

PROJECT No.: TCS/00553/11



**CONTRACT NO. DC/2009/22**  
**DRAINAGE IMPROVEMENT WORKS IN SHUEN WAN**

**CONTRACT NO. DC/2010/02**  
**DRAINAGE IMPROVEMENT WORKS IN SHUEN WAN**  
**AND SHEK WU WAI**

**MONTHLY ENVIRONMENTAL MONITORING AND**  
**AUDIT REPORT FOR OPERATION PHASE-**  
**OCTOBER 2015**

PREPARED FOR  
**KWAN LEE-KULY JOINT VENTURE**

Quality Index

Date	Reference No.	Prepared By	Certified by
17 November 2015	TCS00553/11/600/R0464v2	 Ben Tam (Environmental Consultant)	 T.W. Tam (Environmental Team Leader)

Ver.	Date	Description
1	13 November 2015	First submission
2	17 November 2015	Amended against the IEC's comment on 17 November 2015

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Ref.: DSDSHUWNEM00\_0\_0716.15

18 November 2015

Drainage Services Department  
Drainage Projects Division  
44 & 45/F., Revenue Tower  
5 Gloucester Road,  
Wan Chai, Hong Kong

By Fax (2827 8700) and Post

Attention: Mr. H.K.Chan and Mr. Max Tai

Dear Sirs,

**Re: Agreement No. DP 01/2010  
Services as Independent Environmental Checker for the Drainage  
Improvement Works in Sha Tin and Tai Po under Contract No.  
DC/2009/22 & DC/2010/02  
Monthly Environmental Monitoring and Audit Report for October 2015**

Reference is made to Environment Team's submission of the Monthly Environmental Monitoring and Audit Report for October 2015 by Email on 17 November 2015 (entitled "DC/2009/22 & DC/2010/02 - Monthly EM&A Report for Operation Phase - October 2015").

Please be informed that we have no comment on the captioned report. We write to verify the captioned submission in accordance with Condition 5.4 of EP-303/2008.

Thank you very much for your kind attention and please do not hesitate to contact Mr. Tony Cheng (3465-2822) should you have any queries.

Yours faithfully,



Tony Cheng  
Independent Environmental Checker

c.c.

AUES  
Kwan Lee-Kuly JV

Attn: Mr. T. W. Tam  
Attn: Mr. W. K. Chan

By Fax: 2959 6079  
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**EXECUTIVE SUMMARY**

- ES.01. This is the Monthly Environmental Monitoring and Audit (EM&A) Report for DSD Contract No. DC/2009/22 (hereafter “Contract 1”) and DC/2010/02 (hereafter “Contract 2”) for Drainage Improvement in Shuen Wan under Environmental Permit No.EP-303/2008, covering the Operation Phase period from **1 to 31 October 2015** (hereinafter ‘the Reporting Period’).
- ES.02. Joint site inspection with EPD, DSD, Contractor, IEC and ET was carried out on 24 March 2015 regarding the proposal of commencement of operation phase of DC/2010/02. EPD accepted that the proposal and the operation phase of DC/2010/02 was commenced from 1 April 2015. Therefore, the EM&A programme for both Contracts 1 and 2 were performed in Operation Phase in the Reporting Period.

**ENVIRONMENTAL MONITORING AND AUDIT ACTIVITIES**

- ES.03. In the Reporting Period, environmental monitoring activities for the Operation Phase of the Project under the of EM&A programme are summarized in the following table.

Environmental Aspect	Monitoring Parameters / Inspection	Contract 1	Contract 2
		Operation Phase	Operation Phase
Water Quality	Hydrological characteristics measurement – H1, H2, H3 and H4	5 events	5 events
Ecological	Ecological Monitoring	1 event	1 event
Landscape & Visual	Inspection by a registered Landscape Architect	0 event	0 event

- ES.04. Operation phase ecological monitoring for Contracts 1 and 2 should be undertaken on a quarterly basis. In the Reporting Period, the 4<sup>th</sup> quarterly ecological monitoring under Contract 1 and 3<sup>rd</sup> quarterly ecological monitoring under Contract 2 were carried out **29 October 2015**.
- ES.05. Operation phase Landscape and visual inspection of the Contracts 1 and 2 should be undertaken on a quarterly basis and it was not carried out in the Reporting Period.
- ES.06. The hydrological characteristics of water depth and water flow rate as compared baseline monitoring period, the currently water depth and volumetric flow rate has insignificant change.

**ENVIRONMENTAL COMPLAINT**

- ES.07. No written or verbal complaint was recorded in this Reporting Period.

**NOTIFICATION OF SUMMONS AND SUCCESSFUL PROSECUTIONS**

- ES.08. No environmental summons or successful prosecutions were recorded in this Reporting Period.

**REPORTING CHANGE**

- ES.09. In the Reporting Period, no reporting change was made.

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## 1.0 INTRODUCTION

### PROJECT BACKGROUND

- 1.01 ***Kwan Lee-Kuly Joint Venture*** (hereinafter ‘KLKJV’) has been awarded by Drainage Services Department (hereinafter ‘DSD’) of the Contract No. DC/2010/02 - Drainage Improvement in Shuen Wan and Shek Wu Wai (hereinafter ‘the Project’). For the Project, construction works at Tung Tsz Road Shuen Wan is part of the Drainage Improvement works amongst Shatin and Tai Po and it is defined as a “Designated Project” which controlled under Environmental Permit EP-303/2008. On the other hand, Shek Wu Wai San Tin is a non-designated project work.
- 1.02 The Works at Tung Tsz Road Shuen Wan was divided two DSD Contracts i.e. DC/2009/22 (hereinafter called the “Contract 1”) and DC/2010/02 (hereinafter called the “Contract 2”). The construction works of Contract 1 was commenced in **August 2010** and the Operation Phase was commenced in **December 2014**. For Contract 2, the construction works was commenced in **May 2011** and the Operation Phase was commenced in **April 2015**. The Project site boundary is shown in **Appendix A**.
- 1.03 Action-United Environmental Services and Consulting (AUES) was appointed as the Environmental Team (ET) of Contracts 1 and 2 to implement the relevant EM&A programme of the Project.
- 1.04 This is the Monthly EM&A Report presenting the monitoring results for Operation Phase during the Reporting Period from **1** to **31 October 2015**.

### REPORT STRUCTURE

- 1.05 The Monthly Environmental Monitoring and Audit (EM&A) Report is structured into the following sections:-
- |           |  |
|-----------|--|
| SECTION 1 | INTRODUCTION   |
| SECTION 2 | PROJECT ORGANIZATION AND WORKS PROGRESS AND SUBMISSION |
| SECTION 3 | EM&A PROGRAM REQUIREMENT FOR THE PROJECT               |
| SECTION 4 | IMPACT MONITORING RESULTS                              |
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## 2.0 PROJECT ORGANIZATION AND SUBMISSION

### PROJECT ORGANIZATION AND MANAGEMENT STRUCTURE

- 2.01 Organization structure and contact details of relevant parties with respect to on-site environmental management are shown in *Appendix B*.

### SUMMARY OF ENVIRONMENTAL SUBMISSIONS

- 2.02 Summary of the relevant permits, licences, and/or notifications on environmental protection for this Project in this Reporting Period is presented in *Table 2-1*.

**Table 2-1 Status of Environmental Licenses and Permits**

Item	Description	License/Permit Status
1	Air Pollution Control (Construction Dust)	Notified EPD on 17 October 2011
2	Chemical Waste Producer Registration (WPN5213-727-K2972-02)	Approved on 28 October 2011
3	Water Pollution Control Ordinance (Discharge License) WT00009528-2011	Valid to 31 July 2016
4	Billing Account for Disposal of Construction Waste (Account No.: 7012838)	Effective

### 3.0 EM&A PROGRAM REQUIREMENT

3.01 The EM&A requirements for the Operation Phases are according to the PP, EIAR, Environmental Permit EP303/2008 (hereinafter ‘the EP’), and the associated updated EM&A Manual and they are presented in below sub-section.

#### MONITORING PARAMETERS

3.02 According to the updated EM&A Manual of the Project, the Operation Phases monitoring requirement is showed in **Table 3-1**.

**Table 3-1 Summary of Monitoring Parameters for the Project**

Environmental Aspect	Requirement / Parameter
Hydrological Characteristics Monitoring	<ul style="list-style-type: none"> <li>In-situ measurement including water flow and depth</li> </ul>
(*) Ecological Monitoring and Audit	<ul style="list-style-type: none"> <li>Monitor and inspect including the vegetation, fauna (includes avifauna, herpetofauna, odonate and butterfly) and Stream (includes fish and macroinvertebrates)</li> </ul>
(#) Landscape and Visual Monitoring	<ul style="list-style-type: none"> <li>Inspect and audit the implementation and maintenance of landscape and visual mitigation measures</li> </ul>

Remarks:

(\*) the monitoring is carried out by IEC

(#) The monitoring is carried out by the registered Landscape Architect

#### MONITORING LOCATIONS

3.03 Monitoring locations have been proposed in the updated EM&A Manual. The monitoring location is summarized in **Table 3-2** and shown in **Appendix C**.

**Table 3-2 Monitoring Locations of Operation Phase**

Aspect	Location ID	Address
Hydrological	H1	Between the Shuen Wan Marsh and ECA <ul style="list-style-type: none"> <li>Coordinates: E839306, N836379)</li> </ul>
	H2	Route 10 Sam Kung Temple <ul style="list-style-type: none"> <li>Coordinates: E839163, N836433</li> </ul>
	H3	Upstream of Tung Tze Shan Road <ul style="list-style-type: none"> <li>Coordinates: E838760, N836714</li> </ul>
	H4	Wai Ha Village 29D <ul style="list-style-type: none"> <li>Coordinates: E838865, N836621</li> </ul>
Ecology	Areas within 100m of the works boundary under Contract 1 and Contract 2	
Landscape & Visual	As within and adjacent to the construction sites and works areas under the Contract 1 and Contract 2	

#### MONITORING FREQUENCY OF OPERATION PHASE

3.04 According to the updated EM&A Manual, frequency and duration of the Operation Phase monitoring are summarized below.

##### *Hydrological Characteristics*

Frequency: Once per week at mid-flood and mid-ebb tides

Duration: One year after the construction is complete as operation phase monitoring (in accordance with the Updated EM&A Manual Section 4.32).

##### *Ecology*

3.05 In according with Section 6.17 of the Updated EM&A Manual, the Operation Phase ecological monitoring would be to conduct by the Independent Environmental Checker (hereinafter ‘IEC’). Regular checking and monitoring by quarter month would be performed for one year duration



***Landscape & Visual***

- 3.06 According to Section 7.5 of the Updated EM&A Manual, all landscape and visual mitigation measures would be monitored quarterly during the first year of the Operation Phase to check on the effectiveness of the mitigations.

**MONITORING EQUIPMENT**

***Hydrological Characteristics***

- 3.07 **Water Depth Detector** - A portable, battery-operated echo sounder shall be used for the determination of water depth at each designated monitoring station.
- 3.08 **Stream water flow Equipment** –A portable, battery-operated flow meter should be used for the determination of water flow rate at each designated monitoring location and record in m<sup>3</sup>/s.
- 3.09 The monitoring equipment using for the Project’s EM&A program were proposed by the ET and verified by the IEC prior commencement of the monitoring. Details of the equipment used for impact monitoring are listed in **Table 3-3**.

**Table 3-3 Monitoring Equipment Used for Operation Phase**

<b>Equipment</b>	<b>Model</b>
<b>Hydrological Characteristics</b>	
Water flow meter	GLOBAL WATER model FP211
Water Depth Detector	Eagle Sonar or an appropriate steel ruler or rope with appropriate weight

**MONITORING METHODOLOGY**

***Hydrological Characteristics***

- 3.10 A portable, water flow meter, brand named “*GLOBAL WATER model FP211*” are used to determine the water current flow at the designated monitoring stations. A water flow velocity is measured at mid depth of current water body or 0.5m below water level.
- 3.11 Water depths are determined prior to measurement, using a portable battery operated depth detector, brand named ‘Eagle Sonar’, if the depths exceed 1.5 meter. If the depth between 1.5 meter and 1 meter, plastic tape measurement tied with appropriate weight are used the depth estimation. For the depths well below 1 meter, an appropriate steel ruler or rope with appropriate weight are used for the depth measurement.

**OTHERS MONITORING IMPLEMENTATION FOR THE PROJECT**

**Ecology**

- 3.12 Ecological monitoring and reporting should be performed by IEC. Site survey will be carried out during the construction and 1-year establishment period of the Ecological Compensatory Area. These monitoring events include regular check on the retained and transplanted trees and shrubs, monitoring on fauna groups and aquatic fauna. No equipment and procedure are presented in the EM&A Monthly Report.

**Landscape and Visual**

- 3.13 A registered Landscape Architect as member of the ET is employed by the Contractor to undertake site inspection. Site inspection will undertake once every three months during the first year of the Operation Phase to check on the effectiveness of the mitigations.

**DETERMINATION OF ACTION/LIMIT (A/L) LEVELS**

- 3.14 No performance criteria i.e. Action and Limit levels of hydrological is used for the Operation Phase. The locations H3 and H4 are a reference measurement point in order to monitor any changes in the hydrological characteristics of Wai Ha River arising from the work Contract 2 to affect the Shuen Wan Marsh.

#### 4.0 MONITORING RESULTS OF CONTRACT 1 AND 2 FOR OPERATION PHASE

4.01 The operation phase monitoring schedule is presented in *Appendix D*. The monitoring results are presented in the following sub-sections.

##### RESULTS OF HYDROLOGICAL CHARACTERISTICS MONITORING

4.02 In this Reporting Period, hydrological characteristics measurements were carried out on **3, 7, 15, 24 and 27 October 2015**. The detailed measurement results in this Reporting Period are presented in *Tables 4-1* and the graphical plot area shown in *Appendix E*.

