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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**

**MONTHLY POST-CONSTRUCTION
ECOLOGICAL MONITORING REPORT
No. 19**

Prepared By:

ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:

Drainage Services Department

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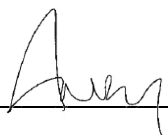
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**Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River
Improvement Work in Upper Lam Tsuen River, She Shan
River and Upper Tai Po River – Investigation**

**Post-Construction Ecological Monitoring Report (No. 19)
Upper Lam Tsuen River**

July 2015



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August 18, 2015

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August 18, 2015

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Post-Construction Ecological Monitoring Report (No. 19)

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 19 post-construction ecological monitoring report for the project conducted **on 22nd of July 2015**. 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 22nd of July 2015**.
- 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 higher than last month due to seasonality;
- Bird diversity and abundance was in natural fluctuation ; and
- Abundance of a target river fauna (i.e. *Paramesotriton hongkongensis* adult was recorded in low abundance along the Lam Tsuen River
- Heavy rain events caused a significant decrease in fish abundance and vegetation coverage along the river.

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) 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 behaviour were recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (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) and other literatures such as Dudgeon (1994).

3.5 Fish and Hong Kong 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 Hong Kong Newt was estimated and recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (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) 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 partially covered the riverbed along Lam Tsuen River. Lower density of vegetation was observed during current wet season since heavy rain events occurred which could wash away plants (Photos 1-3). In total, 65 flora species were recorded within the survey transects along the river course. Among those recorded flora, exotic species *Brachiaria mutica* was the dominated species recorded along the river (Photo 4). 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, 21 species of birds were recorded during the bird survey and 6 of the total were wetland dependent species including *Egretta garzetta*, *Ardea alba*, *Motacilla alba*, *Amaurornis phoenicurus*, *Ardeola bacchus* and *Motacilla cinerea*, they were commonly observed foraging in the river channel. Except one sampling point (T3) was dominated by *Pericrocotus flammeus* with high abundance (Photo 5), the rest sampling points were dominated by abundant *Pycnonotus jocosus*, these two species are both common species in Hong Kong. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of the recorded wetland dependent birds are classified as Regional Concern by Fellowes *et al* (2002), they were *Egretta garzetta*, *Ardea alba* (Photo 6) and *Ardeola bacchus*, which usually observed foraging in the river. A summer visitor *Dicrurus macrocercus* was observed staying above the tree (Photo 7). 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, 14 odonata species were recorded during the survey and all of recorded species were common species (Photos 8-11). The result obtained this month is similar to previous surveys conducted in approximate period of last year. Species richness slightly increased by 2 species in this month compared with last month. The period of conducting survey in this month was within the peak of emergence for most of the odonata species in Hong Kong, thus, higher abundance recorded was a natural phenomenon. Their emerging period will last for few months until late autumn (Wilson *et al*, 2004 & Tam *et al*, 2011). In addition, mating behavior of few species was observed. 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. *Pomacea canaliculata* was found abundant along the river (Photo 12). 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 Lam Tsuen River. Adult *Paramesotriton hongkongensis* was observed at the Lam Tsuen River where the habitat consisted of riparian vegetation during the survey (Photo 13).

During dry season, Hong Kong Newt were easily caught with high abundance within a short transect distance. More difficult of the Hong Kong Newt being caught during current wet season is because Hong Kong Newt normally breeds from September to March and much of the rest of the year is spent on land (Dudgeon, 2003). However, they were still could found near the potential habitats like riparian vegetation. Riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. It 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 (Photo 14). In total, 18 species of freshwater fish, including species recorded from reference site, were recorded. *Oreochromis niloticus* (Photo 15) 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 normally 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 were with low abundance assuming that heavy rain in current period leading to flooding which washed a proportion of fish out of the river. 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 July 2015 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. Mature individual of amphibian *Paramesotriton hongkongensis* were recorded low 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. Increased species richness of odonate and low abundance of fishes were observed in this month due to seasonality.

Aquatic and riparian vegetation along river channel was re-established. Vegetation has generally covered the gabion and partially covered the river bed along Upper Lam Tsuen River. As frequent flooding occurred in July which could wash out the vegetation on the river bed, vegetation coverage on the river bed decreased sharply along the 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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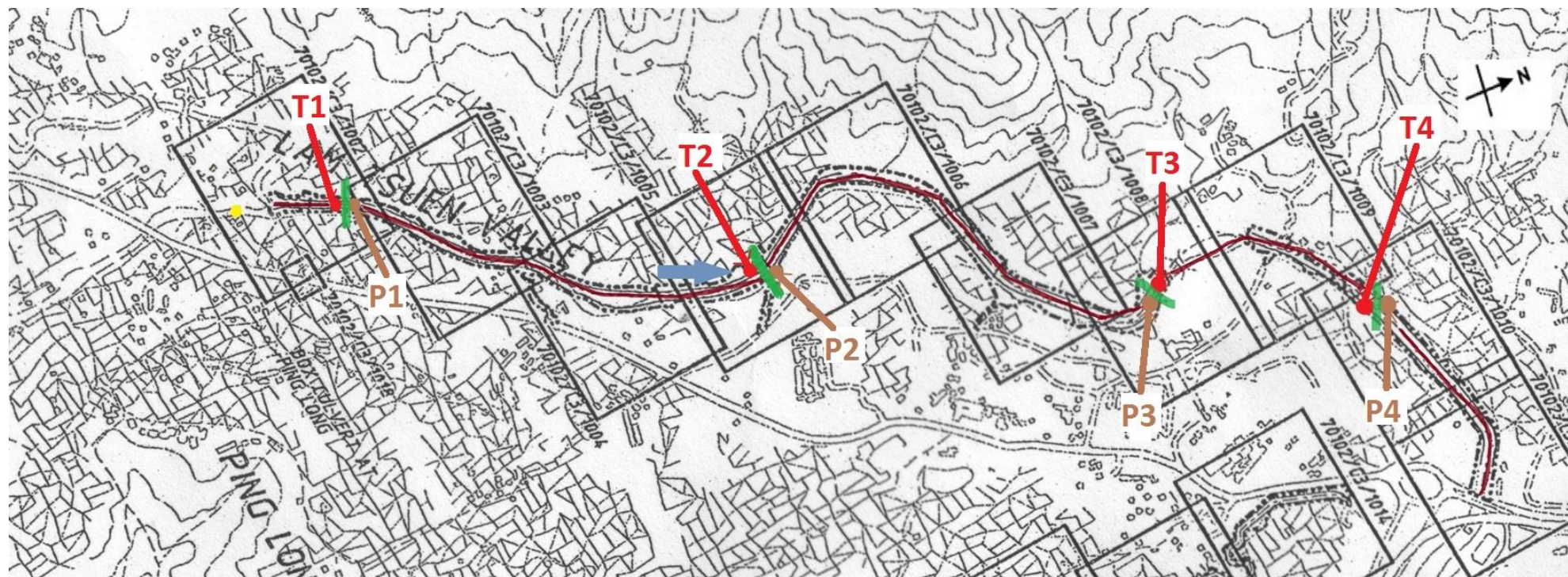
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FIGURES



Legend


	Belt transect -Vegetation -Sediment characteristics		Sampling station -Fish -Aquatic macroinvertebrate -Water quality and flow rate		Point count location -Avifauna
	Reference sample				Line transect -Avifauna -Adult Odonate -Vegetation

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: *Brachiaria mutica* dominated at river bed (Lower section)



Photo 5: Avifauna - *Pericrocotus flammeus*



Photo 6: Avifauna - *Ardea alba*



Photo 7: Avifauna - *Dicrurus macrocercus*



Photo 8: Odonata - *Crimson Dropwing*



Photo 9 : Odonata - *Neurobasis chinensis*

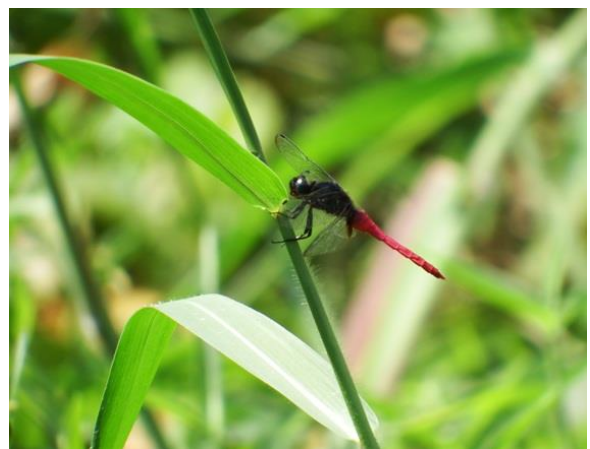


Photo 10: Odonata - *Orthetrum chrysis*



Photo 11 : Odonata - *Neurothemis fulvia*



Photo 12: Marco-Invertebrate - *Pomacea canaliculata*



Photo 13: Amphibian - *Paramesotriton hongkongensis*



Photo 14: Kick sampling for fish and macro-Invertebrate



Photo 15: Fish - *Oreochromis niloticus*



Photo 16: Aquatic samples shown fish and invertebrates collected in Lam Tsuen River.

