


**Public Golf Course at Kau Sai Chau Island, Sai Kung**

**Operation Phase  
Environmental Monitoring & Audit (EM&A) Report  
for August 2008**

**(Report No. 382812/0201/006)**

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## **Executive Summary**

This is the sixth Operation Phase Monthly Environmental Monitoring and Audit (EM&A) Report prepared by Black & Veatch for the Project “Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung”. This report presents the results of the EM&A works conducted in the month of August 2008 (25<sup>th</sup> July to 24<sup>th</sup> August 2008).

### ***Water Quality***

2 sets of water quality monitoring were carried out on 5<sup>th</sup> August and 22<sup>nd</sup> July 2008 at 8 marine and 6 freshwater monitoring locations. No water sample is taken at M\_RO2 (marine station), the monitoring will only be carried out when desalination plant is in operation. For F\_Filter (fresh water station), no filter effluent was discharging during sampling and, thus no water sample was taken except 9<sup>th</sup> August 2008. Heavy rainstorm events were hoisted on 8<sup>th</sup> August 2008 during this reporting month. Water samples were taken on 9<sup>th</sup> August 2008.

Exceedances found at marine stations are considered non-project related while exceedances found at freshwater stations (F\_DB, F\_Filter Lake 1D and F\_Inland M) are considered project-related during the reporting month.

### ***Marine Ecology***

The coral monitoring for the operation of the East Course commenced in July 2008. As the original baseline monitoring for the corals in Site D2 were conducted over 3.5 years before in December 2005 and no construction phase monitoring were required for Site D2 due to the avoidance of dredging at the pier, the previously tagged corals at Site D2 have mostly lost the tags. 20 new corals were selected in Site D2 for operation phase monitoring purposes. The July 2008 coral monitoring covering Site D2, Site C and the Control Site served as the baseline for the operation phase. In accordance with the EM&A manual, the operation phase coral monitoring would cover two year. The frequency would be monthly for the first three months, and if no exceedance is recorded the frequency will change to semi-annually. The August 08 monitoring is the first monthly monitoring.

### ***Landscaping & Visual***

The Contractor is still finalizing the landscaping works, the landscape and visual site audit will be conducted once planting on the golf course are completed. According to the site audit observation, approximate 40-50% compensatory trees have died.

### ***Soil Nutrient***

No soil nutrient analysis was carried out during this reporting month. The soil nutrient sampling will be carried out in October 2008 and available in November 2008.

## **1. Introduction**

### **1.1 Background of the Project**

1.1.1 Black & Veatch (hereinafter called the “ET”) was appointed by The Jockey Club Kau Sai Chau Public Golf Course Limited (hereinafter called the “Project Proponent”) to undertake Operation Phase of Environmental Monitoring and Audit (EM&A) for “Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung” (hereinafter called the “Project”). Under the requirements of Section 4 of Environmental Permit EP-224/2005/A, EM&A programme as set out in the EM&A Manual is required to be implemented. In accordance with the EM&A Manual, environmental monitoring on water quality, marine ecology, landscape and visual and land contamination during operation phase are required for the Project.

1.1.2 This report summarises the environmental monitoring and audit works for the Project in **August 2008**.

### **1.2 Purpose of the Report**

1.2.1 This is the **sixth** EM&A report which summarizes the impact monitoring results and audit findings for the EM&A programme during the reporting period from **25<sup>th</sup> July to 24<sup>th</sup> August 2008**.

### **1.3 Structure of the Report**

1.3.1 The structure of the report is shown in Table 1.1.

**Table 1.1 Structure of the Report**

<b>Section</b>		<b>Description</b>
<b>1</b>	Introduction	Details the scope and structure of the report
<b>2</b>	Project Information	Summarizes background and scope of the project and site description
<b>3</b>	Environmental Monitoring Requirement	Summarizes the monitoring parameters, programmes, methodology, frequency, location, action and limit levels, event action plans, environmental mitigation measures as recommended in the EIA report and relevant environmental requirements.
<b>4</b>	Monitoring Results	Summarizes the monitoring results obtained in the reporting period.
<b>5</b>	Environmental Non-conformance	Summarizes any monitoring exceedance, environmental complaints and environmental summons within the reporting period.
<b>6</b>	Conclusions	Provides an overall conclusion of the results and findings of the EM&A programme for the reporting period.

## **2. Project Information**

### **2.1 Background**

2.1.1 The Project comprises the following major components:

- Construction of the third 18-hole public golf course on the east side of the island, south of the existing golfing area;
- A new irrigation lake to collect surface runoff from the new 18-hole golf course. Water stored at the new irrigation lake can also be diverted to existing reservoir for tertiary treatment and recycling;
- A new desalination plant adjacent to the existing pier to serve as an additional irrigation water supply for the new golf course during dry season; and
- Expansion of existing administration and maintenance buildings.

2.1.2 The potential environmental impacts of the Project have been studied in the Environmental Impact Assessment (EIA) report (EIAO Register No. AEIAR- 091/2005). The EIA was approved on 14 November 2005 under the EIAO. An Environmental Permit (EP-224/2005) was granted on 28 November 2005. Application for Variation of an Environmental Permit by the Project Proponent was submitted on 2 August 2006 (Application No. VEP-222/2006) and the EP was superseded by EP-224/2005/A.

### **2.2 Site Description**

2.2.1 A layout plan of the Project is provided in **Figure 1.1**.

### **2.3 Summary of EM&A Requirements**

2.3.1 The EM&A programme requires environmental monitoring for water quality, marine ecology, landscape and visual and land contamination during operation phase. The EM&A requirements for each parameter are described in subsequent sections, including:

- All monitoring parameters;
- Action and Limit Levels for all environmental parameters;
- Event and Action Plans; and
- Environmental mitigation measures, as recommended in the project EIA final report.

