

Issue No. : Issue 1
Issue Date : May 2016
Project No. : 1266

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

**POST-CONSTRUCTION ECOLOGICAL
MONITORING REPORT (No. 25)**

Prepared By:

ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:

Drainage Services Department

Allied Environmental Consultants Limited
Acousticians & Environmental Engineers

19/F., Kwan Chart Tower, 6 Tonnochy Road, Wan Chai, Hong Kong
Tel: (852) 2815 7028 Fax: (852) 2815 5399 Email: info@aechk.com



Issue No. : Issue 1
Issue Date : May 2016
Project No. : 1266

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


**POST-CONSTRUCTION ECOLOGICAL
MONITORING REPORT (No. 25)**

Prepared By:

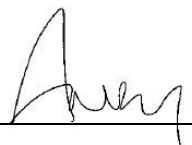
ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:


Drainage Services Department

Author: 

Joanne Ng
BSc MSc
AHKIEIA

Checked: 

Andy Lai
Bsc(Hons) AMHKIOA, MSEE, CEEQUAL,
BEAM Pro

Approved: 

Grace Kwok
BEng(Hons) MHKIEIA MHKIOA
MISWA MIAIA MRAPA LEED AP
BEAM Pro CAP

This report has been prepared by Allied Environmental Consultants Limited with all reasonable skill, care and diligence within the terms of the Agreement with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

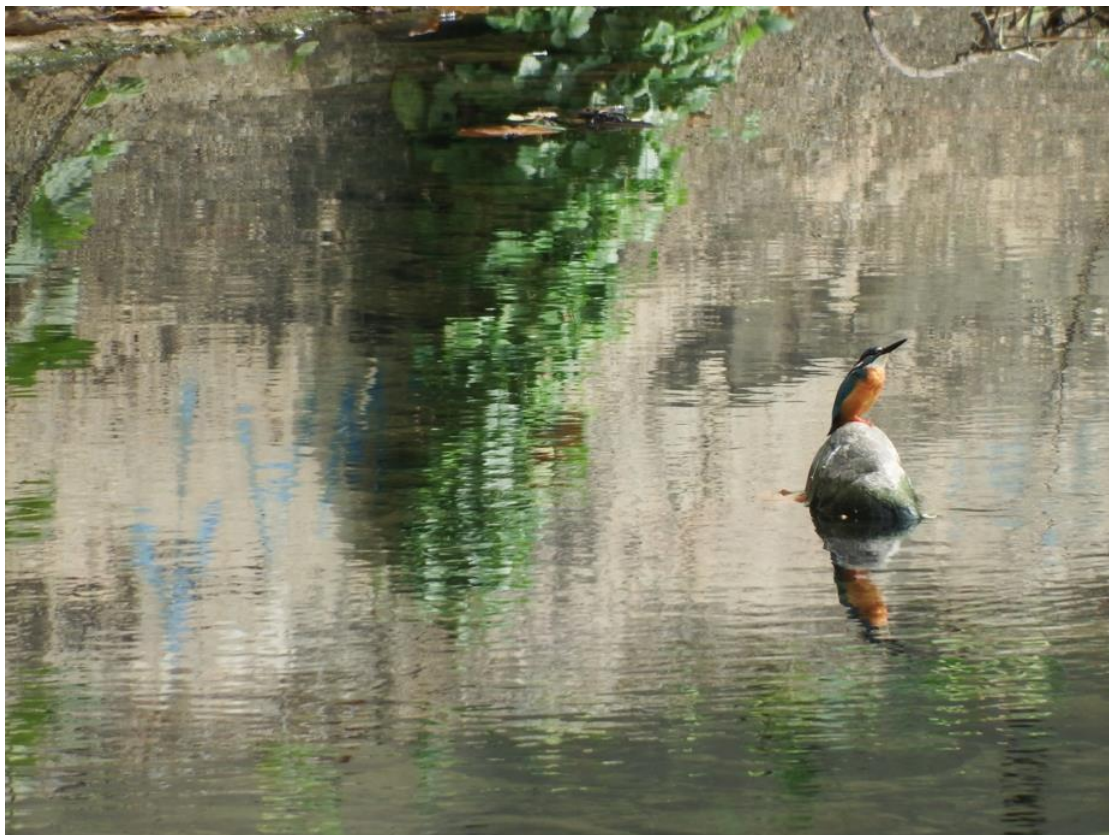
We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

**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. 25)
Upper Lam Tsuen River**

January 2016



Prepared by: Mike pang

January 25, 2016

Validated by: Mark Shea

January 25, 2016

Ecology Team: China-Hong Kong Ecology Consultants

Post-Construction Ecological Monitoring Report (No. 25)

Upper Lam Tsuen River

Table of Contents	Page
1 Introduction	3
2 Summary of Major Points	
3 Monitoring Methodology	4
4 Monitoring Results	6
5 Summary and Commentary	
6 References	11

FIGURES

Figure 1: Sampling location of ecological survey and monitoring at Upper Lam Tsuen River, Tai Po.

PHOTOS

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

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

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

Photo 4: Vegetation clearance at middle section

Photo 5: Avifauna - *Egretta garzetta*

Photo 6: Avifauna - *Alcedo atthis*

Photo 7: Avifauna - *Buteo buteo*

Photo 8: Kick sampling

Photo 9: Hong Kong Newt

Photo 10: Fish - *Zacco platypus*

TABLES

Table 4.1: Flora species recorded along the Upper Lam Tsuen River including riparian habitat.

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

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

Table 4.4: Odonata species recorded at the Upper Lam Tsuen River

Table 4.5: Aquatic Macro invertebrates recorded at Upper Lam Tsuen River.

Table 4.6: Fish species and amphibians recorded at Upper Lam Tsuen River.

Table 4.7: Abiotic data for Upper Lam Tsuen River.

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 25 post-construction ecological monitoring report for the project conducted **on 15th of January 2016**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Field ecological monitoring was undertaken **on 15th of January 2016**.
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration; Plants on river bed was experiencing seasonal changes in abundance and phenological appearance ;
- The species richness of odonata was higher than last month but still at low abundance due to seasonality;
- Bird diversity and abundance was in natural fluctuation ;
- Abundance of a target river fauna (i.e. *Paramesotriton hongkongensis* adult was recorded in medium abundance along the Lam Tsuen River);
- Fish abundance was higher than last month.

3 Monitoring Methodology

3.1 Riparian Vegetation

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

3.2 Avifauna

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

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

3.3 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behavior were recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiodiversity.net), 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 Newt

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

Sampling was conducted at five sampling locations including two sites located at the lower portion (T3 and T4) of the river channel and another two sites at the upper section (T1 and T2) of the river, as well as reference site. Those sampling sites covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish and newt was estimated and recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.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 along Lam Tsuen River. The vegetation coverage should be high in the river bed due to less flooding events in current season. However, the observed river was sparsely covered with vegetation in the river bed because vegetation clearance work was carried out along the river (Photos 1-4). In total, 64 flora species were recorded within the survey transects along the river course. *Brachiaria mutica* was the dominated

species recorded in the survey conducted in last month, but they were mostly cleared out along the river. The recorded floras were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at four selected point count locations. In total, 24 species of birds were recorded during the bird survey and 6 of the total were wetland dependent species including *Ardeola bacchus*, *Motacilla cinerea*, *Egretta garzetta* (Photo 5), *Alcedo atthis* (Photo 6), *Tringa ochropus* and *Motacilla alba*, they were commonly observed foraging in the river channel. *Pycnonotus jocosus* was a dominated species along the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Among the recorded species, *Ardeola bacchus* and *Egretta garzetta* are both classified as Regional Concern by Fellowes *et al.* (2002). *Buteo buteo* (Photo 7) is scheduled under Endangered Species of Animals and Plants Ordinance (Cap. 586). Apart from above mentioned species, the others recorded in Lam Tsuen River were common species in Hong Kong. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

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

4.2.3 Aquatic Macro-invertebrates

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

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted (Photo 8) 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 9). As the time of conducting survey was within the breeding period of Hong Kong Newt, their individuals were easier being found within a short transect distance compared to their non-breeding season. They were captured in all sampling points. They will stay in the river during their breeding period from September to March (Dudgeon, 2003). Riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Lam Tsuen River during field monitoring. In total, 16 species of freshwater fish, including species recorded from reference site, were recorded. *Oreochromis niloticus*, *Zacco platypus* (Photo 10) and *Rhinogobius* spp were the dominated species in the river. *Acrossocheilus parallens* is a rare freshwater fish that only recorded in few of reservoir catchments and streams in Hong Kong (Lee *et al.*, 2004) and listed as Global Concern by Fellowes (2002). It was observed along the surveyed river with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* is classified as Vulnerable in China Red Data Book and observed along the river with low abundance. Fish counting at 2 x 2 meter area were performed and number of fish individuals was recorded with increased abundance compared to last month due to less flooding events during current dry season. 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 January 2016 and relevant biotic and abiotic data was collected according to project specification and EM & A Manual. Benthic fauna was temporally de-faunated in river sections due to river bed engineering works during construction period between 2008 and early 2013 and is under recovery process after that period. Mature individual of amphibian *Paramesotriton hongkongensis* were recorded

medium in abundance at river channel where the river margin covered with riparian vegetation. *Acrossocheilus parallens*, a rare freshwater fish species in Hong Kong, was observed at a few locations in the river channel with pool. Except *Acrossocheilus parallens*, *Parazacco spilurus* recorded in the river is also considered with conservation interest and observed along the river with low abundance. Decreased species richness of odonata and higher 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 sparsely covered the river bed along Upper Lam Tsuen River.

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

6 REFERENCES

Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. and Yung, L.(2001). *The Avifauna of Hong Kong*. Hong Kong Bird Watching Society.

Dudgeon, D. (2003). *Hillstreams*. The Department of Ecology & Biodiversity of The University of Hong Kong and Wan Li Book Co, Ltd. Hong Kong.

