SkyCity Nine Eagles Golf Course

SkyCity Nine Eagles Golf Course

EM&A Quarterly Compliance Report

February to April 2010

Hyder Consulting Limited
Company Number 126012
47th Floor, Hopewell Centre
183 Queen's Road East
Wanchai
Hong Kong
Tel: +852 2911 2233
Fax: +852 2805 5028
hyder.hk@hyderconsulting.com
www.hyderconsulting.com

SkyCity Nine Eagles Golf Course

SkyCity Nine Eagles Golf Course

EM&A Quarterly Compliance Report

February to April 2010

Author	Sharifah OR	
Checker	Roger LEUNG	
Approver	Roger LEUNG	

Report No EB000226-R12-01

Date 30 April 2010

CONTENTS

APPENDICES

FIGURES

TABLES

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 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 SkyCity Nine Eagles Golf Course, who has engaged Asia Turf Solutions 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, monthly compliance monitoring of lake water quality at four locations (W1 to W4) is required during the second phase of the Operation Period, with reporting on a quarterly basis. Parameters monitored comprise Suspended Solids (SS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD_5), nitrogen, phosphorous, temperature and salinity.

This is the twelfth Quarterly Compliance report covering February to April 2010 and complies with the reporting requirements stated in the approved EM&A Manual.

There were exceedances of the Action Levels for SS during scheduled monitoring in the reporting quarter. On each occasion of a series of exceedances, EPD and the Golf Course Supervisor were notified as required, as soon as the results were available, and **no** follow-on monitoring was arranged in the reporting quarter. Furthermore, the Golf Course Supervisor was advised that lake water was not of an acceptable quality for discharge and that the control valve must not be opened until there is no longer any exceedances of the Action Level.

The exceedances of the Action Level for SS level at W1, W2 and W3 in March 2010 were mainly due to the removal of golf balls in the lakes by operation staff before the water quality monitoring. In addition, no excessive algal growth was found in the lakes. Hence the non-compliance was considered not related to the operation of the project and no follow-on monitoring was required. Possible mitigation measures were carried out by the Operator to improve the lake water quality, such as arrangement for the pump cleaning system to remove sand and silts settled in Lakes A and B by the end of January 2010 and by the end of April 2010 respectively.

The exceedance of the Action Level at W2 in April 2010 was caused by some routine cleaning to the aerator in Lake A. Therefore, the exceedance is not considered project related. No follow-up monitoring is necessary.The ET will keep track of the lake water level and will conduct earlier sampling, if necessary before the lakes are full and ready for discharge.

During the reporting quarter, no complaints were received; and there were no notifications of summons. There were also no openings of the control valve, emergency or otherwise.

Location Map

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 standards.

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 2-1.***

2.2 EM&A Programme

Monitoring of Dissolved Oxygen (DO) concentration in mg/ℓ, Suspended Solids (SS) in mg/ℓ, Biochemical Oxygen Demand (BOD_5) in mg/ℓ, Total Nitrogen in mg/ℓ, Total Phosphorous in mg/ℓ, Salinity in mg/ℓ, and temperature in ^{O}C 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, temperature and salinity were 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 monitoring was carried out using a 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 are provided in ***Table 2-1.***

In-situ Parameters	Measuring Devices	Measurement Precision
Dissolved Oxygen	YSI Multi-purpose Meter	0.1 mg/ℓ and 0.1%
Salinity	YSI Multi-purpose Meter	0.1 ppt
Temperature	YSI Multi-purpose Meter	0.1 ^{O}C

Table 2-1 In-situ Monitoring Equipment Details

A Kahlisco water sampler was used to obtain water samples for subsequent SS analysis in the laboratory. A sufficient volume of the sample was collected in clean, high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the ALS laboratory immediately after monitoring. The analysis of the collected samples started within the next working day after sample collection, following 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.

The YSI Multi-purpose Meter is calibrated once per monitoring day by the wet bulb method. Calibration at the ALS laboratory 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
- Suspended Solids
- BOD_5
- Total Nitrogen
- Total Phosphorous

There are no A/L Levels for temperature or salinity – these parameters are recorded for information only.

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, the ET shall immediately implement the Event/Action Plan, shown in ***Table 2-4***, in order to resolve the lake water quality problem:

Event	**Action**
Exceedance of Action Level	▪ Notify the Golf Course Supervisor of the exceedance, providing full details (time, location, parameter, level, etc.). ▪ Increase the frequency of monitoring of the particular parameter(s) to "Action/Limit Level Exceedance" as shown in ***Table 2-2***. ▪ 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. ▪ 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	▪ Notify EPD and Golf Course Supervisor of the exceedance, providing full details (time, location, parameter, level, etc.). ▪ Suspend any ongoing application of organic nutrients. ▪ 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. ▪ 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. ▪ 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 Monitoring Results

2.4.1 Review of Results and Implications

A summary of scheduled lake water monitoring results for the reporting quarter is provided in ***Table 2-5***, below. Detailed results are provided in ***Appendix 1*** and graphical plots since commencement of the second phase of Operation are given in ***Appendix 2***.

Monitoring Location		Salinity (mg/ℓ)	Temperature (^{o}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	18.9	14.3	2.0	84.7	8.3	1.7	0.1
	Minimum	0.1	17.2	2.0	2.0	82.4	8.0	1.6	0.1
	Maximum	0.1	21.2	**25.0**	2.0	89.1	8.6	1.8	0.1
W2	Mean	0.1	18.9	17.3	2.0	84.8	8.4	1.7	0.1
	Minimum	0.1	17.1	2.0	2.0	81.6	8.2	1.6	0.1
	Maximum	0.1	21.2	**26.0**	2.0	89.3	8.7	1.7	0.1
W3	Mean	0.1	19.0	17.7	2.0	87.3	8.6	1.8	0.1
	Minimum	0.1	17.8	15.0	2.0	85.3	8.4	1.7	0.1
	Maximum	0.1	20.5	**21.0**	2.0	88.4	8.7	1.9	0.1
W4	Mean	0.1	19.0	9.3	2.0	88.1	8.6	1.8	0.1
	Minimum	0.1	17.8	7.0	2.0	86.2	8.3	1.6	0.1
	Maximum	0.1	20.6	12.0	2.0	89.6	8.7	1.9	0.1

Note: Bold indicates Action Level exceedance; **Bold** indicates **Limit Level** exceedance

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

As shown above, there were exceedances of the Action Levels for SS at W1, W2 and W3 during scheduled monitoring in the reporting quarter, as shown in ***Appendix 1***. In accordance with the Event / Action Plan, the source(s) of the impact was identified and it was considered that the exceedances of Action Level were considered **non-project related**. In addition, the possible mitigation measures were discussed with the Operator. In light of that, no follow-on action was required, and this is described below.

2.4.2 Follow-on Action

On each occasion of a series of exceedances, EPD and the Golf Course Supervisor were notified as required, as soon as the results were available, and follow-on monitoring was arranged on weekly basis if necessary. Furthermore, the Golf Course Supervisor was advised that lake water was not of an acceptable quality for discharge and that the control valve must not be opened until there is no longer any exceedance of the Action and Limit Levels.

The exceedances of the Action Level for SS at W1 (25 mg/ℓ), W2 (21 mg/ℓ) and W3 (21 mg/ℓ) were recorded on 12 March 2010. According to the Event Action Plan for Marine Water Quality Monitoring, the source(s) of impact was identified. The exceedances of SS levels at W1, W2 and W3 were mainly due to the mixing of lake water from the manual removal of golf balls. The monitored results indicated that the nutrient levels in the water remained were well below the Action Levels (total nitrogen =1.9 mg/ℓ & total phosphorus < 0.1 mg/ℓ). As advised by the Operator, no excessive algal growth was observed in the lakes and the aerators were turned on 10 hours per day. Hence the application of nutrient (Turfgrass Management Plan) did not cause any excessive algal growth in the lakes in March 2010.

On 16 April 2010, an exceedance of the Action Level for SS at W2 (26 mg/ℓ) was recorded. It was caused by the routine cleaning to the aerator in Lake A. Considering the dry seasons and unnecessary discharge of water at the moment, no follow-on water quality monitoring was required.

In light of the previously accumulated silts in Lakes A and B, the Operator has arranged for the pump cleaning system to remove the sand and silts. The lake cleaning in Lake A was completed by the end of January 2010. For Lake B, the cleaning was expected to be completed by the end of April. With the removal of sand and silts, the lake water quality will further be improved. However, the clarity will take time to clear up from the dilution which will naturally happen from irrigation usage and replenishment from rainfall.

The ET will keep track of the lake water level and will conduct earlier sampling, if necessary before the lakes are full and ready for discharge. Further details of “Aqua Bio-Trol” which was applied to Lakes A and B on 2 and 23 September 2009 to reduce the presence of algae, are provided in ***Appendix 4.***

2.5 Operational Practice

Table 2-6 below, shows the operational practice 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 2010	0.5	Yes (from 12 Feb 2010)	No	-
March 2010	0.7	No (from 12 Mar 2010)	No	-
April 2010	1.0	No (from 16 Apr 2010)	No	-

Table 2-6 Operational Results

From ***Section 2.4***, the EM&A results for the reporting quarter have shown that Action Level was exceeded for periods in March and April 2010, the control valve could not be opened. For those periods when the control valve could have been opened, it was not. Overall, no water was discharged from the lakes during the reporting quarter.

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-on 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-on issues to be addressed.

2.7 Future Monitoring Schedule

The lake water monitoring schedule for the next quarter (May to July 2010) is given in ***Table 2-7***, below.

Sampling Date	Sampling Locations
14 May 2010	W1 to W4
11 June 2010	W1 to W4
09 July 2010	W1 to W4