2.3.2 A summary of impact EM&A requirements is presented in Table 2.1.

**Table 2.1 Summary of Impact EM&A Requirements during Operation Phase**

<b>Impacts</b>	<b>Parameters/descriptions</b>	<b>Locations</b>	<b>Frequencies</b>
<b>Water Quality</b>	Dissolved Oxygen, Temperature, Turbidity, pH, Salinity, SS, NO <sub>3</sub> -N, NO <sub>2</sub> -N, NH <sub>3</sub> -N, TP, Chl-a and selected pesticides.	9 marine and 6 freshwater locations	2-year of monitoring period for the operation phase. Monitoring should be carried out on bi-weekly basis for the first 12 months, after when the frequency will be reviewed by EPD. Additional monitoring parameters at Lake 1D are required (TKN, Ortho-P and Conductivity)
	Dissolved Oxygen, Temperature, Turbidity, pH, Salinity, SS, NO <sub>3</sub> -N, NO <sub>2</sub> -N, NH <sub>3</sub> -N, TP, Chl-a and selected pesticides.	8 marine locations	Additional water quality monitoring shall be carried out after heavy rain storm or when there is an overflow event from the reservoir, irrigation buffer lake or detention ponds/tanks.
<b>Marine Ecology</b>	Natural corals	Site C, Site D2 and the Control Site.	First three months would be monthly conducted during the first two years of the operation phase. If no exceedance was recorded, the monitoring schedule would be changed to semi-annually, i.e. once in dry season and once in wet season.
<b>Landscape and Visual</b>	Audits to ensure effective implementation of mitigation measures	Golf course area and at visual sensitive receivers	Auditing inspections and reporting shall be undertaken once every two months for the first year of the operation phase.
<b>Soil Nutrient</b>	Nutrient Status of the Soil	Golf course	Twice annually



### 3. Environmental Monitoring Requirements

#### 3.1 Water Quality

##### Monitoring Requirement

- 3.1.1 Water quality monitoring was conducted in accordance with the EM&A Manual. Tables 3.1 to 3.3 show the established Action/Limit Levels for the water environmental monitoring parameters.

**Table 3.1 Derived Summaries of Action and Limit Levels for Freshwater Water Quality**

Parameters	Location	Action	Location	Limit
DO (mid-depth)		6.3 mg/L	All	4 mg/L ξ
pH (mid-depth)		N/A	All	6.0 - 9.0
SS (mid-depth)	All	3.8 mg/L or 120% of upstream control station's SS at the same tide of the same day	All	8 mg/L or 130% of upstream control station's SS at the same tide of the same day
Turbidity (Tby) (mid-depth)	All	3.1 NTU or 120% of upstream control station's Tby at the same tide of the same day	All	4 NTU or 130% of upstream control station's Tby at the same tide of the same day
Ammonia Nitrogen (mid-depth)		N/A	All	0.01 mg/L
Nitrate Nitrogen (mid-depth)	All	0.10 mg/L	All	0.11 mg/L
Nitrite Nitrogen (mid-depth)		N/A	All	0.01 mg/L
TIN (mid-depth)	All	0.12 mg/L	All	0.13 mg/L
Total Phosphorus (mid-depth)		N/A	All	0.02 mg/L

Remarks:

: Action and limit levels are subjected to review especially for wet season.

Freshwater monitoring locations: F-UA, F-DA, F-UB, F-DB, F-UC, F-DC and F-Inland Marsh

As most of the freshwater samples were reported of NH<sub>3</sub>-N, NO<sub>2</sub>-N levels below the detection limit of 0.01 mg/L, limit level is set at 0.01 mg/L. Similarly for TP, a limit level of 0.02 mg/L (the detection limit of TP) is imposed.

ξ : Water Quality Objectives of the Port Shelter

**Table 3.2 Action and Limit Levels for Water Quality Monitoring  
(applicable to irrigation lake 1D and existing reservoir)**

Parameter (mg/L unless stated)	Action and Limit Levels
pH	6.0 - 9.0 <sup>(1)</sup>
Turbidity (NTU)	-
Dissolved Oxygen	>4 <sup>(1)</sup>
Chlorophyll a (mg/m <sup>3</sup> )	<5 <sup>(1)</sup>
Nitrate N	0.20 <sup>(1)</sup>
Nitrite N	0.20 <sup>(1)</sup>
Ammoniacal N	0.50 <sup>(1)</sup>
Total Kjeldahl N	1.2 <sup>(2)</sup>
Total Phosphate	0.1 <sup>(1)</sup>
Ortho Phosphate	0.05 <sup>(1)</sup>
Conductivity (µS/cm)	<1000 <sup>(1)</sup>

Note: (1) These values are based on professional judgment and knowledge

(2) Based on 90<sup>th</sup> percentile of operational phase monitoring data (1996 to June 1998)

**Table 3.3 Derived Summaries of Action and Limit Levels for Marine Water Quality**

Parameters	Location	Action	Location	Limit
<b>DO (Surface &amp; Middle)</b>	FCZ	6.0 mg/L	FCZ	5.3 mg/L
	All except FCZ	4.9 mg/L	All except FCZ	4.6 mg/L
<b>DO (Bottom)</b>	All	3.7 mg/L	All	3.4 mg/L
<b>pH (depth-averaged)</b>		N/A	All	6.5 - 8.5
<b>SS (Depth-averaged)</b>	FCZ	4.5 mg/L	FCZ	5.6 mg/L
	All except FCZ	6.1 mg/L	All except FCZ	10.6 mg/L
<b>SS (Depth-averaged) Dredging for submarine pipelines</b>	M_RO1	6.1 mg/L	M_RO1	10.6 mg/L
<b>Turbidity (Tby) (depth-averaged)</b>	FCZ	2.9 NTUα	FCZ	3.9 NTUα
	All except FCZ	3.3 NTUα	All except FCZ	6.2 NTUα
<b>Ammonia Nitrogen (depth-averaged)</b>	FCZ	0.02 mg/L	FCZ	0.03 mg/L
	All except FCZ	0.05 mg/L Δ	All except FCZ	0.05 mg/L Δ
<b>Nitrate Nitrogen (depth-averaged)</b>	FCZ	0.08 mg/L	FCZ	0.09 mg/L
	All except FCZ	0.09mg/L Δ	All except FCZ	0.09 mg/L Δ
<b>Nitrite Nitrogen (depth-averaged)</b>	FCZ	0.02 mg/L θ	FCZ	0.02 mg/L θ
	All except FCZ	0.02 mg/L	All except FCZ	0.04 mg/L
<b>TIN (depth-averaged)</b>	FCZ	0.12 mg/L	FCZ	0.14 mg/L
	All except FCZ	0.16 mg/L	All except FCZ	0.18 mg/L
<b>Total Phosphorus (depth-averaged)</b>	All	0.09 mg/L Δ	All	0.09 mg/L Δ

