Airport Management Services Limited

SkyCity Nine Eagles Golf Course EM&A Quarterly Compliance Report

February 2008 to April 2008

Report no: 01508R0041

Hyder Consulting

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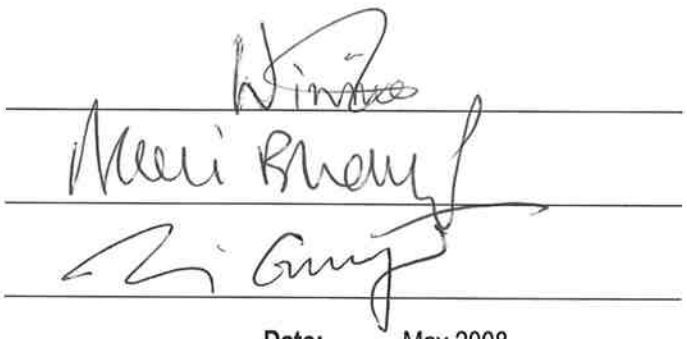

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Hyder Consulting

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1 Executive Summary

The purpose of this Project is to construct and operate a 9-hole Golf Course at the east side of the North Commercial District (NCD) on the Airport Island as an interim arrangement prior to the area's future development as a business park (see ***Figure 1-1***). The proposed interim golf facility, known as "SkyCity Nine Eagles Golf Course" is intended to serve airport passengers, overseas visitors and airport workers until August 2013.

The Project is managed by Airport Management Services Limited (AMS) who have engaged Green Management Ltd to establish and maintain the turfgrass of the Golf Course. Hyder Consulting have been employed as the Environmental Team (ET) for the Operation Period and have engaged ALS Technichem Pty Ltd as the HOKLAS accredited testing laboratory to carry out lake water analysis.

Construction was completed on 31 December 2006. The first phase of the Operation Period was completed on 30 April 2007 and the second phase commenced on 1 May 2007.

According to the approved EM&A Manual, compliance monitoring of lake water quality during the second phase of the Operation Period is required on a monthly basis. Parameters tested for include suspended solids, dissolved oxygen, BOD_5, nitrogen, phosphorous, temperature and salinity. According to the approved EM&A Manual reporting during the second phase of the Operation Period is required on a quarterly basis.

This is the fourth Quarterly Compliance report covering February 2008 to April 2008 and complies with the reporting requirements stated in the approved EM&A Manual.

During the reporting quarter, there were no exceedance of Action/ Limit Levels for lake water quality; no complaints received; and there were no notifications of summons. Overall, there have been no adverse off-site environmental impacts during the reporting quarter. A lake water monitoring schedule for the next quarter is provided in Section 2.7.

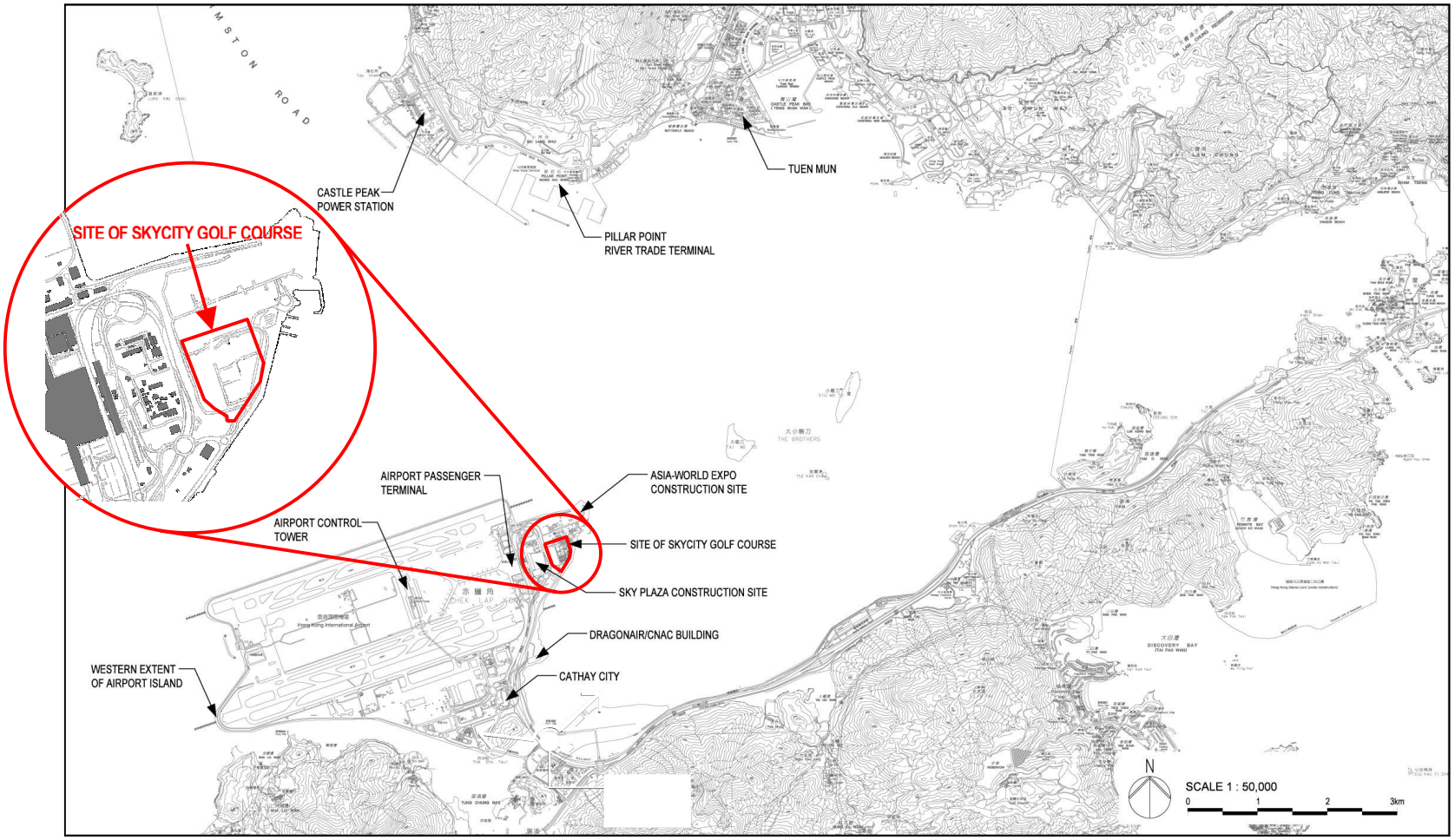


Figure 1-1 Location of SkyCity Golf Course on the Airport Island

2 Lake Water Quality EM&A

2.1 Overview

The Golf Course has been designed to contain water within two artificial lakes, which are linked together by two underwater pipes,. Because of the sloping topography of the site, all rainwater collected within the Golf Course will drain into the lakes through a sub-soil drainage system. The lakes provide a source of freshwater for irrigation, from which surplus water will flow back into the lakes.

The lakes are normally maintained at a capacity of 15,000m^3. This is not "full" but is the level that provides the required visual appearance. During the winter (dry) months, however, the lake water may fall below this level. The maximum capacity of the lakes is 20,000m^3.

If more than 20,000m^3 of water flows into the lakes, then the Golf Course may flood. To avoid this, the Golf Course Supervisor can authorise the opening of a control valve to allow the water to overflow from the lake and into off-site storm drains that discharge via Outfall No. 8. However, the valve can only be opened if the latest lake water monitoring results indicate that water is of an acceptable quality. In normal circumstances, the control valve remains closed and discharge off-site is not possible. All opening/closing of the control valve is logged on site.

If the latest lake water monitoring results indicate that water is not of an acceptable quality, then the valve cannot be opened, the lake water cannot overflow and the Golf Course may begin to flood. This is part of the mitigation design to prevent off-site discharge of water that does not meet the required standard.

The bund that surrounds the site is at least 1.5m high and up to 90,000m^3 of floodwater can be retained within the Golf Course in addition to the 20,000m^3 lake capacity. In this situation, water samples from the flooded Golf Course will be taken more frequently. Only when water has returned to an acceptable quality will the control valve be opened to allow water to overflow from the lake and into off-site storm drains that discharge via Outfall No. 8, thereby allowing the flood to recede.

The system by which this water control is achieved is shown in ***Figure 1-1***.

2.2 EM&A Programme

Monitoring of Dissolved Oxygen (DO) concentration in mg/ℓ, Suspended Solids (SS) in mg/ℓ, BOD_5 in mg/ℓ, Total Nitrogen in mg/ℓ, Total Phosphorous in mg/ℓ and Salinity in mg/ℓ, was carried out by the ET to ensure that any deterioration in lake water quality could be readily detected and timely action could be taken to rectify the situation if this was due to site operations. DO was measured *in-situ* whilst SS was determined in a HOKLAS-accredited laboratory.

2.2.1 Equipment and Methodology

Because of the relatively shallow water, *in-situ* measurements and water sampling were conducted at 0.5m from the surface (the mid-point of the 1m deep lake). Water samples for all monitoring parameters were collected, stored, preserved and analysed according to *APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition,* #17.

In-situ DO concentration and DO saturation were carried out using a YSI Model 85 CE-C-M-Y multi-parameter meter and the range, resolution and accuracy of the equipment is provided in ***Table 2-1***:

Parameter	YSI Model 85 CE-C-M-Y		
	Range	Resolution	Accuracy
DO Concentration	0 to 12 mg/ℓ	0.001 mg/ℓ	0 to 20 mg/ℓ: ± 0.2 mg/ℓ of reading
DO Saturation	0 to 150%	0.1%	0 to 100%: ±1% of reading

Table 2-1 *In-situ* Monitoring Equipment Details

A Kahlisco water sampler was used to obtain the water sample for subsequent SS analysis. The volume of the sample shall not be less than 1ℓ and shall be collected in clean high density polythene bottles, packed in ice (cooled to 4℃ without being frozen), and delivered to ALS' laboratory (HOKLAS accredited) immediately after completion of monitoring. The determination of the collected samples will start within the next working day after sample collection. The analysis follows APHA *Standard Methods #*2540D.

