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**AGREEMENT NO. CE 65/2013 (EP)  
POST-CONSTRUCTION ECOLOGICAL  
MONITORING OF RIVER IMPROVEMENT  
WORKS IN UPPER LAM TSUEN RIVER  
SHE SHAN RIVER AND UPPER TAI PO  
RIVER – INVESTIGATION**

**POST-CONSTRUCTION ECOLOGICAL  
MONITORING REPORT (No. 27)**

Prepared By:

**ALLIED ENVIRONMENTAL CONSULTANTS LTD.**

For:

**Drainage Services Department**

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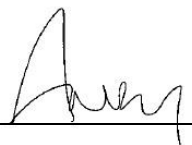
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**Agreement No. CE65/2013(EP)**  
**Post-Construction Ecological Monitoring of River**  
**Improvement Work in Upper Lam Tsuen River, She Shan**  
**River and Upper Tai Po River – Investigation**

**Post-Construction Ecological Monitoring Report (No. 27)**  
**Upper Lam Tsuen River**

**March 2016**

Prepared by: Mike pang



April 19, 2016

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April 19, 2016

Ecology Team: China-Hong Kong Ecology Consultants

## Post-Construction Ecological Monitoring Report (No. 27)

### Upper Lam Tsuen River

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## Introduction

- 1.1 Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation required a post-construction ecological monitoring programme when the project completed. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.
- 1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.
- 1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project for December 2014.
- 1.4 This is the number 27 post-construction ecological monitoring report for the project conducted **on 17<sup>th</sup> of March 2016**. It contains the following subsections:
  - Summary of major points
  - Monitoring Methods and Results
  - Summary and Comments

## 2 Summary of Major Points

- Field ecological monitoring was undertaken **on 17<sup>th</sup> of March 2016**;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration; Plants on river bed was experiencing seasonal changes in abundance and phenological appearance;
- The species richness of odonata was low during current dry season;
- Bird diversity and abundance was in natural fluctuation;
- Abundance of a target river fauna (i.e. *Paramesotriton hongkongensis* adult and larvae were recorded in medium abundance along the Lam Tsuen River ); and
- Fish abundance was similar to last month.

## 3 Monitoring Methodology

### 3.1 Riparian Vegetation

Riparian vegetation, including aquatic and emergent, was sampled using line transects along the affected river channel and riparian habitat. Species, relative abundance and average heights were recorded. Vegetation surveys were conducted at four selected belt transects with two located at the lower portion (T3 and T4) of the river channel and another two at the upper section (T1 and T2) of the river respectively (**Figure 1**). The belt transects was run across the river channel in order to collect quantitative data of the vegetation, e.g., species inventory, height, percentage cover. Qualitative data of plants was collected by recording plant species, relative abundance along line transect. Nomenclature and protection status of the species followed those documented in Lai *et al.* (2004) and Hong Kong Herbarium (2015).

### 3.2 Avifauna

Avifauna survey was conducted during post construction monitoring period. Special attention was given to the river channel and corridor area which birds used as feeding and foraging habitat. Avifauna surveys were undertaken in the early morning plus species recorded in the rest of the day when conducting other taxonomic groups (benthic, fish, insect) monitoring. Numerical abundance was recorded at fixed count points within a radius of 30-50m according to landscape feature and visual penetration extent. The duration of the point count of birds was standardized for 10 minutes at each location in order to collect comparable data. Transect count along accessible section of river channel were used in order to collect qualitative data. Binoculars and digital camera were the main items of equipment used. Nomenclature and protection status of the species follows the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Carey *et al.* (2001).

The point count was conducted at four locations with two located at the lower portion of the river channel (T3&T4) and the other two located at the upper section of the river (T1&T2). The point count and survey transect locations for the bird survey and sampling sites for surveys of other faunal groups and flora were presented in **Figure 1**.

### 3.3 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behavior were recorded. Nomenclature and protection status of the species followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)), Wilson *et al.* (2004) and Tam *et al.* (2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

### 3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the river channel were surveyed. Sampling was conducted at five sampling locations including two sites located at the lower portion (T3 and T4) of the river channel and another two sites at the upper section (T1 and T2) of the river, as well as the reference site. Those sampling sites covered major type of river habitats, e.g. river pool and riffle (**Figure 1**) Five replicates were taken at each sampling point and pool together for further sample sorting and identification. Kick sampling and hand netting were the survey methodologies for river organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance and species identity were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and other literatures such as Dudgeon (1994).

### 3.5 Fish and Newt

Fish community and *Paramesotriton hongkongensis* at the specified river channel was monitored by live trapping, hand netting and direct observation methods.

Sampling was conducted at five sampling locations including two sites located at the lower portion (T3 and T4) of the river channel and another two sites at the upper section (T1 and T2) of the river, as well as reference site. Those sampling sites covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish and newt was estimated and recorded. Nomenclature and protection status of the species followed those documented in the AFCD website ([www.hkbiobiodiversity.net](http://www.hkbiobiodiversity.net)) and Lee *et al.* (2004).

### 3.6 Abiotic Data Collection

#### 3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were measured and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 and AZ8374 respectively. All the instruments were calibrated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20°C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056 (FIA) and SOP057 (FIA) respectively.

#### 3.6.2 Sediment Characteristics

Sediment/substrate characteristics were recorded of sediment cover in percentage e.g. mud, sand, rock, boulder and cemented bottom in the river bed at sampling sites.

#### 3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) to cover a measured distance.

The sampling locations for surveys were presented in **Figure 1**.

## 4 Monitoring Results

### 4.1 Vegetation

Vegetation has generally covered the gabion and river bed along Lam Tsuen River (Photos 1-4). In total, 74 flora species were recorded within the survey transects along the river course. The dominant species *Brachiaria mutica* was observed regenerating after large scale vegetation clearance. The recorded floras were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2m as observed along

survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

## 4.2 Fauna

### 4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at four selected point count locations. In total, 24 species of birds were recorded during the bird survey and 7 of the total were wetland dependent species including *Egretta garzetta* (Photo 5), *Alcedo atthis* (Photo 6), *Ardeola bacchus*, *Motacilla cinerea* (Photo 7), *Amaurornis phoenicurus*, *Tringa ochropus* and *Motacilla alba*, they were commonly observed foraging in the river channel. *Pycnonotus jocosus* was a dominated species along the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Among the recorded species, *Ardeola bacchus* and *Egretta garzetta* are both classified as Regional Concern by Fellowes *et al.* (2002). Call of *Centropus sinensis* was noticed from the river, which is considered as Vulnerable in China Red Data Book. Apart from above mentioned species, the others recorded in Lam Tsuen River were common species in Hong Kong. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

### 4.2.2 Adult Odonata Survey

Odonata survey was performed, and a list of recorded odonata species at Upper Lam Tsuen River is shown in **Table 4.4**. In total, 3 odonata species were recorded during the survey and the recorded species was common species and widely distributed in Hong Kong. The result obtained this month is similar to previous surveys conducted in approximate period of last year. Species richness gradually increased by 2 species in this month compared with last month. The abundance of odonata is still low as the peak of emergence has ended up in late autumn for most of the species in Hong Kong. The remaining species recorded from survey of this month have no specific emergence period, they could be seen throughout the year. It is expected that number of odonata will increase following coming wet season (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Sampling location was shown in **Figure 1**.

### 4.2.3 Aquatic Macro-invertebrates

Upper Lam Tsuen River was flowing with constant water during survey. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans (Photo 8). *Pomacea canaliculata* was found abundant along the river. Details of recorded of river benthic fauna refers to **Table 4.5**. Sampling location was shown on **Figure 1**.



#### 4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted (Photo 9) at Upper Lam Tsuen River. Adult and larvae (Photo 10) *Paramesotriton hongkongensis* were observed at the Lam Tsuen River where the habitat consisted of riparian vegetation during the survey. As the time of conducting survey was within the breeding period of Hong Kong Newt, their individuals were easier being found within a short transect distance compared to their non-breeding season. They were captured in all sampling points. They will stay in the river during their breeding period from September to March (Dudgeon, 2003). Riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

#### 4.2.5 River Fish Fauna

Fish surveys were performed at Upper Lam Tsuen River during field monitoring. In total, 16 species of freshwater fish, including species recorded from reference site, were recorded. *Oreochromis niloticus*, *Zacco platypus* and *Rhinogobius* spp were the dominated species in the river. *Acrossocheilus parallens* is a rare freshwater fish that only recorded in few of reservoir catchments and streams in Hong Kong (Lee *et al.*, 2004) and listed as Global Concern by Fellowes (2002). It was observed along the surveyed river with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* is classified as Vulnerable in China Red Data Book and observed along the river with low abundance. Fish counting at 2 x 2 meter area were performed and number of fish individuals was recorded with similar abundance compared to last month. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

### 4.3 **Abiotic Data**

Data on water quality and major river hydrological feature (water flow and substratum) of the river were collected and are presented in the **Table 4.7**.

Generally, the water was clean and nutrient levels were generally low. Results of water test were presented in the **Table 4.7**.

The river substratum was comprised of over 75-93% stones or rocks in most of the river sections with moderate water flow (up to 0.2m/second at pool and 0.5m/second at riffle).

## 5 **Summary and Commentary**

Post construction ecological monitoring was carried out in March 2016 and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. Benthic fauna was temporally de-faunated in river sections due to river bed engineering works during construction period between 2008 and early 2013 and is under recovery process after that period. Adult and larvae of amphibian *Paramesotriton hongkongensis* were recorded

medium in abundance at river channel where the river margin covered with riparian vegetation. *Acrossocheilus parallens*, a rare freshwater fish species in Hong Kong, was observed at a few locations in the river channel with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* recorded in the river is also considered with conservation interest and observed along the river with low abundance. Abundance of odonata and fish showed similar pattern as last month.

Aquatic and riparian vegetation along river channel was re-established. Vegetation has generally covered the gabion and covered the river bed along Upper Lam Tsuen River.

The water quality of the surveyed river was not polluted although the river receives low concentration of nutrients from the nearby agriculture lands and resident houses.

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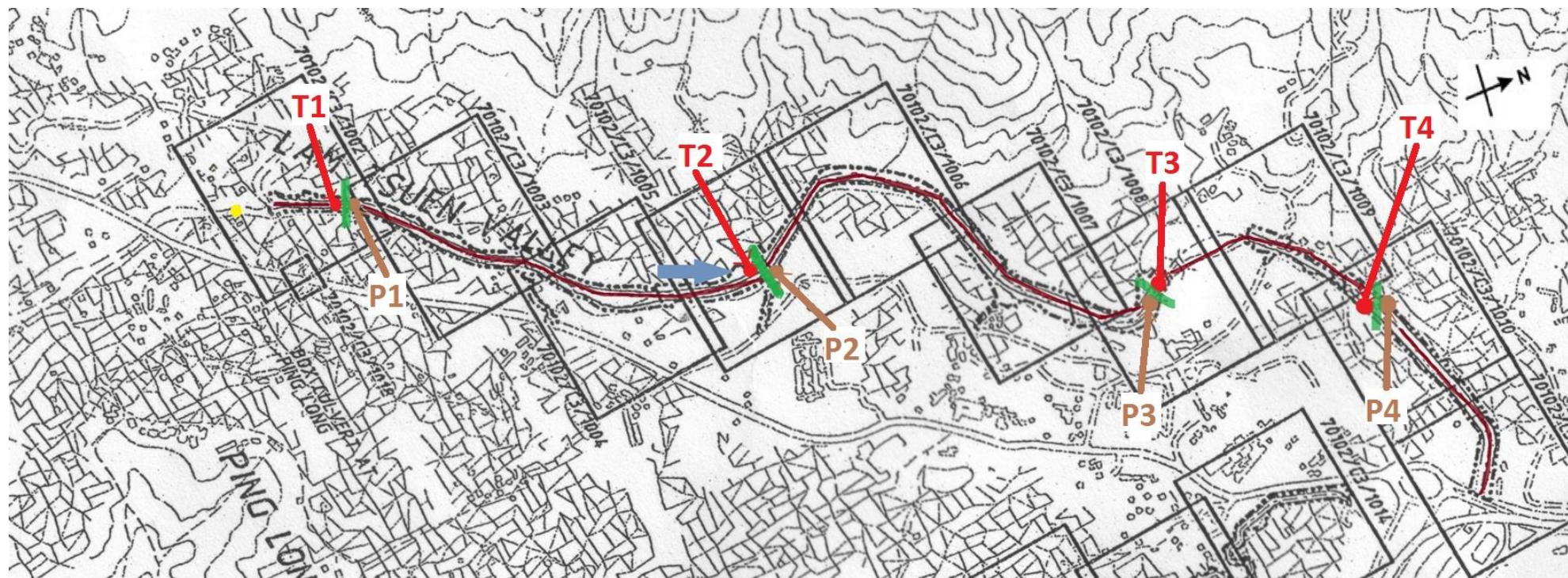
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Wilson, K.D.P., Tam, K.W., Kwan, B.S.P., Wu, K.K.Y., Wong, B.S.F. and Wong, J.K. (2004). *Field guide to the dragonflies of Hong Kong (2<sup>nd</sup> Edition)*. Agriculture, Fisheries and Conservation Department, Friends of the Country Parks and Cosmos Books Ltd., Hong Kong.

# FIGURES



## Legend

- |  |  |  |
|--|--|--|
| <ul style="list-style-type: none"> <li><span style="color: green;">—</span> Belt transect</li> <li>-Vegetation</li> <li>-Sediment characteristics</li> </ul> | <ul style="list-style-type: none"> <li><span style="color: red;">●</span> Sampling station</li> <li>-Fish</li> <li>-Aquatic macroinvertebrate</li> <li>-Water quality and flow rate</li> </ul> | <ul style="list-style-type: none"> <li><span style="color: brown;">●</span> Point count location</li> <li>-Avifauna</li> </ul>                                     |
| <ul style="list-style-type: none"> <li><span style="color: yellow;">●</span> Reference sample</li> </ul>   |  | <ul style="list-style-type: none"> <li><span style="color: red;">—</span> Line transect</li> <li>-Avifauna</li> <li>-Adult Odonate</li> <li>-Vegetation</li> </ul> |

Figure1. Sampling Location of Ecological Survey and Monitoring at Upper Lam Tsuen River, Tai Po.