TABLE

Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River (T1- Upper stream sampling site T4 - Lower stream sampling site)

Post-Construction Ecological Monitoring Report (No.19) - Upper Lam Tsuen River

Family	Species	Chinese name	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																															
			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																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.3	2					0.3	2					0.5	4					0.7	5					0.7	5																														
Fabaceae	<i>Pueraria lobata</i>	野葛			0.3	5			0.3	5					0.3	5					0.3	5					0.3	5											0.6	10																		
Poaceae	<i>Pennisetum purpureum</i>	象草																																																								
Araceae	<i>Alocasia odora</i>	海芋																																					1.8	1																		
Caesalpiniaceae	<i>Cassia alata</i>	翅英決明																																																								
Magnoliaceae	<i>Michelia alba</i>	白蘭																																																								
Poaceae	<i>Bracharia mutica</i>	巴拉草	0.5	5	0.6	6			0.6	6	0.5	5	0.6	8			0.6	10	0.8	10					0.6	10	0.8	12			0.8	8	0.6	10	0.8	12			0.8	8	1	10	1.5	15	1.3	30	1	5	1	10	1.5	15	1.3	30	1	5		
Moraceae	<i>Ficus hispida</i>	對葉榕																																																								
Asteraceae	<i>Mikania micrantha</i>	蕺甘菊		0.3	5	0.3	15			0.3	5					0.3	6	0.3	15	0.3	8					0.3	6	0.3	15	0.3	8			0.3	8	0.3	15	0.3	10	0.3	15	0.3	15	0.3	15	0.3	18	0.3	18	0.3	18	0.3	18					
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	0.5	20	0.5	10	0.7	15			0.6	10	0.5	20	0.5	10	0.5	20	0.5	12	0.7	18			0.6	10	0.5	20	0.6	12	0.7	15	0.6	10	0.5	20	0.6	12	0.7	15	0.6	10	0.5	20	0.6	12	0.7	10										
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																					2	5					2	5												
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>	錦娘菊																																																								
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.2	8			0.3	3			0.2	8			0.3	3			0.2	8			0.3	3			0.3	10			0.3	5			0.3	10			0.3	5			0.3	10	0.8	20			0.3	20	0.3	12	0.8	22			0.3	20
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>	馬纒丹																																																								
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																																																								
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜		0.2	2	0.2	2	0.2	1			0.2	2	0.2	2	0.2	1			0.3	1	0.3	1	0.3	1			0.3	1	0.3	2	0.3	1			0.3	2	0.1	1			0.3	2	0.1	1													
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香																																					2	30	2	15	2	10	1.8	5	2	25	2	13	2	10	1.8	5				
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																																								
Amaranthaceae	<i>Celosia argentea</i>	青葙																																					1.5	15					1.5	15												
Bare Gound				65		77		60		73		65		74		60		70		58		71		58		70		55		69		59		68		55		67		58		66		25		23		18		43		25		20		15		40

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

Table 4.2. Flora species recorded from belt transect survey at the Upper Lam Tsuen River (T1- Upper stream sampling site T4 - Lower stream sampling site)

Post-Construction Ecological Monitoring Report (No.19) - Upper Lam Tsuen River

Family	Species	Chinese name	Post construction monitoring								Post construction monitoring								Post construction monitoring							
			May-15				Jun-15				Jul-15															
			T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4	
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	5							0.3	5	0.5	10					0.4	5	
Poaceae	<i>Pennisetum purpureum</i>	象草					2	15							2	15										
Araceae	<i>Alocasia odora</i>	海芋						0.8	1							0.8	1									
Caesalpiniaceae	<i>Cassia alata</i>	翅英決明																								
Magnoliaceae	<i>Michelia alba</i>	白蘭																								
Poaceae	<i>Brachiaria mutica</i>	巴拉草	0.9	15	1	18	0.8	20	1	10	0.9	15	1	18	0.8	20	1	10	0.9	30	1.5	30	0.5	70	1	15
Moraceae	<i>Ficus hispida</i>	對葉榕																								
Asteraceae	<i>Mikania micrantha</i>	撒甘菊	0.3	5	0.4	10	0.3	5	0.3	10	0.3	5	0.4	10	0.3	5	0.3	10	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>	大漂																								
Urticaceae	<i>Boehmeria nivea</i>	芋麻																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.8	5	0.7	10	0.8	15			0.8	5	0.7	10	0.8	15							0.3	5		
Poaceae	<i>Coix lacryma-jobi</i>	蒺藜																								
Solanaceae	<i>Solanum nigrum</i>	龍葵																								
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草																					0.6	2		
Poaceae	<i>Miscanthus floridulus</i>	五節芒																								
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																								
Asteraceae	<i>Wedelia chinensis</i>	錦麒麟																0.3	20	0.2	10					
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.5	5	0.4	10		0.3	10	0.5	5	0.4	10		0.3	10	0.3	20	0.2	20	0.2	5	0.4	20		
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>	馬纒丹																								
Mimosaceae	<i>Leucaena leucocephala</i>	銀合歡																								
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																								
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香	1.2	10	1.1	5	1.4	5	1.3	5	1.2	10	1.1	5	1.4	5	1.3	5								
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																					0.5	5	2	5
Amaranthaceae	<i>Celosia argentea</i>	青葙																								
Bare Gound				60		47		40		59		60		47		40		59		15		35		13		55

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

Table 4.3 Avifauna recorded along survey transects and at four selected point count locations of Lam Tsuen River.

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

Common Name	Species name	Chinese name	Status	Commonness	Impact monitoring					Impact monitoring					Impact monitoring					Impact monitoring					Impact monitoring					Post construction monitoring					Post construction monitoring														
					Jan-11					Jul-11					Jan-12					Jul-12					Aug-13					Dec-13					Jan-14					Feb-14									
					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance									
					C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4					
Barn Swallow	<i>Hirundo rustica</i>	家燕	PM	C																+++	3	4	3	2	+																				+				
Black Drongo	<i>Dicrurus macrocerus</i>	黑卷尾	Sv	C																																													
Black Kite	<i>Milvus lineatus</i>	鷹	R, RC, Cap.586	C	+										+																														+				
Black-faced bunting	<i>Emberiza spodocephala</i>	灰頭鵯	WV&PM	C																																													
Black-necked Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	R	C	+2		1			+			1		+	1			2	++			3		++	1			2	++		2	3	2	++		2	2	1	++		2	2	1	++		2	2	3
Black-winged Cuckoo-shrike	<i>Corucina melaschistos</i>	暗灰鶇鶇	PM	C																																													
Buzzard (Common Buzzard)	<i>Buteo buteo</i>	普通鵟	WV, Cap.586	C	+																																												
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鵯	R	C	+5		2	2		3	+		1	3	1	+	2		2	1	++	2	1	4	2	++	2	1	1	++	3	3	2	1	+	1		2	3	+	3	1	2	2					
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鶯	R, RC	C	+1					+			1	1	+				1		+	1	1		+		1	1	++	2	3	2	1	++	1	2	4	3	++		1	2	1	2					
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	R	C	+1										+						+																	1						1					
Common Koel	<i>Eudynamys scolopacea</i>	噪鶇	R	C	+										+			4	+						+					+					+					+	1								
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鶯	WV&PM	C	+2		1								+						+				+					+		2	2		+	1	2			+				2					
Common Tailorbird	<i>Orthotomus sutorius</i>	長尾縫葉鶯	R	C	+2		1			1	+	1		2	1	+			1	+		1	1	1		+	1			+	1	1	1	++	2	1	3	2	++	1	1	3	2	++	1	1	2	1	
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鵯	R	C	+3		2	1		2	+	3	1	3	1	+	1		1	2	+++	5	2	4	2	+++	4	2	2	3	+++	5	4	5	3	+++	6	5	4	5	+++	4	3	3	4				
Crested Goshawk	<i>Accipiter trivirgatus</i>	鳳頭鷹	R, CR, Cap.586	R	+					4															+																								
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	R	C	+3		2	1		+		1	2		+		2				++		5	2	++	1	3	3		++	1	2	3	2	++		3	2	3	++		2	4	2					
Crested Serpent Eagle	<i>Spilornis cheela</i>	蛇鵟	R, VU, LC	R	+																																												
Daurian redstart	<i>Phoenicurus aureoreus</i>	北紅尾鶇	WV	U																													1	1					+	1			1						
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C																					+					+					+					+									
Dusky Warbler	<i>Phylloscopus fuscatus</i>	褐柳鶯	WV	U																																				+	1								
Eurasian tree sparrow	<i>Passer montanus</i>	麻雀	R	C	+					+			3	2	+						+++	4	5	3	2	++			2	++					+					+									
Great Coucal	<i>Centropus sinensis</i>	褐翅鴉鶇	R, VU	C	+					+					++	6			3	+					+					+			1	1	+				+	1	1								
Great Tit	<i>Parus major(commixtus)</i>	大山雀	R	C																																				+				2					
Green Sandpiper	<i>Tringa ochropus</i>	白腹草鶯	PM&WV	U																																				+				2					
Grey Heron	<i>Ardea cinerea</i>	蒼鶯	WV, PRC	C																					+					+					+					+									
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶯	WV	C	+2		1	1							+		1	2	1											++	1	3	3	2	++	2	2	4	1	++	2	1	2	2					
Japanese White Eye	<i>Zosterops japonicus(simplex)</i>	綠繡眼鳥	R	C	+4		2	1		+	5	2	3		+	1	1	2	1	+++	4		3		+++	4		3	2	+++	6	4	6	3	+++	4	3	3	5	+++	5			4					
Jungle Crow	<i>Corvus macrorhynchos</i>	大黑鳥	R	C																																				+									
Large Hawk Cuckoo	<i>Cuculus sparveroides</i>	鷹鶇	SV	U																																													
Lesser Coucal	<i>Centropus bengalensis</i>	小鴉鶇	R, VU	C																	+																												
Little Egret	<i>Egretta garzetta</i>	小白鶯	R, RC	C	+1		1			1	+										+						1	1		+	1	2	1	2	+	1	2	3	2	+	2	2	3	3					
Great Egret	<i>Ardea alba</i>	大白鶯	R, WV, RC	C																																													
Little Swift	<i>Apus affinis</i>	小白腰雨燕	R, SpM	C																																								2					
Maggie	<i>Pica pica</i>	喜鵲	R	C	+					+											1									+					+					+									
Maggie Robin	<i>Copsychus saularis</i>	鶇鶇	R	C	+1		1			1	+	2	1	2	1	+	2	3	1	2	++	3	2	3	2	++	1	1	1	++	1	1	1	2	++	2	1	3	1	++	1	2	1	2					
Mandarin Duck	<i>Aix galericulata</i>	鴛鴦	WV	U																																													
Masked Laughing Thrush	<i>Garrulus perspicillatus</i>	黑臉噪鶇	R	C																																								3					
Northern Shoveler	<i>Anas clypeata</i>	琵鷺	WV	C																																													
Olive Backed Pipit	<i>Anthus hodgsoni</i>	樹鶇	WV	C	+										+	1	1								+					++		3	2	3	++	2	1		2	+				1					
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鵑	SV	C																																													
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	紅咀藍鶇	R	C																																													
Red-flanked Bluetail	<i>Tarsiger cyanurus</i>	紅脇藍尾鶇	PM&WV	C																																								1					
Rufous Turtle Dove	<i>Streptopelia orientalis</i>	山斑鶇	R	C																																													
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C	+					+											+																												
Rufous-capped Babbler	<i>Stachyridopsis ruficeps</i>	紅頭穗鶇	R	C																																													
Scarlet Minivet	<i>Pericrocotus flammeus</i>	赤紅山椒鳥	R	C																																													
Siberian Stonechat	<i>Saxicola maurus</i>	黑喉石鶇	WV	U																																													
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅鵯	R	C						+	1										+			1																									