2.2.2 Maintenance and Calibration

All *in-situ* monitoring instruments are calibrated and certified by ALS at monthly intervals throughout all stages of the lake water quality monitoring programme.

For DO, the probe (YSI 85) is calibrated once per monitoring day by the wet bulb method. Calibration at ALS is carried out once every month in a water sample of known dissolved oxygen concentration. The sensor is immersed in the water and after thermal equilibration, the known mg/ℓ value is keyed in and the calibration is carried out automatically. Calibration details are provided in ***Appendix 3***.

2.2.3 Parameters Monitored

The following parameters are monitored and compared to A/L Levels:

- Dissolved Oxygen (DO)
- Suspended Solids (SS)
- BOD_5
- Total Nitrogen
- Total Phosphorous

2.2.4 Monitoring Locations

Monitoring locations together with grid references are shown in ***Figure 2-2***. Monitoring Stations are designated as W1, W2, W3 and W4.

2.2.5 Monitoring Date, Time, Frequency and Duration

In accordance with the EM&A Manual, the monitoring frequency of lake water quality is shown as ***Table 2-2***:

	Operation Phase	
	Below Action/Limit Level	Action/Limit Level Exceedance
Monitoring Frequency	Monthly	Weekly

Table 2-2 Monitoring Frequency

2.3 Action/Limit Levels

According to the approved EM&A manual, the A/L Levels for the compliance monitoring (for monitoring locations W1 to W4) are shown in ***Table 2-3***:

Parameter	Acceptable Standard (mg/ℓ)*	
	Action Level	Limit Level
Suspended Solids	20	30
BOD_5	13.5	20
Dissolved Oxygen	4	3
Total Nitrogen	20	30
Total Phosphorous	3.5	5

Table 2-3 Action and Limit Levels for Lake Water Quality

In case of exceedance of A/L Levels at monitoring locations W1 to W4, ET shall immediately implement the Event/ Action Contingency Plan as shown in the following ***Table 2-4*** in order to resolve the lake water quality problem:

Event	Action
Exceedance of Action Level	1. Notify the Golf Course Supervisor of the exceedance, providing full details (time, location, parameter, level, etc.). 2. Increase the frequency of monitoring of the particular parameter(s) to "Action/Limit Level Exceedance" as shown in Table 2-2. 3. If water quality continues to worsen, it may be prudent to review the Turfgrass Management Plan (TMP) in terms of application of nutrients and agree any revisions with the Golf Facility Supervisor. 4. Notify the Golf Facility Supervisor when water quality falls below "Action Level" and reduce monitoring frequency to "Below Action/Limit Level" as shown in Table 2-2.

Event	Action
Exceedance of Limit Level	1. Notify EPD and Golf Course Supervisor of the exceedance, providing full details (time, location, parameter, level, etc.). 2. Suspend any ongoing application of organic nutrients. 3. Determine the likely cause of the exceedance(s). Review the TMP in terms of application of nutrients and agree any revisions with the Golf Facility Supervisor. Continue to irrigate the Golf Course using lake water. 4. Increase the frequency of monitoring of the particular parameter(s) to "Action/Limit Level Exceedance" as shown in Table 2-2. (if not already at this frequency) to demonstrate the effectiveness of remedial measures and to confirm that water quality has returned to acceptable levels. 5. Notify EPD and Golf Course Supervisor when water quality falls below "Action Level" (not "Limit Level") and reduce monitoring frequency to "Below Action/Limit Level" as shown in Table 2-2.

Table 2-4 Event Action Plan for Lake Water Quality Monitoring

2.4 Summary of Exceedances

2.4.1 Review of Exceedances and Implications

A summary of lake water monitoring results for the reporting month is provided in ***Table 2-5***, below. Detailed results are provided in ***Appendix 1***.

Monitoring Location		Salinity (mg/ℓ)	Temperature (°C)	SS (mg/ℓ)	BOD_5 (mg/ℓ)	DO Saturation (%age)	DO Concentration (mg/ℓ)	Total Nitrogen (mg/ℓ)	Total Phosphorous (mg/ℓ)
W1	**Mean**	0.1	20.6	5.0	3.3	107.3	9.7	1.1	0.1
	Minimum	0.1	13.5	2.0	2.0	98.9	8.5	0.9	0.1
	Maximum	0.1	25.5	11.0	6.0	120.0	10.8	1.2	0.1
W2	**Mean**	0.1	20.6	4.3	3.0	108.0	9.7	1.0	0.1
	Minimum	0.1	13.5	2.0	2.0	103.0	9.2	0.7	0.1
	Maximum	0.1	25.4	9.0	5.0	114.0	10.7	1.3	0.1
W3	**Mean**	0.1	20.4	2.7	3.0	104.2	9.6	0.7	0.1
	Minimum	0.1	12.2	2.0	2.0	99.5	8.5	0.4	0.1
	Maximum	0.1	26.0	4.0	5.0	110.0	10.8	1.0	0.1
W4	**Mean**	0.1	20.4	3.0	3.0	105.1	9.6	0.7	0.1
	Minimum	0.1	12.2	2.0	2.0	99.2	9.0	0.4	0.1
	Maximum	0.1	26.0	4.0	5.0	110.0	10.6	1.2	0.1

Notes: **Bold** indicates Action Level exceedance

Bold indicates Limit Level exceedance

Table 2-5 Summary of Compliance Monitoring Data During Reporting Quarter

Graphical plots of the monitoring result since commencement of second phase of Operation from October 2007 are given in ***Appendix 2***.

No exceedance of Action / Limit Level for water quality monitoring was recorded during the reporting quarter.

2.4.2 Action Taken and Follow-up

There were no exceedances for the reporting quarter.

2.5 Operational Results

Table 2-6, below, shows the operational results during the reporting quarter, i.e., the activities relating to the management of water in the lakes:

Month	Month-end Lake Water Depth (m)	Can Control Valve Be Opened?	Has Control Valve Been Opened?	Quantity of Water Discharged (m^3)
February 2008	0.8	Yes	No	0
March 2008	1.0	Yes	No	0
April 2008	1.5	Yes	No	0

Table 2-6 Operational Results

From Section 2.4***,*** the EM&A results for the reporting quarter have shown that A/L Levels were not exceeded in the reporting quarter. Therefore, the quality of the water in the lakes is acceptable for discharge, should the need arise (i.e. that the control valve can be opened if needed).

The Golf Course Supervisor has, however, confirmed that the control valve has NOT been opened during the reporting quarter and that water has NOT been discharged from the Golf Course.

2.6 Complaints and Notifications of Summons

2.6.1 Complaints

No complaints were received during the reporting month and there are no outstanding follow-up issues to be addressed.

2.6.2 Notifications of Summons

No notifications of summons were received during the reporting month and there are no outstanding follow-up issues to be addressed.

2.7 Future Monitoring Schedule

The lake water monitoring schedule for the next quarter (May to July 2008) is given in ***Table 2-7***, below.

Sampling Date	Sampling Locations
09 May 2008	W1 to W4
13 June 2008	W1 to W4
11 July 2008	W1 to W4