Dudgeon, D. and Corlett, R. (1994). *Hills and Streams - An Ecology of Hong Kong*. Hong Kong University Press, Hong Kong.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

Hong Kong Biodiversity Website (2015) :

<http://www.afcd.gov.hk/english/conservation/hkbiodiversity/hkbiodiversity.html>

Hong Kong Herbarium (2015) :

<http://herbarium.gov.hk/>

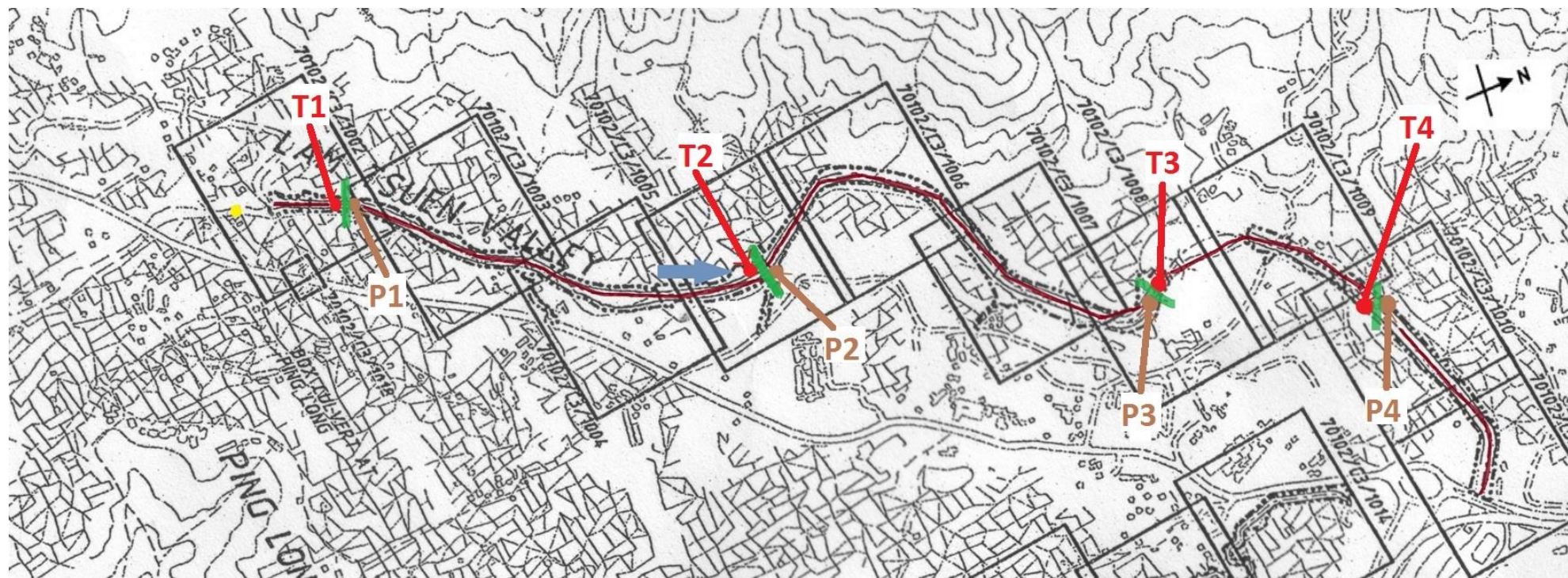
Lai, P.C.C., Lam, Y.W., So, P.S., Tam, K.Y., Wan, P.Y.M. and Yip, K.L. (2004). *Check List of Hong Kong Plants*, Agriculture, Fisheries and Conservation Department. Hong Kong.

Lee, V.L.F., Lam, S.K.S., NG, F.K.Y., Chan, T.K.T. and Young, M.L.C. (2004). *Field Guide to the Freshwater Fish of Hong Kong*, Friends of the Country Parks and Cosmos Books Ltd, Hong Kong.

Tam, T.W., Leung, K.K., Kwan, B.P. S., Wu, K. K. Y., Tang, S. S. H., So, I.W.Y., Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y.M and Leung, H.W. (2011). *The Dragonflies of Hong Kong*. Agriculture, Fisheries and Conservation Department, Friends of the Country Parks and Cosmos Books Ltd., Hong Kong.

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

FIGURES



Legend



	Belt transect		Sampling station		Point count location
	-Vegetation		-Fish		-Avifauna
	-Sediment characteristics		-Aquatic macroinvertebrate		
	Reference sample		-Water quality and flow rate		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: Vegetation clearance at middle section

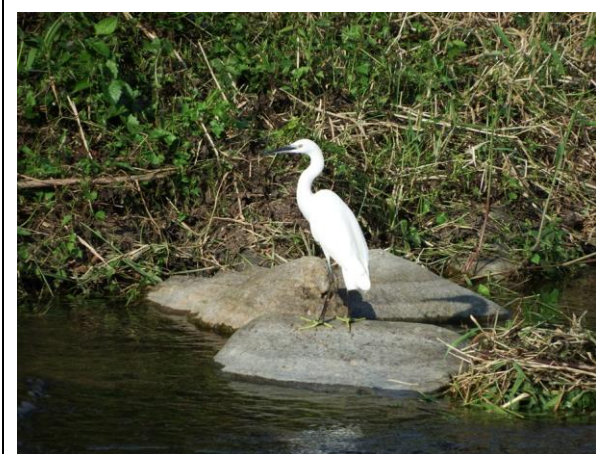


Photo 5: Avifauna - *Egretta garzetta*

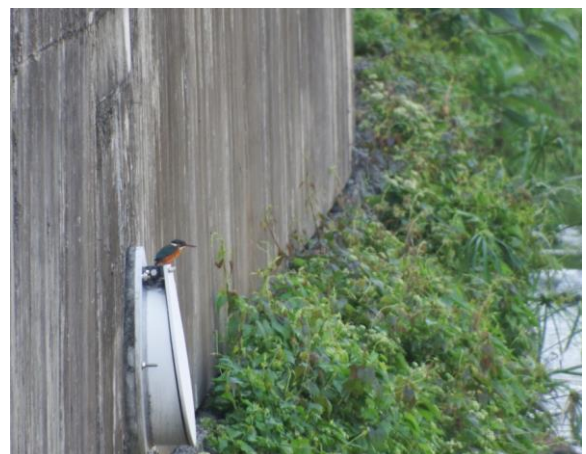


Photo 6: Avifauna - *Alcedo atthis*



Photo 7: Avifauna - *Buteo buteo*



Photo 8: Kick sampling



Photo 9: Hong Kong Newt



Photo 10: Fish - *Zacco platypus*

TABLE

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

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

Family	Species	Chinese name	Baseline monitoring								Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring									
			Jul-08				Aug-08				Jan-09				Jan-09				Jul-09				Jan-10				Jul-10									
			P1		P4		P1		P4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1	
Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%			
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.4	40			0.4	40			0.4	30	0.5	5	1.5	5	1	15																		
Fabaceae	<i>Pueraria lobata</i>	野葛	0.5	30			0.5	30						0.2	5			0.5	50																	
Poaceae	<i>Pennisetum purpureum</i>	象草	3	20			3	20																												
Araceae	<i>Alocasia odora</i>	海芋	1	10			1	10			0.5	2					0.3	<1																		
Caesalpiniaceae	<i>Cassia alata</i>	翅莢決明			1.2	10			1.2	10																										
Magnoliaceae	<i>Michelia alba</i>	白蘭			6	10			6	10																										
Poaceae	<i>Brachiaria mutica</i>	巴拉草			1.2	70			1.2	70	1.5	30					0.5	20			1.2	5	1	40	0.8	40	0.9	50	1	15			0.8	20	0.9	30
Moraceae	<i>Ficus hispida</i>	對葉榕							1.5	5							1.5	5	4	5																
Asteraceae	<i>Mikania micrantha</i>	薇甘菊							0.4	20							0.5	1	0.5	5	0.3	15	0.5	30			0.5	30	0.3	25			0.5	20		
Musaceae	<i>Musa paradisiaca</i>	大蕉												3	5																					
Ulmaceae	<i>Celtis sinensis</i>	朴樹			6	10			6	10							4	10																		
Araceae	<i>Pistia stratiotes L.</i>	大漂																																		
Utriculariaceae	<i>Boehmeria nivea</i>	芋麻																																		
Asteraceae	<i>Bidens alba</i>	白花鬼針草																																		
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																																		
Solanaceae	<i>Solanum nigrum</i>	龍葵																																		
Cyperaceae	<i>Cyperus flabelliformis</i>	風車草																																		
Poaceae	<i>Miscanthus floridulus</i>	五節芒																																		
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐																																		
Asteraceae	<i>Wedelia chinensis</i>	蟛蜞菊																																		
Commelinaceae	<i>Commelina diffusa</i>	節節草																																		
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																																		
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																		
Amaranthaceae	<i>Celosia argentea</i>	青葙																																		
Bare Ground											13		85		85		64		20		80		38		10		50		10		43		24		60	45

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

		Impact monitoring								Impact monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring							
		Aug-13				Dec-13				Jan-14				Feb-14				Mar-14																							
Family	Species	T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4									
	Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%										
Poaceae	<i>Microstegium ciliatum</i>			0.5	5																																				
Fabaceae	<i>Pueraria lobata</i>	0.3	15	0.3	5			0.3	10					0.3	10					0.3	10			0.3	10					0.3	10										
Poaceae	<i>Pennisetum purpureum</i>													1.5	5					1.5	5			1.5	5					1.5	5										
Araceae	<i>Alocasia odora</i>																																								
Caesalpiniaceae	<i>Cassia alata</i>																																								
Magnoliaceae	<i>Michelia alba</i>																																								
Poaceae	<i>Brachiaria mutica</i>	0.8	5	0.8	5	1	10	1	15	0.8	10	0.8	10					0.8	10	0.8	10					1	13	1	13												
Moraceae	<i>Ficus hispida</i>																																								
Asteraceae	<i>Mikania micrantha</i>	0.5	25	0.5	10	0.5	10	0.4	3	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10										
Musaceae	<i>Musa paradisiaca</i>																																								
Ulmaceae	<i>Celtis sinensis</i>																																								
Araceae	<i>Pistia stratiotes L.</i>																																								
Urticaceae	<i>Boehmeria nivea</i>					0.8	2																																		
Asteraceae	<i>Bidens alba</i>	0.4	5	0.4	20	0.5	10	0.5	2	0.4	5			0.5	10			0.4	5			0.5	10			0.4	5			0.5	10										
Poaceae	<i>Coxia lacryma-jobi</i>																																								
Solanaceae	<i>Solanum nigrum</i>																																								
Cyperaceae	<i>Cyperus flabelliformis</i>																																								
Poaceae	<i>Miscanthus floridulus</i>																																								
Euphorbiaceae	<i>Macaranga tanarius</i>																																								
Asteraceae	<i>Wedelia chinensis</i>																																								
Comelinaceae	<i>Commelina diffusa</i>							0.3	5					0.3	5					0.3	5			0.3	5					0.3	5										
Asteraceae	<i>Erechtites hieracifolia</i>																																								
Thelypteridaceae	<i>Cyclosorus parasiticus</i>																																								
Convolvulaceae	<i>Pharbitis nil</i>																																								
Verbenaceae	<i>Lantana camara</i>																																								
Mimosaceae	<i>Leucaena leucocephala</i>							1.2	5																																
Brassicaceae	<i>Nasturtium officinale</i>																																								
Onagraceae	<i>Ludwigia erecta</i>																																								
Poaceae	<i>Pennisetum alopecuroides</i>																																								
Amaranthaceae	<i>Celosia argentea</i>													1	2					1	2			1	2			1	2												
Bare Ground			50		55		68		70		75		85		73		75		75		85		73		75		75		85		73										

