



Quarterly EM&A Compliance Report

SkyCity Nine Eagles Golf Course

February to April 2015









| Project Deliverable No.: | 7076024 D01/20 – Revision No 1 |
|----------------------------|---|
| Project Name: | SkyCity Nine Eagles Golf Course |
| Report Name: | Quarterly EM&A Compliance Report – February to April 2015 |
| Report Date: | April 2015 |
| Report for: | Sky City Nine Eagles Golf Course |

PREPARATION, REVIEW AND AUTHORISATION

| Revision # | Date | Prepared by | Reviewed by | Approved by |
|------------|------------|---------------|-------------|--------------|
| 1 (Final) | April 2015 | Samantha KONG | Antony WONG | Alexi BHANJA |

ISSUE REGISTER

| Distribution List | Date Issued | Number of Copies |
|-------------------------------------|-------------|-------------------------|
| Sky City Nine Eagles – Eddie YUNG | April 2015 | 1 electronic |
| SkyCity Nine Eagles – Vincent LEUNG | April 2015 | 1 electronic |
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SMEC COMPANY DETAILS

SMEC Asia Limited

27/F Ford Glory Plaza, 37-39 Wing Hong Street, Cheung Sha Wan, Kowloon, Hong Kong $\bf T$ +852 3995 8100 | $\bf F$ +852 3995 8101 smecasia@smec.com | www.smec.com

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CONTENTS

| | EXEC | JTIVE SUN | /IMARY | 1-1 |
|---|-------|------------|---------------------------------------|-----|
| 1 | PROJI | ECT DESCR | IPTION | 1-1 |
| | 1.1 | Overview | · | 1-1 |
| | 1.2 | Operation | n | 1-1 |
| 2 | LAKE | WATER Q | UALITY EM&A | 2-1 |
| | 2.1 | EM&A Pr | ogramme | 2-1 |
| | | 2.1.1 | Monitoring This Quarter | 2-1 |
| | | 2.1.2 | Monitoring Next Quarter | 2-1 |
| | 2.2 | Equipme | nt and Methodology | 2-1 |
| | 2.3 | Maintena | ance and Calibration | 2-2 |
| | 2.4 | Paramete | ers Monitored | 2-2 |
| | 2.5 | Monitori | ng Locations | 2-2 |
| | 2.6 | Monitori | ng Date, Time, Frequency and Duration | 2-2 |
| | 2.7 | Action / L | imit Levels | 2-3 |
| 3 | MON | ITORING R | RESULTS | 3-1 |
| | 3.1 | Summary | of Results | 3-1 |
| | 3.2 | Discussio | n | 3-1 |
| | | 3.2.1 | February 2015 | 3-1 |
| | | 3.2.2 | March 2015 | 3-2 |
| | | 3.2.3 | April 2015 | 3-2 |
| | 3.3 | Operation | nal Practice | 3-2 |
| | 3.4 | Complain | ts and Notifications of Summons | 3-2 |
| 4 | COMI | MENTS, RE | COMMENDATIONS AND CONCLUSIONS | 4-1 |



APPENDICES

| Appendix 1 | Equipment Calibration Details |
|------------|---|
| Appendix 2 | Lake Water Quality Monitoring Data |
| Appendix 3 | Graphical Plots of Monitoring Data for the Past Four Months |

TABLES

| Table 2-1 | Monitoring Schedule for This Quarter |
|-----------|--|
| Table 2-2 | Monitoring Schedule for the Next Quarter |
| Table 2-3 | In-situ Monitoring Equipment Details |
| Table 2-4 | Monitoring Frequency |
| Table 2-5 | Action and Limit Levels for Lake Water Quality |
| Table 2-6 | E/AP for Lake Water Quality Monitoring |
| Table 3-1 | Summary of Compliance Monitoring Data During Reporting Quarter |
| Table 3-2 | Operational Results |

FIGURES

| Figure 1-1 | Location of SkyCity Golf Course on the Airport Island |
|------------|---|
| Figure 1-2 | Schematic of Lake Water Control System |
| Figure 2-1 | Locations for Lake Water Quality Monitoring |



EXECUTIVE SUMMARY

The project comprises the construct ion and operation 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. The golf facility, known as "SkyCity Nine Eagles Golf Course" serves airport passengers and workers as well as the general public.