Remarks:

: Action and limit levels are subjected to review especially for wet season throughout the construction phase of the project.

: Action and limit levels are subjected to review before the dredging works.

⌘ : All are based on EM&A baseline monitoring data due to marked difference between EPD turbidity data and those from the baseline survey.

Δ : For nutrient monitoring (except NO<sub>2</sub>-N) at non-FCZ stations, the trigger level has made reference to the existing golf course guideline values. The guideline value of NO<sub>2</sub>-N is below the current detection limit of 0.01mg/L and thus not used.

θ : The same action and limit level of 0.02 mg/L is determined from the EM&A baseline data as 78% of the NO<sub>2</sub>-N data are ≤ 0.01 mg/L and all remaining 22% equal to 0.02 mg/L.

**FCZ** including fish culture zones of Kai Lung Wan, Tai Tau Chau and Kau Sai

**All except FCZ** including remaining impact monitoring station of M\_RO1, M\_Marsh, M\_BP and M\_Coral.

Control monitoring locations: M\_A & M\_B

Monitoring Parameters, Frequency and Programme

- 3.1.2 For marine water quality, measurements shall be taken at both mid-flood and mid-ebb tides and at three water depths (1 m below water surface, mid-depth and 1 m above sea bed, except where the water depth is less than 6 m, in which case the mid-depth station may be omitted). Should the water depth be less than 3 m, only the mid-depth station will be monitored.
- 3.1.3 For the stream course, measurements shall be taken at mid-water depth.
- 3.1.4 The water quality parameters which need to be monitored are as follows:
- Marine water quality - dissolved oxygen (DO), temperature, turbidity, suspended solids (SS), pH and salinity
  - Freshwater water quality - dissolved oxygen (DO), temperature, turbidity, suspended solids (SS), pH, salinity and conductivity (Lake 1D only).
- 3.1.5 Additional marine and freshwater water quality monitoring parameters for the impact monitoring during construction include nitrate nitrogen (NO<sub>3</sub>-N), nitrite nitrogen (NO<sub>2</sub>-N), ammonia nitrogen (NH<sub>3</sub>-N), total phosphate (TP) and selected pesticides. For Lake 1D, Total Kjeldahl Nitrogen (TKN) and Orthophosphate (Ortho P) are required.
- 3.1.6 Additional water quality monitoring at Tai Tau Chau FCZ (TTC), Kai Lung Wan FCZ (KLW), Kau Sai FCZ (KS), downstream of the existing marsh (M\_Marsh), marine water of Port Shelter (M\_Coral), existing reservoir (F\_Inland M) and Control stations (M\_A and M\_B) shall be carried out after heavy rain storm or when there is an overflow event from the reservoir, irrigation buffer lake or detention ponds/tanks. The heavy rain storm shall be defined when there is an amber/red/black rainstorm warning signal issued by the Hong Kong Observatory. The water sample shall be taken within 24 hours after the black/red/amber rainstorm warning signal is cancelled. Please refer to revised EM&A manual for the sampling condition requirement after a heavy rain storm event occurs. The monitoring parameters shall include dissolved oxygen, temperature, turbidity, suspended solids, pH and salinity. Additional parameters shall be the same as stated in paragraphs 3.1.5.

### Monitoring Frequency

3.1.7 After reviewing the water quality monitoring results during construction phase and early operation phase, EPD<sup>1</sup> agreed to revise monitoring parameters and frequency are summarized in Table 3.4. The monitoring programme for the reporting period is shown in **Annex A**.

**Table 3.4 Water Quality Monitoring Parameter, Frequency and Locations**

Parameters	Location	Frequency	Sampling Depth
Dissolved Oxygen (mg/L)	<b>Marine Water</b> Fish culture zone stations: TTC, KLW, KS  Control stations: M_A, M_B  Impact stations: M_RO1, M_RO2, M_Marsh, M_Coral	<b>Bi-weekly</b>  <u>Marine water :</u> 2 times per day – 1 for mid-flood and 1 for mid-ebb  <u>Freshwater :</u> Mid-depth per trip	3 individual water depth samples (surface, middle & bottom)
Temperature (°C)			
Turbidity (NTU)			
pH			
Salinity (ppt)			
Suspended Solids (mg/L)			
Nutrients <sup>2</sup>	<b>Freshwater Water</b> Stream A (F_DA) Stream B (F_DB) Stream C (F_DC) Inland Marsh (F_Inland_M) Filter System (F_Filter) Irrigation Lake 1D (F_lake 1D)	<b>Monthly (wet season) and Bi-Monthly (dry season)</b>  <u>Marine water :</u> 2 times per day – 1 for mid-flood and 1 for mid-ebb  <u>Freshwater :</u> Mid-depth per trip	1 composite sample (combine surface, middle and bottom) with replicate
Chemicals <sup>3</sup>			

Wet season: Apr to October; Dry season: November to March

<sup>1</sup> EPD letter dated 14 July 2008 (Ref. no.: (6) in EP2/N8/O/47 Ax(7) Pt X) regarding the approval on the revised water quality monitoring proposal.