Table 2-7 Future Monitoring Schedule

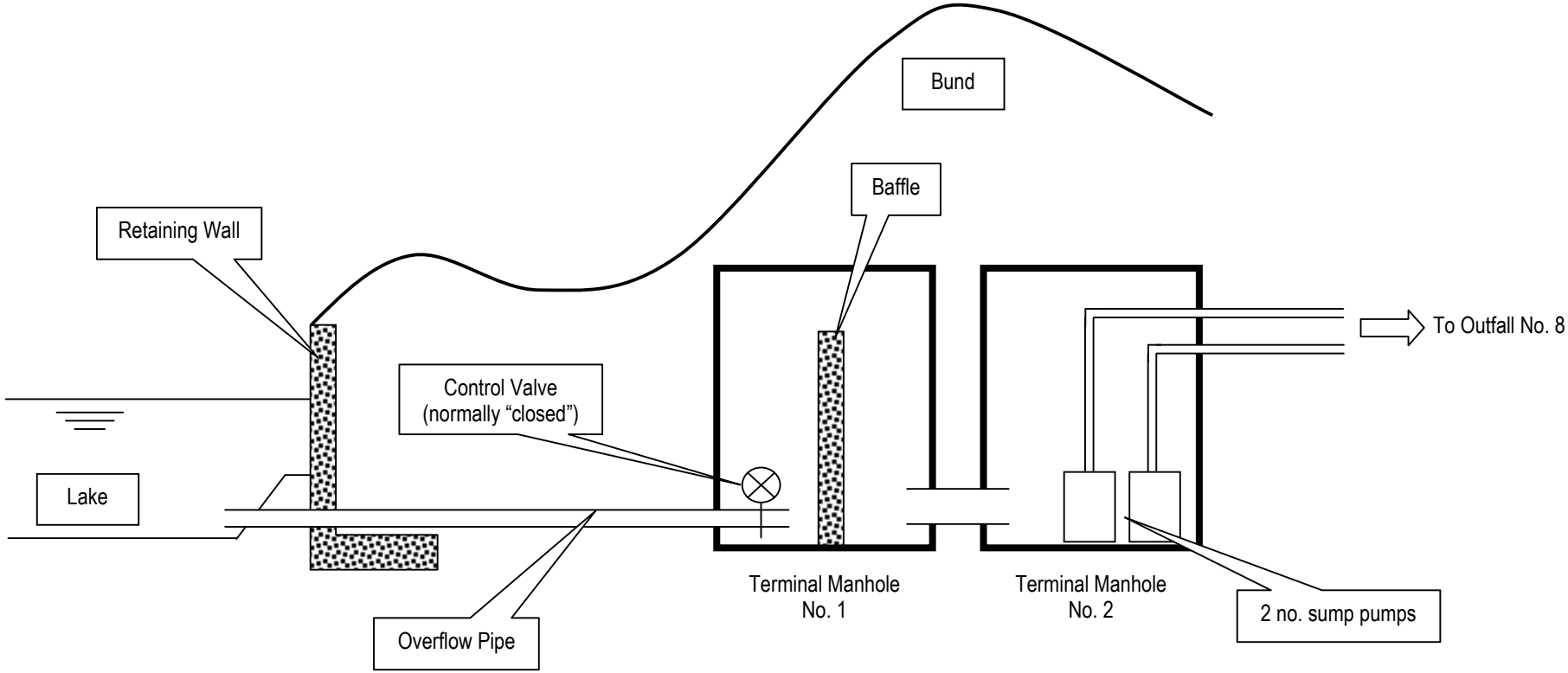


Figure 2-1 Schematic of Lake Water Control System

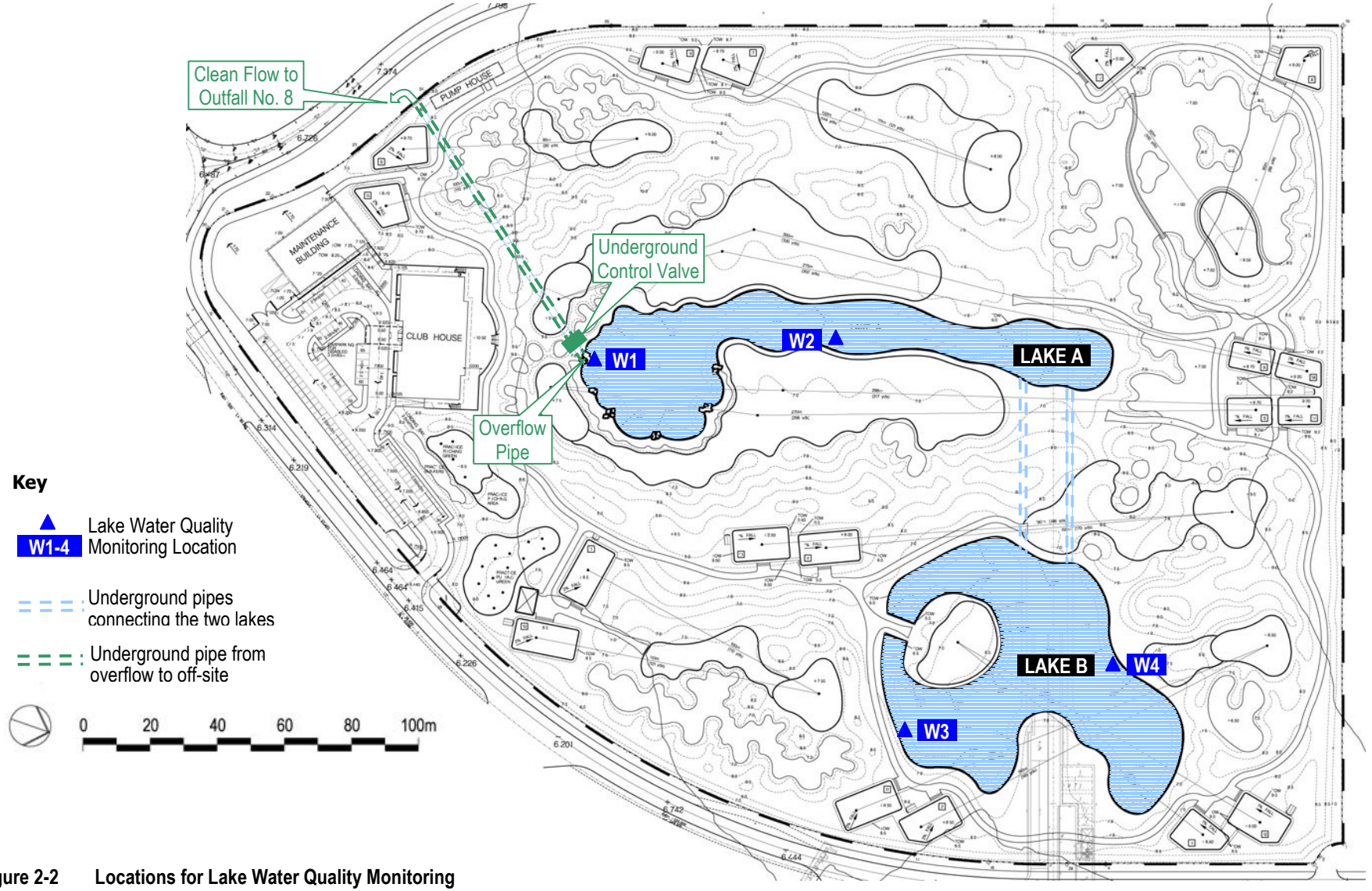


Figure 2-2 Locations for Lake Water Quality Monitoring

3 Comments, Recommendations and Conclusions

Compliance monitoring of lake water quality is required on a monthly basis. Parameters tested for include suspended solids, dissolved oxygen, BOD_5, nitrogen, phosphorous, temperature and salinity. Monthly compliance monitoring was carried out on 15 February 2008, 14 March 2008 and 11 April 2008 at four locations within the two lakes.

Reporting during the second phase of the Operation Period is required on a quarterly basis. This is the fourth Quarterly Compliance report covering February 2008 to April 2008 and complies with the reporting requirements stated in the approved EM&A Manual.

There was no exceedance of Action / Limit Levels for lake water quality during the reporting quarter; no complaints received; and there were no notifications of summons.

Appendix 1

Lake Water Quality Monitoring Data

Date	Time	Station	Salinity (mg/ℓ)	Temperature ^{O}C	Suspended Solids (mg/ℓ)	BOD_5 (mg/ℓ)	Dissolved Oxygen Saturation (%)	Dissolved Oxygen Concentration (mg/ℓ)	Total Nitrogen (mg/ℓ)	Total Phosphorous (mg/ℓ)
15-Feb-08	11:10	W1	0.1	13.5	2.0	2.0	103.0	10.8	1.2	0.1
15-Feb-08	11:15	W2	0.1	13.5	2.0	2.0	103.0	10.7	1.3	0.1
15-Feb-08	11:25	W3	0.1	12.2	2.0	2.0	99.5	10.8	0.6	0.1
15-Feb-08	11:30	W4	0.1	12.2	2.0	2.0	99.2	10.6	0.6	0.1
14-Mar-08	11:10	W1	0.1	22.8	2.0	2.0	98.9	8.5	0.9	0.1
14-Mar-08	11:20	W2	0.1	22.9	2.0	2.0	107.0	9.2	0.7	0.1
14-Mar-08	11:30	W3	0.1	22.9	2.0	2.0	110.0	9.5	0.4	0.1
14-Mar-08	11:40	W4	0.1	23.1	3.0	2.0	106.0	9.1	0.4	0.1
11-Apr-08	11:00	W1	0.1	25.5	11.0	6.0	120.0	9.8	1.1	0.1
11-Apr-08	11:05	W2	0.1	25.4	9.0	5.0	114.0	9.2	1.0	0.1
11-Apr-08	11:10	W3	0.1	26	4.0	5.0	103.0	8.5	1.0	0.1
11-Apr-08	11:20	W4	0.1	26	4.0	5.0	110.0	9.0	1.2	0.1
		Mean	0.1	20.5	3.8	3.1	106.1	9.6	0.9	0.1
		Min	0.1	12.2	2.0	2.0	98.9	8.5	0.4	0.1
		Max	0.1	26.0	11.0	6.0	120.0	10.8	1.3	0.1

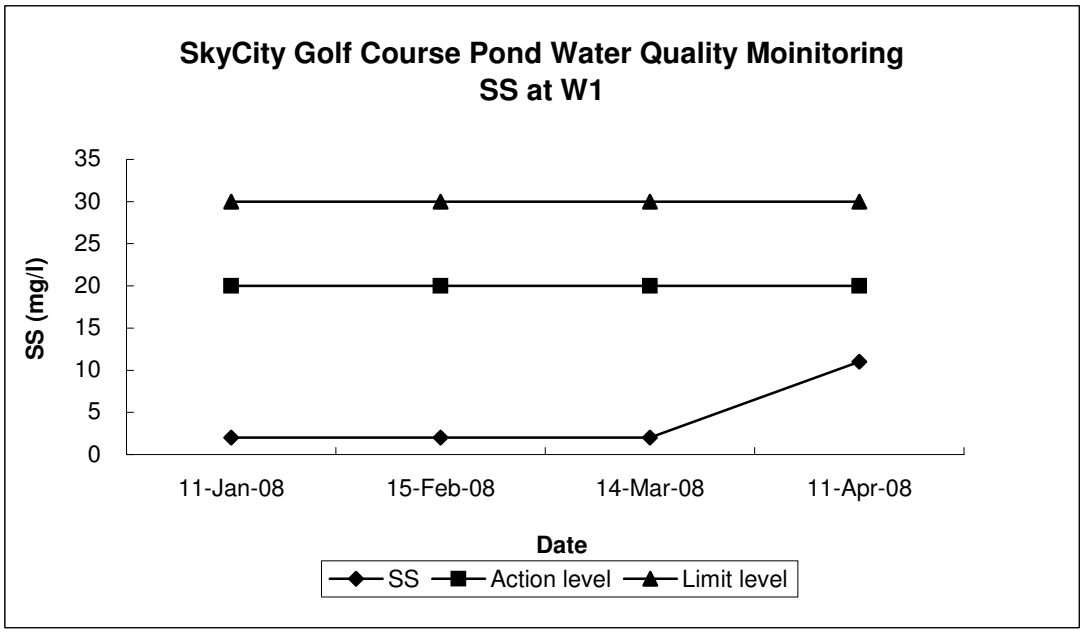
Note : "n/a" indicates data is not available

