

Public Golf Course at Kau Sai Chau Island, Sai Kung
Operation Phase
Environmental Monitoring & Audit (EM&A) Report
for January 2010

(Report No. 382812/0201/023)

Report Authorized For
Issue By:



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Executive Summary

This is the twenty-third 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 January 2010 (25th December 2009 to 24th January 2010).

Water Quality

2 sets of water quality monitoring were carried out on 4th and 20th January 2010 at 9 marine and 6 freshwater monitoring locations. For F_Filter (fresh water station), no filter effluent was discharging during sampling, thus no water sample was taken. No rainstorm event was recorded during this reporting month.

No exceedance was found for marine monitoring stations. Two exceedance (chlorophyll a) were found at F_DA & F_DC during the report month which is considered non project-related.

According to the approved revised pesticides monitoring plan at East Course, the monitoring will reduce to bi-monthly during dry season (i.e. December and February only). Monthly monitoring for pesticides is required during wet season (i.e. April to October). The bi-monthly pesticides monitoring will commence in February 2010.

Marine Ecology

The upcoming coral monitoring will be carried out in February 2010 (dry season).

Soil Nutrient

The soil sampling was carried out in November 2009 and the completed in January 2010.

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 **January 2010**.

1.2 Purpose of the Report

1.2.1 This is the **twenty-third** EM&A report which summarizes the impact monitoring results and audit findings for the EM&A programme during the reporting period from **25th December 2009 to 24th January 2010**.

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

Section		Description
1	Introduction	Details the scope and structure of the report
2	Project Information	Summarizes background and scope of the project and site description
3	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.
4	Monitoring Results	Summarizes the monitoring results obtained in the reporting period.
5	Environmental Non-conformance	Summarizes any monitoring exceedance, environmental complaints and environmental summons within the reporting period.
6	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

Impacts	Parameters/descriptions	Locations	Frequencies
Water Quality	Dissolved Oxygen, Temperature, Turbidity, pH, Salinity, SS, NO3-N, NO2-N, NH3-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, NO3-N, NO2-N, NH3-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.
Marine Ecology	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.
Landscape and Visual	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.
Soil Nutrient	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
Chlorophyll a (mid-depth)	All	0.5 µg/L	All	0.6 µg/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 NH₃-N, NO₂-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 ⁽¹⁾
Turbidity (NTU)	-
Dissolved Oxygen	>4 ⁽¹⁾
Chlorophyll a (mg/m ³)	<5 ⁽¹⁾
Nitrate N	0.20 ⁽¹⁾
Nitrite N	0.20 ⁽¹⁾
Ammoniacal N	0.50 ⁽¹⁾
Total Kjeldahl N	1.2 ⁽²⁾
Total Phosphate	0.1 ⁽¹⁾
Ortho Phosphate	0.05 ⁽¹⁾
Conductivity (µS/cm)	<1000 ⁽¹⁾

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

(2) Based on 90th 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
DO (Surface & Middle)	FCZ	6.0 mg/L	FCZ	5.3 mg/L
	All except FCZ	4.9 mg/L	All except FCZ	4.6 mg/L
DO (Bottom)	All	3.7 mg/L	All	3.4 mg/L
pH (depth-averaged)		N/A	All	6.5 - 8.5
SS (Depth-averaged)☆	FCZ	4.5 mg/L	FCZ	5.6 mg/L
	All except FCZ	6.1 mg/L	All except FCZ	10.6 mg/L
SS (Depth-averaged) Dredging for submarine pipelines⊕	M_RO1	6.1 mg/L	M_RO1	10.6 mg/L
Turbidity (Tby) (depth-averaged) ☆	FCZ	2.9 NTU☼	FCZ	3.9 NTU☼
	All except FCZ	3.3 NTU☼	All except FCZ	6.2 NTU☼
Ammonia Nitrogen (depth-averaged)	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
Nitrate Nitrogen (depth-averaged)	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
Nitrite Nitrogen (depth-averaged)	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
TIN (depth-averaged)	FCZ	0.12 mg/L	FCZ	0.14 mg/L
	All except FCZ	0.16 mg/L	All except FCZ	0.18 mg/L
Total Phosphorus (depth-averaged)	All	0.09 mg/L Δ	All	0.09 mg/L Δ
Chlorophyll a (depth-averaged)	FCZ	1.8 µg/L	FCZ	2.2 µg/L
	All except FCZ	3.8 µg/L	All except FCZ	6.8 µg/L

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 NO₂-N) at non-FCZ stations, the trigger level has made reference to the existing golf course guideline values. The guideline value of NO₂-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 NO₂-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 (NO₃-N), nitrite nitrogen (NO₂-N), ammonia nitrogen (NH₃-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, EPD¹ 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)	<p>Marine Water Fish culture zone stations: TTC, KLW, KS</p> <p>Control stations: M_A, M_B</p> <p>Impact stations: M_RO1, M_RO2, M_Marsh, M_Coral</p> <p>Freshwater Water 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)</p>	<p>Bi-weekly</p> <p><u>Marine water</u> : 2 times per day – 1 for mid-flood and 1 for mid-ebb</p> <p><u>Freshwater</u> : Mid-depth per trip</p>	<p>3 individual water depth samples (surface, middle & bottom)</p>
Temperature (°C)			
Turbidity (NTU)			
pH			
Salinity (ppt)			
Suspended Solids (mg/L)			
Nutrients ²			
Chemicals ³	<p>Monthly (wet season) and Bi-Monthly (dry season)</p> <p><u>Marine water</u> : 2 times per day – 1 for mid-flood and 1 for mid-ebb</p> <p><u>Freshwater</u> : Mid-depth per trip</p>	<p>1 composite sample (combine surface, middle and bottom) with replicate</p>	

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

¹ 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.

² 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).

³ 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⁻¹ 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 m³/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 ₃ ⁻	0.01 mg/L
Nitrite Nitrogen	APHA 4500-NO ₂ ⁻	0.01 mg/L
Ammonia Nitrogen	APHA 4500-NH ₃ (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.
- 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.
- 3.3.2 Landscape and Visual Audit conducted during the Operational Phase of the project to follow up the compensatory planting under the requirements of the EIA for Proposed Extension of Public Golf Course at Kau Sai Chau , Sai Kung.
- 3.3.3 Under the Environmental Impact Assessment for the above, the proposed mitigation measures included both the compensatory planting works and treatment to structures. As stated in paragraphs 8.3 of the EM&A Manual, the contractor shall maintain all soft landscape works for a period of 12 months after implementation. This period shall be the establishment period and will be year one of the operation phase. Auditing inspections and reporting shall be undertaken once every two months of the operation phase.

Scope of Audit

- 3.3.4 The broad scope of the audit on mitigation measures during operation phase of East Course is to monitor the maintenance operations of tree planting to ensure all compensatory plants are well developed and grow during the Establishment Period. 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. The desalination plant commenced operation in December 2008.

4.1.3 Monitoring of marine and freshwater locations was conducted on 2 occasions in January 2010 (4th and 20th January 2010). The QA/QC results for laboratory testing in the reporting month are acceptable and summarised in **Annex D**. No rainstorm signal was recorded during the reporting month.

4.1.4 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. Summary of fertilizer and pesticides applications are summarized in **Annex E**.

4.1.5 Chemical application according to the approved turfgrass management plan was applied during the reporting month.

Marine water

4.1.6 No exceedance was recorded during the reporting month.

Fresh water

4.1.7 Two exceedance (chlorophyll a at F_DA and F_DC) were recorded during the reporting month. The average chlorophyll a value is 0.6 µg/L which is considered low. Therefore, exceedance found was due to natural variation of the stream. Therefore, it is consider non project-related.

Table 4.1-1 Fresh Water Monitoring Results (December 2009 to January 2010)

Monitoring Location	Exceedance Level	Date	Parameters	Project-related
F_DA	Action Level	4 Jan 2010	Chl a	No
F_DC	Limit Level	4 Jan 2010	Chl a	No

4.1.8 As the pesticide monitoring was reduced to bi-monthly during dry season, monitoring will be carried out during next reporting month.

4.2 Marine Ecology

4.2.1 The final semi-annual (dry season) coral monitoring will be carried out in February 2010 (dry season).

4.3 Soil Nutrient

4.3.1 The soil sampling was carried out since November 2008. **Table 4.3-1** following results shows the summary of the full monitoring period. The soil nutrients trend throughout the 2-year monitoring period at East Course is shown in **Annex C**.

Table 4.3-1 Soil Nutrient at East Course (November 2008 to November 2009)

	Ca	Mg	K	P	S	B	Fe	Mn	Cu	Zn	Na	pH
Green												
Average	553	70	131	62	22	0.6	286	57	4	18	43	7.7
min	240	45	49	28	5	0.3	196	33	0.83	2	21	6.7
max	1115	99	294	148	71	1.3	397	73	25.3	88	67	8.6
SD	222	12	55	26	15	0.3	55	9	3.7	17	13	0.5
Fairway												
Average	648	89	99	41	12	0.6	360	57	1	4	50	7.7
min	244	49	25	14	6	0.2	125	29	0.5	2	25	6.2
max	1918	123	231	83	23	1.5	852	91	3.6	17	78	8.6
SD	350	17	49	16	4	0.3	107	13	0.5	2	16	0.5
Tee												
Average	723	98	153	57	11	0.6	333	59	1	5	48	7.6
min	194	48	44	17	5	0.2	137	20	0.56	1	23	6.3
max	2021	149	427	120	31	2.2	552	90	8.1	24	78	8.6
SD	514	19	84	20	4	0.3	116	17	0.9	3	15	0.5

5. Conclusions

- 5.1.1 The Environmental Monitoring and Audit (EM&A) Report presents the operational EM&A works undertaken during the period from 25th December 2009 to 24th January 2010 in accordance with EM&A Manual and the requirement under EP-224-2005/A.
- 5.1.2 No exceedance at marine station was found while two exceedance (chlorophyll a) were recorded at fresh water stations. No rainstorm event was recorded during reporting month.
- 5.1.3 The final semi-annual dry season coral monitoring will be carried out in February 2010.
- 5.1.4 The soil sampling was taken in November 2009 and the analysis results were presented in this report.
- 5.1.5 No environmental complaint / summon was received during the reporting month.

Annex A

Monitoring Programme for the reporting month

December 2009						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
20	21	22	23	24	25	26
27	28	29	30	31		
January 2010						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4 WQ	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20 WQ	21	22	23
24	25	26	27	28	29	30
31						

WQ: Water Quality Monitoring (WQ); Rainstorm Water Sampling (RWQ)
 ME: Marine Ecology

Annex B

Event Action Plan

Event and Action Plan for Water Quality

Should monitoring results of the water quality parameters at any designated monitoring station exceed the water quality criteria related to turf management, action the proposed actions to be taken shall be as follows:

- inform Golf Course Manager immediately and stop chemical application;
- notify EPD and AFCD;
- review the application and re-evaluate suitability and availability of alternatives to chemical controls, etc.;
- agree remedial measures with Golf Course Manager and inform EPD and AFCD;
- implement the agreed remedial measures immediately; and
- increase monitoring frequency and/or locations to demonstrate effectiveness of the remedial measures.

Action and Limit level and Event Action Plan for natural corals monitoring

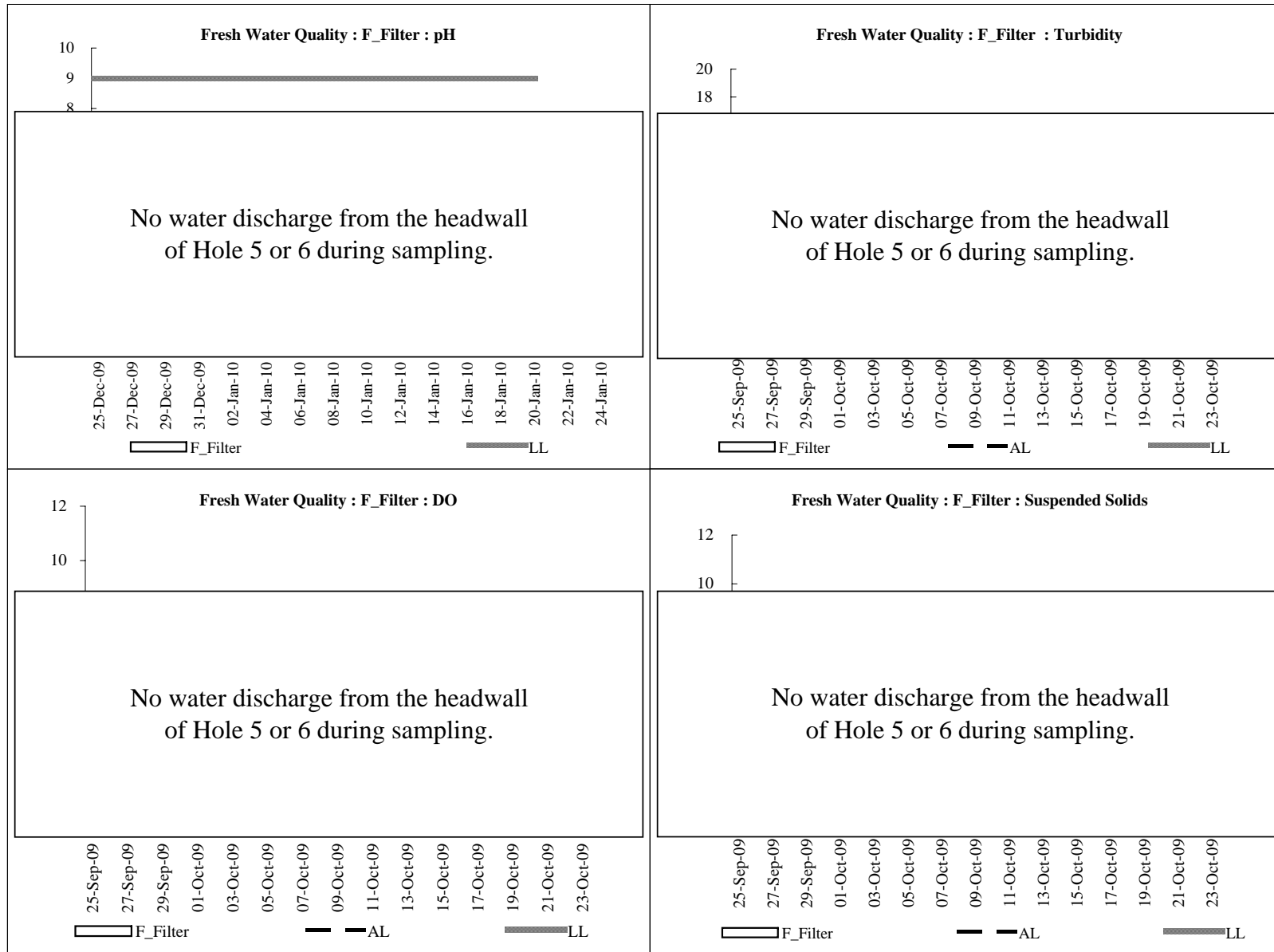
Parameters	Action Level	Limit Level
Sedimentation	a 15% increase in the percentage of sedimentation on the hard corals occurs at more than 20% of the tagged coral colonies at one or more monitoring sites	a 25% increase in the percentage of sedimentation on the hard corals occurs at more than 20% of the tagged coral colonies at one or more monitoring sites
Bleaching	a 15% increase in the percentage of bleaching of hard corals occurs at more than 20% of the tagged coral colonies at one or more monitoring sites	a 25% increase in the percentage of bleaching of hard corals occurs at more than 20% of the tagged coral colonies at one or more monitoring sites
Mortality	a 15% increase in the percentage of partial mortality of corals occurs at more than 20% of the tagged coral colonies at one or more monitoring sites	a 25% increase in the percentage of partial mortality of corals occurs at more than 20% of the tagged coral colonies at one or more monitoring sites

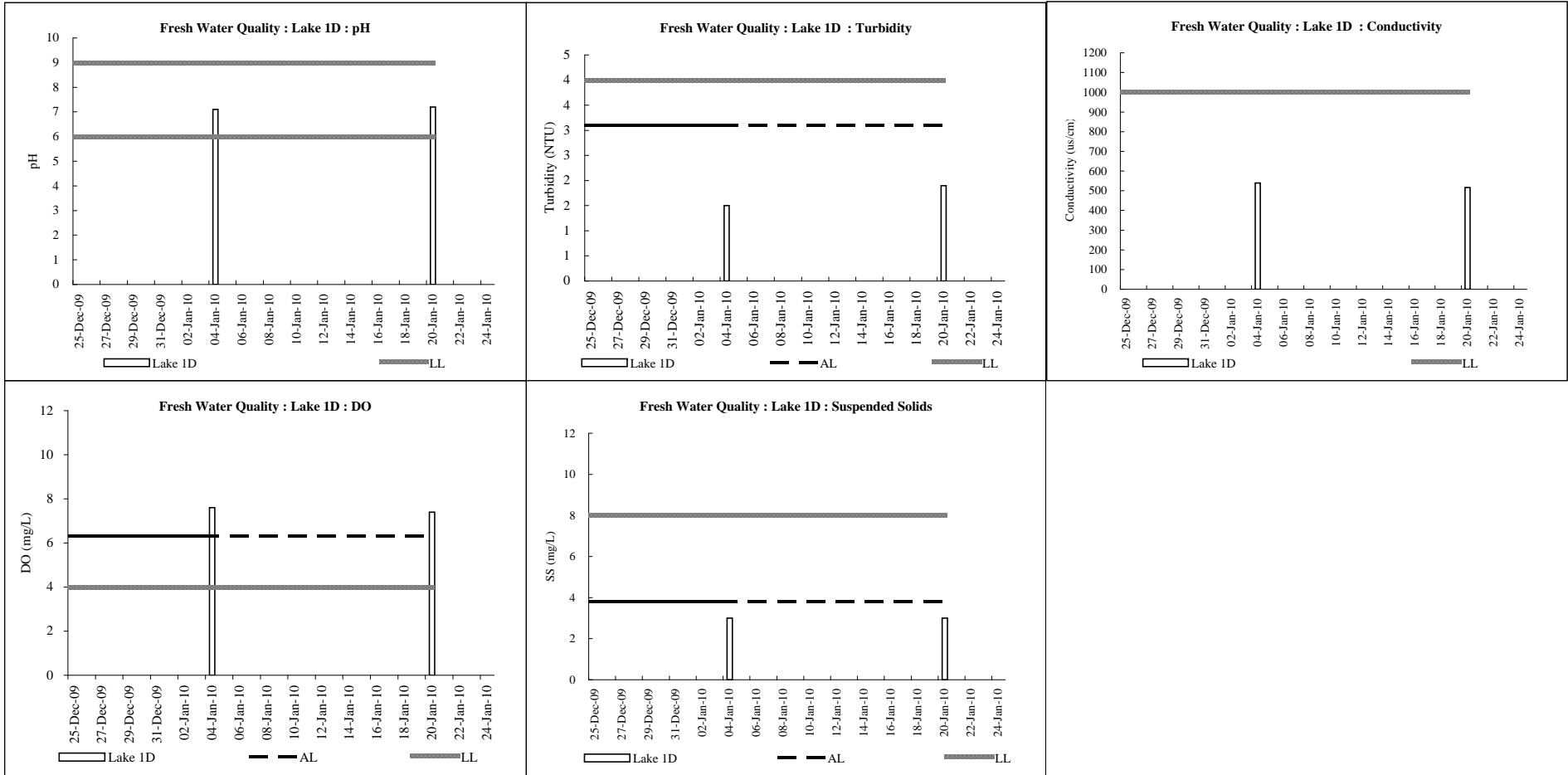
Action	Action Level	Limit Level
Operation phase	If the Action Level is exceeded the ET Leader should inform Golf Course Operator, EPD, and AFCD. The data from the water quality monitoring should also be reviewed. If the water quality monitoring shows no attributable effects of the installation works, then the Action Level is not triggered. If the water quality data indicate exceedances (salinity and/or pesticides) the ET Leader should discuss with the Golf Course Operator the most appropriate method of reducing salinity (e.g. reduce the daily operation time of the desalination plant), and/or control chemicals from runoff (e.g. reduce the frequency and quantity of chemical applied, check the intactness and effectiveness of the closed drainage system and stream buffer zone). This mitigated method should then be enacted on the next working day.	If the Limit Level is exceeded the ET Leader should inform all parties Golf Course Operator, EPD, and AFCD immediately. Should the Limit Level be exceeded, the Golf Course Operator should stop the operation of the desalination plant and/or the application of chemicals immediately and work out the solution according to the requirements of EPD and AFCD. The operation of the desalination plant and/or the application of chemicals would be suspended until an effective solution is identified.