<sup>2</sup> Ammonia Nitrogen, Nitrate Nitrogen, Nitrite Nitrogen, Total Inorganic Nitrogen, Total Phosphorus and Chlorophyll a. For Lake 1D, addition nutrient parameters are Total Kjeldahl Nitrogen, Ortho Phosphate and Conductivity (µS/cm).

<sup>3</sup> Pesticides (approved lists are Imazaquin, Glyphosate, Oxadiazon, 2,4-D/Mecoprop, Chlorothalonil, Mancozeb, Iprodione, Fosetyl Aluminum, Chlorpyrifos, Fipronil and Imidachloprid).

### Monitoring Locations

- 3.1.8 The water quality monitoring locations for marine and freshwater (**Figure 3.1**) are summarized in Table 3.5.

**Table 3.5 Water Quality Monitoring Locations during Operation Phase**

Identification Number	Location	Approx. Water Depth	No. of Depth
<i>Marine Water (9 stations)</i>			
TTC	Tai Tau Chau Fish Culture Zone	9.5 m	3
KLW	Kai Lung Wan Fish Culture Zone	13 m	3
KS	Kau Sai Fish Culture Zone	11 m	3
M_BP	Temporary barging point	9.6 m	3
M_RO1	Desalination plant south of the existing pier	5 m	2
M_RO2	Desalination plant south of the existing pier	13 m	3
M _ Marsh	Discharge point at the existing marsh	7.7 m	3
M _ Coral	Marine water of Port Shelter	10.2m	3
M _ A	Water Control Station of Port Shelter	7.5 m	3
M _ B	Water Control Station of Port Shelter	16.5 m	3
<i>Fresh Water (7 stations)</i>			
F_DA	downstream of stream A	Mid-depth	1
F_DB	downstream of stream B	Mid-depth	1
F_DC	downstream of stream C	Mid-depth	1
F _ Inland M	Downstream of the existing marsh (Inland)	Mid-depth	1
F_lake 1D	Irrigation Lake 1D	Mid-depth	1
F_Filter	Filter effluent point at Holes 5 / 6	Mid-depth	1

### Monitoring Equipment

#### *Dissolved Oxygen and Temperature Measuring Equipment*

- 3.1.9 The instrument shall be a portable and weatherproof DO measuring instrument complete with cable and sensor, and use a DC power source. The equipment shall be capable of measuring:
- dissolved oxygen levels in the range of 0 - 20 mg L<sup>-1</sup> and 0 - 200% saturation; and
  - a temperature of 0 - 45 degrees Celsius.
- 3.1.10 It shall have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary. (For example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

- 3.1.11 Should salinity compensation not be built-in in the DO equipment, in-situ salinity shall be measured to calibrate the DO equipment prior to each DO measurement.

*Turbidity Measurement Instrument*

- 3.1.12 Turbidity shall be measured in situ by the nephelometric method. The instrument shall be portable and weatherproof turbidity measuring instrument using a DC power source complete with cable, sensor and comprehensive operation manuals. It shall have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU (for example, Hach model 2100P or an approved similar instrument). The cable shall not be less than 25m in length. The meter shall be calibrated in order to establish the relationship between NTU units and the levels of suspended solids.

*Suspended Solids*

- 3.1.13 A water sample at least 2.5L in capacity with messenger and using a 10m line should be collected. Samples should be submitted to HOKLAS accredited laboratory as soon as possible for gravimetric analysis for suspended.

*Sampler*

- 3.1.14 A water sampler is required. It shall comprise a transparent PVC cylinder, with a capacity of not less than 2 litres, which can be effectively sealed with latex cups at both ends. The sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (for example, Kahlsico Water Sampler or an approved similar instrument).

*Water Depth Detector*

- 3.1.15 A portable, battery-operated echo sounder shall be used for the determination of water depth at each designated monitoring station. This unit can either be hand held or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

*Salinity*

- 3.1.16 A portable salinometer capable of measuring salinity in the range of 0 - 40 parts per thousand (ppt) shall be provided for measuring salinity of the water at each monitoring location.

*pH*

- 3.1.17 The instrument shall consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It shall be readable to 0.1pH in a range of 0 to 14. Standard buffer solutions of at least pH 7 and pH 10 shall be used for calibration of the instrument before and after use. Details of the method shall comply with APHA, 19th ed. 4500-HTB.

*Flow Rate Meter*

- 3.1.18 A portable, battery-operated flow meter should be used for the determination of water depth at each designated monitoring location and record in m<sup>3</sup>/s. A hand held or meter fixed to the underside of the survey boat may be used.

### *Sample Containers and Storage*

- 3.1.19 Water samples for laboratory analysis shall be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen) and delivered to the laboratory and analysed as soon as possible after collection. Sufficient volume of samples shall be collected to achieve the required detection limit.

### *Monitoring Position Equipment*

- 3.1.20 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication or other equipment instrument of similar accuracy, shall be provided and used during marine water monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

### Monitoring Methodology and Calibration Details

- 3.1.21 Dissolved oxygen (DO), temperature, turbidity, pH and salinity were measured in situ at the designated water quality monitoring stations. General observation, weather conditions, with the sampling time, date and location were marked on the field record sheet.
- 3.1.22 Water samples were taken from each monitoring station for laboratory analysis. The sample identification number, sampling location, date, time, project name and analyses were required.
- 3.1.23 The samples were placed in a cooler with ice (to 4°C without being frozen) and kept away from sunlight. Samples were submitted to a Hong Kong Laboratory Accreditation Scheme (HOKLAS) or other international accredited laboratory for analysis within 24 hours of sampling.

### *Calibration of In-Situ Instruments*

- 3.1.24 All in situ monitoring instruments were checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use and subsequently re-calibrated at three monthly intervals throughout all stages of the water quality monitoring programme. Responses of sensors and electrodes were checked with certified standard solutions before each use. Wet bulb calibration for a DO meter were carried out before measurement at each monitoring location.