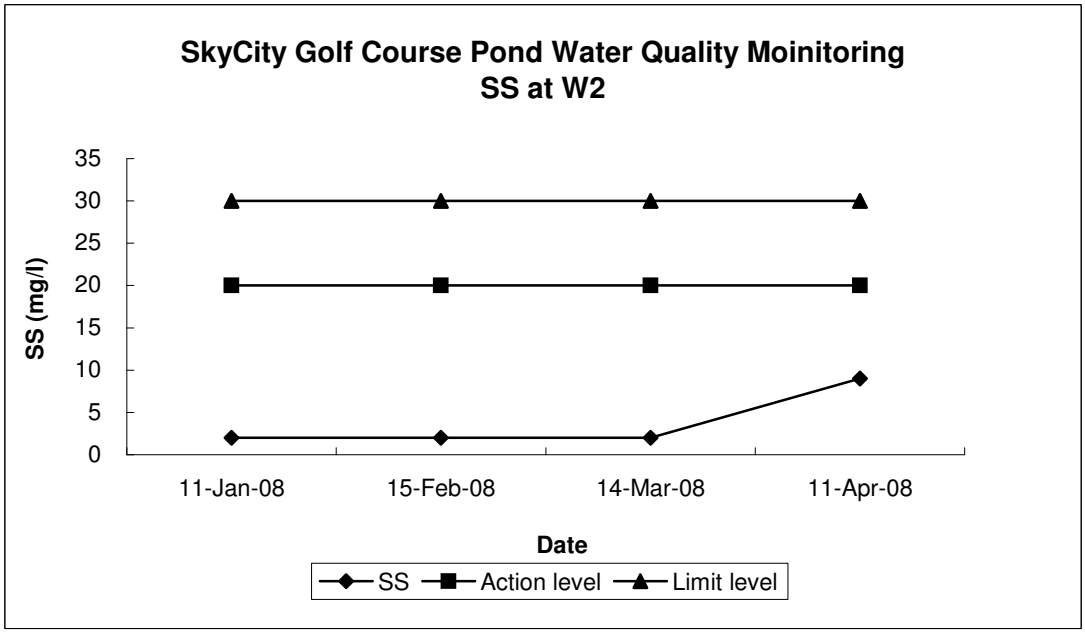
Bold indicates Action Level exceedance

Bold indicates Limit Level exceedance

Appendix 2

Graphical Plots for Monitoring Results


SkyCity Golf Course Pond Water Quality Moinitoring
SS at W1
SS (mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
SS
Action level
Limit level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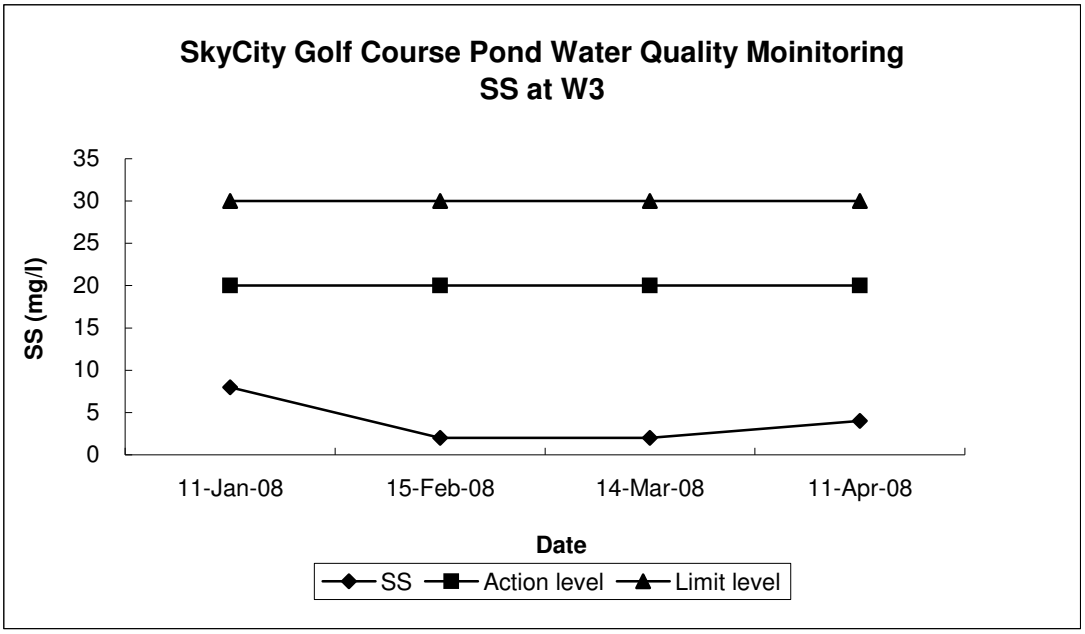
SS at W2
SS (mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
SS
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
SS at W3
SS (mg/l)
35
30
25
20
15
10
5
0
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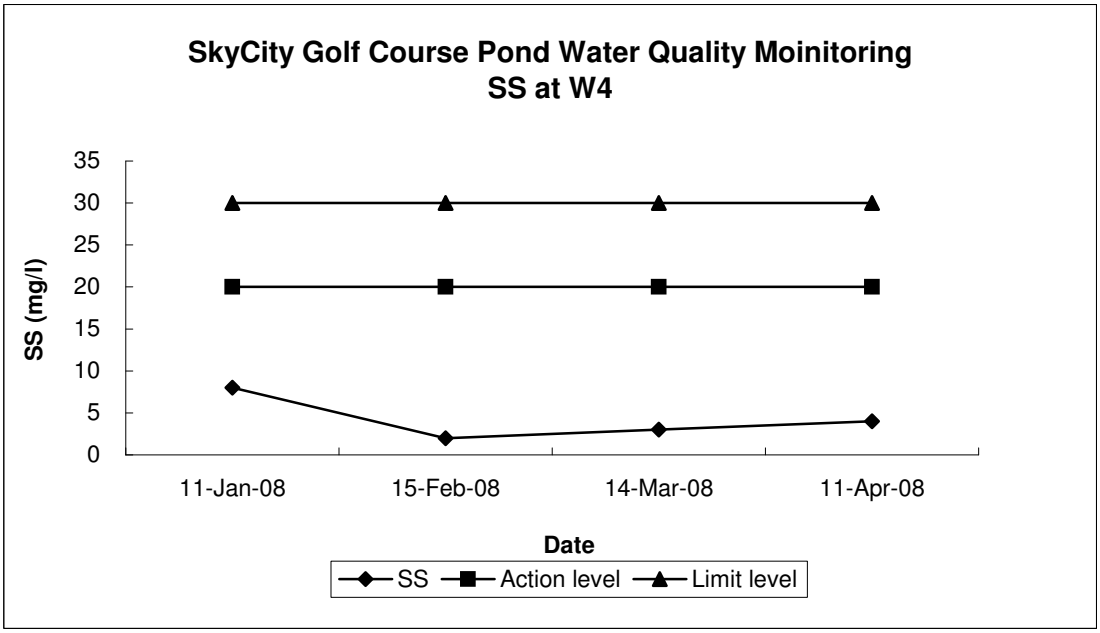
15-Feb-08
14-Mar-08
11-Apr-08
Date
SS
Action level
Limit level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SS at W4
SS (mg/l)
35
30
25
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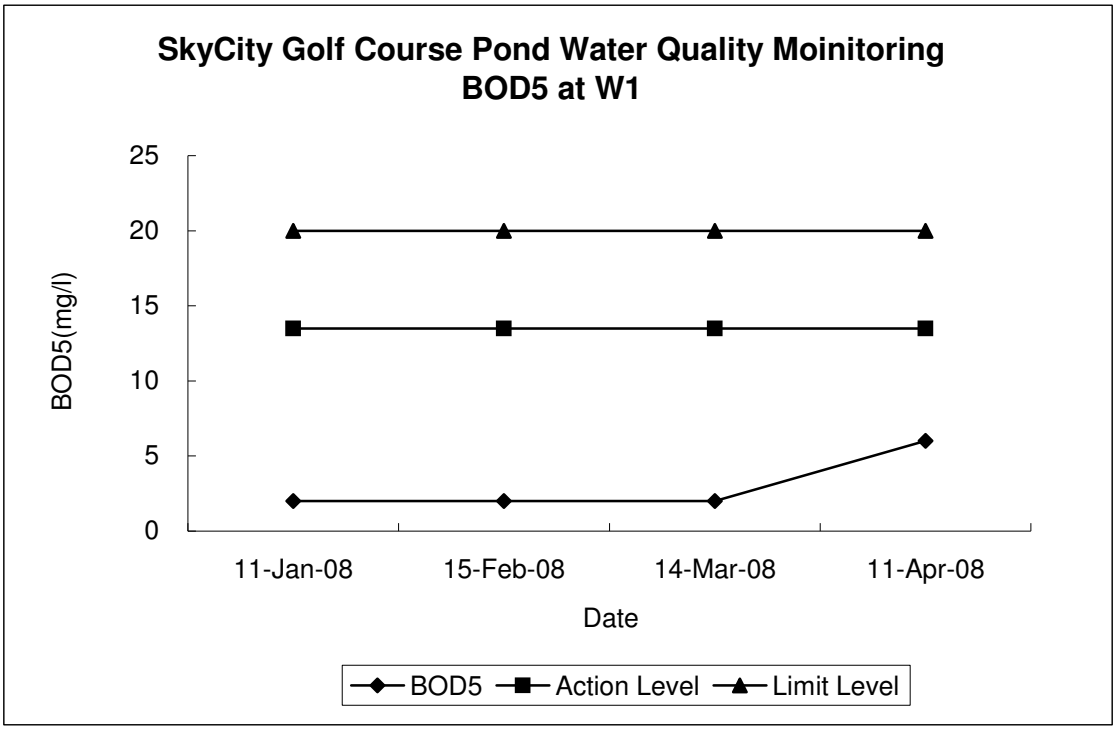
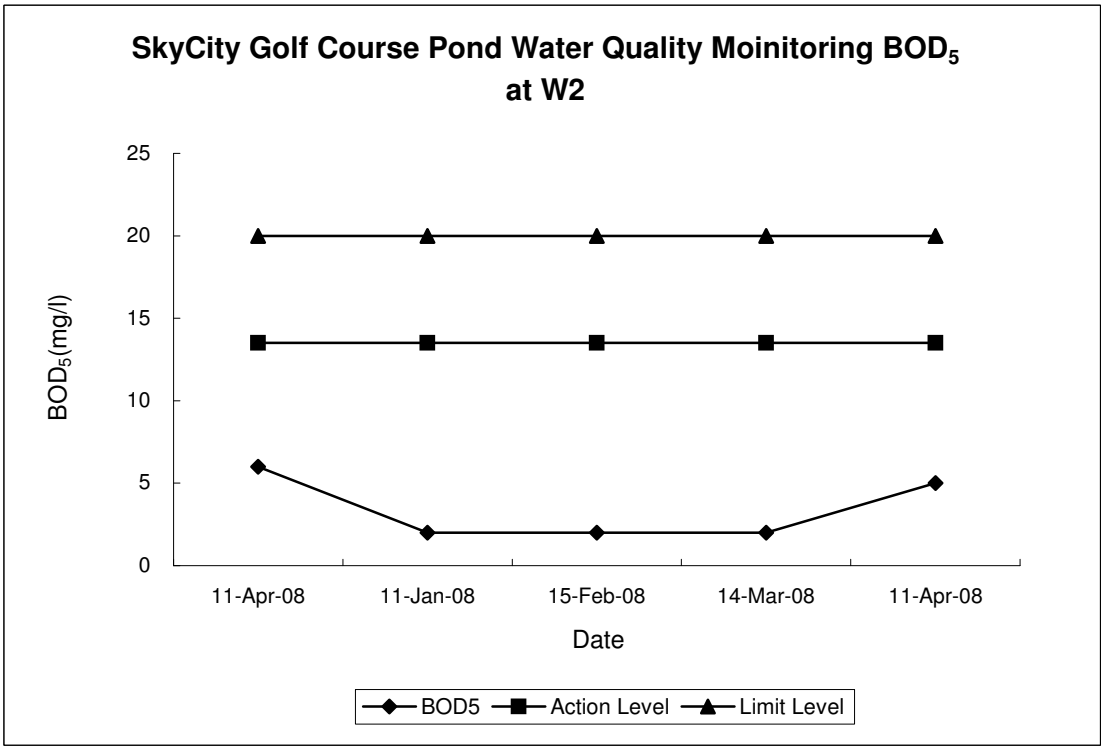
15-Feb-08
14-Mar-08
11-Apr-08
Date
SS
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
BOD5 at W1
25
20
15
10
5
0
BOD5(mg/l)
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
BOD5
Action Level
Limit Level