Table 4.3 Avifauna recorded along survey transects and at four selected point count locations of Lam Tsuen River.

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

Post-Construction Ecological Monitoring Report (No.19)				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		Post construction monitoring		Post construction monitoring											
Common Name	Species name	Chinese name	Status	Commonness	Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15										
					Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance										
					C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4
Barn Swallow	<i>Hirundo rustica</i>	家燕	PM	C																																			
Black Drongo	<i>Dicrurus macrocerus</i>	黑卷尾	Sv	C																																			
Black Kite	<i>Milvus lineatus</i>	鷹	R, RC, Cap.586	C	+					+					+					+																			
Black-faced bunting	<i>Emberiza spodocephala</i>	灰頭鵲	WV&PM	C																																			
Black-necked Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	R	C	++	2		2		++			3	2	++	2			2	+		2		2	++			3	2	++	2			1	2	++	2	2	2
Black-winged Cuckoo-shrike	<i>Corucina melaschistos</i>	暗灰鶇鶇	PM	C																																			
Buzzard (Common Buzzard)	<i>Buteo buteo</i>	普通鵟	WV, Cap.586	C																																			
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鸚	R	C	++	2		3	1	+	1		1		++	2			2	++	2			2	++	2	2	2		++		1	3	2	++		2	1	2
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鶯	R, RC	C	+	2	2		1	+	2	1	2		+	2	1	2	1	+				1	+				1	+	1				+	1			
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	R	C	+		1			+					+		1			+	1				+	1				+	1								
Common Koel	<i>Eudynamys scolopacea</i>	噪鶇	R	C						+	1				+																								
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鶯	WV&PM	C	+					+					+					+					+					+					+				
Common Tailorbird	<i>Orthotomus sutorius</i>	長尾縫葉鶯	R	C	++	1		1		+	1		1	1	+	1			1	+	2			1	+	2			2	+	1			2	++	2			2
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鸚	R	C	+++	3	2	3		+++	2	2	4		+++	2	4			+++	4	3	5	2	+++	5	2	5	2	+++	5	3	5	4	+++	8	3	3	5
Crested Goshawk	<i>Accipiter trivirgatus</i>	鳳頭鷹	R, CR, Cap.586	R																																			
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	R	C	++		3	4	2	++		4	3		++		2	3	2	+++	3	4	2	3	+++	3	4	2	3	++	2	3	2	2	++	3	2	3	3
Crested Serpent Eagle	<i>Spilornis cheela</i>	蛇鵟	R, VU, LC	R																																			
Daurian redstart	<i>Phoenicurus auroreus</i>	北紅尾鶇	WV	U	+	1				+		1																											
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C	+					+					+					+					+					+					+				
Dusky Warbler	<i>Phylloscopus fuscatus</i>	褐柳鶯	WV	U	+		1			+		1	1		+		1			+		1	1		+		1	1		+		1	1		+		1	1	
Eurasian tree sparrow	<i>Passer montanus</i>	麻雀	R	C	+++		3	2	1	++		2		1	++		2		1	++		2		1	++		2		1	++		2		1	++		2		1
Great Coucal	<i>Centropus sinensis</i>	褐翅鴉鶇	R, VU	C	+					+					+					+					+					+					+				
Great Tit	<i>Parus major(commixtus)</i>	大山雀	R	C	+															+	2				+	2				+	2								
Green Sandpiper	<i>Tringa ochropus</i>	白腹草鶯	PM&WV	U	+					+					+					+					+					+					+				
Grey Heron	<i>Ardea cinerea</i>	蒼鶯	WV, PRC	C																																			
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶯	WV	C	+	1	1	1		++	1	2	2	2	++	1		1	2	+		1	1	2	++		1	1	2	++		1	1	1	+		1	1	
Japanese White Eye	<i>Zosterops japonica(simplex)</i>	暗綠繡眼鳥	R	C	++	3		3		++	3		4		++			4	3	++			3	3	++		3	1	3	++	3	3	2	3	++	3	3	2	5
Jungle Crow	<i>Corvus macrorhynchos</i>	大咀烏鶇	R	C																																			
Large Hawk Cuckoo	<i>Cuculus sparveroides</i>	鷹鶇	SV	U											+					+			1	1	+			1	1	+					+				
Lesser Coucal	<i>Centropus bengalensis</i>	小鴉鶇	R, VU	C																																			
Little Egret	<i>Egretta garzetta</i>	小白鶯	R, RC	C	++	1	2	3	2	+	1	1	3	2	+	1	2	3	2	+	2	1			+	2	1			+	1	1	1		+	1	1	1	
Great Egret	<i>Ardea alba</i>	大白鶯	R, WV, RC	C											+		1			+		1			+		1			+	1				+	1			
Little Swift	<i>Apus affinis</i>	小白腰雨燕	R, SpM	C						+	1		2		+			2																					
Maggie	<i>Pica pica</i>	喜鶯	R	C																																			
Maggie Robin	<i>Copsychus saularis</i>	鶇鶇	R	C	++	1	1	2	2	++	1	1	2	1	++	1	1	2	++	2		1	2	++	1	1	1	2	++	2			2	++	2	1	1	2	
Mandarin Duck	<i>Aix galericulata</i>	鶇鶇	WV	U																																			
Masked Laughing Thrush	<i>Garrulax perspicillatus</i>	黑臉鳴鶇	R	C	++	2				+			3		++					++		2			++		2			++	2				++				3
Northern Shoveler	<i>Anas clypeata</i>	琵嘴鴨	WV	C																																			
Olive Backed Pipit	<i>Anthus hodgsoni</i>	樹鶇	WV	C	+			1																															
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鵑	SV	C											+																								
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	紅咀藍鶇	R	C																																			
Red-flanked Bluetail	<i>Tarsiger cyanurus</i>	紅脇藍尾鶇	PM&WV	C																																			
Rufous Turtle Dove	<i>Streptopelia orientalis</i>	山斑鶇	R	C																																			
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C	+		1		1	+					+					+		1			+					+					+				
Rufous-capped Babbler	<i>Stachyridopsis ruficeps</i>	紅頭穗鶇	R	C	++					++					+					+					+					+					+				
Scarlet Minivet	<i>Pericrocotus flammeus</i>	赤紅山椒鳥	R	C											+																				++				12
Siberian Stonechat	<i>Saxicola maurus</i>	黑喉石鶇	WV	U	++		1	1		+		1			++		1	1																					
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅鸚	R	C																																			
Spotted Dove	<i>Streptopelia chinensis</i>	珠頸斑鶇	R	C	+++	2	3	5	2	++	3	2	4	3	++	2	3	2	2	++	4	2	3	2	++	3	3	3	2	++	1	2	2	2	++	2	2	2	4
Spotted Munia	<i>Lonchura punctulata</i>	斑文鳥	R	U	++	5		8		+					+					+			2		+					+					+				
Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	絨鵲	R	U											+					+			1		+			1		+					+				
White Wagtail	<i>Motacilla alba</i>	白鶯	WV	C	++	1	2	3	2	+	1	1	2		++	2	1	2	2	+	1	2	1	2	++	1	1	1	2	++		2	2		++		2		2
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	白胸苦惡鳥	R	C	+					+	</																												

Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River (T1 - upper river channel sampling site . T4 - lower river channel sampling site)

Post-Construction Ecological Mo	Chinese name	Sampling point	Baseline monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring																						
			Jul-08	Aug-08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Aug-13	Dec-13																																											
		Status	Com	Upper stream	Lower stream	Upper stream	Lower stream	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															
Molluscs																																																									
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+																																																		
<i>Brotia hainanensis</i>	--	NP	VC	+++	++	++	++	+	+	+	+	+	+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++																
<i>Melanoides tuberculata</i>	增城黑螺	NP	VC	+		+																																																			
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+																	
<i>Radix plicatulus</i>	羅白螺	NP	VC	+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+																	
<i>Sinotia quadrata</i>	田螺	NP	VC	+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+																	
Insects																																																									
<i>Baetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																	
<i>Caenis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																	
<i>Chironomus sp.</i>	蠓幼虫	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	+	+								+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																	
Crustaceans																																																									
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																	
<i>Cryptopotamon anacoluthon</i>	鯉刺溞	NP	VC	+		+																																																			
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+																	
<i>Somanniathelphusa zanklon</i>	束腰蟹	NP	VC	+		+																																																			
No. of species				9	12	10	11	10	11	3	2	9	10	3	3	2	9	12	5	3	2	7	12	5	4	2	7	15	13	11	13	15	16	4	1	1	2	17	9	6	5	0	15	10	8	5	1	16	12	11	7	3	15	11	9	8	7

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
 "*" - including target species of *Rhinogobius cervicosquamus*
 Reference point was the sampling location outside the works area.

Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River (T1 - upper river channel sampling site . T4 - lower river channel sampling site)

Post-Construction Ecological Mo	Chinese name	Sampling point	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring																						
			Nov-14				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15														
		Status	Com mon	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4	Referenc e point	T1	T2	T3	T4						
Molluscs																																																	
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Brotia hainanensis</i>	--	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++							
<i>Melanoides tuberculata</i>	縮螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Pomacea canaliculata</i>	福寿螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Radix plicatulus</i>	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
Insects																																																	
<i>Baetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Caenis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Chironomus sp.</i>	蠅幼虫	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	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
Crustaceans																																																	
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC	+	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++							
<i>Cryptopotamon anacoluthon</i>	鯉刺溪蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Macrobrachium hainanense</i>	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
<i>Somanniathelphusa zanklon</i>	束腰蟹	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+								
No. of species					13	14	15	14	12	13	12	12	13	11	13	11	11	13	12	11	12	12	11	11	11	13	13	12	12	11	9	12	15	12	11	9	11	13	12	11	9	11	13	12	11	9	11	13	12

Note: NP – Not protected in Hong Kong; P - Protected in Hong
“VC” – Very Common; “UC” – Uncommon; “C” - Common; “I
+, occurred; ++, common; +++, abundant/dominant Species in
“*” - including target species of *Rhinogobius cervicosquamus*
Reference point was the sampling location outside the works are

Table 4.6 Fish species and amphibians at Upper Lam Tsuen River upper river channel sampling site . T4 - lower river channel sam site)

Post-Construction Ecological Monitoring Report (No.19) - Upper Lam Tsuen River				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring															
				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15											
Species	Chinese name	Status	Commonness	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 parallens</i>	側條光唇魚	P, PGC	R		++	++	++	++		++	++	++	++		++	++	++	++		++	++	++	++		+	+	++	++		+	+	++	++		+	+	+	+					
<i>Channa maculate</i>	斑鱧	NP	C																																								
<i>Cirrhina molitorella</i>	鯪魚	NP	C																																								
<i>Clarias fuscus</i>	胡子鯪	NP	C					+					+					+																									
<i>Cyprinus carpio var. viridivulaceus</i>	錦鯉	NP	C																																								
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Liniparomaloptera disparis</i>	擬平鰈	NP	C	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+						
<i>Misgurnus anguillicaudatus</i>	泥鰌	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+					
<i>Parazacco spilurus</i>	異鱾	V and	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+					
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC		+	+							+					+																									
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰈	NP	C	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+																		
<i>Pterocryptis cochinchinensis</i>	黃鯪	NP	C	+	+	+			+		+			+	+	+	+		+	+	+	+		+																			
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+				
<i>Rhinogobius spp.</i>	鰕虎魚	NP	C/UN/R	+	++	++	++	+	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	++	++	++	++	++	++				
<i>Schistura fasciolata</i>	橫紋南鰈	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 counting		No. of fish		60	60	60	50	50	50	60	60	60	50	60	60	60	40	50	60	60	60	40	40	50	55	50	40	20	30	30	20	20	20	30	30	20	20	12	15	18	8	7	
No. of species				11	13	14	14	11	10	11	12	13	10	10	11	12	14	10	10	13	13	14	11	13	12	14	15	11	13	12	14	12	13	12	13	13	13	12	12	12	13	13	12
Amphibian																																											
<i>Paramotriton 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		

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 it
 Cap 170 - List in Wild Animals Protection Ordinance (Cap.170)
 NT - Near Threatened in IUCN Red List Status
 PGC-Potential Global Concerns by Fellowes *et al* (2002)

Table 4.7 Abiotic data for Upper Lam Tsuen River(T1- upper river channel sampling site . T4 - lower river channel sampling site)

Post-Construction Ecological Monit	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
	8-Aug	Jan-09				Jul-09				Jan-10				Jul-10				Jan-11			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Replicate																					
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
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
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
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
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
Conductivity (µS/cm)	60	80	100	120	120	45	51	52	63	62	96	98	114	84	100	460	54	90	87	93	120
BOD (mg/L)	<2	<2	<2	<2	3	<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			
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			
Sand (%)	15	15	10	10	10	10	10	10	15	8	8	8	15	8	8	8	15	8	8	8	15
Stone (%)	80	80	88	88	88	88	88	88	70	90	90	90	70	90	90	90	70	90	90	90	70
Mud (%)	5	5	2	2	2	2	2	2	2	5	2	2	2	5	2	2	5	2	2	2	5

Table 4.7 Abiotic data for Upper Lam Tsuen River(T1- upper river channel sampling site . T4 - lower river channel sampling site)

Post-Construction Ecological Monit	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring								
	8-Aug	Jul-11				Jan-12				Jul-12				Aug-13				Dec-13				Jan-14				Feb-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	
Replicate																														
DO (mg/L)	9.2	9.5	9.6	9.4	9.3	9.4	9.2	9.4	9.2	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	9.1	9.0	8.6	8.5	7.8	8.7	9.8	9.8
pH	7.49	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	6.2	6.9	7.1	7.1	8.2	8.5	8	7.8	
Nitrate (mg N/L)	0.36	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	0.9	0.8	1.3	1.26	1.3	1.8	1.6	2.1	
Ammonia (mg/L)	<0.01	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	0.04	0.1	0.12	0.15	0.05	0.04	0.1	0.12	
Salinity (ppt)	<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	
Conductivity (µS/cm)	60	93	90	90	100	92	84	96	110	41	38	73	86	67	77	74	75	62	64	90	110	72	78	88	108	78	87	118	119	
BOD (mg/L)	<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								
Water flow at riffle (m/s)	0.4-0.7	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	8	8	8	15	10	15	10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5	5	5	
Stone (%)	80	90	90	90	70	80	70	80	70	60	60	60	60	75	75	75	75	90	85	85	85	90	85	85	85	90	85	85	85	
Mud (%)	5	2	2	2	5	10	15	10	20	30	30	30	30	15	15	15	15	5	10	10	10	5	10	10	10	5	10	10	10	

Table 4.7 Abiotic data for Upper Lam Tsuen River(T1- upper river channel sampling site . T4 - lower river channel sampling site)

Post-Construction Ecological Monit	Baseline 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											
	8-Aug	Mar-14				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14							
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	T1	T2	T3	T4
DO (mg/L)	9.2	7.5	7.8	8.2	8.1	7.7	7.6	7.8	8.0	8.2	7.8	8.1	8.2	7.6	7.8	7.4	7.2	8.2	7.6	7.2	7.5	7.6	7.4	7.3	7.6	8.7	8.7	8.4	8.6	7.2	7.3	8.1	7.6	7.3	7.3	8.2	7.8				
pH	7.49	8.3	8.2	7.6	7.2	7.6	7.8	8.2	7.8	7.7	7.8	7.9	8.2	7.6	7.8	7.8	8.1	7.6	7.7	7.8	8	7.8	7.5	7.6	7.8	8.4	8.1	8.4	8.0	8.4	8.2	8.1	8.0	8.1	8.3	8.1	8.3				
Nitrate (mg N/L)	0.36	1.2	1.4	1.1	1.3	1.5	1.5	1.3	1.2	0.9	0.7	0.6	0.7	0.8	0.8	0.9	0.9	0.8	1.1	1.1	0.8	1.2	1.1	0.9	1.1	1.2	1.3	1.2	1.2	0.9	1	0.9	1	1	1	1	0.9				
Ammonia (mg/L)	<0.01	0.06	0.04	0.04	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	<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				
Salinity (ppt)	<0.1	0	0	0	0	0	0	0	0	0.02	0.02	0.03	0.03	0.01	0.02	0.03	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01				
Conductivity (µS/cm)	60	120	123	125	123	96	114	120	122	82	80	72	66	39	58	69	70	82	43	85	72	75	75	78	82	86	73	77	74	72	47	50	80	88	52	56	82				
BOD (mg/L)	<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	<2				
Water flow at pool (m/s)	0.1-0.3	0.01-0.2				0.01-0.2				0.01-0.2				0.03-0.2				0.03-0.2				0.03-0.2				0.03-0.2				0.03-0.2				0.03-0.2							
Water flow at riffle (m/s)	0.4-0.7	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				0.2-0.6				0.2-0.6							
Sand (%)	15	5	5	5	5	5	5	5	10	5	5	5	10	5	5	5	10	5	5	5	10	5	5	8	10	5	5	8	10	5	5	8	10	5	5	8	10				
Stone (%)	80	90	85	85	80	90	85	85	75	90	85	85	75	93	90	90	75	93	90	90	75	93	90	90	75	93	90	90	75	93	90	90	75	93	90	90	75				
Mud (%)	5	5	10	10	15	5	10	10	15	5	10	10	15	2	5	5	15	2	5	5	15	2	5	2	15	2	5	2	15	2	5	2	15	2	5	2	15	2	5	2	15

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.19)
She Shan River

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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.19) She Shan River

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Photo 5: Abundant species: *Brachiaria mutica* (Middle section).