According to the approved EM&A Manual, monthly compliance monitoring of lake water quality at four locations (W1 and W2 in Lake A and W3 and W4 in Lake B) is required during the Operation Period, with reporting on a quarterly basis. Parameters monitored comprise Suspended Solids (SS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD₅), nitrogen, phosphorous, temperature and salinity.

This is the thirty-second Quarterly Compliance report covering February to April 2015 and complies with the reporting requirements stated in the approved EM&A Manual.

In February, two exceedances of Action Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Action Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. However, with continuing cooling of lake water during the winter period (water temperatures were around 2°C cooler on average in February than in January) algal growth has slowed. There were no exceedances of any other parameters.

In March, two exceedances of Limit Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Limit Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. There were no exceedances of any other parameters.

In April, two exceedances of Limit Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Limit Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. There were no exceedances of any other parameters.

Because the lake water was not considered to be of an acceptable quality for discharge into the surrounding marine waters, there were no openings of the control valve, emergency or otherwise, in February, March and April. As such, there was no off-site release of lake water and therefore no impact to the marine environment.

There were no complaints, notifications of summons received during the reporting quarter.



1 PROJECT DESCRIPTION

1.1 Overview

The project comprises the construct ion and operation 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 golf facility, known as "SkyCity Nine Eagles Golf Course" serves airport passengers and workers as well as the general public.

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. SMEC Asia Ltd has been employed as the Environmental Team (ET) for the Operation Period since May 2010 and has engaged ALS Technichem Pty Ltd as the HOKLAS accredited testing laboratory to carry out lake water analysis.

Construction of the golf course was completed on 31 December 2006, the first phase of the Operation Period was completed on 30 April 2007, and the second (and current) phase commenced on 1 May 2007.

1.2 Operation

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

The lakes are maintained at a capacity of 15,000m³. 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 20,000m³.

If the capacity of the lakes exceeds 20,000m³, 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 lakes into storm drains that discharge off-site via Outfall No. 8. However, the valve can only be opened if the lake water monitoring results indicate that water is of an acceptable quality. Under 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 90,000m³ of floodwater can be retained within the Golf Course in addition to the 20,000m³ 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 1-2*.

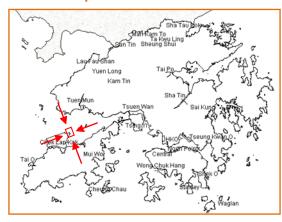


Figure 1-1 Location of SkyCity Golf Course on the Airport Island



Source: Image courtesy of Airport Authority.