SkyCity Golf Course Pond Water Quality Moinitoring BOD5
at W2
25
20
15
10
5
0
BOD5(mg/l)
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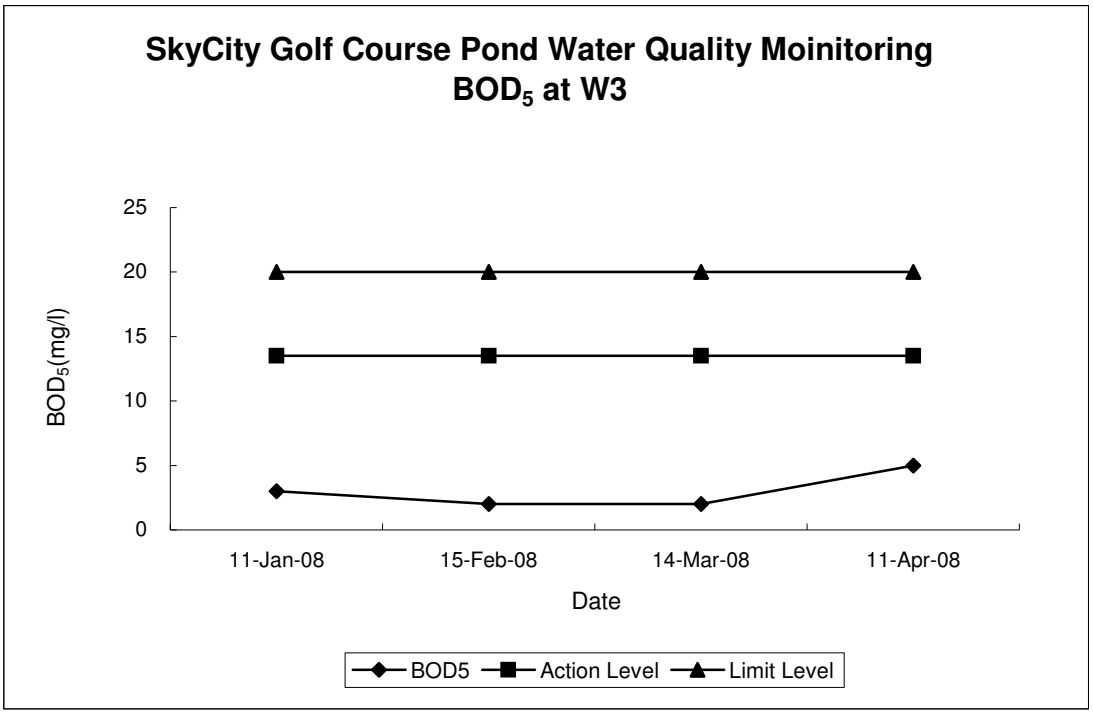
15-Feb-08
14-Mar-08
11-Apr-08
Date
BOD5
Action Level
Limit Level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BOD5 at W3
25
20
15
10
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BOD5(mg/l)
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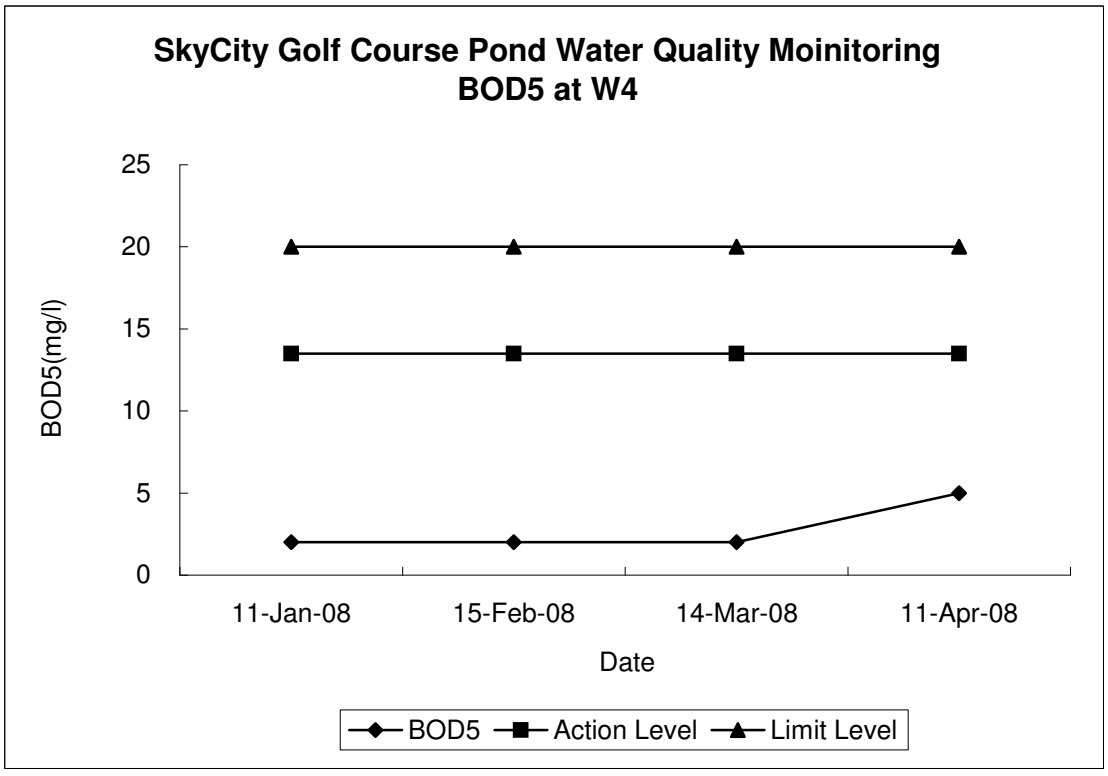
14-Mar-08
11-Apr-08
Date
BOD5
Action Level
Limit Level


SkyCity Golf Course Pond Water Quality Moinitoring
BOD5 at W4
25
20
15
10
5
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BOD5(mg/l)
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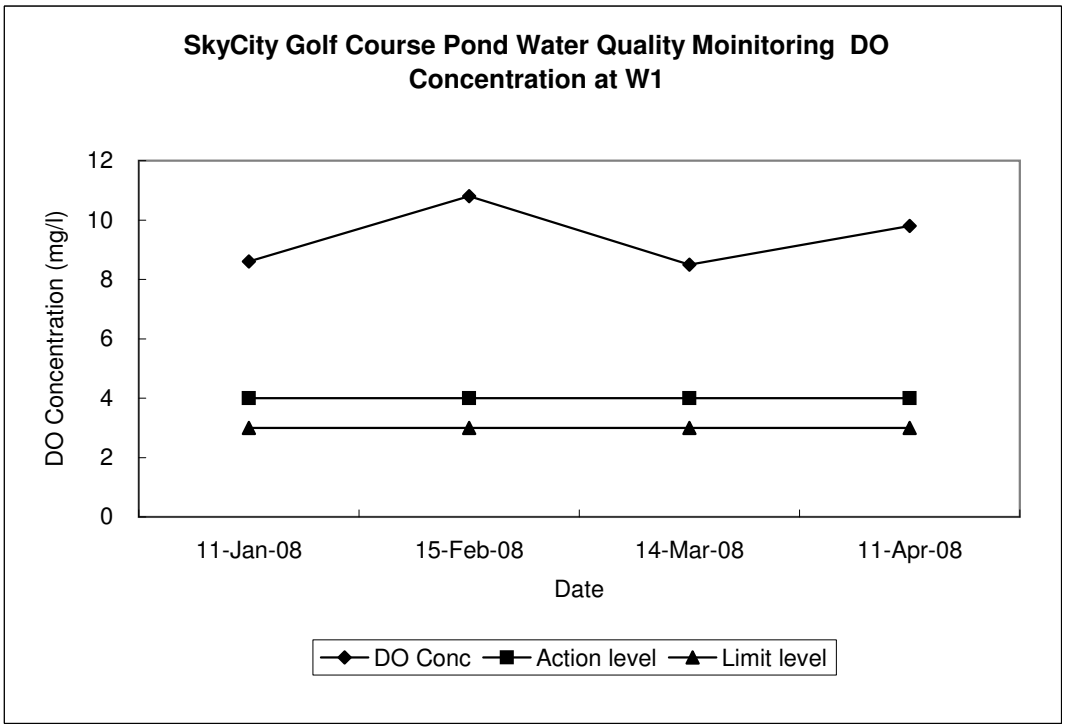
14-Mar-08
11-Apr-08
Date
BOD5
Action Level
Limit Level