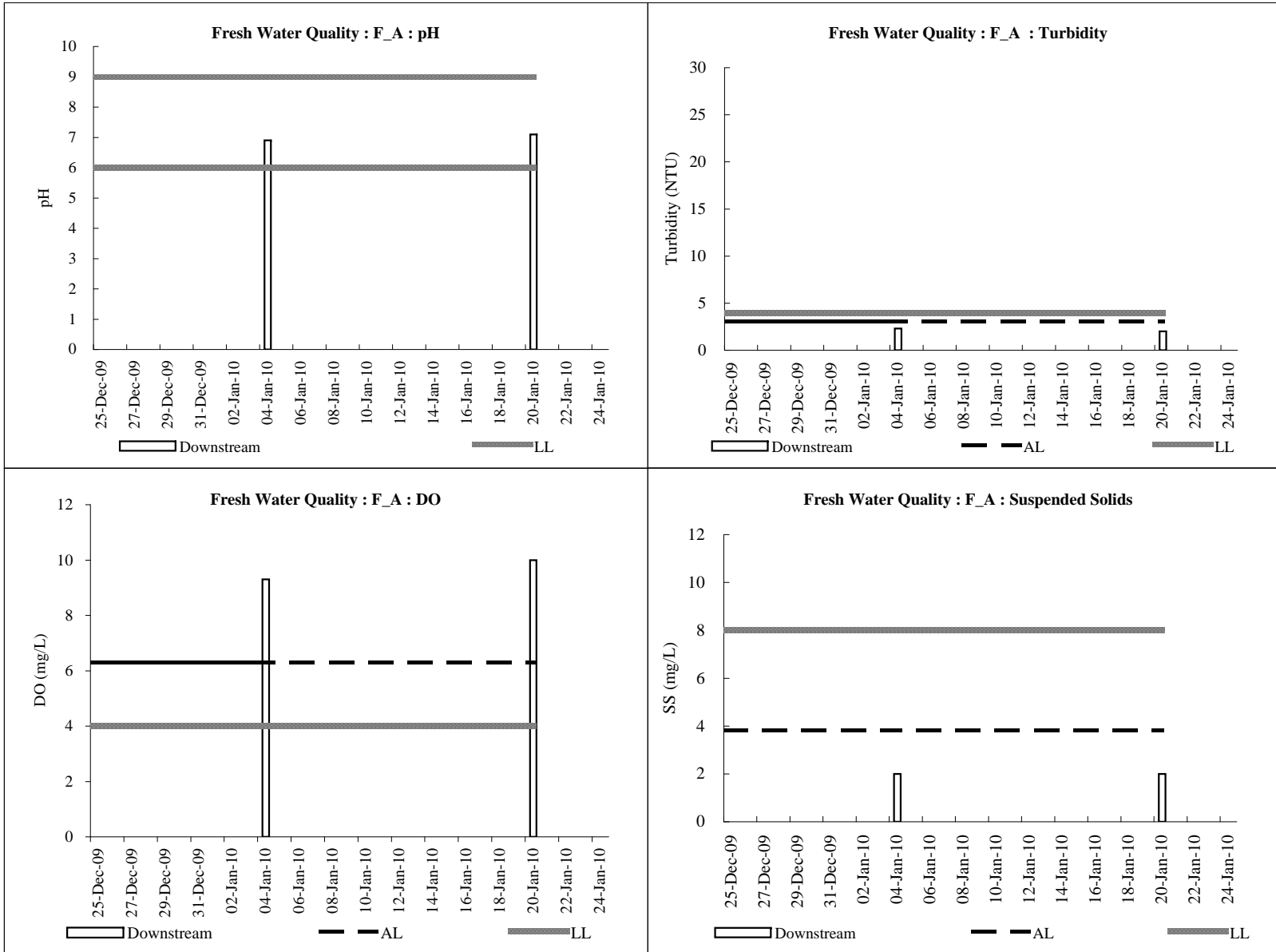
Annex C

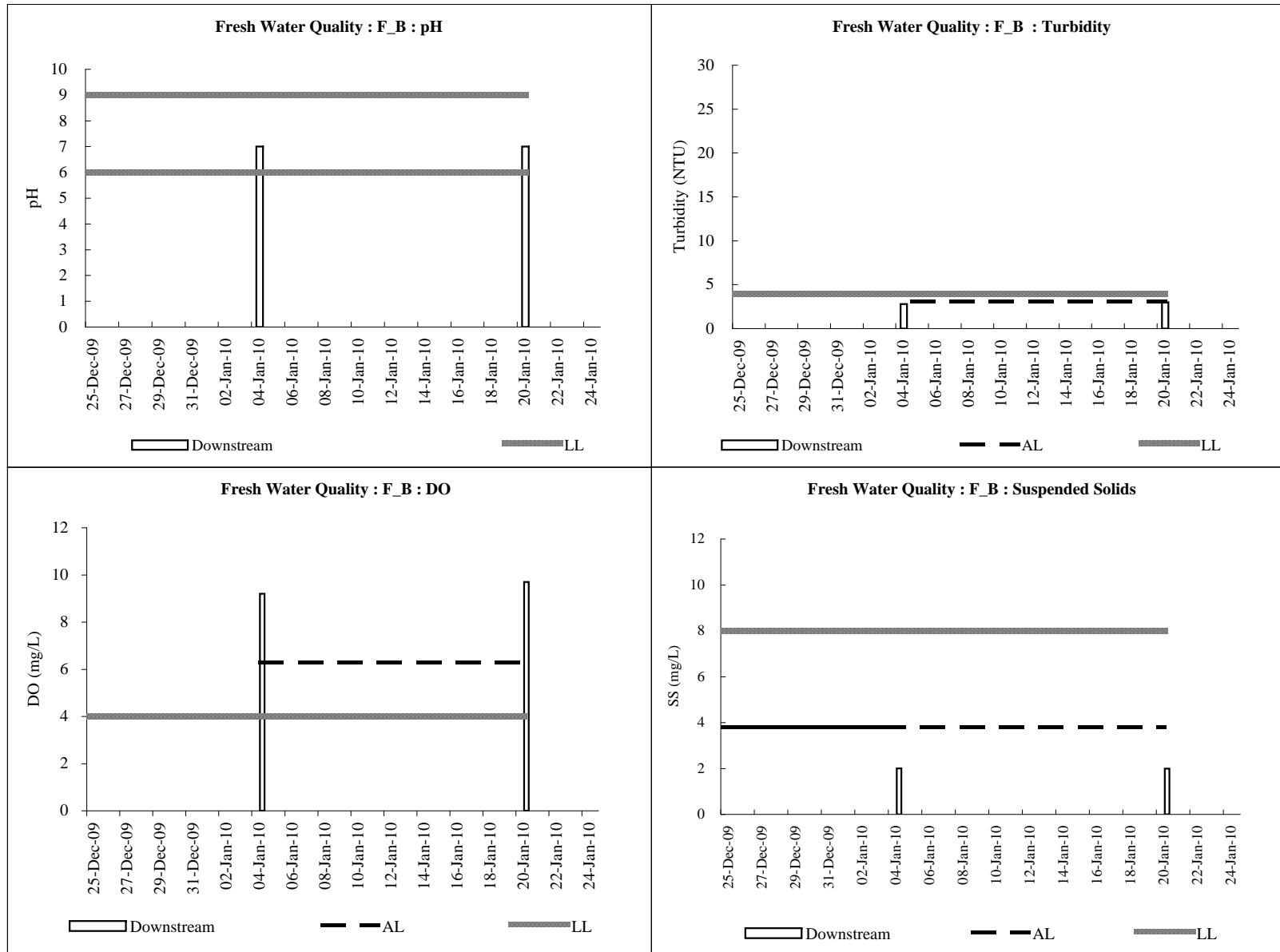
Monitoring results

Water Quality



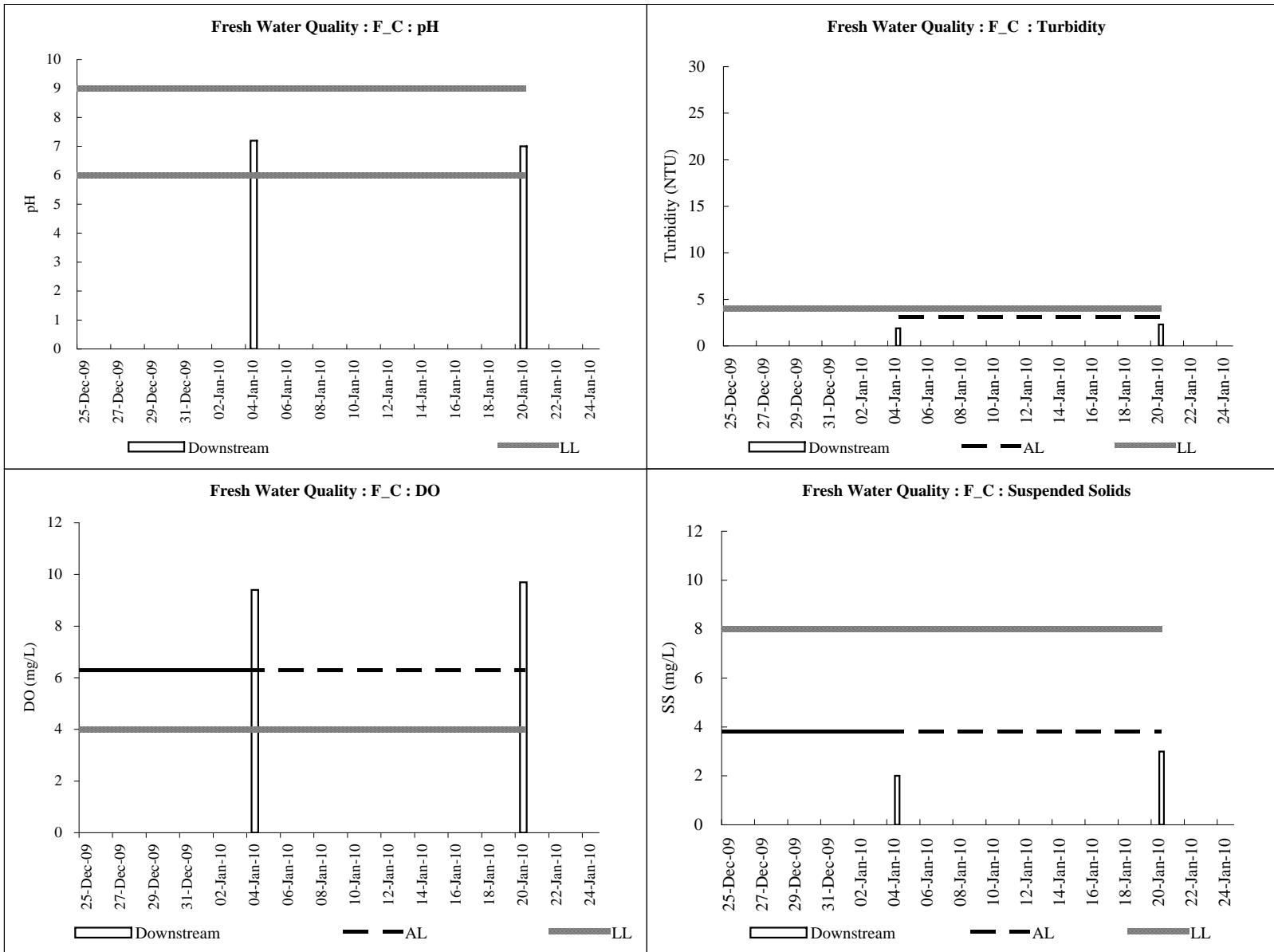






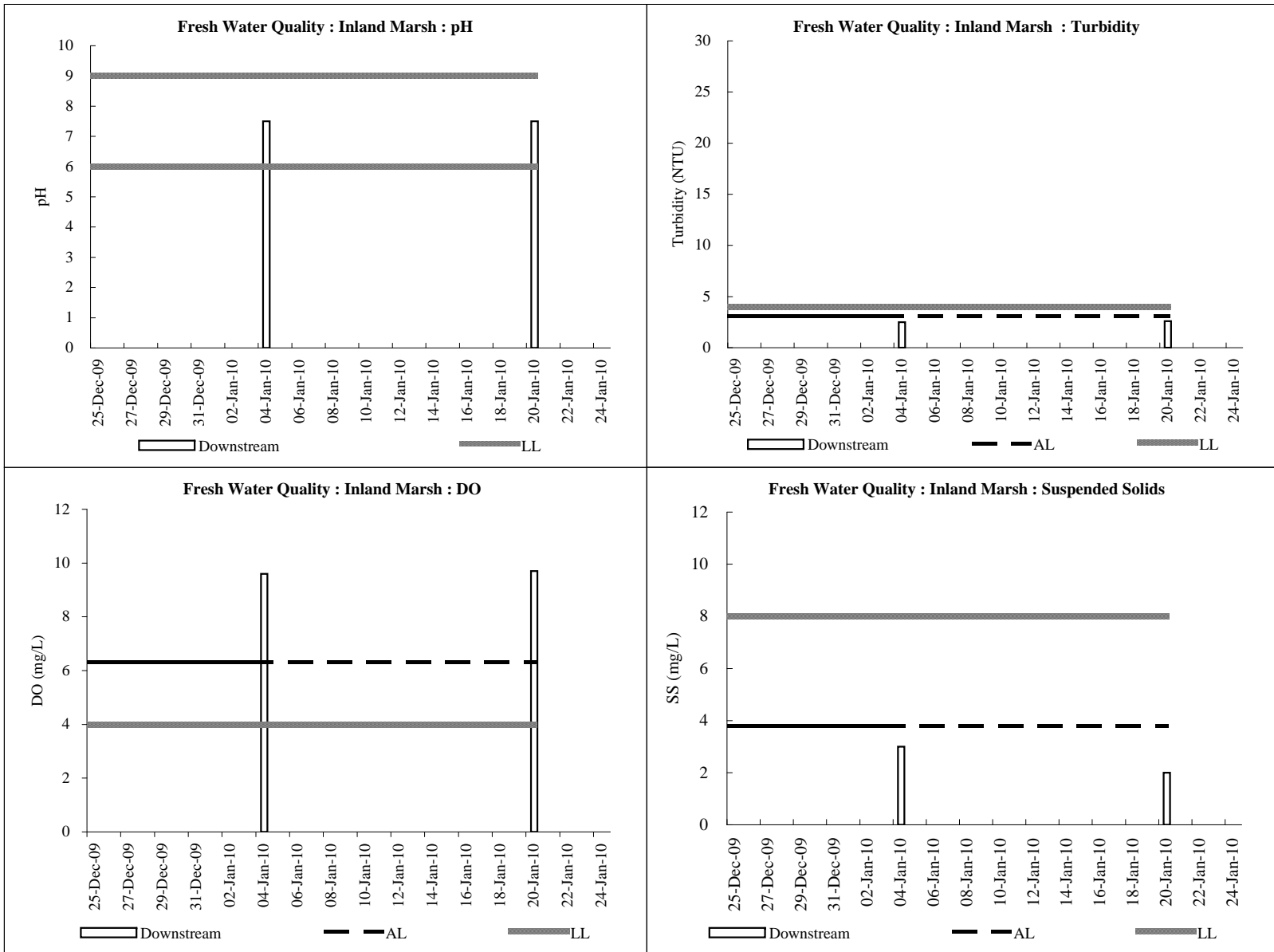
Jockey Club Kau Sai Chau Public Golf Course - East Course
Water Quality Monitoring Results

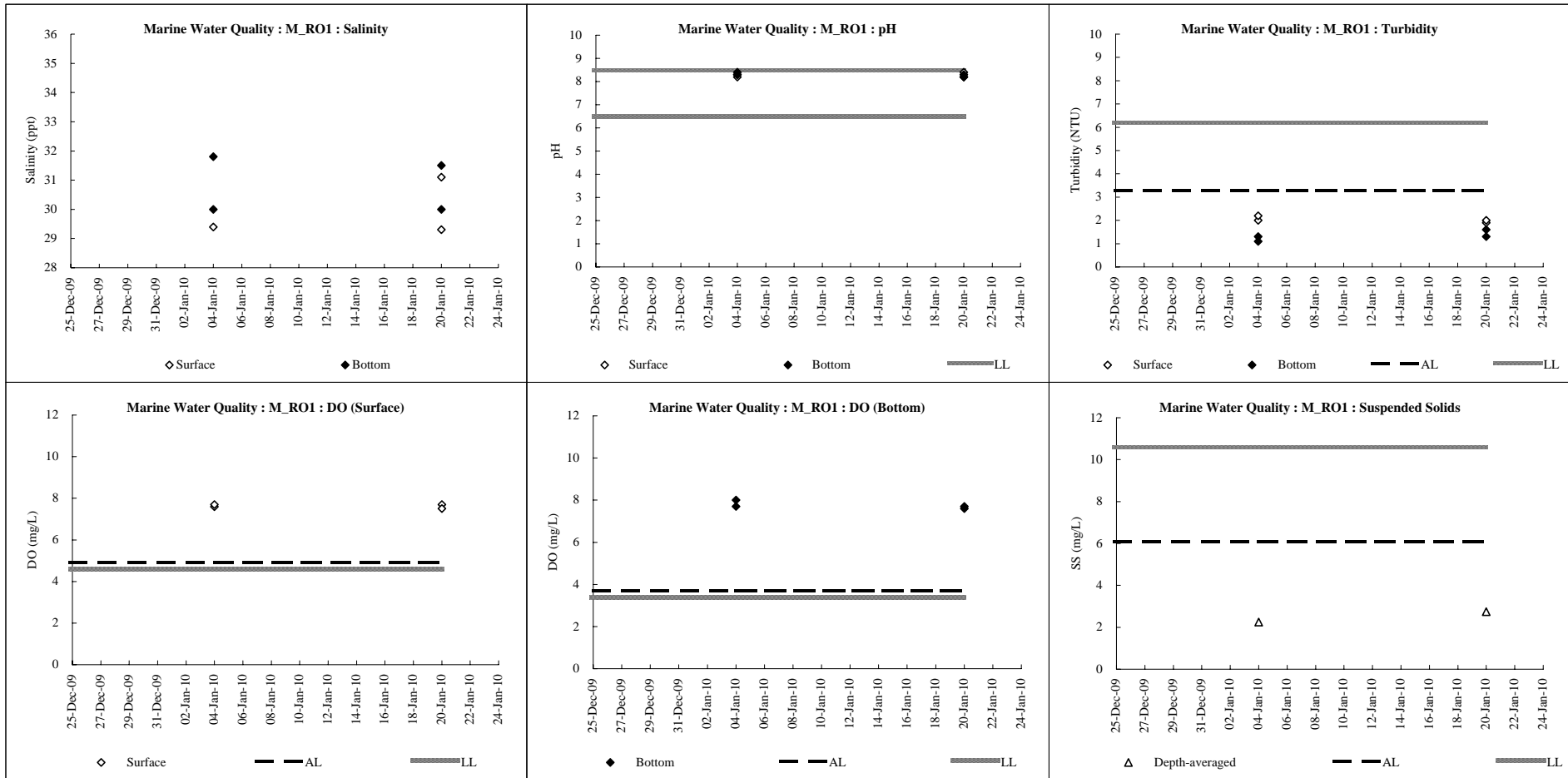
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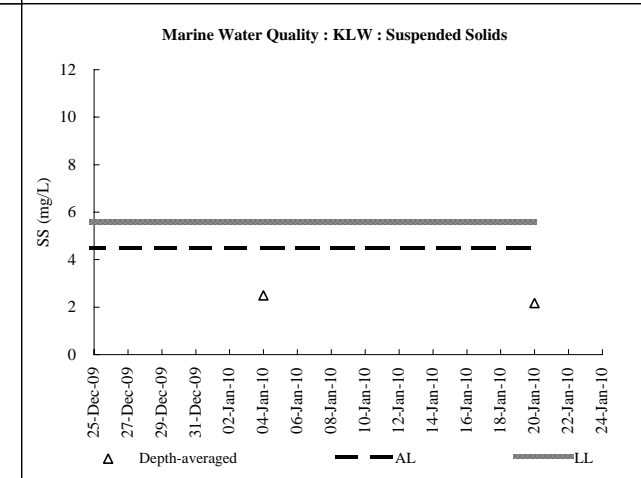
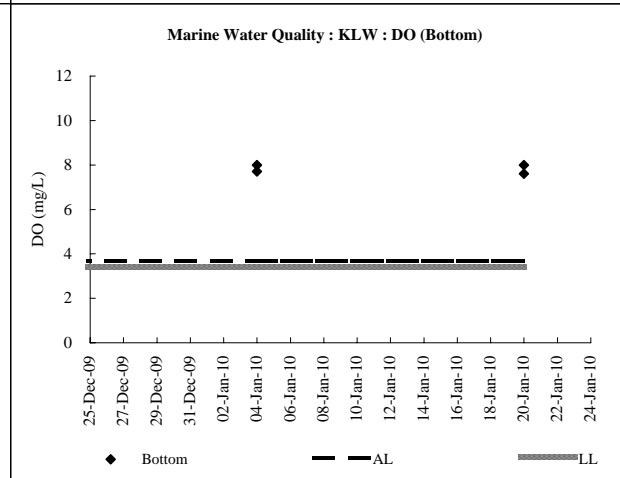
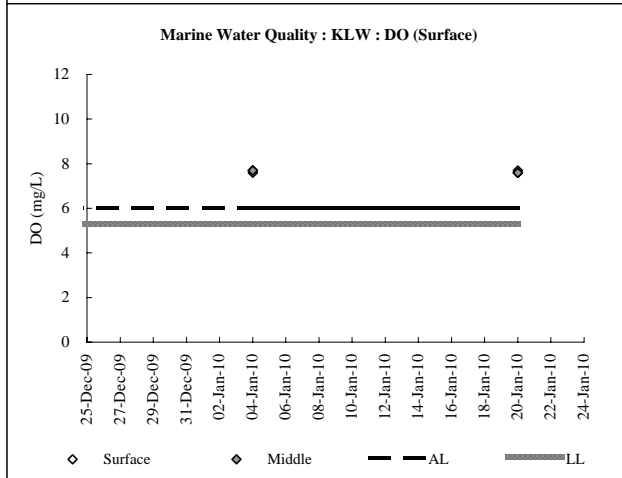
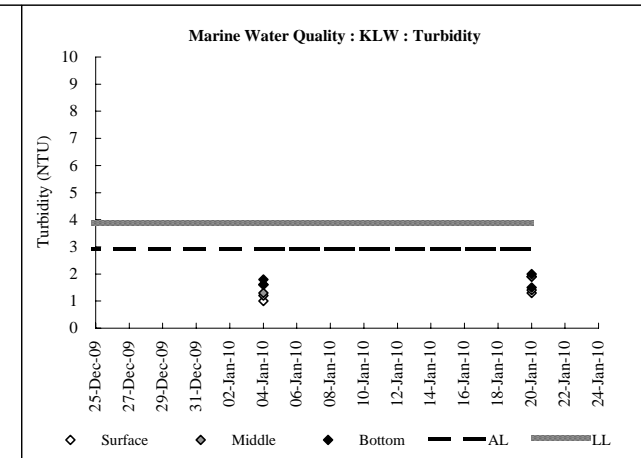
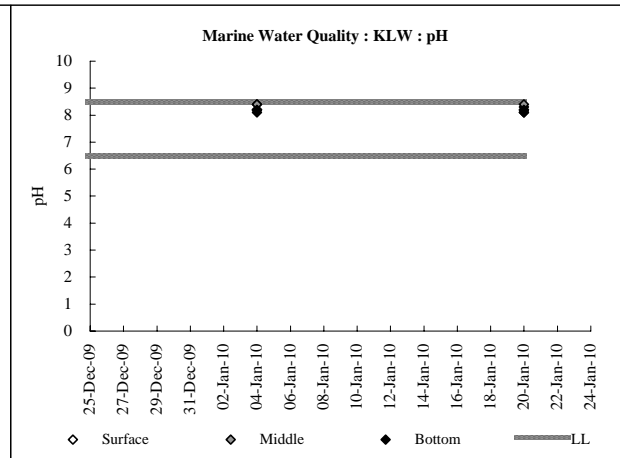
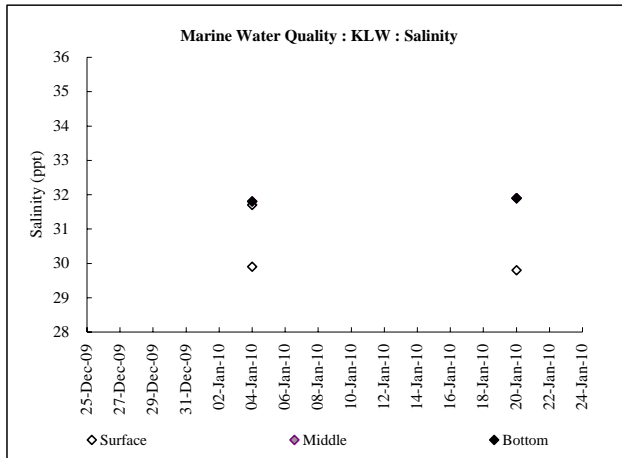


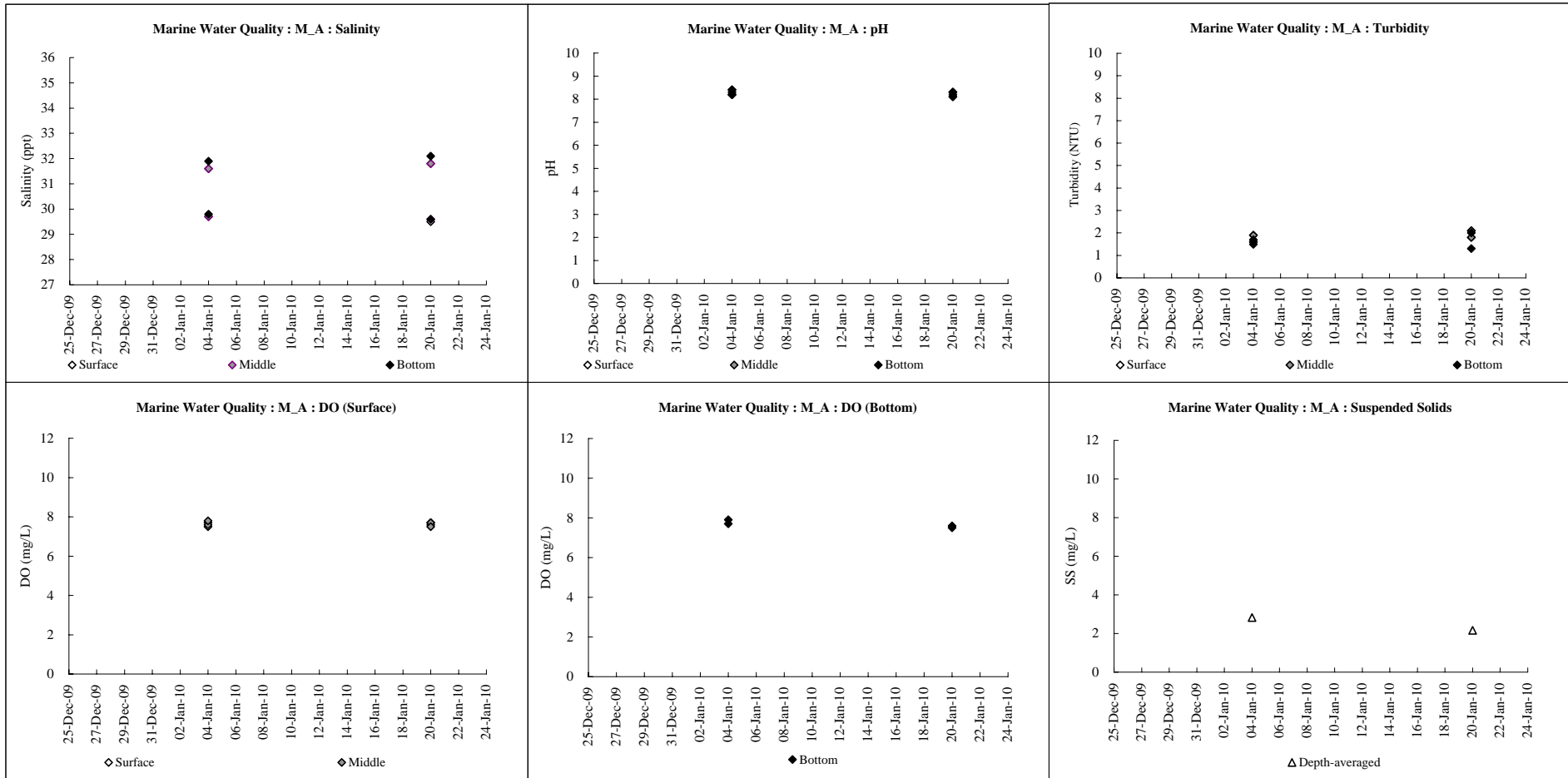
Jockey Club Kau Sai Chau Public Golf Course - East Course
 Water Quality Monitoring Results