Location Map



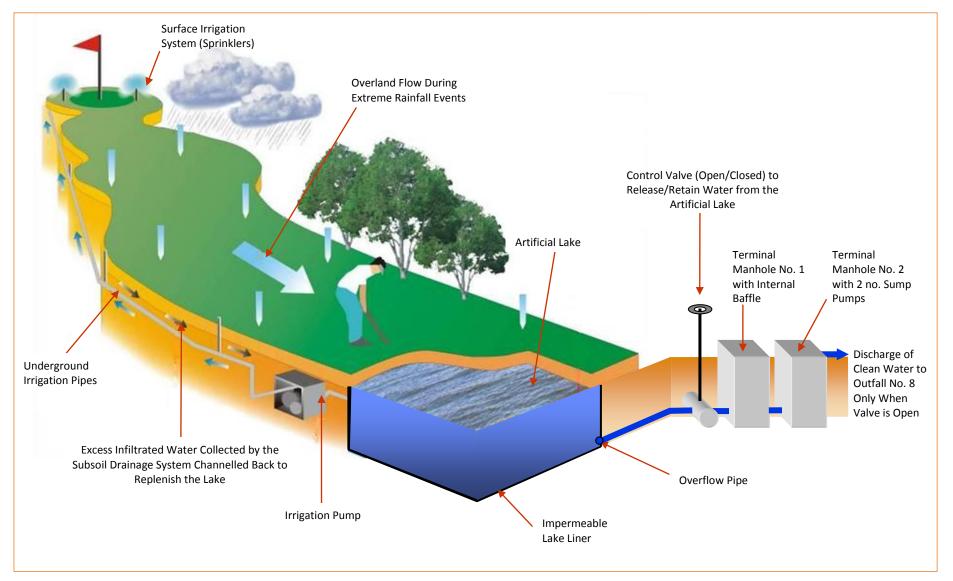
Key

- 1 Terminal 2 & SkyPlaza (Retail, F&B & Entertainment) 二號客運大樓及翔天廊(零售、食肆及娛樂區)
- 2 HKIA Tower 機場行政大樓
- 3 AsiaWorld Expo 亞洲國際博覽館
- 4 2nd on-airport hotel 第二間機場酒店
- 5 SkyPier 海天客運碼頭
- 6 SkyCity Nine Eagles Golf Course 航天城高爾夫球場
- → Airport World Trade Centre

 「
 暫名:機場世界貿易中心



Figure 1-2 Schematic of Lake Water Control System





2 LAKE WATER QUALITY EM&A

2.1 EM&A Programme

Monitoring of Dissolved Oxygen (DO) 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 g/ ℓ , and temperature in °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 other parameters were determined in a HOKLAS-accredited laboratory.

2.1.1 Monitoring This Quarter

The actual lake water monitoring schedule for this quarter (November 2014 to January 2015) is given in *Table 2-1*, below.

Table 2-1 Monitoring Schedule for This Quarter

| Sampling Date | Sampling Locations |
|------------------|--------------------|
| 13 February 2015 | W1 to W4 |
| 13 March 2015 | W1 to W4 |
| 10 April 2015 | W1 to W4 |

2.1.2 Monitoring Next Quarter

The planned lake water monitoring schedule for the next quarter (February to April 2015) is given in *Table 2-2*, below.

Table 2-2 Monitoring Schedule for the Next Quarter

| Sampling Date | Sampling Locations |
|---------------|--------------------|
| 8 May 2015 | W1 to W4 |
| 12 June 2015 | W1 to W4 |
| 10 July 2015 | W1 to W4 |

2.2 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 Ed, #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 is provided in *Table 2-3*.



Table 2-3 In-situ Monitoring Equipment Details

| In-situ Parameters | Measuring Devices | Measurement Precision |
|--------------------|-----------------------|-----------------------|
| Dissolved Oxygen | | 0.1mg/ℓ and 0.1% |
| Salinity | YSI Professional Plus | 0.1ppt (or g/ℓ) |
| Temperature | | 0.1°C |

A Kahlisco water sampler was used to obtain water samples for subsequent SS analysis in the laboratory. A sufficient volume of the sample is 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 starts by the next working day following APHA *Standard Methods* #2540D.

2.3 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* 1.

2.4 Parameters Monitored

The following parameters are monitored and compared to Action/Limit (A/L) Levels:

- Dissolved Oxygen
- Suspended Solids
- BOD₅
- Total Nitrogen
- Total Phosphorous

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

2.5 Monitoring Locations

Monitoring locations together with grid references are shown in *Figure 2-1*. Monitoring Stations are designated as W1, W2, W3 and W4.

2.6 Monitoring Date, Time, Frequency and Duration

In accordance with the EM&A Manual, the monitoring frequency of lake water quality is shown as *Table 2-4*.



Table 2-4 Monitoring Frequency

| | Operation Phase | | |
|----------------------|--------------------------------------|--------|--|
| | Below A/L Level A/L Level Exceedance | | |
| Monitoring Frequency | Monthly | Weekly | |

2.7 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 2-5*, below.