**Table 4-1 Detailed Monitoring Results of hydrological characteristics at Designated Measurement Points**

Measurement		Tide Condition	River Width (m)	Water Depth (m)	Cut Section (m <sup>2</sup> )	Velocity Flow Rate (m/s)	Average Volumetric Flow Rate (Q), m <sup>3</sup> /s
Point	Time						
<b>Date: 3 October 2015</b>							
H1	10:14	Flood	5.5	0.41	2.2550	0.4	0.902
	14:51	Ebb	5.5	0.44	2.4200	0.4	0.968
H2	9:57	Flood	4.7	0.3	1.4100	0.1	0.141
	14:30	Ebb	4.7	0.3	1.4100	0.1	0.141
H3	9:31	Flood	7.45	0.39	2.9055	0.3	0.872
	14:10	Ebb	7.45	0.38	2.8310	0.4	1.132
H4	9:44	Flood	2.74	0.27	0.7398	0.3	0.222
	14:22	Ebb	2.74	0.28	0.7672	0.3	0.230
<b>Date: 7 October 2015</b>							
H1	12:17	Flood	5.5	0.51	2.8050	0.3	0.842
	12:03	Ebb	5.5	0.51	2.8050	0.3	0.842
H2	12:32	Flood	4.7	0.32	1.5040	0.1	0.150
	11:46	Ebb	4.7	0.32	1.5040	0.1	0.150
H3	12:45	Flood	7.45	0.44	3.2780	0.3	0.983
	11:33	Ebb	7.45	0.44	3.2780	0.3	0.983
H4	12:57	Flood	2.74	0.3	0.8220	0.3	0.247
	11:21	Ebb	2.74	0.3	0.8220	0.3	0.247
<b>Date: 15 October 2015</b>							
H1	10:44	Flood	5.5	0.44	2.4200	0.3	0.726
	11:57	Ebb	5.5	0.43	2.3650	0.3	0.710
H2	10:25	Flood	4.7	0.29	1.3630	0.1	0.136
	10:43	Ebb	4.7	0.29	1.3630	0.1	0.136
H3	10:07	Flood	7.45	0.26	1.9370	0.3	0.581
	12:26	Ebb	7.45	0.26	1.9370	0.3	0.581
H4	10:17	Flood	2.74	0.38	1.0412	0.2	0.208
	10:34	Ebb	2.74	0.39	1.0686	0.2	0.214
<b>Date: 24 October 2015</b>							
H1	14:06	Flood	5.5	0.47	2.5850	0.3	0.776
	11:34	Ebb	5.5	0.48	2.6400	0.4	1.056
H2	13:52	Flood	4.7	0.3	1.4100	0.1	0.141
	12:06	Ebb	4.7	0.3	1.4100	0.1	0.141
H3	13:33	Flood	7.45	0.28	2.0860	0.3	0.626
	11:52	Ebb	7.45	0.27	2.0115	0.3	0.603
H4	13:42	Flood	2.74	0.36	0.9864	0.3	0.296
	11:59	Ebb	2.74	0.37	1.0138	0.3	0.304
<b>Date: 27 October 2015</b>							
H1	18:17	Flood	5.5	0.44	2.4200	0.2	0.484
	13:16	Ebb	5.5	0.42	2.3100	0.2	0.462
H2	18:02	Flood	4.7	0.29	1.3630	0.1	0.136

Measurement		Tide Condition	River Width (m)	Water Depth (m)	Cut Section (m <sup>2</sup> )	Velocity Flow Rate (m/s)	Average Volumetric Flow Rate (Q), m <sup>3</sup> /s
Point	Time						
	13:58	Ebb	4.7	0.27	1.2690	0.1	0.127
H3	17:46	Flood	7.45	0.27	2.0115	0.2	0.402
	13:42	Ebb	7.45	0.26	1.9370	0.2	0.387
H4	17:55	Flood	2.74	0.36	0.9864	0.2	0.197
	13:49	Ebb	2.74	0.36	0.9864	0.2	0.197

4.03 Hydrological characteristics results of the all measurement points are summarized in *Tables 4-2* and *4-3*.

**Table 4-2 Summarized Hydrological Characteristics of Water Depth, m**

Date	Mid-Flood				Mid-Ebb			
	H1	H2	H3	H4	H1	H2	H3	H4
3-Oct-15	0.41	0.30	0.39	0.27	0.44	0.30	0.38	0.28
7-Oct-15	0.51	0.32	0.44	0.30	0.51	0.32	0.44	0.30
15-Oct-15	0.44	0.29	0.26	0.38	0.43	0.29	0.26	0.39
24-Oct-15	0.47	0.30	0.28	0.36	0.48	0.30	0.27	0.37
27-Oct-15	0.44	0.29	0.27	0.36	0.42	0.27	0.26	0.36

**Table 4-3 Summarized Hydrological Characteristics of Average Volumetric flow rate (Q), m<sup>3</sup>/s**

Date	Mid-Flood				Mid-Ebb			
	H1	H2	H3	H4	H1	H2	H3	H4
3-Oct-15	0.902	0.141	0.872	0.222	0.968	0.141	1.132	0.230
7-Oct-15	0.842	0.150	0.983	0.247	0.842	0.150	0.983	0.247
15-Oct-15	0.726	0.136	0.581	0.208	0.710	0.136	0.581	0.214
24-Oct-15	0.776	0.141	0.626	0.296	1.056	0.141	0.603	0.304
27-Oct-15	0.484	0.136	0.402	0.197	0.462	0.127	0.387	0.197

4.04 To compare the monitoring data between the Reporting Period and baseline monitoring period, the currently water depth and volumetric flow rate has insignificant change.

#### RESULTS OF ECOLOGICAL MONITORING

4.05 According to updated EM&A Manual, quarterly ecological monitoring shall be conducted and it is undertaken by the IEC – Ramboll Environ Hong Kong Limited. In brief, the monitoring tasks include regular check on the retained and transplanted trees and shrubs, monitoring on fauna groups and aquatic fauna within the works area and any ecologically sensitive area within 100 m of the works boundary.

4.06 In the Reporting Period, the 4<sup>th</sup> quarterly ecological monitoring under Contract 1 and 3<sup>rd</sup> quarterly ecological monitoring under Contract 2 were carried out **29 October 2015**.

#### METEOROLOGICAL INFORMATION

4.07 The meteorological information during the measurement day of Operation Phase would be extracted from Tai Po and Shatin Stations of the Hong Kong Observatory (HKO). The meteorological data during the measurement days are presented in *Table 4-4*.

**Table 4-4 Meteorological Data in Reporting Period**

Date		Weather	Total Rainfall (mm)	Tai Po Station		Shatin Station	
				Mean Air Temp. (°C)	Mean Relative Humidity (%)	Wind Speed (km/h)	Wind Direction
3-Oct-15	Sat	Sunny periods in the afternoon. Mainly cloudy tonight. Moderate easterly winds, fresh at times.	0	26.2	84.7	13.3	N/NE
7-Oct-15	Wed	Cloudy with showers and a few thunderstorms. Moderate east to southeasterly winds.	5.8	25.3	93	6.5	N/NE
15-Oct-15	Thu	Fine and dry apart from some haze. Light to moderate northeasterly winds.	0	24.5	74.7	4.9	N/NE
24-Oct-15	Sat	It will be dry. Mainly cloudy overnight. Sunny periods tomorrow. Moderate northerly winds.	Trace	25.7	71.6	5.5	N/NE
27-Oct-15	Tue	Mainly fine. Dry in the afternoon. Moderate northerly winds.	0	25.9	76	6.3	N/NE

## 5.0 SITE INSPECTION

### REGULAR SITE INSPECTION AND MONTHLY AUDIT

- 5.01 According to the Updated Environmental Monitoring and Audit Manual, regular site inspection to evaluate the project environmental performance is not required during operation phase.

### LANDSCAPE AND VISUAL INSPECTION

- 5.02 According to Section 7.5 of the Updated EM&A Manual, quarterly landscape and visual inspection shall be carried out during the first year of the Operation Phase.

#### Operation Phase of Contract 1

- 5.03 The 3<sup>rd</sup> quarterly Landscape & Visual inspection for Contract 1 which signed by the Registered Landscape Architect was last undertaken on 17 September 2015. In the Reporting Period, no Landscape & Visual inspection for Contract 1 was carried out.

#### Operation Phase of Contract 2

- 5.04 The 2<sup>nd</sup> quarterly Landscape & Visual inspection for Contract 2 which signed by the Registered Landscape Architect was undertaken on 17 September 2015. In the Reporting Period, no Landscape & Visual inspection for Contract 2 was carried out.

## 6.0 ENVIRONMENTAL COMPLAINT AND NON-COMPLIANCE

### ENVIRONMENTAL COMPLAINT, SUMMONS AND PROSECUTION

6.01 For the Project, no environmental complaint, summons and prosecution was received in this Reporting Period. The statistical summary table of environmental complaint for the **Contracts 1 and 2** is presented in *Tables 6-1, 6-2* and *6-3*.

**Table 6-1 Statistical Summary of Environmental Complaints**

Reporting Period	Environmental Complaint Statistics		
	Frequency	Cumulative	Complaint Nature
July 2011 – September 2015	1	1	Air Quality (1)
October 2015	0	1	Air Quality (1)

**Table 6-2 Statistical Summary of Environmental Summons**

Reporting Period	Environmental Summons Statistics		
	Frequency	Cumulative	Complaint Nature
July 2011 – September 2015	0	0	NA
October 2015	0	0	NA

**Table 6-3 Statistical Summary of Environmental Prosecution**

Reporting Period	Environmental Prosecution Statistics		
	Frequency	Cumulative	Complaint Nature
July 2011 – September 2015	0	0	NA
October 2015	0	0	NA

## 7.0 IMPLEMENTATION STATUS OF MITIGATION MEASURES

7.01 According to the Updated Environmental Monitoring and Audit Manual, mitigation measures of Operation Phase of the Project is included the Ecological and Landscape & Visual as listed below.

### Ecological

- To minimize sedimentation, de-silting should be limited to the dry season; and
- Waste material produced during de-silting should be disposed of in a timely and appropriate manner

### Landscape and visual

- Viewing area formation by planting with shrubs, grasses and benches along the area
- Architectural design of the pump house will help it fit into the existing suburban, natural to semi-natural surroundings
- Landscape design of pump house by providing sufficient planting around its boundary fence
- Enhancement planting along Tung Tsz Road with shrubs / trees of suitable species to help protect the stream and marshes
- Construction of box culvert should be with at least 1.0m soil depth for enhancement planting
- Transplanting of existing affected trees to adjacent locations should be carried out
- Preparation for transplanting is needed to allow sufficient time for root pruning and rootball preparation prior to transplanting
- Reinstatement of affected area should be carried out to check that the works areas are properly reinstated

## 8.0 CONCLUSIONS AND RECOMMENTATIONS

### CONCLUSIONS

- 8.01 This is the monthly EM&A report for Contract 1 and Contract 2 presenting the Operation Phases monitoring results during the Reporting Period of **1 to 31 October 2015**.
- 8.02 The hydrological characteristics of water depth and water flow rate as compared baseline monitoring period, the currently water depth and volumetric flow rate has insignificant change.
- 8.03 Operation phase ecological monitoring of the Contracts 1 and 2 should be undertaken on a quarterly basis. In the Reporting Period, the 4<sup>th</sup> quarterly ecological monitoring under Contract 1 and 3<sup>rd</sup> quarterly ecological monitoring under Contract 2 were carried out **29 October 2015**.
- 8.04 Operation phase Landscape and visual inspection of the Contracts 1 and 2 should be undertaken on quarterly basis and it was not carried out in the Reporting Period.
- 8.05 No documented complaint, notification of summons or successful prosecution was received in the Reporting Period.

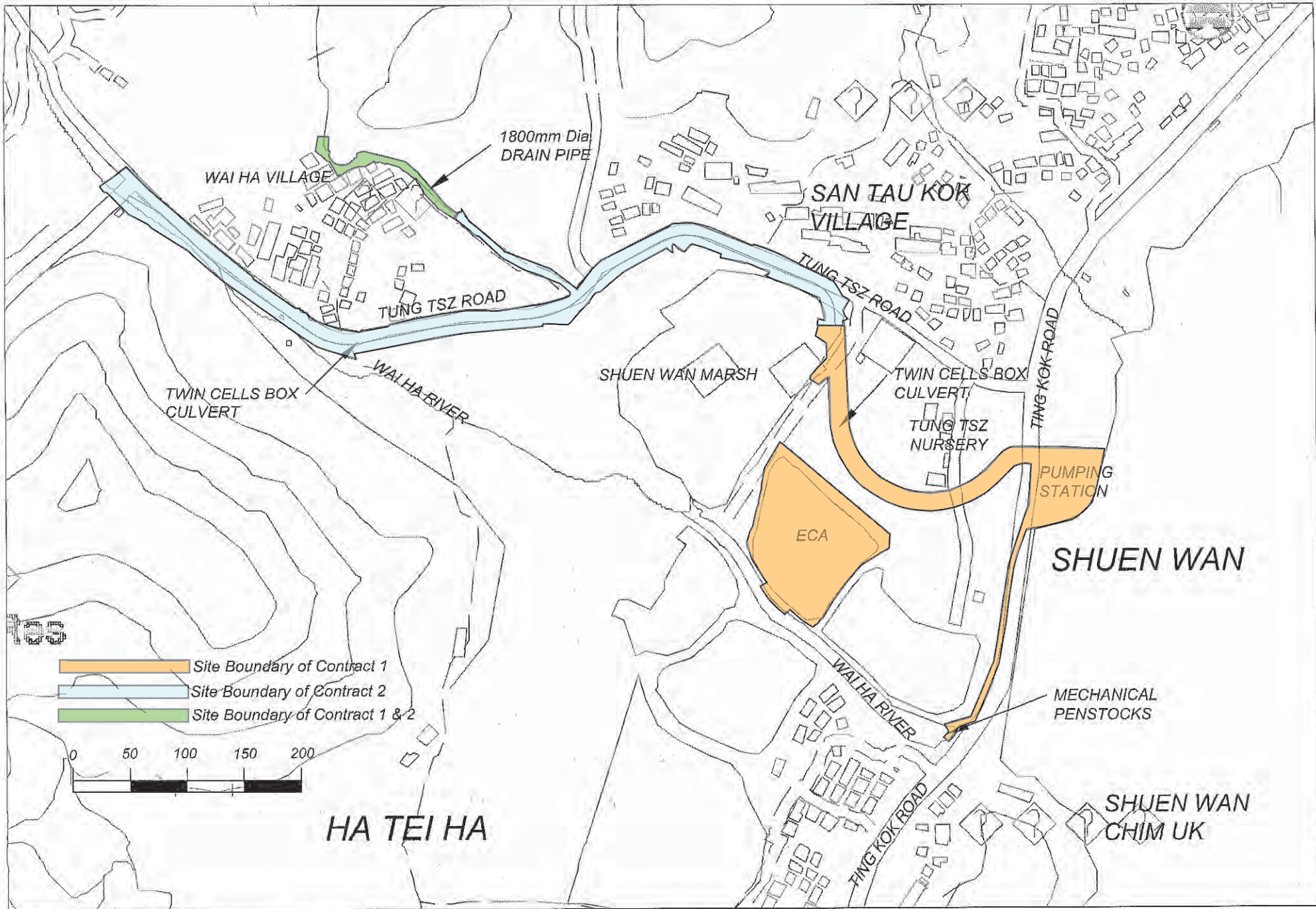
### RECOMMENDATIONS

- 8.06 Mitigation Measures of Operation Phase shall fulfill the updated EM&A Manual requirements.