Photo 6 : Odonata - *Neurothemis fulvia*

Photo 7: Odonata - *Trithemis aurora* (Left); *Ictinogomphus pertinax* (Right)

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Photo 9: Odonata - *Ictinogomphus pertinax* (Mating behavior)

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TABLE

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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 19 post-construction ecological monitoring report for the project conducted **on 23rd of July 2015**. 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 23rd of July 2015**;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Heavy rain events occurred in July, affecting the coverage of vegetation and abundance of fish in the river.
- Bird diversity and abundance was in natural fluctuation; and
- Odonata abundance was similar to last month. *Paramesotriton hongkongensis* could not be found during the survey due to seasonality.

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 AFCDC website (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 behaviour were recorded. Nomenclature and protection status of the species has followed those documented in the AFCDC website (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 AFCDC website (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. And the 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.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 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, 59 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 1.5m 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 and partially covered of the riverbed in middle to lower section. Lower vegetation coverage at lower section was observed when comparing with dry season (Photos 1-3) as heavy rain was frequently recorded in July that led to occur flooding. As river bed in She Shan River was mainly concrete, most of the plants were easily washed out to lower river section. However, dense vegetation on the river bed and gabion was recorded in the upper section of the river (Photo 4). Aquatic plants *Brachiaria muticawas* the most abundant plants found along the river channel (Photo 5). 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, 19 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 *Ardeola bacchus*, *Egretta garzetta*, *Actitis hypoleucos*, *Motacilla alba* and *Motacilla cinerea*. 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 including *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes et al (2002), they were always found foraging in the river. Except foraging behaviour of some wetland dependent 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**. Although similar result was obtained as last month, the abundance of odonata was still high due to current wet season, in which provided the most favorable condition such as increased temperature for most species of odonata in Hong Kong to emerge, their emerging period will last for few months until late autumn (Wilson *et al*, 2003 & Tam *et al* (2011). In total of 13 species were recorded, those recorded species were common species in Hong Kong (Photos 6-9) and the result was similar to approximate period of last year. Mating behavior was observed (Photo 10). Sampling location was shown on **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Survey of aquatic macro-invertebrates was carried out. 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. No Hong Kong Newt was captured in this month. It is assumed that the disappearance of Hong Kong Newt in the river is mainly related to seasonality. As it normally breeds from September to March and much of the rest of the year is spent on land (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 (Photos 10) and total 13 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 density of fish recorded was similar to last month with a bit of decrease assuming that flooding was one of the reasonable explanation which dispersing part of the fish out of the river. 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 moderate as a result of effluent from nearby cultivation lands, but the impact from the effluent is anticipated. 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 not recorded due to seasonality. Mating behavior and high abundance of odonata were observed. The rest of fauna was in a natural fluctuation except slight decrease in fish abundance was observed.

Aquatic plants and riparian vegetation were generally established at new drainage channel. Vegetation has completely covered the gabion wall mainly in upper sections River and partially covered the river bed along the river channel. Vegetation coverage of the river bed decreased averagely in entire river due to frequent flooding event in July.

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

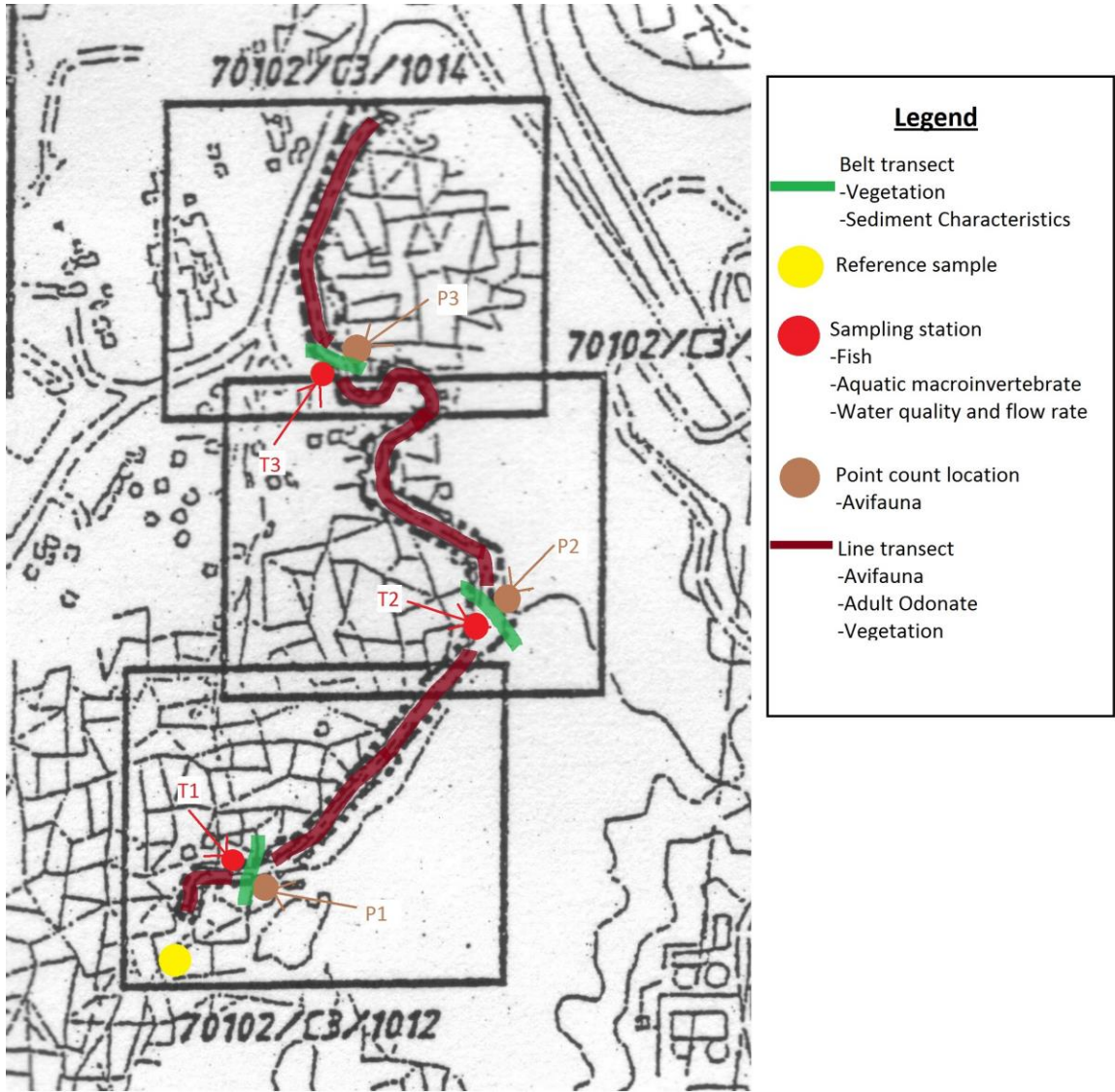


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

PHOTOS



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



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



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



Photo 4: Vegetation coverage of gabion and river bed in upper section.



Photo 5: Abundant species: *Brachiaria mutica* (Middle section).



Photo 6 : Odonata - *Neurothemis fulvia*



Photo 7: Odonata - *Trithemis aurora* (Left);
Ictinogomphus pertinax (Right)



Photo 8: Odonata : *Orthetrum chrysis*



Photo 9: Odonata - *Ictinogomphus pertinax*
(Mating behavior)