SkyCity Golf Course Pond Water Quality Moinitoring DO Concentration at W1
DO Concentration (mg/l)
12
10
8
6
4
2
0
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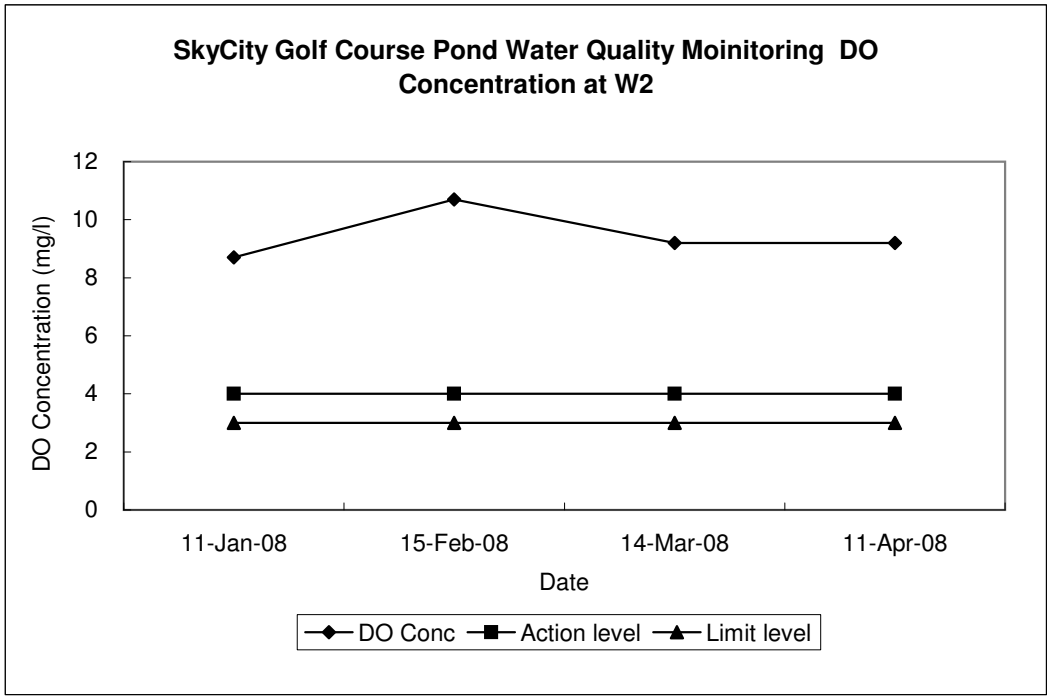
15-Feb-08
14-Mar-08
11-Apr-08
Date
DO Conc
Action level
Limit level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DO Concentration (mg/l)
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10
8
6
4
2
0
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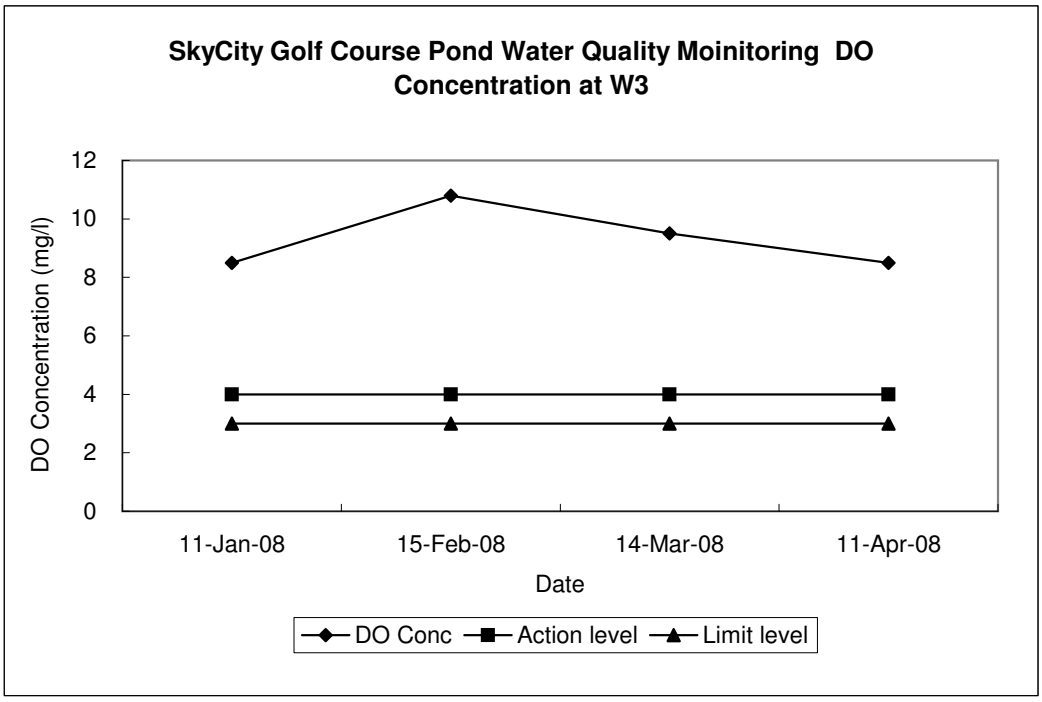
14-Mar-08
11-Apr-08
Date
DO Conc
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring DO Concentration at W3
DO Concentration (mg/l)
12
10
8
6
4