Table 2-7 Future Monitoring Schedule

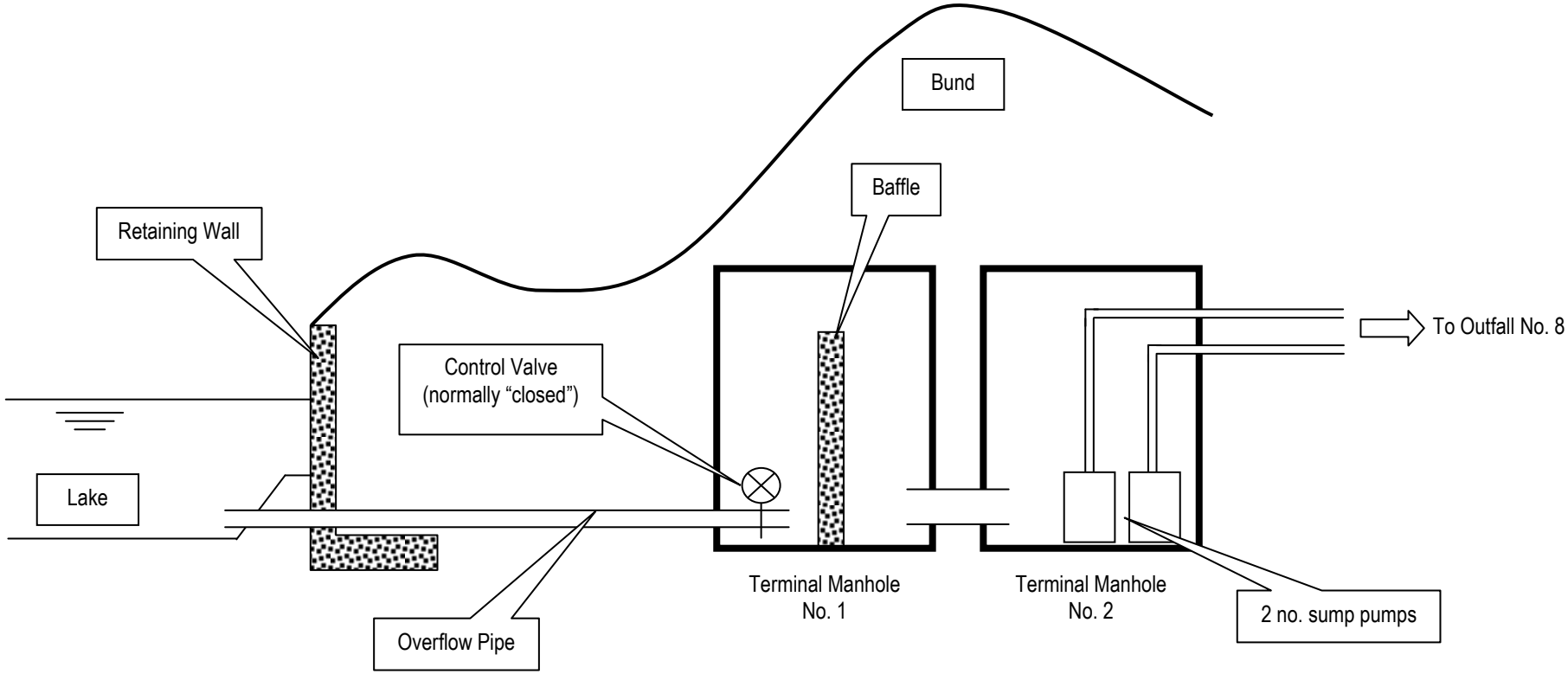


Figure 2-1 Schematic of Lake Water Control System

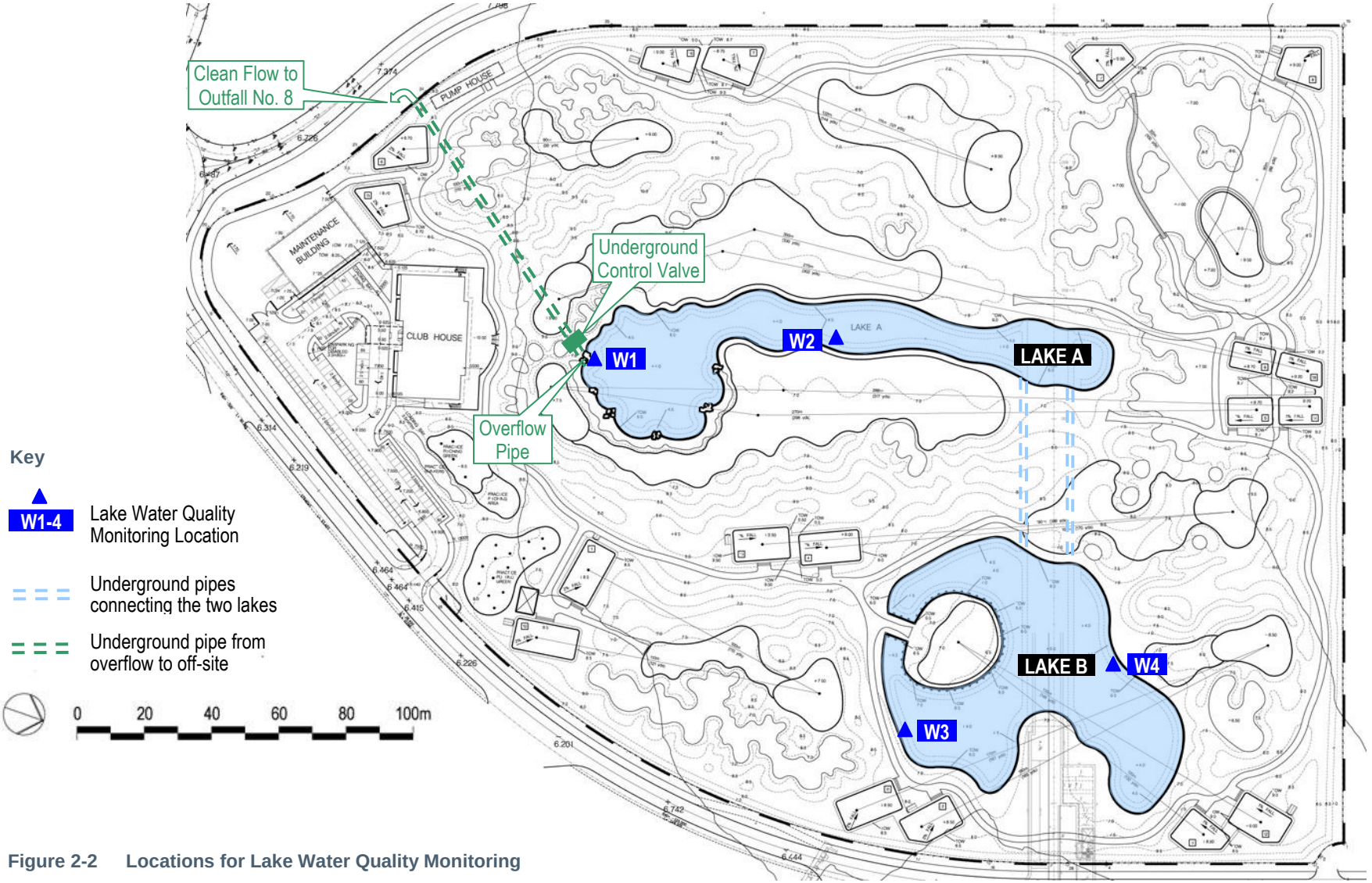


Figure 2-2 Locations for Lake Water Quality Monitoring

3 COMMENTS, RECOMMENDATIONS AND CONCLUSIONS

Compliance monitoring of lake water quality is required on a monthly basis, with an increase in frequency to weekly if there are exceedances of Action or Limit Levels. Parameters tested for comprise SS, DO, BOD_5, nitrogen, phosphorous, temperature and salinity. Monthly compliance monitoring was carried out on 12 February 2010, 12 March 2010 and 16 April 2010 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 twelfth Quarterly Compliance report covering February to April 2010 and complies with the reporting requirements stated in the approved EM&A Manual.

There were exceedances of the Action Level for SS during scheduled monitoring in the reporting quarter. On each occasion of a series of exceedances, EPD and the Golf Course Supervisor were notified as required, as soon as the results were available, and no follow-on monitoring was arranged in the reporting quarter. Furthermore, the Golf Course Supervisor was advised that lake water was not of an acceptable quality for discharge and that the control valve must not be opened until there is no longer any exceedance of the Action Levels.

The exceedances of the Action Level for SS level at W1, W2 and W3 in March 2010 were mainly due to the removal of golf balls in the lakes by operation staff before the water quality monitoring. In addition, no excessive algal growth was found in the lakes. The exceedance of Action Level for SS level at W2 was due to some routine cleaning to the aerators in Lake A.

Hence the non-compliance was considered not related to the operation of the project and no follow-on monitoring was required. Possible mitigation measures were carried out by the Operator to improve the lake water quality, such as arrangement for the pump cleaning system to remove sand and silts settled in Lakes A and B by the end of January 2010 and mid April 2010 respectively. ET will keep track of the lake water level and will conduct earlier sampling, if necessary before the lakes are full and ready for discharge.

During the reporting quarter, no complaints were received; and there were no notifications of summons. There were also no openings of the control valve, emergency or otherwise.

Appendix 1

Lake Water Quality Monitoring Data

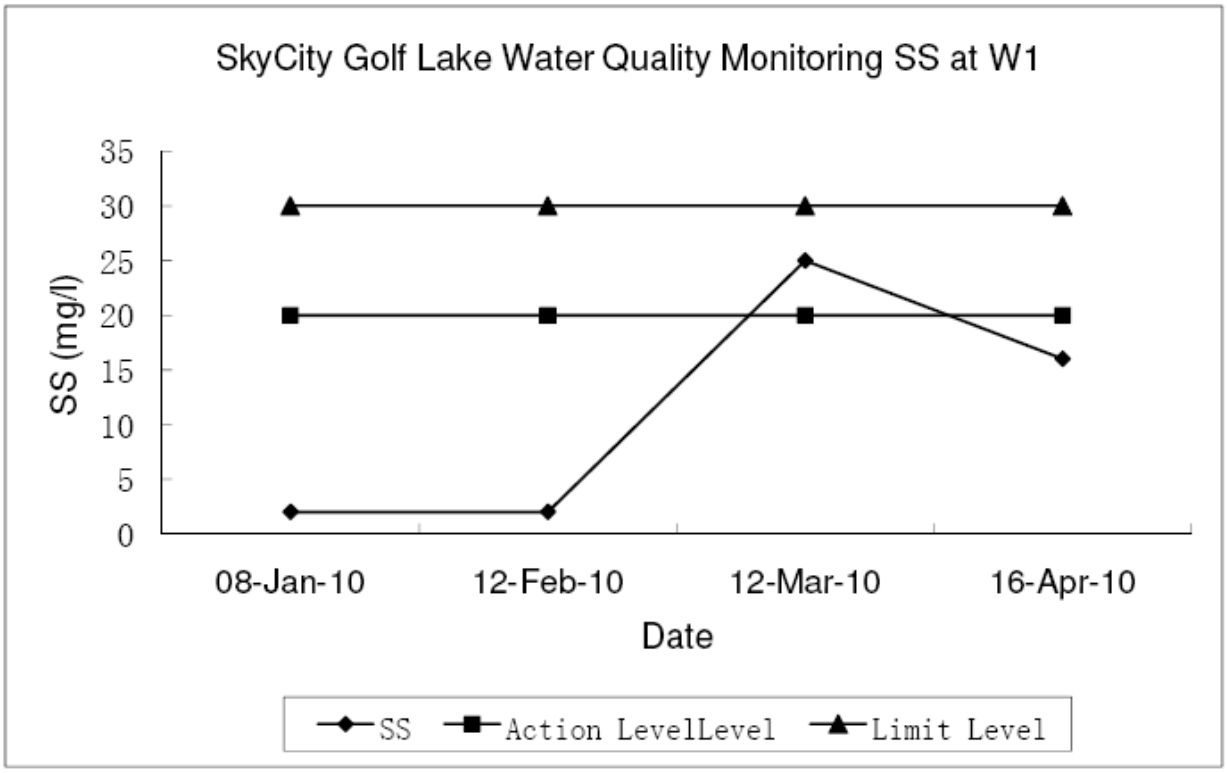
Date	Time	Station	Salinity (mg/ℓ)	Temperature (^{O}C)	SS (mg/ℓ)	BOD_5 (mg/ℓ)	DO Saturation (%age)	DO Conc. (mg/ℓ)	Total Nitrogen (mg/ℓ)	T. Phosphorous (mg/ℓ)
12-Feb-10	07:15	W1	0.1	21.2	2.0	2.0	82.6	8.3	1.7	0.1
	07:18	W2	0.1	21.2	5.0	2.0	83.4	8.4	1.7	0.1
	07:25	W3	0.1	20.5	15.0	2.0	85.3	8.7	1.7	0.1
	07:30	W4	0.1	20.6	7.0	2.0	86.2	8.7	1.6	0.1
12-Mar-10	08:00	W1	0.1	18.2	**25.0**	2.0	82.4	8.0	1.6	0.1
	08:05	W2	0.1	18.3	**21.0**	2.0	81.6	8.2	1.7	0.1
	08:10	W3	0.1	18.6	**21.0**	2.0	88.2	8.4	1.8	0.1
	08:15	W4	0.1	18.6	12.0	2.0	88.5	8.3	1.9	0.1
16-Apr-10	07:30	W1	0.1	17.2	16.0	2.0	89.1	8.6	1.8	0.1
	07:35	W2	0.1	17.1	**26.0**	2.0	89.3	8.7	1.6	0.1
	07:40	W3	0.1	17.8	17.0	2.0	88.4	8.6	1.9	0.1
	07:45	W4	0.1	17.8	9.0	2.0	89.6	8.7	1.8	0.1
		Mean	0.1	18.9	14.7	2.0	86.2	8.5	1.7	0.1
		Minimum	0.1	17.1	2	2	81.6	8	1.6	0.1
		Maximum	0.1	21.2	**26**	2	89.6	8.7	1.9	0.1