## **PHOTOS**



Photo 1: General view of the river (Lower section)



Photo 2: General view of the river (Middle section)



Photo 3: General view of the river (Upper section)



Photo 4: Vegetation regeneration after clearance in last month



Photo 5: Avifauna - *Egretta garzetta*

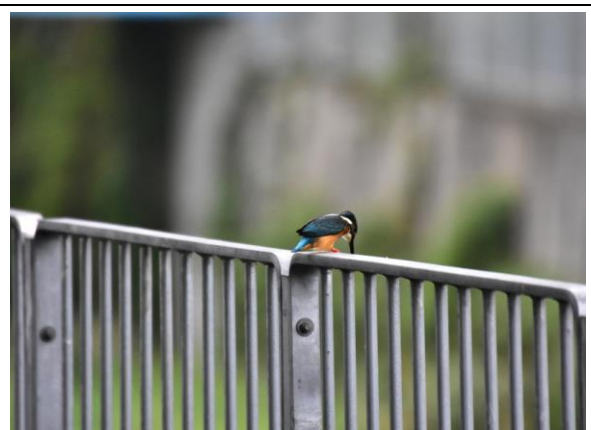


Photo 6: Avifauna - *Alcedo atthis*



Photo 7: Avifauna - *Motacilla cinerea*



Photo 8: Aquatic samples



Photo 9: Kick sampling



Photo 10: Hong Kong Newt

## **TABLE**











Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River

(T1- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Stream	Transect	Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring																
		Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-14																												
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4																					
Family	Species	Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%												
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																																																
Fabaceae	<i>Pueraria lobata</i>	野葛							0.3	10																																								
Poaceae	<i>Pennisetum purpureum</i>	象草							1.5	5																																								
Araceae	<i>Alocasia odora</i>	海芋																																																
Caesalpiniaceae	<i>Cassia alata</i>	翅荳豨																																																
Magnoliaceae	<i>Michelia alba</i>	白蘭																																																
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.8	10	0.8	10					1	13	1	13																																				
Moraceae	<i>Ficus hispida</i>	野葛																																																
Asteraceae	<i>Mikania micrantha</i>	鐵甘菊	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10	0.4	10																																
Musaceae	<i>Musa paradisiaca</i>	大蕉																																																
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																
Araceae	<i>Pistia stratiotes L.</i>	大漂																																																
Urticaceae	<i>Boehmeria nivea</i>	芋麻																																																
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.4	5			0.5	10																																										
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																																
Solanaceae	<i>Solanum nigrum</i>	龍葵																																																
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草																																																
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																																
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																																
Asteraceae	<i>Wedelia chinensis</i>	蝴蝶菊																																																
Commelinaceae	<i>Commelina diffusa</i>	蘭蘭草			0.3	5																																												
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																																																
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																																
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																																
Verbenaceae	<i>Lantana camara</i>	馬鞭丹																																																
Mimosaceae	<i>Leucaena leuccephala</i>	銀合歡																																																
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																																
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																																
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																																
Amaranthaceae	<i>Celosia argentea</i>	青葙																																																
Bare Gound				75		85		73		75		72		82		73		75		63		70		12		65		65		77		60		73		65		74		60		70		58		71		58		70

P1 - Point count location 1; P4 - Point count location 4





(Continous) Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River

(T1- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Family	Species	Chinese name	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring																											
			Sep-15				Oct-15				Nov-15				Dec-15				Jan-16				Feb-16				Mar-16																							
			T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4																				
Poaceae	<i>Microstegium ciliatum</i>	兩秀竹																																																
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	10																																														
Poaceae	<i>Pennisetum purpureum</i>	象草																																																
Araceae	<i>Alocasia odora</i>	海芋																																																
Caesalpiniaceae	<i>Cassia alata</i>	胡荽法明																																																
Magnoliaceae	<i>Michelia alba</i>	白蘭																																																
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.1	30	1.5	35	1	70	1.2	15	0.7	5	1.5	30	1	60	1.2	20	0.8	5	1.5	35	1.2	60	1.2	20	0.3	5	0.3	20	0.3	30	0.3	10	0.3	5	0.3	20	0.3	30	0.3	10	0.4	10	0.4	25	0.4	35	0.4	15
Moraceae	<i>Ficus hispida</i>	樹薯榕																																																
Asteraceae	<i>Mikania micrantha</i>	鐵甘菊	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5	0.3	5	0.2	5	0.3	5	0.4	5								
Musaceae	<i>Musa paradisiaca</i>	大蕉																																																
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																
Araceae	<i>Pistia stratiotes L.</i>	水浮蓮																																																
Urticaceae	<i>Boehmeria nivea</i>	芋麻																																																
Asteraceae	<i>Bidens alba</i>	白花鬼針草					0.4	5																																										
Poaceae	<i>Coix lacryma-jobi</i>	薏苡									1	5											1	5																										
Solanaceae	<i>Solanum nigrum</i>	酸漿																																																
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草					0.6	2																																										
Poaceae	<i>Miscanthus floridulus</i>	五節草									1	10											1	10																										
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																																
Asteraceae	<i>Wedelia chinensis</i>	銀蟻菊	0.4	20	0.2	10									0.4	5							0.4	5							0.4	5																		
Compositae	<i>Commelina diffusa</i>	番薯草	0.3	20	0.2	20	0.2	5	0.4	20	0.3	10	0.2	20	0.2	5	0.4	25	0.3	10	0.2	20	0.2	5	0.4	25	0.3	10	0.2	20	0.2	5	0.4	25	0.3	10	0.2	20	0.2	5	0.4	25								
Asteraceae	<i>Erechtites hieracifolia</i>	革命菜																																																
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																																
Convolvulaceae	<i>Pharbitis nil</i>	牽牛																																																
Verbenaceae	<i>Lantana camara</i>	馬纓丹																																																
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																																																
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																	0.2	10							0.2	10																						
Onagraceae	<i>Ludwigia erecta</i>	水鴻水丁香																																																
Poaceae	<i>Pennisetum alopecuroides</i>	雀尾草					0.8	5	2	5																																								
Amaranthaceae	<i>Clethra argentea</i>	苦蕒																																																
Acanthaceae	<i>Dicliptera chinensis</i>	狗肝菜																																																
Bare Ground			15	30	13	55	30	45	20	55	30	40	20	45	30	40	20	45	35	30	55	50	45	30	55	50	45	25	50	45	45	25	50	45																

P1 - Point count location 1, P4 - Point count location 4













Table 4.4. Odonate species recorded at the Upper Lam Tsuen River

Species name	Common name	Chinese name	Status	Commonness	Post construction monitoring					Post construction monitoring					Post construction monitoring									
					Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	紺翅蜻	NP	VC											+									
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC																				
<i>Ceragrion aurantiacum ruyuanum</i>	Orange-tailed Sprite	瑤球桶背蜉	NP	VC	+	+	+	+			+				+	+	+							
<i>Coeliccia cyanomelas</i>	Blue Forest Damselfly	藍紋碧腹蜉	NP	VC																				
<i>Copeia marginipes</i>	Yellow Featherlegs	黃脊扇蜉	NP	VC	+	+	+								+	+	+							
<i>Crocthemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+		+	+	+	+	+				+	+	+	+	+					
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶綉蜉	NP	VC																				
<i>Ichinogomphus pertinax</i>	Common Flangetail	霸王墨春蜉	NP	C												+	+	+	+	+				
<i>Ischnura senegalensis</i>	Common Blue Jewel	瀾斑墨綠蜉	NP	VC																				
<i>Mnais lacteola</i>	Indochinese Copperwing	瀾綠綠翅蜉	P, LC	C																				
<i>Nannophya pygmaea</i>	Scarlet Dwarf	珠紅小蜻	P, LC	C																				
<i>Neurobasis chinensis</i>	Chinese Greenwing	華翠色蜉	NP	VC	+	+	+	+	+						+	+	+	+	+					
<i>Neurothemis fulvia</i>	Russet Percher	綉紫翅蜻	NP	VC	+	+	+	+							+	+	+	+	+					
<i>Neurothemis tullia tullia</i>	Pied Percher	戴斑藍翅蜻	NP	C																				
<i>Orithetrum chrysis</i>	Red-faced Skimmer	紅面灰蜻	NP	VC													+	+	+	+			+	
<i>Orithetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC	+																			
<i>Orithetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC																				
<i>Orithetrum prasinum neglectum</i>	Common Red Skimmer	赤尾灰蜻	NP	VC	+	+	+																+	
<i>Orithetrum sabina sabina</i>	Green Skimmer	綠尾灰蜻	NP	VC	+																			
<i>Pantala flavescens</i>	Wandering Glider	黃翅蜻	NP	VC				+	+	+													+	
<i>Paracercion calamorum duveri</i>	Dusky Lijdsquatter	黑尾蜉	P, LC	C																				
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒扇蜉	NP	VC	+	+	+																	
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蜉	NP	UC	+	+	+	+																
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三折墨蜉	NP	VC	+	+	+	+																
<i>Rhyothemis variegata arria</i>	Variiegated Flutterer	斑藍翅蜉	NP	C																				
<i>Tritemis aurora</i>	Crimson Dropwing	繡翅蜻	NP	VC	+	+	+	+	+	+					+	+	+	+	+	+				
<i>Tritemis festiva</i>	Indigo Dropwing	靛翅蜻	NP	VC	+	+	+	+								+	+	+	+	+	+	+	+	
<i>Zygonyx iris insignis</i>	Emerald Cascader	綉紅翅	P, PGC	VC																				
No. of species					15	11	13	9	4	3	2	4	9	11	13	14	15	13	9	7	2	3	1	3

Note: NP - Not protected in Hong Kong; P-Protection in Hong Kong

"VC" - Very Common; "UC" - Uncommon; "C" - Common

"+" - Species exists in the study area

"++" - Species common in the study area

"+++" - Species abundant/dominant in study area

Commonness and status were decided according to AFCD biodiversity website (www.hkhabiodiversity.net)

LC- Local Concern - Fellowes *et al* (2002)

PGC - Potential Global Concern - Fellowes *et al* (2002)



Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River

(T1- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Species name	Chinese name	Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring																																			
				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15																			
				Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4																						
<b>Molluscs</b>																																																																											
<i>Biomphalaria sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																								
<i>Brotia hainanensis</i>	-	NP	VC	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+																								
<i>Melanoides tuberculata</i>	腐蝕黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																								
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																								
<i>Radix plicatulus</i>	蓮白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<b>Insects</b>																																																																											
<i>Baetis sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																						
<i>Caenis sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																						
<i>Chironomus sp.</i>	孑孓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Electrogenus sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Hydropsyche sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Indobaetis sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Mnais sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Orithetrum sp.</i>	-	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																						
<b>Crustaceans</b>																																																																											
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																						
<i>Cryptopotamon anacoluthon</i>	網副溪蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
<i>Somanniathelphusa zanklon</i>	束腰蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																							
No. of species				17	15	16	13	12	13	15	10	10	10	11	12	11	10	9	13	11	13	13	10	13	13	15	9	13	14	16	14	12	13	14	16	15	11	13	14	15	14	12	13	12	13	11	13	11	13	12	11	12	12	11	11	11	13	13	12	12	11	13	13	12	12	11	9	12	15	12	11	9	11	13	12

Note: NP - Not protected in Hong Kong; P - Protected in Hong Kong  
 "VC" - Very Common; "UC" - Uncommon; "C" - Common; "R" - Rare  
 +, occurred; ++, common; +++, abundant/dominant Species in the the study area  
 Reference point was the sampling location outside the works area.



Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River

(T1- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Species name	Chinese name	Status	Commonness	Post construction monitoring Jun-15				Post construction monitoring Jul-15				Post construction monitoring Aug-15				Post construction monitoring Sep-15				Post construction monitoring Oct-15				Post construction monitoring Nov-15				Post construction monitoring Dec-15				Post construction monitoring Jan-16				Post construction monitoring Feb-16				Post construction monitoring Mar-16									
				Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4						
<b>Molluscs</b>																																																	
<i>Biomphalaria sp.</i>	–	NP	VC	+																																													
<i>Brotia hainanensis</i>	–	NP	VC	++	++	+	+	+	+	++	++	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++								
<i>Melanoides tuberculata</i>	福寿螺	NP	VC																																														
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++								
<i>Radix plicatulus</i>	蓮白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Sinoia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<b>Insects</b>																																																	
<i>Baetis sp.</i>	–	NP	VC	+																																													
<i>Caenis sp.</i>	–	NP	VC																																														
<i>Chironomus sp.</i>	孑孓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Electrogenus sp.</i>	–	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Hydropsyche sp.</i>	–	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Indobaetis sp.</i>	–	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Mnais sp.</i>	–	NP	VC																																														
<i>Orithetrum sp.</i>	–	NP	VC																																														
<b>Crustaceans</b>																																																	
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++								
<i>Cryptopotamon anacoluthon</i>	網副溪蟹	NP	VC																																														
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+																																													
<i>Somaniathelphusa zanklon</i>	束腰蟹	NP	VC																																														
No. of species				11	9	11	13	12		11	9	11	13	12	12	9	11	13	12		11	9	11	13	13		11	9	11	13	13		12	10	11	13	13		12	10	11	13	13		12	10	11	13	13

Note: NP - Not protected in Hong Kong; P - Protected in Hong Kong  
 "VC" - Very Common; "UC" - Uncommon; "C" - Common; "R" - Rare  
 +, occurred; ++, common; +++, abundant/dominant Species in the the study area  
 Reference point was the sampling location outside the works area.