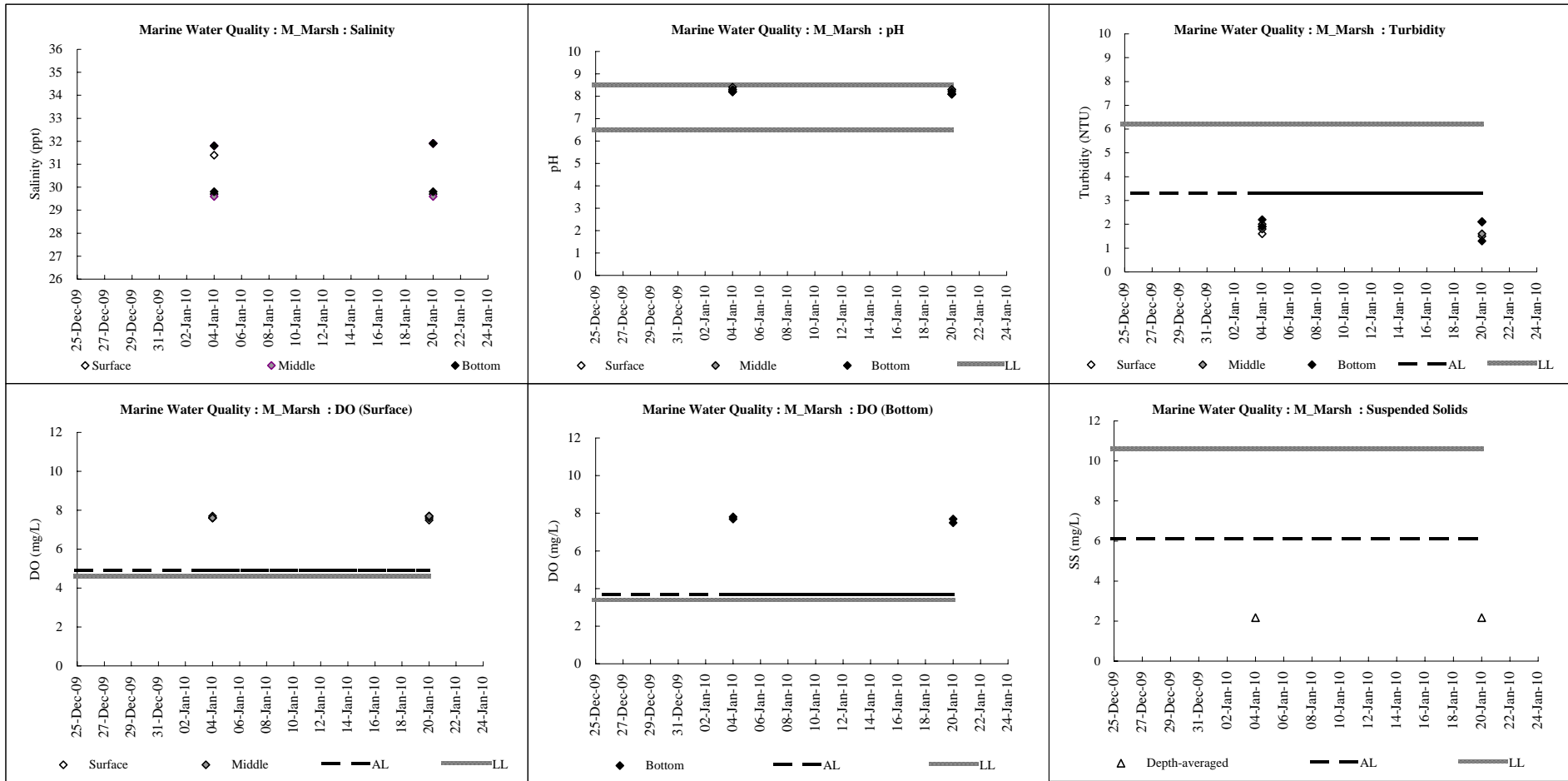
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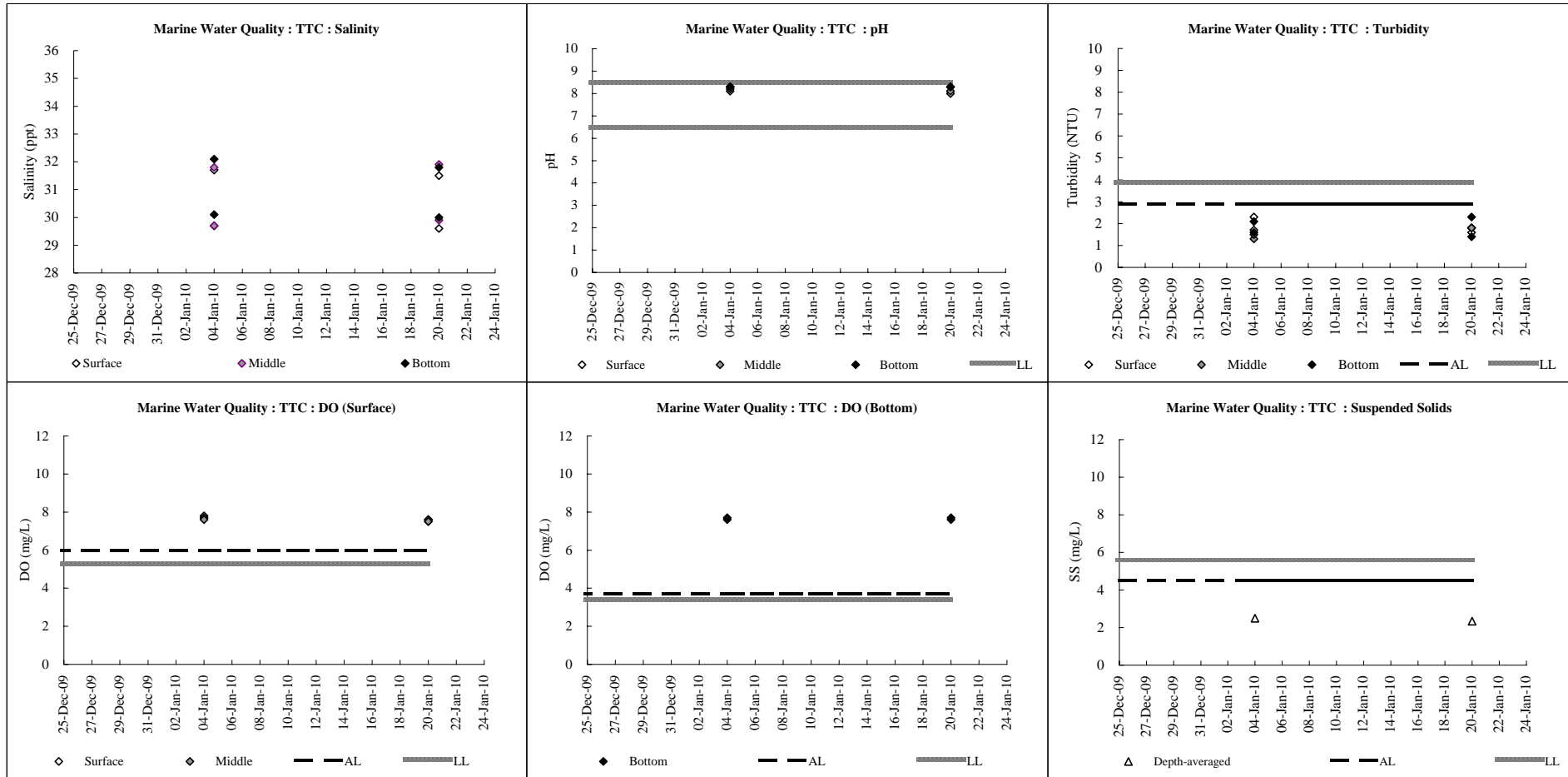


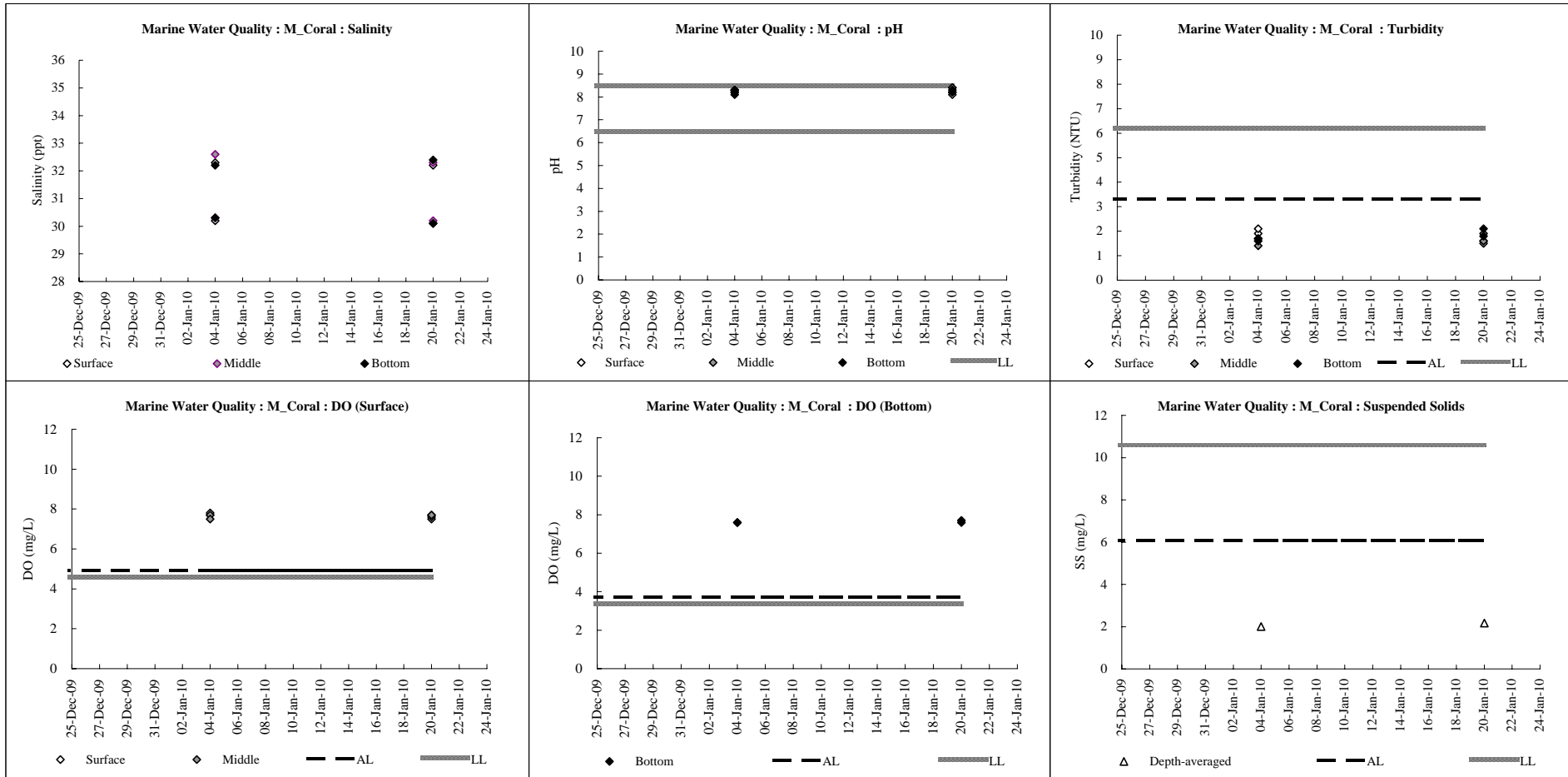


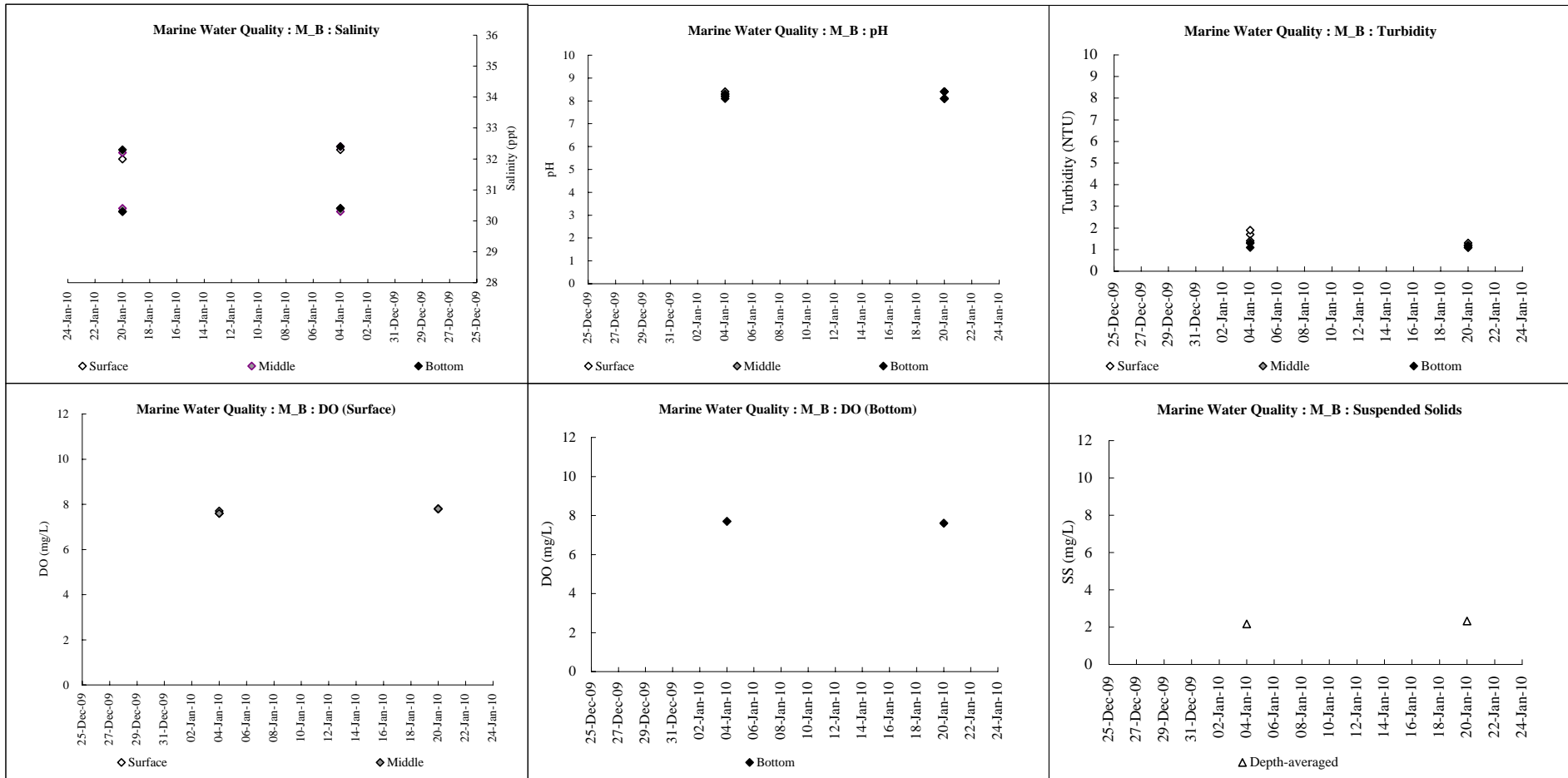


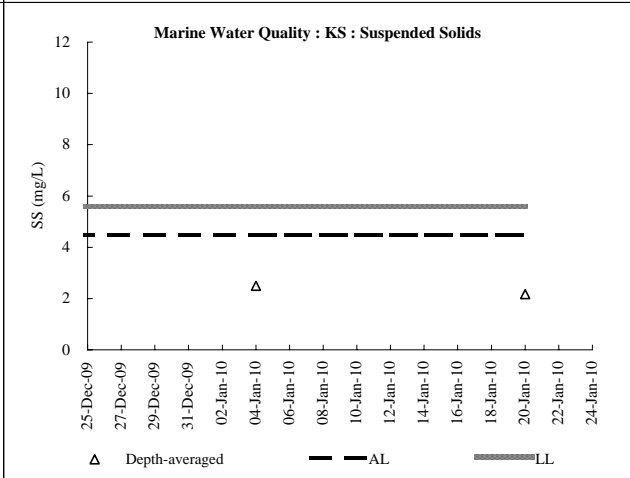
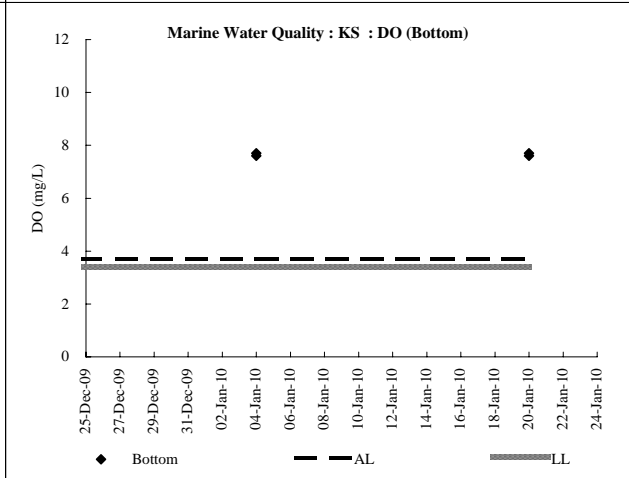
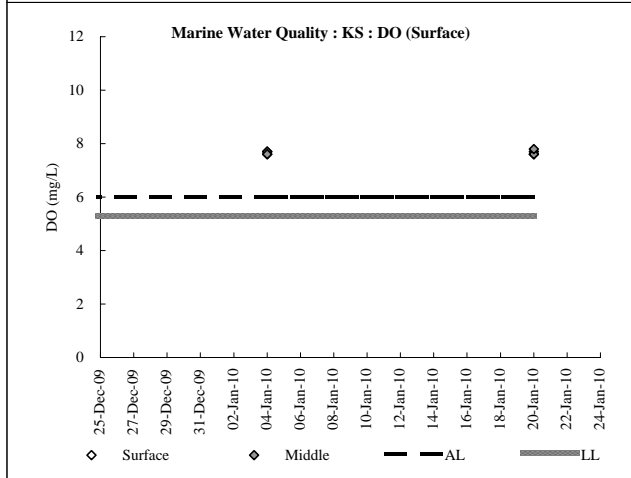
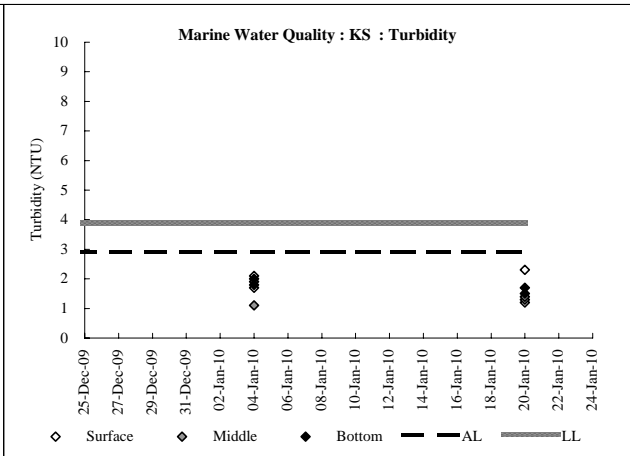
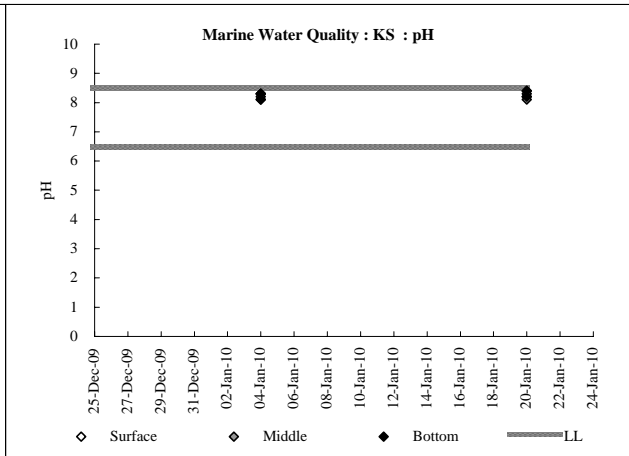
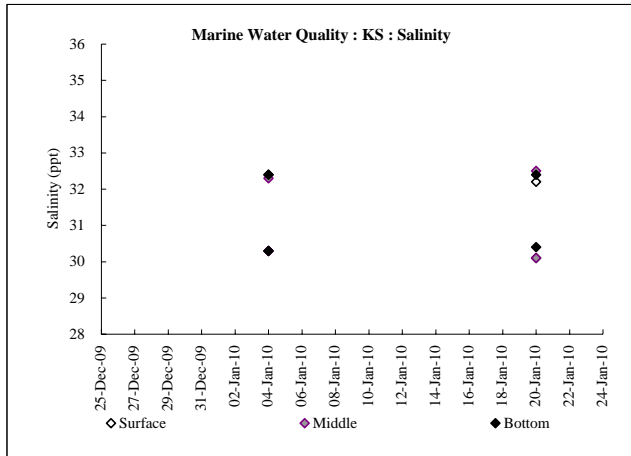