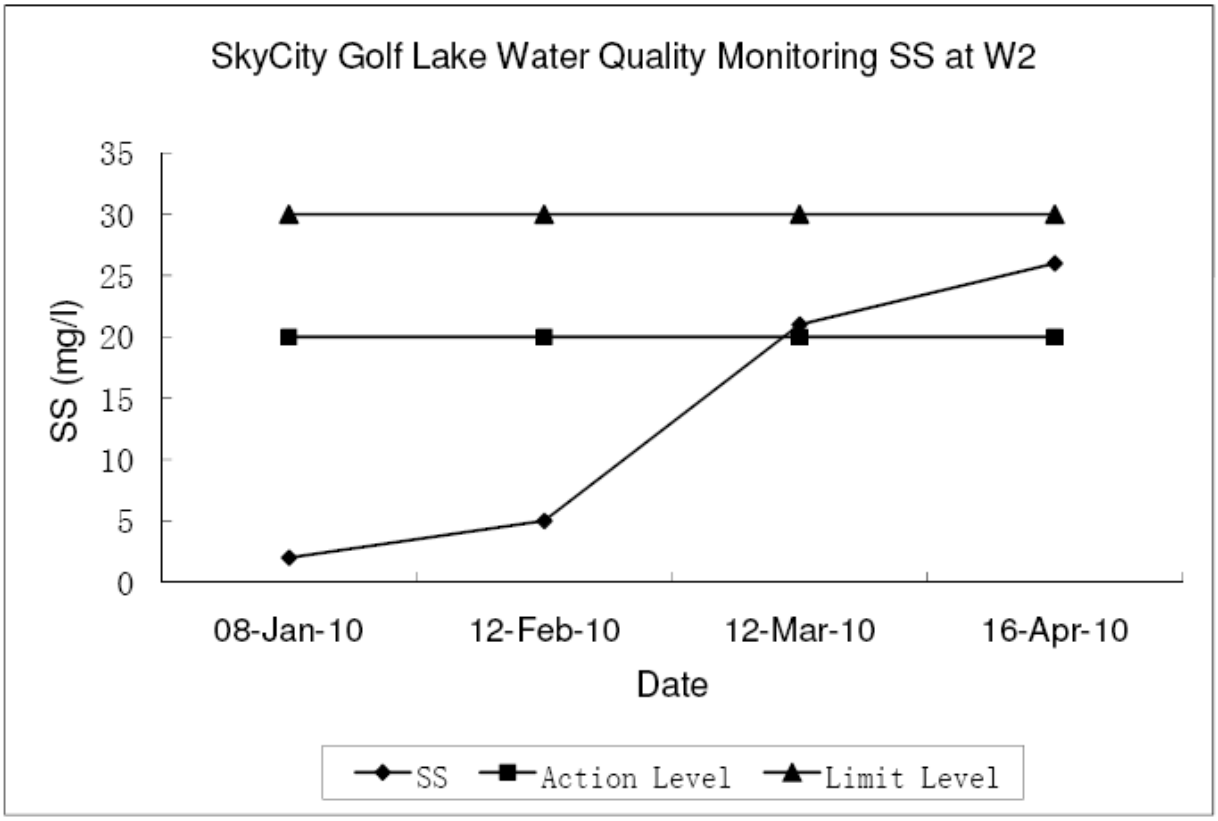
Notes: Bold indicates Action Level exceedance; **Bold** indicates **Limit Level** exceedance

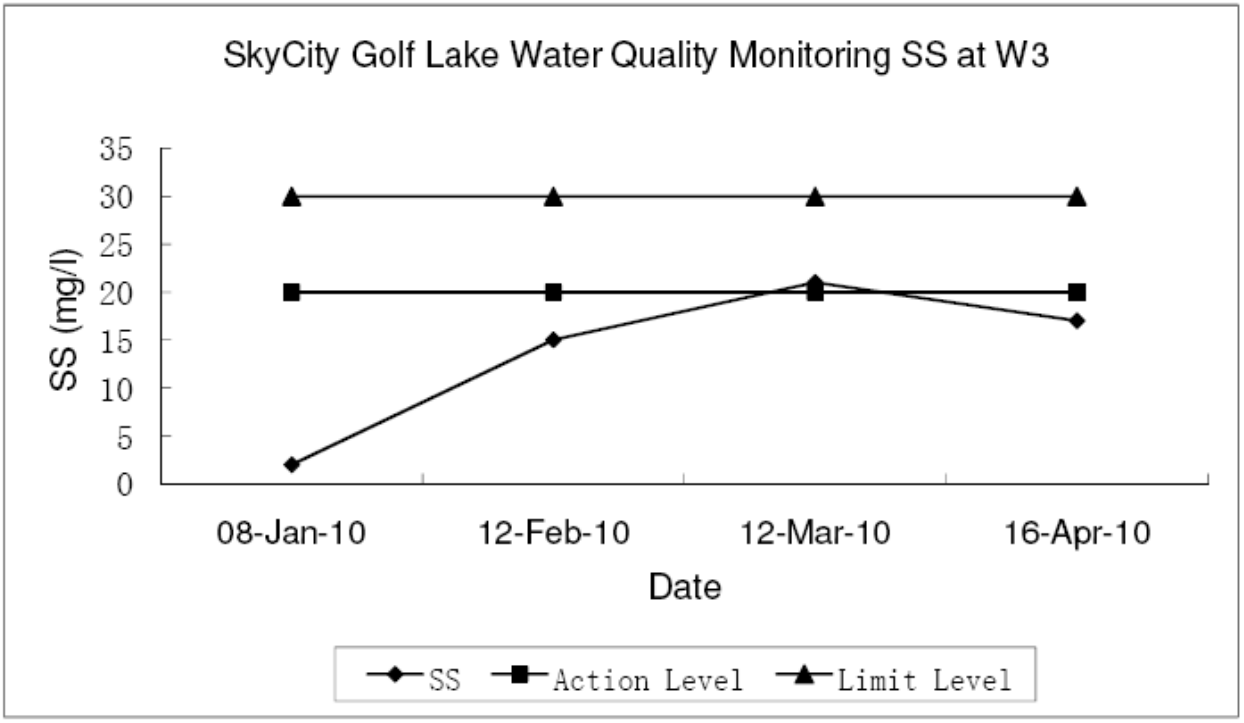
* Additional follow-on monitoring (shown in *italic*) carried out only at those locations and only for those parameters which had previously shown exceedance in A/L Levels (these follow-on results are excluded from the mean, minimum and maximum calculations)