Table 2-5 Action and Limit Levels for Lake Water Quality

| Dayamatay | Acceptable Standard (mg/€) | | |
|-------------------|----------------------------|-------------|--|
| Parameter | 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 | |

In case of exceedance of A/L Levels caused by the operation of the Golf Course, the ET shall immediately implement the Event/ Action Plan (E/AP), shown in *Table 2-6*, below, in order to resolve lake water quality problems:

Table 2-6 Event/Action P for Lake Water Quality Monitoring

| 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 2-4 |
| | 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 2-4 |
| 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 2-4 (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 2-4 |



Figure 2-1 Locations for Lake Water Quality Monitoring



Key

- Lake Water Quality
 Monitoring Location
- Underground Control Valve
- Overflow from Lake into Control Valve
- Underground Pipe for Clean Flow
- Connection to Outfall No. 8
- Underground Pipes
 Connecting Lakes A and B



3 MONITORING RESULTS

3.1 Summary of Results

A summary of scheduled lake water monitoring results for the reporting quarter is provided in *Table 3-1*, below. Detailed results are provided in *Appendix 2* and graphical plots since commencement of the second phase of Operation are given in *Appendix 3*.

Table 3-1 Summary of Compliance Monitoring Data during Reporting Quarter

| Monitoring Location | | Salinity (g/8) | Temperature (°C) | SS (mg/8) | BOD ₅ (mg/e) | DO Saturation (%age) | DO Concentration (mg/ e) | Total Nitrogen (mg/e) | Total Phosphorous (mg/e) |
|---------------------|---------|----------------|------------------|-----------|-------------------------|-------------------------|-------------------------------------|--------------------------|-----------------------------|
| | Mean | 0.1 | 18.0 | 10 | 2.0 | 100.0 | 9.6 | 1.9 | 0.0 |
| W1 | Minimum | 0.1 | 16.5 | 8 | 2.0 | 96.9 | 8.8 | 1.7 | 0.0 |
| | Maximum | 0.1 | 20.4 | 15 | 2.0 | 102.0 | 10.0 | 2.1 | 0.0 |
| | Mean | 0.1 | 17.6 | 10 | 2.0 | 101.3 | 9.7 | 1.9 | 0.0 |
| W2 | Minimum | 0.1 | 16.0 | 8 | 2.0 | 98.9 | 9.0 | 1.7 | 0.0 |
| | Maximum | 0.1 | 19.9 | 13 | 2.0 | 103.0 | 10.1 | 2.0 | 0.0 |
| | Mean | 0.1 | 17.3 | 34 | 4.3 | 96.4 | 9.3 | 1.6 | 0.1 |
| W3 | Minimum | 0.1 | 15.7 | 26 | 2.0 | 86.2 | 7.9 | 1.4 | 0.1 |
| | Maximum | 0.1 | 19.9 | 41 | 6.0 | 102.0 | 10.0 | 1.8 | 0.1 |
| | Mean | 0.1 | 17.2 | 33 | 5.3 | 96.8 | 9.4 | 1.5 | 0.2 |
| W4 | Minimum | 0.1 | 15.6 | 21 | 3.0 | 88.8 | 8.2 | 1.4 | 0.1 |
| | Maximum | 0.1 | 19.6 | 40 | 8.0 | 102.0 | 10.0 | 1.7 | 0.4 |

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

3.2 Discussion

3.2.1 February 2015

In February, two exceedances of Action Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Action Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. However, with continuing cooling of lake water during the winter period (water temperatures were around 2°C cooler on average in February than in January) algal growth has slowed.

There were no exceedances of any other parameters. Total nitrogen and total phosphorous concentrations remained below Action Levels, which indicate that application of organic nutrients is NOT the cause of the exceedances.



3.2.2 March 2015

In March, two exceedances of Limit Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Limit Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water.

There were no exceedances of any other parameters. Total nitrogen and total phosphorous concentrations remained below Action Levels, which indicate that application of organic nutrients is NOT the cause of the exceedances.

3.2.3 April 2015

In April, two exceedances of Limit Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Limit Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water.