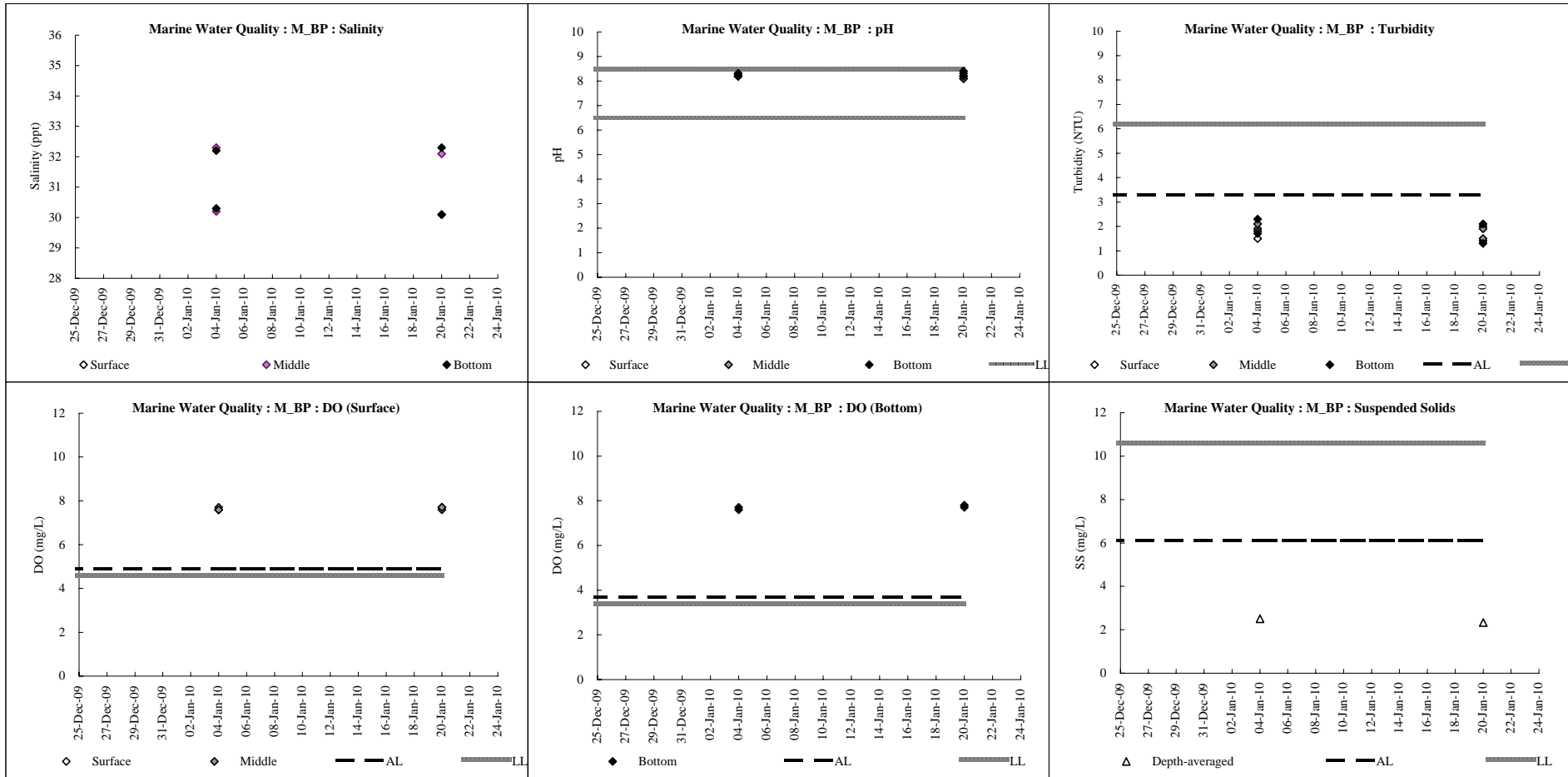


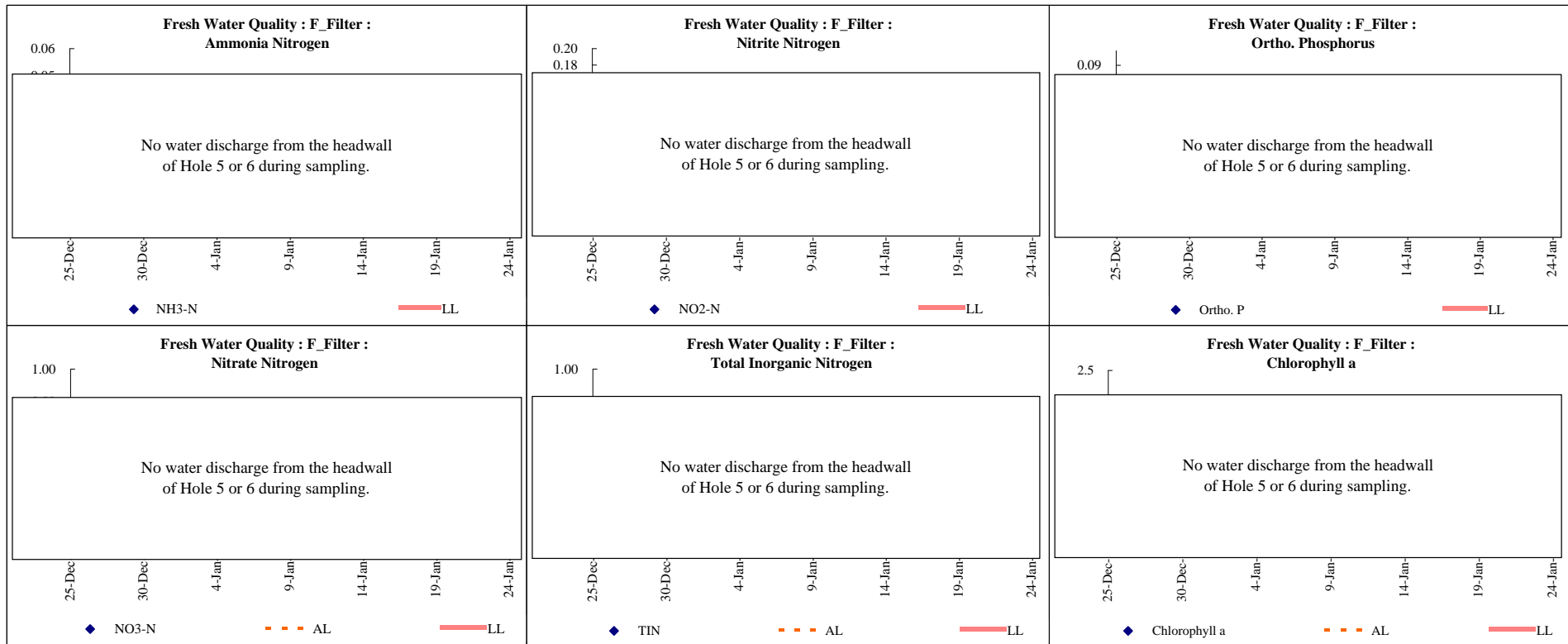


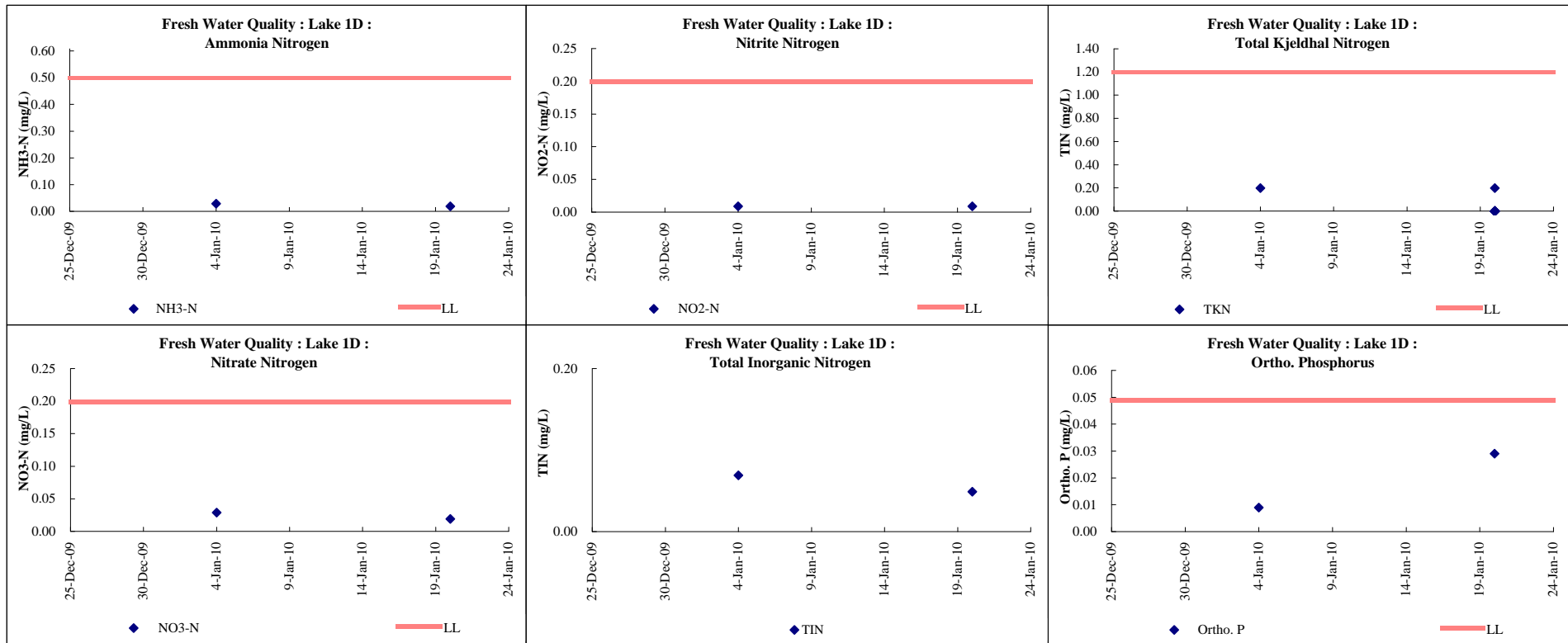


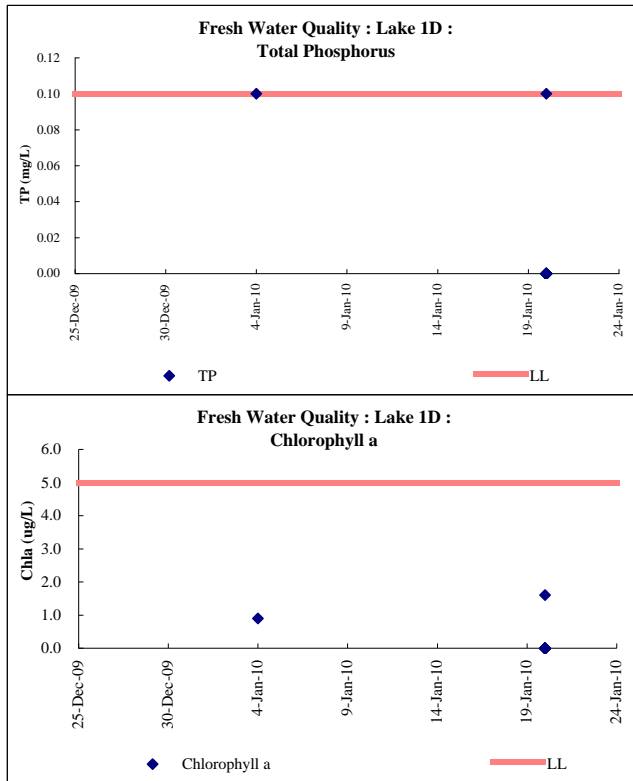


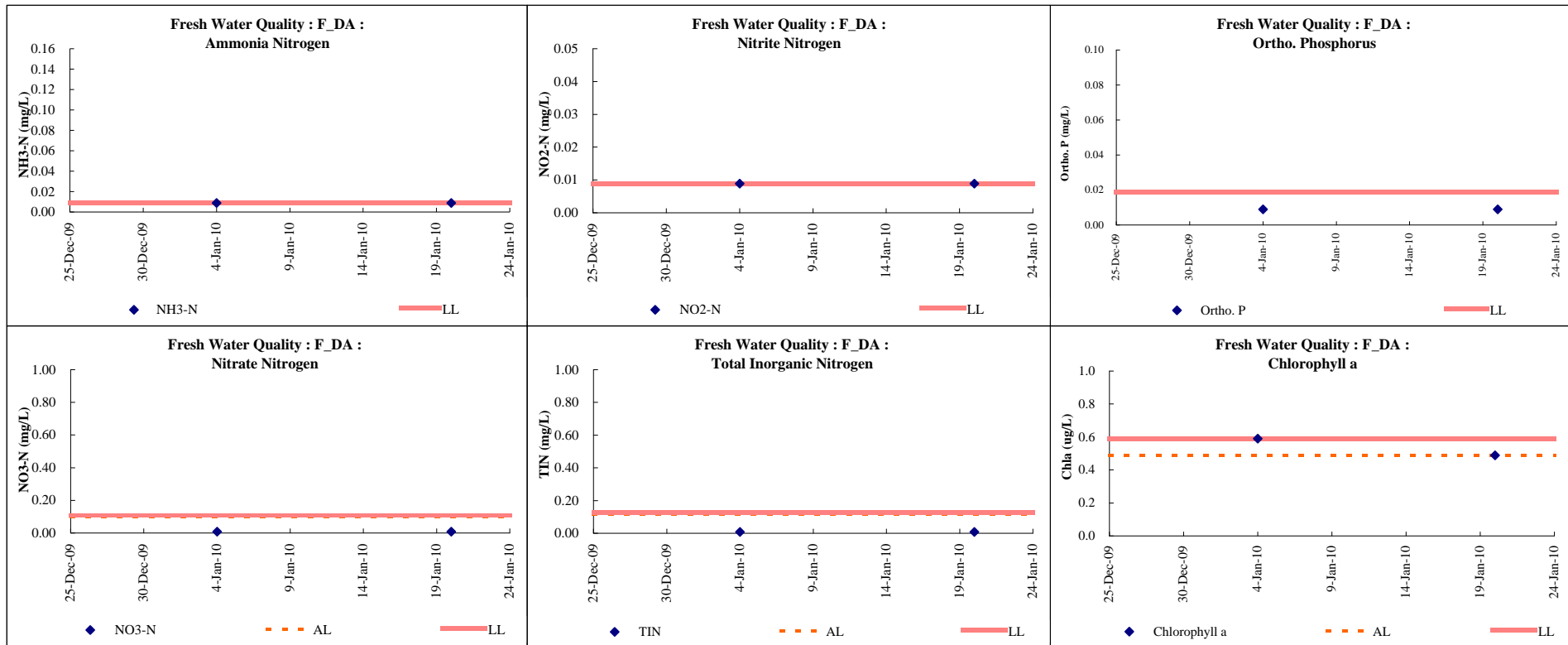


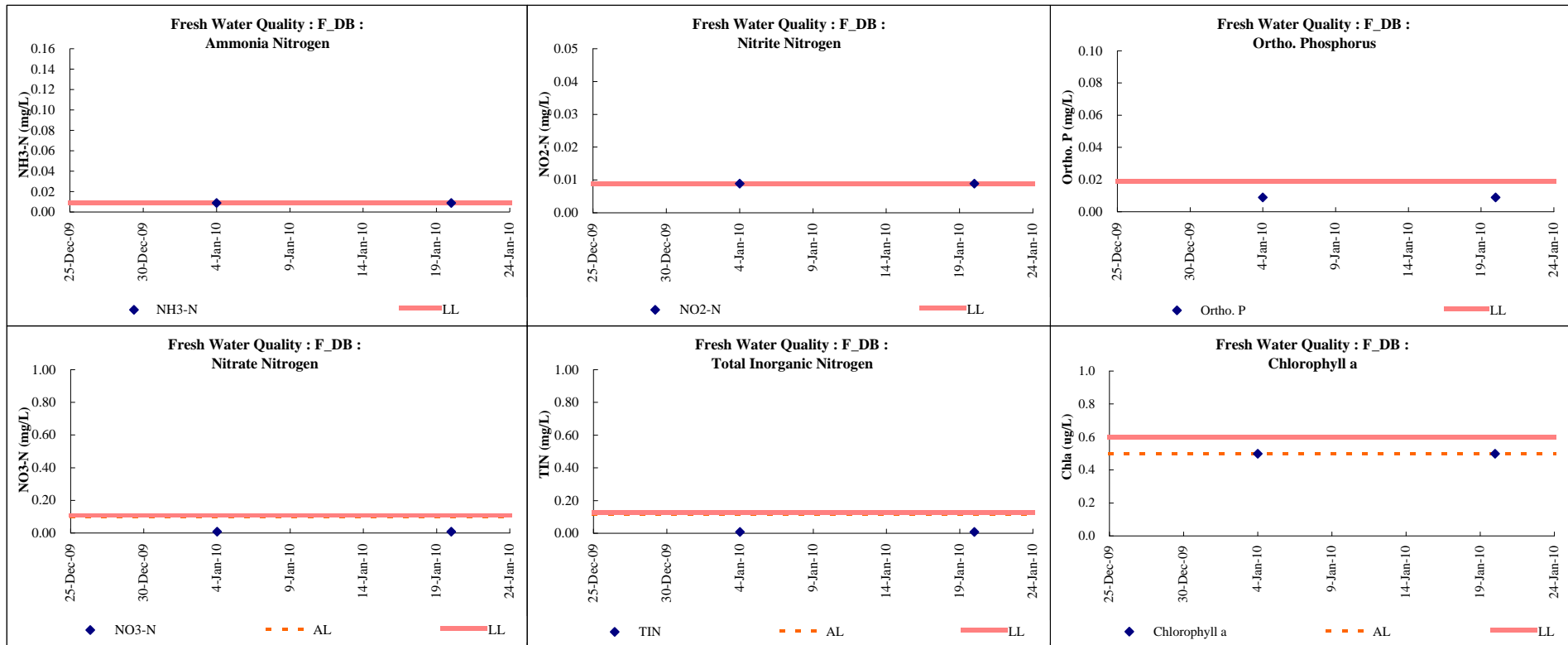


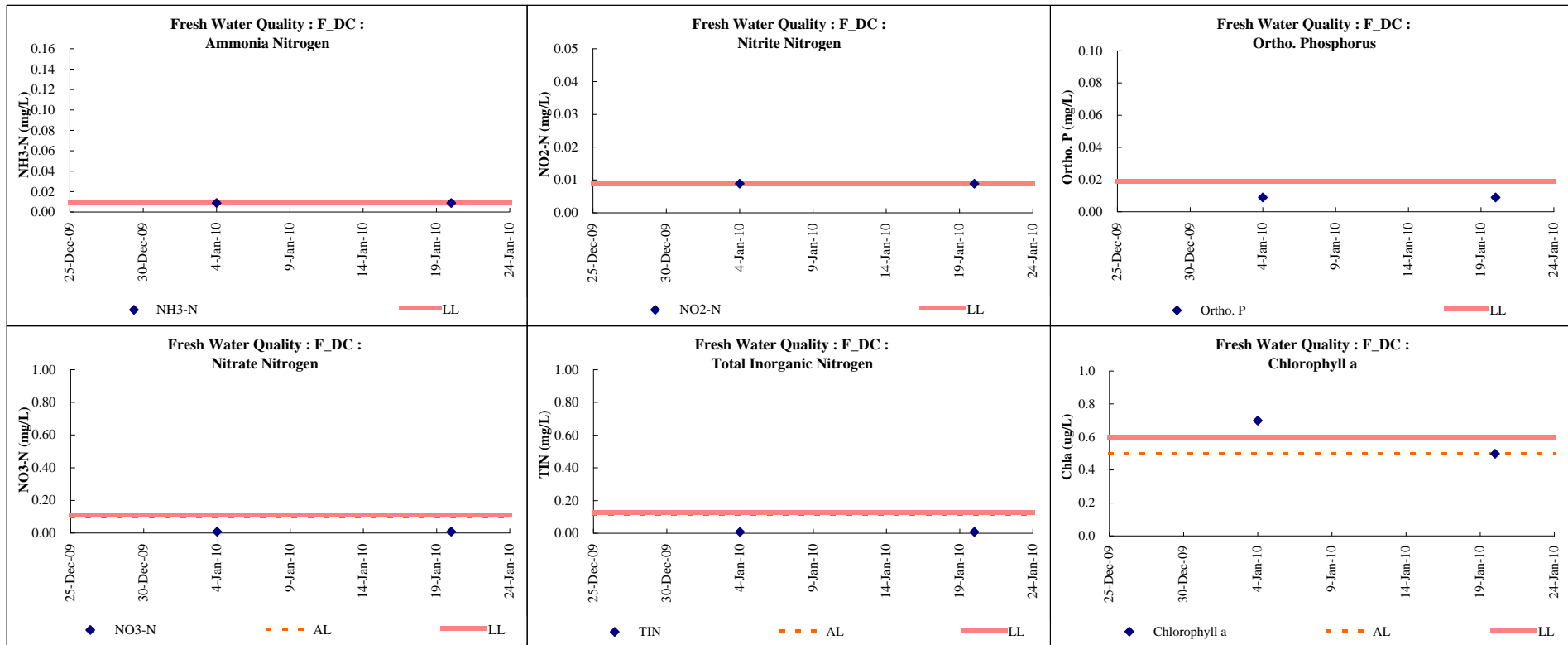


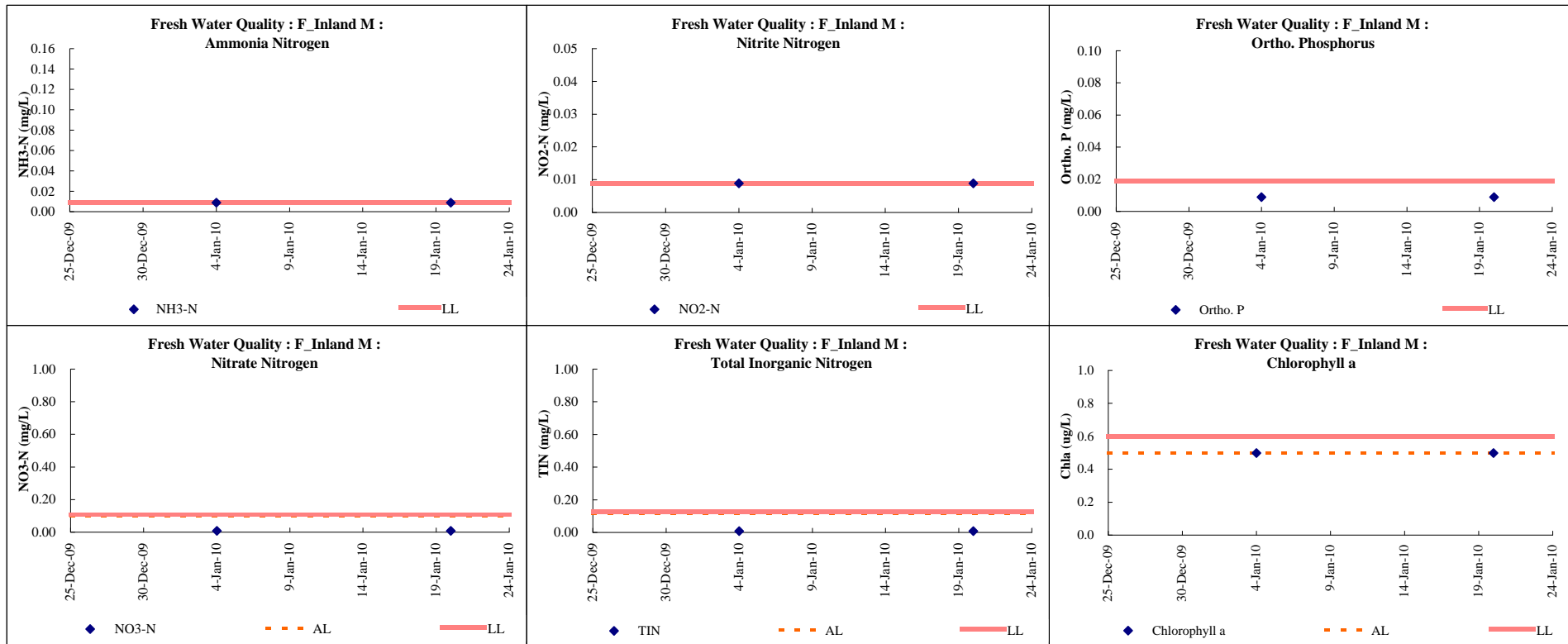


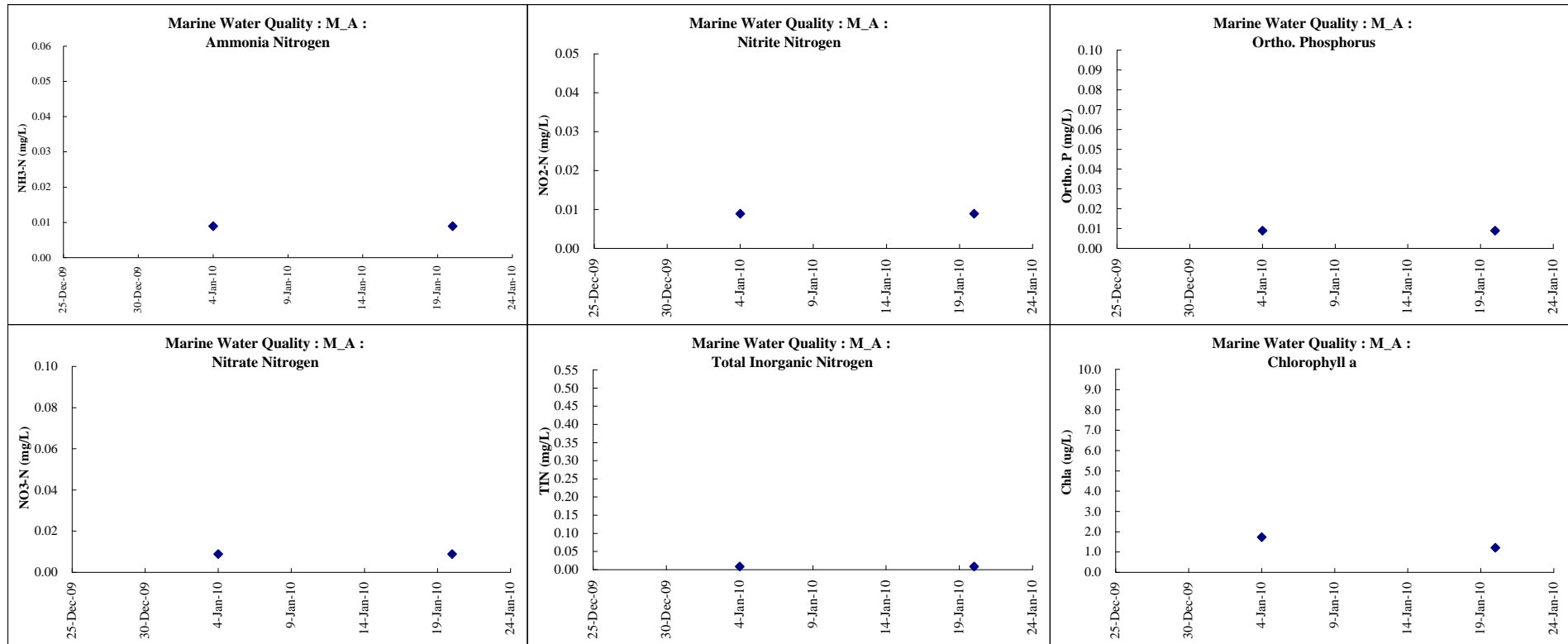