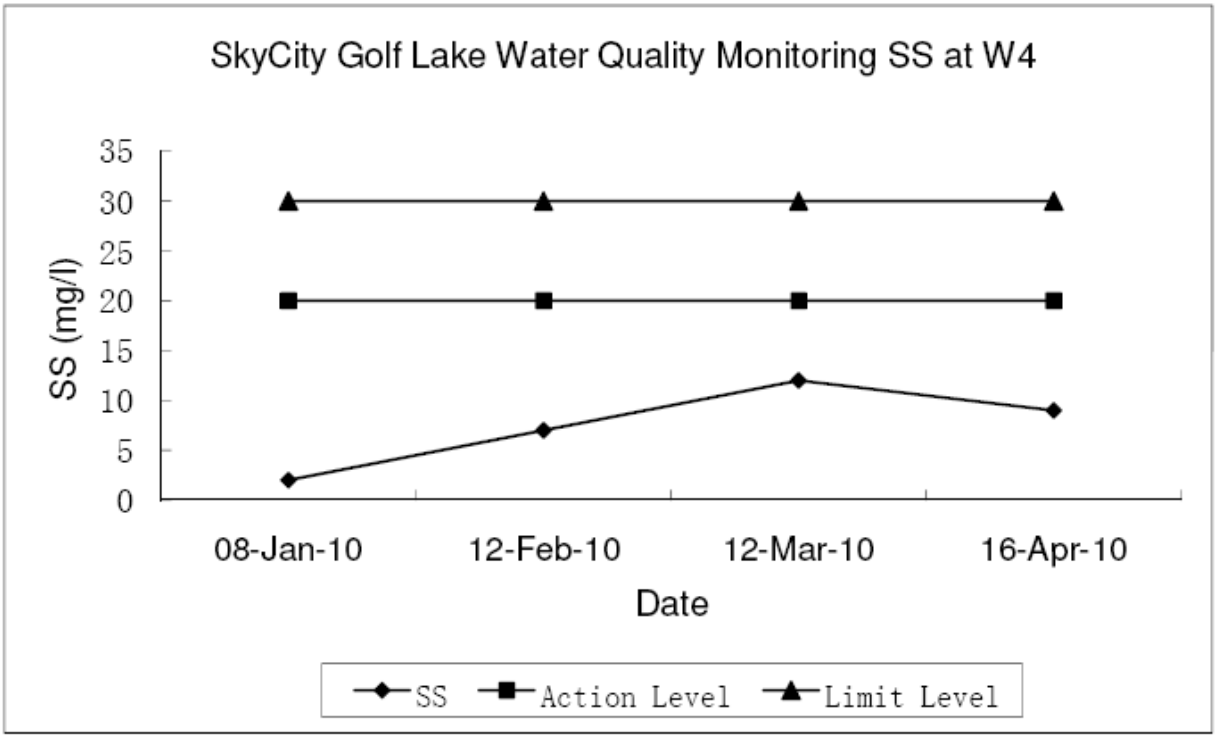
Appendix 2

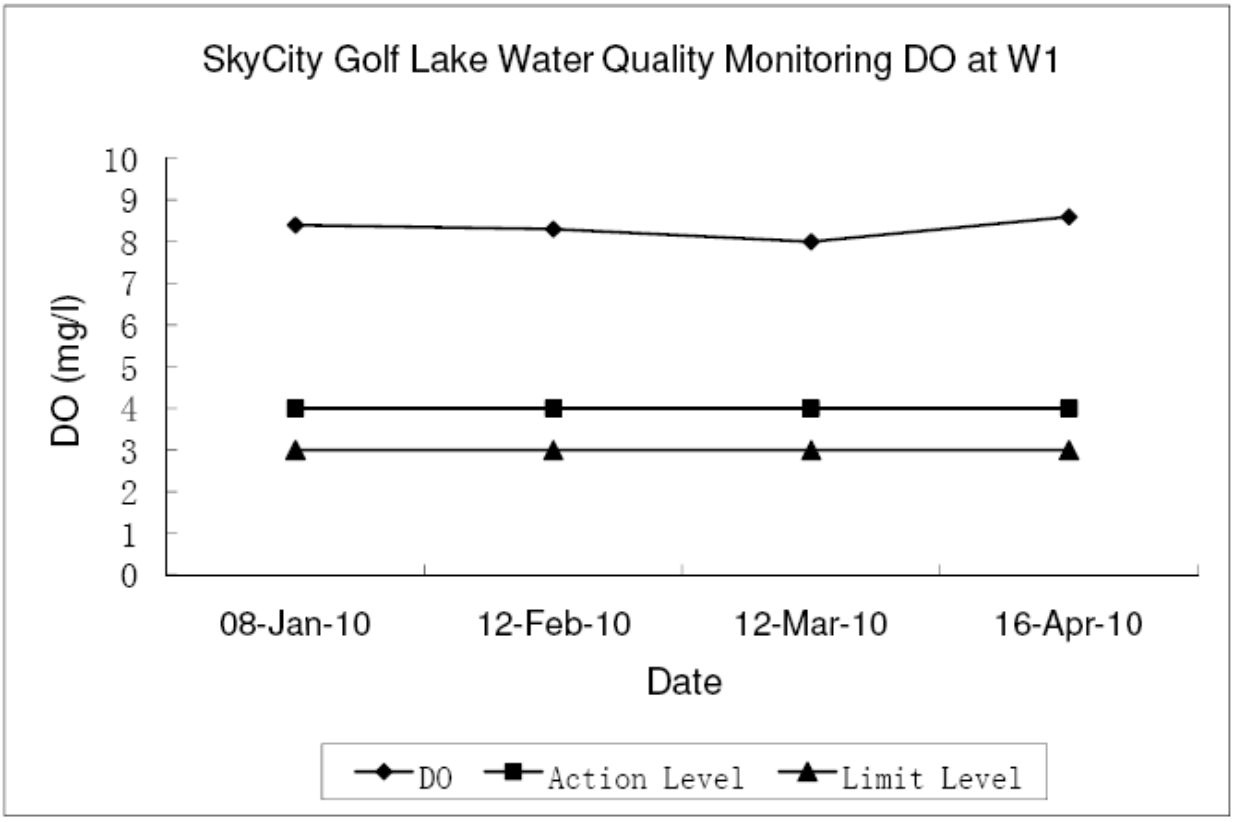
Graphical Plots of Monitoring Results

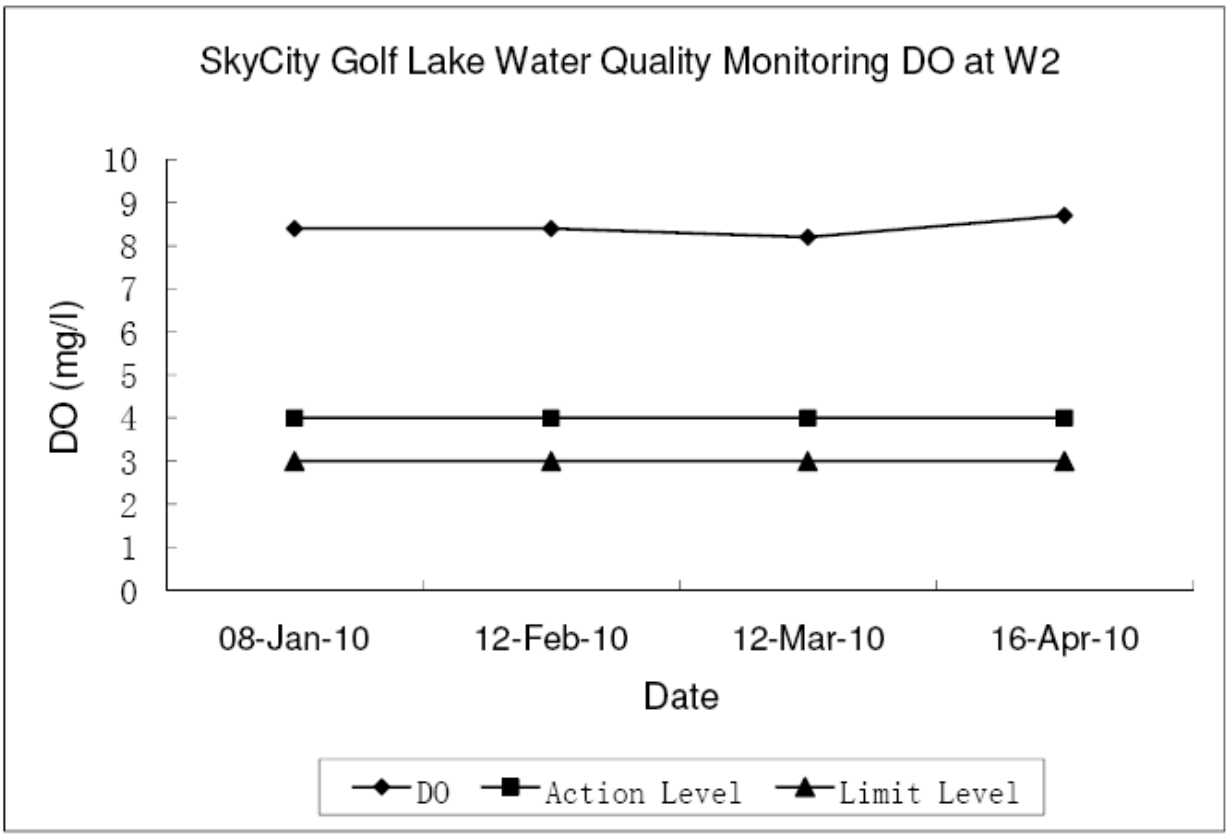

SkyCity Golf Lake Water Quality Monitoring SS at W1
SS (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
SS
Action LevelLevel
Limit Level

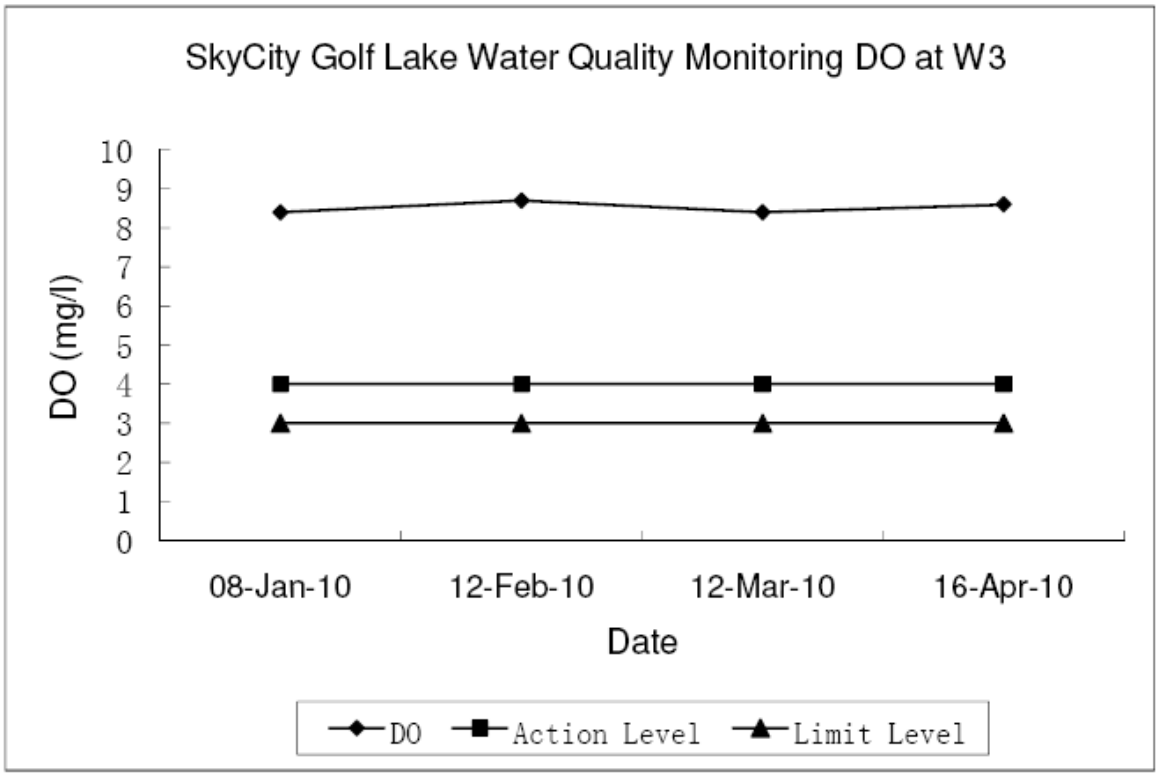

SkyCity Golf Lake Water Quality Monitoring SS at W2
SS (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
SS
Action Level
Limit Level

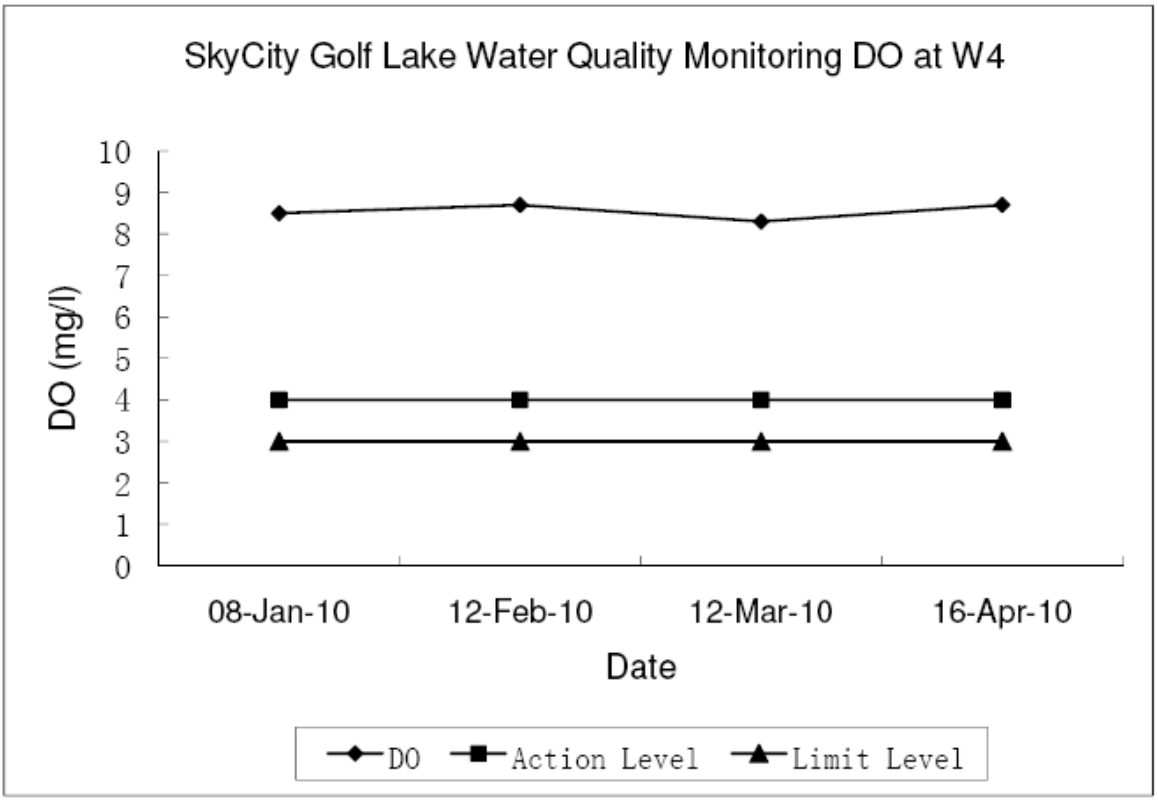

SkyCity Golf Lake Water Quality Monitoring SS at W3
SS (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
SS
Action Level
Limit Level