## **Appendix A**

### **Project Location at Shuen Wan**

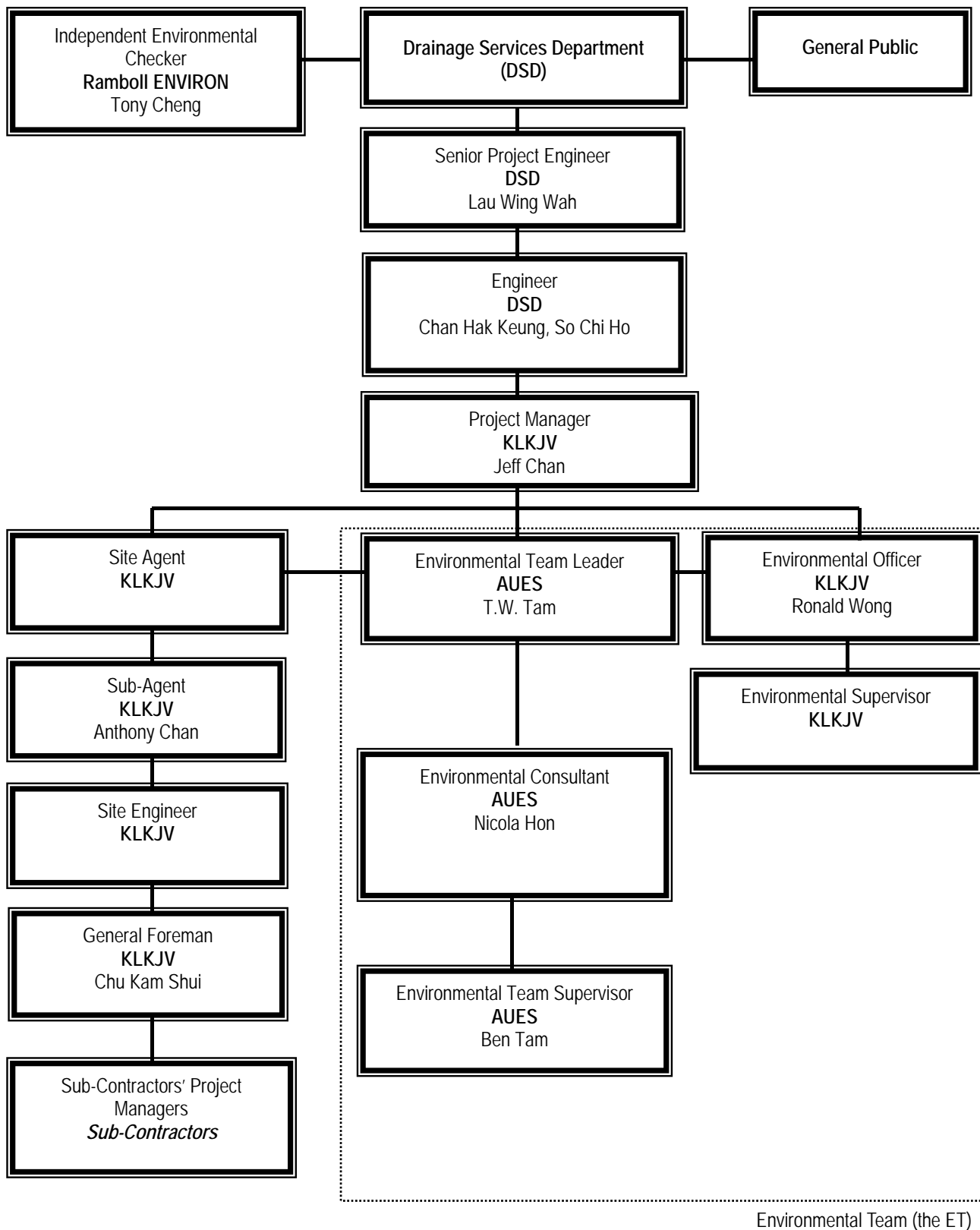




**Site Location Plan of DSD Contract 1 and Contract at Shuen Wan**

## **Appendix B**

### **Organization Chart and the Key Contact Person**



Environmental Management Organization

**Contact Details of Key Personnel**

<b>Organization</b>	<b>Project Role</b>	<b>Name of Key Staff</b>	<b>Tel No.</b>	<b>Fax No.</b>
DSD	Employer	Mr. Luk Wai Hung	2594 7400	2827 8700
DSD	Senior Engineer	Mr. Lau Wing Wah	2594 7402	2827 8700
DSD	Engineer	Mr. Chan Hak Keung	2594 7596	2827 8700
DSD	Engineer	Mr. So Chi Ho	2594 7356	2827 8700
DSD	Senior Inspector	Mr. Tso Si On	6778 2708	2827 8700
Ramboll Environ	Independent Environmental Checker	Mr. Tong Cheng	3465-2888	3465-2899
KLKJV	Project Director	Mr. Poon Chi Yeung Francis	2674 3888	2674 9988
KLKJV	Project Manager	Mr. Jeff Chan	2674 3888	2674 9988
KLKJV	Sub- Agent	Mr. Anthony Chan	2674 3888	2674 9988
KLKJV	Site Forman	Mr. Chu Kam Shui	2674 3888	2674 9988
KLKJV	Environmental Officer	Mr. Ronald Wong	2674 3888	2674 9988
AUES	Environmental Team Leader	Mr. T.W. Tam	2959-6059	2959-6079
AUES	Environmental Consultant	Miss. Nicola Hon	2959-6059	2959-6079
AUES	Environmental Supervisor	Mr. Ben Tam	2959-6059	2959-6079

**Legends:**

*DSD (Employer) – Drainage Services Department*

*DSD (Engineer) – Drainage Services Department*

*KLKJV (Main Contractor) – Kwan Lee-Kuly Joint Venture*

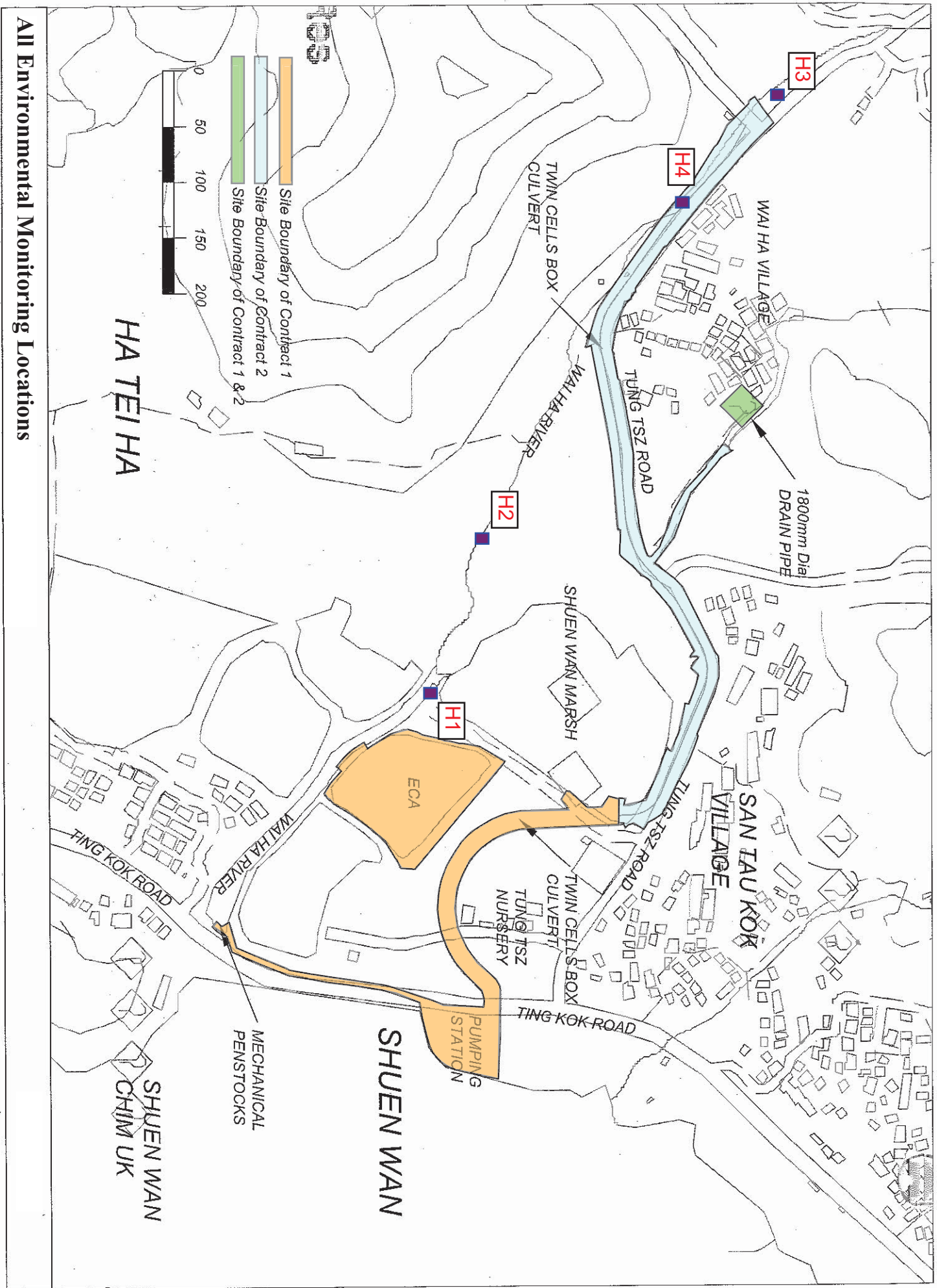
*RAMBOLL ENVIRON (IEC) – Ramboll Environ Hong Kong Limited*

*AUES (ET) – Action-United Environmental Services & Consulting*

## Appendix C

### Operation Phase Environmental Monitoring Locations





All Environmental Monitoring Locations

## **Appendix D**

### **Operation Phase Monitoring Schedule**

Monitoring/Inspection Schedule for the coming year (April 2015 to March 2016)

Operational Phase Commencement Date		Hydrological Monitoring											
		Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Contract 1	4-Dec-14	Once per week at mid-flood and mid-ebb tides								N/A	N/A	N/A	N/A
Contract 2	1-Apr-15	Once per week at mid-flood and mid-ebb tides											

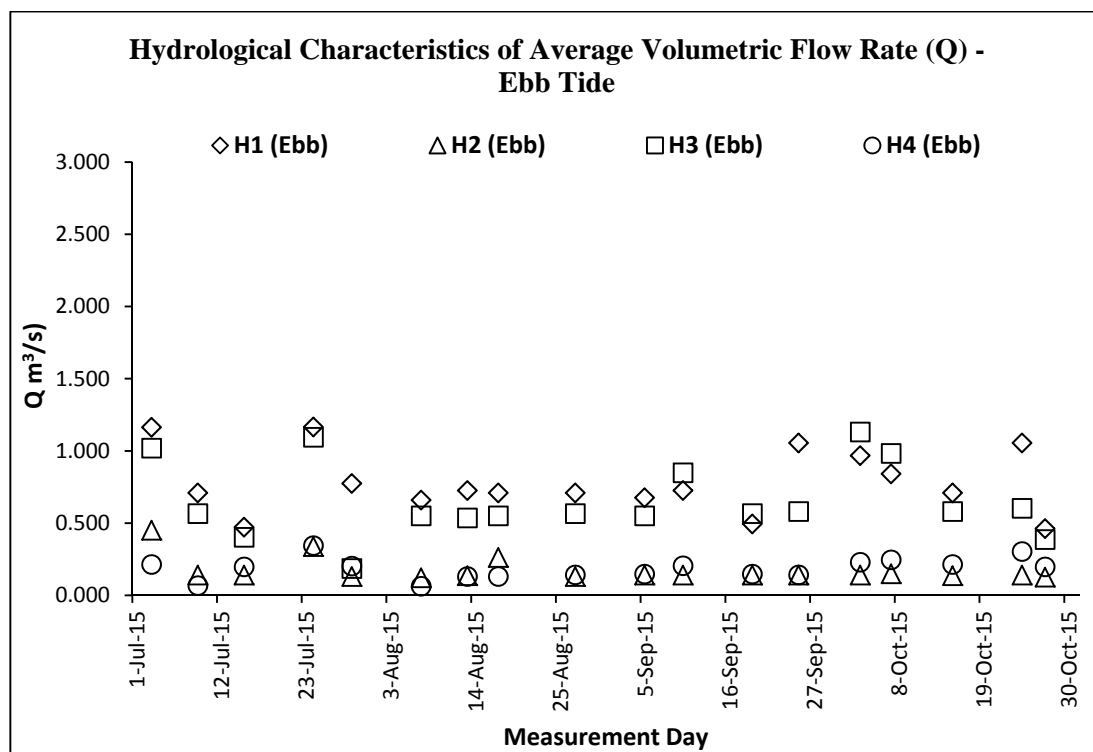
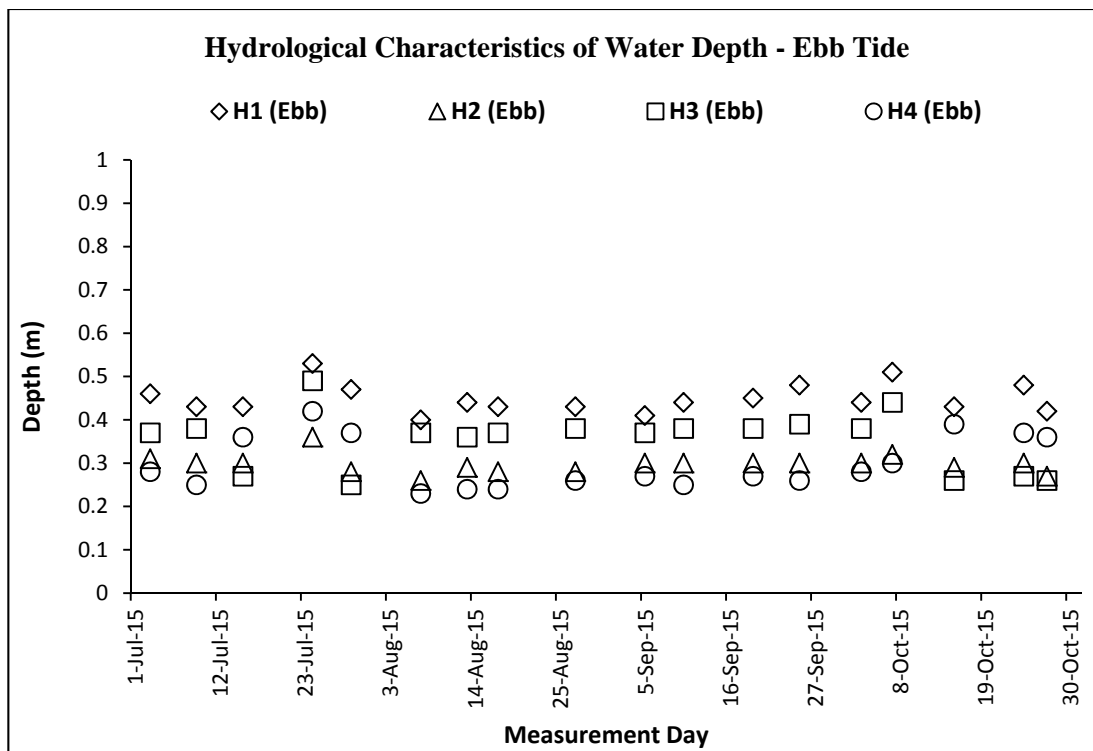
Operational Phase Commencement Date		Landscape & Visual Inspection											
		Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Contract 1	4-Dec-14		×				×			×			
Contract 2	1-Apr-15		×				×			×			×