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

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

Species name	Common name	Chinese name	Status	Commonness	Baseline monitoring		Impact monitoring						Impact monitoring		Post construction 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	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	雉腹蜻	NP	VC																		+		
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC											+	+								
<i>Ceriatrigon auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟋	NP	VC															+		+	+	+	
<i>Coeliccia cyanomelas</i>	Blue Forest Damsel	黃紋長腹蟋	NP	VC																		+		
<i>Coperia marginipes</i>	Yellow Featherlegs	黃狹扇蟋	NP	VC	+										+							+	+	+
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+	+	+			++								+	+	+	+	+	+
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟋	NP	VC																		+		+
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C																				+
<i>Ischnura senegalensis</i>	Common Blue Jewel	褐斑異痣蟋	NP	VC																		+	+	+
<i>Mnais lacteola</i>	Indochinese Copperwing	煙翅綠色蟋	P, LC	C																		+		
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	P, LC	C																		+		
<i>Neurobasis chinensis</i>	Chinese Greenwing	華麗色蟋	NP	VC							+		+	+	+	+					+	+	+	+
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC																				+
<i>Neurothemis tullia tullia</i>	Pied Percher	截斑脈蜻	NP	C																				
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC	+	+	+	+			+				++	++	+							
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC			+								+	+								
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC																				
<i>Orthetrum pruinsum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC										+								+	+	+
<i>Orthetrum sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	VC							+													
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+	+		+							++					+		+		
<i>Paracercion calamorum duyerei</i>	Dusky Lilysquatter	葦尾蟋	P, LC	C																				
<i>Prodiasineura autumnalis</i>	Black Threadtail	烏齒原蟋	NP	VC																		+	+	+
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟋	NP	UC																		+	+	+
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟋	NP	VC			+				+											+	+	+
<i>Rhyothemis variegata arria</i>	Variegated Flutterer	斑麗翅蜻	NP	C																				+
<i>Trithemis aurora</i>	Crimson Dropwing	曉褐蜻	NP	VC												++	+	+	+	+	+	+	+	+
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC				+			+					+						+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PGC	VC																			+	+
No. of species					4	5	3	4	0	6	0	7	1	7	5	3	2	1	3	12	9	14	13	

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundant/dominant in study area

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

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

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

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

Species name	Common name	Chinese name	Status	Commonness	Post construction monitoring						Post construction monitoring						Post construction monitoring					
					Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16
<i>Acisoma panorpoides panorpoides</i>	Asian Pintail	錐腹蜻	NP	VC												+						
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC																		
<i>Ceriatrigon auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蟌	NP	VC	+	+	+	+		+					+	+	+	+	+	+		
<i>Coeliccia cyanomelas</i>	Blue Forest Damsel	黃紋長腹蟌	NP	VC																		
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蟌	NP	VC	+	+	+							+	+	+	+	+	+	+		
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蟌	NP	VC																		
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C											+	+	+	+	+	+	+	
<i>Ischnura senegalensis</i>	Common Blue Jewel	褐斑異痣蟌	NP	VC																		
<i>Mnais lacteola</i>	Indochinese Copperwing	煙翅綠色蟌	P, LC	C																		
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	P, LC	C																		
<i>Neurobasis chinensis</i>	Chinese Greenwing	華麗色蟌	NP	VC	+	+	+	+	+			+	+	+	+	+	+	+	+	+	+	
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC	+	+	+							+	+	+	+	+	+	+		
<i>Neurothemis tullia tullia</i>	Pied Percher	截脈蜻	NP	C	+																	
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC														+	+	+	+	
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC	+									+								
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC														+	+	+	+	
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC	+	+	+								+	+	+	+	+	+		+
<i>Orthetrum sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	VC	+																+	
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC			+	+	+				+	+	+	+	+	+	+	+	+	+
<i>Paracercion calamorum duyeri</i>	Dusky Lilysquatter	葦尾蟌	P, LC	C																		
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蟌	NP	VC	+	+	+							+	+	+	+	+	+	+		
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蟌	NP	UC	+	+	+	+							+	+						
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蟌	NP	VC	+	+	+	+							+	+	+	+	+	+	+	
<i>Rhyothemis variegata arria</i>	Variegated Flutterer	斑麗翅蜻	NP	C	+	+	+	+														
<i>Trithemis aurora</i>	Crimson Dropwing	曉褐蜻	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Trithemis festiva</i>	Indigo Dropwing	慶褐蜻	NP	VC	+	+	+	+						+	+	+	+	+	+	+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PGC	VC																		
No. of species					15	11	13	9	4	3	2	4	9	11	13	14	15	13	9	7	2	3

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

“+++” – Species abundant/dominant in study area

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

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

Table 4.5 Aquatic Macro invertebrates recorded at Lam Tsuen River

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

				Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					
				Oct-15					Nov-15					Dec-15					Jan-16					
		Sampling point		Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	
Species name	Chinese name	Status	Commonness																					
Molluscs																								
<i>Biomphalaria sp.</i>	--	NP	VC					+					+					+					+	
<i>Brotia hainanensis</i>	--	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>	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Sinotaia 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>Electrogenas sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Hydropsyche sp.</i>	--	NP	VC	+	+	+			+	+	+			+	+	+		+	+	+			+	
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+		+	+	+		+					+					+		
<i>Mnais sp.</i>	--	NP	VC				+					+		+	+	+	+	+	+	+	+	+	+	
<i>Orthetrum 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>Somaniathelphusa zanklon</i>	束腰蟹	NP	VC																					
No. of species				11	9	11	13	13	11	9	11	13	13	12	10	11	13	13	12	10	11	13	13	

Note: NP – Not protected in Hong Kong; P - Protected in Hong Kong
 “VC” – Very Common; “UC” – Uncommon; “C” - Common; "R" - Rare
 +, occurred; ++, common; +++, abundant/dominant Species in the the study area

Reference point was the sampling location outside the works area.

Table 4.6 Fish species and amphibians at Upper Lam Tsuen River

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

Species	Chinese name	Status	Sampling point	Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring									
				Sep-15					Oct-15					Nov-15					Dec-15					Jan-16									
				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			Commonnes																														
<i>Acrossocheilus parallens</i>	側條光唇魚	P, PGC	R			+	+	+			+	+	+			+	+	+			+	+	++					+	+	+	++		
<i>Channa maculate</i>	斑鱧	NP	C					+					+					+					+										
<i>Cirrhina molitorella</i>	鱮魚	NP	C																														
<i>Clarias fuscus</i>	胡子鯰	NP	C					+					+					+					+										
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C				+					+					+						+					+					
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Liniparhomaloptera disparis</i>	擬平鰾	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Misgurnus anguillicaudatus</i>	泥鰱	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	++	++	++	+	+	++	++	++	+	+	++	++	++	+	+	++	++	++	+	+	++	++	++	+	+	++	++	
<i>Parazacco spilurus</i>	異鱧	V and	C	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC			+	+	+			+	+	+			+	+	+			+	+	+			+	+	+			+	+	
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰾	NP	C	+	+				+	+				+	+				+	+				+	+				+	+			
<i>Pterocryptis cochinchinensis</i>	黃鯰	NP	C	+					+					+					+					+					+				
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C/UN/R	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	
<i>Schistura fasciolata</i>	橫紋南鰾	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>	寬鳍鱮	NP	C	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	
2x2m fish counting		No. of fish		18	15	20	15	15	25	20	22	18	20	40	35	40	35	40	55	40	45	45	40	60	50	50	50	40					
No. of species				12	10	13	13	12	12	10	13	13	12	12	10	13	13	12	12	10	13	12	12	12	10	14	13	10					
Amphibian																																	
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P (Cap 170, NT, PGC)	R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Fejervarya limnocharis</i>	澤蛙	NP	VC																														
No. of species				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					

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

Table 4.7 Abotic data for Upper Lam Tsuen River

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

Parameter / date	Baseline monitoring	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring			
	8-Aug	Jan-09				Jul-09				Jan-10				Jul-10				Jan-11				Jul-11			
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
DO (mg/L)	9.2	9.8	9.9	9.4	9.1	6.4	6.4	6.5	6.8	9.7	9.5	9.5	9.3	8.3	8.5	8.5	8.7	9.6	9.5	9.5	9.1	9.5	9.6	9.4	9.3
pH	7.49	7.24	7.36	7.53	7.44	7.1	7.25	7	7.05	7.9	8.1	8.1	8.2	7.4	7.5	7.3	7.4	7.1	7.2	7.2	7.1	7.3	7.1	7.1	7.1
Nitrate (mg N/L)	0.36	0.79	1.1	1.2	1.2	0.31	0.48	0.48	0.59	0.56	1.11	1.13	1.33	0.1	0.2	0.2	0.3	0.1	0.2	0.4	0.5	0.1	0.2	0.3	0.45
Ammonia (mg/L)	<0.01	PO4-P (µg P/L): <100				0.02	0.02	0.02	0.03	0.01	0.16	0.17	0.07	0.2	0.4	0.2	0.2	0.05	0.07	0.07	0.1	0.06	0.05	0.08	0.1
Salinity (ppt)	<0.1	<0.1	0.1	0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conductivity (µS/cm)	60	80	100	120	120	45	51	52	63	62	96	98	114	84	100	460	54	90	87	93	120	93	90	90	100
BOD (mg/L)	<2	<2	<2	<2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
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	0.2-0.5				0.2-0.5				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6			
Sand (%)	15	15	10	10	10	10	10	10	15	8	8	8	15	8	8	8	15	8	8	8	15	8	8	8	15
Stone (%)	80	80	88	88	88	88	88	88	70	90	90	90	70	90	90	90	70	90	90	90	70	90	90	90	70
Mud (%)	5	5	2	2	2	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5	2	2	2	5

Table 4.7 Abotic data for Upper Lam Tsuen River

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

Parameter / date	Impact monitoring				Impact monitoring				Impact monitoring				Impact monitoring				Post construction monitoring				Post construction monitoring							
	Jan-12				Jul-12				Aug-13				Dec-13				Jan-14				Feb-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
DO (mg/L)	9.4	9.2	9.4	9.2	8.2	8	7.8	7.3	8.9	8.5	8.7	8.8	9.3	8.6	8.8	8.7	9.1	9.0	8.6	8.5	7.8	8.7	9.8	9.8	7.8	8.7	9.8	9.8
pH	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	8.2	8.5	8	7.8
Nitrate (mg N/L)	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	1.3	1.8	1.6	2.1
Ammonia (mg/L)	0.04	0.05	0.06	0.2	0.01	0.02	0.04	0.03	0.02	0.03	0.03	0.03	0.04	<0.01	<0.01	<0.01	0.04	0.1	0.12	0.15	0.05	0.04	0.1	0.12	0.05	0.04	0.1	0.12
Salinity (ppt)	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)	92	84	96	110	41	38	73	86	67	77	74	75	62	64	90	110	72	78	88	108	78	87	118	119	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
Water flow at pool (m/s)	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)	0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6							
Sand (%)	10	15	10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Stone (%)	80	70	80	70	60	60	60	60	60	75	75	75	75	90	85	85	85	90	85	85	85	90	85	85	90	85	85	85
Mud (%)	10	15	10	20	30	30	30	30	30	15	15	15	15	5	10	10	10	5	10	10	10	5	10	10	10	5	10	10