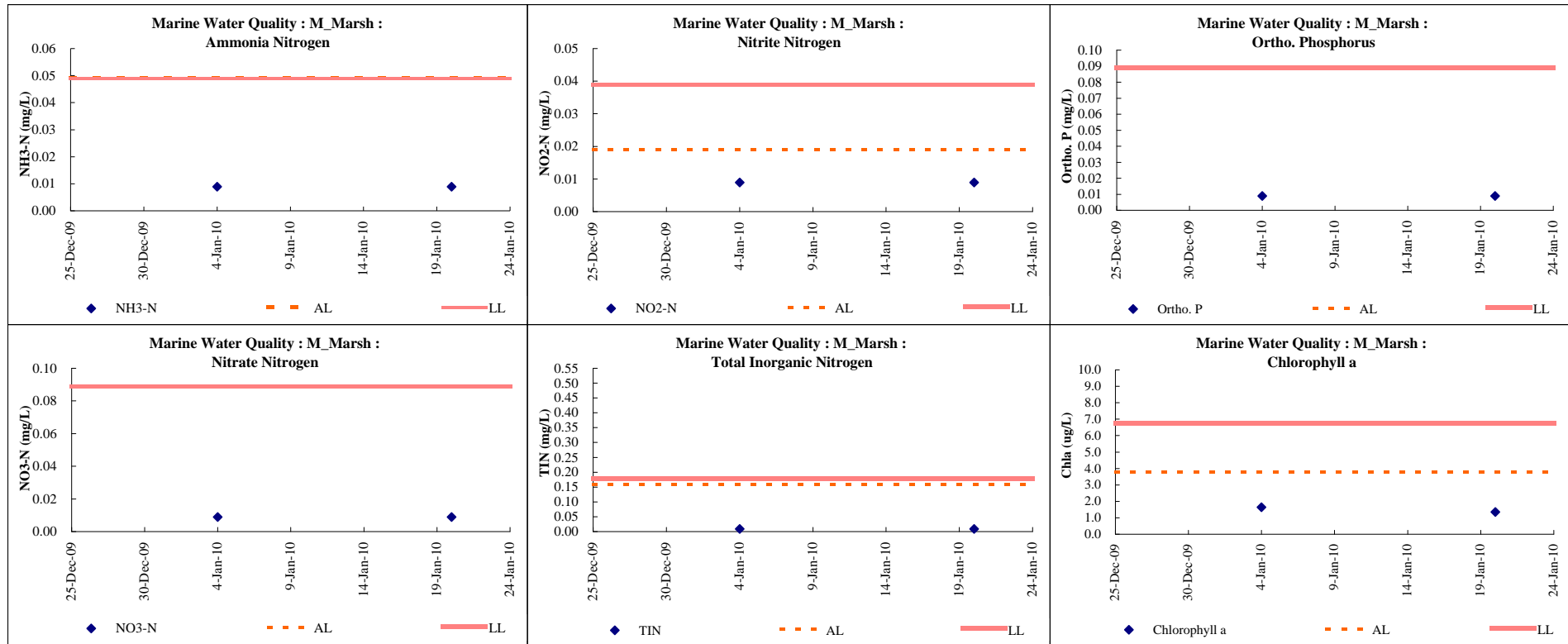


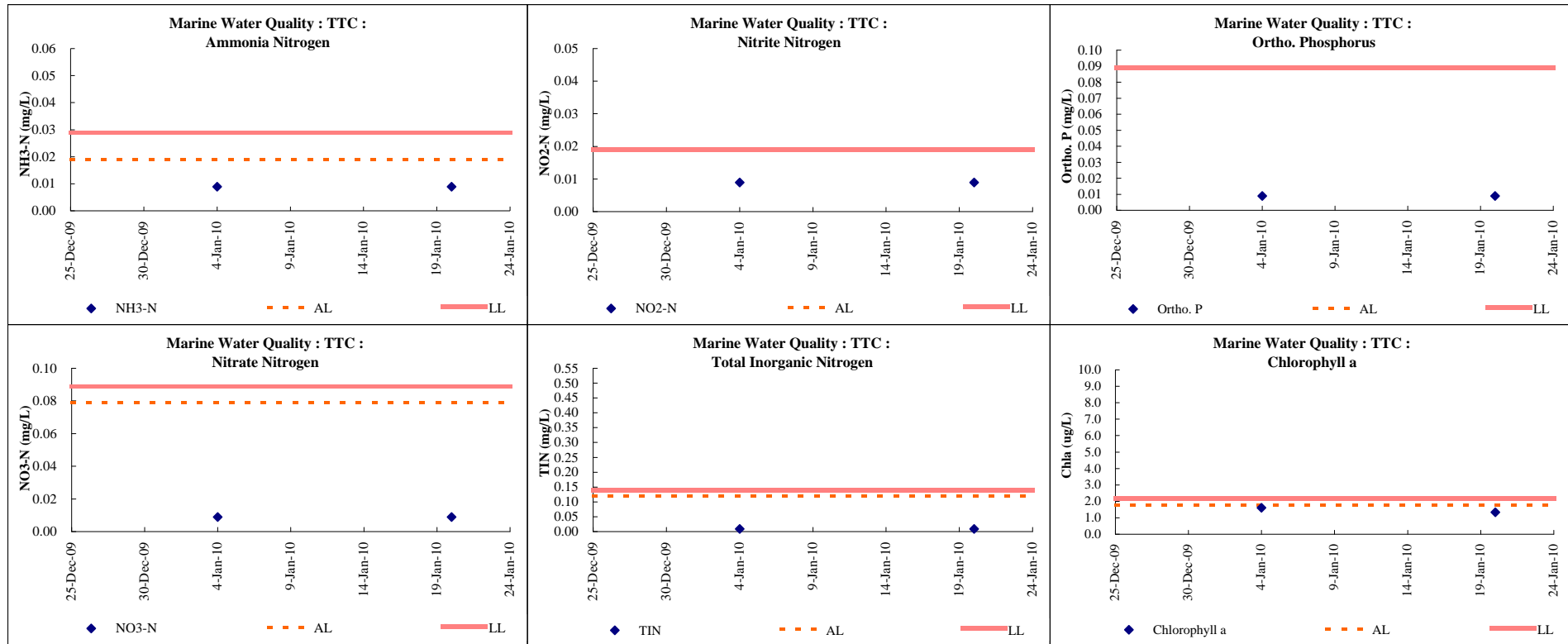


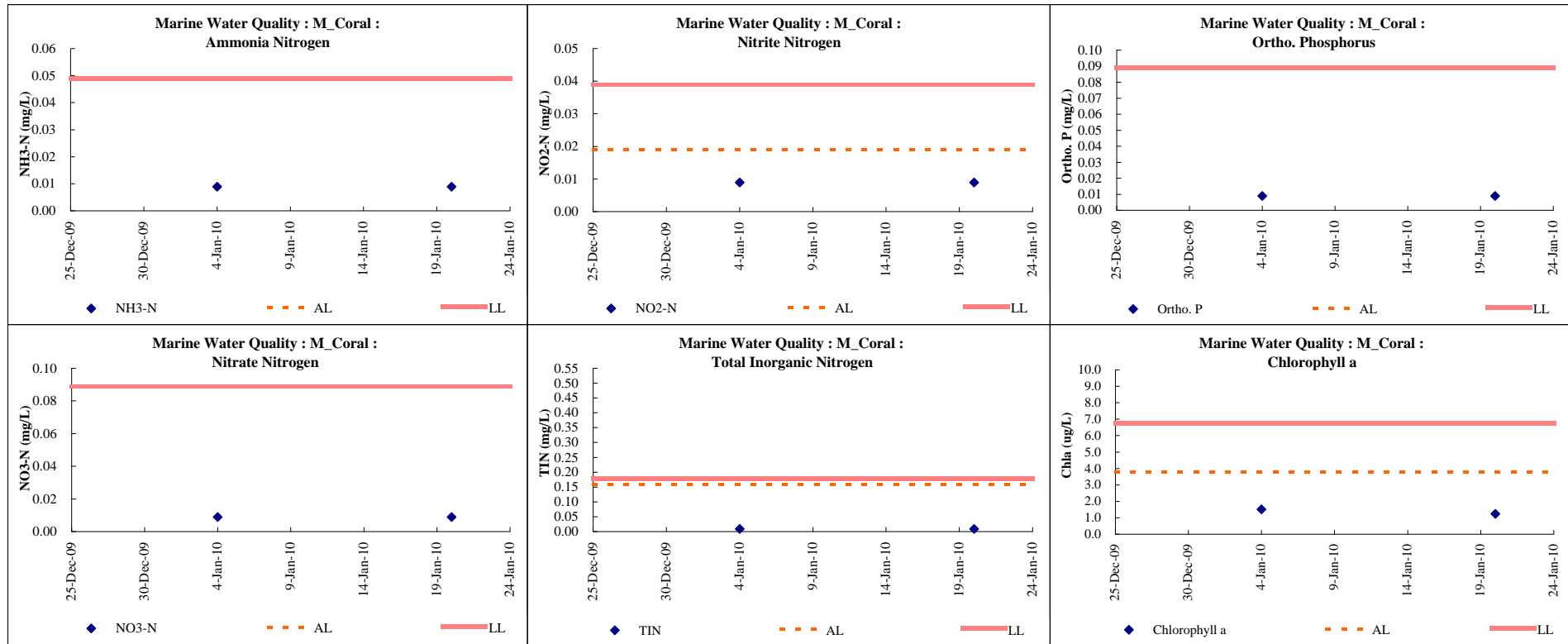


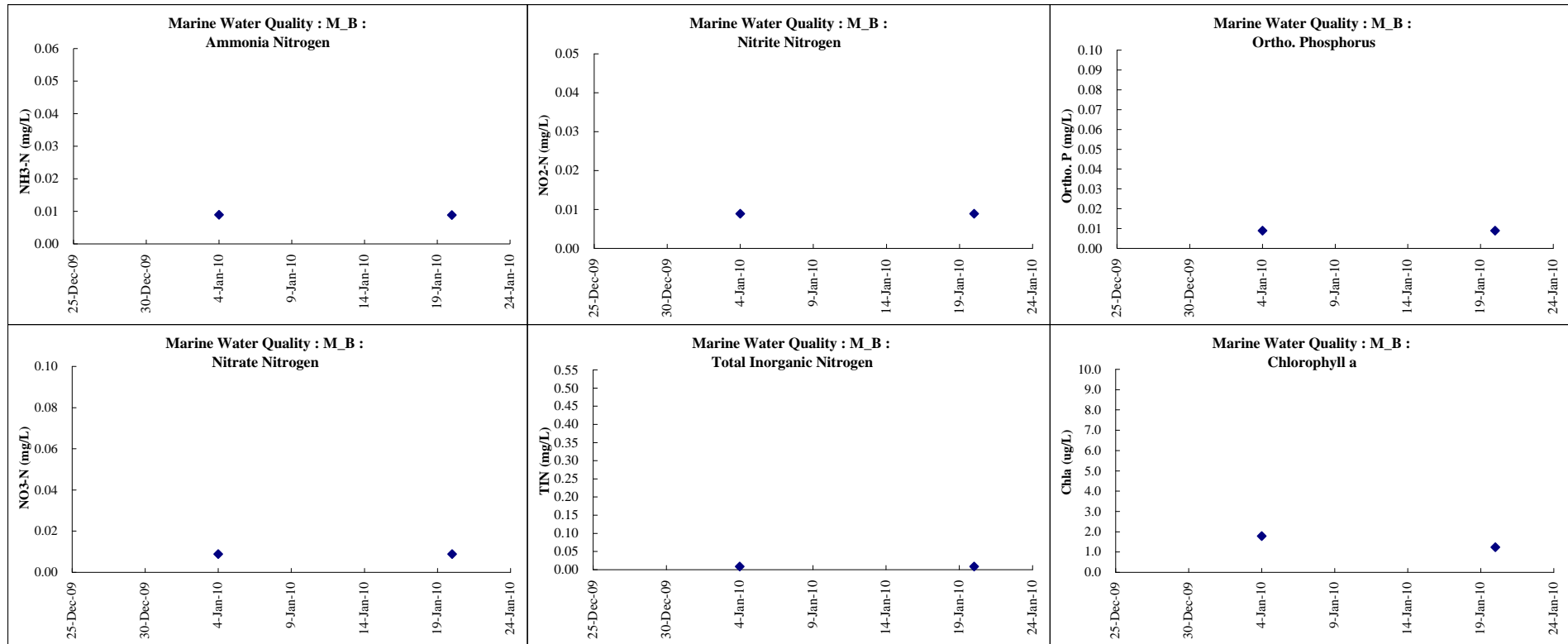


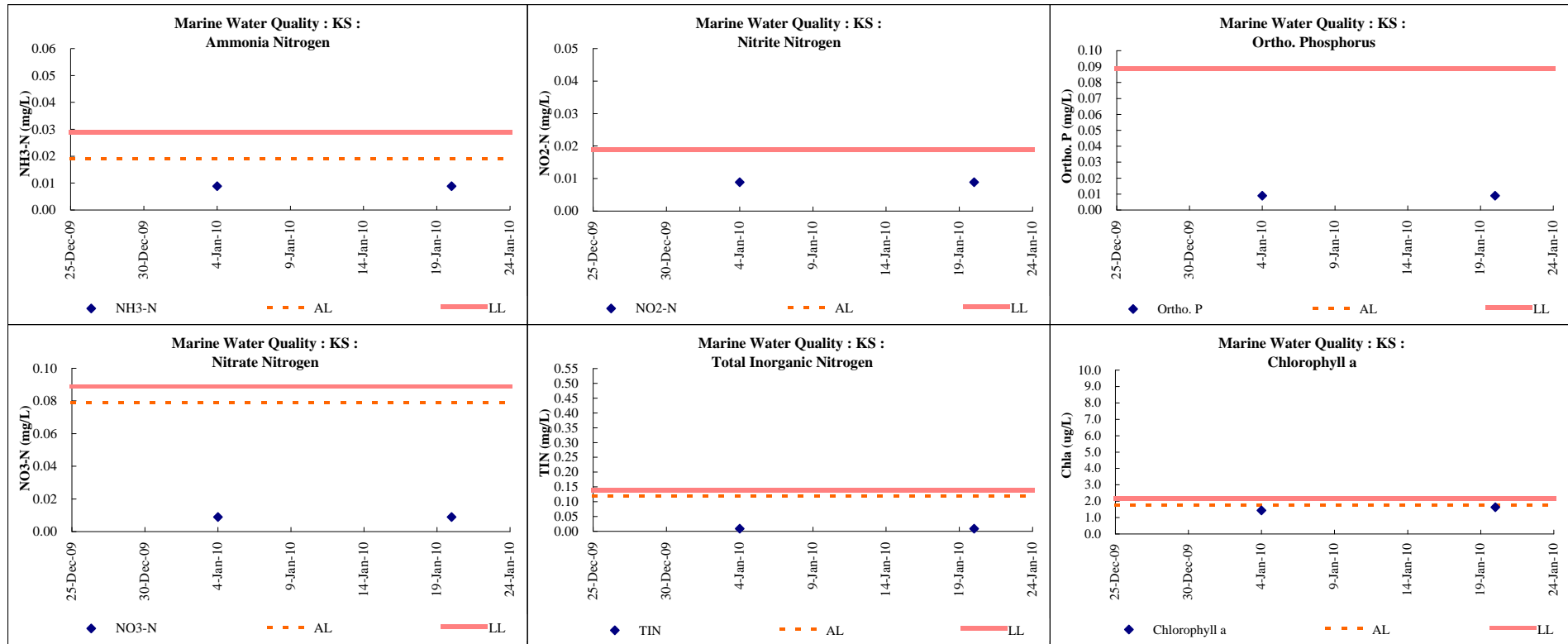










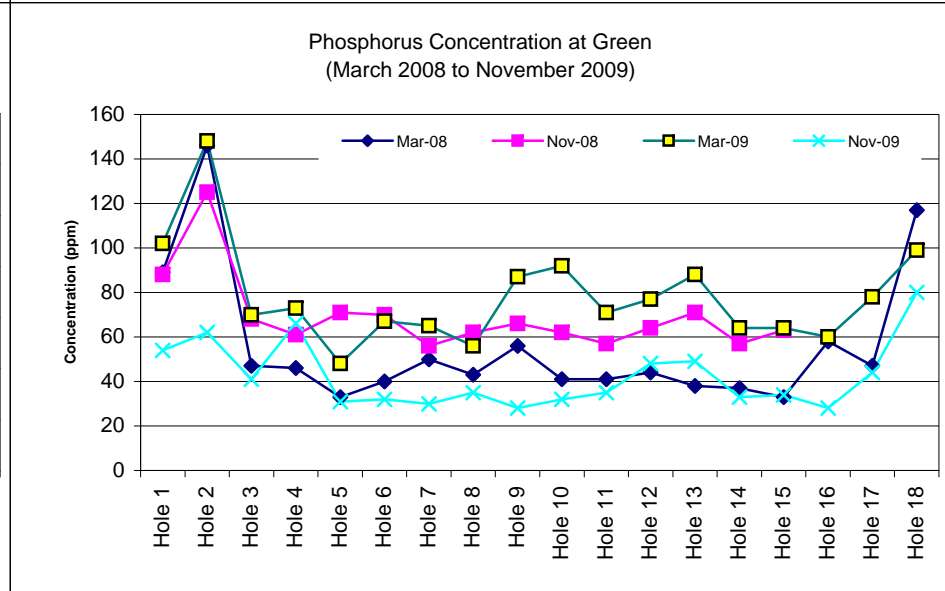
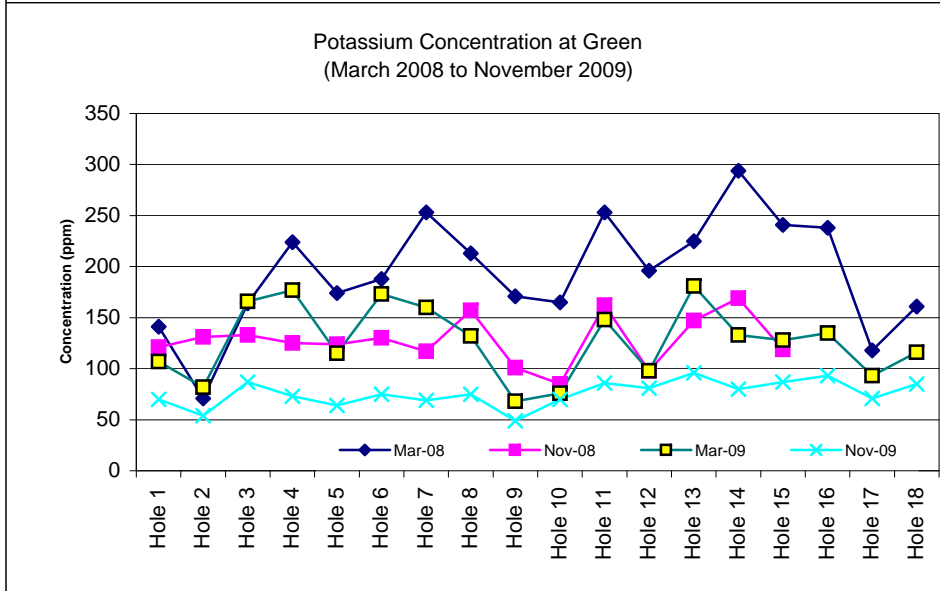
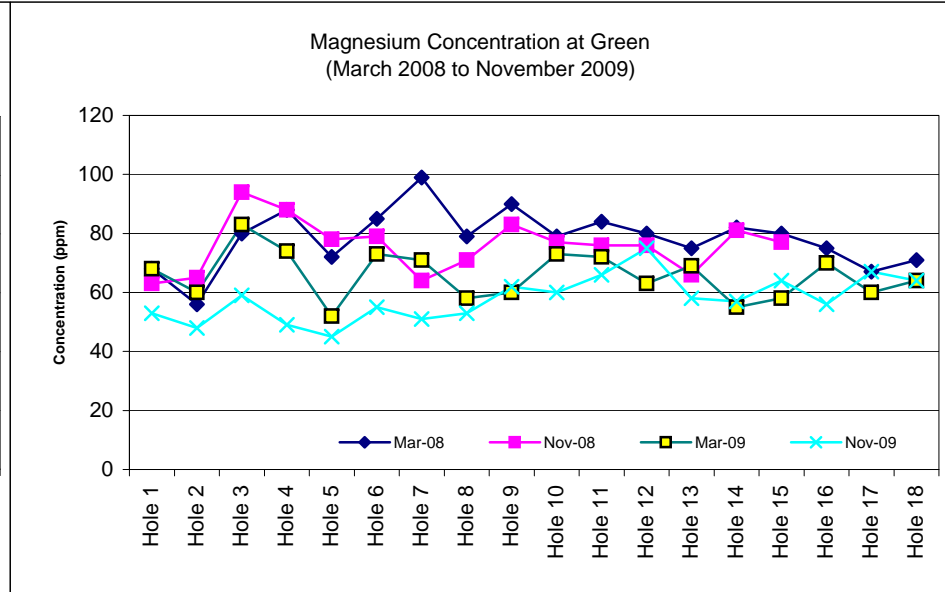
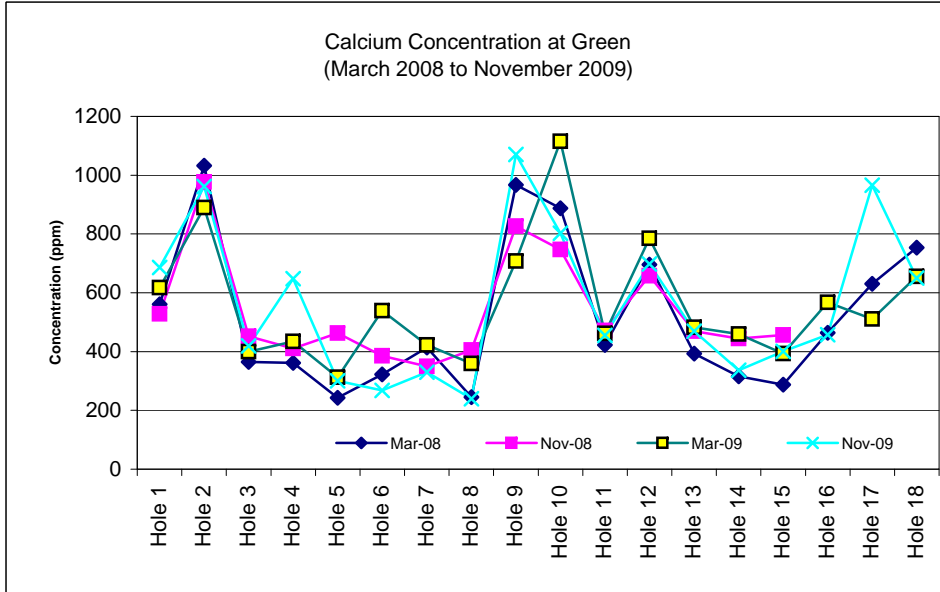