Table 4.6 Fish species and amphibians at Upper Lam Tsuen River

(T1- located at upper river channel sampling site to T4 - located at lower river Channel sampling site)

Species	Chinese name	Status	Sampling point	Commonness	Post construction monitoring Jul-15				Post construction monitoring Aug-15				Post construction monitoring Sep-15				Post construction monitoring Oct-15				Post construction monitoring Nov-15				Post construction monitoring Dec-15				Post construction monitoring Jan-16				Post construction monitoring Feb-16				Post construction monitoring Mar-16												
					Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4										
					Fish																																												
<i>Acrossocheilus parrellens</i>	副條光唇魚	P, PGC	R		+	+	+	+		+	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+								
<i>Channa maculata</i>	暹羅	NP	C					+					+					+								+																							
<i>Cirrhina moolitorella</i>	鯪魚	NP	C																																														
<i>Clarias fuscus</i>	胡子鯪	NP	C					+																																									
<i>Cyprinus carpio var. viridivittatus</i>	錦鯉	NP	C					+																																									
<i>Gambusia affinis</i>	食蚊魚	NP	VC		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Limniphiloptera disparis</i>	鱒平鰱	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Oreochromis niloticus</i>	尼羅口鯪非鯪	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Parazacco spilurus</i>	黑鰱	V and	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Pocilia reticulata</i>	孔雀石魚將	NP	VC					+					+					+								+																							
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰍	NP	C		+	+				+	+							+	+							+	+																						
<i>Pterocryptis cochinchinensis</i>	鰱鯪	NP	C		+					+								+								+																							
<i>Puntius semifasciolatus</i>	七星魚	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Rhinogobius spp.</i>	鰍魚	NP	C/UN/R		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Schistura fasciolata</i>	縵紋南鰍	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Xiphophorus hellerii</i>	麗魚	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Xiphophorus variatus</i>	麗魚副厚魚	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Zacco platypus</i>	黃鰱	NP	C		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
2x2m fish counting		No. of fish			12	15	18	8	7	15	12	16	10	10	18	15	20	15	15	25	20	22	18	20	40	35	40	35	40	55	40	45	45	40	60	50	50	50	40	65	55	55	55	40	60	60	60	55	40
No. of species					12	12	13	13	12	12	12	13	13	12	12	10	13	13	12	12	10	13	13	12	12	12	10	13	13	12	12	12	10	14	13	10	12	10	14	13	10	12	10	14	13	10			
Amphibian																																																	
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P (Cap 170, NT, PGC)	R		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+					
<i>Fejervarya limnocharis</i>	澤蛙	NP	VC																																														
No. of species					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			

Note: NP - Not protected in Hong Kong  
 "VC" - Very Common; "UC" - Uncommon; "C" - Common; "R" - Rare  
 +, occurred; ++, common; +++, abundant/dominant Species in the study area  
 -V - Listed as vulnerable in China Fish Red Data Book  
 -Reference point was the sampling location outside the works area used to compare the with the data within works area.  
 \*Cap 170\* - List in Wild Animals Protection Ordinance (Cap.170)  
 \*NT\* - Near Threatened in IUCN Red List Status  
 \*PGC\* - Potential Global Concern by Fellowes *et al* (2002)

Table 4.7 Abotic data for Upper Lam Tsuen River

(T1- located at upper river channel sampling site  
to T4 - located at lower river Channel sampling  
site)

Parameter / date	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring										
	8-Aug	Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11				Jan-12				Jul-12				Aug-13				Dec-13						
Replicate	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4								
DO (mg/L)	9.2	9.8	9.9	9.4	9.1	6.4	6.4	6.5	6.8	9.7	9.5	9.5	9.3	8.3	8.5	8.5	8.7	9.6	9.5	9.5	9.1	9.5	9.6	9.4	9.3	9.4	9.2	9.4	9.2	8.2	8	7.8	7.3	8.9	8.5	8.7	8.8	9.3	8.6	8.8	8.7			
pH	7.49	7.24	7.36	7.53	7.44	7.1	7.25	7	7.05	7.9	8.1	8.1	8.2	7.4	7.5	7.3	7.4	7.1	7.2	7.2	7.1	7.3	7.1	7.1	7.1	7.2	6.9	6.8	6.7	6.8	7.1	7.3	7.6	6.5	6.8	6.8	7.1	6.2	6.9	7.1	7.1			
Nitrate (mg N/L)	0.36	0.79	1.1	1.2	1.2	0.31	0.48	0.48	0.59	0.56	1.11	1.13	1.33	0.1	0.2	0.2	0.3	0.1	0.2	0.4	0.5	0.1	0.2	0.3	0.45	0.2	0.3	0.5	0.6	0.13	0.67	0.62	0.82	0.74	0.72	0.83	0.79	0.48	0.57	0.77	0.89			
Ammonia (mg/L)	<0.01	PO4-P (µg P/L): <100				0.02	0.02	0.02	0.03	0.01	0.16	0.17	0.07	0.2	0.4	0.2	0.2	0.05	0.07	0.07	0.1	0.06	0.05	0.08	0.1	0.04	0.05	0.06	0.2	0.01	0.02	0.04	0.03	0.02	0.03	0.03	0.04	<0.01	<0.01	<0.01	<0.01			
Salinity (ppt)	<0.1	<0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Conductivity (µS/cm)	60	80	100	120	120	45	51	52	63	62	96	98	114	84	100	460	54	90	87	93	120	93	90	90	100	92	84	96	110	41	38	73	86	67	77	74	75	62	64	90	110			
BOD (mg/L)	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2			
Water flow at pool (m/s)	0.1-0.3	0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2										
Water flow at riffle (m/s)	0.4-0.7	0.2-0.5				0.2-0.5				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6										
Sand (%)	15	15	10	10	10	10	10	10	15	8	8	8	15	8	8	8	15	8	8	8	15	8	8	8	15	10	15	10	10	10	10	10	10	10	10	10	10	10	10	10	5	5	5	5
Stone (%)	80	80	88	88	88	88	88	88	70	90	90	90	70	90	90	90	70	90	90	90	70	90	90	90	70	80	70	80	70	60	60	60	60	75	75	75	75	90	85	85	85			
Mud (%)	5	5	2	2	2	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	10	15	10	20	30	30	30	30	15	15	15	15	5	10	10	10			





**Agreement No. CE65/2013(EP)**  
**Post-Construction Ecological Monitoring of River**  
**Improvement Work in Upper Lam Tsuen River, She Shan**  
**River and Upper Tai Po River – Investigation**  
**Post-Construction Ecological Monitoring Report (No.27)**  
**She Shan River**

**March 2016**



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April 18, 2016

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# Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation

## Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring Report (No.27) She Shan River

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## 1 Introduction

- 1.1 Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation required a post-construction ecological monitoring programme when the project completed. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.
- 1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.
- 1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project from December 2014.
- 1.4 This is the number 27 post-construction ecological monitoring report for the project conducted **on 16<sup>th</sup> of March 2016**. It contains the following subsections:
  - Summary of major points
  - Monitoring Methods and Results
  - Summary and Comments

## 2 Summary of Major Points

- Field ecological monitoring was undertaken **on 16<sup>th</sup> of March 2016**;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Fish kept in high abundance during current dry season;
- Bird diversity and abundance was in natural fluctuation; and
- Odonata abundance was gradually increased compared to last month.  
*Paramesotriton hongkongensis* was found during the survey.

## 3 Monitoring Methodology

### 3.1 Riparian Vegetation

Riparian vegetation, including aquatic and emergent, was sampled using line transects along the affected river channel and riparian habitat. Species, relative abundance and average heights were recorded. Vegetation survey was conducted at three selected belt transects located at the upper (T1), middle (T2) and lower portion (T3) of the river channel respectively (**Figure 1**). The belt transects was run across the river channel in order to collect quantitative data of vegetation, e.g., species inventory, height, percentage cover. Qualitative data of plants was collected by recording plant species along line transect, e.g., species inventory, relative abundance. Nomenclature and protection status of the species has followed those documented in the Lai *et al.* (2004) and Hong Kong Herbarium (2015).

### 3.2 Avifauna

Avifauna survey was conducted during the post construction monitoring period. Special attention was given to those stream channel area which birds used as feeding and foraging habitat. Avifauna surveys were undertaken in the early morning plus species recorded in the rest of the day when conducting other taxonomic groups (benthic, fish, insect) monitoring. Numerical abundance was recorded at fixed count points within a radius of 30 to 50m according to landscape feature and visual penetration extent. The duration of the point count of birds was standardized for 10 minutes at each location in order to collect comparable data. Transect count along accessible section of river channel were used in order to collect qualitative data. Binoculars and digital camera were the main items of equipment used. Nomenclature and protection status of the species has followed in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Carey *et al.* (2001).

The point count was conducted at three locations located at the lower (T3), middle (T2) and upper (T1) portion of the river channel respectively. The point count and survey transect locations for the bird survey and sampling sites for surveys of other faunal groups and flora were presented in **Figure 1**.

### 3.3 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behavior were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)), Wilson *et al.* (2004) and Tam *et al.* (2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

### 3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the riverbed were surveyed. Four sampling sites were selected to collect necessary macro-invertebrate fauna for ecological monitoring information, which covered upper (T1), middle (T2) and lower (T3) sections of the river respectively, as well as reference site (**Figure 1**). Five replicates were taken at each sampling point and pool together for further sample process. Kick sampling and hand netting were the survey methodologies for stream organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance, species identity was recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)), and other literatures such as Dudgeon (1994).

### 3.5 Fish Population and Hong Kong Newt

Fish community at the specified river channel was monitored by live trapping, hand netting and direct observation methods. Hong Kong newt was surveyed by direct observation and hand netting as well.

Sampling was conducted at four proposed sampling locations at upper (T1), middle (T2), lower (T3) sections and reference site respectively. Those

sampling sites covered major type of stream habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish was estimated and recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Lee *et al.* (2004).

### 3.6 Abiotic Data Collection

#### 3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were sampled and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 and AZ8374 respectively. All the instruments were calculated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20°C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056 (FIA) and SOP057 (FIA) respectively.

#### 3.6.2 Sediment Characteristics

Sediment/substrate characteristics were recorded of sediment cover in percentage e.g. mud, sand, rock, boulder and cemented bottom in the stream bed at sampling sites.

#### 3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) in a measured distance. The sampling locations for surveys were presented in **Figure 1**.

## 4 Monitoring Results

### 4.1 Vegetation

In total, 77 flora species was recorded within the survey transects along the river course. The recorded floras were generally common wetland species. The height of the dominated riparian grass and herb species were in a range from 0.3m to 1.2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Vegetation has generally covered the riverbed and riparian habitat in upper sections. Vegetation in lower to middle section was observed in regenerating after clearance work conducted in previous months. Aquatic plants *Brachiaria mutica* was the most abundant plants found along the river channel. *Mucuna championii* and *Cibotium barometz* (Photo 4) are classified as endangered and vulnerable in China respectively, were recorded in the woodland adjacent to She Shan River. *Cibotium barometz* is also classified as category II in wild plant under state protection. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

## 4.2 Fauna

### 4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at three selected point count locations. In total, 25 species of birds were recorded during the bird surveys within project area. 5 recorded species were wetland dependant birds and observed foraging in the river channel including *Motacilla cinerea*, *Ardeola bacchus*, *Egretta garzetta*, *Tringa ochropus* and *Motacilla alba*. The dominant species of the river was a common species *Pycnonotus jocosus*. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of wetland dependent species with conservation interest including *Ardeola bacchus* and *Egretta garzetta* were observed foraging in the river. *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes *et al.* (2002). A raptor was recorded during the survey, which was *Spilornis cheela* (Photo 5). It was scheduled under Endangered Species of Animals and Plants Ordinance (Cap. 586), was classified as vulnerable in China Red Data Book and local concern by Fellowes *et al.* (2002). *Garrulax canorus* (Photo 6) was first time recorded in She Shan River and it was protected by Endangered Species of Animals and Plants Ordinance (Cap. 586). Except foraging and roosting behaviour of some birds were observed, no other remarkable behaviour was noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

### 4.2.2 Adult Odonata Survey

Odonata survey was performed and a list of recorded odonata species at She Shan River is shown in **Table 4.4**. The number of odonata species was gradually increased by 2 species compared to last month. The abundance was still low during current dry season. Their emerging peak usually ends up with late autumn (Wilson *et al.*, 2003 & Tam *et al.*, 2011). A total of 3 species was recorded, those recorded species were common species in Hong Kong and the result was similar to approximate period of last year. Sampling location was shown on **Figure 1**.

### 4.2.3 Aquatic Macro-invertebrates

Survey of aquatic macro-invertebrates was carried out (Photos 7-8). The river benthic fauna collected was mainly comprised of insects, mollusks and crustaceans. Details of recorded benthic fauna refer to **Table 4.5**. Sampling location was shown on **Figure 1**.

### 4.2.4 Hong Kong Newt

Survey of Hong Kong Newt was performed (Photo 9). Hong Kong Newt was captured only in middle section where covered with dense vegetation (Photo 10). The Newt restricted in middle section of the river because only where can provide ideal conditions for Newt to colonize such as dense vegetation, slow flowing water, pool areas. In addition, lower section is fully covered with concrete, where Newts were not likely to present due to its limited food source and artificial structure. Although upper section has more natural environment

in terms of natural river bed and dense vegetation, Newt were not found in there as high density of vegetation has limited diversity of mirco-habitats such as riffle and pool areas, remaining straight and narrow stream that is not preferable for Newt. It was absent in previous surveys during wet season. The presence of Hong Kong Newt in this month is related to their breeding behavior, they are usually breeding in the river during dry season from September to March (Dudgeon, 2003). Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

#### 4.2.5 Fish Fauna

Fish surveys were performed at She Shan River and total 12 species of freshwater fish were recorded. Native fish *Zacco platypus* and *Oreochromis niloticus* were abundant species dominating in the river channel. Among the recorded fish, *Parazacco spilurus* is classified as “Vulnerable” in Red China Data Book, it was commonly observed along the river with low abundance. The number of fish was similar to last month. Details of recorded of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

### 4.3 **Abiotic Data**

Data on water quality and major stream hydrological feature (water flow and substratum) of the stream were collected and are presented in the **Table 4.7**.

Generally, the water was clean and nutrient levels were low even though there were cultivation activities observed nearby the river. Results of water test are presented in the **Table 4.7**.

The river substratum was comprised of over 30-80% stones or rocks in large proportion of the river sections with slow water flow (up to 0.2m/second at pool and 0.5m/second at riffle).

## 5 **Summary and Commentary**

Ecological monitoring was carried out in current months and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. *Paramesotriton hongkongensis* was only recorded in middle section of the river. The rest of fauna was in a natural fluctuation.

Aquatic plants and riparian vegetation were generally established at new drainage channel. Vegetation has completely covered the gabion wall mainly in upper sections and partially covered the river bed along the river channel.

The water quality of the river was generally good along river channel. Water was clean and nutrient levels were low to moderate.