2
0
11-Jan-08
15-Feb-08
14-Mar-08
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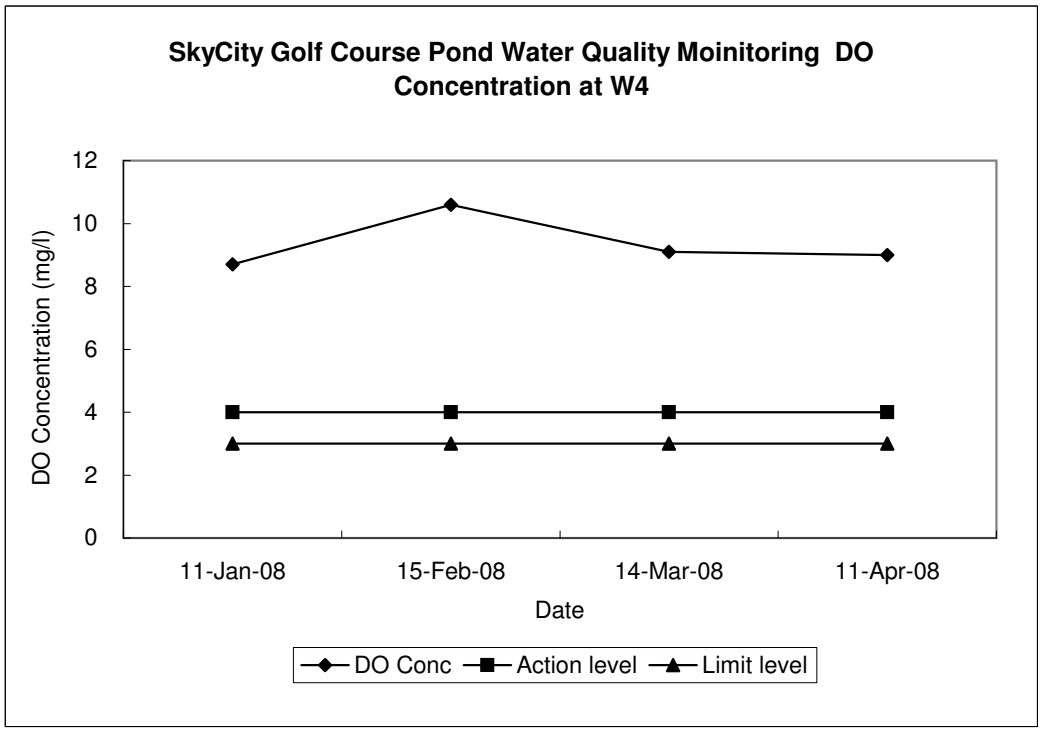
DO Conc
Action level
Limit level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DO Concentration (mg/l)
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8
6
4
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14-Mar-08
11-Apr-08
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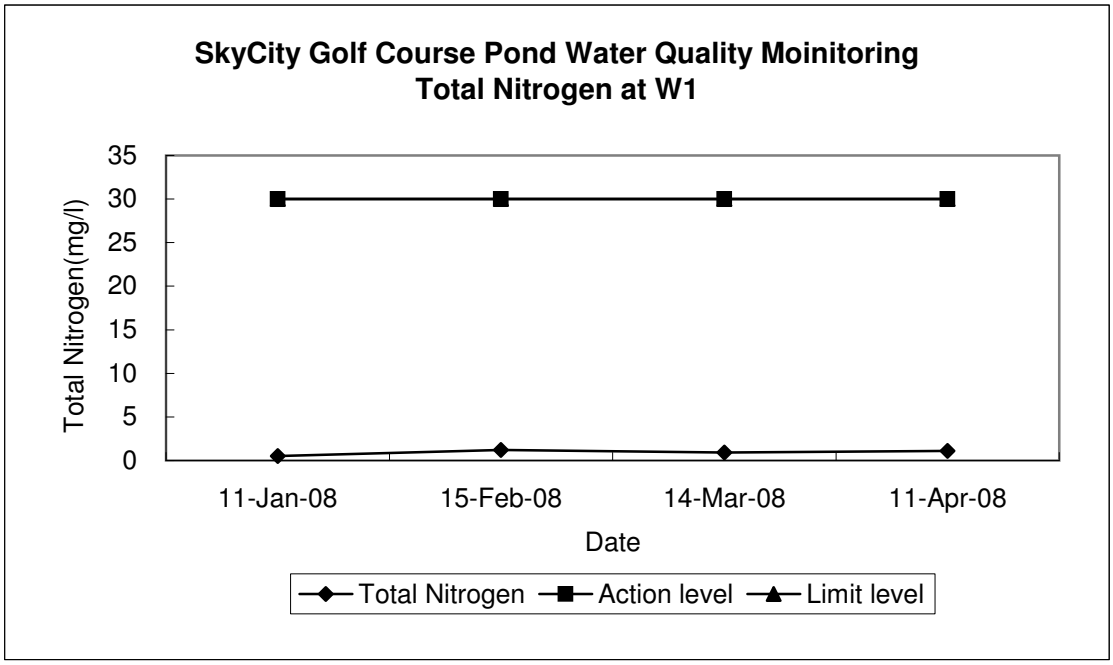
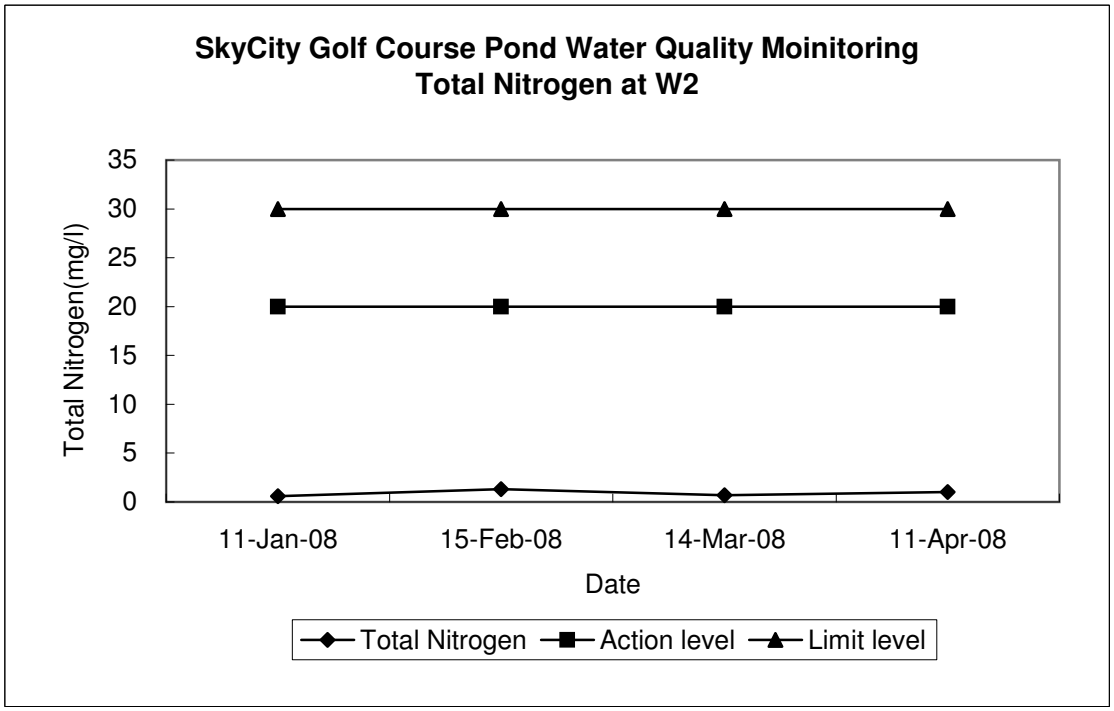
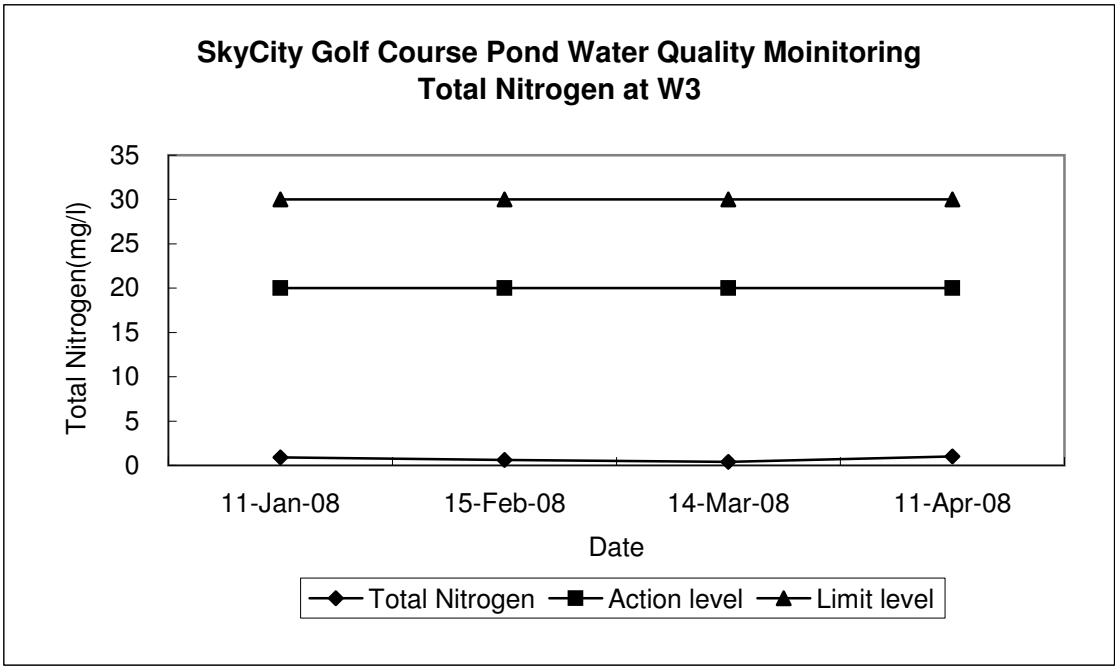
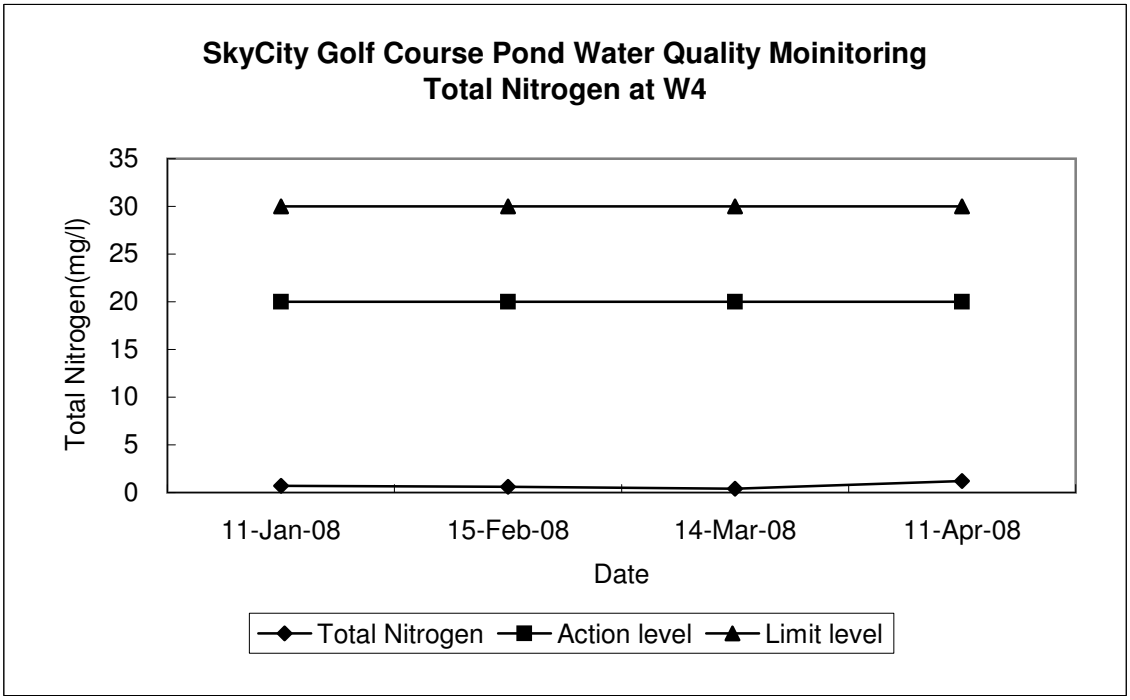
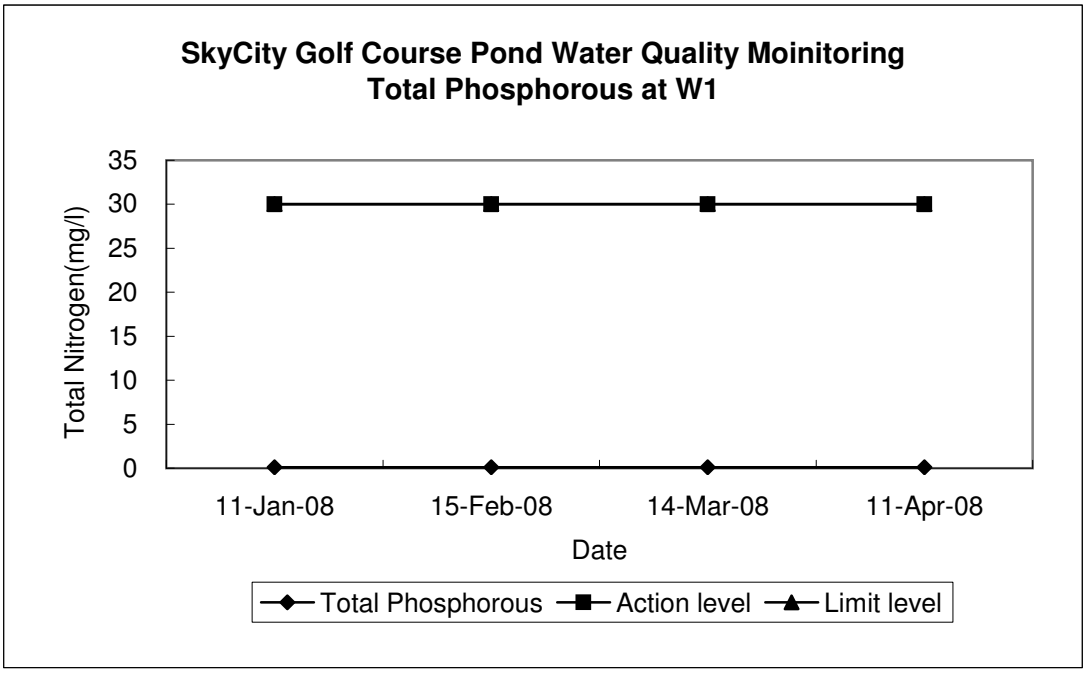
DO Conc
Action level
Limit level