Table 4.7 Abotic data for Upper Lam Tsuen River

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

Parameter / date	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
	Mar-14				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-14			
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
DO (mg/L)	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	7.6	7.2	7.6	7.5	7.6	7.4	7.3	7.6	8.7	8.7	8.4	8.6
pH	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
Nitrate (mg N/L)	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
Ammonia (mg/L)	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
Salinity (ppt)	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
Conductivity (µS/cm)	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
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
Water flow at pool (m/s)	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			
Water flow at riffle (m/s)	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 (%)	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
Stone (%)	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
Mud (%)	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

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.25)
She Shan River

January 2016



Prepared by: Mike Pang

January 26, 2016

Validated by: Mark Shea

January 26, 2016

Ecology Team: China Hong Kong Ecology Consultants

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

Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring Report (No.25) She Shan River

Table of Contents	Page
1 Introduction	3
2 Summary of Major Points	3
3 Monitoring Methodology	4
4 Monitoring Results	6
5 Summary and Commentary	
6 References	

FIGURES

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: *Nasturtium officinale* being planted at lower section of the river
- Photo 5: Endangered species in China - *Mucuna championii*
- Photo 6: Avifauna - *Ardeola bacchus*
- Photo 7: Avifauna - *Motacilla cinerea*
- Photo 8: Avifauna - *Spilornis cheela*
- Photo 9: Avifauna - *Accipiter trivirgatus*
- Photo 10: Kick Sampling
- Photo 11: Hong Kong Newt
- Photo 12: Fish - *Oreochromis niloticus*

TABLES

- Table 4.1: Flora species recorded along the She Shan River including riparian habitat.
- Table 4.2: Flora species recorded from belt transect survey at the She Shan River.
- Table 4.3: Avifauna recorded along survey transects and at three selected point count locations at She Shan River.
- Table 4.4: Odonata species recorded at the She Shan River
- Table 4.5: Aquatic Macro invertebrates recorded at She Shan River.
- Table 4.6: Fish species and Hong Kong Newt recorded at She Shan River.
- Table 4.7: Abiotic data for She Shan River.

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 25 post-construction ecological monitoring report for the project conducted **on 16th of January 2016**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

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

3 Monitoring Methodology

3.1 Riparian Vegetation

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

3.2 Avifauna

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

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

3.3 Adult Odonata Survey

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

3.4 Aquatic Macro-invertebrates

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

3.5 Fish Population and Hong Kong Newt

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

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

sampling sites covered major type of stream habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish was estimated and recorded. Nomenclature and protection status of the species has followed those documented in the AFCD website (www.hkbiodiversity.net) 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, 62 flora species was recorded within the survey transects along the river course. The recorded floras were generally common wetland species. The height of the dominated riparian grass and herb species were in a range from 0.3m to 1.2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Vegetation has generally covered the riverbed and riparian habitat in upper sections. Due to the vegetation clearance work at lower to middle section, the coverage of vegetation from lower section to middle section were generally low except relative high abundance of vegetable, *Nasturtium officinale* was remained at middle section (Photo 4). Aquatic plants *Brachiaria mutica* was the most abundant plants found along the river channel. *Mucuna championii* is classified as endangered status in China, was first recorded in the woodland adjacent to She Shan River (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, 27 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* (Photo 6), *Alcedo atthis*, *Motacilla cinerea* (Photo 7), *Egretta garzetta* and *Motacilla alba*. The dominant species of the river was a common species *Pycnonotus jocosus*. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of wetland dependent species with conservation interest including *Ardeola bacchus* and *Egretta garzetta* were observed foraging in the river. *Ardeola bacchus* and *Egretta garzetta* are considered as Regional Concern by Fellowes *et al.* (2002). 3 raptors were recorded during the survey including *Milvus lineatus*, *Spilornis cheela* (Photo 8) and *Accipiter trivirgatus* (Photo 9). They were all scheduled under Endangered Species of Animals and Plants Ordinance (Cap. 586). *Milvus lineatus* and *Spilornis cheela* were considered as Regional Concern and Local Concern by Fellowes *et al.* (2002) respectively; while *Spilornis cheela* was also listed as Vulnerable in China Red Data Book Status. *Accipiter trivirgatus* was listed as Rare in China Red Data Book Status. *Centropus sinensis* was classified as Vulnerable in China Red Data Book as well. Except foraging and roosting behaviour of some birds were observed, no other remarkable behaviour was noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

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

4.2.3 Aquatic Macro-invertebrates

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

4.2.4 Hong Kong Newt

Survey of Hong Kong Newt was performed (Photo 10). Hong Kong Newt was captured only in middle section where covered with dense vegetation as shelter (Photo 11). It was absent in previous surveys during wet season. The presence of Hong Kong Newt in this month is related to their breeding behavior, they are usually breeding in the river during dry season from September to March (Dudgeon, 2000). Hong Kong Newt is listed in Wild

Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 Fish Fauna

Fish surveys were performed at She Shan River and total 12 species of freshwater fish were recorded. Native fish *Zacco platypus* and *Oreochromis niloticus* (Photo 12) were abundant species dominating in the river channel. Among the recorded fish, *Parazacco spilurus* is classified as “Vulnerable” in Red China Data Book, it was commonly observed along the river with low abundance. The number of fish increased compared to last month assuming that less flooding events during current dry season. 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 only recorded in middle section of the river. The rest of fauna was in a natural fluctuation.

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

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

6 REFERENCES

Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. and Yung, L.(2001). *The Avifauna of Hong Kong*. Hong Kong Bird Watching Society.

Dudgeon, D. and Corlett, R. (1994). *Hills and Streams - An Ecology of Hong Kong*. Hong Kong University Press, Hong Kong.

Dudgeon, D. (2003). *Hillstreams*. The Department of Ecology & Biodiversity of The University of Hong Kong and Wan Li Book Co, Lte. Hong Kong.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

Hong Kong Herbarium (2015) :
<http://herbarium.gov.hk/>

Hong Kong Biodiversity Website (2015) :
<http://www.afcd.gov.hk/english/conservation/hkbiodiversity/hkbiodiversity.html>

Lai, P.C.C., Lam, Y.W., So, P.S., Tam, K.Y., Wan, P.Y.M. and Yip, K.L. (2004). *Check List of Hong Kong Plants*, Agriculture, Fisheries and Conservation Department. Hong Kong.

Lee, V.L.F., Lam, S.K.S., NG, F.K.Y., Chan, T.K.T. and Young, M.L.C. (2004). *Field Guide to the Freshwater Fish of Hong Kong*, Friends of the Country Parks and Cosmos Books Ltd, Hong Kong.

Tam, T.W., Leung, K.K., Kwan, B.P. S., Wu, K. K. Y., Tang, S. S. H., So, I.W.Y., Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y.M and Leung, H.W. (2011). *The Dragonflies of Hong Kong*. Agriculture, Fisheries and Conservation Department, Friends of the Country Parks and Cosmos Books Ltd., Hong Kong.

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

FIGURE

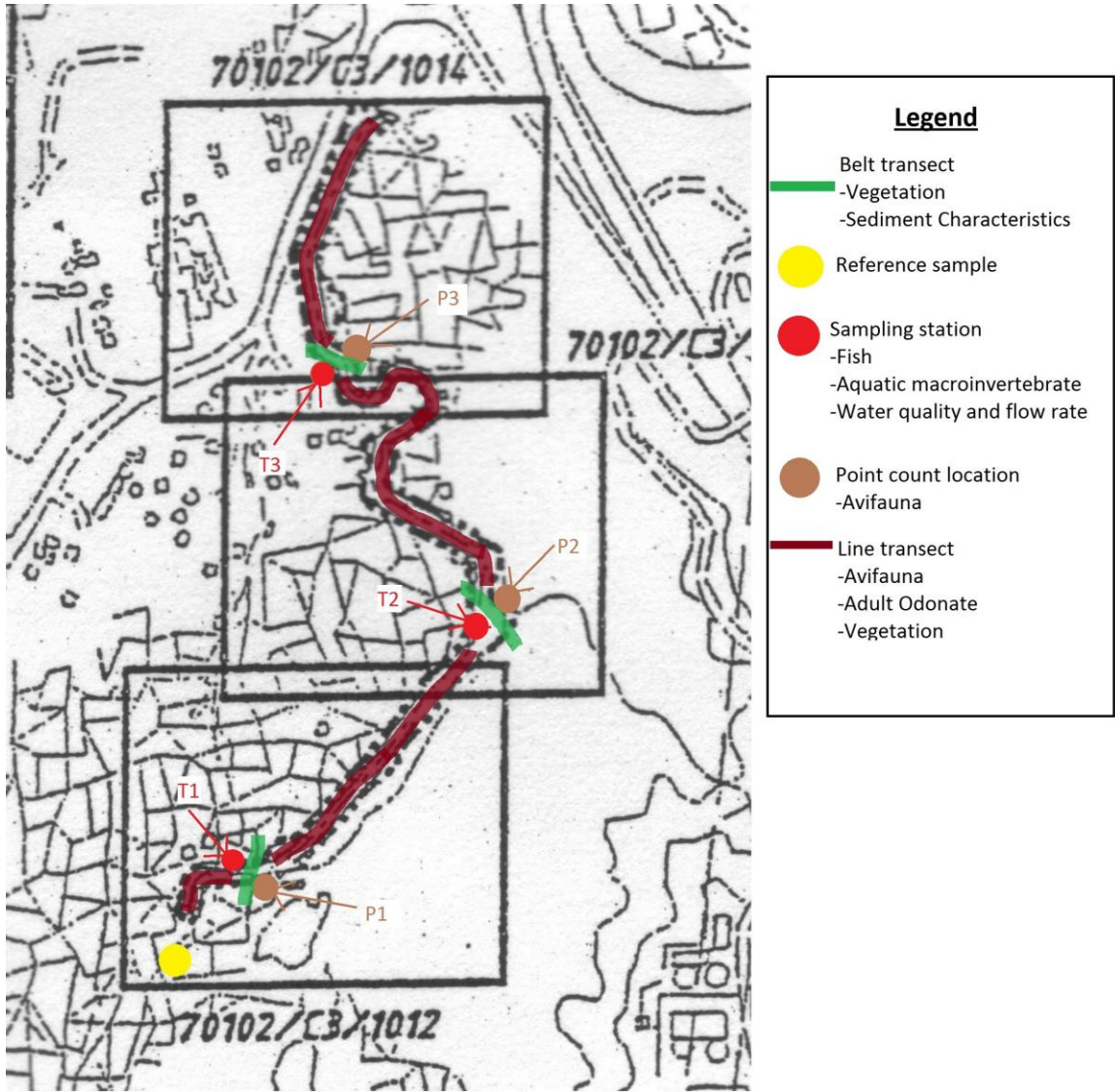


Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

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: *Nasturtium officinale* being planted at lower section of the river



Photo 5: Endangered species in China - *Mucuna championii*



Photo 6 : Avifauna - *Ardeola bacchus*



Photo 7 : Avifauna - *Motacilla cinerea*



Photo 8: Avifauna - *Spilornis cheela*



Photo 9: Avifauna - *Accipiter trivirgatus*



Photo 10: Kick Sampling



Photo 11: Hong Kong Newt



Photo 12: Fish - *Oreochromis niloticus*

TABLE

Table 4.2. Flora species recorded from belt transect survey at the She Shan River