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## **FIGURE**



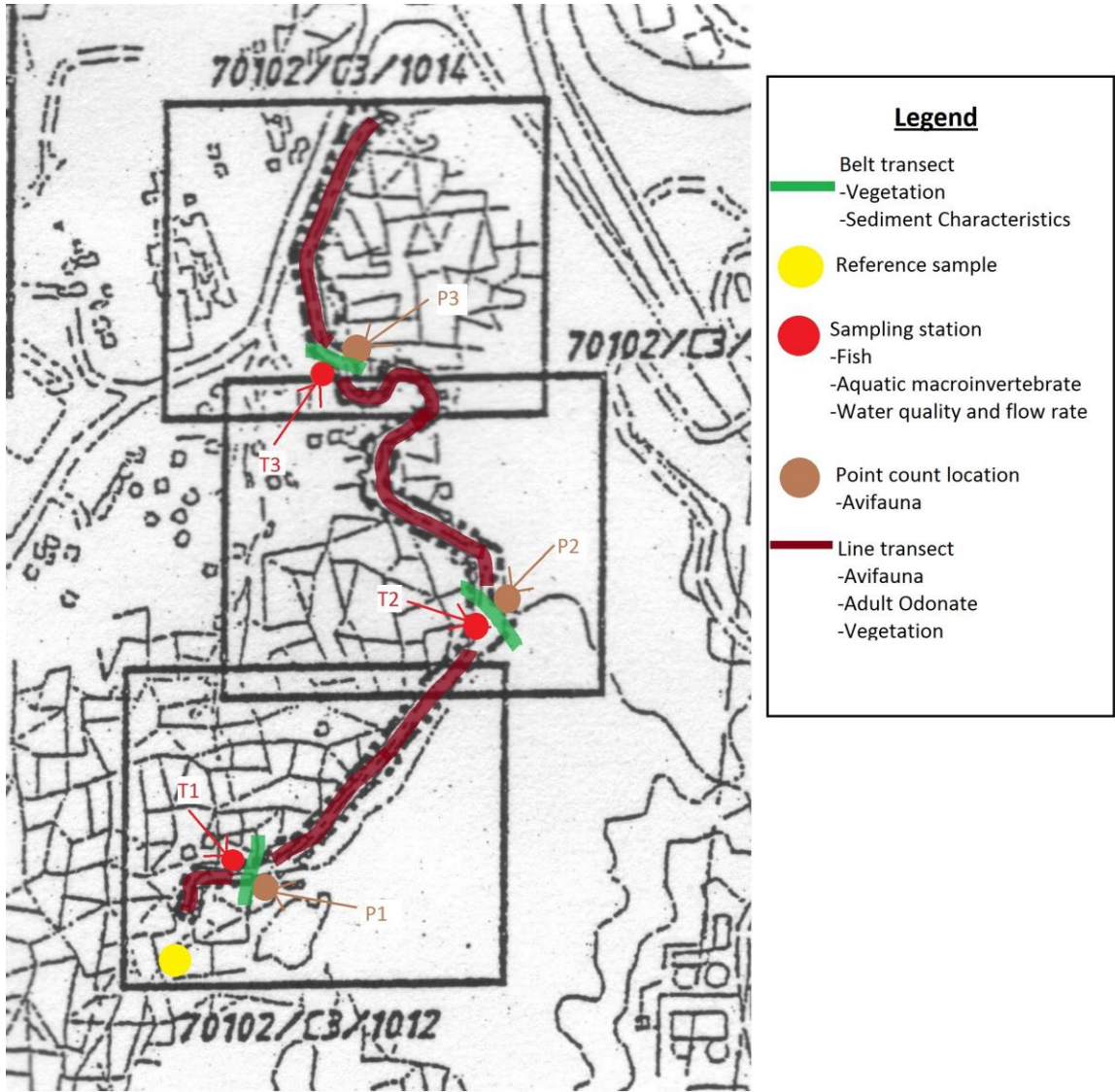


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

## **PHOTOS**







	
<p>Photo 1: General view of the river habitat (Lower section).</p>	<p>Photo 2: General view of the river habitat (Middle section).</p>
	
<p>Photo 3: General view of the river habitat (Upper section)</p>	<p>Photo 4: Species of conservation - <i>Cibotium barometz</i></p>
	
<p>Photo 5: Avifauna - <i>Spilornis cheela</i></p>	<p>Photo 6 : Avifauna - <i>Garrulax canorus</i></p>



Photo 7: Aquatic sampling



Photo 8: Aquatic sampling



Photo 9: Kick Sampling



Photo 10: Hong Kong Newt

## **TABLE**









Table 4.2. Flora species recorded from belt transect survey at the She Shan River  
(T1 - Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Family	Species	Chinese name	Impact monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring																							
			Jul-12			Jul-13			Dec-13			Jan-14			Feb-14			Mar-14			Apr-14			May-14			Jun-14																													
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3																											
Comneliaceae	<i>Commelina diffusa</i>	節節草	0.3	2	0.3	30	0.3	20	0.3	15	0.3	5	0.1	10	0.5	30	0.1	1	0.2	15	0.5	30	0.2	1	0.2	20	0.5	30	0.2	5	0.3	20	0.5	35	0.3	6	0.5	30	0.5	25																
Poaceae	<i>Panicum repens</i>	結骨草																																																						
Asteraceae	<i>Mikania micrantha</i>	蕺甘菊	0.2	2																																																				
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																																						
Moraceae	<i>Ficus microcarpa</i>	細葉榕																																																						
Moraceae	<i>Ficus hispida</i>	對葉榕																																																						
Poaceae	<i>Microstegium ciliatum</i>	細秀竹			0.8	30				0.8	35																																													
Fabaceae	<i>Pueraria lobata</i>	野葛																																																						
Araceae	<i>Colocasia esculenta</i>	芋																																																						
Urticaceae	<i>Boehmeria nivea</i>	苧麻																																																						
Asteraceae	<i>Bidens alba</i>	白花鬼針草				0.3	10																																																	
Poaceae	<i>Pennisetum purpureum</i>	象草	2.5	1	2.5	5			2.5	5			1.5	10	1.5	10			1.5	10	1.5	10			1.5	10	1.5	10																												
Poaceae	<i>Coxis lacryma-jobi</i>	蓬草																																																						
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蕺子草				0.1	5																																																	
Poaceae	<i>Panicum maximum</i>	大黍																																																						
Moraceae	<i>Broussonetia papyrifera</i>	構樹																																																						
Polygonaceae	<i>Polygonum chinense</i>	大葉母	0.2	2																																																				
Onagraceae	<i>Ludwigia hyssopifolia</i>	苘藍																																																						
Cyperaceae	<i>Cyperus sp.</i>	莎草				1	5																																																	
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																																						
Poaceae	<i>Brachiaria mutica</i>	巴拉草		1	15	1	10	1	20	1	50			1.5	60	0.8	20			1.5	55	0.8	25			1.5	60	0.8	30			1.5	50	1	50			1.5	40	1	40			1.5	45	1	45									
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																																						
Poaceae	<i>Pennisetum alopecuroides</i>	狗尾草																																																						
Araceae	<i>Alocasia macrorrhiza</i>	海芋																																																						
Lemnaceae	<i>Lemna minor</i>	浮萍																																																						
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																																																						
Cyperaceae	<i>Cyperus involucreatus</i>	福車草																																																						
Onagraceae	<i>Ludwigia erecta</i>	澳洲水丁香					0.8	3			0.5	5			0.8	30						0.8	30					0.8	25																											
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																																						
Bare Ground				93		20		50		65		5		94		10		10		94		5		10		94		5		5		91		5		5		90		0		5		84		30		25		84		25		15		84

P1 - Point count location 1; P3 - Point count location 3

Table 4.2. Flora species recorded from belt transect survey at the She Shan River  
(T1 - Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Family	Species	Chinese name	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	
Comelinaceae	<i>Commelina diffusa</i>	番薯草		0.5	25																									
Poaceae	<i>Panicum repens</i>	結骨草																												
Asteraceae	<i>Mikania micrantha</i>	蕺甘菊	0.3	10	0.3	2	0.3	12	0.3	5	0.3	12	0.3	5	0.3	12	0.3	5	0.3	12	0.3	5	0.3	12	0.3	5	0.3	12	0.3	5
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜	0.3	2			0.3	2	0.3	1			0.3	1			0.3	1			0.3	1								
Moraceae	<i>Ficus microcarpa</i>	細葉榕																												
Moraceae	<i>Ficus hispida</i>	刺葉榕																												
Poaceae	<i>Microstegium ciliatum</i>	簡秀竹																												
Fabaceae	<i>Pueraria lobata</i>	野葛																												
Araceae	<i>Colocasia esculenta</i>	芋																												
Urticaceae	<i>Boehmeria nivea</i>	苧麻																												
Asteraceae	<i>Bidens alba</i>	白花鬼針草		0.3	5	0.8	2		0.3	5	0.8	5		1	2	0.5	5	0.8	10		1	2	0.5	5	0.8	10		1	2	
Poaceae	<i>Pennisetum purpureum</i>	象草																												
Poaceae	<i>Coxia lacrymosa</i>	蓬草			0.8	1						1.2	1				1.5	1												
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蕪子草																												
Poaceae	<i>Panicum maximum</i>	大黍																												
Moraceae	<i>Broussonetia papyrifera</i>	構樹																												
Polygonaceae	<i>Polygonum chinense</i>	大紫苧																												
Onagraceae	<i>Ludwigia hyssopifolia</i>	香龍																												
Cyperaceae	<i>Cyperus sp.</i>	莎草																												
Poaceae	<i>Miscanthus floridulus</i>	五節草																												
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.5	45	1	45		1.5	50	1	50		1.5	50	1	50		1.8	65	1.8	20	1.5	5	1.8	70	1.8	25	1.5	8	
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																												
Poaceae	<i>Pennisetum alopecuroides</i>	狗屎草	2	12				2	10							2	15	3	5			2	10	3	2					
Araceae	<i>Alocasia macrorrhiza</i>	海芋				0.8	1					0.8	1																	
Lemnaceae	<i>Lemna minor</i>	浮萍																												
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼				N.A	1																							
Polygonaceae	<i>Polygonum chinense</i>	大紫苧																												
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																												
Polygonaceae	<i>Polygonum chinense</i>	大紫苧																												
Cyperaceae	<i>Cyperus involucreatus</i>	福東草																												
Onagraceae	<i>Ludwigia erecta</i>	澳洲水丁香				1	4					1	6			1	6	1.5	1	1.7	2		2	5	1.5	1	1.7	1		
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																												
	Bare Ground			31		15		87		27		8		8		27		8		80		2		0		75		2	1	

P1 - Point count location 1; P3 - Point count location 3



Table 4.2. Flora species recorded from belt transect survey at the She Shan River  
(T1 - Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Family	Species	Chinese name	Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
			Dec-15		T3		Jan-16		T3		Feb-16		T3		Mar-16		T3									
			Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%								
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.3	10	0.2	5			0.3	5	0.2	5			0.3	5	0.2	5						
Poaceae	<i>Panicum repens</i>	荳蔻草																								
Asteraceae	<i>Mikania micrantha</i>	蕺甘菊	0.5	10	0.5	10			0.5	10	0.5	5			0.5	10	0.5	5								
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																								
Moraceae	<i>Ficus microcarpa</i>	細葉榕																								
Moraceae	<i>Ficus hispida</i>	對葉榕																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																								
Fabaceae	<i>Pueraria lobata</i>	野葛																								
Araceae	<i>Colocasia esculenta</i>	芋																								
Urticaceae	<i>Boehmeria nivea</i>	苧麻																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	1	30			1	30			1	30			1	35										
Poaceae	<i>Pennisetum purpureum</i>	象草																								
Poaceae	<i>Coxia lacrymosa</i>	蕓草	1	2			1	2			1	2			1	2										
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蕓子草																								
Poaceae	<i>Panicum maximum</i>	大黍																								
Moraceae	<i>Broussonetia papyrifera</i>	構樹																								
Polygonaceae	<i>Polygonum chinense</i>	大葉母																								
Onagraceae	<i>Ludwigia hyssopifolia</i>	苘藤																								
Cyperaceae	<i>Cyperus sp.</i>	莎草																								
Poaceae	<i>Miscanthus floridulus</i>	五節草																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.3	30	1	5	1	1	0.3	15	1	5	1	5	0.3	15	1	5	0.3	15	1	5	1	5		
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																								
Poaceae	<i>Pennisetum alopecuroides</i>	狗尾草																								
Araceae	<i>Alocasia macrorrhiza</i>	海芋																								
Lemnaceae	<i>Lemna minor</i>	浮萍																								
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																								
Cyperaceae	<i>Cyperus involucreatus</i>	兩車草			1.2	5	0.4	2			1.2	5	0.4	2			1.2	5	0.4	2			1.2	5	0.4	2
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香					0.3	5					0.3	5					0.3	5				0.3	5	
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍			0.3	5					0.3	5					0.3	5					0.3	5		
Bare Ground			28		70		87		43		70		83		43		70		83		38		70		83	

P1 - Point count location 1; P3 - Point count location 3











Table 4.5 Aquatic Macro invertebrates recorded at She Shan River.

(T1- Upper stream section, T2 - middle stream section, T3 - Lower stream section)

Table with 31 columns: Species, Chinese name, Sampling location (Status, Common-ness), Baseline monitoring (Jul-08, Aug-08), Impact monitoring (Jan-09, Jul-09, Jan-10, Jul-10, Jan-11, Jul-11, Jan-12, Jul-12, Jan-13, Dec-13), Post construction monitoring (Jan-14, Feb-14, Mar-14, Apr-14). Rows include Mollusks (Anodonta woodiana, Biomphalaria sp., Brotia hainanensis, Corbicula fluminea, Melanoides tuberculata, Ponnacea canaliculata, Radix plicatulus, Sinotaia quadrata), Insects (Baetis sp., Caenis sp., Chironomus sp., Euphaea sp., Indobaetis sp., Odonate larvae, Orithetrum spp., Pseudagrion spp., Pseudocloeon sp., Serratella sp.), and Crustaceans (Caridina cantanensis, Cryptopotamon anacoluthon). Bottom row shows 'No of Species' counts for each category.