### *Laboratory Analysis*

- 3.1.25 All laboratory work were carried out by ALS Technichem Pty Ltd (HOKLAS accredited laboratory). Water samples were collected at the monitoring and control stations for carrying out the laboratory determinations. The determination work will start within 24 hours after collection of the water samples. The analysis shall follow the standard methods according to APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition, or an equivalent method approved by EPD.

**Table 3.9 Analytical Methods to be applied to Water Quality Samples**

Determinant	Standard Method	Reporting Limit
Suspended Solids	APHA 2540 D	2 mg/L
Nitrate Nitrogen	APHA 4500-NO <sub>3</sub> <sup>-</sup>	0.01 mg/L
Nitrite Nitrogen	APHA 4500-NO <sub>2</sub> <sup>-</sup>	0.01 mg/L
Ammonia Nitrogen	APHA 4500-NH <sub>3</sub> (D)	0.01 mg/L
Total phosphorus	ASTM D515-88B	0.02 mg/L*

Determinant	Standard Method	Reporting Limit
Chlorophyll a	APHA 10200 H2 &3	0.5 µg/L

Remarks: \*After review baseline data, the detection limit report will be revised to 0.02 mg/L.

### *QA/QC Procedure*

- 3.1.26 ALS Technichem Pty Ltd. has comprehensive quality assurance and quality control programmes. For QA/QC procedures of parameters, one duplicate sample was analysed for every batch of 20 samples as required by HOKLAS.

### Event and Action Plans

- 3.1.27 The Event and Action Plan (EAP) for water quality monitoring is presented in **Annex B**.

## **3.2 Marine Ecology**

### Introduction

- 3.2.1 The marine ecological monitoring surveys are conducted in accordance with the EM&A manual.
- 3.2.2 As stipulated in the EM&A Manual, the ecological monitoring surveys for marine ecology included coral monitoring at both the eastern (Site C) and western (Site D2) coasts of Kau Sai Chau Island and Control Site. The purpose of the monitoring survey was to check the conditions of the tagged corals and the sites.

### Monitoring Frequency and Schedule

- 3.2.3 At each of the Site C and a Control Site near the AFCD's Coral Buoy at Sharp Island (**Figure 3.2**), 20 natural coral colonies are already selected and tagged during construction phase. If the tagged coral is found die or not suitable for sequent operation phase monitoring during the first month survey, new coral will be selected, tagged and replaced for the damage one. The species of corals had been tagged included the following 15 species: *Cyphastrea serailia*, *Favia speciosa*, *Favites abdita*, *Favites pentagona*, *Goniastrea aspera*, *Goniopora columna*, *Hydnophora exesa*, *Leptastrea pruinosa*, *Lithophyllon undulatum*, *Pavona decussata*, *Platygyra acuta*, *Platygyra carnosus*, *Plesiastrea versipora*, *Psammocora superficialis*, and *Turbinaria peltata*. As the construction of the desalination plant intake and outfall at the existing pier was terminated, no dredging work had been carried out during the construction phase. According to the EM&A manual, no coral monitoring was required at Site D2 during the construction phase. As the original baseline coral monitoring at Site D2 was conducted 3.5 years ago (December 2005), most of the tags at the previous tagged corals were lost. Twenty (20) new corals were selected in Site D2 for operation phase monitoring purposes. The species of corals selected in Site D2 included the following 10 species: *Acropora tumida*, *Cyphastrea serailia*, *Favia speciosa*, *Favites chinensis*, *Goniastrea aspera*, *Goniopora columna*, *Gonipora stutchburyi*, *Pavona decussata*, *Porties lobata*, and *Turbinaria peltata*. The operation phase coral monitoring covering Site D2, Site C and the Control Site. The August 08 monitoring is the first monthly monitoring.
- 3.2.4 The coral monitoring will be conducted monthly for the first three months of the operation phase, and if no exceedance was recorded, the monitoring schedule will be changed to semi-annually (i.e. one dry season and one in wet season) during the rest of the operation phase. Monitoring survey will consist of checking tagged corals at both impact sites and control site. Percentages of survival, sedimentation and bleaching for each tagged corals will be recorded. The monitoring programme for the reporting period is shown in **Annex A**.



#### Event and Action Plans

- 3.2.5 The Event and Action Plan (EAP) for ecology monitoring is presented in **Annex B**.

### **3.3 Landscape and Visual**

- 3.3.1 The EIA concluded that the landscape and visual impacts associated with the construction of the third golf course are anticipated to be acceptable with mitigation. In order to ensure that the effective management and implementation of landscape mitigation measures developed and defined in the EIA, regular site inspections on trees health will be conducted. Auditing inspections and reporting are undertaken once every two months during the first year of the operation phase. The monitoring programme for the reporting period is shown in **Annex A**.

### **3.4 Soil Nutrient**

- 3.4.1 Routine soil testing for nutrients at East Course will be conducted semi-annually to ensure that nutrient applications to the golf course are having the desired effect. Adjustments, if necessary, are made to the applications program approved by Golf Course Superintendent to amend any soil imbalances or deficiencies in nutrients. The details of the fertilizers and pesticides application will also be recorded.

#### 4. Monitoring Results

4.1.1 Monitoring data are provided in **Annex C**.

##### 4.1 Water Quality

4.1.2 Marine and freshwater water quality monitoring were conducted at the 9 and 6 designated monitoring stations respectively.

4.1.3 Application of the discharge licence of the desalination plant is in progress. The monitoring M\_RO2 is not necessary until the desalination plant fully is operational.

4.1.4 Monitoring of marine and freshwater locations was conducted on 2 occasions in August 2008 (5<sup>th</sup> and 19<sup>th</sup> August 2008). The QA/QC results for laboratory testing in the reporting month are acceptable and summarised in **Annex D**. Rainstorm signal was hoisted on 8<sup>th</sup> August 2008 during this reporting month. Water samples were taken on 9<sup>th</sup> August 2008.