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

		Baseline monitoring										Impact monitoring						Impact monitoring						Impact monitoring											
		Jul-08					Aug-08					Jan-09						Jul-09						Jan-10						Jul-10					
		P1		P3			P1		P3			T1	T2		T3	T1	T2		T3	T1	T2		T3	T1	T2		T3	T1	T2		T3				
Family	Species	Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(cm)	%	Height(cm)	%	Height(cm)	%	Height(cm)	%	Height(cm)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%			
Commelinaceae	<i>Commelina diffusa</i>	節節草			0.2	20				10	6	0.2	2	0.1	5	0.2	5			0.2	10	0.3	60					0.5	50	0.5	50				
Poaceae	<i>Panicum repens</i>	枯骨草	0.3	5										0.2	5			0.6	5			0.6	25												
Asteraceae	<i>Mikania micrantha</i>	蕨甘菊							0.2	7												0.2	5							1	20				
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																																	
Moraceae	<i>Ficus microcarpa</i>	細葉榕			0.7	5			0.6	7																									
Moraceae	<i>Ficus hispida</i>	對葉榕			3	10			3	10																									
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	0.5	5			0.5	3																				1.5	30						
Fabaceae	<i>Pueraria lobata</i>	野葛			0.3	5	0.5	3	0.3	5			0.2	5	0.2	5																			
Araceae	<i>Colocasia esculenta</i>	芋						0.2	5																										
Urticaceae	<i>Boehmeria nivea</i>	苧麻	1.5	30			2	7																											
Asteraceae	<i>Bidens alba</i>	白花鬼針草																																	
Poaceae	<i>Pennisetum purpureum</i>	象草	3	50	1	60	3	80	2	60				4	40																				
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																				1.5	20												
Amaranthaceae	<i>Alternanthera philoxeroides</i>	空心蓮子草	0.2	10			0.2	7																											
Poaceae	<i>Panicum maximum</i>	大黍											0.5	5																					
Moraceae	<i>Broussonetia papyrifera</i>	構樹												6	5												0.4	5			1.5	5			
Polygonaceae	<i>Polygonum chinense</i>	火炭母											0.1	10																					
Onagraceae	<i>Ludwigia hyssopifolia</i>	草龍																								0.4	5								
Cyperaceae	<i>Cyperus sp.</i>	莎草																								0.5	5								
Poaceae	<i>Miscanthus floridulus</i>	五節芒																											1.5	5					
Poaceae	<i>Brachiaria mutica</i>	巴拉草																																	
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																																	
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																																	
Araceae	<i>Alocasia macrorrhizos</i>	海芋																																	
Lemnaceae	<i>Lemna minor</i>	浮萍																																	
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																																	
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																																	
Bare Gound											98	75	30	##	95	10	15	70	##	80	15	25													

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

Table 4.2. Flora species recorded from belt transect survey at the She Shan River

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

Family	Species	Chinese name	Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						
			Mar-15		Apr-15		May-15		Jun-15		Jul-15		Mar-15		Apr-15		May-15		Jun-15		Jul-15		Mar-15		Apr-15		May-15		Jun-15		Jul-15		
			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	
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.6	10	1	70	0.5	40	0.6	10	1	70	0.5	40	0.3	5	0.7	50	0.5	25	0.3	5	0.7	50	0.5	25			0.3	25			
Poaceae	<i>Panicum repens</i>	枯骨草																															
Asteraceae	<i>Mikania micrantha</i>	薔甘菊	0.4	10	0.5	15			0.4	10	0.5	15			0.3	5	0.5	10			0.3	5	0.5	10			0.4	10	0.4	10			
Brassicaceae	<i>Nasturtium officinale</i>	西洋菜																															
Moraceae	<i>Ficus microcarpa</i>	細葉榕																															
Moraceae	<i>Ficus hispida</i>	對葉榕																															
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹																															
Fabaceae	<i>Pueraria lobata</i>	野葛																															
Araceae	<i>Colocasia esculenta</i>	芋																															
Urticaceae	<i>Boehmeria nivea</i>	苧麻																															
Asteraceae	<i>Bidens alba</i>	白花鬼針草																										0.9	15			0.3	2
Poaceae	<i>Pennisetum purpureum</i>	象草																															
Poaceae	<i>Coix lacryma-jobi</i>	薏苡																										1	2				
Amaranthaceae	<i>Alternanthera philoxeroides</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	80	1.3	5	1.3	25	1.5	80	1.4	5	1.4	25	1.5	40	1.2	5	1.2	15	1.5	45	1.2	10	1.2	20	0.8	60	1	50	0.8	10	
Blechnaceae	<i>Blechnum orientale</i>	烏毛蕨																															
Poaceae	<i>Pennisetum alopecuroides</i>	狼尾草																															
Araceae	<i>Alocasia macrorrhizos</i>	海芋																															
Lemnaceae	<i>Lemna minor</i>	浮萍																															
Polygonaceae	<i>Polygonum hydropiper</i>	水蓼																															
Cyperaceae	<i>Cyperus involucratus</i>	風車草		1.5	5					1.5	5				1.4	5						1.4	5					1.2	5				
Onagraceae	<i>Ludwigia erecta</i>	美洲水丁香				2	10					2	10				1.6	5					1.6	5						1.5	50		
Convolvulaceae	<i>Ipomoea cairica</i>	五爪金龍																										0.3	5				
Bare Gound			0	5	25	0	5	25	50	30	55	45	25	50	13	10																	

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

Table 4.4. Odonate species recorded at the She Shan River

Species name	Common name	Chinese name	Status	Commonness	Baseline monitoring		Impact monitoring				Impact monitoring					Post construction monitoring										
					Jul-08	Aug-08	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Jul-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	
<i>Agriocnemis pygmalis</i>	Wandering Midget	黃尾小蠅	NP	VC																+						
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC																						
<i>Ceriatagrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蠅	NP	VC																+	++	+			+	
<i>Copera ciliata</i>	Black-knees Featherleg	白狹扇蠅	NP	VC																	+					
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蠅	NP	VC																	+	+		+	+	+
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+			+															+	+	+
<i>Diplacodes trivialis</i>	Blue Percher	紋藍小蜻	NP	VC	+																					
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C																					+	+
<i>Ischnura senegalensis</i>	Common Bluetail	褐斑異痣蠅	NP	VC																						
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	NP	C																						
<i>Neurobasis chinensis chinensis</i>	Chinese Greenwing	華麗色蠅	NP	VC																						
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC																					+	+
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC	+	+			+																	
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC																						
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC																						
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC																						
<i>Orthetrum Sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	C	+	+																				+
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+	+																				
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蠅	NP	VC																						
<i>Pseudagrion pruinosum fraseri</i>	Ferruginous-faced Sprite	赤斑蠅	NP	C																						
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蠅	NP	UC	+																					
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蠅	NP	VC																						
<i>Rhyothemis variegata arria</i>	Variegated Flutterer	斑麗翅蜻	NP	C																						
<i>Trithemis aurora</i>	Crimson Dropwing	曉靄蜻	NP	VC																						
<i>Trithemis festiva</i>	Indigo Dropwing	靄靄蜻	NP	VC					+																	
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PG	VC																						
No of Species					6	4	3	4	1	6	1	11	1	4	10	4	6	6	8	7	9	13	9	11	9	

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

Commonness and status were decided according to AFCD biodiversity website

(www.hkbiodiversity.net)

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

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

Table 4.4. Odonate species recorded at the She Shan River

Species name	Common name	Chinese name	Status	Commonness	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	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16
<i>Agriocnemis pygmalis</i>	Wandering Midget	黃尾小蠅	NP	VC																
<i>Brachythemis contaminata</i>	Asian Amberwing	黃翅蜻	NP	VC																
<i>Ceragrion auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蠅	NP	VC						+	+		+	+	+	+				
<i>Copera ciliata</i>	Black-knees Featherleg	白狹扇蠅	NP	VC																
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蠅	NP	VC	+					+	+		+	+	+	+				
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+	+	+	+		+	+		+	+	+	+	+			
<i>Diplacodes trivialis</i>	Blue Percher	紋藍小蜻	NP	VC																
<i>Ictinogomphus pertinax</i>	Common Flangetail	霸王葉春蜓	NP	C	+								+	+	+	+	+			
<i>Ischnura senegalensis</i>	Common Bluetail	褐斑異痣蠅	NP	VC																
<i>Nannophya pygmaea</i>	Scarlet Dwarf	侏紅小蜻	NP	C																
<i>Neurobasis chinensis chinensis</i>	Chinese Greenwing	華麗色蠅	NP	VC	+	+				+	+		+		+	+	+	+		
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC						+	+		+	+	+	+				
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC											+	+	+	+		+
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC																
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC										+	+					
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC	+						+		+	+						
<i>Orthetrum Sabina sabina</i>	Green Skimmer	狹腹灰蜻	NP	C	+												+	+		
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+	+							+	+	+	+	+	+	+	+
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蠅	NP	VC							+		+	+	+					
<i>Pseudagrion pruinosum fraseri</i>	Ferruginous-faced Sprite	赤斑蠅	NP	C																
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蠅	NP	UC	+	+														
<i>Rhinocypha perforata perforata</i>	Common Blue Jewel	三斑鼻蠅	NP	VC	+	+					+		+	+	+	+	+			
<i>Rhythemis variegata arria</i>	Variegated Flutterer	斑麗翅蜻	NP	C									+	+	+	+				
<i>Trithemis aurora</i>	Crimson Dropwing	曉褐蜻	NP	VC	+	+	+	+	+		+		+	+	+	+	+	+		
<i>Trithemis festiva</i>	Indigo Dropwing	靛褐蜻	NP	VC	+	+					+		+	+	+	+	+	+	+	+
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩虹蜻	P,PG	VC																
No of Species					11	7	2	2	1	5	10	12	13	13	13	12	9	7	2	3

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

Commonness and status were decided according to AFCD biodiversity website

(www.hkbiodiversity.net)

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

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

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	Baseline monitoring				Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring																		
			Status	Common-ness	Jul-08		Aug-08		Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11			Jan-12			Jul-12			Jan-13										
					Upper stream	Lower stream	Upper stream	Lower stream	Referen	T1	T2	T3	Referen	T1	T2	T3	Referen	T1	T2	T3	Referen	T1	T2	T3	Referen	T1	T2	T3	Referen	T1	T2	T3	Referen	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>	河蚌	NP	VC																																								
<i>Melanoides tuberculata</i>	縮螺黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Pomacea canaliculata</i>	福壽螺	NP	VC	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Sinotia quadrata</i>	田螺	NP	VC	+	+	+	++	+																																			
Insects																																											
<i>Baetis sp.</i>		NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Caenis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Chironomus sp.</i>	鯉幼虫	NP	VC	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Euphaea sp.</i>		NP	VC																																								
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+									
<i>Odonate larvae</i>		NP	VC																																								
<i>Orthetrum spp.</i>	--	NP	VC					+	+																																		
<i>Pseudagrion spp.</i>	--	NP	UC																																								
<i>Pseudocloeon sp.</i>	--	NP	VC	+	+	+	+																																				
<i>Serratella 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																																								
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	11	8	7	6