Note: NP - Not protected in Hong Kong; P - protected species in Hong Kong; "VC" - Very Common; "UC" - Uncommon; "C" - Common; "+" - Species exists in the study area; "++" - Species common in the study area; "+++" - Species abundance in the study area; - Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.5 Aquatic Macro invertebrates recorded at She Shan River

(T1 - Upper stream section, T2 - middle stream section, T3 - Lower stream section)

Species	Chinese name	Sampling location	Status	Common-ness	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring																									
					May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15			Feb-15			Mar-15			Apr-15			May-15			Jun-15																
					Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3																
<b>Mollusks</b>																																																												
<i>Anodonta woodiana</i>	青角無齒蚌	NP	VC		+	+	+																																																					
<i>Biomphalaria sp.</i>	--	NP	VC		+	+	+																																																					
<i>Brotia hainanensis</i>	--	NP	VC		+	+	+																																																					
<i>Corbicula fluminea</i>	河蚬	NP	VC		+	+	+																																																					
<i>Melanooides tuberculata</i>	福壽螺	NP	VC		+	+	+																																																					
<i>Pomacea canaliculata</i>	福壽螺	NP	VC		+	+	+																																																					
<i>Radix plicatulus</i>	--	NP	VC		+	+	+																																																					
<i>Sinoia quadrata</i>	田螺	NP	VC		+	+	+																																																					
<b>Insects</b>																																																												
<i>Baetis sp.</i>	--	NP	VC		+	+	+																																																					
<i>Caenis sp.</i>	--	NP	VC		+	+	+																																																					
<i>Chironomus sp.</i>	孑孓幼虫	NP	VC		+	+	+																																																					
<i>Euphaea sp.</i>	--	NP	VC		+	+	+																																																					
<i>Indobaetis sp.</i>	--	NP	VC		+	+	+																																																					
<i>Odontate larvae</i>	--	NP	VC		+	+	+																																																					
<i>Orthetrum spp.</i>	--	NP	VC		+	+	+																																																					
<i>Pseudagrion spp.</i>	--	NP	UC		+	+	+																																																					
<i>Pseudocloeon sp.</i>	--	NP	VC		+	+	+																																																					
<i>Serratella sp.</i>	--	NP	VC		+	+	+																																																					
<b>Crustaceans</b>																																																												
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC																																																									
<i>Cryptopotamon anacoluthon</i>	雙刺溪蟹	NP	VC																																																									
No of Species					11	11	13	8	10	12	13	8	10	11	14	7	10	12	15	6	12	12	14	8	12	12	13	7	12	11	13	7	10	8	13	6	10	11	14	6	7	10	12	6	9	12	13	6	9	12	13	6	9	12	13	6	9	12	13	6

Note: NP - Not protected in Hong Kong;  
P - protected species in Hong Kong  
"VC" - Very Common; "UC" - Uncommon; "C" - Common  
"+" - Species exists in the study area  
"++" - Species common in the study area  
"+++" - Species abundance in the study area  
- Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.5 Aquatic Macro invertebrates recorded at She Shan River

(T1 - Upper stream section, T2 - middle stream section, T3 - Lower stream section)

Species	Chinese name	Sampling location	Post construction monitoring												Post construction monitoring												Post construction monitoring												Post construction monitoring											
			Jul-15				Aug-15				Sep-15				Oct-15				Nov-15				Dec-15				Jan-16				Feb-16				Mar-16															
			Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3												
<b>Mollusks</b>																																																		
<i>Anodonta woodiana</i>	青角無齒蚌	NP	VC																																															
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+												
<i>Brotia hainanensis</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+												
<i>Corbicula fluminea</i>	河蜆	NP	VC																																															
<i>Melanoïdes tuberculata</i>	福壽螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+											
<i>Pomacea canaliculata</i>	福壽螺	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++											
<i>Radix plicatulus</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+												
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	++											
<b>Insects</b>																																																		
<i>Baetis sp.</i>	--	NP	VC			+																																												
<i>Caenis sp.</i>	--	NP	VC																																															
<i>Chironomus sp.</i>	孑孓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+											
<i>Euphaea sp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+												
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+												
<i>Odonate larvae</i>	--	NP	VC																																															
<i>Orthetrum spp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+											
<i>Pseudagrion spp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+												
<i>Pseudocloeon sp.</i>	--	NP	VC																																															
<i>Serratella sp.</i>	--	NP	VC			+																																												
<b>Crustaceans</b>																																																		
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC			+																																												
<i>Cryptopotamon anacoluthon</i>	雙刺溪蟹	NP	VC																																															
No of Species				9	12	14	6	9	12	15	6	9	13	15	6	9	13	15	6	9	13	15	6	9	14	15	6	9	14	15	6	9	14	15	6	9	14	15	6											

Note: NP - Not protected in Hong Kong;  
 P - protected species in Hong Kong  
 "VC" - Very Common; "UC" - Uncommon; "C" - Common  
 "+" - Species exists in the study area  
 "++" - Species common in the study area  
 "+++ - Species abundance in the study area  
 - Reference point was the sampling location outside the works area used to compare the with the data within works area.



Table 4.6 Fish species and Hong Kong Newt recorded at She Shan River  
(T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Species	Commonness	Status	Reference	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring											
				Mar-14				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14				Jan-15				Feb-15				Mar-15			
				T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference				
<i>Channa maculata</i>	斑鱧	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
<i>Clarias gariepinus</i>	草胡子鯪	NP	VC	+				+				+				+				+				+				+				+				+				+				+				+				+			
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Parazacco spilurus</i>	異鰻	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Pterocryptis cochinchinensis</i>	越南隱鱗鮡	NP	C	+				+				+				+				+				+				+				+				+				+				+				+							
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++				
2x2m fish number				60	60	70	70	40	40	50	40	20	10	20	10	12	5	8	6	16	8	10	10	12	10	16	12	20	20	30	16	40	30	40	30	50	50	60	50	60	50	50	40	50	40	40	50	40	30	40	40	40	40	50	50
No of Species				12	11	11	8	12	11	12	9	10	10	13	9	10	10	11	9	9	8	11	10	9	9	12	10	8	9	11	10	8	9	12	8	7	6	11	9	7	6	11	8	7	9	12	8	8	10	12	9				
<b>Amphibian</b>																																																							
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R	+	+	+					+				+				+				+				+				+				+				+				+				+								

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Table 4.6 Fish species and Hong Kong Newt recorded at She Shan River  
(T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Species		Status	Commonness	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction 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							
				Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3								
<i>Channa maculata</i>	斑鱧	NP	C		+				+	+				+				+				+				+				+					+					+															
<i>Clarias gariepinus</i>	草胡子鯪	NP	VC			+				+	+				+	+						+	+				+	+									+	+				+	+												
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C	+	+	+			+	+	+			+	+	+			+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	++			+	+	++	++		+	+	++	++		+	+	++	++		+	++	++		+	++	++		+	++	++		+	++	++		+	++	++		+	++	++									
<i>Parazacco spilurus</i>	異鱧	NP, V	C	+	+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC			+				+	+				+	+						+	+				+	+									+	+					+	+											
<i>Pterocryptis cochinchinensis</i>	越南隱鱔	NP	C			+				+	+				+	+						+	+				+	+																											
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C	+	+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C		+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Zacco platypus</i>	寬鱔	NP	C	+	++	++			+	+	++	++		+	+	++	++		+	+	++	++		+	++	++		+	++	++		+	++	++		+	++	++		+	++	++		+	++	++									
2x2m fish number				30	35	55	45	20	10	20	10	20	10	20	10	15	8	15	8	20	10	20	10	20	12	23	12	35	35	25	20	45	45	35	30	55	50	40	35	55	45	35	25	60	45	40	30	60	50	35	25				
No of Species				8	10	12	9	8	9	13	10	8	8	13	10	8	8	13	10	8	8	13	7	8	8	13	6	8	8	13	6	8	8	13	6	8	8	13	6	8	8	12	7	8	8	12	7	8	8	12	7	8	8	12	7
<b>Amphibian</b>																																																							
<i>Parameotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R			+				+																																													

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Table 4.7 Abiotic data for the Upper She Shan River

(T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Parameter / date	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring							
	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Jul-13			Dec-13			Jan-14			Feb-14			Mar-14			Apr-14			May-14				
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3						
DO (mg/L)	8.9	--	9.1	8.3	6	5.8	6.5	--	8.9	--	8.2	8.3	8.3	8	8.5	8.8	8	8.5	9	8.6	8.2	8.8	7.7	7.7	6.3	7.8	7.8	7.7	8.7	8.6	9.2	8.3	8.2	8.6	7.2	7.6	7.8	7.1	7.2	7.2	7.3	7.5	7.6	7.8	7.6	7.7		
pH	7.29	--	7.51	7.42	7.22	7.16	7.35	--	7.5	--	7.5	7.5	7.5	6.9	7	7.2	7	7.2	7.5	6.9	6.6	7.1	6.7	6.6	6.6	6.8	7.2	7.6	6.6	6.9	7.1	6.8	7.3	7.4	7.8	6.7	7.6	7.2	6.8	7.5	6.6	7.3	7.2	7.5	7.5	7.4		
Nitrate (mg N/L)	0.5	--	1.6	1.5	0.22	0.3	0.4	--	0.75	--	0.1	0.14	0.2	0.1	0.2	0.7	0.1	0.3	0.4	0.2	0.2	0.4	0.84	0.86	1.14	0.6	0.61	0.7	0.78	0.63	0.53	1.2	1.12	1.02	1.5	1.2	1.6	1.2	1.1	0.77	0.6	0.8	1.2	1.1	1.0	1.1		
Ammonia (mg N/L)	0.1	--	PO4-P (µg P/L) <100	PO4-P (µg P/L) :110	0.83	0.97	0.99	--	0.03	--	0.25	0.2	0.12	0.1	0.1	0.12	0.1	0.1	0.15	0.2	0.2	0.3	0.05	0.02	1.08	0.14	0.06	0.05	0.08	<0.01	0.42	1.9	1.8	1.73	0.8	1.2	1.4	0.4	0.6	0.01	0.6	0.5	0.8	<0.1	<0.1	<0.1		
Salinity (ppt)	<0.1	--	0.1	0.1	0	0	0	--	0	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0	0	0	0.03	0.04	0.07	0.03	0.03	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.04	0.06	
Conductivity (µS/cm)	90	--	140	170	116	114	116	--	105	--	410	410	390	110	111	115	120	115	130	122	118	126	121	120	160	94	97	97	116	116	134	124	118	132	128	113	132	123	136	140	112	116	120	124	121	123		
BOD (mg/L)	<2	--	<2	4	<2	<2	<2	--	2	--	<2	3.2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Water flow at pool (m/s)	0.1-0.3	--	<0.01-0.1	<0.01	N.A	<0.01-0.1	--	<0.01-0.1	--	0.1	0	0	0.1	0	0	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Water flow at riffle (m/s)	0.4-0.5	--	0.2-0.3	<0.01	N.A	0.2-0.3	--	0.01	--	0.1	0	0	0.1	0	0	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Sand (%)	55	65	23	65	23	23	65	5	23	--	5	30	5	5	30	2	5	30	2	10	25	5	10	25	5	15	25	5	15	10	5	15	10	5	15	10	5	15	10	5	10	10	5	5	5	5		
Stone (%)	25	30	75	30	75	75	30	40	75	--	40	65	80	40	65	40	40	65	2	45	65	5	45	65	5	65	65	15	65	80	20	65	80	20	65	80	20	65	80	20	70	80	30	80	80	30		
Mud (%)	30	5	2	5	2	2	5	5	2	--	5	5	5	5	5	1	5	5	1	5	10	10	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10		
Concrete (%)	0	0	0	0	0	0	0	50	0	100	50	0	10	50	0	95	50	0	95	40	0	80	40	0	80	10	0	70	10	0	70	10	0	70	10	0	70	10	0	70	10	0	60	10	10	63		







**Agreement No. CE65/2013(EP) Post-Construction  
Ecological Monitoring of River Improvement Work in  
Upper Lam Tsuen River, She Shan River and Upper Tai Po  
River – Investigation  
Post-Construction Ecological Monitoring Report (No. 27)  
Upper Tai Po River**

**March 2016**



Prepared by : Mike Pang

April 18, 2016

Validated by: Mark Shea

April 18, 2016

Ecology Team: China Hong Kong Ecology Consultants

**Post-Construction Ecological Monitoring of River  
Improvement Work in Upper Lam Tsuen River, She Shan  
River and Upper Tai Po River – Investigation  
Agreement No. CE65/2013(EP)**

**Post-Construction Ecological Monitoring Report (No.27)  
Upper Tai Po River**

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**FIGURES**

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- Photo 2: General view of the river channel (Upper section)
- Photo 3: General view of the river channel (Middle section)
- Photo 4: Vegetation growing on gabion (Middle section)
- Photo 5: Abundant species - *Commelina diffusa* (Middle section)
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- Table 4.7: Abiotic data for Upper Tai Po River.

## 1 Introduction

- 1.1 The current post-construction ecological monitoring programme is under Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.
- 1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.
- 1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project from December 2014.
- 1.4 This is the number 27 post-construction ecological monitoring report for the project conducted **on 18<sup>th</sup> March 2016**. It contains the following subsections:
  - Summary of major points
  - Monitoring Methods and Results
  - Summary and Comments

## 2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Bird abundance was similar to those recorded during baseline survey;
- The abundance of target river fauna, i.e., fish *Parazacco spilurus* recorded was lower than those recorded during baseline monitoring (before fish capture/relocation took place). The reason for low fish population of *Parazacco spilurus* was due to river bed modification. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. The other target species, Hong Kong Newt *Paramesotriton hongkongensis*, was not found within works area during baseline, impact monitoring and it was recorded in the river during post construction monitoring. Apart from fauna species, 66 flora species was recorded within the survey transects along the river course. Some common herbs were observed generating on the embankment, which indicating that vegetation was recovering. Flora species of *Tibouchina semidecandra* and *Ipomoea pes-caprae* were planted on the gabion along the river for landscape purpose;
- The abundance of fish was similar to last month;
- The abundance of odonata was still low compared with the data of wet season.
- Larvae Hong Kong Newt was recorded at reference site.