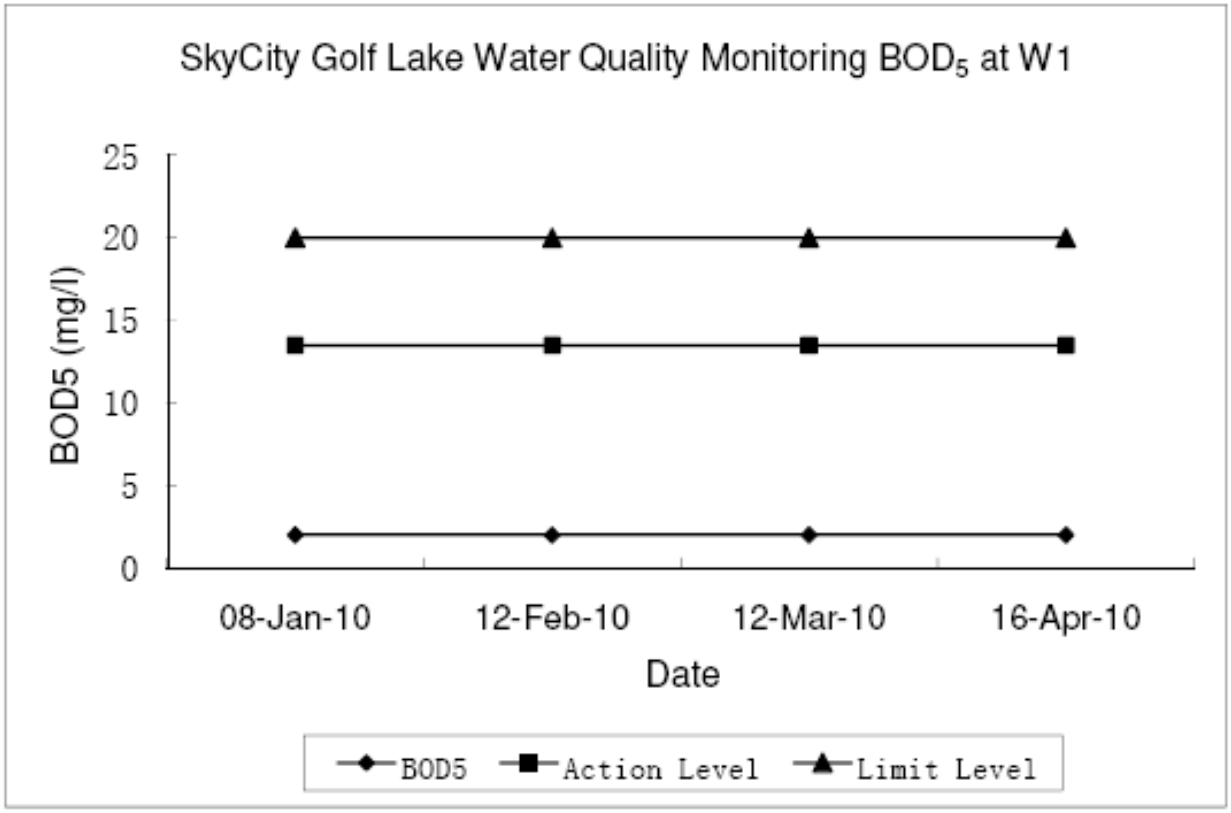

SkyCity Golf Lake Water Quality Monitoring SS at W4
SS (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
SS
Action Level
Limit Level

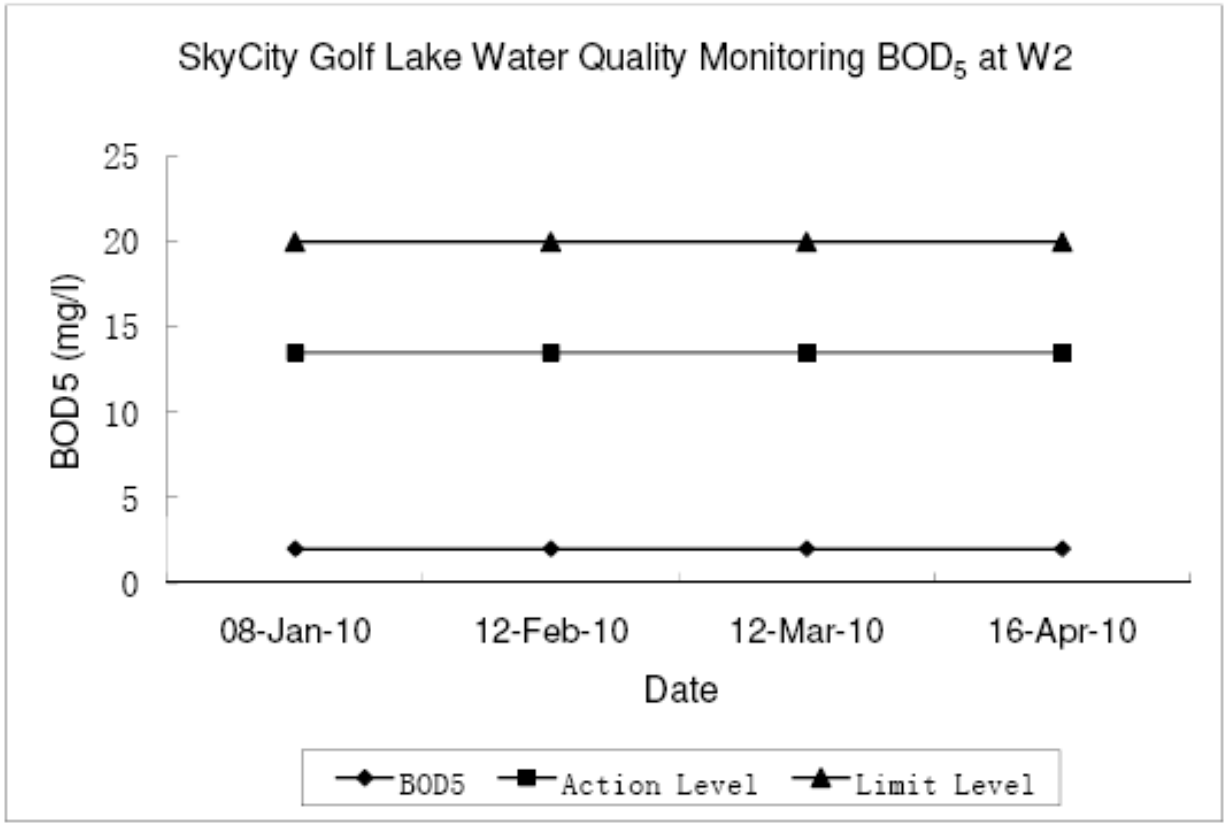

SkyCity Golf Lake Water Quality Monitoring DO at W1
DO (mg/l)
10
9
8
7
6
5
4
3
2
1
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
DO
Action Level
Limit Level

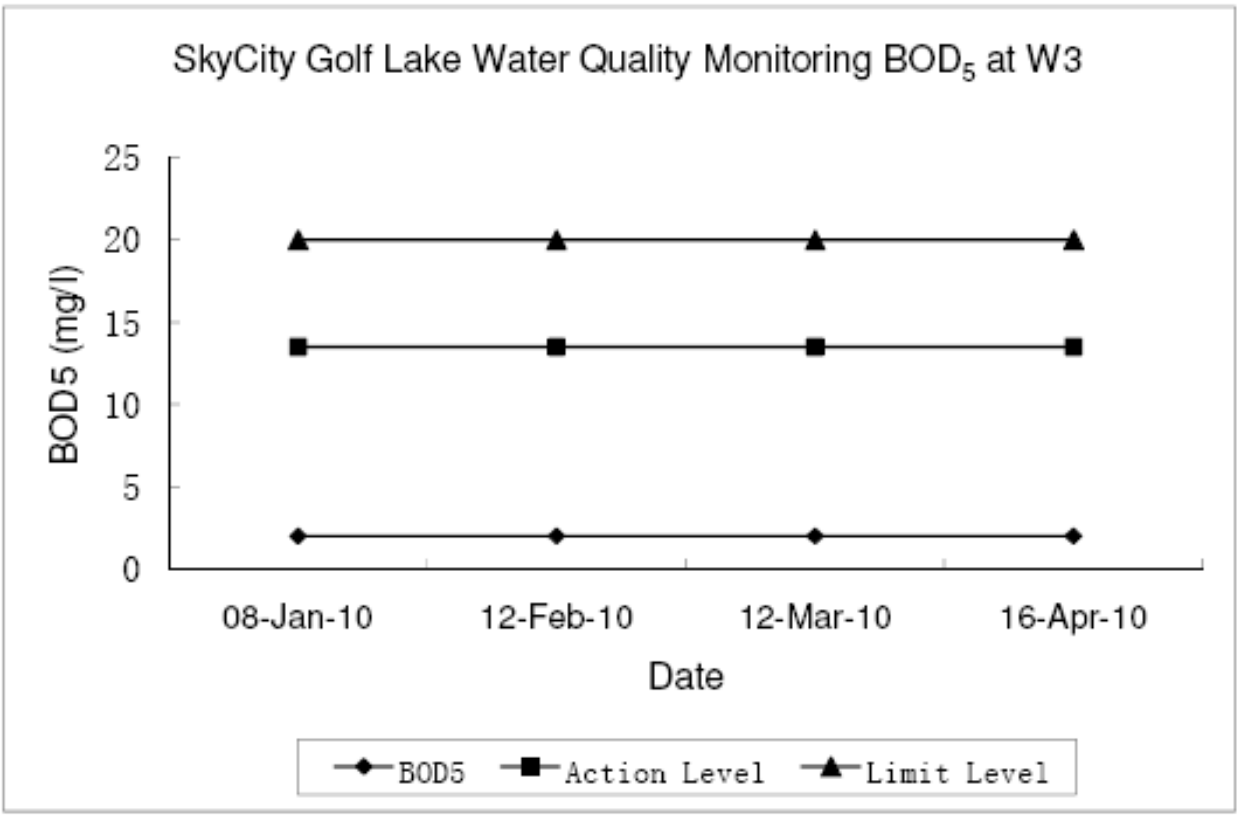

SkyCity Golf Lake Water Quality Monitoring DO at W2
DO (mg/l)
10
9
8
7
6
5
4
3
2
1
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
DO
Action Level
Limit Level

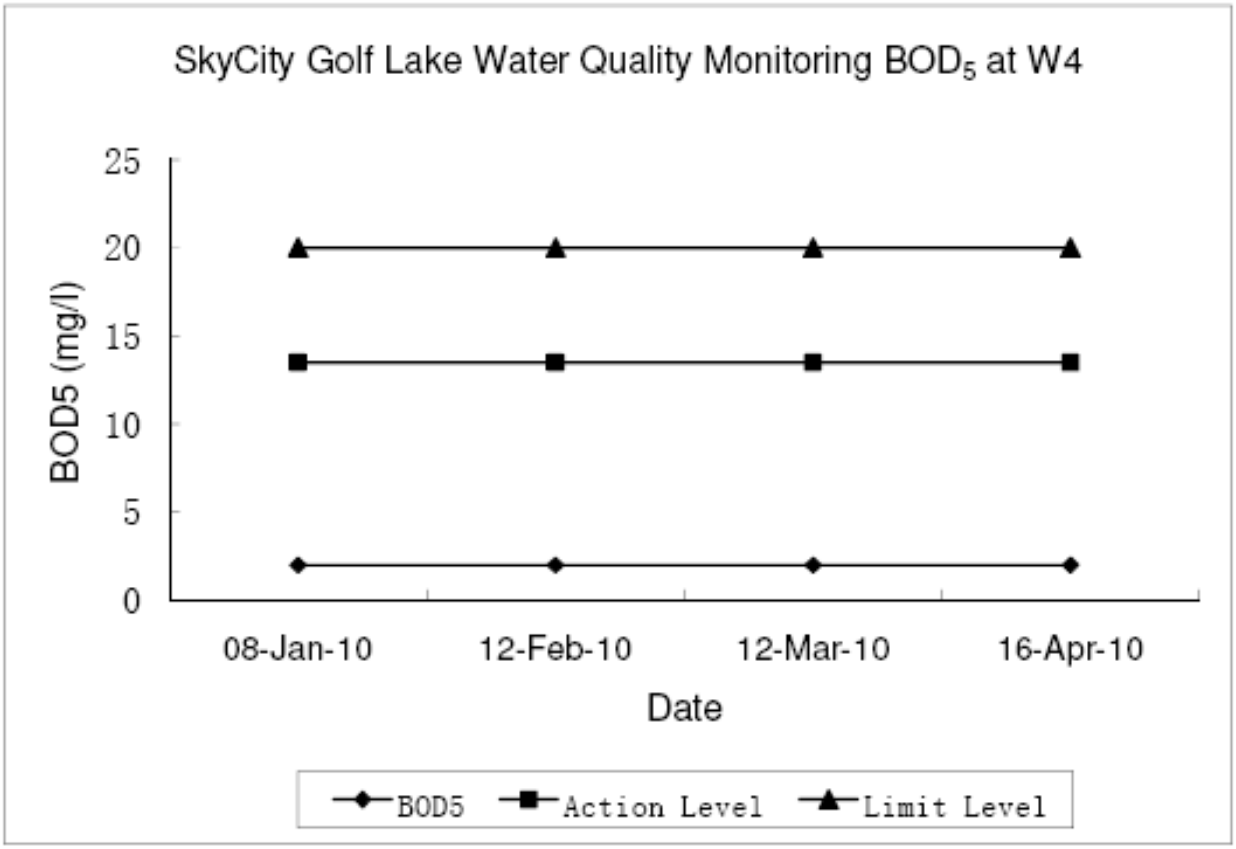

SkyCity Golf Lake Water Quality Monitoring DO at W3
DO (mg/l)
10
9
8
7
6
5
4
3
2
1
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
DO
Action Level
Limit Level