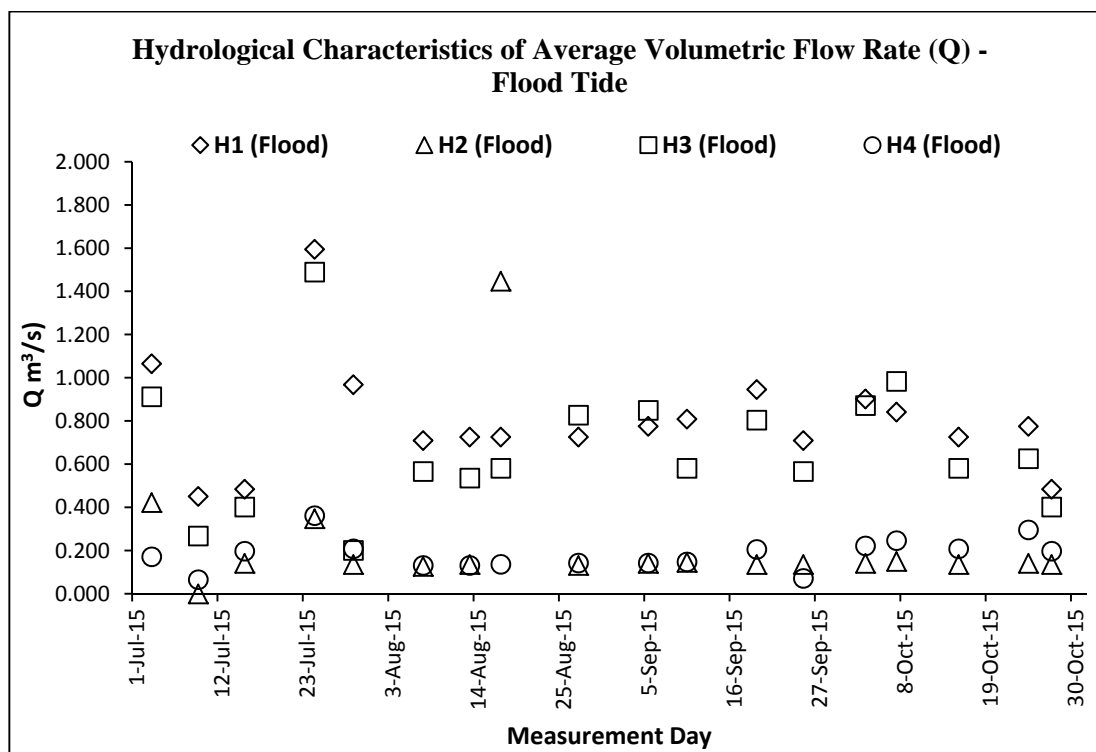
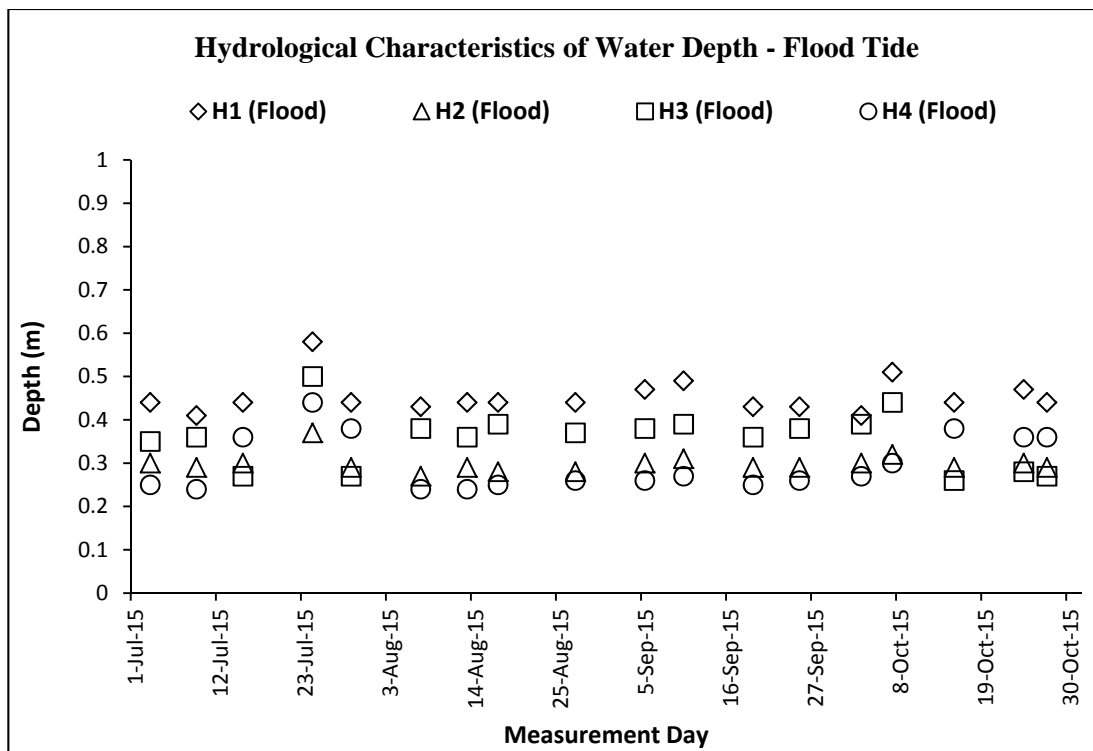
Operational Phase Commencement Date		Ecology Monitoring											
		Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Contract 1	4-Dec-14	×			×			×					
Contract 2	1-Apr-15	×			×			×			×		



## **Appendix E**

### **Graphical Plots of Hydrological Characteristics**





## **Appendix F**

### **Ecological Monitoring Report for Operation Phase**

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Agreement No. DP/01/2010  
Drainage Improvement Works in Shatin and Tai Po:  
Ecological Monitoring in area under Contract 1  
(Report OP-4a for October 2015)

Prepared for:

**Drainage Services Department**

Prepared by:

**Ramboll Environ Hong Kong Limited**

Date:

**November 2015**

Reference Number:

R4781\_V1.0

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Agreement No. DP/01/2010  
Drainage Improvement Works in Shatin and Tai Po:  
Ecological Monitoring in area under Contract 1  
(Report OP-4a for October 2015)

Prepared by:



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Daisy Au Yeung  
Assistant Environmental Consultant

Approved by:



---

Tony Cheng  
Project Manager

**Ramboll Environ Hong Kong Limited**  
**Room 2403, Jubilee Centre**  
**18 Fenwick Street, Wan Chai, Hong Kong**  
Tel: (852) 3465 2888  
Fax: (852) 34652899  
Email: hkinfo@environcorp.com

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Report\201510\OP-4a\R4781\_V1.0.doc*

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- Figure 2: SEMP 1, the first sampling point of Wai Ha River under Contract 1.



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## 1. Introduction

### 1.1 Project description

The Drainage Improvement Works in Shuen Wan was undertaken to minimize the potential flooding impacts in Sha Tin and Tai Po area. Although the Ecological Impact Assessment in the EIA Report identified that ecological impacts resulting from the proposed drainage improvement works at Shuen Wan were anticipated to be very minor in scale, ecological mitigation and ecological monitoring were recommended in the EM&A Manual ([http://env-shuenwan.com/pdf/review\\_note\\_em&a\\_rev.3.pdf](http://env-shuenwan.com/pdf/review_note_em&a_rev.3.pdf)) as stipulated under Environment Permit No. EP-303/2008.

1.2 Scope of ecological impact monitoring was described in the Particular Specifications and EM&A Manual of the projects. In brief, the monitoring tasks include regular check on the retained and transplanted trees and shrubs, monitoring on fauna groups and aquatic fauna within the works area and any ecologically sensitive area within 100m of the works boundary.

1.3 China-Hong Kong Ecology Consultants Co. was commissioned by Ramboll Environ Hong Kong Limited (formerly ENVIRON Hong Kong Limited) to perform the ecological impact monitoring survey (Operational phase) for areas under Contract 1 starting from January 2015.

1.4 The construction work of Contract 1 was completed in November 2014 and the operation phase of Contract 1 commenced in December 2014. The first quarterly ecological impact monitoring under Contract 1 for operation phase was conducted in January 2015.

1.5 The outline of this ecological monitoring report was as follow:

- Highlights of this report
- Monitoring methodology
- Monitoring data
- Review of monitoring results
- Comments and brief summary

1.6 This report No. OP-4a is the fourth quarterly ecological impact monitoring report for operation phase monitoring conducted on 29 October 2015 within the works boundary under Contract 1 and area within 100m from the works boundary.

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## 2. Highlights of this report

- Field survey was conducted on 29 October 2015
- Construction activities of Contract 1 were completed in November 2014 and the operational phase monitoring of Contract 1 was started in January 2015.
- This is the fourth quarterly ecological impact monitoring for Operation Phase under Contract 1.
- Lower number of species was observed within the works area under Contract 1 due to urbanized area in nature.
- Habitats in the 100m buffer area retain its natural condition.

## 3. Monitoring Methodology

Ecological monitoring methods were generally followed those described in the baseline ecological surveys (DC/2009/22). However, sampling area maybe reduced because of habitat change, for instance, deforestation and channel modification due to drainage works, where sampling was not applicable. Moreover, as the Ecological Monitoring for Ecological Compensatory Area (ECA) was completed and the ECA was handover to AFCD on January 2013 already, thus the monitoring survey and photo taking on SEMP 2 was not applicable also. Survey data and evaluation are detailed in the following sections.

### 3.1 Vegetation survey

Vegetation survey was performed along the designated transects (Figure 1) for ecological monitoring as described in the project specifications to monitor the vegetation health which could be adversely influenced by any bad site practice. Qualitative data of plants within the works boundary and wetland vegetation in the 100m buffer area of Contract 1 adjacent to construction site and wetland was recorded. Riparian vegetation including aquatic and emergent at 4 stream ecological monitoring points (hereinafter referred to as "SEMP") under Contract 1 (i.e. SEPM 1; Figure 2) along the affected stream channel and riparian habitat was recorded in terms of species, relative abundance and average heights. Any signs of damages and adverse health problems directly caused the works were recorded and reported. Nomenclature and protection status of the species followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Hong Kong Herbarium (2004).

### 3.2 Avifauna

Bird survey was conducted by following the proposed transects which cover the major ecologically sensitive areas of the Project (Figure 1). All bird species were recorded with special attention paid on the species of conservation importance and wetland-dependent species. List of bird species recorded and the relative abundance was provided.

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### 3.3 Herpetofauna

Herpetofauna survey was conducted via direct observation and active searching along the survey transects with a focus in the work areas (Figure 1). All reptiles and amphibians encountered or heard were recorded. Nomenclature and conservation status of herpetofauna species follows AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)).

### 3.4 Butterflies and Odonata

Odonates and butterfly survey of different habitats within the Study Area was conducted along the proposed transect (Figure 1). All butterflies and odonata were identified and relative abundance was recorded. Nomenclature and status of conservation of butterflies follows Lo & Hui (2005) while that of odonata follows AFCD websites ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)).

### 3.5 Mammals

As the monitoring site was situated near traffics, plant nursery and residential buildings, mammals were unlikely inhabited at the site except rodents, domestic dogs and cats. Detailed mammal monitoring was not conducted. However, any sighting, tracks and signs of mammals encountered during survey of other faunal groups was recorded. Bat was surveyed by search for potential colony habitat, such as palm trees, which are often used by fruit bats as nesting sites.

### 3.6 Aquatic fauna

Monitoring of aquatic fauna was carried out mainly by bank-side observation, sometimes with the aid of binoculars, at stream ecological monitoring points under Contract 1 (i.e. SEMP 1). These points were selected for covering representative sections of Wai Ha River and are shown in Figure 1. Netting and fish traps were also deployed at these points to collect supplementary data. Aquatic fauna seen/collected was identified *in situ* to the lowest possible taxon and relative abundance was presented.

---

## 4. Monitoring data

### 4.1 Vegetation survey

The habitats identified in area under Contract 1 are marine, recreational fish pond, river course, wooded area, mangrove, marsh and developed area (including village). Vegetation were found in wooded area, mangrove, marsh, develop area and river bank. Periodic vegetation clearance has been carried out at SEMP 1 only some weed plants such as *Wedelia chinensis* was recorded, with average coverage of 20% (Table 1). A list of plant species recorded from different habitats within the assessment area under Contract 1 is presented on Table 2. A total of 128 species were recorded within the assessment boundary of Contract 1 in which 127 species were recorded within the buffer area, while 50 species recorded within the work areas under Contract 1. No protected species were recorded.

### 4.2 Avifauna

A total of 13 bird species were recorded in the current survey under Contract 1 (Table 3). In the work area under Contract 1, 5 common bird species were recorded in which *Egretta garzetta* was with conservation interest. A total of 12 bird species including *Egretta garzetta*, *Ardeola bacchus*, *Ardea cinerea* and *Nycticorax nycticorax* were recorded in the 100m buffer area. *Egretta garzetta*, *Ardea cinerea* and *Ardeola bacchus* were recognized as being regional conservation concern while *Nycticorax nycticorax* was considered as local concern, though they are common in suitable habitats in Hong Kong. (Viney et al., 2005).

### 4.3 Herpetofauna

Herpetofauna was general in inactive state due to recent cold and dry environment. No reptile or amphibian was recorded within the assessment area (Table 4).

### 4.4 Butterflies

A total of 3 butterfly species were recorded during surveys (Table 5). All butterfly species were recorded in both the work boundary of Contract 1 and in the 100m buffer area. None of the species are of the conservation concern.

### 4.5 Odonata

Only 1 odonata species was recorded during the surveys (Table 6). The species Wandering glider (*Pantala flavescens*) was found within the work boundaries under Contract 1, which was a common species in Hong Kong.

### 4.6 Mammal

A few Short-nosed Fruit Bats *Cynopterus sphinx* were observed nesting in a few palm trees at the playground near Ting Kok Nursery Community Garden within Contract 1

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boundary. No other mammals or trace of mammals was observed within the assessment area.

#### 4.7 Aquatic fauna

Under Contract 1 (i.e. SEMP 1), a total of 4 fish species, 1 bivalve, 1 snail and 1 crustacean were recorded and most of them were residing in brackish environments (Table 7). River works at in SEMP 1 was finished as showed in Figure 2. Overall, no protected or rare species were recorded.

### 5. Review of the monitoring results

During the reporting period, construction activities at Tung Tsz Nursery and pumping station under Contract 1 were completed. In general, lower numbers of species were recorded within the works area under Contract 1 than that of 100 m buffer area because of the urbanized in nature where is considered as “low ecological significance”. As mitigation measures recommended in the EM&A Manual were properly implemented during the construction phase period, and hence the residual environmental impacts would be minimized.

### 6. Comments and summary

The fourth quarterly ecological impact monitoring under Contract 1 (excluding the ECA) for operation phase was conducted in October 2015 and relevant flora and fauna data were collected according to project specification and EM&A Manual. As indicated by the low diversity and abundance of species recorded within the work areas, habitats within the work boundary under Contract 1 offer few ecological opportunities for inhabitation of fauna and flora. On the other hand, the natural habitats in the 100m buffer area are retained at acceptable condition, and hence the 100 m buffer area has not been significantly affected by the project.

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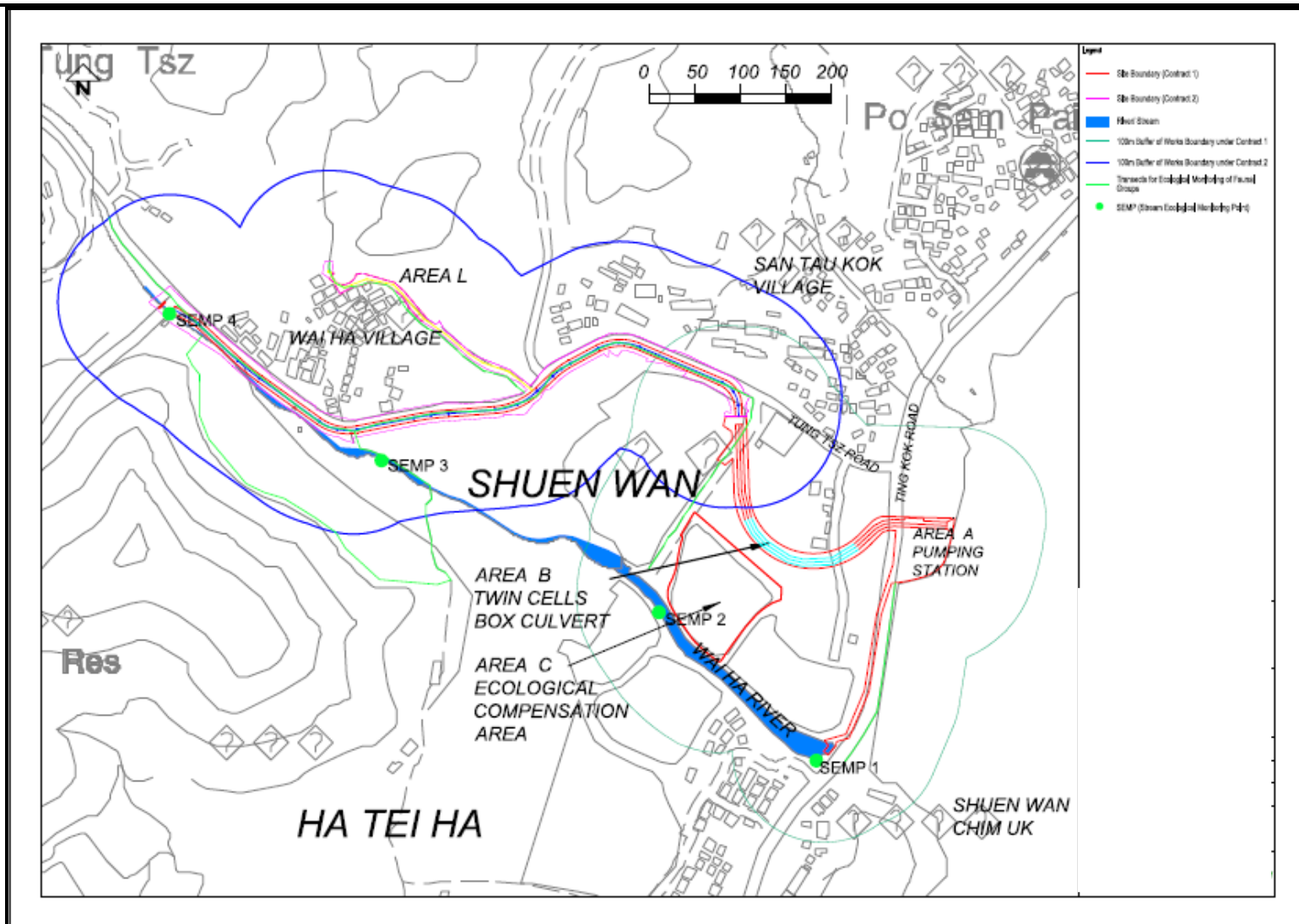
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## Figures



**Figure:** 1

**Title:** Map showing the ecological monitoring transect and the boundary of assessment area.

**Project:** Agreement No. DP/01/2010 Drainage Improvement Works in Shatin and Tai Po: Ecological Monitoring in area under Contract 1 (October 2015, Report OP-4a)

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Checked by: DAY

Rev.: 1.0

Date: November 2015





**Figure:** 2

**Title:** SEMP 1, the first sampling point of Wai Ha River under Contract 1.

**Project:** Agreement No. DP/01/2010 Drainage Improvement Works in Shatin and Tai Po: Ecological Monitoring in area under Contract 1 (October 2015, Report OP-4a )

**RAMBOLL ENVIRON**

Drawn by: IT

Checked by: DAY

Rev.: 1.0

Date: November 2015

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## Tables

**Table 1.** List of riparian vegetation and coverage (%) recorded from stream sampling points under Contract 1 (i.e. SEMP 1).