### 3 Monitoring Methodology

#### 3.1 Riparian Vegetation

Riparian vegetation including aquatic and emergent was sampled by line transects along the affected river channel and riparian habitat. Species, relative abundance and average heights were recorded. Vegetation surveys were conducted at three selected belt transects with one located at the upper portion of the river channel (T1) and another one at the middle section of the river (T2), as well as reference site (**Figure 1**). The belt transects was run across the river channel in order to collect quantitative data of the vegetation, e.g., species inventory, height, percentage cover. Qualitative data of plants was collected by recording plant species along line transect, e.g., species inventory, relative abundance. Nomenclature and protection status of the species has followed those documented in Lai *et al.* (2004) and Hong Kong Herbarium (2015).

#### 3.2 Avifauna

Avifauna survey was conducted during post construction monitoring period. Special attention was given to the river channel and corridor area which birds used as feeding and foraging habitat. Avifauna survey was undertaken in the early morning plus species recorded in the rest of the day when conducting other taxonomic groups (benthic, fish, insect) monitoring. Numerical abundance was recorded at fixed count points within a radius of 30 to 50m according to landscape feature and visual penetration extent. The duration of the point count of birds was standardized for 10 minutes at each location in order to collect comparable data. Transect count along accessible sections of river channel were used in order to collect qualitative data. Binoculars and digital camera were the main items of equipment used. Nomenclature and protection status of the species has followed in the AFCDD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Carey *et al.* (2001).

The point count was conducted at two locations with one located at the lower portion of the river channel (T2) and the other located at the upper section of the river (T1). The point count locations, survey transect for bird survey and sampling sites for surveys of other faunal groups and flora was given in **Figure 1**.

#### 3.3 Adult Odonata Survey

Adult Odonata surveys were conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behavior were recorded. Nomenclature and protection status of the species has followed those documented in the AFCDD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)), Wilson *et al.* (2004) and Tam *et al.* (2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

### 3.4 Aquatic Macro-invertebrates

Macro-invertebrates in the river channel were surveyed in three sampling sites with two located at upper (T1) and middle (T2) proportion of the river respectively and one reference site. It aims to collect necessary macro-invertebrate fauna for ecological monitoring programme (**Figure 1**). Five replicates were taken at each sampling point and pool together for further sample sorting and identification. Kick sampling and hand netting were the survey methodologies for river organisms. Dissection microscope and digital camera were used to aid identification and enumeration. Numerical abundance and species identity were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and other literatures such as Dudgeon (1994).

### 3.5 Fish and Newt

Fish community including target species *Parazacco spilurus* and *Paramesotriton hongkongensis* at the specified river channel was monitored by live trapping, hand netting and direct observation methods.

Sampling was conducted at three sampling locations with one located at upper section (T1) and one located at middle section (T2), as well as reference site. The selected sampling site covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish and newt was estimated and recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website ([www.hkbiodiversity.net](http://www.hkbiodiversity.net)) and Lee *et al.* (2004).

### 3.6 Abiotic Data Collection

#### 3.6.1 Water Quality Monitoring

Dissolved oxygen level, pH value, conductivity, salinity, BOD and nutrient level (nitrate and ammonium) were measured and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 and AZ8374 respectively. All the instruments were calibrated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20°C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056 (FIA) and SOP057 (FIA) respectively.

#### 3.6.2 Sediment Characteristics

Sediment/substrate characteristics were recorded of sediment cover in percentage e.g. mud, sand, rock, boulder and cemented bottom in the river bed at sampling sites.

#### 3.6.3 Water Flow

Water flow rates in river channel were measured by recording the time taken for a floating object (e.g. floating ball) in a measured distance. The sampling sites for surveys were given in **Figure 1**.

## 4 Monitoring Results

### 4.1 Vegetation

Major proportion of river bed and bank was concrete and without plant colonizing (Photos 2-3). Vegetation has sparsely covered the gabion wall along the upper Tai Po River and the river bed with some common plants including invasive species *Mikania micrantha*, and native species *Commelina diffusa* (Photo 4). In total, 66 flora species were recorded within the survey transects along the river course. Abundant native species *Commelina diffusa* was the dominant species established in the river bed (Photo 5). The flora were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

### 4.2 Fauna

#### 4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at two defined point count locations. In total, 17 species of birds were recorded during bird survey. Among them, 4 species were wetland dependant birds observed feeding in the river channel including *Motacilla alba* (Photo 6), *Egretta garzetta*, *Ardeola bacchus* and *Motacilla cinerea*. A common species *Pycnonotus jocosus* was the dominant species of most of the proportion of the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of the wetland dependent species recorded are classified as Regional Concern by Fellowes *et al.* (2002) including *Egretta garzetta* and *Ardeola bacchus*, which were usually observed feeding in the river. A winter visitor, *Anthus hodgsoni* (Photo 7), was still recorded in this month. Only foraging behaviour of some wetland dependent birds were noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

#### 4.2.2 Adult Odonata Survey

Odonata surveys were performed and a list of recorded odonata species at Upper Tai Po River is shown in **Table 4.4**. Number of odonata species recorded was gradually increased by 1 species compared with the survey conducted in last month and the result was similar to previous surveys conducted in approximate period of last year. In total, 2 species odonata was found, the recorded odonata species was common species in Hong Kong. The species richness of odonata is still low during current dry season. The peak of emergence has ended up in late autumn for most of the species in Hong Kong. The remaining species recorded have no specific emergence period, they could be seen throughout the year (Wilson *et al.*, 2004 & Tam *et al.*, 2011). Sampling location was shown in **Figure 1**.

#### 4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans. Details of recorded of river benthic fauna refers to **Table 4.5**. Sampling location was shown on **Figure 1**.

#### 4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted at Upper Tai Po River. One larvae Newt (Photo 8) was captured in this month at reference site. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

#### 4.2.5 River Fish Fauna

Fish surveys were performed at Upper Tai Po River during surveys. In total, 11 species freshwater fish were recorded within project area. Fish abundance was low along the modified river channel. The *Parazacco spilurus* and *Pseudobagrus trilineatus*, which have conservation interest, were restricted in the upper section of the surveyed river outside the works boundary where the habitat was not affected by construction works, while *Parazacco spilurus* is listed in China Red Data Book Status as Vulnerable and *Pseudobagrus trilineatus* is classified as Global Concern by Fellowes *et al.* (2002). The data showed that fish abundance has not changed significantly compared with last month. Details of records of fish fauna refers to **Table 4.6**. Sampling location was shown on **Figure 1**.

### 4.3 **Abiotic Data**

Data on water quality and major river hydrological feature (water flow and substratum) of the river were collected and are presented in the **Table 4.7**.

Generally, the water was not polluted and nutrient levels were generally low. Results of water test were presented in the **Table 4.7**.

The river substratums of upper and lower sections were comprised of 40% stone and 60% concrete, 20% stone and 80% concrete respectively. Moderate water flow up to 0.3m/second at pool and 0.6m/second at riffle was measured.

## 5 **Summary and Commentary**

Post construction ecological monitoring was carried out in current month and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. One individual of larvae Newt was recorded at reference site. Fishes abundance was recorded with tiny change in this month. Bird abundance was similar to those recorded during baseline survey. Species richness of odonata was still low during current dry season.



Aquatic and riparian vegetation along river channel was re-established compared to those recorded during baseline surveys. Vegetation has sparsely covered gabion wall and river bed along to the Upper Tai Po River.

The water quality of the surveyed river was not polluted as indicated by low nutrient concentration level of ammonium and nitrate although the river channel may receive discharge and runoff from the village areas.

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## **FIGURE**

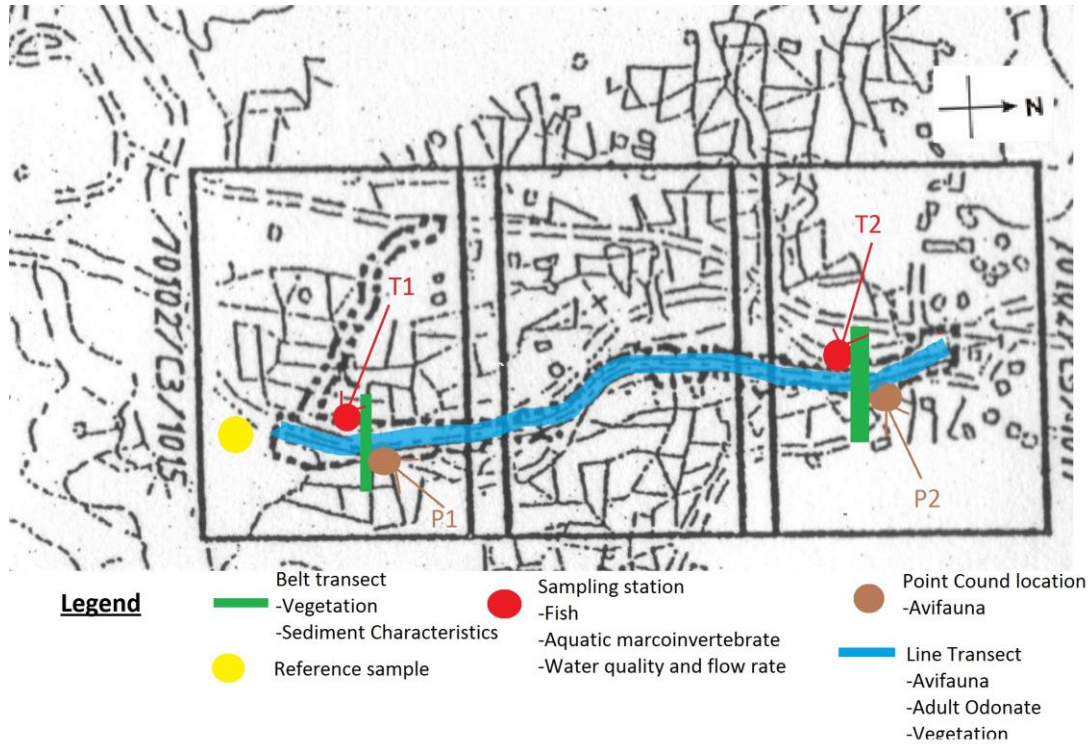


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River, Tai Po.

## **PHOTOS**



Photo 1: General view of the river channel (Reference site)



Photo 2: General view of the river channel (Upper section)



Photo 3: General view of the river channel (Middle section)



Photo 4: Vegetation sparsely growing on gabion



Photo 5: Abundant species - *Commelina diffusa* (Middle section)

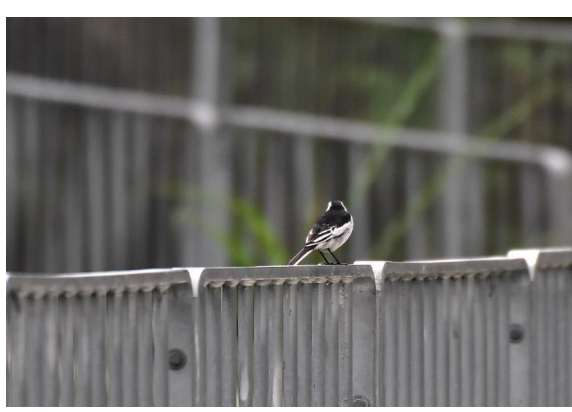


Photo 6: Avifauna – *Motacilla alba*



Photo 7: Avifauna – *Anthus hodgsoni*



Photo 8: Larvae Hong Kong Newt

## **TABLE**





Table 4.1. Flora species recorded at the transect along the Upper Tai Po River including riparian habitat.

Family	Species name	Species name in Chinese	Impact Monitoring									Post Construction Monitoring									Post Construction Monitoring									Post Construction Monitoring										
			Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Polygonaceae	<i>Polygonum chinense</i>	火炭母													+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Polygonaceae	<i>Rumex crispifolius</i>	假菠菜																																						
Rutaceae	<i>Clausena lansium</i>	黃皮	+	+	+	+	+	+																																
Sapindaceae	<i>Dimocarpus longan</i>	龍眼	+	+	+	+	+	+																																
Sapindaceae	<i>Litchi chinensis</i>	荔枝	+	+	+	+	+	+																																
Scrophulariaceae	<i>Scoparia dulcis</i>	冰糖草													+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Solanaceae	<i>Solanum torvum</i>	水茄	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Solanaceae	<i>Solanum nigrum</i>	龍葵				+	+	+	+						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	<i>Celtis sinensis</i>	朴樹	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	<i>Boehmeria nivea</i>	苧麻	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	<i>Pouzolzia zeylanica</i>	露水葛													+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	<i>Lantana camara</i>	馬纓丹	+	+	+	+	+	+							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Eleusine indica</i>	牛筋草																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	<i>Rorippa indica</i>	塘蔴菜																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Isachne globosa</i>	柳葉簕																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	<i>Paspalum distichum</i>	雙穗雀稗																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cyperaceae	<i>Cyperus involucreatus</i>	風車草													+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Dioscoreaceae	<i>Dioscorea alata</i>	參薯																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Menispermaceae	<i>Stephania longi</i>	莠莠																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Rubiaceae	<i>Paederia scandens</i>	雞欠藤																						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Ulmaceae	<i>Trema tomentosa</i>	山黃麻																						+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Verbenaceae	<i>Duranta erecta</i>	假連翹													+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<b>Floating plant</b>																																								
Lemnaceae	<i>Lemna minor</i>	浮萍																							+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<b>No of Species</b>			38	38	38	39	39	34	11	12	4	17	23	27	36	39	59	60	61	61	61	62	63	63	63	61	63	63	66	67	67	67	67	67	67	67	67	67	67	

Note:  
+, occurred; ++, common; +++, abundant/dominant species recorded in study area

Table 4.2. Flora species recorded from belt transect survey at the Upper Tai Po stream (T1 - Upper stream sampling site and T2 - Lower stream sampling site)