Photo 10: Aquatic samples collected from
kick sampling

TABLE

Table 4.2. Flora species recorded from belt transect survey at the She Sha
(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												
			Apr-14		May-14		Jun-14		Jul-14		Aug-14		Sep-14		Oct-14		Post																												
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2																				
Comelinaceae	<i>Commelina diffusa</i>	節節草		0.5	30				0.5	20				0.5	25				0.5	25				0.5	25				1	10	1	50	0.1	2		1	10								
Poaceae	<i>Panicum repens</i>	枯骨草																																											
Asteraceae	<i>Mikania micrantha</i>	蕺甘菊	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	2	0.3	12	0.3	12	0.3	5	0.3	12	0.3	12	0.3	5	0.3	5	1	15	0.3	2	0.3	5					
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜	0.3	20			0.3	5	0.3	5			0.3	5	0.3	5	0.3	2			0.3	2	0.3	1			0.3	1	0.3	1															
Moraceae	<i>Ficus microcarpa</i>	細葉榕																																											
Moraceae	<i>Ficus hispida</i>	封葉榕																																											
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>	芋麻																																											
Asteraceae	<i>Bidens alba</i>	白花鬼針草		0.3	5	0.8	1		0.3	5	0.8	1		0.3	5	0.8	2			0.3	5	0.8	5			0.5	5	0.8	5	1	2	0.5	5	0.8	10	1	2								
Poaceae	<i>Pennisetum purpureum</i>	象草																																											
Poaceae	<i>Coix lacryma-jobi</i>	薏苡				0.8	1				0.8	1				0.8	1						1.2	1				1.5	1				1.5	1											
Amaranthaceae	<i>Alemanthera phloxeroides</i>	空心蓮子草																																											
Poaceae	<i>Panicum maximum</i>	大黍																																											
Moraceae	<i>Broussonetia papyrifera</i>	構樹																																											
Polygonaceae	<i>Polygonum chinense</i>	火炭母																																											
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																																											
Cyperaceae	<i>Cyperus sp.</i>	莎草																																											
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																											
Poaceae	<i>Brachiaria mutica</i>	巴拉草	1.5	50	1	50		1.5	40	1	40		1.5	45	1	45		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					
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																											
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草	2	20				2	15				2	15				2	12				2	10			2	10				2	15	3	5			2	10						
Araceae	<i>Alocasia macrorrhizos</i>	海芋				0.8	1			0.8	1					0.8	1					0.8	1				0.8	1																	
Lemnaceae	<i>Lemna minor</i>	浮萍				N.A.	5			N.A.	5					N.A.	1					N.A.	1				N.A.	1																	
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																																											
Cyperaceae	<i>Cyperus involucratus</i>	風車草																																											
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香				1	2			1	2					1	4					1	6				1	6	1.5	1					2	5	1.5	1							
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																											
Bare Ground			0		5		84		30		25		84		25		15		84		31		15		87		27		8		80		27		8		80		2		0		75		2

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

Table 4.3 Avifauna recorded along survey transects and at three selected point count locations at She Shan River.

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

Common Name	Species name	Chinese name	Status	Commonness	Nov-14				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15			
					Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance							
					C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Barn Swallow	<i>Hirundo rustica</i>	家燕	PM	C																																				
Black Drongo	<i>Dicrurus macrocerus</i>	黑卷尾	Sv	C																																				
Black Kite	<i>Milvus lineatus</i>	黑鷹	R, RC, Cap.5 86	C	+			+																																
Black-necked Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	R	C	+		2	+	2																															
Black-throated Laughingthrush	<i>Garrulax chinensis</i>	黑喉噪鵲	R	C																																				
Buzzard (Common Buzzard)	<i>Buteo buteo</i>	普通鵟	WV, Cap	U																																				
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鵲	R	C	+	1		3	+		2	2																												
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鷺	R,RC	C	++	1			+		1																													
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥	R	C	+																																			
Common Koel	<i>Eudynamis scolopacea</i>	噪鵲	R	C	+																																			
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鵲	WV& PM	C																																				
Common Tailorbird	<i>Orithotomus utrorius</i>	長尾縫葉鶯	R	C	+		1		++	1	1																													
Crested bulbul	<i>Pycnonotus jocosus</i>	紅耳鵲	R	C	++	2	1	3	+++	2	3	2	+++	3	2	4	+++	2	2	4	+++	3	1	4	+++	3	2	3	+++	4	3	3	+++	5	4	4	+++	5	5	7
Crested Goshawk	<i>Accipiter trivirgatus</i>	鳳頭鷹	R, CR, Cap.5	R																																				
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	R	C	+	3	2		+	1																														
Crested Serpent Eagle	<i>Spilornis cheela</i>	蛇鵟	R, ML	R																																				
Domestic pigeon	<i>Columba sp.</i>	鴿	R	C					++												++																			
Dusky Warbler	<i>Phylloscopus fuscescens</i>	褐柳鶯	WV	U	+	1		1	++				++	1	2	1	++																							
Eurasian tree sparrow	<i>Passer montanus</i>	麻雀	R	C	+		2	+++			5	3	+++	2	4	3	+++																							
Fork-tailed Sunbird	<i>Aethopyga christinae</i>	叉尾太陽鳥	R	C																																				
Great Coucal	<i>Centropus sinensis</i>	褐翅鴉鵂	R,VU	C	+				+																															
Great Egret	<i>Ardea alba</i>	大白鷺	R,RC	U																																				
Great Tit	<i>Parus montanus</i>	大山雀	R	C																																				
Green Sandpiper	<i>Tringa ochropus</i>	白腰草鶯	PM& WV	U																																				
Grey Heron	<i>Ardea cinerea</i>	蒼鷺	WV, P, RC	C																																				
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶺鴒	WV	C	+		1	+		1																														
Japanese White Eye	<i>Zosterops japonica (simplex)</i>	暗綠繡眼鳥	R	C	+				+																															
Large Hawk	<i>Circus melanoleucos</i>	鷹鵟	SV	U					+																															
Little Egret	<i>Egretta garzetta</i>	小白鷺	R,RC	C	+	1	2	2	+	2	1	1	+	1	2	1	+	2	1	1	+	1	1	2	+	1	1	1	+	1	1	1	+	1	1	1				
Magpie Robin	<i>Copsychus saularis</i>	鶻鵲	R	C	+	1	1	1	+		1		+	1	1	2	+	1																						
Night Heron	<i>Nycticorax nycticorax</i>	夜鷺	R,LC	U																																				
Olive Backed Pipit	<i>Anthus hodgsoni</i>	樹鵲	WV	C																																				
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鵑	SV	C																																				
Rufous-backed Shrike	<i>Lanius schach</i>	棕背伯勞	R	C	+	1			+																															
Rufous-capped Warbler	<i>Stachyridopsis affinis</i>	紅頭穗鵲	R	C	+				+																															
Scarlet Minivet	<i>Picrocotus erythrogastrus</i>	赤紅山椒鳥	R	C																																				
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅臀鵲	R	C																																				
Spotted Dove	<i>Streptopelia chinensis</i>	珠頸斑鳩	R	C	++	3	3	4	+	1	2	2	+	2	3	4	++	2	3	3	++	3	3	1	++	3	1	2	++	2	2	2	++	2	2	2				
Spotted Munia	<i>Lonchura punctulata</i>	斑文鳥	R	U	+	6	5		+	5																														
White Wagtail	<i>Motacilla alba</i>	白鶺鴒	WV	C	+	1	2	2	++	1	2	2	++	1	2	2	++	1	2	2	+																			
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	白胸苦惡鳥	R	C	+																																			
Yellow Bellied Prinia	<i>Prinia flaviventris</i>	黃腹鶺鴒	R	C	+		1	1																																
Number of birds						21	20	20		15	19	15		15	16	17		12	19	21		12	19	21		12	21	29		20	24	25		24	24	34				
No. of species						23	19	17	16	21	9	11	7	24	10	13	14	25	9	12	10	26	9	12	10	28	8	18	18	24	11	15	14	25	11	13				

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; SpM – Spring migrant; Sv - Summer visitor; C – transect count; P1 – Point count; +, occurred; ++, common; +++, abundant/dominant species in the study.

Commonness and status were decided according to AFCD biodiversity website. All bird species are under protection of Wild Animals Protection Ordinance (Endangered Species of Animals and Plants Ordinance (Cap. 586).

RC: Regional concern Fellowes *et al* (2002)

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

PRC: Potential regional concern Fellowes *et al* (2002)

CR: Rare in China Red Data Book Status

VU: Vulnerable in China Red Data Book Status

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	Baseline monitoring		Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring														
					Upper stream	Lower stream	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12											
					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							
Mollusks																																							
<i>Anodonta woodiana</i>	背角無齒蚌	NP	VC																																				
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Brotia hainanensis</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Corbicula fluminea</i>	河蜆	NP	VC																																				
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC	+	+	+	++																																
<i>Pomacea canaliculata</i>	蘋果螺	NP	VC	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	++																																
Insects																																							
<i>Baetis sp.</i>		NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Caenis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Chironomus sp.</i>	蠓幼虫	NP	VC	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Euphaea sp.</i>		NP	VC																																				
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+										
<i>Odonate larvae</i>		NP	VC																																				
<i>Orithetrum spp.</i>	--	NP	VC					+	+																														
<i>Pseudagrion spp.</i>	--	NP	UC																																				
<i>Pseudocloeon sp.</i>	--	NP	VC	+	+	+	+																																
<i>Serratella sp.</i>		NP	VC	+	+	+	+																																
Crustaceans																																							
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC																																				
No of Species				12	12	12	12	9	0	7	11	9	0	0	12	10	0	11	0	10	8	14	4	10	9	9	8	10	10	9	7	11	7	6	5	9	8	7	5

Note: NP – Not protected in H K, 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 Riv

(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			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring								
				Oct-14			Nov-14			Dec-14			Jan-15			Feb-15			Mar-15			Apr-15			May-15			Jun-15			Jul-15								
		Status	Common-ness	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
Mollusks																																							
<i>Anodonta woodiana</i>	背角無齒蚌	NP	VC																																				
<i>Biomphalaria sp.</i>	--	NP	VC	+	+	+		+	+			+		+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
<i>Brotia hainanensis</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
<i>Corbicula fluminea</i>	河蜆	NP	VC			+				+				+				+				+				+				+				+					
<i>Melanooides tuberculata</i>	瘤擬黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pomacea canaliculata</i>	蘋果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Insects																																							
<i>Baetis sp.</i>		NP	VC	+	+	+		+	+	+				+								+															+		
<i>Caenis sp.</i>	--	NP	VC																																				
<i>Chironomus sp.</i>	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Euphaea sp.</i>		NP	VC																																				
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+		+	+	+		+		+		+		+		+		+		+		+		+		+		+		+		+		+	
<i>Odonate larvae</i>		NP	VC																																				
<i>Orithetrum spp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pseudagrion spp.</i>	--	NP	UC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pseudocloeon sp.</i>	--	NP	VC	+	+	+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+		+	
<i>Serratella sp.</i>		NP	VC																																				
Crustaceans																																							
<i>Caridina cantanensis</i>	廣東米蝦	NP	VC																																			+	
No of Species				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	14	6

