba>	-Land Use. -Landfill strategy. -Acquisition Lot 31.

Appendix 7: References

- 1) Cardno, Desalination Plant Detailed Study – August 2005.
- 2) Cardno, SEQ Water Grid Capacity Assessment of Southern Regional Water Pipeline and Tugun Desalination Plant, Preliminary Report, December 2007.
- 3) GCD Alliance, Business Case – Stage 1 TOC, 45MLD Desalination Expansion, November 2007.
- 4) GCD Alliance, Pre-feasibility Study Targeting Increase in Desalination Plant Capacity (Report No. GCDA-D-RE-001) – August 2007.
- 5) Gold Coast Airport Australia Master Plan 2006.  
([http://www.goldcoastairport.com.au/pdf/Master\\_Plan\\_2006.pdf](http://www.goldcoastairport.com.au/pdf/Master_Plan_2006.pdf))
- 6) Sinclair Knight Merz, Gold Coast Waterfuture – Preliminary Desalination Siting Study Draft – May 2005.
- 7) Queensland Water Commission, South East Queensland Water Strategy – March 2008.
- 8) [http://www.mainroads.qld.gov.au/web/AttachStore.nsf/allobjects/Tugun%20Bypass%20-%20EIS\\_Chapter1/\\$file/eis-chapter01.pdf](http://www.mainroads.qld.gov.au/web/AttachStore.nsf/allobjects/Tugun%20Bypass%20-%20EIS_Chapter1/$file/eis-chapter01.pdf)
- 9) [http://www.transport.qld.gov.au/Home/Projects\\_and\\_initiatives/Projects/Robina\\_to\\_tugun\\_rail\\_impact\\_assessment\\_study/Robina\\_to\\_tugun\\_rail\\_impact\\_assessment\\_study](http://www.transport.qld.gov.au/Home/Projects_and_initiatives/Projects/Robina_to_tugun_rail_impact_assessment_study/Robina_to_tugun_rail_impact_assessment_study)