There were no exceedances of any other parameters. Total nitrogen and total phosphorous concentrations remained below Action Levels, which indicate that application of organic nutrients is NOT the cause of the exceedances.

3.3 **Operational Practice**

Table 3-2, below, shows the operational practice during the reporting quarter, i.e., the activities relating to the management of water in the lakes.

Table 3-2 Operational Results

| Month | Month-end Lake Water Depth (m) | Can Control Valve Be Opened? | Was Control Valve Opened? | Quantity of Water Discharged (m³) | |
|---------------|--------------------------------------|------------------------------------|------------------------------|---|--|
| February 2015 | 0.7 | No | No | 0 | |
| March 2015 | 0.7 | No | No | 0 | |
| April 2015 | 1.0 | No | No | 0 | |

Water quality in February, March and April was not considered to be of an acceptable quality for discharge and so the control valve could not be opened. As such, no water was discharged off-site during February, March and April.

3.4 Complaints and Notifications of Summons

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



4 COMMENTS, RECOMMENDATIONS AND CONCLUSIONS

According to the approved EM&A Manual, monthly compliance monitoring of lake water quality at four locations (W1 and W2 in Lake A and W3 and W4 in Lake B) is required during the Operation Period, with reporting on a quarterly basis. Parameters monitored comprise Suspended Solids (SS), Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD₅), nitrogen, phosphorous, temperature and salinity.

This is the thirty-second Quarterly Compliance report covering EM&A from February to April 2015 and complies with the reporting requirements stated in the approved EM&A Manual.

In February, two exceedances of Action Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Action Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. However, with continuing cooling of lake water during the winter period (water temperatures were around 2°C cooler on average in February than in January) algal growth has slowed. There were no exceedances of any other parameters.

In March, two exceedances of Limit Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Limit Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. There were no exceedances of any other parameters.

In April, two exceedances of Limit Level were recorded. SS concentrations at monitoring locations W3 and W4 exceeded the Limit Level. The SS concentration in the lakes is predominantly caused by naturally occurring algae in the water. There were no exceedances of any other parameters.

Water quality in February, March and April was not considered to be of an acceptable quality for discharge and so the control valve could not be opened. As such, no water was discharged off-site during February, March and April.

There were no complaints, notifications of summons received during the reporting quarter.



APPENDIX 1

Equipment Calibration Details



ALS Technichem (HK) Pty Ltd 11/F, Chung Shun Knitting Centre 1-3 Wing Yip Street Kwai Chung, N.T., Hong Kong T: +852 2610 1044

F: +852 2610 2021 www.alsglobal.com

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

CONTACT:

MR ALEXI BHANIA

CLIENT:

SMEC ASIA LIMITED

ADDRESS:

27/F, FORD GLORY PLAZA,

37-39 WING HONG STREET,

CHEUNG SHA WAN,

KOWLOON, HONG KONG.

PROJECT:

SKY CITY GOLF COURSE

WORK ORDER:

HK1509002

SUB-BATCH:

LABORATORY:

HONG KONG

DATE RECEIVED:

DATE OF ISSUE:

24/03/2015

COMMENTS

It is certified that the item under calibration/checking has been calibrated/checked by corresponding calibrated equipment in the laboratory.

Maximum Tolerance and calibration frequency stated in the report, unless otherwise stated, the internal aceptance criteria of ALS will be followed.

Scope of Test:

Dissolved Oxygen and Temperature

Description:

Multimeter

Brand Name:

YSI

Model No.:

YSI 550A 14C103000

Serial No.: Equipment No.:

Date of Calibration: 12 February, 2015

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.