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

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Rive

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

Species	Chinese name	Sampling location		Impact monitoring	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring															
		Status	Common-ness	Dec-13				Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-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					
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>	河蚌	NP	VC	+																																								
<i>Melanoides tuberculata</i>	摺扇黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Pomacea canaliculata</i>	福壽螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Sinotaia quadrata</i>	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
Insects																																												
<i>Baetis sp.</i>		NP	VC																																									
<i>Caenis sp.</i>	--	NP	VC																																									
<i>Chironomus sp.</i>	蚊幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
<i>Euphaea sp.</i>		NP	VC																																									
<i>Indobaetis sp.</i>	--	NP	VC																																									
<i>Odonate larvae</i>		NP	VC																																									
<i>Orthetrum spp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+						
<i>Pseudagrion spp.</i>	--	NP	UC																																									
<i>Pseudocloeon sp.</i>	--	NP	VC																																									
<i>Serratella 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																																									
No of Species					11	8	8	7	11	8	8	7	13	10	9	8	14	12	12	9	14	12	13	9	11	11	13	8	10	12	13	8	10	11	14	7	10	12	15	6	12	12	14	8

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

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Rive

(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											
		Status	Common-ness	Oct-14				Nov-14				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				May-15				Jun-15				Jul-15			
				Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3				
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>	河蚌	NP	VC			+				+				+				+				+				+				+				+				+				+	
<i>Melanoides tuberculata</i>	摺殼黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pomacea canaliculata</i>	福壽螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Sinotaia quadrata</i>	田螺	NP	VC	+	+	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++
Insects																																											
<i>Baetis sp.</i>	--	NP	VC	+	+	+		+	+	+			+					+				+				+				+				+				+				+	
<i>Caenis sp.</i>	--	NP	VC																																								
<i>Chironomus sp.</i>	鯉幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Euphaea sp.</i>	--	NP	VC																																								
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
<i>Odonate larvae</i>	--	NP	VC																																								
<i>Orthetrum spp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pseudagrion spp.</i>	--	NP	UC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pseudocloeon sp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
<i>Serratella 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																																								
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	13	6	9	12	14	6

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

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Rive

(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							
				Aug-15				Sep-15				Oct-15				Nov-15				Dec-15				Jan-16							
				Referenc	T1	T2	T3	Referenc	T1	T2	T3	Referenc	T1	T2	T3	Referenc	T1	T2	T3	Referenc	T1	T2	T3	Referenc	T1	T2	T3	Referenc	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>	河蚌	NP	VC			+				+				+				+										+			
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Pomacea canaliculata</i>	福壽螺	NP	VC	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	++	
<i>Radix plicatulus</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Sinotaia quadrata</i>	田螺	NP	VC	+	+	+	++	+	+	+	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+		
Insects																															
<i>Baetis sp.</i>		NP	VC			+				+				+				+										+			
<i>Caenis sp.</i>	--	NP	VC																												
<i>Chironomus sp.</i>	鯉幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Euphaea sp.</i>		NP	VC		+	+			+	+			+	+			+	+			+	+			+	+		+	+		
<i>Indobaetis sp.</i>	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+		
<i>Odonate larvae</i>		NP	VC			+			+	+			+	+			+	+			+	+			+	+		+	+		
<i>Orthetrum spp.</i>	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Pseudagrion spp.</i>	--	NP	UC		+	+			+	+			+	+			+	+			+	+			+	+		+	+		
<i>Pseudocloeon sp.</i>	--	NP	VC																												
<i>Serratella 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							+				+					+							+		+			
No of Species				9	12	15	6	9	13	15	6	9	13	15	6	9	13	15	6	9	14	15	6	9	14	15	6	9	14	15	6

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

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

Species		Status	Commonness	Baseline 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							
				Upper stream	Lower stream	Upper stream	Lower stream	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>	泥鰌	NP	C													+						+																	
<i>Oreochromis niloticus</i>	尼羅口非鯽	NP	C			+	++			+	+			+			+			+		+	++	+			+												
<i>Parazacco spilurus</i>	異鱧	NP, V	C	+	++	+	++	+	+	+	++	+	+				+	+			+	+	++	+			+												
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC			++	++					+	+			+	+			+		+	+	+	+		+				+	+							
<i>Pterocryptis cochinchinensis</i>	越南隱鰭鮡	NP	C																																				
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+++	++	+++	+++	++		+	+	+			+	+			+	+	+	+	+	+		+				+	+								
<i>Rhinogobius spp.</i>	鯢虎魚	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>	寬鰭鱧	NP	C	++	+	+	+	+		+	+	+			+	+			+		+	+	+	+		+			+	+									
				2x2m fish number				80	60	80	60	30		15	45	30	0	0	300	30	0	13		20	5	20	200	22	16	3	0	6	4	2	3	8	2	4	0
				No of Species				4	4	9	9	6	1	6	9	7	1	0	5	7	1	6	0	7	3	9	8	8	6	1	0	8	0	2	1	8	6	1	0
Amphibian																																							
<i>Paramotriton hongkongensis</i>	香港瘳蟾	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 the with the data within works area.
 "Cap 170" - List in Wild Animals Protection Ordinance (Cap.170)
 "NT" - Near Threatened in IUCN Red List Status
 "PGC"-Potential Global Concern by Fellowes *et al* (2002)
 "V" - Vulnerable - in Red China Data Book

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				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring												
			Jul-12				Jul-13				Dec-13				Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-14								
			Reference	T1	T2	T3	Referenc	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>	革胡子鯪	NP	VC																																												
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C	+				+				+				+				+				+				+				+				+				+							
<i>Oreochromis niloticus</i>	尼羅口非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Parazacco spilurus</i>	異鱧	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC	+				+	+	+																																					
<i>Pterocryptis cochinchinensis</i>	越南隱鰭鯪	NP	C																																												
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+					
<i>Rhinogobius spp.</i>	鯽虎魚	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+					
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																																												
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+					
2x2m fish number				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				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	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 the with the data within works area.
“Cap 170” - List in Wild Animals Protection Ordinance (Cap.170)
“NT” - Near Threatened in IUCN Red List Status
“PGC” - Potential Global Concern by Fellowes *et al* (2002)
“V” - Vulnerable - in Red China Data Book

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	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring								
			Aug-14				Sep-14				Oct-14				Nov-14				Dec-14				Jan-15				Feb-15				Mar-15				Apr-15				
			Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	
<i>Channa maculata</i>	斑鱧	NP	C	+	+	+		+	+	+			+	+											+									+					
<i>Clarias gariepinus</i>	革胡子鯪	NP	VC			+	+					+	+																								+		
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Oreochromis niloticus</i>	尼羅口非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Parazacco spilurus</i>	異鱸	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Poecilia reticulata</i>	孔雀花魚	NP	VC				+					+																											
<i>Pterocryptis cochinchinensis</i>	越南隱鰭鯪	NP	C			+						+																											
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Rhinogobius spp.</i>	鯽虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C			+						+																											
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
	2x2m fish number			12	10	16	12	20	20	30	16	40	30	40	30	50	50	60	50	60	50	50	40	50	40	40	40	40	40	50	50	30	35	55	45				
	No of Species			9	9	12	10	9	9	12	10	8	9	11	10	8	9	12	8	7	6	11	9	7	8	11	8	7	9	12	8	8	10	12	9	8	10	12	9
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 the with the data within works area.
 "Cap 170" - List in Wild Animals Protection Ordinance (Cap.170)
 "NT" - Near Threatened in IUCN Red List Status
 "PGC"-Potential Global Concern by Fellowes *et al* (2002)
 "V" - Vulnerable - in Red China Data Book

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	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring							
			May-15				Jun-15				Jul-15				Aug-15				Sep-15				Oct-15				Nov-15				Dec-15				Jan-16			
			Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
<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>	泥鰌	NP	C	+	+	+																														+		
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+		
<i>Parazacco spilurus</i>	異鱾	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Poecilia reticulata</i>	孔雀花魚將	NP	VC				+	+						+	+																					+		
<i>Pterocryptis cochinchinensis</i>	越南隱鰭鮠	NP	C				+	+						+	+																					+		
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C				+	+						+	+																					+		
<i>Zacco platypus</i>	寬鰭鱈	NP	C	+	+	++	+	+	+	++	+	+	+	++	+	+	++	+	+	++	+	+	++	+	+	++	+	+	++	+	+	++	+	+	++	+		
	2x2m fish number			20	10	20	10	20	10	15	8	15	8	20	10	20	10	20	12	23	12	35	35	25	20	45	45	35	30	55	50	40	35	55	45	35	25	
	No of Species			8	9	13	10	8	8	13	10	8	8	13	10	8	13	7	8	8	13	6	8	8	13	6	8	8	13	6	8	8	13	6	8	8	12	7
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 the with the data within works area.
 "Cap 170" - List in Wild Animals Protection Ordinance (Cap.170)
 "NT" - Near Threatened in IUCN Red List Status
 "PGC" - Potential Global Concern by Fellowes *et al* (2002)
 "V" - Vulnerable - in Red China Data Book

Table 4.7 Abotic data for the Upper She Shan River

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

Parameter / date	Baseline monitoring	Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring		
	Aug-08	Jan-09			Jul-09			Jan-10			Jul-10			Jan-11			Jul-11		
Replicate		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
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
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
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
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
Conductivity (µS/cm)	90	--	140	170	116	114	116	--	105	--	410	410	390	110	111	115	120	115	130
BOD (mg/L)	<2	--	<2	4	<2	<2	<2	--	2	--	<2	3.2	<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
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
Sand (%)	55	65	23	65	23	23	65	5	23	--	5	30	5	5	30	2	5	30	2
Stone (%)	25	30	75	30	75	75	30	40	75	--	40	65	80	40	65	2	40	65	2
Mud (%)	30	5	2	5	2	2	5	5	2	--	5	5	5	5	5	1	5	5	1
Concrete (%)	0	0	0	0	0	0	0	50	0	100	50	0	10	50	0	95	50	0	95