4.1.5 As there is no water discharge from the Holes 5 / 6 through the drainage system during sampling, no water sample for F\_Filter was collected during the reporting month except 9 August 2008. Summary of fertilizer and pesticides applications are summarized in **Annex E**.

4.1.6 Chemical applications were applied during the reporting month. They are approved pesticides listed in the turfgrass management plan in the final EIA report. Water samples were required to send to overseas laboratory for analysis and testing.

##### Marine water

4.1.7 The marine water exceedance is summarised in **Table 4.1-1**.

4.1.8 SS exceedances recorded at KLW, M\_Marsh, TTC were ranging 4.7 to 6.3 mg/L which had similar SS concentration measured at M\_A and M\_B (3.3 to 4.8 mg/L). The SS exceedance is considered non-project related.

4.1.9 Similar to SS, Chlorophyll a exceedances recorded at TTC, M\_Coral and KS were ranging 2.4 to 3.9 µg/L, which had similar SS concentration measured at M\_A and M\_B (2.2 to 3.5 mg/L). The Chlorophyll a exceedance is considered non-project related.

**Table 4.1-1 Marine Water Exceedance Summary (July to August 2008)**

Monitoring Location	Exceedance Level	Date	Parameters	Project-related
KLW	Action Level	9 August 2008	SS	No
M_Marsh	Action Level	19 August 2008	SS	No
TTC	Limit Level	5 August 2008	Chl a	No
	Action Level	9 August 2008	SS	No
	Limit Level	9 August 2008	Chl a	No
	Action Level	19 August 2008	SS	No
	Limit Level	19 August 2008	Chl a	No
M_Coral	Action Level	5 August 2008	Chl a	No
KS	Limit Level	5 August 2008	Chl a	No
	Limit Level	9 August 2008	Chl a	No
	Limit Level	19 August 2008	Chl a	No

### Fresh water

4.1.10 The fresh water exceedances are summarised in **Table 4.1-2**.

**Table 4.1-2 Fresh water Exceedance Summary (July to August 2008)**

Monitoring Location	Exceedance Level	Date	Parameters	Project-related
F_DB	Limit Level	9 August 2008	NH <sub>3</sub> -N	No
	Action Level	19 August 2008	Turbidity, Chl a	No
F_Inland M	Limit Level	5 August 2008	Chl a	No
	Action Level	9 August 2008	SS	No
	Limit Level	19 August 2008	NO <sub>3</sub> -N, TIN	No
F_Filter	Limit Level	9 August 2008	NO <sub>3</sub> -N, TIN	No
Lake 1D	Action Level	5 August 2008	Turbidity	No
	Limit Level	5 August 2008	Ortho P, TP	No
	Limit Level	9 August 2008	NO <sub>3</sub> -N, Ortho P, TP	No
	Action Level	19 August 2008	Turbidity	No
	Limit Level	19 August 2008	Ortho P, TP	No

- 4.1.11 Low values of turbidity, ammonia nitrogen and chlorophyll a were recorded leading to action / limit level exceedances at downstream B at 3.3 mg/L, 0.02 mg/L and 0.6µg/L. It is considered non-project related and mainly due to natural variation of stream.
- 4.1.12 Water quality of the streams before any commencement works were measured in April 2006 in order to indicate natural variation between dry and wet seasons. By taking into account the seasonal variation (wet season) together with the baseline monitoring data (dry season), the 95%-ile and 99%-ile for NO<sub>3</sub>-N are 0.22 and 0.55 mg/L respectively while the 95%-ile and 99%-ile for TIN are 0.25 and 0.67 mg/L respectively.
- 4.1.13 Neither action nor limit levels exceedance of nutrient was recorded at all downstream during the reporting month. As same rate of fertilizer application are applied to the East Course according to the Turf Grass Management Plan, it is confirmed that former nutrient exceedances are mainly due to the wet season natural variation.
- 4.1.14 Action level of SS and limit level of chlorophyll a, nitrate nitrogen (NO<sub>3</sub>-N) and total inorganic nitrogen (TIN) exceedances were recorded at F\_Inland M and F\_Filter. NO<sub>3</sub>-N and TIN concentrations are well within the wet season natural variation range. Therefore, it is considered that all exceedances are non-project related.
- 4.1.15 The lake 1D is designed for temporary storage to collect the runoff from East Course through the closed low flow drainage system. The water will be recycled and reused as one of the irrigation water sources for the East Course. NO<sub>3</sub>-N, ortho-phosphorus and total phosphorus exceedances were recorded. As there is no overflow / discharge from the Lake 1D to marine or fresh water bodies, no further action has to be taken.
- 4.1.16 The monitoring of pesticides are summarised in **Table 4.1-3**. All applied pesticides were below detection limit.

**Table 4.1-3 Pesticides Monitoring Results (August 2008)**

Date	Monitoring Station	Parameters	Monitoring Result
5 <sup>th</sup> August 08	M_Marsh, TTC, F_Inland_M	Iprodione	Undetectable