Family	Species	Chinese name	Baseline survey				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring												
			Oct-07		Jan-09		Jul-09		Jan-10		Jul-10		Jan-11		Oct-07		Jan-09		Jul-09		Jan-10		Jul-10		Jan-11										
			Height (m)	%	Height (m)	%	Reference (m)	%	Height (m)	%	Height (m)	%	Reference (m)	%	Height (m)	%	Reference (m)	%	Height (m)	%	Reference (m)	%	Height (m)	%	Reference (m)	%	Height (m)	%							
Asteraceae	<i>Mikania micrantha</i>	蕨甘菊	0.4	15	1	40	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5	0.5	5							
Moraceae	<i>Ficus hispida</i>	野櫻栲	1	2			5	5			2	10	5	5			2	10	5	5			5	5											
Ulmaceae	<i>Celtis sinensis</i>	朴樹	5	2							6	15					6	15																	
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1.2	45	1.2	30			0.8	10	0.5	12					0.7	30					1	35	1	5	0.5	10							
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐	2	2			5	5	3	5	1.5	4	5	5	3	5	1.5	5	5	5	5		5	5			4m	5							
Araceae	<i>Alocasia odora</i>	海芋	1.5	23							1.5	25					2	30							2	10									
Araceae	<i>Colocasia esculenta</i>	芋	0.3	<1	0.4	<1	0.3	2			0.3	2	0.8	5			0.3	1																	
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁					0.4	10	7	5							0.4	10	7	5			0.4	10			0.4	5							
Athyriaceae	<i>Callipteris esculenta</i>	葉蕨			0.6	1	0.8	10			0.4	10	0.8	10			0.4	2	0.8	6			0.8	6											
Poaceae	<i>Phragmites karka</i>	卡爾蘆					1.5	51					1.5	51			1.5	53					1.5	10			1.5	2							
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨	0.4	10							0.4	10					0.4	2																	
Equisetaceae	<i>Equisetum debile</i>	篳管草			0.6	<1	0.3	2			0.3	2					0.3	2																	
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒							0.4	2			0.4	2			0.2	2										0.3	2						
Commelinaceae	<i>Commelina diffusa</i>	箭筈草													0.2	5	0.2	5					0.5	20				0.2	4						
Solanaceae	<i>Solanum nigrum</i>	龍葵															0.4	5																	
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸															0.3	5																	
Poaceae	<i>Eleusine indica</i>	牛筋草											0.5	5				5																	
Poaceae	<i>Pennisetum purpureum</i>	象草							3	4																									
Asteraceae	<i>Wedelia chinensis</i>	柳蠟菊																																	
Asteraceae	<i>Bidens alba</i>	白花鬼針草																										0.5	5						
Poaceae	<i>Panicum repens</i>	結骨草																																	
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																	
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																	
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																										0.2	5						
Fabaceae	<i>Pueraria lobata</i>	野葛																																	
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草																																	
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																	
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																	
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																	
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																	
Cyperaceae	<i>Cyperus sp.</i>	莎草																																	
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																																	
Amaranthaceae	<i>Celosia argentea</i>	青葙																																	
Bare Ground							10		73		10		10		78		6		10		73		88		9		15		65		68		80		89

- Reference point was the sampling location outside the works area used to compare with the data within works area.

P1 - Point count location 1; P2 - Point count location 2

Table 4.2. Flora species recorded from belt transect survey at the Upper Tai Po stream (T1 - Upper stream sampling site and T2 - Lower stream sampling site)

Family	Species	Chinese name	Impact monitoring						Impact monitoring						Impact monitoring						Impact monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
			Jul-11			Jan-12			Jul-12			Mar-13			Jul-13			Jan-14			Feb-14			Mar-14																				
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2															
Asteraceae	<i>Mikania micrantha</i>	微甘菊	0.5	10				0.4	20							0.4	60																											
Moraceae	<i>Ficus hispida</i>	對葉榕																																										
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																										
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1	2																																								
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																										
Araceae	<i>Alocasia odora</i>	海芋																																										
Araceae	<i>Colocasia esculenta</i>	芋																																										
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																										
Athyriaceae	<i>Callipteris esculenta</i>	蕨蕨																																										
Poaceae	<i>Phragmites karka</i>	卡叻蘆	1.5	2																																								
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																										
Equisetaceae	<i>Equisetum debile</i>	筴管草																																										
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒	1.2	10				0.4	20																																			
Commelinaceae	<i>Commelina diffusa</i>	箭筈草					0.4	10																																				
Solanaceae	<i>Solanum nigrum</i>	龍葵						0.4	5																																			
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸					0.5	4																																				
Poaceae	<i>Eleusine indica</i>	牛筋草					0.3	5																																				
Poaceae	<i>Pennisetum purpureum</i>	象草																																										
Asteraceae	<i>Wedelia chinensis</i>	鵝鵝菊																																										
Asteraceae	<i>Bidens alba</i>	白花鬼針草					0.2	2																																				
Poaceae	<i>Panicum repens</i>	結骨草	1.5	5			1.5	5																																				
Poaceae	<i>Coix lacryma-jobi</i>	薏苡					1.5	5																																				
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍					0.2	5																																				
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																																										
Fabaceae	<i>Pueraria lobata</i>	野葛																																										
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草					0.2	5																																				
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																										
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																										
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																										
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																										
Cyperaceae	<i>Cyperus sp.</i>	莎草																																										
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																																										
Amaranthaceae	<i>Celosia argentea</i>	青葙																																										
Bare Ground			71	100	89	35	100	100	20	100	100	10								20	76					19	74				19	69			19	67								

- Reference point was the sampling location outside the works area used to compare with the data within works area.

P1 - Point count location 1; P2 - Point count location 2

Table 4.2. Flora species recorded from belt transect survey at the Upper Tai Po stream (T1 - Upper stream sampling site and T2 - Lower stream sampling site )

Family	Species	Chinese name	Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
			Apr-14		May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14													
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2												
			Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%								
Asteraceae	<i>Mikania micrantha</i>	蕨甘菊	0.3	5	0.3	20	0.3	5	0.3	25	0.3	5	0.3	25	0.4	8	0.4	25	0.4	10	0.4	28	0.4	10	0.4	28	0.4	10	0.4	30								
Moraceae	<i>Ficus hispida</i>	野梧桐																																				
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																				
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.4	5			0.4	5			0.4	5			0.6	5			0.6	5			0.6	5			0.6	10										
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐		0.5	1			0.5	1				0.5	1			0.6	1			0.6	1			0.6	1			0.6	1								
Araceae	<i>Alocasia odora</i>	海芋																																				
Araceae	<i>Colocasia esculenta</i>	芋																											0.5	5								
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																				
Athyriaceae	<i>Callipteris esculenta</i>	葉蕨																																				
Poaceae	<i>Phragmites karka</i>	卡門蘆	1.5	5			1.5	5			1.5	5			1.5	5			1.8	5			1.8	5			2	5										
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																				
Equisetaceae	<i>Equisetum debile</i>	筆管草																											0.3	5								
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒																																				
Commelinaceae	<i>Commelina diffusa</i>	箭筒草		0.1	5			0.1	3			0.1	3				0.2	4			0.3	5			0.3	5			0.3	10								
Solanaceae	<i>Solanum nigrum</i>	龍葵																																				
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸																																				
Poaceae	<i>Eleusine indica</i>	牛筋草																																				
Poaceae	<i>Pennisetum purpureum</i>	象草																																				
Asteraceae	<i>Wedelia chinensis</i>	鵝樹菊																																				
Asteraceae	<i>Bidens alba</i>	白花鬼針草																												1	10							
Poaceae	<i>Panicum repens</i>	結骨草	0.3	5			0.3	3			0.3	3			0.4	3			0.6	3			0.6	4			0.6	4										
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																				
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																				
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																																				
Fabaceae	<i>Pueraria lobata</i>	野葛	0.4	10			0.4	15			0.4	15			0.4	15			0.4	15			0.4	18			0.4	18										
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草																																				
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草		1.5	5			1.5	5				1.5	5				1.5	5				1.5	5					2	20								
Poaceae	<i>Brachiaria mutica</i>	巴拉草																											1.5	25								
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																				
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																				
Cyperaceae	<i>Cyperus sp.</i>	莎草																																				
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																																				
Amaranthaceae	<i>Celosia argentea</i>	青葙																																				
Bare Gound			70		69			67		66			67		66			64		65			62		61			58		61		43		4				

- Reference point was the sampling location outside the works area used to compare with the data within works area.

P1 - Point count location 1; P2 - Point count location 2



Table 4.2. Flora species recorded from belt transect survey at the Upper Tai Po stream (T1 - Upper stream sampling site and T2 - Lower stream sampling site )

		Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring											
		Aug-15			Sep-15			Oct-15			Nov-15			Dec-15			Jan-16			Feb-16			Mar-16														
Family	Species	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2									
Asteraceae	<i>Mikania micrantha</i>	0.5	10		0.5	10		0.5	10		0.5	10		0.5	10		0.5	5		0.5	5		0.5	5		0.5	5		0.6	5							
Moraceae	<i>Ficus hispida</i>																																				
Ulmaceae	<i>Celtis sinensis</i>																																				
Poaceae	<i>Microstegium ciliatum</i>	1	5	1	1	1	1	1	5	1	3	1	3	1	5	1	3	1	5	1	3	1	5	1	3	1	5	1	3								
Euphorbiaceae	<i>Macaranga tanarius</i>			1.5	5			1.5	5			1.5	5			1.5	5			1.5	5			1.5	5			1.5	5		1.5	5					
Araceae	<i>Alocasia odora</i>																																				
Araceae	<i>Colocasia esculenta</i>	0.5	5	1.2	5	0.5	5	1.2	5	0.5	5	1.2	5	0.5	5	1.2	5	0.5	5	1.2	5	0.5	5	1.2	5	0.5	5	1.2	5	0.5	5	1.2	5				
Myrtaceae	<i>Cleistocalyx operculatus</i>																																				
Athyriaceae	<i>Callipteris esculenta</i>																																				
Poaceae	<i>Phragmites karka</i>	1.5	10		1.5	10		1.5	10		1.5	10		1.5	10		1.5	7		1.5	7		1.5	7		1.5	7		1.5	7		1.5	7				
Thelypteridaceae	<i>Cyclosorus parasiticus</i>																																				
Equisetaceae	<i>Equisetum debile</i>	0.3	5		0.3	5		0.3	5		0.3	5		0.3	5		0.3	5		0.3	5		0.3	5		0.3	5		0.3	5		0.3	5				
Asteraceae	<i>Ageratum conyzoides</i>																																				
Commelinaceae	<i>Commelina diffusa</i>	0.4	10	0.2	20	0.4	30	0.4	10	0.2	15	0.4	30	0.4	10	0.2	20	0.4	30	0.4	10	0.2	25	0.4	35	0.4	10	0.2	25	0.4	35	0.4	10	0.3	25	40	0
Solanaceae	<i>Solanum nigrum</i>																																				
Euphorbiaceae	<i>Mallotus paniculatus</i>																																				
Poaceae	<i>Eleusine indica</i>																																				
Poaceae	<i>Pennisetum purpureum</i>																																				
Asteraceae	<i>Wedelia chinensis</i>																																				
Asteraceae	<i>Bidens alba</i>	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5	0.5	5	0.7	5		
Poaceae	<i>Panicum repens</i>	0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5			0.4	5		
Poaceae	<i>Coix lacryma-jobi</i>																																				
Convolvulaceae	<i>Ipomoea cairica</i>																																				
Cucurbitaceae	<i>Benincasa hispida</i>																																				
Fabaceae	<i>Pueraria lobata</i>																																				
Convolvulaceae	<i>Merremia hederacea</i>																																				
Poaceae	<i>Pennisetum alopecuroides</i>		2.5	5	2	20	2.5	5	2	20																											
Poaceae	<i>Brachiaria mutica</i>		1.2	30	0.5	15	1.2	2	0.5	15																											
Onagraceae	<i>Ludwigia erecta</i>																																				
Malvaceae	<i>Hibiscus rosa-sinensis</i>																																				
Cyperaceae	<i>Cyperus sp.</i>		0.2	5			0.2	2			0.2	2			0.2	2			0.2	2			0.2	2			0.2	2			0.2	2			0.2	2	
Balsaminaceae	<i>Impatiens walleriana</i>																																				
Amaranthaceae	<i>Celosia argentea</i>	1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5			1.7	5		
Bare Ground		40		34		25	40		83	25		40		66	25		40		58	25		51	58	25		48	53	20	48	53	20	48	53	20	48	53	

- Reference point was the sampling location outside the works area used to compare with the data within works area.

P1 - Point count location 1; P2 - Point count location 2







Table 4.4. Odonate species recorded at the UpperTai Po River

Species	Common name	Chinese name	Status	Commonness	Baseline survey	Impact monitoring					Impact monitoring					Post construction monitoring									
					Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14
<i>Macrodiplax cora</i>	Coastal Glider	高翔濉蜻	NP	C																					
<i>Ceriagrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃濉	NP	VC														+	+						
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇濉	NP	VC																	+	+	+	+	
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅濉	NP	VC	+		+		+												+				
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽濉	NP	VC							+											+	+		
<i>Neurobasis chinensis</i>	Chinese Greenwing	華艷色濉	NP	C					+									+	+	+		+	+	+	
<i>Neurothemis fulvia</i>	Russet Percher	網脈濉	NP	VC																					
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰濉	NP	VC		+	+		+						+	+									
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰濉	NP	VC	+	+	+								+								+	+	
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰濉	NP	VC																		+	+	+	+
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰濉	NP	VC																					
<i>Palpopleura sexmaculata sexmaculata</i>	Asian Widow	六斑曲緣濉	NP	C																					
<i>Pantala flavescens</i>	Wandering Glider	黃濉	NP	VC	+		+	+	+	+	++	+	+	+	+									+	
<i>Paracercion calamorum dyeri</i>	Dusky Lilysquatter	蒼尾濉	P, LC	C															+						
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原濉	NP	VC																					
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑濉	NP	C																			+		
<i>Rhinocypha perforata</i>	Common Blue Jewel	三斑鼻濉	NP	VC					+														+	+	+
<i>Trithemis Aurora</i>	Crimson dropwing	曉褐濉	NP	VC	+				+													+	+	+	+
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐濉	NP	VC									+		+	+	+	+	+	+	+		+	+	+
<i>Urothemis signata signata</i>	Scarlet Basket	赤斑曲鈎脈濉	NP	C											+										
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹濉	P	P,PGC																			+	+	+
No of Species					4	2	4	1	6	1	5	1	5	1	4	2	1	3	4	4	2	5	7	8	9

Note: NP – Not protected in Hong Kong P- Protected in Hong Kong

“VC” – Very Common; “UC” – Uncommon; “C” - Common

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundance in the study area

Commonness and status were decided according to AFCD biodiversity website ([www.hkbiobiodiversity.net](http://www.hkbiobiodiversity.net))

LC- Local Concern - Fellowes *et al* (2002)