Soil Nutrient

Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

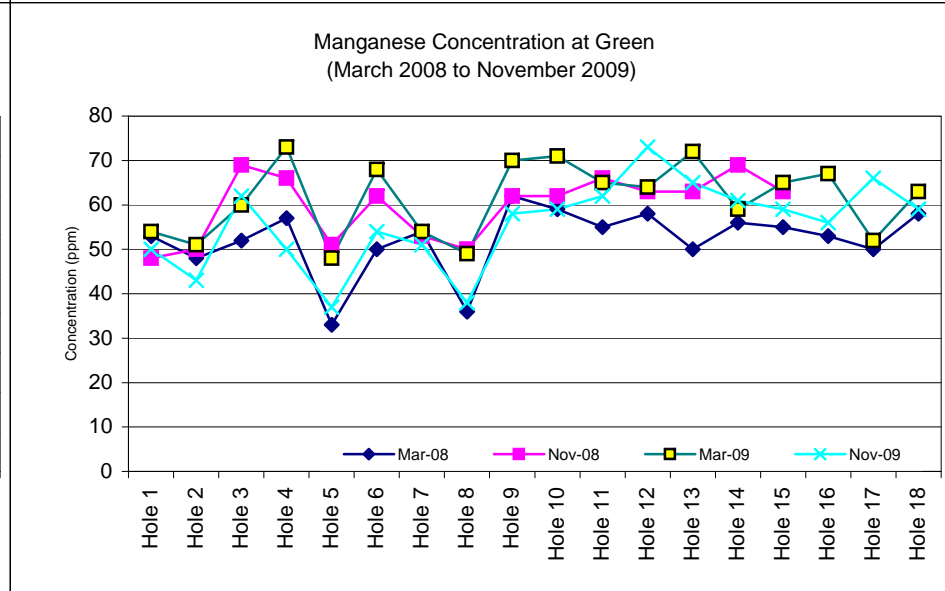
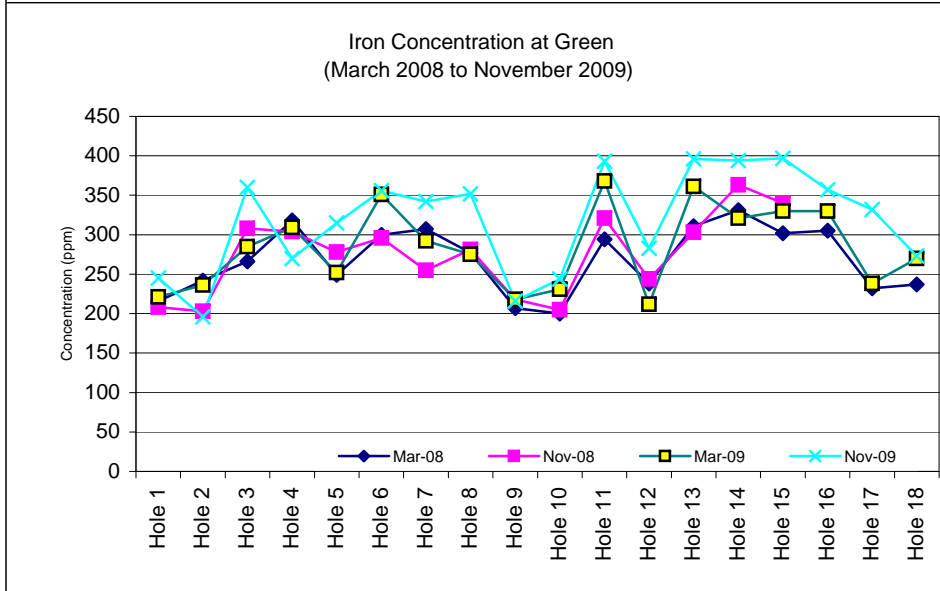
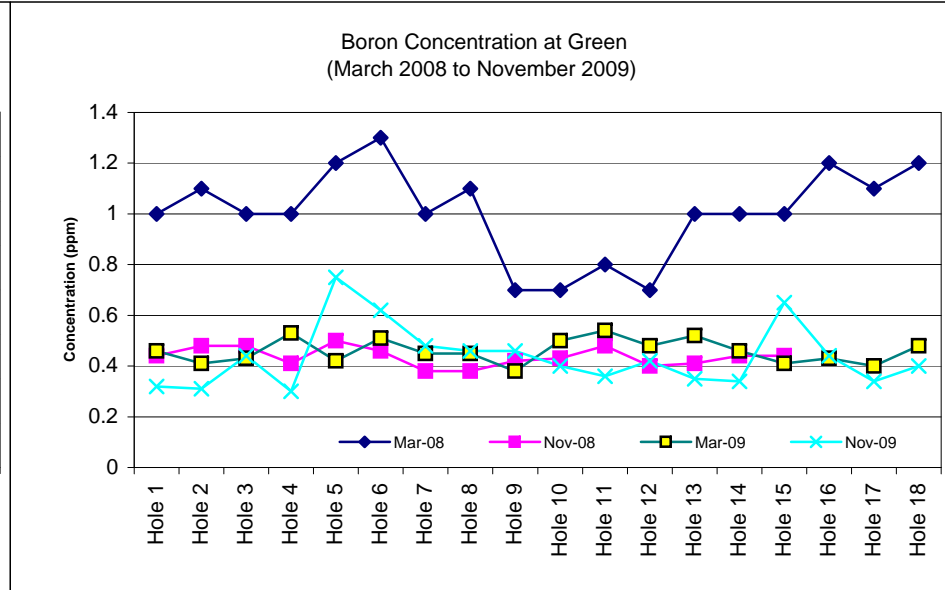
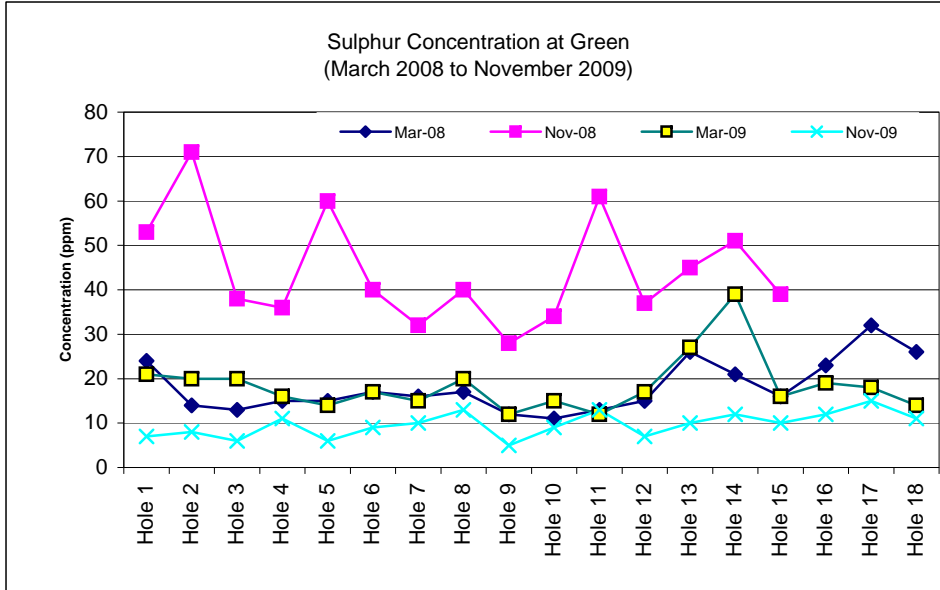
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

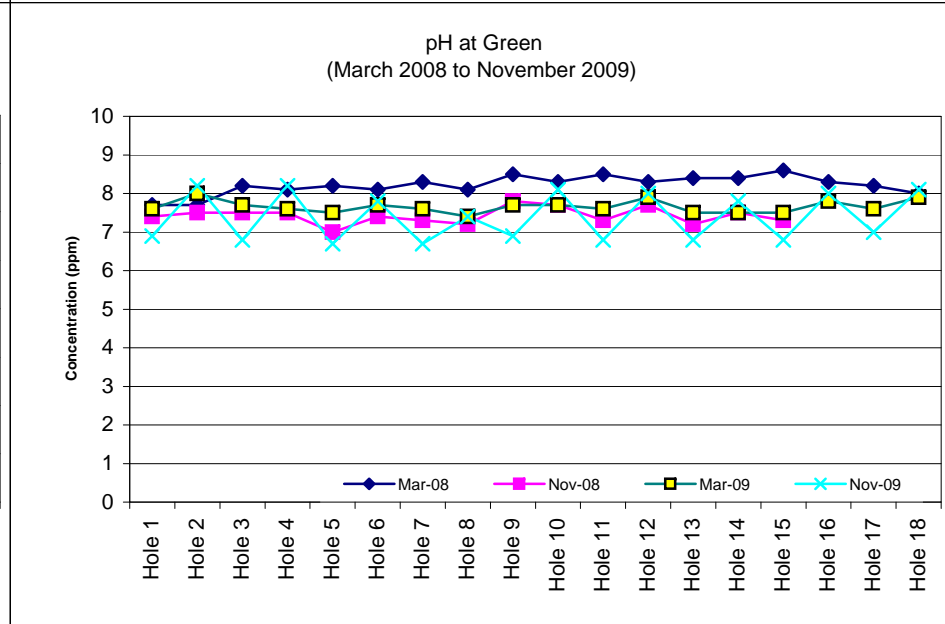
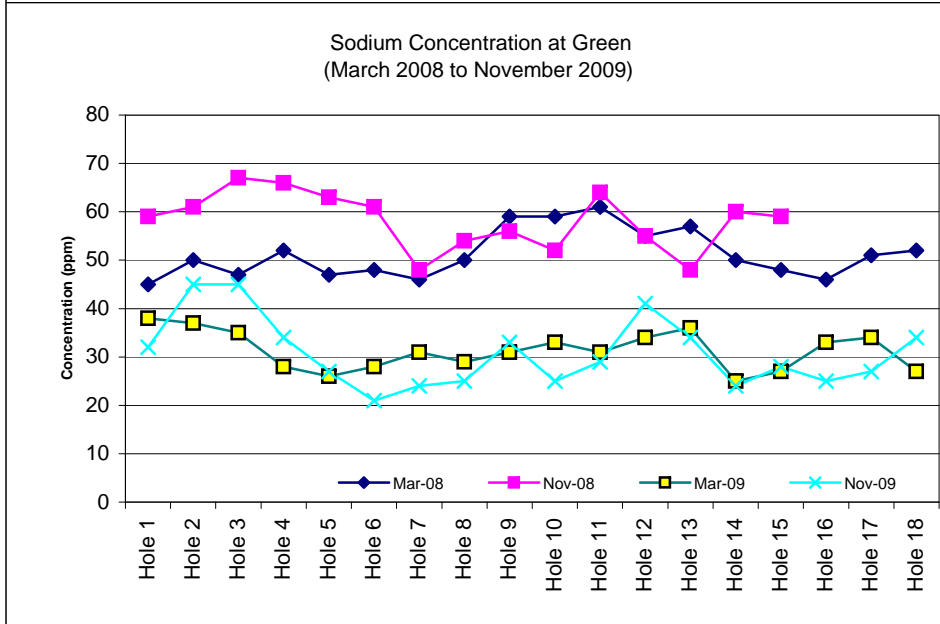
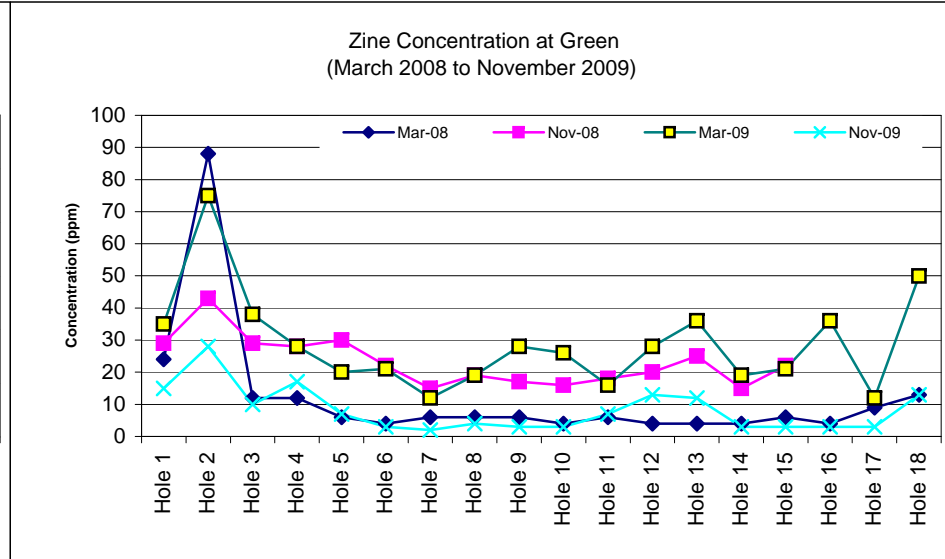
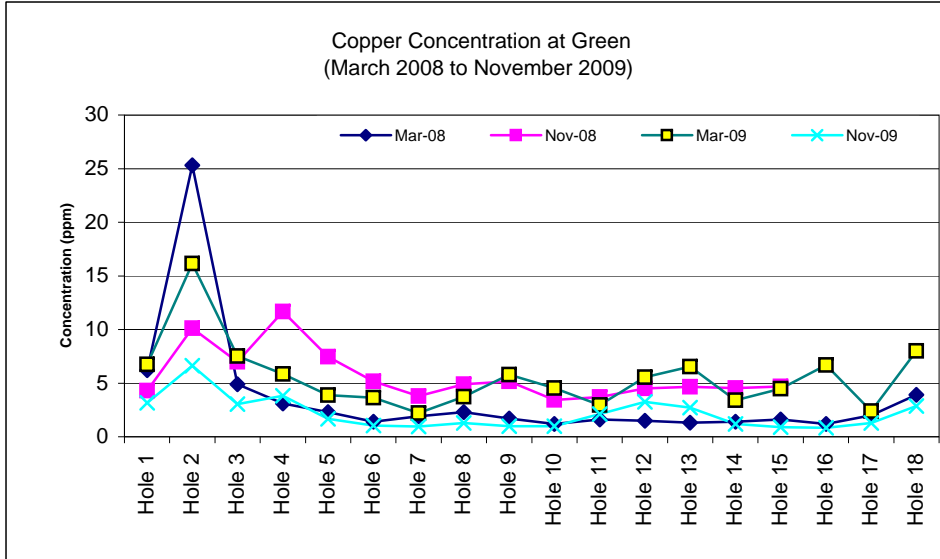
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

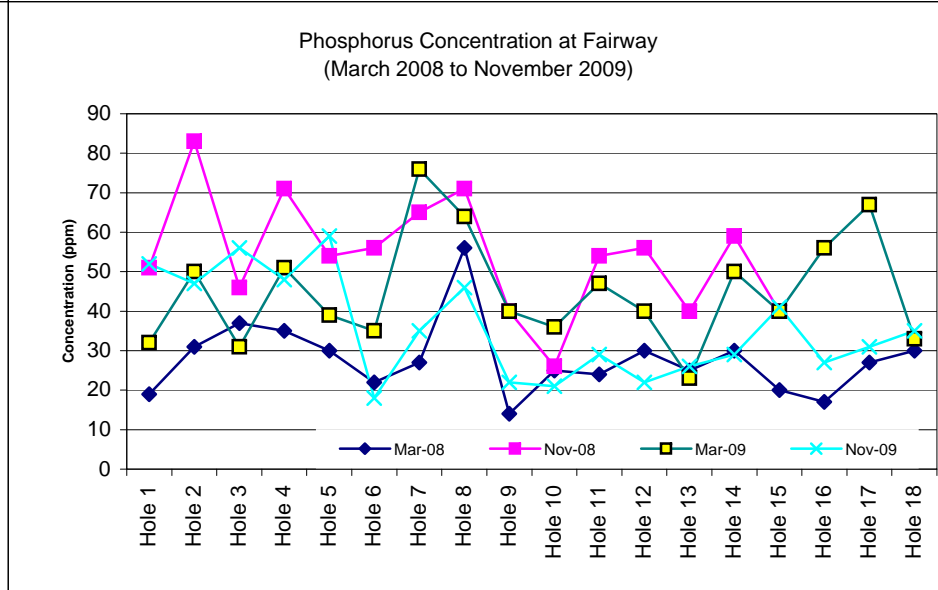
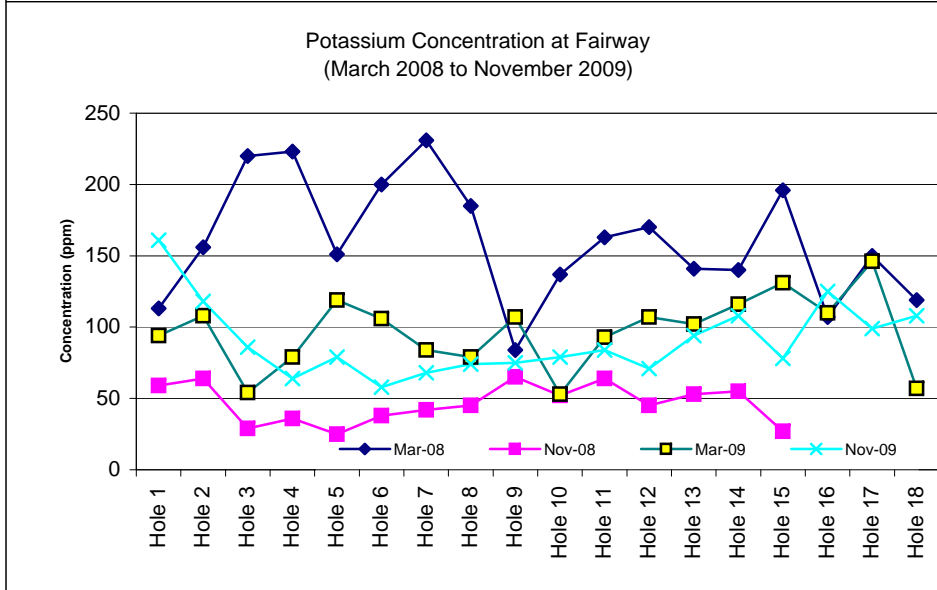
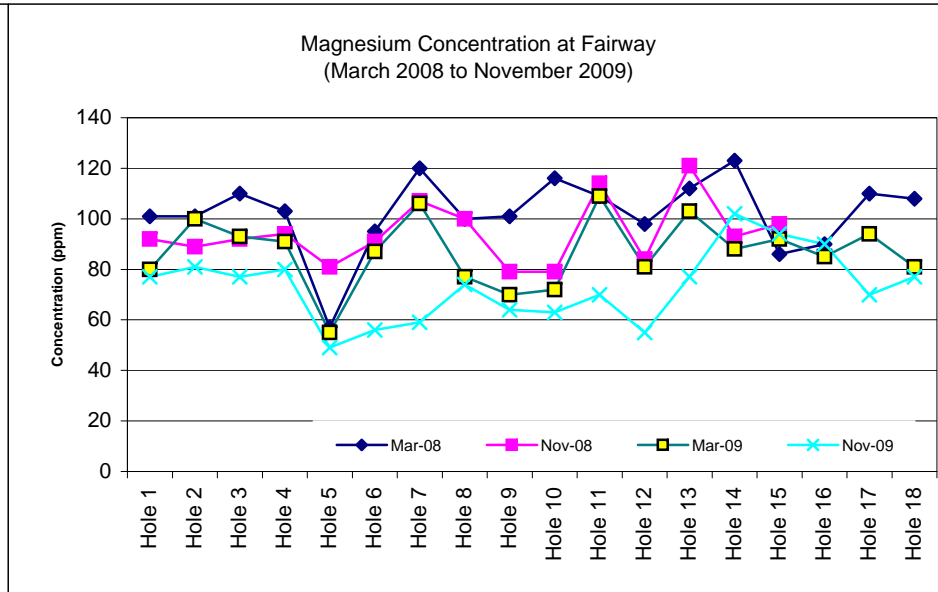
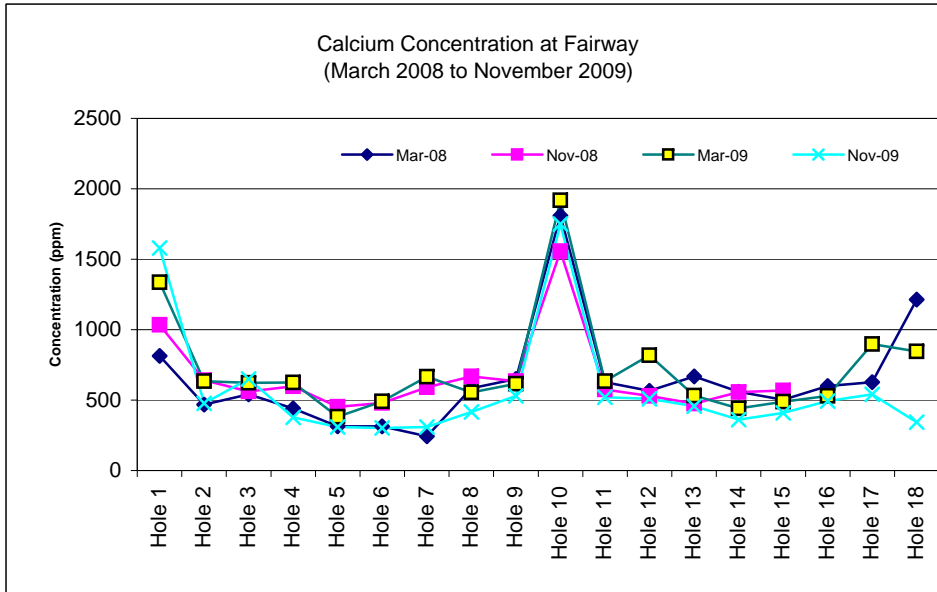
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

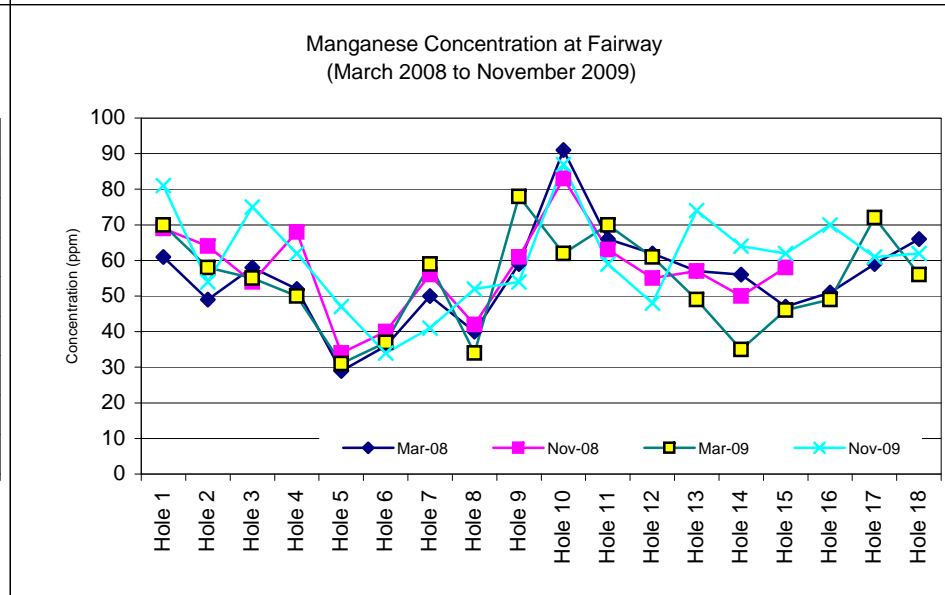
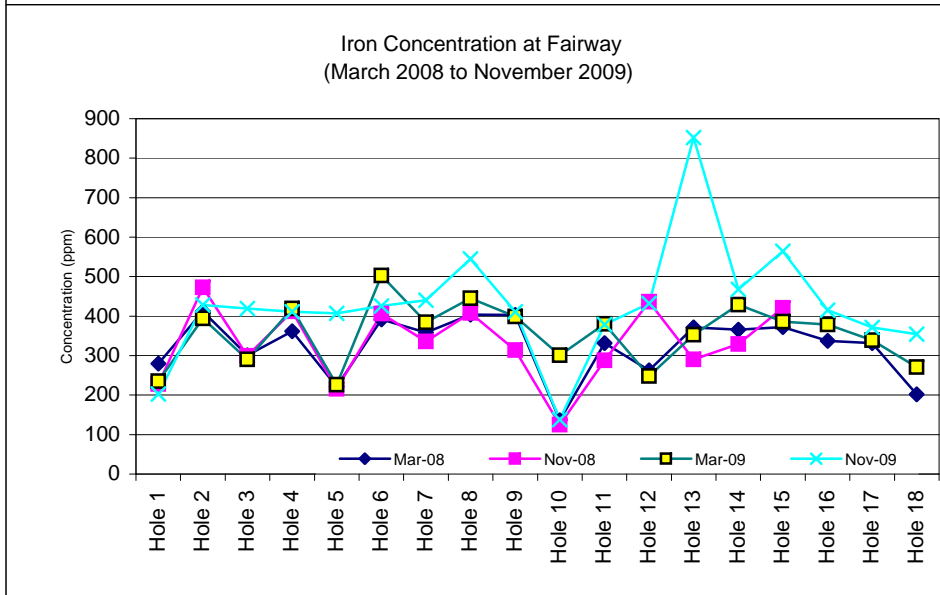
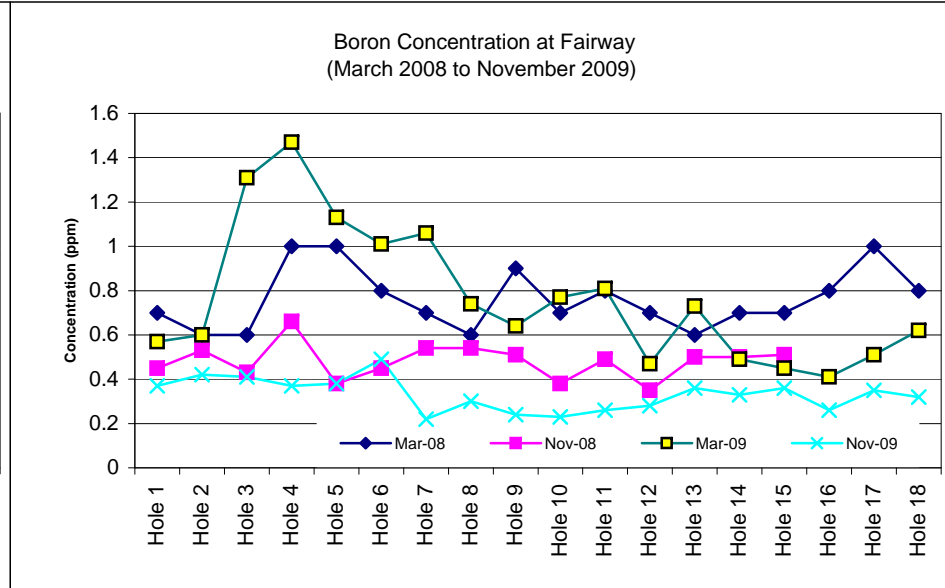
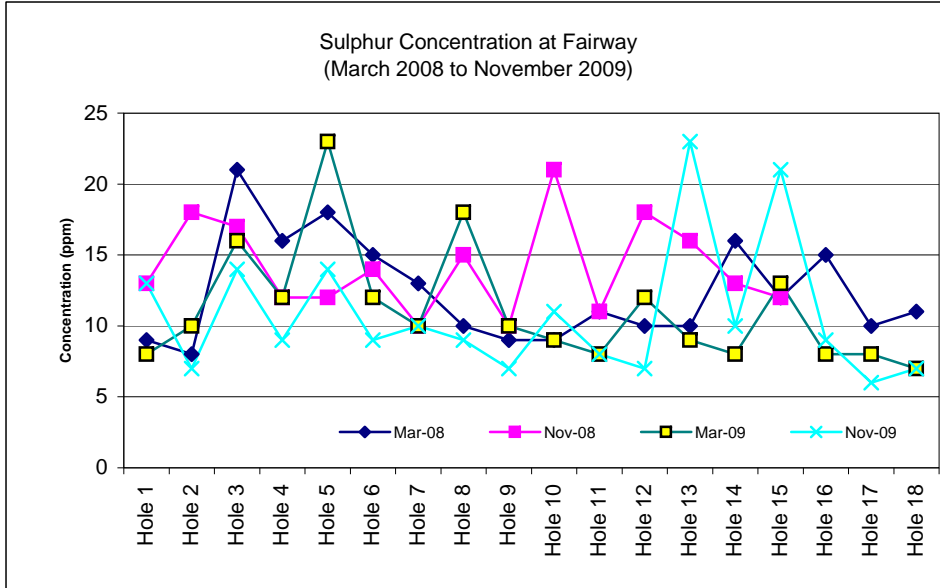
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