## 4.2 Marine Ecology

- 4.2.1 Due to the removal of the temporary barging point, the operation phase coral monitoring was postponed and commenced in July 2008. The July 08 monitoring covering Site D2, Site C and the Control Site served as the baseline for the operation phase.
- 4.2.2 The present Marine Ecological Monitoring Survey was the first monthly monitoring and conducted on 30<sup>th</sup> August 2008. The weather conditions were good and shiny, and the underwater visibility was also good (over 3m). At Site D2, the 20 colonies of natural corals selected during the July 2008 Baseline Survey were recovered and checked for conditions, while at, Site C and the Control Site, the same coral colonies adopted for construction phase monitoring were continuously used for monitoring purposes in operation phase.
- 4.2.3 Some corals in Site C and the Control Site were found missing during the July 2008 baseline monitoring, probably due to the wave actions. Replacement coral colonies were selected (two in Site C and one in Control site) to maintain the number of tagged corals in each site to be 20.
- 4.2.4 Site C was on the south-eastern coast of Kau Sai Chau Island and had a high coral coverage among the sites investigated during the EIA Study. The sizes of coral colonies at Site C were also larger than those at other sites. Site C was away from the boundary of the East course and would not be subject to direct impacts during construction and operation. The site and its vicinity still remained similar conditions as during the Baseline Survey. Among the 20 tagged corals in Site C, C-04 and C-20 were found missing during the July 2008 baseline survey. Replacement coral colonies were selected. For other recovered corals, no mortality or sedimentation was found except C-17 on which about 10% of mortality was observed. But there was no sign of sedimentation or other adverse impacts caused by the East course operation was found. The mortality on C-17 might be caused by natural factors such as attacks from coral-feeding snails. (see **Table 4.2-1** and **Annex E - Photo Plates 4.2-1 to 4.2-2**).
- 4.2.5 Site D2 is close to the desalination plant. The monitoring site was not within area to be directly impacted by the project, but was located about 80m to the south of the existing ferry pier, where an area of hard substrates (bedrock and boulders) was present. The seabed was covered by bedrock. The bedrock cover continued to over 100m south from the pier. It was estimated that less than 5% coverage of corals on the bedrock area, but the sizes of those colonies were fairly large (some reach 30cm). 20 natural corals were selected during the baseline survey in December 2005 (with codes ranging from D-01 to D-20). The distribution of these selected corals ran along the contour of the bedrock, rather than parallel with the coastline as most natural corals occurred along the bed rock edge. Due to no commencement of dredging work for the desalination plant during the construction phase, monitor at Site D2 were not required during the construction phase. As the original baseline monitoring for the corals in Site D2 were conducted over 3.5 years before in December 2005, the previously tagged corals at Site D2 have mostly lost the tags. 20 new corals were selected during the July 2008 baseline monitoring in Site D2 for operation phase monitoring purposes. The species of corals selected in Site D2 included the following 10 species: *Acropora tumida*, *Cyphastrea serailia*, *Favia speciosa*, *Favites chinensis*, *Goniastrea aspera*, *Goniopora columna*, *Gonipora stutchburyi*, *Pavona decussata*, *Porties lobata*, and *Turbinaria peltata*. The conditions, mortality,

sedimentation and bleaching of these 20 corals were shown in **Table 4.2-2** and **Annex E - Photo Plates 4.2-3 to 4.2-4**). No mortality or sedimentation was found

- 4.2.6 The occurrence of seagrasses at Site D2 and Site D3 were checked. No seagrasses were found at Site D2, but an area of about 50m x 60m at Site D3 was found colonized by *Halophila* sp. The conditions of the seagrasses at Site D3 were fair given the summer high temperature.
- 4.2.7 The Control Site is the buoy of coral marker established by AFCD in Sharp Island. Similar with Site C, both the coral coverage percentage and the sizes of coral colonies were high at this site and would not be impacted by the Project. The site and its vicinity still remained similar conditions as during the Construction Phase Monitoring. Coral X-05 was lost in previous construction phase monitoring in June 2006. Replacement coral for X-05 was selected in the present monitoring survey. The remaining 19 tagged corals remained similar conditions as during the July 08 baseline monitoring and construction phase monitoring (**Annex E - Photo Plates 4.2-5 to 4.2-6**). No mortality, sedimentation or bleaching was found on any of the tagged corals (see **Table 4.2-3**).
- 4.2.8 **Photo Plates 4.2-1 to 4.2-6** showed the photos of each tagged corals. The assigned numbers, species, mortality percentage, sedimentation coverage percentage and bleaching percentage of the baseline conditions of tagged corals and their present conditions were presented in **Tables 4.2-1 to 4.2-3** below.

**Table 4.2-1 Conditions of tagged corals at Site C**

Code of tagged corals	Species	Baseline Survey (July 2008)			Monitoring Survey (August 2008)		
		Mortality (%)	Sedimentation (%)	Bleaching (%)	Mortality (%)	Sedimentation (%)	Bleaching (%)
C-01	<i>Platygyra carnosus</i>	0	0	0	0	0	0
C-02	<i>Platygyra carnosus</i>	0	0	0	0	0	0
C-03	<i>Favia speciosa</i>	0	0	0	0	0	0
C-04*	<i>Favia speciosa</i>	Missing	Missing	Missing	0	0	0
C-05	<i>Turbinaria peltata</i>	0	0	0	0	0	0
C-06	<i>Favia speciosa</i>	0	0	0	0	0	0
C-07	<i>Platygyra acuta</i>	0	0	0	0	0	0
C-08	<i>Platygyra acuta</i>	0	0	0	0	0	0
C-09	<i>Favia speciosa</i>	0	0	0	0	0	0
C-10	<i>Platygyra acuta</i>	0	0	0	0	0	0
C-11	<i>Favia speciosa</i>	0	0	0	0	0	0
C-12	<i>Platygyra acuta</i>	0	0	0	0	0	0
C-13	<i>Platygyra carnosus</i>	0	0	0	0	0	0
C-14	<i>Favia speciosa</i>	0	0	0	0	0	0
C-15	<i>Goniopora columna</i>	0	0	0	0	0	0
C-16	<i>Platygyra carnosus</i>	0	0	0	0	0	0
C-17	<i>Goniopora columna</i>	0	0	0	10	0	0
C-18	<i>Platygyra carnosus</i>	0	0	0	0	0	0
C-19	<i>Favites pentagona</i>	0	0	0	0	0	0
C-20**	<i>Goniopora columna</i>	Missing	Missing	Missing	0	0	0

\*The original C-04 has been missing during the construction phase monitoring and a replacement colony of *Favia speciosa* was selected.