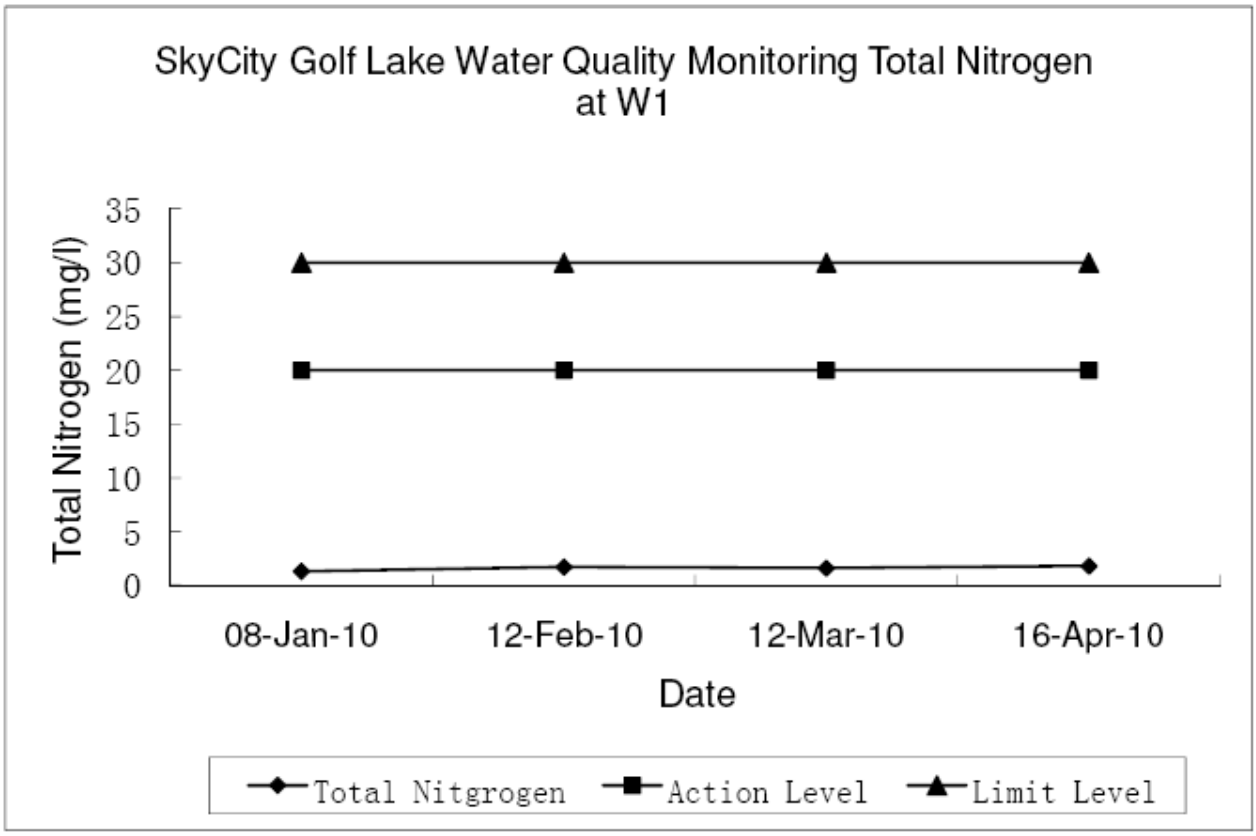

SkyCity Golf Lake Water Quality Monitoring DO at W4
DO (mg/l)
10
9
8
7
6
5
4
3
2
1
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
DO
Action Level
Limit Level

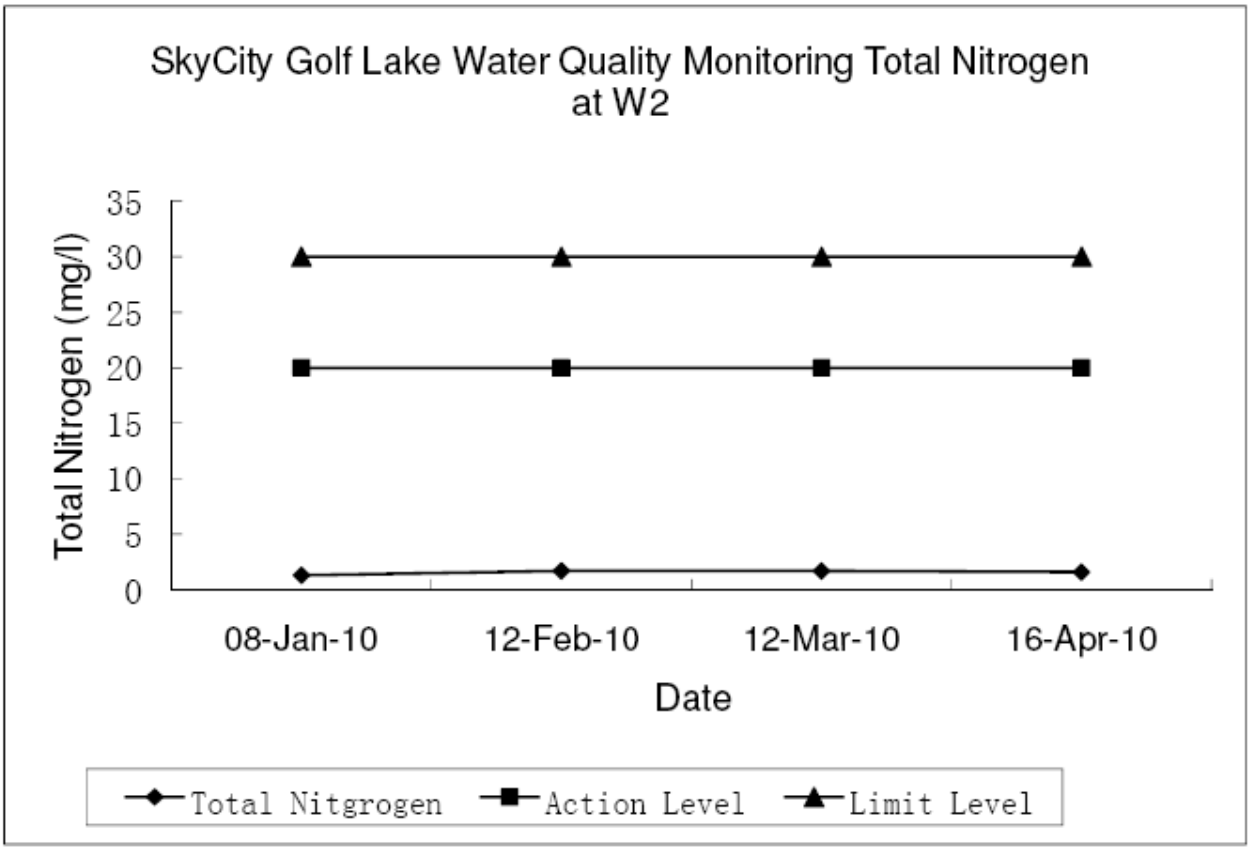

SkyCity Golf Lake Water Quality Monitoring BOD5 at W1
BOD5 (mg/l)
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
BOD5
Action Level
Limit Level

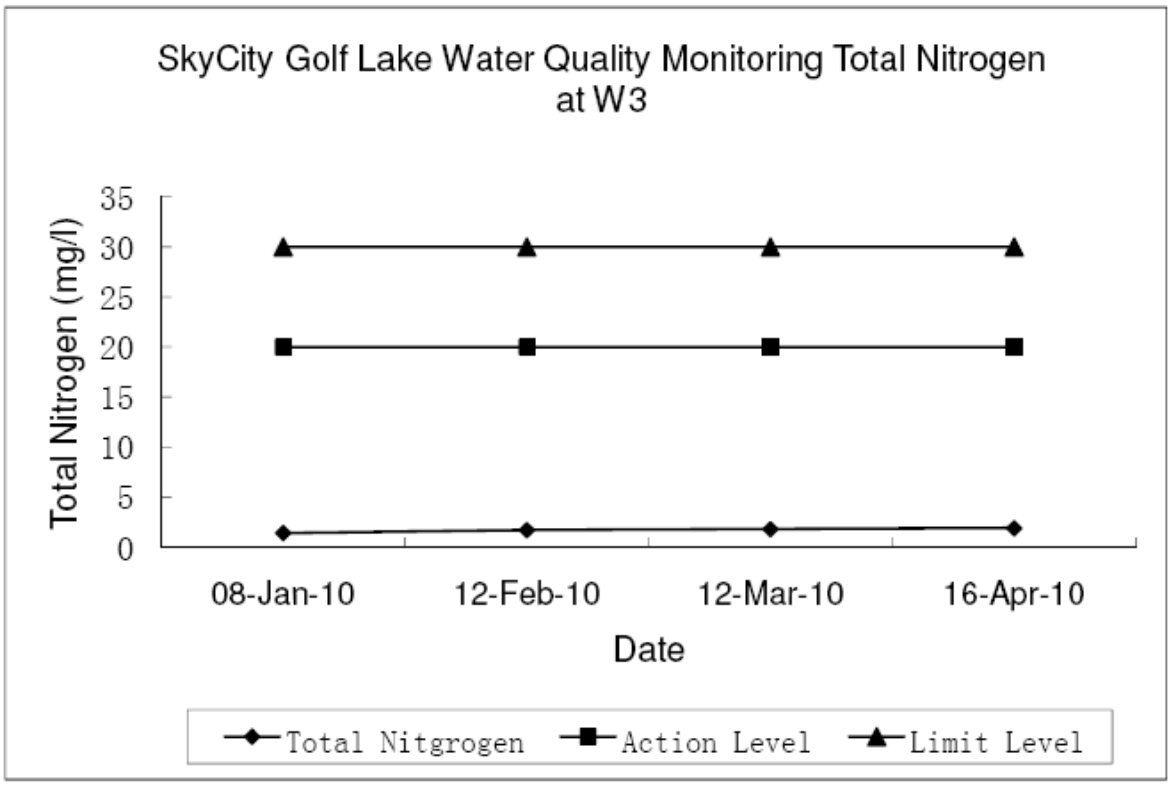

SkyCity Golf Lake Water Quality Monitoring BOD5 at W2
BOD5 (mg/l)
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
BOD5
Action Level
Limit Level