Table 4.7 Abiotic data for the Upper She Shan River

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

Parameter / date	Impact monitoring			Impact monitoring			Impact monitoring			Impact 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								
	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			
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	8.6	8.2	8.8	7.7	7.7	6.3	7.8	7.8	7.7	8.7	8.6	9.2	8.3	8.2	8.6	7.2	7.6	7.8	7.1	7.2	7.2	7.3	7.5	7.6	7.8	7.6	7.7						
pH	6.9	6.6	7.1	6.7	6.6	6.6	6.8	7.2	7.6	6.6	6.9	7.1	6.8	7.3	7.4	7.8	6.7	7.6	7.2	6.8	7.5	6.6	7.3	7.2	7.5	7.5	7.4						
Nitrate (mg N/L)	0.2	0.2	0.4	0.84	0.86	1.14	0.6	0.61	0.7	0.78	0.63	0.53	1.2	1.12	1.02	1.5	1.2	1.6	1.2	1.1	0.77	0.6	0.8	1.2	1.1	1.0	1.1						
Ammonia (mg N/L)	0.2	0.2	0.3	0.05	0.02	1.08	0.14	0.06	0.05	0.08	<0.01	0.42	1.9	1.8	1.73	0.8	1.2	1.4	0.4	0.6	0.01	0.6	0.5	0.8	<0.1	<0.1	<0.1						
Salinity (ppt)	0	0	0	0.03	0.04	0.07	0.03	0.03	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.04	0.06			
Conductivity (µS/cm)	122	118	126	121	120	160	94	97	97	116	116	134	124	118	132	128	113	132	123	136	140	112	116	120	124	121	123						
BOD (mg/L)	<2	<2	<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)	0.2	0.05	0.1	0.2	0.05	0.1	0.2	0.05	0.1	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1-0.2	0.1-0.2	0.1-0.2			
Water flow at riffle (m/s)	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2-0.4	0.2-0.3	0.2-0.4	0.2-0.5	0.2-0.4	0.2-0.5			
Sand (%)	10	25	5	10	25	5	15	25	5	15	10	5	15	10	5	15	10	5	15	10	5	10	10	5	5	5	5						
Stone (%)	45	65	5	45	65	5	65	65	15	65	80	20	65	80	20	65	80	20	65	80	20	70	80	30	80	80	30						
Mud (%)	5	10	10	5	10	10	10	10	10	10	10	5	10	10	5	10	10	5	10	10	5	10	10	5	5	5	2						
Concrete (%)	40	0	80	40	0	80	10	0	70	10	0	70	10	0	70	10	0	70	10	0	70	10	0	60	10	10	63						

Table 4.7 Abiotic data for the Upper She Shan River

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

Parameter / date	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring					
	Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15					
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
DO (mg/L)	7.6	7.8	7.4	7.7	7.7	7.4	7.2	7.2	7.4	7.8	7.0	8.1	7.8	8.0	7.5	7.6	8.1	7.6	8.5	8.6	8.6	8.6	8.6	8.7			
pH	7.5	7.5	7.4	7.4	7.5	7.3	7.2	7.3	7.1	8.2	8.2	8.2	8.4	8.3	8.1	7.9	8	7.8	8.2	8.5	8.4	9.0	8.8	8.8			
Nitrate (mg N/L)	0.5	0.6	0.6	0.8	0.6	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4			
Ammonia (mg N/L)	< 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)	0.04	0.05	0.05	0.04	0.05	0.05	0	0	0	0.03	0.04	0.03	0.03	0.03	0.04	0.01	0.03	0.02	0.02	0.02	0.02	0.03	0.03	0.03			
Conductivity (µS/cm)	118	115	119	110	113	111	120	116	108	125	125	123	113	114	116	110	96	106	127	132	121	156	162	147			
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			
Water flow at pool (m/s)	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2			
Water flow at riffle (m/s)	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	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	0.2-0.5	0.2-0.5			
Sand (%)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5			
Stone (%)	80	80	30	80	80	30	80	80	30	80	80	30	80	80	30	80	80	30	80	80	30	80	80	30			
Mud (%)	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2			
Concrete (%)	10	10	63	10	10	63	10	10	63	10	10	63	10	10	63	10	10	63	10	10	63	10	10	63			

Table 4.7 Abotic data for the Upper She Shan River

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

Parameter / date	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
	Sep-15			Oct-15			Nov-15			Dec-15			Jan-16		
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	8	8.1	8.2	8.1	7.9	8	7.9	7.8	7.9	8	7.8	8	7.8	7.7	7.8
pH	7.7	7.7	7.5	7.5	7.5	7.6	7.6	7.5	7.5	7.6	7.6	7.5	7.9	7.8	7.8
Nitrate (mg N/L)	0.4	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.5
Ammonia (mg N/L)	< 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)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Conductivity (µS/cm)	29	31	32	33	32	39	30	29	36	32	29	42	29	35	32
BOD (mg/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Water flow at pool (m/s)	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2	0.1-0.2
Water flow at riffle (m/s)	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	0.2-0.5	0.2-0.5	0.2-0.5	0.2-0.5
Sand (%)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Stone (%)	80	80	30	80	80	30	80	80	30	80	80	30	80	80	30
Mud (%)	5	5	2	5	5	2	5	5	2	5	5	2	5	5	2
Concrete (%)	10	10	63	10	10	63	10	10	63	10	10	63	10	10	63

**Agreement No. CE65/2013(EP) Post-Construction
Ecological Monitoring of River Improvement Work in
Upper Lam Tsuen River, She Shan River and Upper Tai Po
River – Investigation
Post-Construction Ecological Monitoring Report (No. 25)
Upper Tai Po River**

January 2016



Prepared by : Mike Pang

January 26 , 2016

Validated by: Mark Shea

January 26, 2016

Ecology Team: China Hong Kong Ecology Consultants

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

**Post-Construction Ecological Monitoring Report (No.25)
Upper Tai Po River**

Table of Contents	Page
1 Introduction	3
2 Summary of Major Points	
3 Monitoring Methodology	4
4 Monitoring Results	5
5 Summary and Commentary	
6 References	7

FIGURES

Figure 1: Sampling location of ecological survey and monitoring at Upper Tai Po River, Tai Po.

PHOTOS

- Photo 1: General view of the river channel (Reference site)
- Photo 2: General view of the river channel (Upper section)
- Photo 3: General view of the river channel (Middle section)
- Photo 4: Vegetation growing on gabion (Middle section)
- Photo 5: Abundant species - *Commelina diffusa* (Middle section)
- Photo 6: Avifauna – *Motacilla alba*
- Photo 7: Avifauna – *Ardeola bacchus*
- Photo 8: Avifauna – *Motacilla cinerea*
- Photo 9: Avifauna – *Tringa ochropus*
- Photo 10: Sample collected from kick sampling

TABLES

- Table 4.1: Flora species recorded at the survey transect along the Upper Tai Po River including riparian habitat.
- Table 4.2: Flora species recorded from belt transect survey at the Upper Tai Po River
- Table 4.3: Avifauna recorded along survey transects and at two selected point count locations at Upper Tai Po River.
- Table 4.4: Odonata species recorded at the Upper Tai Po River
- Table 4.5: Aquatic Macro-invertebrates recorded at Upper Tai Po River.
- Table 4.6: Fish species and Hong Kong Newt recorded at Upper Tai Po River.
- Table 4.7: Abiotic data for Upper Tai Po River.

1 Introduction

- 1.1 The current post-construction ecological monitoring programme is under Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River. The collected data are mainly used to assess ecological recovery process and effectiveness of ecological migration proposed and enforced during the construction period.
- 1.2 The scope of the ecological monitoring was detailed in EM & A Manual of the project. In brief, the survey aimed to collect data on abiotic factors such as water quality, substratum characteristics, water flow as well as flora and fauna.
- 1.3 China Hong Kong Ecology Consultants Ltd. was committed by Allied Environmental Consultants Ltd (AEC) to undertake the ecological monitoring tasks for the project from December 2014.
- 1.4 This is the number 25 post-construction ecological monitoring report for the project conducted **on 17th January 2016**. It contains the following subsections:
 - Summary of major points
 - Monitoring Methods and Results
 - Summary and Comments

2 Summary of Major Points

- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Bird abundance was similar to those recorded during baseline survey;
- The abundance of target river fauna, i.e., fish *Parazacco spilurus* recorded was lower than those recorded during baseline monitoring (before fish capture/relocation took place). The reason for low fish population of *Parazacco spilurus* was due to river bed modification. The rare fish *Pseudobagrus trilineatus* was consistently recorded in the river during recent monitoring. The other target species, Hong Kong Newt *Paramesotriton hongkongensis*, was not found within works area during baseline, impact monitoring and it was recorded in the river during post construction monitoring. Apart from fauna species, 65 flora species was recorded within the survey transects along the river course. Some common herbs were observed generating on the embankment, which indicating that vegetation was recovering. Flora species of *Tibouchina semidecandra* and *Ipomoea pes-caprae* were planted on the gabion along the river for landscape purpose;
- The abundance of fish increased in this month;
- The abundance of odonata was still low compared with the data of wet season.
- Hong Kong Newt could not be found in this month.

3 Monitoring Methodology

3.1 Riparian Vegetation

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

3.2 Avifauna

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

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

3.3 Adult Odonata Survey

Adult Odonata surveys were conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behavior were recorded. Nomenclature and protection status of the species has followed those documented in the AFCDD website (www.hkbiodiversity.net), 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 AFCDC website (www.hkbiobiodiversity.net) and other literatures such as Dudgeon (1994).

3.5 Fish and Newt

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

Sampling was conducted at three sampling locations with one located at upper section (T1) and one located at middle section (T2), as well as reference site. The selected sampling site covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of the observed fish and newt was estimated and recorded. Nomenclature and protection status of the species has followed those documented in the AFCDC 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 measured and analyzed by conventional methods in situ or in laboratory. The instruments for measuring dissolved oxygen level, pH value, conductivity, salinity were model: DO-5510, AZ8685, AZ8361 and AZ8374 respectively. All the instruments were calibrated every monitoring month according to the operation manuals in order to obtain the precise result. BOD test took 5 days to complete within darkness incubator with stable temperature at 20°C and was performed using model: DO-5510 for measuring dissolved oxygen. Nutrient levels including nitrate and ammonia were performed in laboratory by applying the In-house method SOP056 (FIA) and SOP057 (FIA) respectively.

3.6.2 Sediment Characteristics

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

3.6.3 Water Flow

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

4 Monitoring Results

4.1 Vegetation

Major proportion of river bed and bank was concrete and without plant colonizing (Photos 2-3). Vegetation has sparsely covered the gabion wall along the upper Tai Po River and the river bed (Photo 4) with some common plants including invasive species *Mikania micrantha*, and native species *Commelina diffusa*. In total, 65 flora species were recorded within the survey transects along the river course. Abundant native species *Commelina diffusa* was the dominant species established in the river bed (Photo 5). The flora were generally in good health, and the height of the dominated riparian grass and herb species were in a range from 0.2m to 2m as observed along survey transect. Dominant flora species were shown in the **Table 4.1** marked with relative abundance sign “+++”. Results of vegetation survey and belt transect survey were presented in **Table 4.1** and **Table 4.2**. **Figure 1** shows the transect line for the flora surveys.

4.2 Fauna

4.2.1 Avifauna

An avifauna survey was undertaken along survey transects and at two defined point count locations. In total, 15 species of birds were recorded during bird survey. Among them, 5 species were wetland dependant birds observed feeding in the river channel including *Motacilla alba* (Photo 6), *Egretta garzetta*, *Ardeola bacchus* (Photo 7), *Motacilla cinerea* (Photo 8) and *Tringa ochropus* (Photo 9). A common species *Pycnonotus jocosus* was the dominant species of most of the proportion of the river. All the birds in Hong Kong are under protection of Wild Animals Protection Ordinance (Cap. 170). Some of the wetland dependent species recorded are classified as Regional Concern by Fellowes *et al.* (2002) including *Egretta garzetta* and *Ardeola bacchus*, which were usually observed feeding in the river. Sound call of *Centropus sinensis* was noticed during transect survey, this species was considered as Vulnerable in China Red Data Book. Bird abundance was similar to those recorded during baseline survey. Only foraging behaviour of some wetland dependent birds were noticed. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4.3**.