\*The original C-20 has been missing during the construction phase monitoring and a replacement colony of *Goniopora columna* was selected.

**Table 4.2-2 Conditions of tagged corals at Site D2**

Code of tagged corals	Species	Baseline Survey (July 2008)			Monitoring Survey (August 2008)		
		Mortality (%)	Sedimentation (%)	Bleaching (%)	Mortality (%)	Sedimentation (%)	Bleaching (%)
D-01	<i>Goniopora columna</i>	0	0	0	0	0	0
D-02	<i>Goniastrea aspera</i>	0	0	0	0	0	0
D-03	<i>Favia speciosa</i>	0	0	0	0	0	0
D-04	<i>Favia speciosa</i>	0	0	0	0	0	0
D-05	<i>Goniastrea aspera</i>	0	0	0	0	0	0
D-06	<i>Goniastrea aspera</i>	0	0	0	0	0	0
D-07	<i>Goniopora stutchburyi</i>	0	0	0	0	0	0
D-08	<i>Turbinaria peltata</i>	0	0	0	0	0	0
D-09	<i>Goniastrea aspera</i>	0	0	0	0	0	0
D-10	<i>Goniastrea aspera</i>	0	0	0	0	0	0
D-11	<i>Favia speciosa</i>	0	0	0	0	0	0
D-12	<i>Turbinaria peltata</i>	0	0	0	0	0	0
D-13	<i>Turbinaria peltata</i>	0	0	0	0	0	0
D-14	<i>Favites chinensis</i>	0	0	0	0	0	0
D-15	<i>Porites lobata</i>	0	0	0	0	0	0
D-16	<i>Turbinaria peltata</i>	0	0	0	0	0	0
D-17	<i>Acropora tumida</i>	0	0	0	0	0	0
D-18	<i>Cyphastrea serailia</i>	0	0	0	0	0	0
D-19	<i>Cyphastrea serailia</i>	0	0	0	0	0	0
D-20	<i>Pavonna descussata</i>	0	0	0	0	0	0

**Table 4.2-3 Conditions of tagged corals at Control Site**

Code of tagged corals	Species	Baseline Survey (July 2008)			Monitoring Survey (August 2008)		
		Mortality (%)	Sedimentation (%)	Bleaching (%)	Mortality (%)	Sedimentation (%)	Bleaching (%)
X-01	<i>Platygyra carnosus</i>	0	0	0	0	0	0
X-02	<i>Platygyra carnosus</i>	0	0	0	0	0	0
X-03	<i>Platygyra carnosus</i>	0	0	0	0	0	0
X-04	<i>Pavona decussata</i>	0	0	0	0	0	0
X-05*	<i>Platygyra carnosus</i>	Missing	Missing	Missing	0	0	0
X-06	<i>Platygyra carnosus</i>	0	0	0	0	0	0
X-07	<i>Platygyra carnosus</i>	0	0	0	0	0	0
X-08	<i>Favites abdita</i>	0	0	0	0	0	0
X-09	<i>Cyphastrea serailia</i>	0	0	0	0	0	0
X-10	<i>Cyphastrea serailia</i>	0	0	0	0	0	0
X-11	<i>Platygyra carnosus</i>	0	0	0	0	0	0
X-12	<i>Platygyra acuta</i>	0	0	0	0	0	0
X-13	<i>Platygyra acuta</i>	0	0	0	0	0	0
X-14	<i>Platygyra acuta</i>	0	0	0	0	0	0
X-15	<i>Platygyra acuta</i>	0	0	0	0	0	0
X-16	<i>Platygyra acuta</i>	0	0	0	0	0	0

Code of tagged corals	Species	Baseline Survey (July 2008)			Monitoring Survey (August 2008)		
		Mortality (%)	Sedimentation (%)	Bleaching (%)	Mortality (%)	Sedimentation (%)	Bleaching (%)
X-17	<i>Favia speciosa</i>	0	0	0	0	0	0
X-18	<i>Platygyra acuta</i>	0	0	0	0	0	0
X-19	<i>Goniastrea aspera</i>	0	0	0	0	0	0
X-20	<i>Cyphastrea serailia</i>	0	0	0	0	0	0

\* The original X-05 has been missing during the construction phase monitoring and a replacement colony of *Platygyra carnosus* was selected.

### 4.3 Landscape & Visual

- 4.3.1 The landscape work is not yet completed by the Contractor. The operation phase monitoring will commence when the Final Landscape Plan is available from the Contractor.

### 4.4 Soil Nutrient

- 4.4.1 No soil nutrient was taken and reported during this reporting month. The sampling will be carried out in October 2008 and available in November 2008.

## **5. Conclusions**

- 5.1.1 The Environmental Monitoring and Audit (EM&A) Report presents the operational EM&A works undertaken during the period from 25<sup>th</sup> July to 24<sup>th</sup> August 2008 in accordance with EM&A Manual and the requirement under EP-224-2005/A.
- 5.1.2 Exceedances on marine stations are recorded and considered non-project related. The exceedances are mainly due to the natural variation.
- 5.1.3 Exceedances on fresh water stations are recorded and considered non-project related for downstream B (F\_DB). The exceedances are mainly due to wet season variation. Very low concentrations of exceedance record were found at F\_Inland M, F\_Filter and Lake 1D, it is considered non project-related.
- 5.1.4 Application of discharge licence of the desalination plant is in progress. Marine water monitoring location at M\_RO2 is not required.
- 5.1.5 The first monthly coral monitoring was conducted in the August 2008. No coral mortality was recorded except C-17 located at Site C which about 10% of mortality was observed. As there was no sign of sedimentation or other adverse impacts caused by the East course operation, it is considered non project-related.
- 5.1.6 The landscape work is not yet completed by the Contractor. The operation phase monitoring will commence when the Final Landscape Plan is available from the Contractor.
- 5.1.7 No environmental complaint / summon was received during the reporting month.