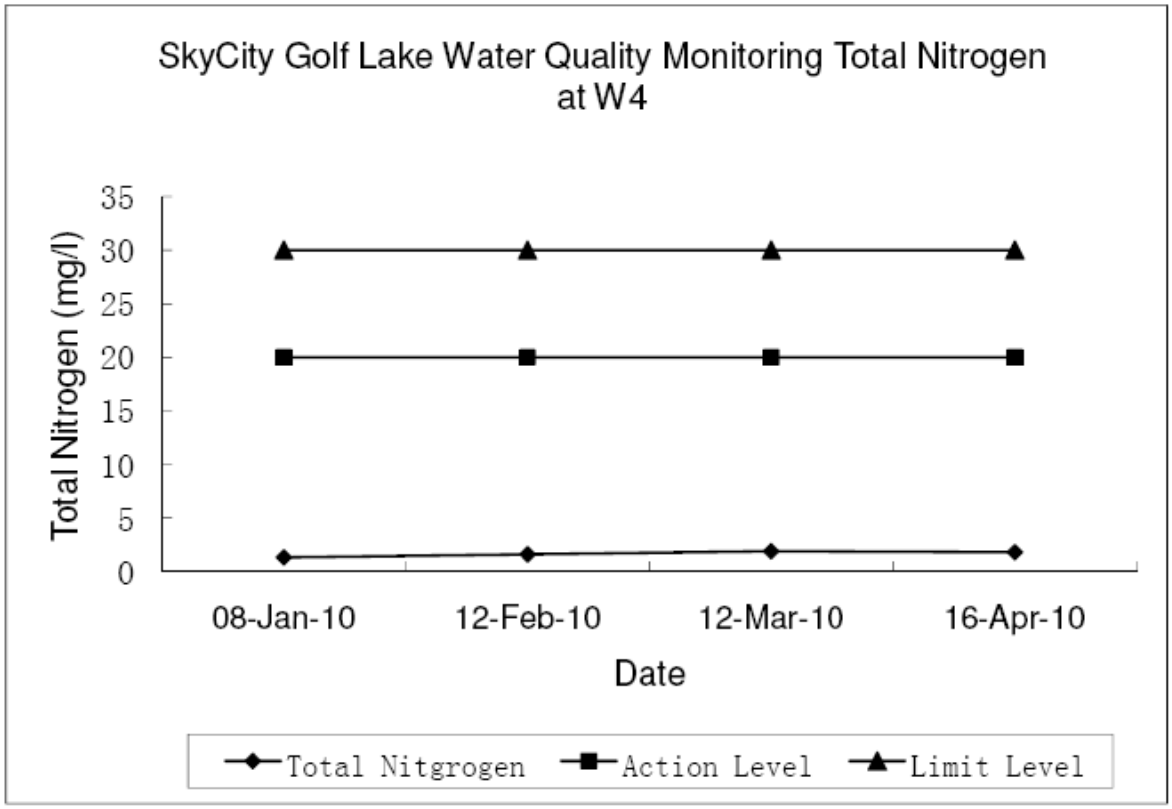

SkyCity Golf Lake Water Quality Monitoring BOD5 at W3
BOD5 (mg/l)
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
BOD5
Action Level
Limit Level

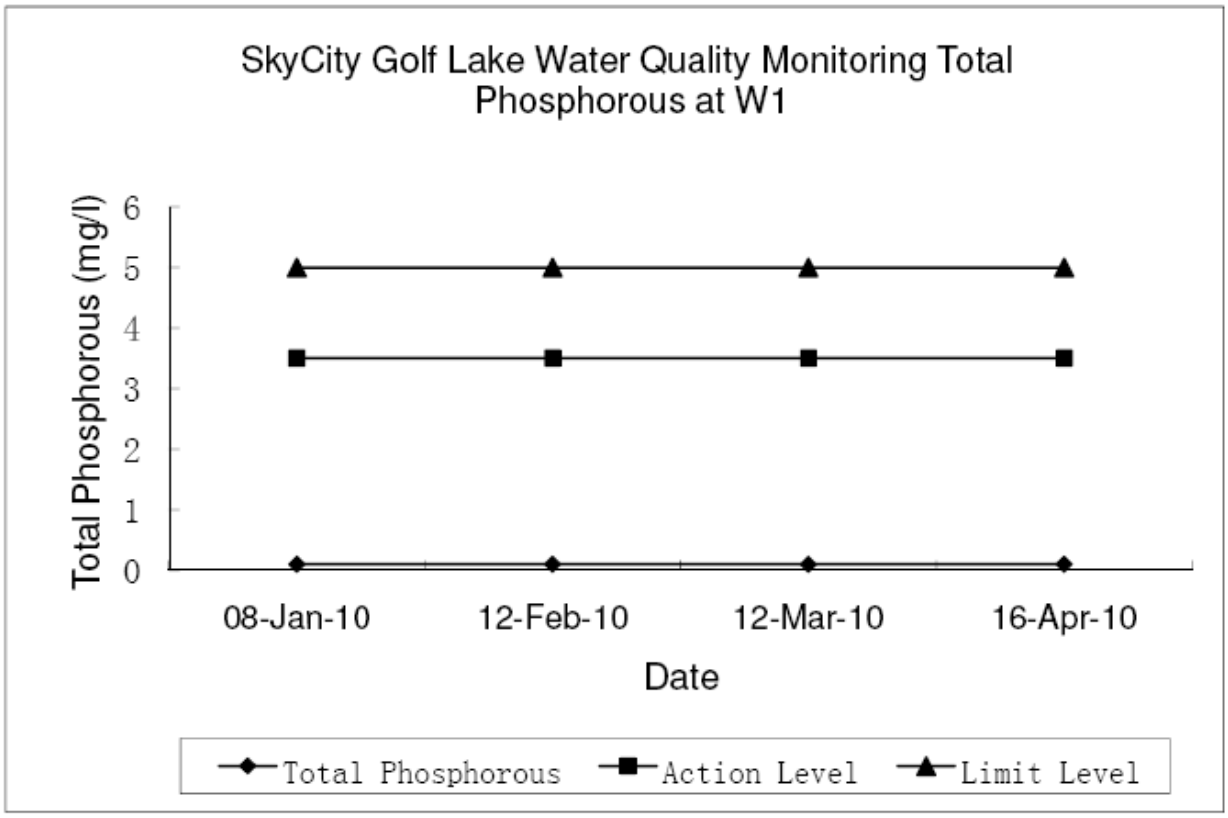

SkyCity Golf Lake Water Quality Monitoring BOD5 at W4
BOD5 (mg/l)
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
BOD5
Action Level
Limit Level

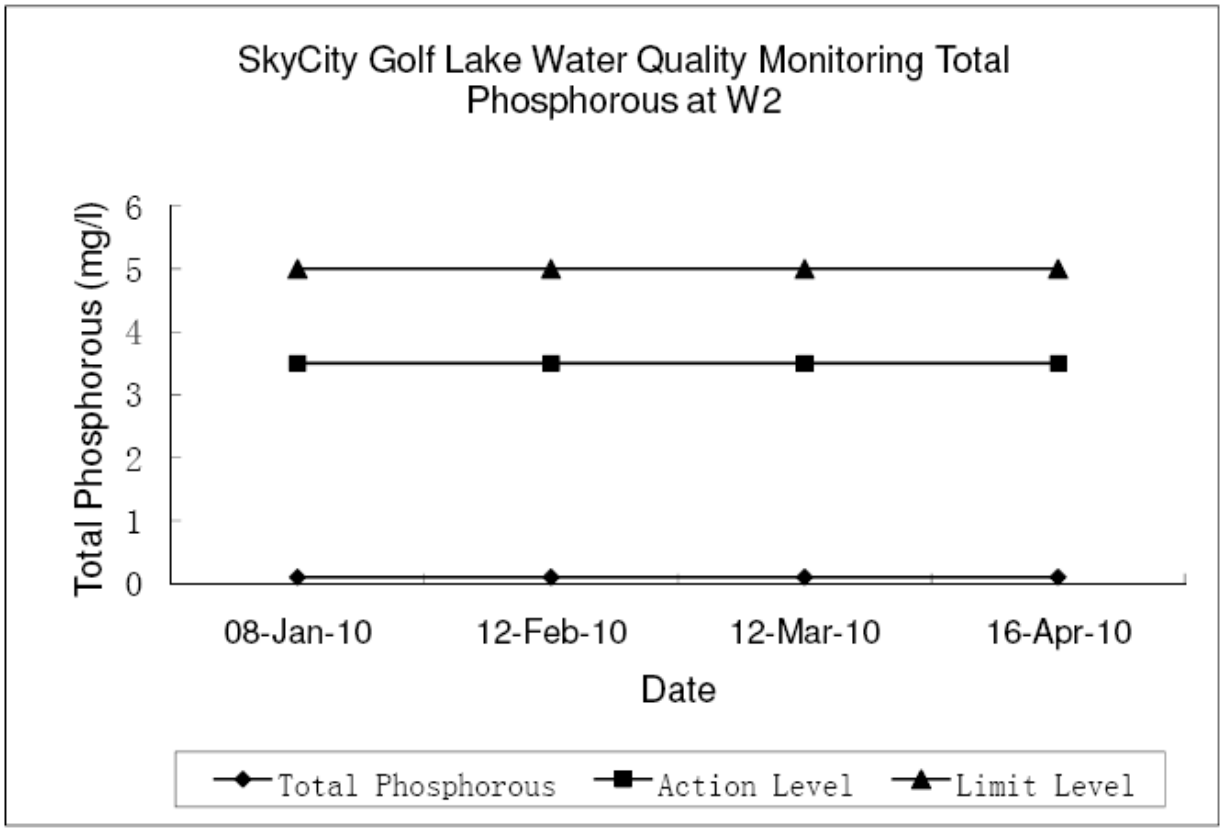

SkyCity Golf Lake Water Quality Monitoring Total Nitrogen at W1
Total Nitrogen (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Nitgrogen
Action Level
Limit Level

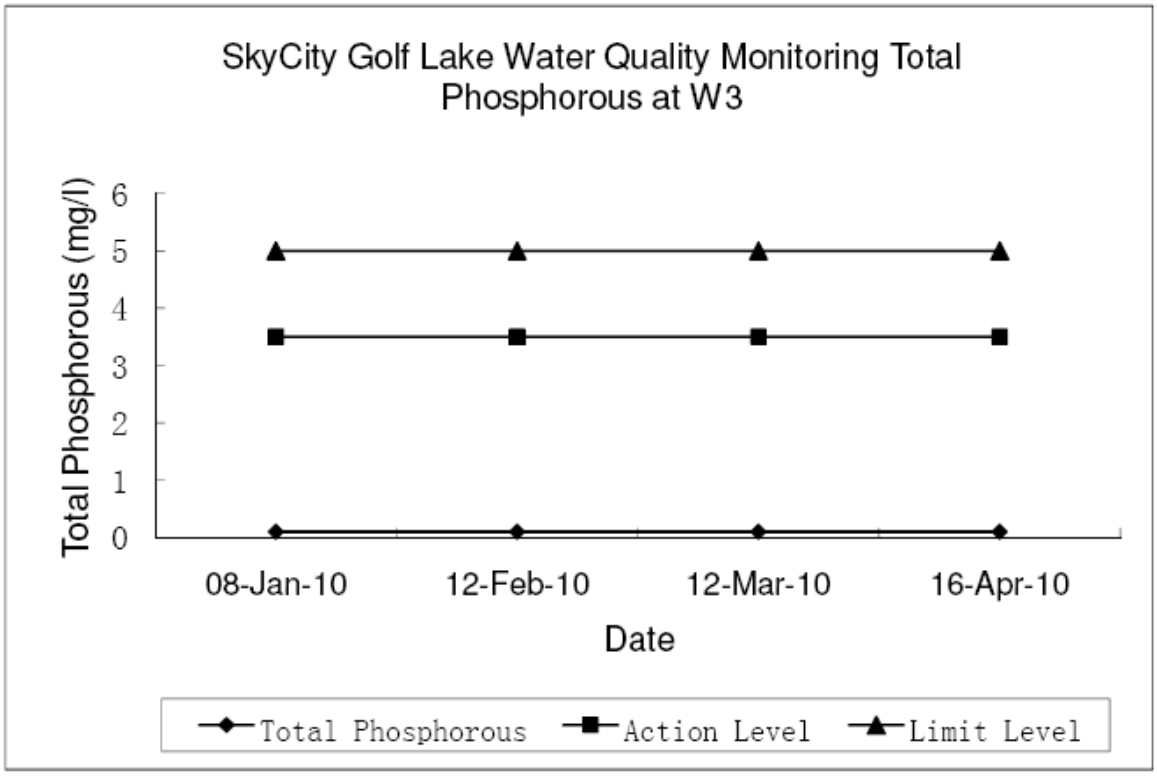

SkyCity Golf Lake Water Quality Monitoring Total Nitrogen at W2
Total Nitrogen (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Nitgrogen
Action Level
Limit Level