PGC - Potential Global Concern - Fellowes *et al* (2002)

Table 4.4. Odonate species recorded at the UpperTai Po River

Species	Common name	Chinese name	Status	Commonness	Post construction monitoring							Post construction monitoring										
					Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	
<i>Macrodiplox cora</i>	Coastal Glider	高翔濛蜻	NP	C								+	+									
<i>Ceriagrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟳	NP	VC	+						+	+	+	+								
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蟳	NP	VC							+	+	+	+								
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC								+	+	+	+	+						
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟳	NP	VC																		
<i>Neurobasis chinensis</i>	Chinese Greenwing	華艷色蟳	NP	C	+				+	+				+	+	+						
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC									+	+	+							
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC										+	+	+	+					+
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC												+	+					
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC					+	+	+	+	+	+								
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC							+	+	+									
<i>Palpopleura sexmaculata sexmaculata</i>	Asian Widow	六斑曲緣蜻	NP	C								+	+									
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+												+	+	+	+	+	+
<i>Paracercion calamorum dyeri</i>	Dusky Lilysquatter	蒼尾蟳	P, LC	C																		
<i>Prodasinieura autumnalis</i>	Black Threadtail	烏齒原蟳	NP	VC										+								
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟳	NP	C																		
<i>Rhinocypha perforata</i>	Common Blue Jewel	三斑鼻蟳	NP	VC							+	+	+	+	+	+						
<i>Trithemis Aurora</i>	Crimson dropwing	曉褐蜻	NP	VC	+	+	+										+	+				
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+					+	
<i>Urothemis signata signata</i>	Scarlet Basket	赤斑曲鈎脈蜻	NP	C																		
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P	P,PGC	+																	
No of Species					6	2	2	1	3	6	7	9	11	10	8	8	5	1	2	1	2	

Note: NP – Not protected in Hong Kong P- Protected in Hong Kong

“VC” – Very Common; “UC” – Uncommon; “C” - Common

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundance in the study area

Commonness and status were decided according to AFCD biodiversity website ([www.hkbiobiodiversity.net](http://www.hkbiobiodiversity.net))

LC- Local Concern - Fellowes *et al* (2002)

PGC - Potential Global Concern - Fellowes *et al* (2002)

Table 4.5 Aquatic Macro invertebrates recorded at Upper Tai Po River (T1- Upper stream sampling site and T2- Lower stream sampling site)

Species	Chinese name	Sampling point	Baseline survey		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Post construction monitoring												
			Oct-07	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2									
<b>Mollusca</b>																																									
<i>Biomphalaria sp.</i>	--	NP	VC		+			+		+	+		+	+				+													+										
<i>Brotia hainanensis</i>	--	NP	VC	++	+	++			++			++	+	++				+			+								+	+		+	+								
<i>Melanoides tuberculata</i>	縮螺	NP	VC					+	+	+	+	+	+	++				+		+	+	+	+					+	+	+	+	+	+								
<i>Physella acuta</i>	尖唇蚌	NP	VC															+	+	++																					
<i>Pomacea canaliculata</i>	福果螺	NP	VC					+	+		++	+	+	+		++		+	+	+	+	+	+					+	+	+	+	+	+								
<i>Radix plicatulus</i>	羅白螺	NP	VC		++							+	+	+		+		+	+	+	+	+						+		+	+	+	+								
<i>Sinotia quadrata</i>	田螺	NP	VC					++		+	++				++			+		+	+	+						+		+	+	+	+								
<b>Insects</b>																																									
<i>Anisocentropus sp.</i>	--	NP	VC																																						
<i>Arctonora sp.</i>	--	NP	VC																																						
<i>Aulocodes sp.</i>	--	NP	VC																																						
<i>Baetis sp.</i>	--	NP	VC	+		+						+	+																												
<i>Chironomus sp.</i>	蠓幼虫	NP	VC	+	+	+						+	+																												
<i>Ephemera sp.</i>		NP	VC																																						
<i>Indobaetis sp.</i>	--	NP	VC	+		+						+	+																												
<i>Mnais sp.</i>	--	NP	VC		+	+						+	+																												
Odonate Larvae	--	NP	VC																																						
<i>Orthetrum sp.</i>	--	NP	VC	+	+	+						+	+																												
<i>Perla sp.</i>	--	NP	VC									+	+																												
<i>Rhaphium sp.</i>	--	NP	VC																																						
<i>Tipulidae spp.</i>	--	NP	VC																																						
<b>Crustacea</b>																																									
<i>Caridina cantonensis</i>	廣東米蝦	NP	VC			+						+	++																												
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	C			+						+	+																												
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC			+						+	+																												
No of Species				5	6	9	0	5	11	2	5	11	12	6	11	16	8	10	6	5	12	4	4	10	6	4	14	7	1	14	2	0	13	4	1	13	7	4	14	10	8

Note:  
 "NP" – Not protected in Hong Kong  
 "L" – Listed in Wild Animals Protection Ordinance (Cap. 170) and listed as "Near Threatened" in IUCN Red List Status  
 "VC" – Very Common; "UC" – Uncommon; "C" – Common  
 "+" – Species exists in the study area  
 "++" – Species common in the study area  
 "+++" – Species abundance in the study area  
 - Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.5 Aquatic Macro invertebrates recorded at Upper Tai Po River (T1 - Upper stream sampling site and T2 - Lower stream sampling site )

Species	Chinese name	Sampling point	Post construction monitoring																		Post construction monitoring																				
			Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15			Feb-15			Mar-15		
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2			
<b>Mollusca</b>																																									
<i>Biomphalaria sp.</i>	--	NP VC	+			+			+			+			+			+			+			+			+			+			+			+					
<i>Brotia hainanensis</i>	--	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Melanoides tuberculata</i>	縮螺	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Physella acuta</i>	小膀胱螺	NP VC																																							
<i>Pomacea canaliculata</i>	福果螺	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Radix plicatulus</i>	羅白螺	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Sinozota quadrata</i>	田螺	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<b>Insects</b>																																									
<i>Anisocentropus sp.</i>	--	NP VC	+			+			+			+			+			+			+			+			+			+			+			+					
<i>Arctopora sp.</i>	--	NP VC	+			+			+			+			+			+			+			+			+			+			+			+					
<i>Aulocodes sp.</i>	--	NP VC																																							
<i>Baetis sp.</i>	--	NP VC	+			+			+			+			+			+			+			+			+			+			+			+					
<i>Chironomus sp.</i>	孳幼虫	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Ephemera sp.</i>		NP VC																																							
<i>Indobaetis sp.</i>	--	NP VC	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+				
<i>Mnais sp.</i>	--	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
Odonate Larvae	--	NP VC																																							
<i>Orthetrum sp.</i>	--	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Perla sp.</i>	--	NP VC				+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+				
<i>Rhaphium sp.</i>	--	NP VC	+			+			+			+			+			+			+			+			+			+			+			+					
<i>Tipulidae spp.</i>	--	NP VC																																							
<b>Crustacea</b>																																									
<i>Caridina cantonensis</i>	廣東米蝦	NP VC	+	+	+	++	+		+	+		+	+		+	+		+	+		+	+		++	+		+	+		++	+		+	+		++	+				
<i>Cryptopotamon anacoluthon</i>	刺溪蟹	NP C	+			+			+			+			+			+			+			+			+			+			+			+					
<i>Macrobrachium hainanense</i>	海南沼蝦	NP VC	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+				
No of Species			17	11	9	18	13	9	15	9	7	15	9	5	18	10	6	18	9	8	19	12	8	19	13	7	19	11	6	16	10	5	19	10	5	18	7	4	19	7	5

Note:  
 "NP" – Not protected in Hong Kong  
 "r" - Listed in Wild Animals Protection Ordinance (Cap. 170) and Listed as "Near Threatened" in IUCN Red List Status  
 "VC" – Very Common; "UC" – Uncommon; "C" - Common  
 "+" – Species exists in the study area  
 "++" – Species common in the study area  
 "+++ " – Species abundance in the study area  
 - Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.5 Aquatic Macro invertebrates recorded at Upper Tai Po River (T1 - Upper stream sampling site and T2 - Lower stream sampling site)

Species	Chinese name	Sampling point	Post construction monitoring									Post construction monitoring									Post construction 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
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	
<b>Mollusca</b>																																				
<i>Biomphalaria sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Brotia hainanensis</i>	--	NP	VC	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+	
<i>Melanoides tuberculata</i>	縮螺	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Physella acuta</i>	尖唇肺螺	NP	VC	+																																
<i>Pomacea canaliculata</i>	福果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Radix plicatulus</i>	羅白螺	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Sinoiatia quadrata</i>	田螺	NP	VC	+	+	+	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+	
<b>Insects</b>																																				
<i>Anisocentropus sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Arctonora sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Aulocodes sp.</i>	--	NP	VC																																	
<i>Baetis sp.</i>	--	NP	VC	+																																
<i>Chironomus sp.</i>	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Ephemera sp.</i>		NP	VC	+																																
<i>Indobaetis sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Mnais sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
Odonate Larvae	--	NP	VC																																	
<i>Orthetrum sp.</i>	--	NP	VC	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+	
<i>Perla sp.</i>	--	NP	VC	+			+			+			+			+			+			+			+			+			+			+		
<i>Rhaphium sp.</i>	--	NP	VC																																	
<i>Tipulidae spp.</i>	--	NP	VC																																	
<b>Crustacea</b>																																				
<i>Caridina cantonensis</i>	廣東米蝦	NP	VC	++	++		++	++	+	++	++	+	++	++	+	++	++	+	++	++	+	++	++	+	++	++	+	++	++	+	++	++	+	++	++	
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	C	+		+				+			+			+			+			+			+			+			+			+		
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+		+			+			+			+			+			+			+			+			+			+		
No of Species				20	7	4	15	7	4	15	7	4	16	6	4	16	6	3	16	6	3	16	6	3	16	6	3	16	6	3	16	6	3	16	6	3

Note:  
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 "VC" - Very Common; "UC" - Uncommon; "C" - Common  
 "+" - Species exists in the study area  
 "++" - Species common in the study area  
 "+++" - Species abundance in the study area  
 - Reference point was the sampling location outside the works area used to compare the with the data within works area.

Table 4.6 Fish species and Hong Kong Newt recorded at Upper Tai Po River (T1- Upper stream sampling site and T2 - Lower stream sampling site )

Species	Status	Commonness	Baseline survey		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Post construction monitoring										
			Oct-07		Jan-09		Jul-09		Jan-10		Jul-10		Jan-11		Jul-11		Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Jan-14		Feb-14										
			T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2							
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																																						
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	++			+		+	+		+	++			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Glyptothorax pallozonum</i>	白線紋胸鮡	NP	R																																						
<i>Liniparhomaloptera disparis</i>	擬平鮫	NP	C																																						
<i>Misgurnus anguillicaudatus</i>	泥鮡	NP	C																																						
<i>Oreochromis niloticus</i>	尼羅口鯽非鯽	NP	C																																						
<i>Parazacco spilurus</i>	異鱸	V and	C	++																																					
<i>Poecililia reticulata</i>	孔雀花魚將	NP	C	++	+																																				
<i>Pseudobagrus trilineatus</i>	三線擬鱧	NP,GC	R																																						
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鮡	NP	C																																						
<i>Pterocryptis cochinchinensis</i>	越南隱鰮鮡	NP	C																																						
<i>Puntius semifasciolatus</i>	七星魚	NP	C																																						
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C																																						
<i>Schistura fasciolata</i>	橫紋南鮡	NP	C																																						
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	++																																					
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																																						
		2x2m fish		70	60	15	8	25	10	20	100	10	2	8	10	7	100	10	5	20	6	2	4	6	2	5	5	2	2	5	2	1	5	2	1	12	8	6	10	12	10
		No of Speices		10	2	7	3	2	7	4	4	7	5	5	7	9	7	8	5	3	11	2	7	10	3	5	8	2	2	9	2	1	9	4	1	9	4	3	8	5	4
<b>Amphibian</b>																																									
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC																																						

Note: NP – Not protected in Hong Kong; P - Protected in Hong Kong

“VC” – Very Common; “UC” – Uncommon; “C” - Common

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundance in the study area

V – Listed as vulnerable in China Fish Red Data Book

GC- Global Concern - Fellowes *et al* (2002)

- Reference point was the sampling location outside the works area used to compare with the data within works area.



Table 4.6 Fish species and Hong Kong Newt recorded at Upper Tai Po River (T1- Upper stream sampling site and T2 - Lower stream sampling site )

Species	Status	Commonness	Post construction monitoring																		Post construction 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									
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2										
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C																																										
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Glyptothorax pallozonum</i>	白線紋胸鮡	NP	R	+			+			+			+			+																													
<i>Liniparhomaloptera disparis</i>	擬平鰲	NP	C	+			+			+			+			+																													
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C	+																																									
<i>Oreochromis niloticus</i>	尼羅口非鯰	NP	C		+			+			+			+			+			+			+			+			+			+													
<i>Parazacco spilurus</i>	異鱧	V and	C	+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+	+		+											
<i>Poecilia reticulata</i>	孔雀花魚將	NP	C																																										
<i>Pseudobagrus trilineatus</i>	三線擬鱔	NP,GC	R	+			+			+			+			+			+			+			+			+																	
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰓	NP	C	+			+			+			+			+			+			+			+			+																	
<i>Pterocryptis cochinchinensis</i>	越南隱鰐	NP	C	+			+			+			+			+			+			+			+			+																	
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Schistura fasciolata</i>	橫紋南鰍	NP	C	+			+			+			+			+			+			+			+			+																	
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+			+			+			+			+			+			+			+			+																	
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																																										
		2x2m fish		40	15	20	12	4	2	10	4	2	8	4	2	10	5	2	15	7	6	20	10	5	35	15	10	45	20	5	50	15	5	45	20	5	45	20	5	45	20	5	45	20	5
		No of Speices		12	4	4	11	4	4	11	4	4	11	4	4	11	4	3	11	4	3	12	4	1	12	4	1	12	4	1	11	4	1	11	4	1	11	4	1	11	4	1	11	4	1
<b>Amphibian</b>																																													
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC	+			+			+			+			+			+			+			+			+																	

Note: NP – Not protected in Hong Kong; P - Protected in Hong Kong

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“+” – Species exists in the study area

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