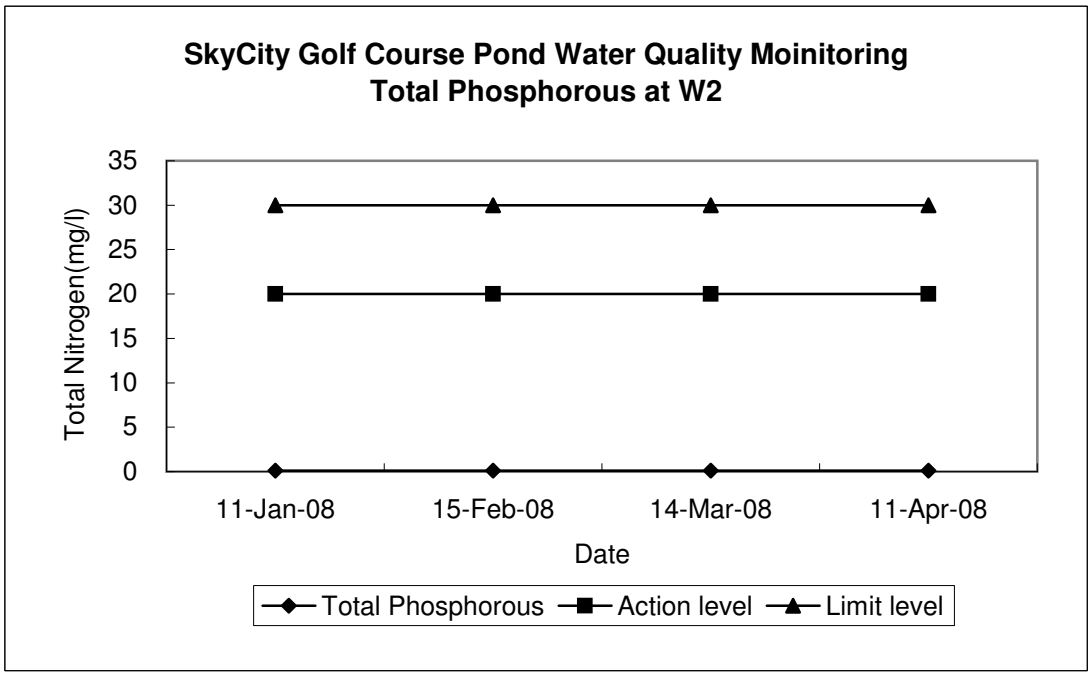

SkyCity Golf Course Pond Water Quality Moinitoring
Total Nitrogen at W1
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Nitrogen
Action level
Limit level

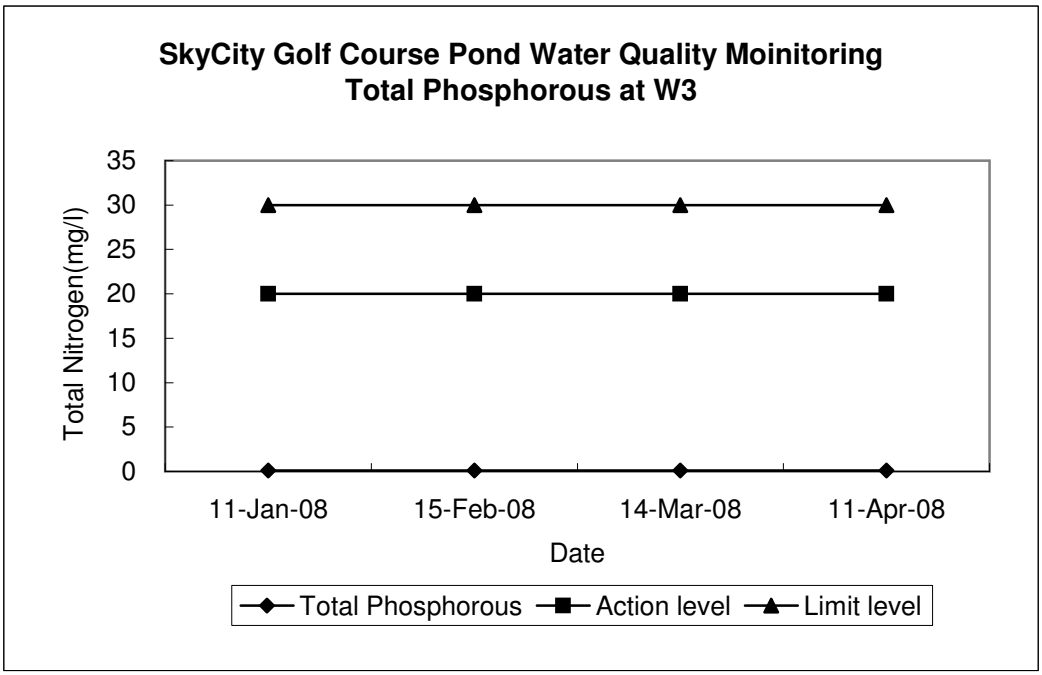

SkyCity Golf Course Pond Water Quality Moinitoring
Total Nitrogen at W2
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Nitrogen
Action level
Limit level

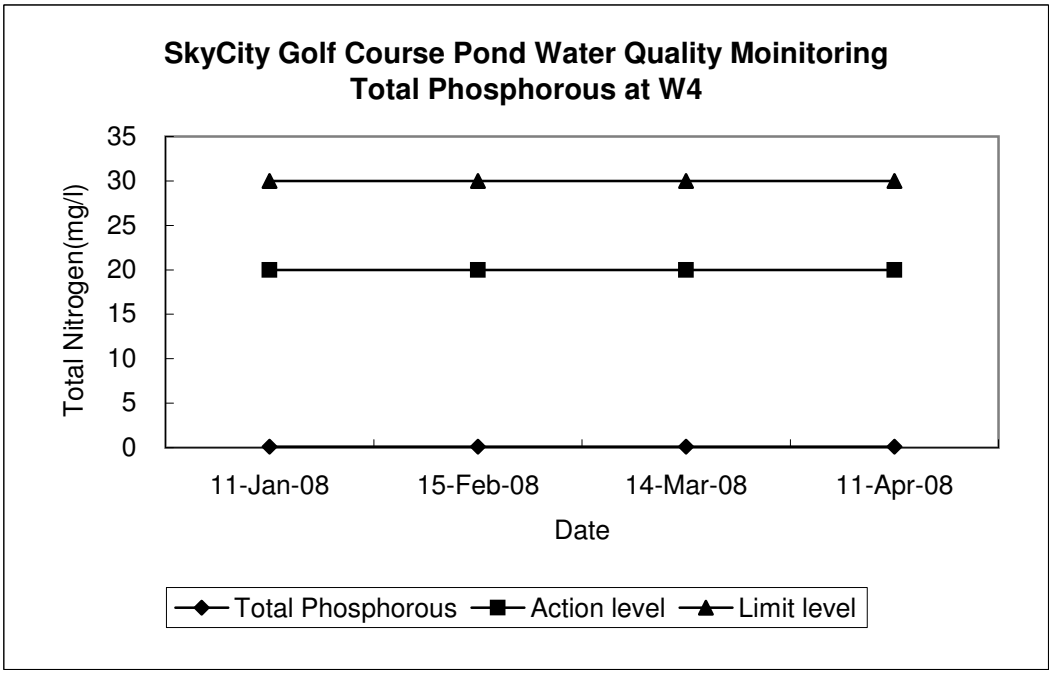

SkyCity Golf Course Pond Water Quality Moinitoring
Total Nitrogen at W3
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Nitrogen
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
Total Nitrogen at W4
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Nitrogen
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
Total Phosphorous at W1
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Phosphorous
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
Total Phosphorous at W2
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Phosphorous
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
Total Phosphorous at W3
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Phosphorous
Action level
Limit level


SkyCity Golf Course Pond Water Quality Moinitoring
Total Phosphorous at W4
Total Nitrogen(mg/l)
35
30
25
20
15
10
5
0
11-Jan-08
15-Feb-08
14-Mar-08
11-Apr-08
Date
Total Phosphorous
Action level
Limit level

Appendix 3

Equipment Calibration Details

CERTIFICATE OF ANALYSIS

Date of Issue: 27/03/2008
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item : YSI Mulitimeter

Model No. : YSI 85

Serial No. : 98A0725AB

Calibration Method : This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-0C & G

Date of Calibration : 21 February, 2008

Testing Results :

Expected Reading	Recording Reading
9.72 mg/L	9.58 mg/L
Allowing Deviation	±0.2 mg/L

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS

Date of Issue: 30/04/2008
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item : YSI Mulitimeter

Model No. : YSI 85

Serial No. : 98A0725AB

Calibration Method : This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-0C & G

Date of Calibration : 04 March, 2008

Testing Results :

Expected Reading	Recording Reading
4.60 mg/L 7.72 mg/L 9.10 mg/L	4.55 mg/L 7.84 mg/L 9.18 mg/L
Allowing Deviation	±0.2 mg/L

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong

CERTIFICATE OF ANALYSIS

Batch: HK0805463
Date of Issue: 07/04/2008
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item : YSI Mulitimeter

Model No. : YSI 85/10FT

Serial No. : 01J0362AJ

Equipment No. : HK065

Calibration Method : This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-0C & G

Date of Calibration : 07 April, 2008

Testing Results :

Expected Reading	Recording Reading
5.71 mg/L 7.37 mg/L 8.47 mg/L	5.89 mg/L 7.42 mg/L 8.49 mg/L
Allowing Deviation	±0.2 mg/L

Ms Wong Wai Man, Alice
Laboratory Manager - Hong Kong