Species	Family	Growth form	Sampling point	SEMP 1	
			Status in Hong Kong	Height (cm)	%
<i>Albizia lebeck</i>	MIMOSACEAE	Tree	E		
<i>Arundinella nepalensis</i>	POACEAE	Perennial Herb	N		
<i>Bidens alba</i>	ASTERACEAE	Herb	E		
<i>Celtis sinensis</i>	ULMACEAE	Tree	N		
<i>Eclipta prostrata</i>	ASTERACEAE	Perennial herb	N		
<i>Ficus virens</i>	MORACEAE	Tree	N		
<i>Kandelia obovata</i>	RHIZOPHORACEAE	Shrub or Small Tree	N		
<i>Leucaena leucocephala</i>	MIMOSACEAE	Small Tree	E		
<i>Macaranga tanarius</i>	EUPHORBIACEAE	Tree	N		
<i>Mikania micrantha</i>	ASTERACEAE	Climbing Herb	E	10	1
<i>Pennisetum alopecuroides</i>	POACEAE	Perennial Herb	N	10	1
<i>Plantago major</i>	PLANTAGINACEAE	Perennial herb	N		
<i>Panicum maximum</i>	POACEAE	Perennial Herb	N		
<i>Wedelia chinensis</i>	ASTERACEAE	Perennial herb	N	5	2
<i>Kandelia obovata</i>	RHIZOPHORACEAE			1	2
Bare	n/a	n/a	n/a	n/a	79

\*Key:

E = Exotic

N = Native

n/a = not available

**Table 2.** List of vegetation recorded from works area under Contract 1 and 100m buffer area in the operation phase impact monitoring survey. Vegetation species presents in the identified location was indicated by “V”.

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	P	N	Man	M	Work Area under Contract 1	100 m buffer area under Contract 1
ACANTHACEAE	<i>Acanthus ilicifolius</i>	老鼠簕	N					V	V		V
ACANTHACEAE	<i>Rhinacanthus nasutus</i>	靈枝草	E		V						V
ACROSTICHACEAE	<i>Acrostichum aureum</i>	鹵蕨	N						V		V
AGAVACEAE	<i>Cordyline fruticosa</i>	朱蕉	E		V						V
AGAVACEAE	<i>Dracaena draco</i>	龍血樹	E		V						V
AGAVACEAE	<i>Sansevieria trifasciata</i>	虎尾蘭	E		V					V	V
APOCYNACEAE	<i>Catharanthus roseus</i>	長春花	N		V						V
ARACEAE	<i>Alocasia odora</i>	海芋	N	V	V		V		V		V
ARALIACEAE	<i>Acanthopanax gracilistylus</i>	五加皮	E	V							V
ARALIACEAE	<i>Schefflera actinophylla</i>	傘樹	E		V						V
ARALIACEAE	<i>Schefflera heptaphylla</i>	鴨腳木	N		V				V	V	V
ARECACEAE	<i>Archontophoenix alexandrae</i>	假檳榔	E		V						V
ARECACEAE	<i>Caryota ochlandra</i>	魚尾葵	E		V		V				V
ARECACEAE	<i>Chrysalidocarpus lutescens</i>	散尾葵	E		V					V	V
ARECACEAE	<i>Phoenix roebelenii</i>	日本葵	E		V		V				V
ARECACEAE	<i>Rhapis excelsa</i>	棕竹	N		V		V				V
ASTERACEAE	<i>Bidens alba</i>	白花鬼針草	E	V	V		V			V	V
ASTERACEAE	<i>Emilia sonchifolia</i>	一點紅	N		V		V			V	V
ASTERACEAE	<i>Mikania micrantha</i>	薇甘菊	E	V	V	V	V		V	V	V
ASTERACEAE	<i>Pterocypsela indica</i>	山萵苣	N		V					V	V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	P	N	Man	M	Work Area under Contract 1	100 m buffer area under Contract 1
ASTERACEAE	<i>Wedelia chinensis</i>	蟛蜞菊	N	V		V	V			V	V
ASTERACEAE	<i>Youngia japonica</i>	黃鵪菜	N	V	V		V			V	V
BIGNONIACEAE	<i>Pyrostegia venusta</i>	炮仗花	E		V		V				V
BIGNONIACEAE	<i>Tabebuia chrysantha</i>	黃花風鈴木	E				V			V	V
BOMBACACEAE	<i>Bombax ceiba</i>	木棉	E		V		V			V	V
BRASSICACEAE	<i>Brassica rapa</i>	大頭菜	E			V					V
CAESALPINIACEAE	<i>Bauhinia blakeana</i>	洋紫荊	N		V		V			V	V
CAESALPINIACEAE	<i>Bauhinia purpurea</i>	紅花羊蹄甲	E		V		V			V	V
CAESALPINIACEAE	<i>Bauhinia variegata</i>	宮粉羊蹄甲	E		V		V			V	V
CAESALPINIACEAE	<i>Cassia spectabilis</i>	美麗決明	E		V					V	V
CAPRIFOLIACEAE	<i>Lonicera japonica</i>	忍冬	N				V			V	V
CARICACEAE	<i>Carica papaya</i>	番木瓜	E			V					V
CASUARINACEAE	<i>Casuarina equisetifolia</i>	木麻黃	E		V					V	V
CASUARINACEAE	<i>Citrus grandis</i>	柚	E		V						V
COMBRETACEAE	<i>Lumnitzera racemosa</i>	欖李	N		V					V	V
COMBRETACEAE	<i>Terminalia catappa</i>	欖仁樹	E		V					V	V
COMMELINACEAE	<i>Commelina diffusa</i>	節節草	N	V							V
COMMELINACEAE	<i>Tradescantia spathacea</i>	蚌花	E		V		V			V	V
CONVOLVULACEAE	<i>Ipomea cairica</i>	五爪金龍	E			V			V	V	V
CUPRESSACEAE	<i>Thuja orientalis</i>	側柏	E		V						V
CYPERACEAE	<i>Cyperus flabelliformis</i>	風車草	E	V							V
DILLENiaceae	<i>Dillenia indica</i>	第倫桃	E				V			V	V
ELAEocarpaceae	<i>Elaeocapus haminanensis</i>	水石榕	E		V		V				V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	P	N	Man	M	Work Area under Contract 1	100 m buffer area under Contract 1
EUPHORBIACEAE	<i>Antidesma bunius</i>	五月茶	N			V					V
EUPHORBIACEAE	<i>Aporosa dioica</i>	銀柴	N			V					V
EUPHORBIACEAE	<i>Bischofia javanica</i>	秋風	N		V	V	V				V
EUPHORBIACEAE	<i>Bridelia tomentosa</i>	土蜜樹	N	V	V		V			V	V
EUPHORBIACEAE	<i>Excoecaria agallocha</i>	海漆	N					V			V
EUPHORBIACEAE	<i>Glochidion zeylanicum</i>	香港算盤子	N	V							V
EUPHORBIACEAE	<i>Macaranga tanarius</i>	血桐	N	V	V	V	V			V	V
EUPHORBIACEAE	<i>Mallotus apelta</i>	白桐	N			V					V
EUPHORBIACEAE	<i>Sapium discolor</i>	山烏柏	N	V							V
FABACEAE	<i>Desmodium heterocarpon</i>	假地豆	N		V		V				V
FABACEAE	<i>Pueraria lobata</i>	葛	N	V					V		V
FABACEAE	<i>Sesbania cannabina</i>	田菁	E		V					V	V
FABACEAE	<i>Wisteria sinensis</i>	紫藤	E				V				V
FLACOURTIACEAE	<i>Scolopia chinensis</i>	刺柊	N			V					V
GRAMINEAE	<i>Panicum maximum</i>	大黍	E		V		V		V	V	V
LAMIACEAE	<i>Salvia japonica</i>	鼠尾草	N		V						V
LAURACEAE	<i>Litsea monopetala</i>	假柿樹	N			V					V
LYGODIACEAE	<i>Lygodium japonicum</i>	海金沙	N		V					V	V
LYTHRACEAE	<i>Lagerstroemia speciosa</i>	大花紫薇	E		V	V	V			V	V
MALVACEAE	<i>Hibiscus rosa-sinensis</i>	大紅花	E		V		V			V	V
MALVACEAE	<i>Hibiscus tiliaceus</i>	黃槿	N	V					V	V	V
MALVACEAE	<i>Thespesia populnea</i>	恒春黃槿	N					V			V
MELIACEAE	<i>Melia azedarach</i>	楝	E	V							V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	P	N	Man	M	Work Area under Contract 1	100 m buffer area under Contract 1
MENISPERMACEAE	<i>Cocculus orbiculatus</i>	木防己	N	V			V				V
MENISPERMACEAE	<i>Pericampylus glaucus</i>	細圓藤	N		V					V	V
MIMOSACEAE	<i>Acacia confusa</i>	台灣相思	E		V					V	V
MIMOSACEAE	<i>Albizia lebbekii</i>	大葉合歡	E	V	V		V				V
MIMOSACEAE	<i>Calliandra haematocephala</i>	朱纓花	E		V					V	V
MIMOSACEAE	<i>Leucaena leucocephala</i>	銀合歡	E	V	V	V				V	V
MORACEAE	<i>Artocarpus macrocarpon</i>	菠蘿蜜	E		V						V
MORACEAE	<i>Ficus benjamina</i>	垂葉榕	E		V		V			V	V
MORACEAE	<i>Ficus elastica</i>	印度榕樹	E		V		V				V
MORACEAE	<i>Ficus microcarpa</i>	榕樹	N		V		V				V
MORACEAE	<i>Ficus hispida</i>	對葉榕	N	V	V	V			V		V
MORACEAE	<i>Ficus simplicissima</i>	五指毛桃	N		V					V	V
MORACEAE	<i>Ficus variegata</i>	青果榕	N		V					V	V
MORACEAE	<i>Ficus virens</i>	大葉榕	N	V	V		V			V	V
MORACEAE	<i>Morus alba</i>	桑	N		V						V
MYRSINACEAE	<i>Aegiceras corniculatum</i>	蠟燭果	N					V	V		V
MYRSINACEAE	<i>Maesa perularius</i>	鯽魚胆	N			V					V
MYRTACEAE	<i>Callistemon viminalis</i>	串錢柳	E				V				V
MYRTACEAE	<i>Cleistocalyx operculatus</i>	水翁	N	V		V					V
MYRTACEAE	<i>Melaleuca quinquenervia</i>	白千層	E		V					V	V
MYRTACEAE	<i>Psidium guajava</i>	番石榴	E		V						V
OLEACEAE	<i>Ligustrum sinensis</i>	山指甲	N		V	V	V				V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	P	N	Man	M	Work Area under Contract 1	100 m buffer area under Contract 1
ONAGRACEAE	<i>Ludwigia perennis</i>	細花丁香蓼	N		V				V	V	V
OXALIDACEAE	<i>Averrhoa carambola</i>	楊桃	E		V						V
OXALIDACEAE	<i>Oxalis corniculata</i>	酢漿草	N		V					V	V
PANDANACEAE	<i>Pandanus tectorius</i>	露兜樹	N	V				V			V
PINACEAE	<i>Pinus massoniana</i>	馬尾松	N		V						V
PIPERACEAE	<i>Piper hancei</i>	山蒟	N			V					V
PLANTAGINACEAE	<i>Plantago major</i>	車前草	N		V		V		V	V	V
POACEAE	<i>Arundinella nepalensis</i>	石珍芒	N	V							V
POACEAE	<i>Cynodon dactylon</i>	狗牙根	N		V		V			V	V
POACEAE	<i>Digitaria ciliaris</i>	升馬唐	N		V				V		V
POACEAE	<i>Eleusine indica</i>	牛筋草	N		V		V			V	V
POACEAE	<i>Microstegium ciliatum</i>	剛莠竹	N	V	V					V	V
POACEAE	<i>Panicum repens L.</i>	鋪地黍	N		V				V		V
POACEAE	<i>Pennisetum alopecuroides</i>	狼尾草	N		V				V		V
POACEAE	<i>Phragmites australis</i>	蘆葦	N						V		V
POACEAE	<i>Zoysia sp.</i>	結縷草	N					V	V		V
POACEAE	<i>Panicum maximum</i>	大黍	N	V	V	V					
POLYGONACEAE	<i>Polygonum hydropiper</i>	水蓼	N		V						V
POLYGONACEAE	<i>Polygonum lapathifolium</i>	大馬蓼	N						V		V
RHIZOPHORACEAE	<i>Kandelia obovata</i>	秋茄樹	N	V				V	V	V	V
ROSACEAE	<i>Eriobotrya japonica</i>	枇杷	E		V						V
ROSACEAE	<i>Rubus reflexus</i>	蛇泡筋	N			V					V



Family	Species name	Chinese name	*Status in Hong Kong	S	DA	P	N	Man	M	Work Area under Contract 1	100 m buffer area under Contract 1
RUBIACEAE	<i>Paederia scandens</i>	雞屎藤	N		V	V	V		V	V	V
RUBIACEAE	<i>Psychotria serpens</i>	蔓九節	N		V					V	V
RUTACEAE	<i>Citrus reticulata Blanco</i>	柑橘	E		V						V
RUTACEAE	<i>Clausena lansium</i>	黃皮	E		V						V
RUTACEAE	<i>Murraya paniculata</i>	九里香	E	V	V						V
SAPINDACEAE	<i>Dimocarpus longan</i>	龍眼	E		V	V					V
SAPINDACEAE	<i>Litchi chinensis</i>	荔枝	E		V						V
SAPINDACEAE	<i>Sapindus saponaria</i>	無患子	N		V	V					V
SAPOTACEAE	<i>Manilkara zapota</i>	人心果	E	V							V
SOLANACEAE	<i>Solanum nigrum</i>	龍葵	N		V				V		V
SOLANACEAE	<i>Solanum torvum</i>	水茄	E						V		V
STERCULIACEAE	<i>Sterculia lanceolata</i>	假蘋婆	N	V							V
TILIACEAE	<i>Microcos paniculata</i>	布渣葉	N			V					V
ULMACEAE	<i>Celtis sinensis</i>	朴樹	N	V	V	V				V	V
URTICACEAE	<i>Boehmeria nivea</i>	苧麻	E	V		V					V
VERBENACEAE	<i>Avicennia marina</i>	白骨壤	N					V	V		V
VERBENACEAE	<i>Clerodendrum inerme</i>	苦郎樹	N	V							V
VERBENACEAE	<i>Lantana camara</i>	馬櫻丹	E	V	V	V	V			V	V

Note: "S" = Stream; "N" = Ting Kok Nursery Community Garden; "M" = Marsh; "Man" = Mangrove; "DA" = Developed area; "P" = Plantation

**Table 3.** List of avifauna species and maximum counts recorded from the operation phase impact monitoring survey at work area under Contract 1 and 100m buffer area.