Note: NP – Not protected in H K; 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	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring													
			Jan-12				Jul-12				Jul-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-14									
			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>	革胡子鮠	NP	VC																																																	
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C					+				+				+				+				+				+				+				+				+												
<i>Oreochromis niloticus</i>	巨羅口非鯽	NP	C	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Parazacco spilurus</i>	異鱧	NP, V	C	+				+	+	+		+	+	+		+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Poecilia reticulata</i>	孔雀花魚鱒	NP	VC	+	+			+				+	+	+						+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Pterocryptis cochinchinensis</i>	越南隱鱨	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	+	+			+	+	+		+	+	+		+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++					
No of Species				2x2m fish number	8	2	4	0	4	2	2	0	5	3	4	2	5	3	4	2	12	16	30	40	30	40	50	60	60	60	70	70	40	40	50	40	20	10	20	10	12	5	8	6	16	8	10	10				
No of Species					8	6	1	0	9	7	7	3	9	8	8	3	8	8	7	6	8	8	7	7	12	8	7	7	12	11	11	8	12	11	12	9	10	10	10	13	9	10	9	11	9	9	8	11	10			
Amphibian																																																				
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P, Cap 170, NT, PGC	R													+								+		+																										

Note: NP – Not 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
 - Reference point was the sampling location outside the works area used to compare th
 Cap 170 - List in Wild Animals Protection Ordinance (Cap.170)
 NT - Near Treated in IUCN Red List Status
 PGC-Potential Gola Concern by Fellowes *et al* (2002)
 V - Vulnerable - in Red China Data Book

Table 4.7 Abiotic data for the Upper She Shan River (T1- Upper stream section, T2 - middle stream section and T3 - Lower stream section)

Stream	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring						
	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Jan-13			Dec-13			
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	
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	
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	
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	
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	
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	<0.1	0	0	0	0.03	0.04	0.07	0.03	0.03	0.04	0	0	0	
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	
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	
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	0.1	0.05	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	
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	
Stone (%)	25	30	75	30	75	75	30	40	75	--	40	65	80	40	65	2	40	65	2	45	65	5	45	65	5	65	65	15	65	80	20	
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	5	
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	

**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. 19)
Upper Tai Po River**

July 2015



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Aug 22 , 2015

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Aug 22, 2015

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
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Upper Tai Po River**

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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 19 post-construction ecological monitoring report for the project conducted **on 24th July 2015**. 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 *P. 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 this post construction monitoring. Apart from fauna species, 67 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.
- Heavy rain events was frequently recorded in current wet season, leading to strong flooding which could wash out fish and vegetation out of the river.

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 (T1 and T2) 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 AFCD website (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 behaviour were recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (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) and other literatures such as Dudgeon (1994).

3.5 Fish and Hong Kong 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 Hong Kong Newt was estimated and recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (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, 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 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 partially covered the gabion wall along the upper Tai Po River and the river bed (Photo 4) with some common plants including invasive species *Mikania micrantha*, and native species *Commelina diffusa*. In total, 67 flora species was 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 recorded florae were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2.5m as observed along survey transect. The frequent flooding events occurred during current wet season has washed part of vegetation out of the river. 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, 16 species of birds were recorded during bird survey. Among them, 4 species were dependant birds observed feeding in the river channel including *Egretta garzetta*, *Motacilla cinerea* (Photo 6), *Motacilla alba* (Photo 7) and *Ardeola bacchus* (Photo 8). A common species *Pycnonotus jocosus* was the dominant species of most of the proportion of the river, except middle section is dominated by *Lonchura punctulata* (Photo 9). 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) such as *Egretta garzetta* and *Ardeola bacchus*, which were usually observed feeding in the river. Bird abundance was similar to those recorded during baseline survey. Only foraging behaviour of some 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 slightly increased by 2 species compared with last surveys and the result was similar to previous surveys conducted in approximate period of last year. In total, 11 species odonata were found, those recorded odonata were common species in Hong Kong (Photos 10-11). Increased abundance of odonata in this month was due to seasonality. The mean ambient temperature is highly related to their emergence for most species in Hong Kong, their abundance will increase following increased temperature from spring, when the peak emergence initiated until later late autumn (Wilson *et al*, 2004 & Tam *et al*, 2011). Mating behavior was observed during survey. Sampling location was shown in **Figure 1**.

4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river (Photo 12). The river benthic fauna collected was mainly comprised of insects, mollusks 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. No newt was captured in this month. It is assumed that the disappearance of newt in the river is mainly related to seasonality. As newt normally breeds from September to March and much of the rest of the year is spent on land (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 River Fish Fauna

Fish surveys were performed at Upper Tai Po River during surveys (Photo 12). In total, 12 species freshwater fish were recorded within project area. Fish abundance was low along the modified river channel. The *Glyptothorax pallozonum*, *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 *Glyptothorax pallozonum* is a rare freshwater fish in Hong Kong, *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). And the rare fish *Pseudobagrus trilineatus* was recorded consistently during recent monitoring. Very low abundance of fish was recorded because of frequent strong flooding occurred current wet season which could wash the fish out of the river. 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 clean 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. No newt was recorded within the surveyed area

assuming that newt was back to lands during current non-breeding season. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. Abundance of fish decreased sharply due to frequent heavy rain events in current wet season. Bird abundance was similar to those recorded during baseline survey. Species richness of odonata increased this month and mating behavior was observed.

Aquatic and riparian vegetation along river channel was re-established compared to those recorded during baseline surveys. Vegetation has partially covered gabion wall and river bed along to the Upper Tai Po River. Vegetation coverage on the river bed decreased due to frequent heavy rain events in current wet season.

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

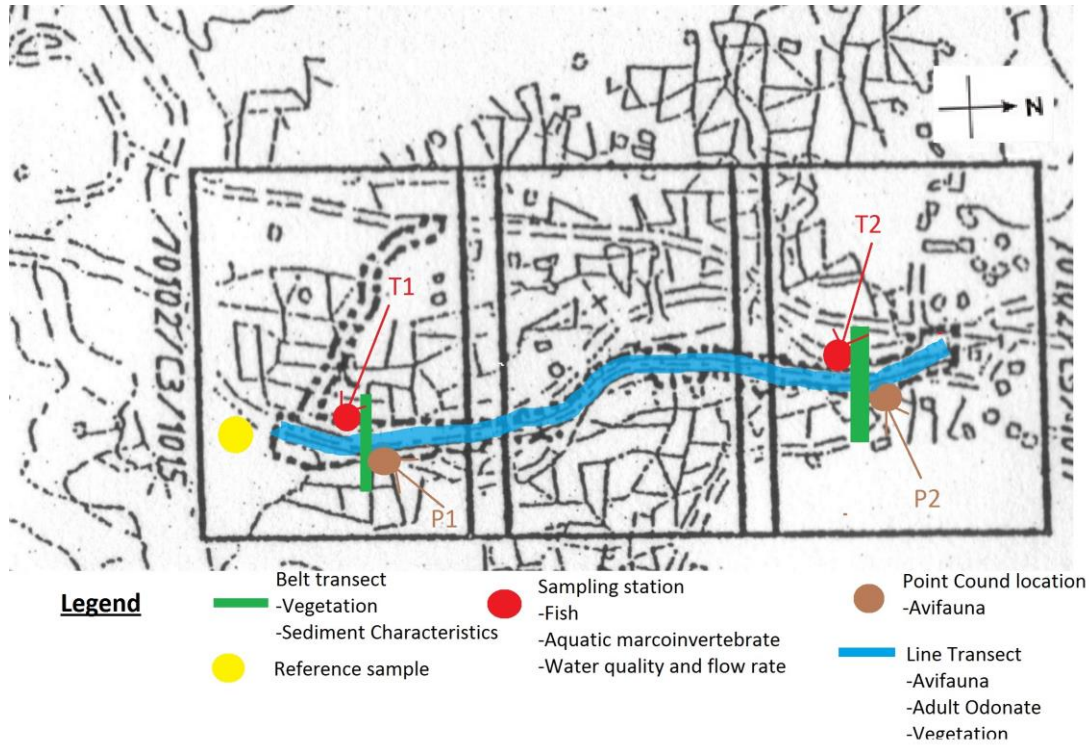


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River, Tai Po.