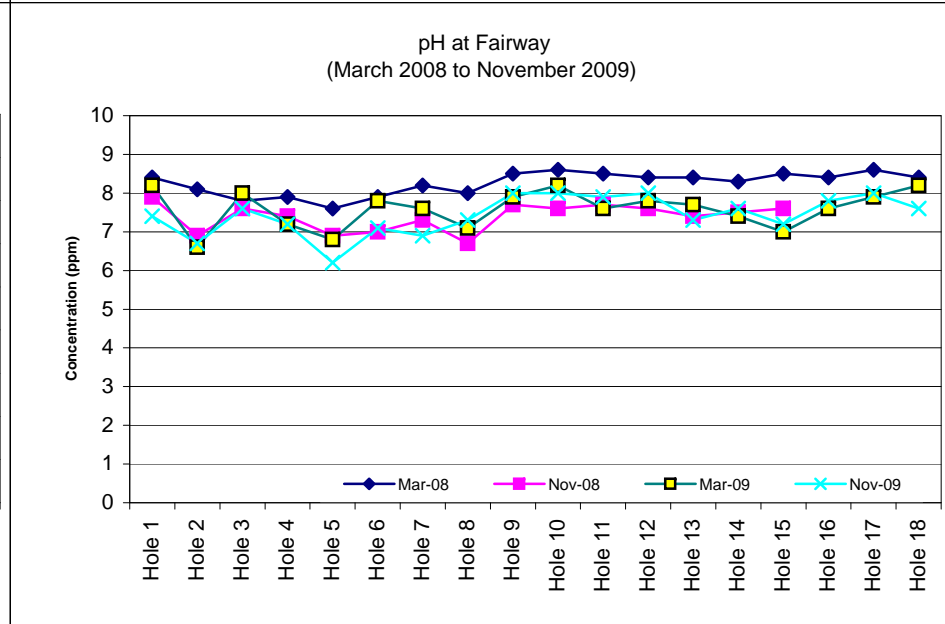
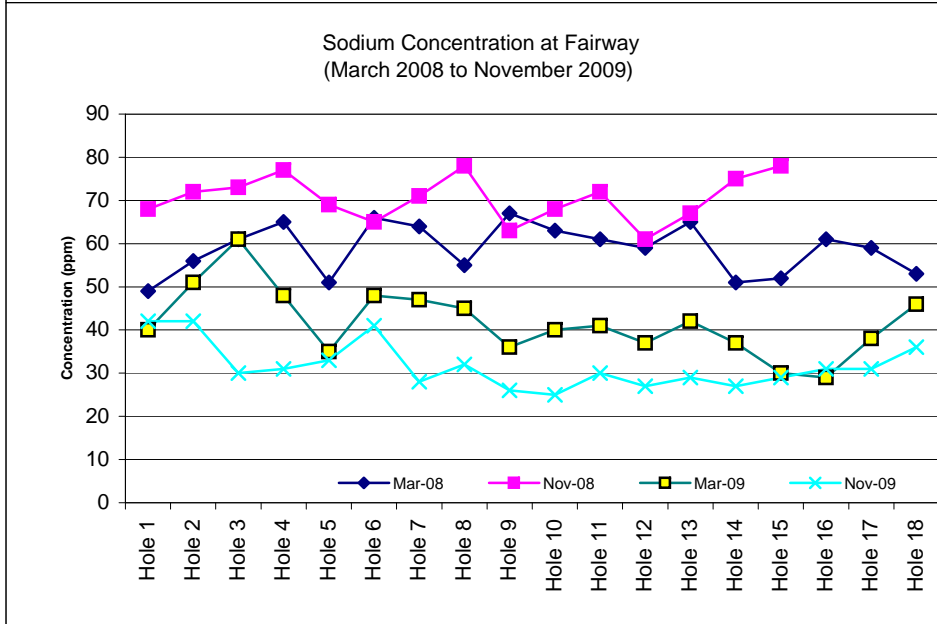
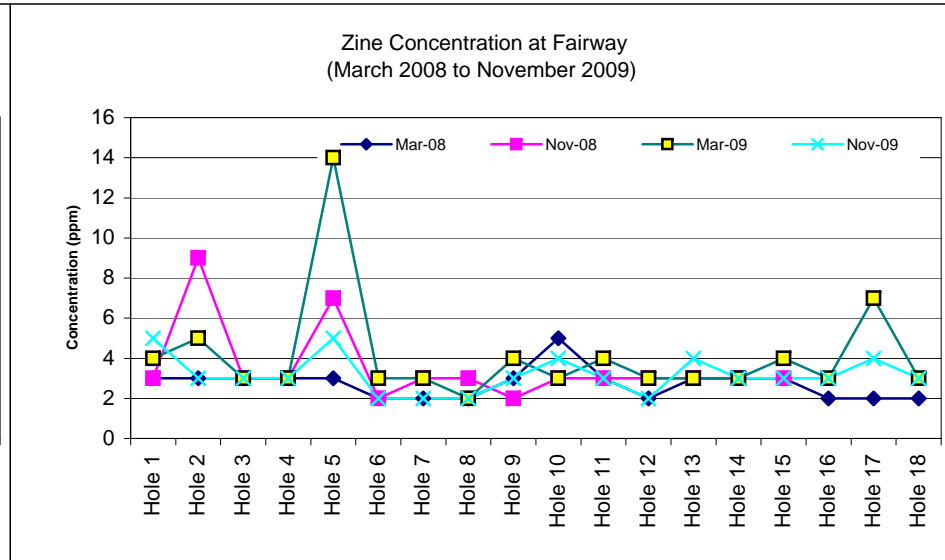
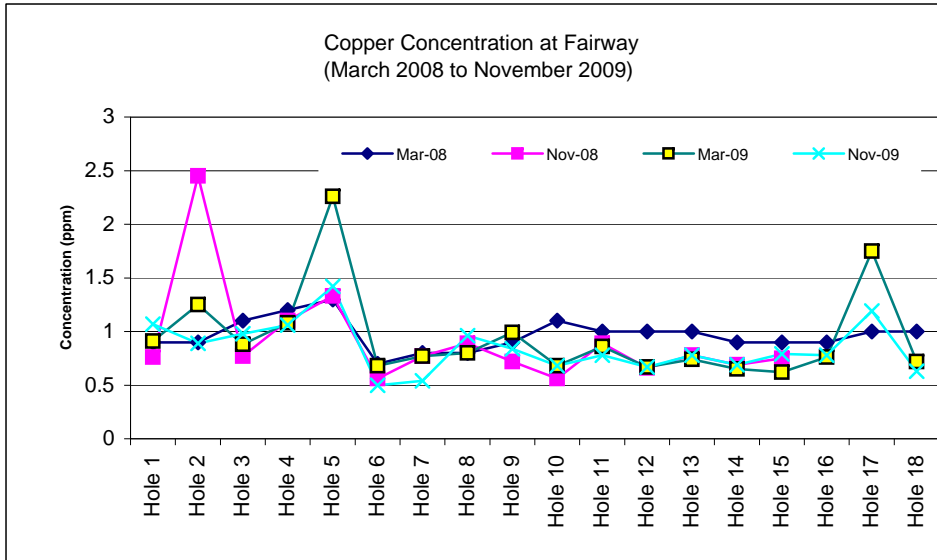
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

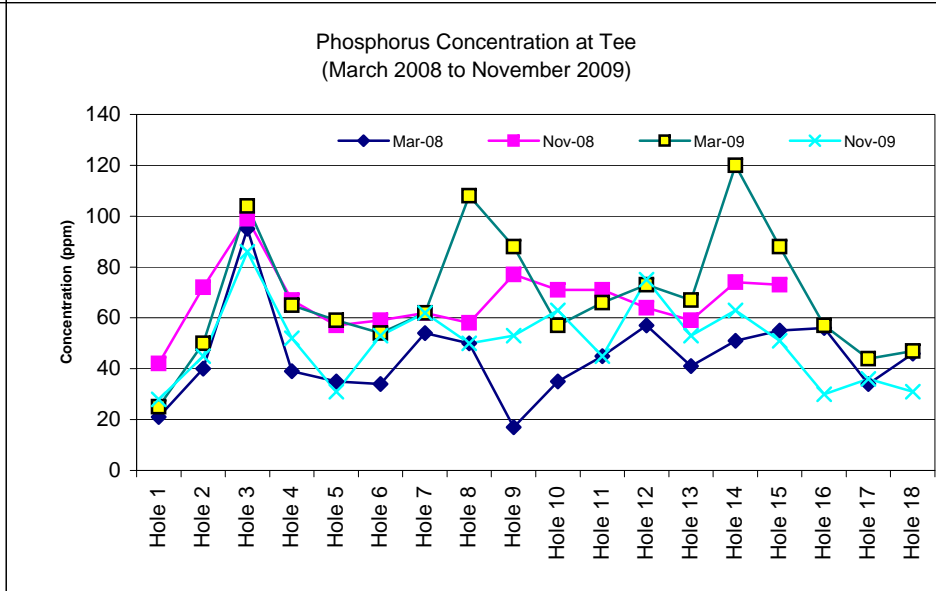
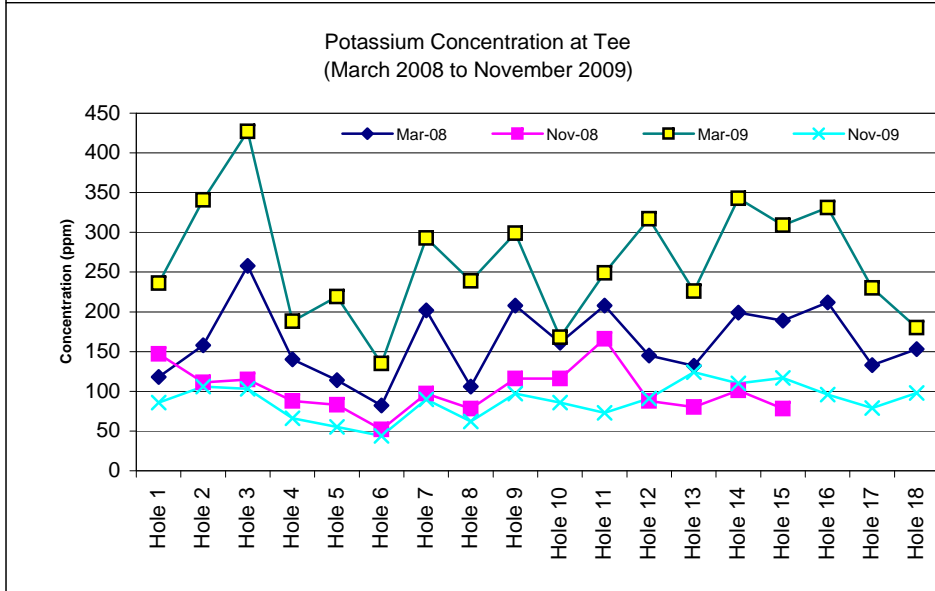
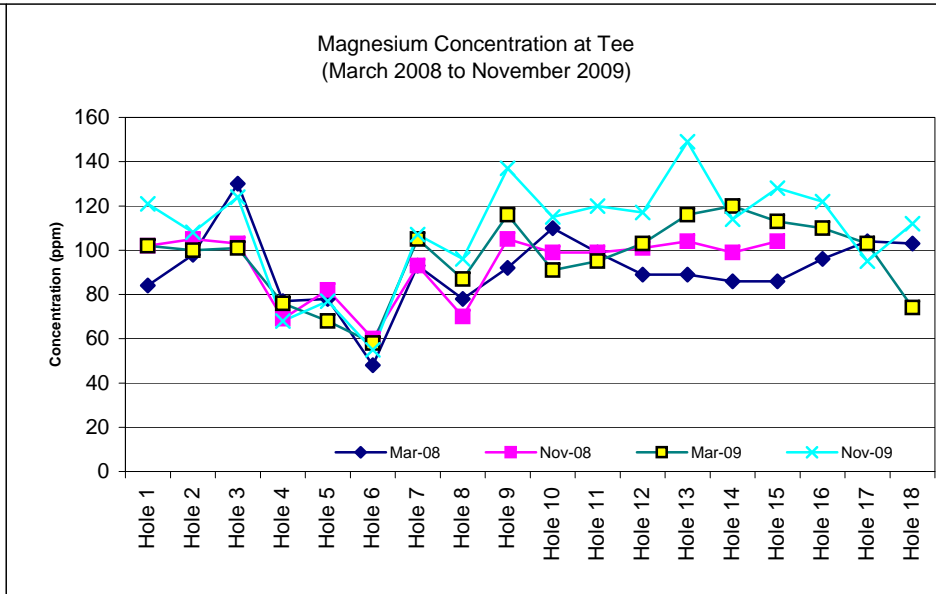
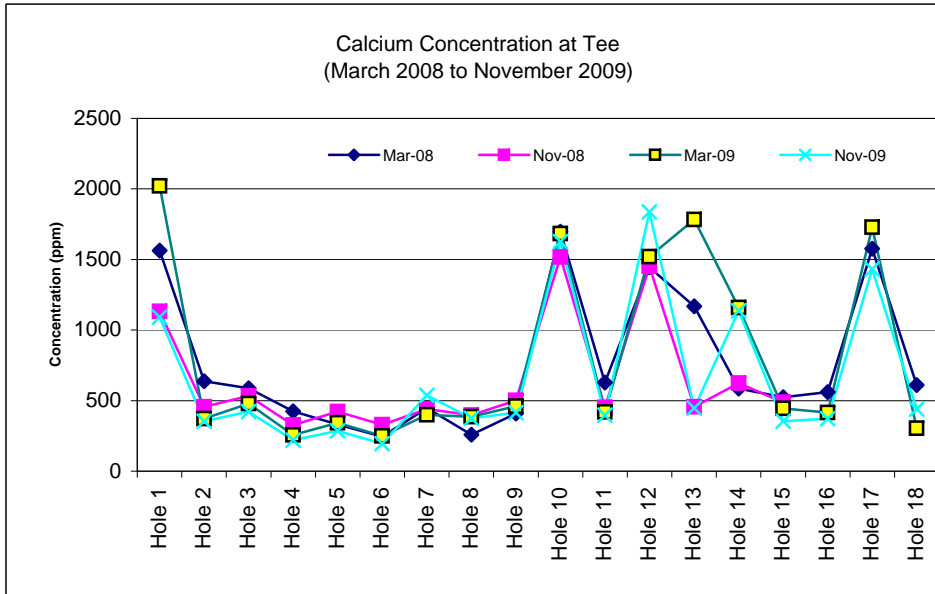
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

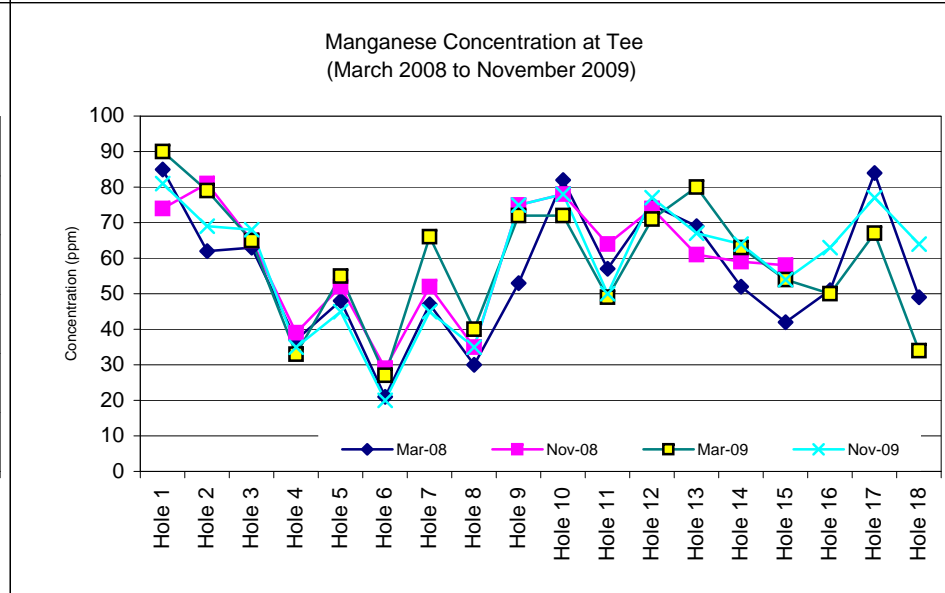
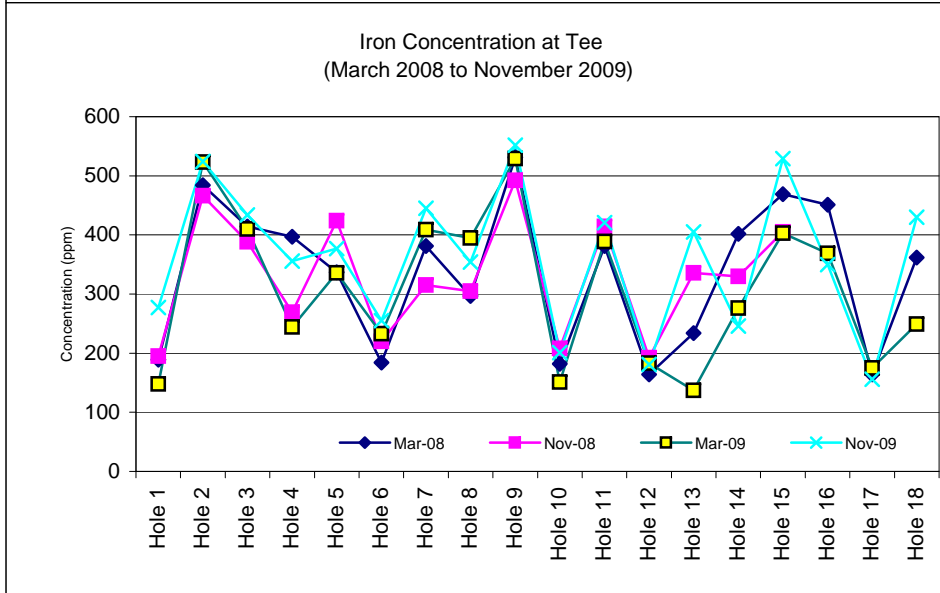
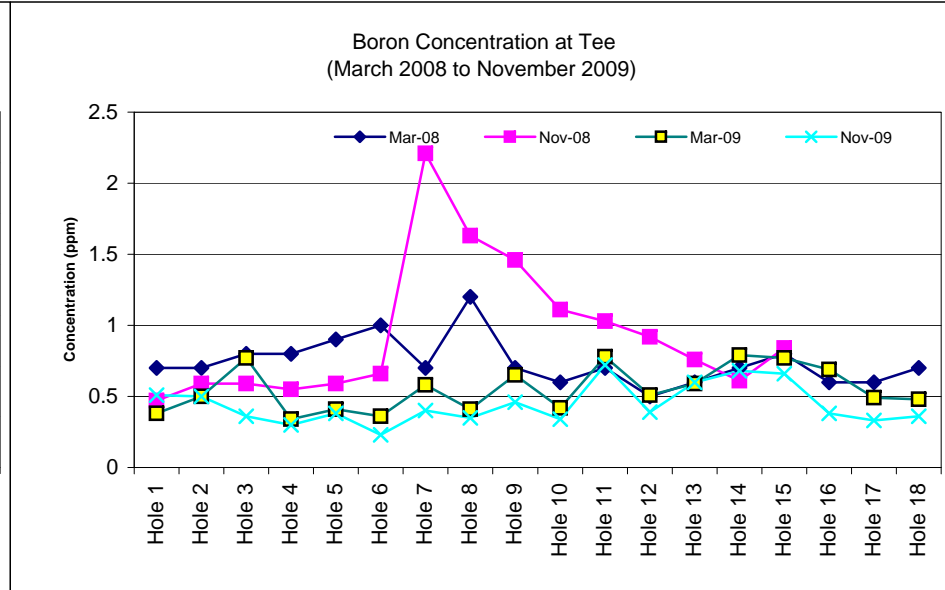
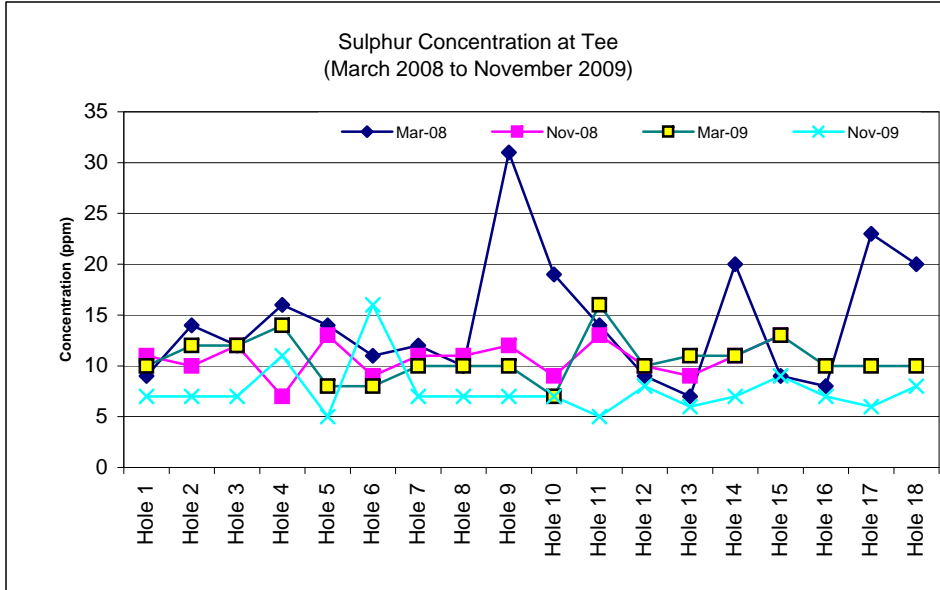
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