Common name	Species	Habitat	Conservation status in Hong Kong	Work area: Contract 1	100m buffer area
Chinese Bulbul	<i>Pycnonotus sinensis</i>	W		1	2
Chinese Pond Heron	<i>Ardeola bacchus</i>	W	RC		1
Common Tailorbird	<i>Orthotomus sutorius</i>				1
Eurasian Tree Sparrow	<i>Passer montanus</i>				3
Little Egret	<i>Egretta garzetta</i>	W	RC	1	1
Oriental Magpie Robin	<i>Copsychus saularis</i>			1	1
Masked Laughing thrush	<i>Garrulax perspicillatus</i>			1	2
White-breasted Water	<i>Amaurornis phoenicurus</i>	W			1
Spotted Dove	<i>Streptopelia chinensis</i>				2
Yellow-bellied Prinia	<i>Prinia flaviventris</i>			1	
Black-crowned Night	<i>Nycticorax nycticorax</i>		LC		1
Crested Myna	<i>Acridotheres cristatellus</i>				1
Grey Heron	<i>Ardea cinerea</i>		RC		2
<b>Total number of species :</b>				<b>5</b>	<b>12</b>

\* **Key:**

W = Wetland dependent species ; RC = Regional Concern LC = Local Concern

**Table 4. List of herpetofauna and maximum counts recorded from the operation phase impact monitoring survey at work area under Contract 1 and 100 m buffer area.**

<b>Species</b>	<b>Common name</b>	<b>Conservation status in Hong Kong</b>	<b>Work area: Contract 1</b>	<b>100m Buffer area of Contract 1</b>
<i>No herpetofauna recorded</i>				

**Table 5.** Relative abundance of butterfly species recorded under Contract 1 in operation phase impact monitoring survey.

<b>Species</b>	<b>Chinese name</b>	<b>Common name</b>	<b>Conservation status in Hong Kong</b>	<b>Work area: Contract 1</b>	<b>100m Buffer area of Contract 1</b>
<i>Eurema hecabe</i>	寬邊黃粉蝶	Common Grass Yellow	Very Common	+	+
<i>Mycalesis mineus</i>	小眉眼蝶	Dark-brand Bush Brown	Very Common		+
<i>Papilio polytes polytes</i>	玉帶鳳蝶	Common Mormon	Common	+	+

Key:

+ : Species exists in the survey area

++ : Species common in the survey area

+++ : Species abundant in the survey area

**Table 6.** Relative abundance of odonata species recorded under Contract 1 in the operation impact monitoring survey.

<b>Species</b>	<b>Common name</b>	<b>Conservation status in Hong Kong</b>	<b>Work area: Contract 1</b>	<b>100m Buffer area of Contract 1</b>
<i>Pantala flavescens</i>	Wandering Glider	Abundant	+	+

Key:

+ : Species exists in the survey area

++ : Species common in the survey area

+++ : Species abundant in the survey area

**Table 7.** Relative abundance of aquatic species recorded in Wai Ha River within the 100 m buffer of works boundary under Contract 1 in the operation phase impact monitoring survey.

<b>Species</b>	<b>Common name</b>	<b><sup>1</sup>Life-cycle characteristics</b>	<b><sup>2</sup>Origin</b>	<b>SEMP 1</b>
<i>Ambassis gymnocephalus</i>	Glassperch	M	N	+
<i>Mugil cephalus</i>	Flatehead Grey Mullet	M	N	+
<i>Opsariichthys evolans</i>	Minnnow	F	N	+
<i>Oreochromis niloticus</i>	Nile Tilapa	F	I	+++
<i>Saccostrea cucullata</i>	Rock Oyster	M	N	++
<i>Sesarma (Perisesarma) bidens</i>	Sesarmino crab	M	N	+
<i>Cerithidea cingulata</i>	Mud snail	M	N	+
<b>Total number of species:</b>				<b>7</b>

**Key:**

Relative abundance:

+ : Species exists in the survey area

++ : Species common in the survey area available

+++ : Species abundant in the survey area

<sup>1</sup> Life-cycle characteristics:

M = Marine vagrant

F = Freshwater species

<sup>2</sup>Origin:

N = Native

I = Introduced; / = not

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Agreement No. DP/01/2010  
Drainage Improvement Works in Shatin and Tai Po:  
Ecological Monitoring in area under Contract 2  
(Report OP-3b for October 2015)

Prepared for:  
**Drainage Services Department**

Prepared by:  
**Ramboll Environ Hong Kong Limited**

Date:  
**November 2015**

Reference Number:  
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Agreement No. DP/01/2010  
Drainage Improvement Works in Shatin and Tai Po:  
Ecological Monitoring in area under Contract 2  
(Report OP-3b for October 2015)

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## **1. Introduction**

### **1.1 Project description**

The Drainage Improvement Works in Shuen Wan was undertaken to minimize the potential flooding impacts in Sha Tin and Tai Po area. Although the Ecological Impact Assessment in the EIA Report identified that ecological impacts resulting from the proposed drainage improvement works at Shuen Wan were anticipated to be very minor in scale, ecological mitigation and ecological monitoring were recommended in the EM&A Manual ([http://env-shuenwan.com/pdf/review\\_note\\_em&a\\_rev.3.pdf](http://env-shuenwan.com/pdf/review_note_em&a_rev.3.pdf)) as stipulated under Environment Permit No. EP-303/2008.

1.2 Scope of ecological impact monitoring (Operation phase) was described in the Particular Specifications and EM&A Manual of the projects. In brief, the monitoring tasks include regular check on the retained and transplanted trees and shrubs, monitoring on fauna groups and aquatic fauna within the works area and any ecologically sensitive area within 100m of the works boundary.

1.3 China-Hong Kong Ecology Consultants Co. was commissioned by Ramboll Environ Hong Kong Limited (formerly ENVIRON Hong Kong Limited) to perform the ecological impact monitoring survey for the projects under Contract2 since April 2015.

1.4 The construction work of Contract 2 was completed in March 2015 and the operation phase of Contract 2 commenced in April 2015. The first quarterly ecological impact monitoring under Contract 2 for operation phase was conducted in April 2015.

1.5 The outline of this ecological monitoring report was as follow:

- Highlights of this report
- Monitoring methodology
- Monitoring data
- Review of monitoring results
- Comments and brief summary

1.6 This report no. OP-3b is the third quarterly ecological impact monitoring for operation phase monitoring conducted on 29 October 2015 within the works boundary under Contract 2 and area within 100m from the works boundary.

## **2. Highlights of this report**

- Field survey was conducted on 29 October 2015
- Construction phase ecological impact monitoring of Contract 2 was completed in March 2015 and the operational phase ecological impact monitoring of Contract 2 was started in April 2015.
- Lower number of species was observed within the works area under Contract 2 but habitats in the 100m buffer area retain its natural condition.

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### 3. Monitoring Methodology

Ecological monitoring methods were generally followed those described in the baseline ecological surveys (DC/2009/22). However, sampling area maybe reduced because of habitat change, for instance, deforestation and channel modification due to drainage works, where sampling was not applicable. Survey data and evaluation are detailed in the following sections.

#### 3.1 Vegetation survey

Vegetation survey was performed along the designated transects (Figure 1) for ecological monitoring as described in the project specifications to monitor the vegetation health which could be adversely influenced by any bad site practice. Qualitative data of plants within the works boundary and wetland vegetation in the 100m buffer area of Contract 2 adjacent to construction site and wetland was recorded. Riparian vegetation including aquatic and emergent at 4 stream ecological monitoring points (hereinafter referred to as “SEMP”) under Contract 2 (i.e. SEMP 3 & 4; Figure 2 & 3) along the affected stream channel and riparian habitat was recorded in terms of species, relative abundance and average heights. Any signs of damages and adverse health problems directly caused the works were recorded and reported. Nomenclature and protection status of the species followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Hong Kong Herbarium (2004).

#### 3.2 Avifauna

Bird survey was conducted by following the proposed transects which cover the major ecologically sensitive areas of the Project (Figure 1). All bird species were recorded with special attention paid on the species of conservation importance and wetland-dependent species. List of bird species recorded and the relative abundance was provided.

#### 3.3 Herpetofauna

Hepetofauna survey was conducted via direct observation and active searching along the survey transects with a focus in the work areas (Figure 1). All reptiles and amphibians encountered or heard were recorded. Nomenclature and conservation status of herpetofauna species follows AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)).

#### 3.4 Butterflies and Odonata

Odonates and butterfly survey of different habitats within the Study Area was conducted along the proposed transect (Figure 1). All butterflies and odonata were identified and relative abundance was recorded. Nomenclature and status of conservation of butterflies follows Lo & Hui (2005) while that of odonata follows AFCD websites ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)).

#### 3.5 Mammals

As the monitoring site was situated near traffics, plant nursery and residential buildings, mammals were unlikely inhabited at the site except rodents, domestic dogs and cats. Detailed mammal monitoring was not conducted. However, any sighting, tracks and signs of mammals encountered during survey of other faunal groups was recorded. Bat was surveyed by search for potential colony habitat, such as palm trees, which are often used by fruit bats as nesting sites.

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### 3.6 Aquatic fauna

Monitoring of aquatic fauna was carried out mainly by bank-side observation, sometimes with the aid of binoculars, at two stream ecological monitoring points under Contract2 (i.e. SEMP 3 & 4). These points are selected for covering representative sections of Wai Ha River and are shown in Figure 1. Netting and fish traps were also deployed at these points to collect supplementary data. Aquatic fauna seen/collected was identified *in situ* to the lowest possible taxon and relative abundance was presented.

## 4. Monitoring data

### 4.1 Vegetation survey

The habitats identified in area under Contract 2 are river course, wooded area, mangrove, marsh and developed area (including village). Vegetation were found in wooded area, mangrove, marsh, develop area and river bank. The riparian vegetation which were dominated by *Leucaena leucocephala* and *Pueraria labata* with average coverage ranged from 5% to 20% (**Table 1**) at SEMP 4. A list of plant species recorded from different habitats within the assessment area under Contract 2 is presented on **Table 2**. A total of 209 species were recorded within the assessment boundary in which 208 species were recorded within the buffer area, while 93 species recorded within the work areas under Contract 2. Among them, species protected under Hong Kong ordinance were found in buffer area under Contract 2, namely *Aquilaria sinensis* (Cap. 586), *Cibotium barometz* (Cap. 586). Three individuals of protected species *Pavetta hongkongensis* located within works area of Contract 2 were transplanted to ECA on 20<sup>th</sup> Dec 2011. Currently, some trees were planted along the project site for landscaped purpose. Moreover, some drainage section has been restored as marsh habitat by planting wetland species such as *Juncus effuses*. Wetland flora species including *Juncus effuses* were growth healthily as their coverage was found increased compared with previous monitoring in July 2015. Some wetland dependant birds such as Grey Heron were found utilizing the restored marsh habitat.

### 4.2 Avifauna

A total of 11 bird species were recorded in the current survey (Table 3). Among recorded species, one wetland dependent species *Ardea cinerea* was recognized as being regional conservation concern which was recorded from both the 100m buffer zone and project site.

#### Herpetofauna

No reptile was recorded within the assessment area. Only a few individuals of common toad were seen at roadside within the 100m buffer zone and project site. The species recorded are common species in Hong Kong. (Table 4)

### 4.3 Butterflies

A total of 6 butterfly species were recorded during surveys (**Table 5**). All of them were recorded within both the 100m buffer zone and project site. None of the species were of the conservation concern.

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#### 4.4 Odonata

Four odonata species were recorded during the surveys (**Table 6**). All recorded species were common species in Hong Kong.

#### 4.5 Mammal

No other mammals or trace of mammals was observed within the assessment area.

#### 4.6 Aquatic fauna

Under Contract 2 (i.e. SEMP 3 & 4), a total of 13 fish species, 3 crustaceans, 1 gastropod, 1 bivalve and 1 arthropod were recorded and most of them were freshwater species (**Table 7**). *Carassius auratus* was commonly observed at SEMP 3 because of the traditional Buddhist practice from the nearby temple in which captured organisms were released back to nature. The density of fish species was obviously reduced at SEMP 3 and SEMP 4 during the last monitoring period in July 2015 due to heavy rainstorm. Since no construction work was found in vicinity of the monitoring stream, fish density was restored to normal level currently. Overall, no protected species were recorded.

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## 5. Review of the monitoring results

During the present survey period, no construction activity was carried out at works area under Contract 2. In general, lower numbers of species were recorded within the works area under Contract 2 than that of 100 m buffer area because of the urbanized in nature. Water quality in river section of Contract 2 (i.e. SEMP 3 and SEMP 4) was maintained at acceptable condition as indicated by the presence of *Parazacco spilurus*. Density of fish species was found reduced at SEMP 3 and SEMP 4 due to heavy rainstorm during monitoring survey in July. Nevertheless, the fish density was found to be restored in current reporting period. Currently, project construction work was completed. The impact on downstream of SEMP 4 is anticipated to be insignificant. As mitigation measures recommended in the EM&A Manual were properly implemented during the construction phase period, and hence the residual environmental impacts would be minimized.

## 6. Comments and summary

The third quarterly ecological impact monitoring under Contract 2 for operation phase was conducted in October 2015 and relevant flora and fauna data were collected according to project specification and EM&A Manual. As indicated by the low abundance and diversity of species within the work areas, habitats within the work boundary under Contract 2 offer few ecological opportunities for colonization of fauna and flora. On the other hand, the natural habitats in the 100m buffer area are retained at acceptable condition, and hence the 100m buffer area has not been significantly affected by the construction works. Currently, project work was completed. Thus, the impact on downstream of SEMP4 is anticipated to be insignificant.