PHOTOS

	
<p>Photo 1: General view of the river channel (Reference site)</p>	<p>Photo 2: General view of the river channel (Upper section)</p>
	
<p>Photo 3: General view of the river channel (Middle section)</p>	<p>Photo 4: Vegetation growing on gabion (Middle section)</p>
	
<p>Photo 5: Abundant species - <i>Commelina diffusa</i> (Middle section)</p>	<p>Photo 6: Avifauna – <i>Motacilla cinerea</i></p>



Photo 7: Avifauna – *Motacilla alba*



Photo 8: Avifauna – *Ardeola bacchus*



Photo 9: Avifauna – *Lonchura punctulata*



Photo 10: Odonata - *Neurothemis fulvia*



Photo 11: Odonata - *Orthetrum luzonicum*



Photo 12: Aquatic sample collected from kick sampling

TABLE

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		Jul-11		Jan-11		Jul-11		Jan-11		Jul-11		Jan-11		Jul-11		Jan-11		Jul-11												
			P1		P2		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>	薇甘菊	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	0.5	5	0.5	5											
Moraceae	<i>Ficus hispida</i>	對葉榕	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																											
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																			
Araceae	<i>Alocasia odora</i>	海芋	1.5	23							1.5	25			2	30																											
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																									
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨			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>	卡開蘆					1.5	51					1.5	51					1.5	10																							
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨	0.4	10							0.4	10			0.4	2																											
Equisetaceae	<i>Equisetum debile</i>	筆管草			0.6	<1	0.3	2			0.3	2			0.3	2																											
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊							0.4	2					0.4	2																											
Commelinaceae	<i>Commelina diffusa</i>	節節草													0.2	5	0.2	5	0.2	5			0.5	20																			
Solanaceae	<i>Solanum nigrum</i>	龍葵																																									
Euphorbiaceae	<i>Mallotus paniculatus</i>	白楸																																									
Poaceae	<i>Eleusine indica</i>	牛筋草											0.5	5																													
Poaceae	<i>Pennisetum purpureum</i>	象草									3	4																															
Asteraceae	<i>Wedelia chinensis</i>	鋤銀菊																																									
Asteraceae	<i>Bidens alba</i>	白花鬼針草																																									
Poaceae	<i>Panicum repens</i>	枯骨草																																									
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																									
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																									
Cucurbitaceae	<i>Benincasa hispida</i>	冬瓜																																									
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 nutica</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		71		100		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						Post construction monitoring									
			Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-14		Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-14		Jan-12		Jul-12		Mar-13		Jul-13		Jan-14		Feb-14		Mar-14		Apr-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	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2										
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.4	20			0.4	10				0.4	60				0.4	40	0.4	3				0.4	40	0.4	8				0.4	40	0.4	8				0.4	40	0.4	8				0.3	5	0.3	20						
Moraceae	<i>Ficus hispida</i>	對葉榕																																																				
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																																				
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹					1	55											0.6	3							0.6	5																										
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																																				
Araceae	<i>Alocasia odora</i>	海芋																																																				
Araceae	<i>Colocasia esculenta</i>	芋											0.3	2																																								
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																																				
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																																				
Poaceae	<i>Phragmites karka</i>	卡開蘆																																																				
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																																				
Equisetaceae	<i>Equisetum debile</i>	筆管草																																																				
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒	0.4	20																																																		
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.4	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>	鋤耨菊																																																				
Asteraceae	<i>Bidens alba</i>	白花鬼針草																																																				
Poaceae	<i>Panicum repens</i>	枯骨草	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																																																				
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				35		100			100																																													

- Reference point was the sampling location outside the works area used to 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									
			Jan-15			Feb-14			Mar-14			Apr-14			May-15			Jun-15			Jul-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																
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.8	15		0.3	10		0.8	15		0.3	10		0.8	15		0.3	10		0.5	10		0.3	10		0.5	10		0.3	10		0.5	10		0.3	10		0.5	10		
Moraceae	<i>Ficus hispida</i>	對葉榕																																								
Ulmaceae	<i>Celtis sinensis</i>	朴樹																																								
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1.3	5		1	5		1.3	5		1	5		1.3	5		1	5		1	5		1	3		1	5		1	3		1	5		1	1					
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐				0.6	1					0.6	1					0.6	1					0.5	1					0.5	1						1.5	5				
Araceae	<i>Alocasia odora</i>	海芋																																								
Araceae	<i>Colocasia esculenta</i>	芋	0.8	5					0.8	5					0.8	5					0.5	5						0.5	5					0.5	5		1.2	10				
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																																								
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																																								
Poaceae	<i>Phragmites karka</i>	卡開蘆	1.7	10					1.7	10					1.7	10					1.5	10					1.5	10						1.5	10							
Thelypteridaceae	<i>Cyclosorus parasiticus</i>	華南毛蕨																																								
Equisetaceae	<i>Equisetum debile</i>	筆管草	0.3	5					0.3	5					0.3	5					0.3	5					0.3	5					0.3	5								
Asteraceae	<i>Ageratum conyzoides</i>	勝紅菊		0.3	2				0.3	2				0.3	2			0.3	2			0.3	2			0.3	2			0.3	2											
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.2	10		0.4	60		0.3	10		0.5	60		0.3	10		0.5	60		0.3	10		0.5	35		0.3	10		0.5	35		0.3	10				0.4	40			
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>	鋤耨菊																																								
Asteraceae	<i>Bidens alba</i>	白花鬼針草	1	5		0.8	2		1	5		0.8	2		1	5		0.8	2		0.7	5		0.6	2		0.7	5		0.6	2		0.7	5		0.5	5					
Poaceae	<i>Panicum repens</i>	枯骨草	0.6	5					0.6	5					0.6	5					0.4	5				0.4	5			0.4	5			0.4	5							
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																																								
Convolvulaceae	<i>Merremia hederacea</i>	魚黃草																																								
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草			4	10					4	10					4	10					2	7				2	7							2.5	20	2	30			
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																			1.2	50	0.5	15		
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香		0.2	4				0.3	4				0.3	4					0.3	2					0.3	5															
Malvaceae	<i>Hibiscus rosa-sinensis</i>	大紅花																																								
Cyperaceae	<i>Cyperus sp.</i>	莎草		0.2	6				0.2	6				0.2	6					0.2	3					0.2	5								0.2	5						
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙				1	5				1	5				1	5							1	3				1	3												
Amaranthaceae	<i>Celosia argentea</i>	青葙	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				35		88		7		35		88		7		35		88		7		35		88		7		35		88		7		35		88		7		35		88

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

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

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							
			Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	T1	T2	Referenc	T1	T2	Referenc	T1	T2	Referenc	T1	T2	Referenc	T1	T2	Referenc	T1	T2				
Mollusca																																		
<i>Biomphalaria sp.</i>	--	NP VC		+																														
<i>Brotia hainanensis</i>	--	NP VC	++	+	++			++			++	+					+	+			+						+							
<i>Melanoides tuberculata</i>	褶皺黑螺	NP VC					+	+	+	+	+	+		++	+		+		+	+	+	+				+	+							
<i>Physella acuta</i>	尖膀胱螺	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					++		+	++							+		+		+	+				+		+						
Insects																																		
<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>	蠅幼虫	NP VC	+	+	+			+			+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+					
<i>Ephemera sp.</i>	--	NP VC																																
<i>Indobaetis sp.</i>	--	NP VC	+		+			+			+	+																						
<i>Mnais sp.</i>	--	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									+																							
Crustacea																																		
<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

Note:
 "NP" – Not protected in Hong Kong
 "P" - 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	Reference	Jul-15		
				T1	T2	
Mollusca						
<i>Biomphalaria sp.</i>	--	NP	VC	+		
<i>Brotia hainanensis</i>	--	NP	VC	+	+	
<i>Melanoides tuberculata</i>	褶皺黑螺	NP	VC	+		+
<i>Physella acuta</i>	尖膀胱螺	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	+	+	
Insects						
<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>	蠅幼虫	NP	VC	+	+	+
<i>Ephemera sp.</i>		NP	VC			
<i>Indobaetis sp.</i>	--	NP	VC	+		
<i>Mnais sp.</i>	--	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			
Crustacea						
<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				15	7	4

Note:

"NP" – Not protected in Hong Kong

"P" - 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 4.7 Abotic data for Upper Tai Po River (T1- Upper stream sampling site and T2- Lower stream sampling site)

Stream	Baseline survey		Impact monitoring																			
	Oct-07		Jan-09		Jul-09		Jan-10		Jul-10		Jan-11		Jul-11		Jan-12		Jul-12		Mar-13		Jul-13	
Replicate	T1	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	
DO (mg/L)	8.2	9	4	6.3	6	9.4	8.8	9	6.5	10.5	9.8	9	8.2	8.8	8.4	7.6	7.8	7.9	8.1	8	7.8	
pH	6.9	7.18	6.86	7.28	6.96	8.2	8.5	7.3	7.2	6.9	7.1	7.1	7.3	6.8	7.6	6.9	7.8	6.8	7.5	7.2	7.6	
Nitrate (mg N/L)	0.39	0.1	1.3	0.07	1.32	0.12	0.71	0.1	0.5	0.1	0.5	0.1	0.5	<0.1	0.5	0.29	0.26	0.15	0.22	0.21	0.29	
Ammonia (mg/L)	<0.01	PO4-P (µg P/L): <100		0.01	0.22	<0.01	0.2	0.1	0.2	0.01	0.3	0.01	0.2	<0.01	0.3	<0.01	0.03	<0.01	0.02	<0.01	0.04	
Salinity (ppt)	<0.1	<0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.02	0.01	0.01	
Conductivity (mS/cm)	40	40	190	34	118	42	72	49	43	50	60	50	60	65	74	52	54	54	58	44	42	
BOD (mg/L)	<2	<2	12	<2	<2	<2	2	<2	2	<2	<2	<2	2	<2	3	<2	<2	<2	<2	<2	<2	
Water flow at pool	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		0.01-0.2		0.01-0.2	
Water flow at riffle	0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5		0.2-0.5	
Sand (%)	15	15		15	25	15	25	15	25	15	25	15	15	15	15	15	15	0	0	0	0	
Stone (%)	80	80		80	70	80	70	80	70	80	70	80	70	80	70	80	70	40	20	40	20	
Mud (%)	5	5		5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0	
Concrete(%)	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	0	10	60	80	60	80	