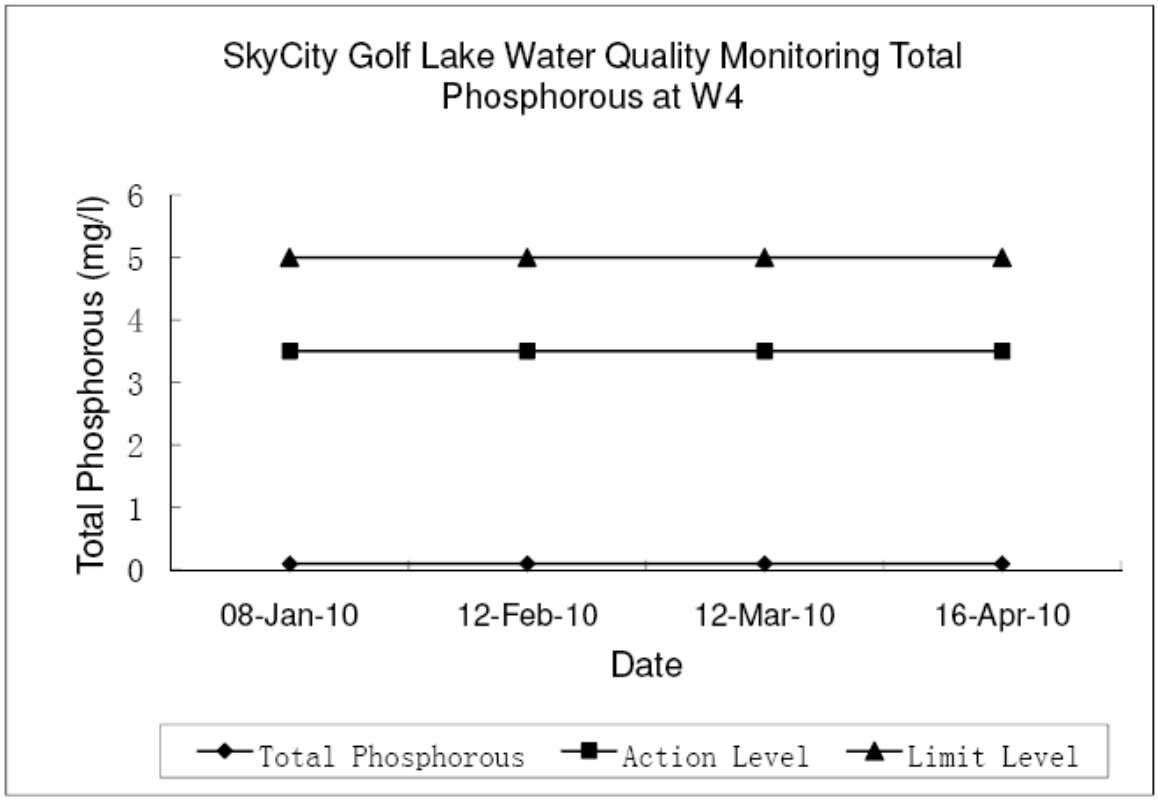

SkyCity Golf Lake Water Quality Monitoring Total Nitrogen at W3
Total Nitrogen (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Nitgrogen
Action Level
Limit Level


SkyCity Golf Lake Water Quality Monitoring Total Nitrogen at W4
Total Nitrogen (mg/l)
35
30
25
20
15
10
5
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Nitgrogen
Action Level
Limit Level


SkyCity Golf Lake Water Quality Monitoring Total Phosphorous at W1
Total Phosphorous (mg/l)
0
1
2
3
4
5
6
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Phosphorous
Action Level
Limit Level


SkyCity Golf Lake Water Quality Monitoring Total Phosphorous at W2
Total Phosphorous (mg/l)
0
1
2
3
4
5
6
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Phosphorous
Action Level
Limit Level


SkyCity Golf Lake Water Quality Monitoring Total Phosphorous at W3
Total Phosphorous (mg/l)
6
5
4
3
2
1
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Phosphorous
Action Level
Limit Level


SkyCity Golf Lake Water Quality Monitoring Total Phosphorous at W4
Total Phosphorous (mg/l)
6
5
4
3
2
1
0
08-Jan-10
12-Feb-10
12-Mar-10
16-Apr-10
Date
Total Phosphorous
Action Level
Limit Level

Appendix 3

Equipment Calibration Details

CERTIFICATE OF ANALYSIS

Batch: HK1003296
Sub-batch: 1
Date of Issue: 14/04/2010
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item :	YSI Mulitimeter	Serial No. :	02C0073AB
Model No. :	YSI5100 230V	Equipment No. :	HK739
Calibration Method :	This meter was calibrated in accordance with standard method APHA (18th Ed.) 4500-O C & G		
Date of Calibration :	10 February, 2010		

Testing Results :

Temperature

Expected Reading	Recording Reading
20.5 °C	20.4 °C
41.5 °C	41.0 °C
Allowing Deviation	±2.0°C

Testing Method:

In-House Method

DO

Expected Reading	Recording Reading
5.95 mg/L	6.02 mg/L
6.70 mg/L	6.55 mg/L
8.54 mg/L	8.68 mg/L
Allowing Deviation	± 0.2 mg/L

Testing Method:

APHA (20th edition), 4500-OC & G

Mr Chan Kwok Fai, Godfrey
Laboratory Manager - Hong Kong

ALS Technichem (HK) Pty Ltd
ALS Environmental

CERTIFICATE OF ANALYSIS

Batch: HK1005416
Sub-batch: 1
Date of Issue: 13/04/2010
Client: HYDER CONSULTING LTD
Client Reference:

Calibration of DO System

Item :	YSI Mulitimeter	Serial No. :	02C0073AB
Model No. :	YSI5100 230V	Equipment No. :	HK739

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

Date of Calibration : 04 March, 2010

Testing Results :

Temperature

Expected Reading	Recording Reading
20.0 °C	20.2 °C
38.5 °C	37.1 °C
Allowing Deviation	±2.0°C

Testing Method:

In-House Method

DO

Expected Reading	Recording Reading
4.53 mg/L	4.49 mg/L
6.64 mg/L	6.49 mg/L
8.68 mg/L	8.74 mg/L
Allowing Deviation	± 0.2 mg/L

Testing Method:

APHA (20th edition), 4500-OC & G

Mr Chan Kwok Fai, Godfrey
Laboratory Manager - Hong Kong

ALS Technichem (HK) Pty Ltd
ALS Environmental

Page 2 of 2

CERTIFICATE OF ANALYSIS

Batch: HK1007882
Sub-batch: 1
Date of Issue: 23/04/2010
Client: HYDER CONSULTING LTD
Client Reference: SKY CITY GOLF COURSE

Calibration of DO System

Item :	YSI Mulitimeter	Serial No. :	02C0073AB
Model No. :	YSI5100 230V	Equipment No. :	HK739

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

Date of Calibration : 08 April, 2010

Testing Results :

Temperature

Expected Reading	Recording Reading
22.5 °C	22.5 °C
33.5 °C	33.2 °C
Allowing Deviation	±2.0°C

Testing Method:

In-House Method

DO

Expected Reading	Recording Reading
4.36 mg/L	4.30 mg/L
5.85 mg/L	5.94 mg/L
8.32 mg/L	8.45 mg/L
Allowing Deviation	± 0.2 mg/L

Testing Method:

APHA (20th edition), 4500-OC & G

Mr Chan Kwok Fai, Godfrey
Laboratory Manager, Hong Kong

ALS Technichem (HK) Pty Ltd

ALS Environmental

Page 2 of 2

Appendix 4

Aqua Bio-Trol Liquid – Product Data Sheet

Aqua Bio-Trol Liquid

Liquid Microbial Pond Clarifier

PRODUCT DATA BULLETIN

Features

- *Eliminates pond scum and green, soupy conditions*
- *Improves water clarity*
- *Reduces foul odors and organic sediment*
- *Contains facultative bacteria capable of withstanding low oxygen levels*
- *Reduces levels of harmful nitrates & ammonia*
- *Effective under a wide range of climactic conditions*
- *Enhances conditions for all aquatic life*
- *Reduces biological oxygen demand*
- *Non-toxic, safe for fish, plants & applicator*
- *Microencapsulated, microbial stimulants*

Aqua Bio-Trol Liquid is the safe, natural way to establish and maintain cleaner pond and lake water without chemicals. *Aqua Bio-Trol Liquid* eliminates pond scum and green, *soupy* conditions, while eliminating foul odors. *Aqua Bio-Trol Liquid* improves water clarity and digests excess organic matter in ponds, lakes and fountains.

Aqua Bio-Trol Liquid helps to create and maintain a healthier pond, lake and fountain water ecosystem through non-chemical treatment. *Aqua Bio-Trol Liquid* is an all natural, microbial based product effective for improving poor water conditions, and especially for maintenance of healthy water conditions once they are established. *Aqua Bio-Trol Liquid* is a concentration of naturally occurring microbes, which act to bring pond and lake water into proper ecological balance.

Aqua Bio-Trol Liquid is completely biodegradable and non-toxic to humans, animals and water life. The result of treatment is reduced organic sediment and particulate, reduced sludge, clear water, and enhanced conditions for all aquatic life.

Aqua Bio-Trol Liquid microbes preemptively consume organic matter which feeds algae and which leads to anaerobic conditions, including bad odors. The active microbes in *Aqua Bio-Trol Liquid* feed on excess nutrients in the entire water column, from sludge at the bottom to suspended particulate, to green organic matter on the surface. Routine application helps keep water in it's best condition without the use of potentially harmful chemicals.

DIRECTIONS FOR USE

Aqua Bio-Trol Liquid is most effective when water temperatures range from 50º to 100º F. For best results, provide adequate surface or subsurface aeration. Subsuface aeration is preferred. For maximum efficiency, assure a minimum of 5-6 % dissolved oxygen.

Apply by distributing liquid as much as possible around pond and lake edges. Avoid dumping liquid in one location.

Pond Volume	Initial Treatment	Monthly Maintenance
Acre Foot 325,900 gallons	4 gallons	2 gallons

Formulas to help in your calculations

- **Length x Width x Depth (feet) x 7.48 – Number of Gallons**
- **One acre-foot of water – 325,900 gallons**
- **One acre-foot of water – 1,233 CuMt**

Active Ingredients

A proprietary blend of 58 strains of aerobic and facultative beneficial bacteria at a minimum concentration of 6.6 x 10^7 CFU per ml (including Bacillus subtilis)

Parkway Research
A Division of BRANDT CONSOLIDATED

13802 Chrisman Road ▪ Houston, Texas 77039 USA
800.442.9821 ▪ Fax 281.590.3353

www.parkwayresearch.com ▪ www.brandtconsolidated.com