Mr. Fung Lim Chee, Richard

General Manager -

Greater China & Hong Kong

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REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order:

HK1509002

SUB-BATCH:

H:

Date of Issue:

24/03/2015

Client:

SMEC ASIA LIMITED



Description:

Multimeter

Brand Name:

YSI

Model No.:

YSI 550A 14C103000

Serial No.: Equipment No.:

Name of the last

Date of Calibration:

12 February, 2015

Date of next Calibration:

12 May, 2015

Parameters:

Dissolved Oxygen

Method Ref: APHA (21st edition), 45000: G

| Expected Reading (mg/L) | Displayed Reading (mg/L) | Tolerance (mg/L) | | |
|-------------------------|--------------------------|------------------|--|--|
| 10 500 | 2.22 | 0.00 | | |
| 2.80 | 2.83 | +0.03 | | |
| 4.78 | 4.82 | +0.04 | | |
| 6.66 | 6.62 | -0.04 | | |
| | | | | |
| | Tolerance Limit (±mg/L) | 0.20 | | |

Temperature

Method Ref: Section 6 of International Accreditation New Zealand Technical

Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure.

| Expected Reading (°C) | Displayed Reading (°C) | Tolerance (°C) | | |
|------------------------|-------------------------|-----------------|--|--|
| 10.0 | 10.2 | +0.2 | | |
| 20.0 | 20.8 | +0.8 | | |
| 36.0 | 36.2 | +0.2 | | |
| | Tolerance Limit (±°C) | 2.0 | | |

Mr. Fung Lim Chee, Richard General Manager –

Greater China & Hong Kong



APPENDIX 2

Lake Water Quality Monitoring Data



| Date | Time | Station | Salinity (g/୧) | Temperature (°C) | SS (mg/€) | BOD5 (mg/ℓ) | DO Sat (%Saturation) | DO Conc (mg/e) | Total Nitrogen (mg/୧) | Total Phosphorous (mg/୧) |
|-----------|---------|---------|-------------------|---------------------|--------------|----------------|-------------------------|-------------------|--------------------------|-----------------------------|
| | 6:50 | W1 | 0.1 | 16.5 | 8 | 2 | 101.0 | 9.9 | 1.7 | 0.0 |
| | 7:00 | W2 | 0.1 | 16.0 | 9 | 2 | 102.0 | 10.1 | 1.7 | 0.0 |
| 13-Feb-15 | 7:20 | W3 | 0.1 | 15.7 | 26 | 5 | 101.0 | 10.0 | 1.5 | 0.1 |
| | 7:10 | W4 | 0.1 | 15.6 | 21 | 5 | 99.6 | 9.9 | 1.4 | 0.4 |
| | 6:35 | W1 | 0.1 | 17.2 | 8 | 2 | 102.0 | 10.0 | 1.9 | 0.0 |
| | 6:45 | W2 | 0.1 | 16.8 | 8 | 2 | 103.0 | 10.0 | 1.4 | 0.1 |
| 13-Mar-15 | 6:55 | W3 | 0.1 | 16.4 | 34 | 2 | 102.0 | 10.0 | 1.5 | 0.1 |
| | 7:05 | W4 | 0.1 | 16.3 | 40 | 3 | 102.0 | 10.0 | 3.3 | 0.2 |
| 10-Apr-15 | 6:45 | W1 | 0.1 | 20.4 | 15 | 2 | 96.9 | 8.8 | 2.1 | 0.0 |
| | 6:55 | W2 | 0.1 | 19.9 | 13 | 2 | 98.9 | 9.0 | 2.0 | 0.0 |
| | 7:25 | W3 | 0.1 | 19.9 | 41 | 6 | 86.2 | 7.9 | 1.8 | 0.1 |
| | 7:10 | W4 | 0.1 | 19.6 | 38 | 8 | 88.8 | 8.2 | 1.7 | 0.1 |
| | | | | | | | | | | |
| Mean 0.1 | | | | 17.5 | 22 | 3 | 98.6 | 9.5 | 1.7 | 0.1 |
| Minimum | | | 0.1 | 15.6 | 8 | 2 | 86.2 | 7.9 | 1.4 | 0.0 |
| | Maximum | | | 20.4 | 41 | 8 | 103.0 | 10.1 | 2.1 | 0.4 |



APPENDIX 3

Graphical Plots of Monitoring Data for the Past Four Months