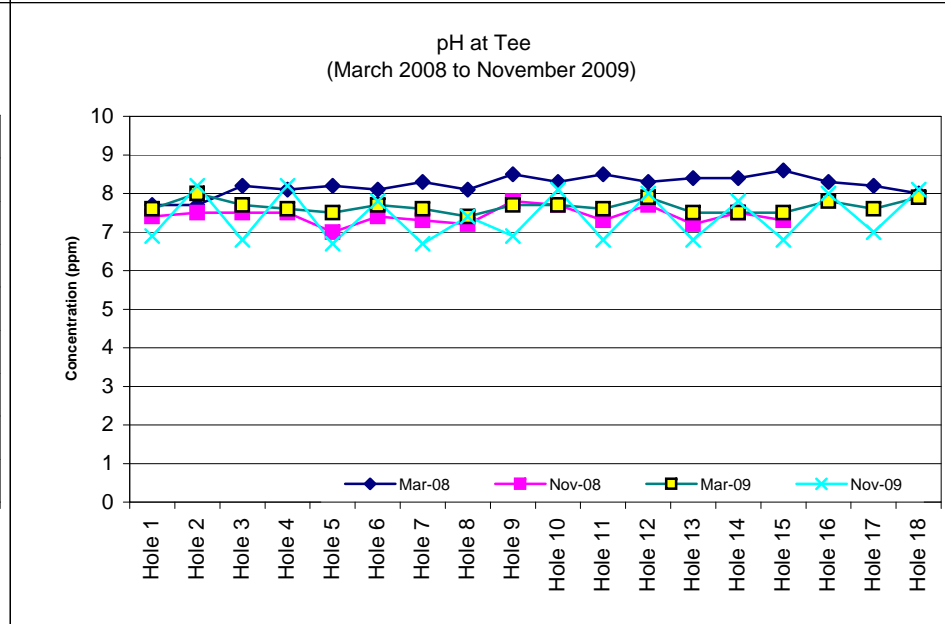
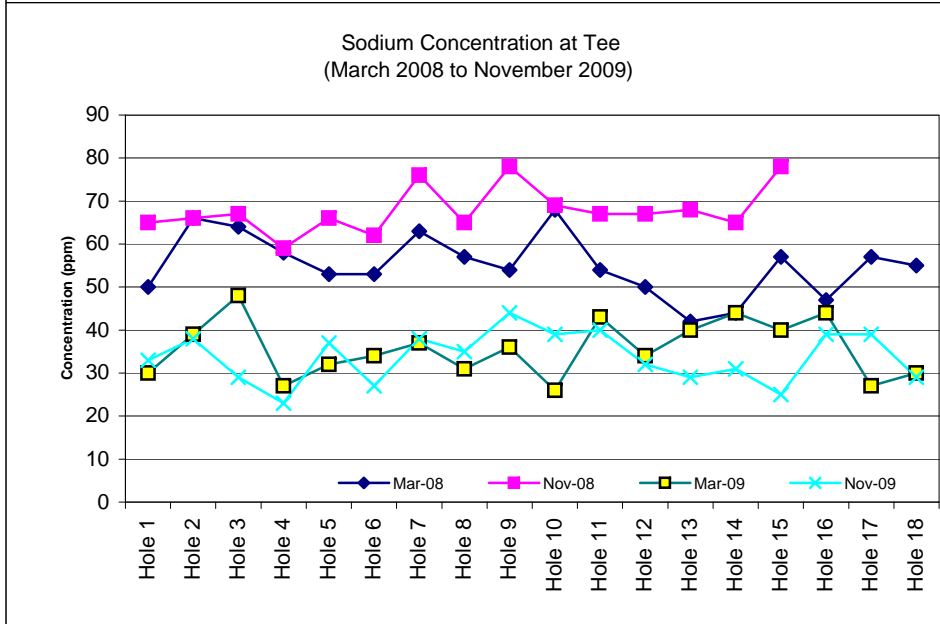
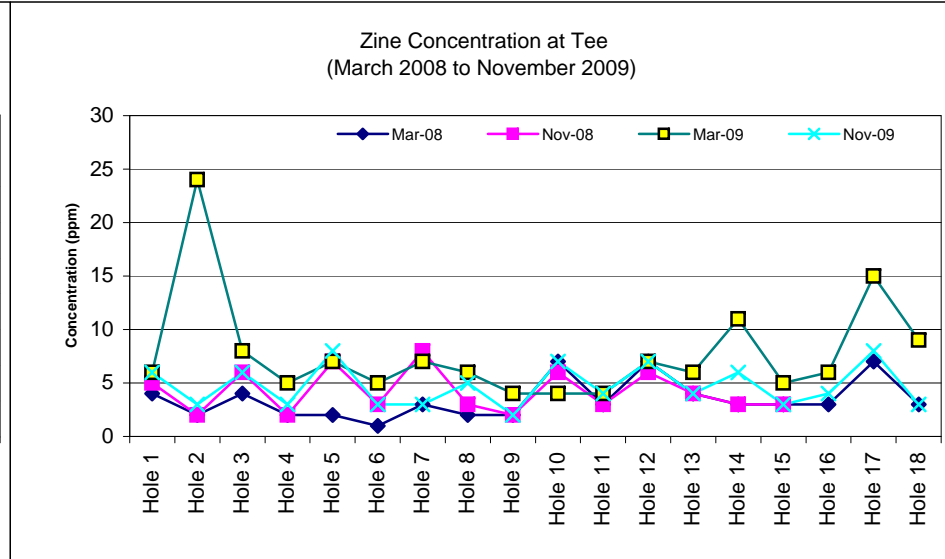
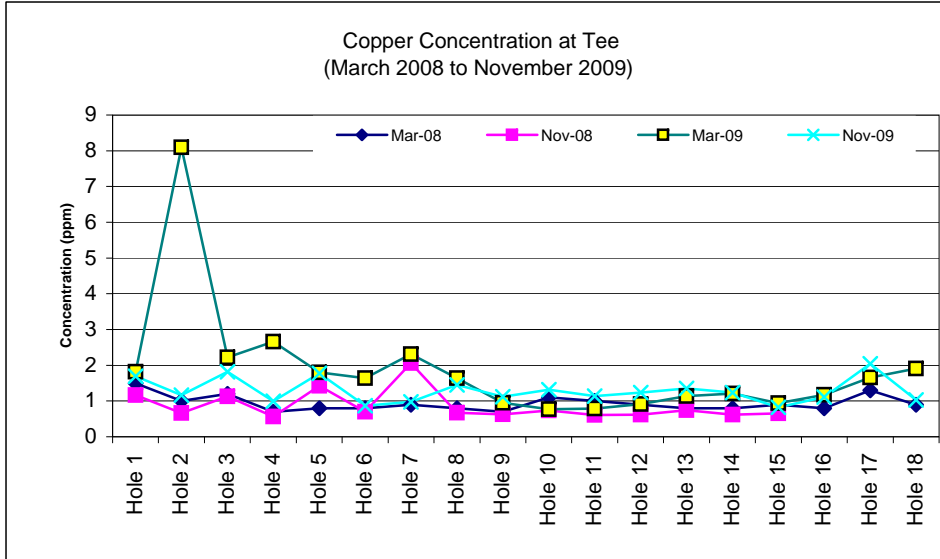
Soil Nutrients



Jockey Club Kau Sai Chau Public Golf Course - East Course

Water Quality Monitoring Results

Soil Nutrients



Annex D

Calibration Certificates



Environmental Division

CERTIFICATE OF ANALYSIS

CONTACT: MR WONG SIU HO
CLIENT: ENOVATIVE ENV TECHNOLOGY CO
ADDRESS: RM 3704 SIK MAN HOUSE
HOMANTIN ESTATE
KOWLOON
ORDER No.:
PROJECT:

Batch: HK164371
Sub Batch: 0
LABORATORY: HONG KONG
DATE RECEIVED: 25/01/2010
DATE OF ISSUE: 28/01/2010
SAMPLE TYPE: EQUIPMENT
No. of SAMPLES: 1

COMMENTS

The calibration procedure used for the analysis has been applied for the calibration of the above instrument.

NOTES

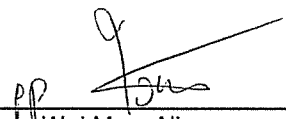
This is the Final Report and supersedes any preliminary report with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY: HONG KONG

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Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

Other ALS Environmental Laboratories

AUSTRALIA	AMERICAS
Brisbane	Hong Kong
Melbourne	Singapore
Sydney	Kuala Lumpur
Newcastle	Bogor

Vancouver
Santiago
Amtofagasta
Lima

ALS Technichem (HK) Pty Ltd
Part of the **ALS Laboratory Group**

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Phone: 852-2610 1044 Fax: 852-2610 2021 www.alsenviro.com
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CERTIFICATE OF ANALYSIS



Batch: HK164371
Sub Batch : 0
Date of Issue: 28/01/2010
Client: ENOVATIVE ENV TECHNOLOGY CO
Client Reference:

Calibration of Turbidimeter

Item : YSI SONDE Environmental Monitoring System
Model No. : 6920
Serial No. : 000109DF
Calibration Method : This meter was calibrated in accordance with standard method APHA (19th Ed.) 2130B
Date of Calibration : 25 January, 2010
Testing Results :

Expected Reading	Recording Reading
0.00 NTU	0.0 NTU
4.00 NTU	4.05 NTU
16.0 NTU	16.1 NTU
80.0 NTU	79.8 NTU
160 NTU	160 NTU
Allowing Deviation	±10%


Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS




Batch: HK164371
Sub Batch : 0
Date of Issue: 28/01/2010
Client: ENOVATIVE ENV TECHNOLOGY CO
Client Reference:

Calibration of Conductivity System

Item : YSI SONDE Environmental Monitoring System
Model No. : 6920
Serial No. : 000109DF
Calibration Method : This meter was calibrated in accordance with standard method APHA (19th Ed.) 2510B
Date of Calibration : 25 January, 2010

Testing Results :

Expected Reading	Recording Reading
1412 uS/cm	1422 uS/cm
6667 uS/cm	6673 uS/cm
58670 uS/cm	58550 uS/cm
Allowing Deviation	±10%


PP
Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS




Batch: HK164371
Sub Batch : 0
Date of Issue: 28/01/2010
Client: ENOVATIVE ENV TECHNOLOGY CO
Client Reference:

Calibration of Salinity System

Item : YSI SONDE Environmental Monitoring System
Model No. : 6920
Serial No. : 000109DF
Calibration Method : This meter was calibrated in accordance with standard method APHA (19th Ed.) 2520 A and B
Date of Calibration : 25 January, 2010

Testing Results :

Expected Reading	Recording Reading
10.0 g/L	10.0 g/L
20.0 g/L	20.0 g/L
30.0 g/L	30.0 g/L
Allowing Deviation	±10%


Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS



Batch: HK164371
Sub Batch : 0
Date of Issue: 28/01/2010
Client: ENOVATIVE ENV TECHNOLOGY CO
Client Reference:

Calibration of Thermometer

Item : YSI SONDE Environmental Monitoring System
Model No. : 6920
Serial No. : 000109DF
Calibration Method : In-house Method
Date of Calibration : 25 January, 2010

Testing Results :

Reference Temperature (°C)	Recorded Temperature (°C)
3.5 °C 19.7 °C	3.6 °C 19.8 °C
Allowing Deviation	±2.0°C

CERTIFICATE OF ANALYSIS

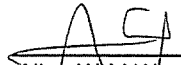


Batch: HK164371
Sub Batch : 0
Date of Issue: 28/01/2010
Client: ENOVATIVE ENV TECHNOLOGY CO
Client Reference:

Calibration of DO System

Item : YSI SONDE Environmental Monitoring System
Model No. : 6920
Serial No. : 000109DF
Calibration Method : This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-OC & G
Date of Calibration : 25 January, 2010
Testing Results :

Expected Reading	Recording Reading
0.00 mg/L	0.10 mg/L
2.26 mg/L	2.31 mg/L
4.87 mg/L	4.83 mg/L
8.01 mg/L	8.09 mg/L
Allowing Deviation	±0.2 mg/L



Alice W M Wong
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS



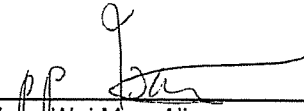
Batch: HK164371
Sub Batch : 0
Date of Issue: 28/01/2010
Client: ENOVATIVE ENV TECHNOLOGY CO
Client Reference:

Calibration of pH System

Item : YSI SONDE Environmental Monitoring System
Model No. : 6920
Serial No. : 000109DF
Calibration Method : This meter was calibrated in accordance with standard method APHA (19th Ed.) 4500 H:B
Date of Calibration : 25 January, 2010

Testing Results :













Expected Reading	Recording Reading
4.00	4.00
7.00	7.00
10.0	10.0
Allowing Deviation	±0.2 unit



Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

Annex E

Fertilizer and Pesticides Application

December 2009						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
20 	21 	22  F (1-18)	23  F (1-18, PG2) WQ	24 	25 	26 
27 	28 	29  F (1-18, PG2)	30 	31  F (1-18, PG2)		

January 2010						
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1 	2 
3 	4  F (1-18) WQ	5 	6  C (1-18)	7 	8  F (1-18, PG2)	9 
10 	11  F (1-18)	12  F (1-18)	13  F (1-18)	14 	15  F (1-18, PG2)	16  F (1-18, PG2)
17 	18 	19 	20  WQ	21  F (1-18, PG2)	22 	23 
24 	25 	26 	27 	28 	29 	30 
31 						

Remarks:

1. Dosage Application by JCKSC

F (follow with numbers) – fertilizers were applied at those holes of East Golf Course.

C (follow with numbers) – non-biological chemicals (eg. pesticides, fungicides, etc.) were applied at those holes of East Golf Course.

2. Weather Information (from Hong Kong Observatory)



daily duration of sunshine > 4 hours and without raining



daily rainfall > 0.5 mm at Kau Sai Chau Island



daily duration of sunshine < 4 hours and without raining



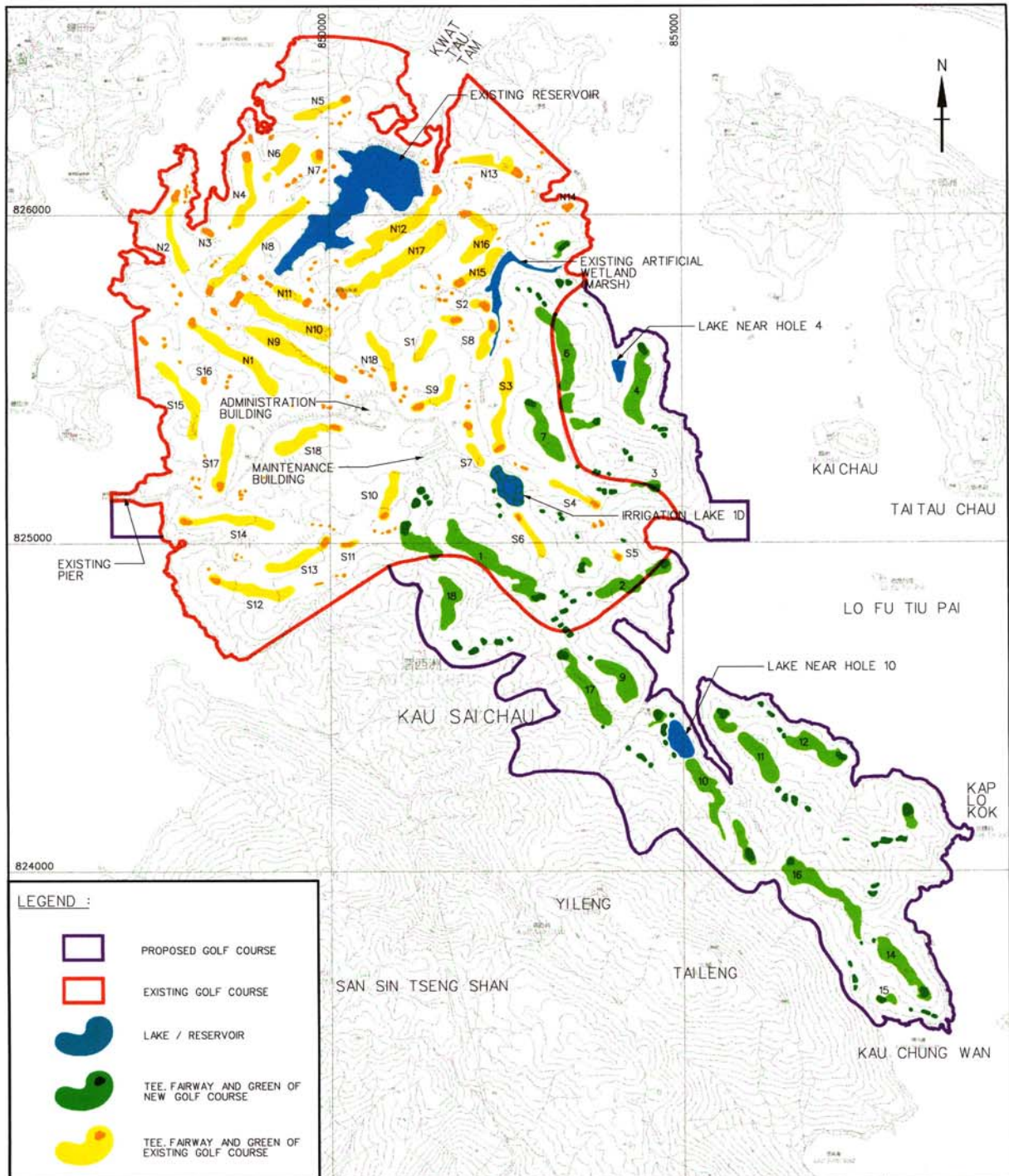
daily rainfall > 30 mm at Kau Sai Chau Island

{R} Rainstorm signal was hoisted; “A” stands for Amber, “R” stands for Red and “B” stands for Black rainstorm signals were hoisted.





3. Environmental Monitoring

WQ – fresh and marine water quality monitoring were implemented.

FIGURES



LEGEND :

	PROPOSED GOLF COURSE
	EXISTING GOLF COURSE
	LAKE / RESERVOIR
	TEE, FAIRWAY AND GREEN OF NEW GOLF COURSE
	TEE, FAIRWAY AND GREEN OF EXISTING GOLF COURSE

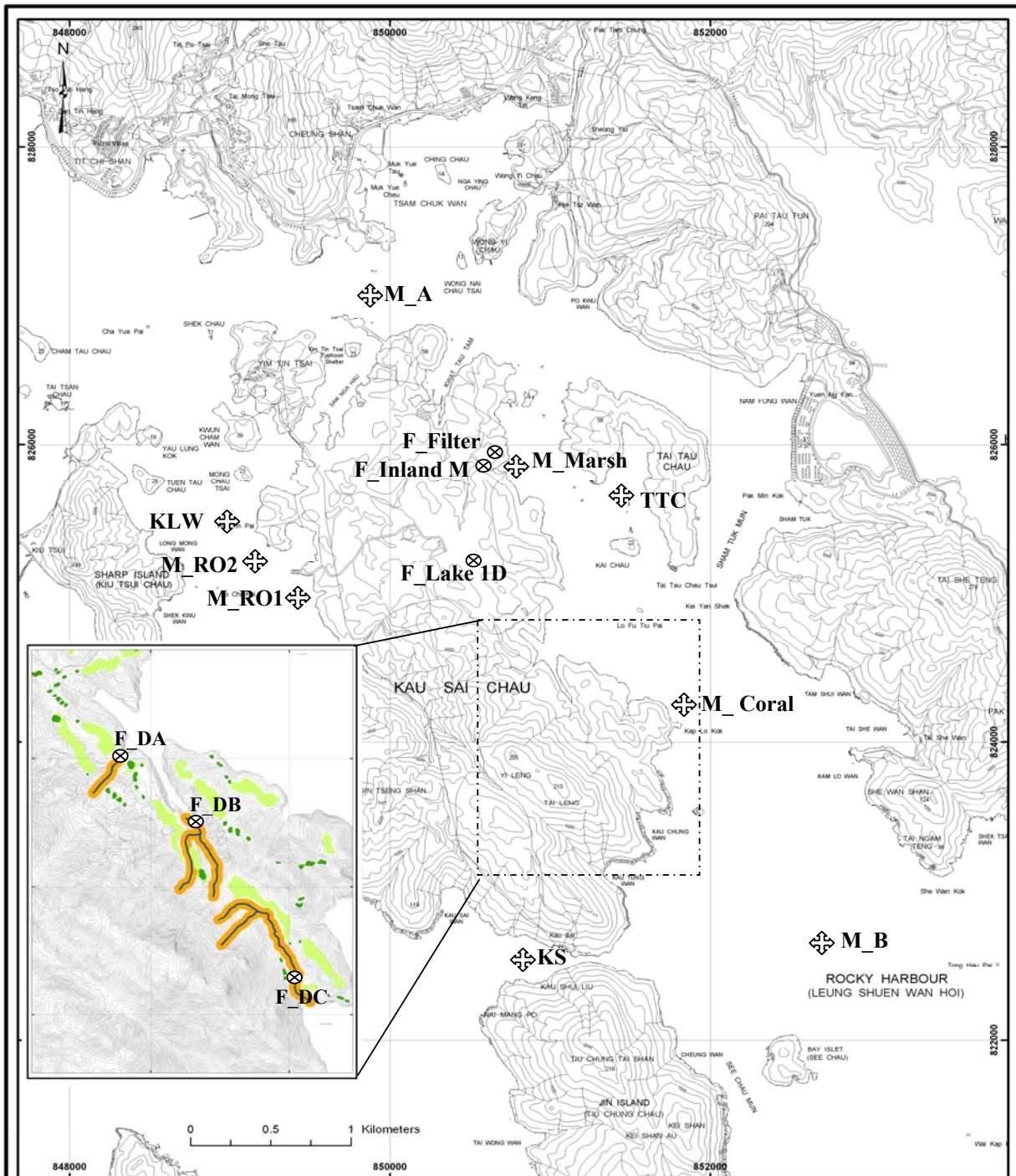
 The Hong Kong Jockey Club

 **BLACK & VEATCH HONG KONG LIMITED**
博威工程顧問有限公司

PROPOSED EXTENSION OF PUBLIC GOLF
Public Golf Course at Kau Sai Chau Island,
Sai Kung

Master Layer Plan

Fig 1.1	Revision
Reference	File Name
Prepared	Checked
Date	Scale
ET	PKL
Apr 08	1:15000 (A4)



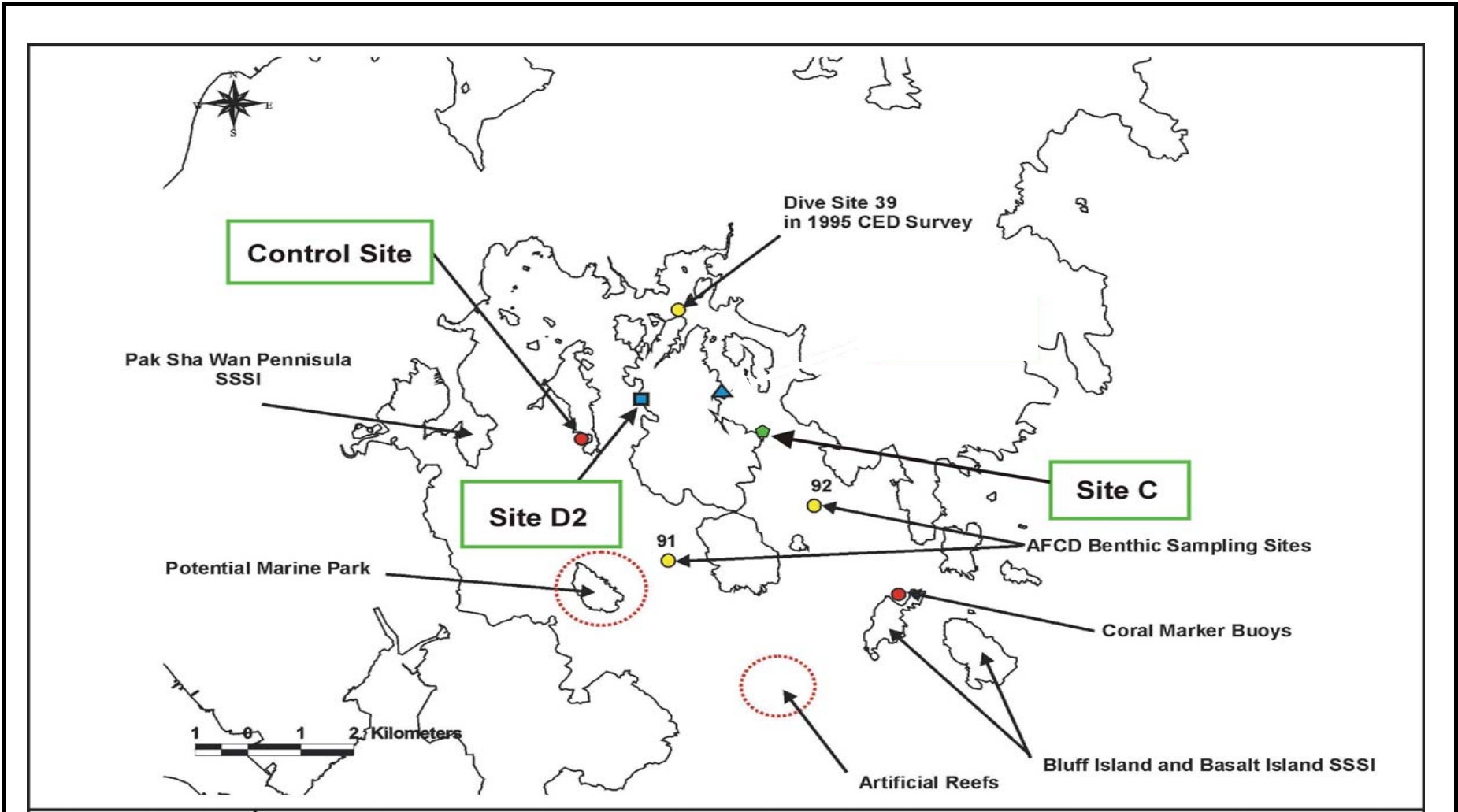

 香港賽馬會
 The Hong Kong Jockey Club


 BLACK & VEATCH HONG KONG LIMITED
 博威工程顧問有限公司

Public Golf Course at Kau Sai Chau Island, Sai Kung
 Water Quality Monitoring Locations -
 Operation Phase

Fig 3.1	
ET	PKL
Apr 08	

MXD: \\s:\p566\0\Project\032219_022\location.mxd
 Plot No: C:\P566\0\Project\032219_022\location.pdf



香港賽馬會
The Hong Kong Jockey Club



BLACK & VEATCH HONG KONG LIMITED
博威工程顧問有限公司

Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung

Coral Survey Monitoring Location

Fig 3.2

Prepared	Checked
ET	PKL
Date	Apr-08