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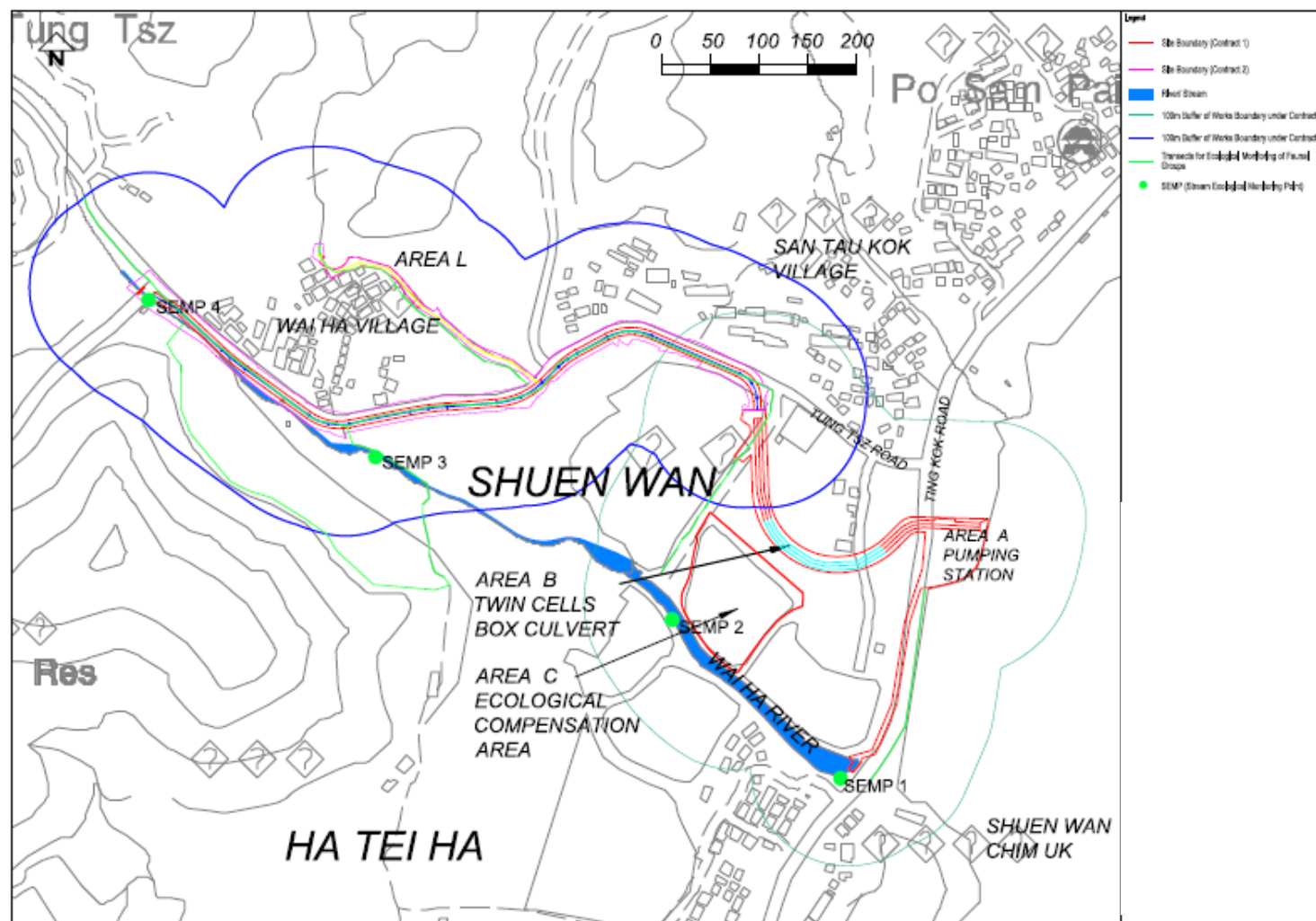
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## Figures



**Figure:** 1

**Title:** Map showing the ecological monitoring transect and the boundary of assessment area.

**Project:** Agreement No. DP/01/2010 Drainage Improvement Works in Shatin and Tai Po: Ecological Monitoring in area under Contract 2 (October 2015, Report OP-3b)

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**Figure:** 2

**Title:** SEMP 3, the third sampling point of Wai Ha River under Contract 2.

**Project:** Agreement No. DP/01/2010 Drainage Improvement Works in Shatin and Tai Po: Ecological Monitoring in area under Contract 2 (October 2015, Report OP-3b )

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**Figure:** 3

**Title:** SEMP 4, the forth sampling point along Wai Ha River under Contract 2.

**Project:** Agreement No. DP/01/2010 Drainage Improvement Works in Shatin and Tai Po: Ecological Monitoring in area under Contract 2 (October 2015, Report OP-3b)

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## Tables

**Table 1.** List of riparian vegetation and coverage (%) recorded from two stream sampling points under Contract 2 (i.e. SEMP 3 & 4).

Species	Family	Growth form	Sampling point	SEMP 3		SEMP 4	
			Status in Hong Kong	Height (cm)	%	Height (cm)	%
<i>Bidens alba</i>	ASTERACEAE	Herb	E			0.9	10
<i>Alocasia odora</i>	ARACEAE	Shrub	N	1	2	1	5
<i>Commelina diffusa</i>	COMMELINACEAE	Herb	N	0.2	10		
<i>Leucaena leucocephala</i>	MIMOSACEAE	Small Tree	E			4	20
<i>Microstegium ciliatum</i>	POACEAE	Perennial Procumbent Herb	N	0.5	20		
<i>Pistia stratiotes</i>	ARACEAE	Floating Aquatic Herb	N				
<i>Polygonum chinensis</i>	POLYGONACEAE	Herb	N				
<i>Polygonum lapathifolium</i>	POLYGONACEAE	Herb	N				
<i>Rhaphiolepis salicifolia</i>	ROSACEAE	Shrub or Small Tree	N				
<i>Spirodela polyrrhiza</i>	LEMNACEAE	Floating Small Herb	N				
<i>Pueraria lobata</i>	FABACEAE	Climber	N			0.5	20
<i>Cyclosorus parasiticus</i>	THELYPTERIDACEAE	Herb	N	0.2	2		
<i>Wedelia chinensis</i>	ASTERACEAE	Perennial Herb	N				
<i>Erythrina speciosa</i>	FABACEAE	Herb	E	0.3	2		
Bare	n/a	n/a	n/a	n/a	64	n/a	45

**\*Key:**

E = Exotic

N = Native

n/a = not available

**Table 2.** List of vegetation recorded from works area under Contract 2 and 100m buffer area in the operation phase impact monitoring survey. Vegetation species presents in the identified location was indicated by “V”.

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
ACANTHACEAE	<i>Acanthus ilicifolius</i>	老鼠簕	N		V	V	V					V
ACANTHACEAE	<i>Rhinacanthus nasutus</i>	靈枝草	E		V							V
ACROSTICHACEAE	<i>Acrostichum aureum</i>	鹵蕨	N		V	V						V
AGAVACEAE	<i>Cordyline fruticosa</i>	朱蕉	E		V							V
AGAVACEAE	<i>Dracaena draco</i>	龍血樹	E		V							V
AGAVACEAE	<i>Sansevieria trifasciata</i>	虎尾蘭	E		V							V
AMARANTHACEAE	<i>Amaranthus viridis</i>	野莧	N		V	V			V	V	V	V
ANACARDIACEAE	<i>Mangifera indica</i>	杧果	E					V				V
ANACARDIACEAE	<i>Rhus hypoleuca</i>	白背漆	N					V				V
ANACARDIACEAE	<i>Rhus succedanea</i>	野漆樹	N					V				V
ANNONACEAE	<i>Desmos chinensis</i>	假鷹爪	N					V				V
ANNONACEAE	<i>Uvaria macrophylla</i>	紫玉盤	N					V				V
APIACEAE	<i>Coriandrum sativum</i>	芫荽	E						V			V
APOCYNACEAE	<i>Catharanthus roseus</i>	長春花	N		V						V	V
ARACEAE	<i>Alocasia odora</i>	海芋	N		V	V					V	V
ARACEAE	<i>Colocasia esculenta</i>	芋	N						V			V
ARACEAE	<i>Pistia stratiotes</i>	大藻	N	V							V	V
ARALIACEAE	<i>Acanthopanax gracilistylus</i>	五加皮	E	V							V	V
ARALIACEAE	<i>Schefflera actinophylla</i>	傘樹	E		V							V
ARALIACEAE	<i>Schefflera heptaphylla</i>	鴨腳木	N		V	V					V	V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
ARECACEAE	<i>Archontophoenix alexandrae</i>	假檳榔	E		V							V
ARECACEAE	<i>Caryota ochlandra</i>	魚尾葵	E		V							V
ARECACEAE	<i>Chrysalidocarpus lutescens</i>	散尾葵	E	V	V							V
ARECACEAE	<i>Phoenix roebelenii</i>	日本葵	E		V							V
ARECACEAE	<i>Rhapis excelsa</i>	棕竹	N		V							V
ASTERACEAE	<i>Bidens alba</i>	白花鬼針	E	V							V	V
ASTERACEAE	<i>Chrysanthemum coronarium</i>	茼蒿	E						V			V
ASTERACEAE	<i>Conyza canadensis</i>	小蓬草	E		V			V	V	V	V	V
ASTERACEAE	<i>Emilia sonchifolia</i>	一點紅	N		V						V	V
ASTERACEAE	<i>Ageratum conyzoides</i>	蒼香薷	E	V	V				V		V	V
ASTERACEAE	<i>Lactuca sativa</i>	萵苣	E						V			V
ASTERACEAE	<i>Mikania micrantha</i>	薇甘菊	E	V	V	V		V	V	V	V	V
ASTERACEAE	<i>Pterocypsela indica</i>	山萵苣	N		V						V	V
ASTERACEAE	<i>Wedelia chinensis</i>	蟛蜞菊	N		V					V	V	V
ASTERACEAE	<i>Youngia japonica</i>	黃鵪菜	N		V						V	V
ASTERACEAE	<i>Spilanthes paniculata</i>	金鈕扣	N		V						V	V
ASTERACEAE	<i>Artemisia indica</i>	五月艾	N		V				V		V	V
ASTERACEAE	<i>Eclipta prostrata</i>	鱧腸	N	V	V				V		V	V
BIGNONIACEAE	<i>Pyrostegia venusta</i>	炮仗花	E		V							V
BRASSICACEAE	<i>Brassica rapa</i>	大頭菜	E						V			V
CAESALPINIACEAE	<i>Bauhinia blakeana</i>	洋紫荊	N		V							V
CAESALPINIACEAE	<i>Bauhinia variegata</i>	宮粉羊蹄	E		V							V
CAESALPINIACEAE	<i>Cassia spectabilis</i>	美麗決明	E		V							V
CARICACEAE	<i>Carica papaya</i>	番木瓜	E							V		V



Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
CARYOPHYLLACEAE	<i>Drymaria diandra</i>	荷蓮豆	N						V		V	V
CARYOPHYLLACEAE	<i>Myosoton aquaticum</i>	鵝腸菜	N						V		V	V
CASUARINACEAE	<i>Casuarina equisetifolia</i>	木麻黃	E		V							V
CASUARINACEAE	<i>Citrus grandis</i>	柚	E		V							V
CHENOPODIACEAE	<i>Chenopodium ficifolium</i>	小藜	N			V			V		V	V
CLUSIACEAE	<i>Cratoxylum cochinchinense</i>	黃牛木	N					V				V
COMBRETACEAE	<i>Lumnitzera racemosa</i>	欖李	N			V	V				V	V
COMBRETACEAE	<i>Terminalia catappa</i>	欖仁樹	E		V							V
COMMELINACEAE	<i>Commelina diffusa</i>	節節草	N	V							V	V
COMMELINACEAE	<i>Tradescantia spathacea</i>	蚌花	E		V							V
CONNARACEAE	<i>Rourea microphylla</i>	紅葉藤	N					V				V
CONVOLVULACEAE	<i>Ipomoea cairica</i>	五爪金龍	E		V	V	V	V			V	V
CONVOLVULACEAE	<i>Merremia hederacea</i>	魚黃草	N		V				V	V	V	V
CONVOLVULACEAE	<i>Ipomoea aquatica</i>	蕹菜	E			V					V	V
CUPRESSACEAE	<i>Thuja orientalis</i>	側柏	E		V							V
CUPRESSACEAE	<i>Juniperus chinensis L.</i>	龍柏			V							V
CUSCUTACEAE	<i>Cuscuta chinensis</i>	菟絲子	N						V		V	V
CYPERACEAE	<i>Cyperus flabelliformis</i>	風車草	E	V							V	V
CYPERACEAE	<i>Pycnus polystachyos</i>	多枝扁莎	N			V			V		V	V
DICKSONIACEAE	<i>Cibotium barometz</i>	金毛狗	N (Cap. 586)					V				V
ELAEOCARPACEAE	<i>Elaeocarpus haminanensis</i>	水石榕	E		V							V
EQUISETACEAE	<i>Equisetum debile</i>	筆管草	N	V								V
EUPHORBIACEAE	<i>Antidesma bunius</i>	五月茶	N					V		V	V	V
EUPHORBIACEAE	<i>Aporosa dioica</i>	銀柴	N					V		V		V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
EUPHORBIACEAE	<i>Bischofia javanica</i>	秋風	N							V		V
EUPHORBIACEAE	<i>Bridelia insulana</i>	禾串樹	N					V				V
EUPHORBIACEAE	<i>Bridelia tomentosa</i>	土蜜樹	N		V						V	V
EUPHORBIACEAE	<i>Excoecaria agallocha</i>	海漆	N				V					V
EUPHORBIACEAE	<i>Glochidion eriocarpum</i>	毛果算盤	N					V			V	V
EUPHORBIACEAE	<i>Glochidion puberum</i>	算盤子	N		V							V
EUPHORBIACEAE	<i>Glochidion zeylanicum</i>	香港算盤	N	V							V	V
EUPHORBIACEAE	<i>Macaranga tanarius</i>	血桐	N		V	V	V					V
EUPHORBIACEAE	<i>Mallotus apelta</i>	白桐	N							V		V
EUPHORBIACEAE	<i>Mallotus paniculatus</i>	白楸	N					V				V
EUPHORBIACEAE	<i>Sapium discolor</i>	山烏柏	N	V				V				V
EUPHORBIACEAE	<i>Euphorbia thymifolia</i>	千根草			V				V		V	V
FABACEAE	<i>Mucuna championii Benth.</i>	港油麻藤	N					V		V	V	V
FABACEAE	<i>Pueraria lobata</i>	葛	N		V	V			V			V
FABACEAE	<i>Sesbania cannabina</i>	田菁	E		V						V	V
FABACEAE	<i>Crotalaria pallida var. obovata</i>	豬屎豆	E		V						V	V
FABACEAE	<i>Desmodium heterocarpon</i>	假地豆	N		V						V	V
FABACEAE	<i>Millettia reticulata</i>	雞血藤	N					V				V
FABACEAE	<i>Mucuna birdwoodiana</i>	白花油麻	N	V				V			V	V
FABACEAE	<i>Uraria crinita</i>	貓尾草	E					V				V
FABACEAE	<i>Pueraria lobata</i>	葛	N	V	V			V	V	V	V	V
FLACOURTIACEAE	<i>Scolopia chinensis</i>	刺柃	N							V		V
GLEICHENIACEAE	<i>Dicranopteris pedata</i>	芒萁	N					V				V
HALORAGACEAE	<i>Gonocarpus chinensis</i>	黃花小二	N		V				V		V	V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
JUNCACEAE	<i>Juncus effusus</i>	燈心草	N			V					V	V
LAMIACEAE	<i>Salvia japonica</i>	鼠尾草	N		V							V
LAURACEAE	<i>Cinnamomum burmannii</i>	陰香	N		V			V			V	V
LAURACEAE	<i>Cinnamomum camphora</i>	樟	N					V				V
LAURACEAE	<i>Litsea cubeba</i>	山蒼樹	N					V				V
LAURACEAE	<i>Litsea glutinosa</i>	潺槁樹	N		V			V			V	V
LAURACEAE	<i>Litsea monopetala</i>	假柿樹	N							V	V	V
LEMNACEAE	<i>Spirodela polyrrhiza</i>	青萍	N	V							V	V
LILIACEAE	<i>Allium fistulosum</i>	蔥	E						V			V
LILIACEAE	<i>Disporum cantoniense</i>	萬壽竹	E					V				V
LYGODIACEAE	<i>Lygodium japonicum</i>	海金沙	N		V							V
MALVACEAE	<i>Hibiscus rosa-sinensis</i>	大紅花	E		V							V
MALVACEAE	<i>Hibiscus tiliaceus</i>	黃槿	N	V		V					V	V
MALVACEAE	<i>Thespesia populnea</i>	恒春黃槿	N				V					V
MALVACEAE	<i>Abelmoschus moschatus</i>	黃葵	N			V					V	V
MELASTOMATACEAE	<i>Melastoma candidum</i>	野牡丹	N					V				V
MELASTOMATACEAE	<i>Melastoma sanguineum</i>	毛茛	N					V				V
MELIACEAE	<i>Melia azedarach</i>	楝	E	V							V	V
MENISPERMACEAE	<i>Coculus orbiculatus</i>	木防己	N	V	V	V		V	V	V	V	V
MENISPERMACEAE	<i>Pericampylus glaucus</i>	細圓藤	N		V						V	V
MENISPERMACEAE	<i>Stephania longa</i>	糞箕篤	N		V			V				V
MIMOSACEAE	<i>Acacia confusa</i>	台灣相思	E		V							V
MIMOSACEAE	<i>Albizia lebbek</i>	大葉合歡	E	V								V
MIMOSACEAE	<i>Calliandra haematocephala</i>	朱纓花	E		V							V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
MIMOSACEAE	<i>Leucaena leucocephala</i>	銀合歡	E	V	V						V	V
MIMOSACEAE	<i>Mimosa pudica</i>	含羞草	E		V				V		V	V
MORACEAE	<i>Artocarpus macrocarpon</i>	菠蘿蜜	E		V						V	V
MORACEAE	<i>Ficus benjamina</i>	垂葉榕	E		V						V	V
MORACEAE	<i>Ficus elastica</i>	印度榕樹	E		V							V
MORACEAE	<i>Ficus hispida</i>	對葉榕	N	V	V	V					V	V
MORACEAE	<i>Ficus microcarpa</i>	榕樹	N		V			V				V
MORACEAE	<i>Ficus simplicissima</i>	五指毛桃	N		V			V				V
MORACEAE	<i>Ficus triangularis</i>	三角榕	E	V							V	V
MORACEAE	<i>Ficus variegata</i>	青果榕	N		V			V				V
MORACEAE	<i>Ficus virens</i>	大葉榕	N	V	V						V	V
MORACEAE	<i>Morus alba</i>	桑	N		V							V
MUSACEAE	<i>Musa x paradisiaca L.</i>	大蕉	E		V				V			V
MYRSINACEAE	<i>Aegiceras corniculatum</i>	蠟燭果	N		V	V	V					V
MYRSINACEAE	<i>Ardisia quinquegona</i>	羅傘樹	N					V				V
MYRSINACEAE	<i>Embelia ribes</i>	白花酸藤	N					V			V	V
MYRSINACEAE	<i>Maesa perlarius</i>	鯽魚胆	N		V					V		V
MYRTACEAE	<i>Cleistocalyx operculatus</i>	水翁	N	V						V	V	V
MYRTACEAE	<i>Melaleuca quinquenervia</i>	白千層	E		V							V
MYRTACEAE	<i>Psidium guajava</i>	番石榴	E		V							V
MYRTACEAE	<i>Syzygium jambos (L.) Alston</i>	蒲桃	E		V			V				V
OLEACEAE	<i>Ligustrum sinensis</i>	山指甲	N		V							V
ONAGRACEAE	<i>Ludwigia perennis</i>	細花丁香	M			V					V	V
OXALIDACEAE	<i>Averrhoa carambola</i>	楊桃	E		V							V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
OXALIDACEAE	<i>Oxalis corniculata</i>	酢漿草	N		V						V	V
PANDANACEAE	<i>Pandanus tectorius</i>	露兜樹	N				V					V
PINACEAE	<i>Pinus massoniana</i>	馬尾松	N							V		V
PIPERACEAE	<i>Piper hancei</i>	山蒟	N							V		V
PLANTAGINACEAE	<i>Plantago major</i>	車前草	N		V	V					V	V
POACEAE	<i>Apluda mutica</i>	水蔗草	N		V	V				V		V
POACEAE	<i>Arundinella nepalensis</i>	石珍芒	N	V	V			V				V
POACEAE	<i>Bambusa sp.</i>	竹	/					V				V
POACEAE	<i>Coix lacryma-jobi</i>	薏苡	N	V								V
POACEAE	<i>Cynodon dactylon</i>	狗牙根	N		V						V	V
POACEAE	<i>Digitaria ciliaris</i>	升馬唐	N		V	V						V
POACEAE	<i>Eleusine indica</i>	牛筋草	N		V						V	V
POACEAE	<i>Microstegium ciliatum</i>	剛莠竹	N	V							V	V
POACEAE	<i>Panicum maximum</i>	大黍	E								V	V
POACEAE	<i>Panicum repens L.</i>	鋪地黍	N		V	V						V
POACEAE	<i>Brachiaria mutica</i>	巴拉草	E			V			V		V	V
POACEAE	<i>Pennisetum alopecuroides</i>	狼尾草	N		V	V		V				V
POACEAE	<i>Phragmites australis</i>	蘆葦	N		V	V						V
POACEAE	<i>Phragmites karka</i>	卡開蘆	N									V
POACEAE	<i>Zoysia sp.</i>	結縷草	N			V	V				V	V
POACEAE	<i>Eragrostis tenella</i>	鯽魚草	N		V				V	V	V	V
POACEAE	<i>Chloris virgata</i>	虎尾草	N		V	V			V	V	V	V
POACEAE	<i>Echinochloa crusgalli</i>	稗	N		V	V			V		V	V
POACEAE	<i>Echinochloa colona</i>	光頭稗	N		V				V	V	V	V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
POACEAE	<i>Paspalum vaginatum</i>	海雀稗	N			V	V				V	V
POLYGONACEAE	<i>Polygonum chinensis</i>	火炭母	N						V			V
POLYGONACEAE	<i>Polygonum hydropiper</i>	水蓼	N		V							V
POLYGONACEAE	<i>Polygonum lapathifolium</i>	大馬蓼	N			V			V		V	V
PTERIDACEAE	<i>Pteris semipinnata</i>	半邊旗	N					V				V
PTERIDIACEAE	<i>Pteridium aquilinum</i>	蕨	N						V			V
PTERIDACEAE	<i>Pteris vittata L</i>	蜈蚣草	N		V				V		V	V
RHIZOPHORACEAE	<i>Kandelia obovata</i>	秋茄樹	N			V	V					V
ROSACEAE	<i>Eriobotrya japonica</i>	枇杷	E		V							V
ROSACEAE	<i>Rubus reflexus</i>	蛇泡筋	N							V	V	V
RUBIACEAE	<i>Canthium dicoccum</i>	鐵矢	N					V				V
RUBIACEAE	<i>Hedyotis hedyotideia</i>	牛白藤	N									V
RUBIACEAE	<i>Lasianthus chinensis</i>	粗葉木	N					V				V
RUBIACEAE	<i>Paederia scandens</i>	雞屎藤	N		V					V	V	V
RUBIACEAE	<i>Pavetta hongkongensis</i>	香港大沙	N (Cap. 96)					V				V
RUBIACEAE	<i>Psychotria asiatica</i>	九節	N					V				V
RUBIACEAE	<i>Psychotria serpens</i>	蔓九節	N		V							V
RUBIACEAE	<i>Spermacoce stricta</i>	豐花草	N	V	V			V	V	V	V	V
RUBIACEAE	<i>Hedyotis corymbosa</i>	傘房花耳	N	V	V			V	V	V	V	V
RUTACEAE	<i>Acronychia pedunculata</i>	降真香	N					V			V	V
RUTACEAE	<i>Citrus reticulata</i>	柑橘	E		V							V
RUTACEAE	<i>Clausena lansium</i>	黃皮	E		V							V
RUTACEAE	<i>Murraya paniculata</i>	九里香	E	V	V						V	V
SAPINDACEAE	<i>Dimocarpus longan</i>	龍眼	E		V					V		V

Family	Species name	Chinese name	*Status in Hong Kong	S	DA	M	Man	SW	CL	P	Work Area of Contract 2	100 m buffer area under Contract 2
SAPINDACEAE	<i>Litchi chinensis</i>	荔枝	E		V							V
SAPINDACEAE	<i>Sapindus saponaria</i>	無患子	N							V		V
SAPOTACEAE	<i>Manilkara zapota</i>	人心果	E	V								V
SCROPHULARIACEAE	<i>Scoparia dulcis</i>	野甘草	N		V				V		V	V
SCROPHULARIACEAE	<i>Lindernia crustacea</i>	母草		V	V	V			V		V	V
SELAGINELLACEAE	<i>Selaginella uncinata</i>	翠雲草	N					V				V
SOLANACEAE	<i>Lycopersicon esculentum</i>	番茄	E						V			V
SOLANACEAE	<i>Solanum nigrum</i>	龍葵	N		V	V					V	V
SOLANACEAE	<i>Solanum torvum</i>	水茄	E			V		V			V	V
STERCULIACEAE	<i>Byttneria aspera</i>	刺果藤	N					V				V
STERCULIACEAE	<i>Sterculia lanceolata</i>	假蘋婆	N	V	V						V	V
THYMELAEACEAE	<i>Aquilaria sinensis</i>	土沉香	N (Cap. 586)					V				V
TILIACEAE	<i>Microcos paniculata</i>	布渣葉	N		V					V		V
THELYPTERIDACEAE	<i>Cyclosorus parasiticus</i>	華南毛蕨	N	V	V	V		V	V	V	V	V
ULMACEAE	<i>Celtis sinensis</i>	朴樹	N		V		V				V	V
URTICACEAE	<i>Boehmeria nivea</i>	苧麻	E							V	V	V
URTICACEAE	<i>Pouzolzia zeylanica</i>	霧水葛	N	V	V				V	V	V	V
VERBENACEAE	<i>Avicennia marina</i>	白骨壤	N			V	V					V
VERBENACEAE	<i>Clerodendrum inerme</i>	苦郎樹	N	V								V
VERBENACEAE	<i>Lantana camara</i>	馬櫻丹	E	V	V						V	V

**Note:** "S" = Stream; "SW" = Secondary Woodland; "M" = Marsh; "Man" = Mangrove; "DA" = Developed area; "CL" = Cultivated area; "P" = Plantation

**Table 3.** List of avifauna species and maximum counts recorded from the operation phase impact monitoring survey at work area under Contract 2 and 100m buffer area.

Common name	Species	Habitat	Conservation status in Hong Kong	Work area: Contract 2	100m buffer area
Chinese Bulbul	<i>Pycnonotus sinensis</i>		--		2
Common Tailorbird	<i>Orthotomus sutorius</i>		--	1	1
Crested Myna	<i>Acridotheres cristatellus</i>		--		3
Common Koel	<i>Eudynamys scolopacea</i>		--		2
Eurasian Tree Sparrow	<i>Passer montanus</i>		--		2
Masked Laughing thrush	<i>Garrulax perspicillatus</i>		--		2
Oriental Magpie Robin	<i>Copsychus saularis</i>		--	1	
Spotted Dove	<i>Streptopelia chinensis</i>		--		3
Yellow-bellied Prinia	<i>Prinia flaviventris</i>		--	1	1
Japanese White-eye	<i>Zosterops japonicus</i>		--		2
Grey Heron	<i>Ardea cinerea</i>	W	RC	1	1
<b>Total number of species:</b>				<b>4</b>	<b>10</b>

**\*Key:**

W = Wetland dependent species; RC = Regional Concern; LC = Local Concern



**Table 4.** List of herpetofauna and maximum counts recorded from the operation phase impact monitoring survey at work area under Contract 2 and 100 m buffer area.

<b>Species</b>	<b>Common name</b>	<b>Conservation status in Hong Kong</b>	<b>Work area: Contract 2</b>	<b>100m Buffer area of Contract 2</b>
<i>Bufo melanostictus</i>	Common Toad	Common	1	1

**Table 5.** Relative abundance of butterfly species recorded under Contract 2 in the operation phase impact monitoring survey.

Species		Common name	Conservation status in Hong Kong	Work area: Contract 2	100m Buffer area of Contract 2
<i>Eurema hecabe</i>	寬邊黃粉蝶	Common Grass Yellow	Very Common	+	+
<i>Mycalesis mineus</i>	小眉眼蝶	Dark-brand Bush Brown	Very Common	+	+
<i>Neptis hylas</i>	中環蛺蝶	Common Sailer	Common	+	+
<i>Papilio polytes polytes</i>	玉帶鳳蝶	Common Mormon	Common	+	+
<i>Pseudozizeeria maha</i>	酢漿灰蝶	Pale Grass Blue	Very Common	+	+
<i>Euploea core</i>	幻紫斑蝶	Common Idian Crow	Common	+	+

Key:

+ : Species exists in the survey area

++ : Species common in the survey area

+++ : Species abundant in the survey area

**Table 6.** Relative abundance of odonata species recorded under Contract 2 in the operation phase impact monitoring survey.

<b>Species</b>	<b>Common name</b>	<b>Conservation status in Hong Kong</b>	<b>Work area: Contract 2</b>	<b>100m Buffer area of Contract 2</b>
<i>Pantala flavescens</i>	Wandering Glider	Abundant	+	+
<i>Orthetrum Sabina sabina</i>	Green Skimmer	Abundant	+	
<i>Neurobasis chinensis</i>	Chinese Greenwing	Common	+	+
<i>Copera marginipes</i>	Yellow Featherlegs	Abundant	+	+

Key:

+ : Species exists in the survey area

++ : Species common in the survey area

+++ : Species abundant in the survey area

**Table 7.** Relative abundance of aquatic species recorded in Wai Ha River within the 100m buffer of works boundary under Contract 2 in the operation phase impact monitoring survey.

Species	Common name	<sup>1</sup> Life-cycle characteristics	<sup>2</sup> Origin	SEMP 3	SEMP 4
<i>Carassius auratus</i>	Goldfish	F	I	+	+
<i>Cirrhinus molitorella</i>	Mud carp	F	I	++	
<i>Cyprinus carpio</i>	Common Carp	F	I	+	
<i>Gambusia affinis</i>	Mosquito Fish	F	I	+	+
<i>Oreochromis niloticus</i>	Nile Tilapa	F	I	+	
<i>Parazacco spilurus</i>	Predaceous Chub	F	N	++	++
<i>Zacco platypus</i>	Freshwater Minnow	F	N	+	+
<i>Poecilia reticulata</i>	Guppy	F	I	+	+
<i>Puntius semifasciolatus</i>	Chinese Barb	F	N	+	
<i>Rhinogobius duospilus</i>	Goby	F	N	+	+
<i>Pseudogastromyzon myersi</i>	Sucker-belly Loach	F	N	+	
<i>Xiphophorus hellerii</i>	Swordtail	F	I	+	+
<i>Uca arcuata</i>	Fiddler Crab	M	N	+	
<i>Pomacea lineata</i>	Apple snail	F	I	+	
<i>Caridina contonensis</i>	Bee shrimp	F	N	+	+
<i>Biomphalaria straminea</i>	Bivalve	F	I	+	+
<i>Eriocheir japonicus</i>	Mitten crab	F	N	+	
<i>Glossogobius sp.</i>	Goby	F	/	+	
<i>Gerris sp.</i>	Water Strider	F	/	+	
		<b>Total number of species:</b>		<b>19</b>	<b>9</b>

**Key:**

Relative abundance:

+ : Species exists in the survey area

++ : Species common in the survey area

+++ : Species abundant in the survey area

<sup>1</sup> Life-cycle characteristics:

M = Marine vagrant

F = Freshwater species

<sup>2</sup>Origin:

N = Native

I = Introduced; / = not available

**Appendix G**

**Quarterly EM&A (Landscape & Visual) Report**

**(Not Used)**