4.2.2 Adult Odonata Survey

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

4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the river. The river benthic fauna collected was mainly comprised of insects, molluscs and crustaceans (Photo 9). 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. Hong Kong Newt is listed in Wild Animals Protection Ordinance (Cap. 170) and classified as “Near Threatened” under IUCN Red List Status and as “Potential Global Concern” by Fellowes *et al.* (2002). Record of Hong Kong Newts can be referred to **Table 4.6**.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Tai Po River during surveys. In total, 11 species freshwater fish were recorded within project area. Fish abundance was low along the modified river channel. The *Parazacco spilurus* and *Pseudobagrus trilineatus*, which have conservation interest, were restricted in the upper section of the surveyed river outside the works boundary where the habitat was not affected by construction works, while *Parazacco spilurus* is listed in China Red Data Book Status as Vulnerable and *Pseudobagrus trilineatus* is classified as Global Concern by Fellowes *et al.* (2002). The abundance of fish was observed in increase in this month due to less flooding events. 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. Fish’s abundance was recorded in increase in this month. Bird abundance was similar to those recorded during baseline survey. Species richness of odonata was still low during current dry season.

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

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

6 REFERENCES

Carey, G.J., Chalmers, M.L., Diskin, D.A., Kennerley, P.R., Leader, P.J., Leven, M.R., Lewthwaite, R.W., Melville, D.S., Turnbull, M. and Yung, L. (2001) *The Avifauna of Hong Kong*. Hong Kong Bird Watching Society.

Dudgeon, D. and Corlett, R. (1994). *Hills and Streams - An Ecology of Hong Kong*. Hong Kong University Press, Hong Kong.

Hong Kong Herbarium (2015):
<http://herbarium.gov.hk/>

Hong Kong Biodiversity Website (2015):
<http://www.afcd.gov.hk/english/conservation/hkbiodiversity/hkbiodiversity.html>

Lai, P.C.C., Lam, Y.W., So, P.S., Tam, K.Y., Wan, P.Y.M. and Yip, K.L. (2004). *Check List of Hong Kong Plants*, Agriculture, Fisheries and Conservation Department, Hong Kong.

Lee, V.L.F., Lam, S.K.S., NG, F.K.Y., Chan, T.K.T. and Young, M.L.C. (2004). *Field Guide to the Freshwater Fish of Hong Kong*, Friends of the Country Parks and Cosmos Books Ltd, Hong Kong.

Tam, T.W., Leung, K.K., Kwan, B.P. S., Wu, K. K. Y., Tang, S. S. H., So, I.W.Y., Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y.M and Leung, H.W. (2011). *The Dragonflies of Hong Kong*. Agriculture, Fisheries and Conservation Department, Friends of the Country Parks and Cosmos Books Ltd., Hong Kong.

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

FIGURE

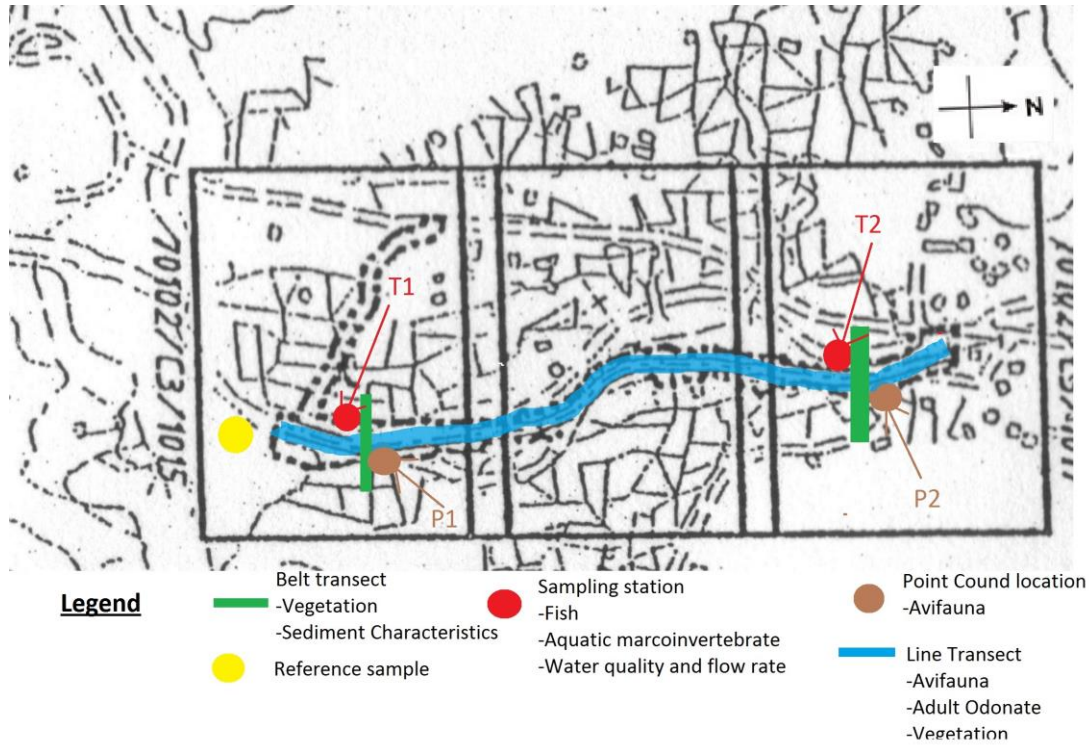


Figure 1. Sampling Location of Ecological Survey and Monitoring at Upper Tai Po River, Tai Po.

PHOTOS



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



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

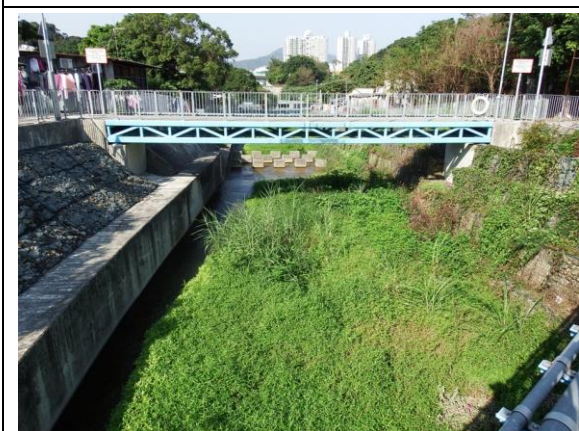


Photo 3: General view of the river channel (Middle section)

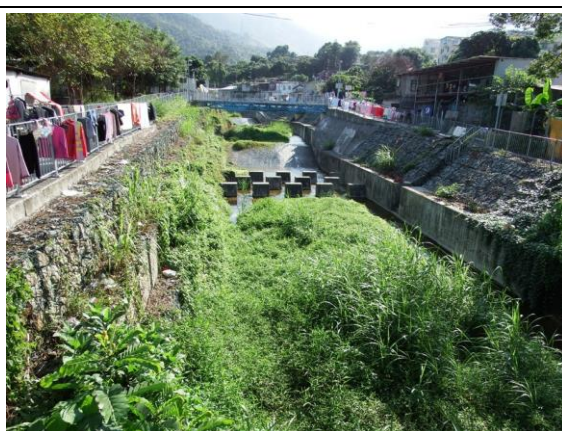


Photo 4: Vegetation sparsely growing on gabion and river bed



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



Photo 6: Avifauna – *Motacilla alba*



Photo 7: Avifauna – *Ardeola bacchus*

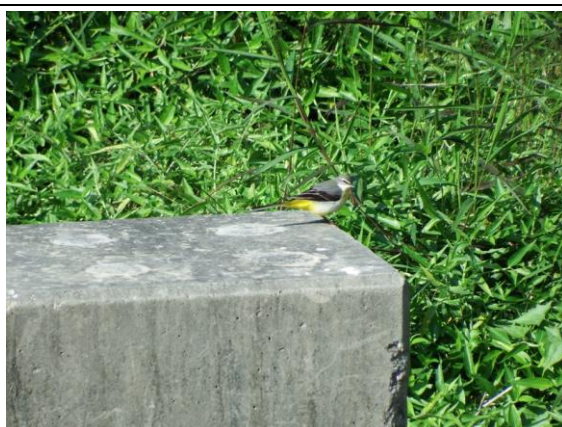


Photo 8: Avifauna – *Motacilla cinerea*



Photo 9: Avifauna – *Tringa ochropus*



Photo 10: 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	Post construction monitoring																											
			Feb-14			Mar-14			Apr-14			May-15			Jun-15			Jul-15			Aug-15									
			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	3	0.5	10	0.3	3	0.5	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	5				
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																								1.5	5			
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																									0.5	5		
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																										0.5	5	
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			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			0.3	5		
Asteraceae	<i>Ageratum conyzoides</i>	勝紅薊		0.3	2			0.3	2			0.3	2			0.3	2			0.3	5			0.3	5					
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.3	10	0.5	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	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>	鋤蟲菊																												
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	0.7	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		0.3	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			0.2	5	
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙			1	5			1	5			1	5			1	3			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		
Bare Gound			35	88	7	35	88	7	35	88	7	35	88	7	40	93	46	40	85	46	40	85	46	40	14	5	40	34	25	

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

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

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

		Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						
		Sep-15						Oct-15						Nov-15						Dec-15						Jan-16						
Stream		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		Reference		T1		T2		
Family	Species	Chinese name	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%	Height (m)	%		
Asteraceae	<i>Mikania micrantha</i>	薇甘菊	0.5	10					0.5	10					0.5	10					0.5	5					0.5	5				
Moraceae	<i>Ficus hispida</i>	對葉榕																														
Ulmaceae	<i>Celtis sinensis</i>	朴樹																														
Poaceae	<i>Microstegium ciliatum</i>	剛秀竹	1	5	1	1			1	5	1	3			1	5	1	3			1	5	1	3			1	5	1	3		
Euphorbiaceae	<i>Macaranga tanarius</i>	血桐					1.5	5									1.5	5					1.5	5					1.5	5		
Araceae	<i>Alocasia odora</i>	海芋																														
Araceae	<i>Colocasia esculenta</i>	芋	0.5	5	1.2	2			0.5	5	1.2	5			0.5	5	1.2	5			0.5	5	1.2	5			0.5	5	1.2	5		
Myrtaceae	<i>Cleistocalyx operculatus</i>	水翁																														
Athyriaceae	<i>Callipteris esculenta</i>	菜蕨																														
Poaceae	<i>Phragmites karka</i>	卡開蘆	1.5	10					1.5	10					1.5	10					1.5	7					1.5	7				
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				
Asteraceae	<i>Ageratum conyzoides</i>	勝紅蕒																														
Commelinaceae	<i>Commelina diffusa</i>	節節草	0.4	10	0.2	5	0.4	30	0.4	10	0.2	15	0.4	30	0.4	10	0.2	20	0.4	30	0.4	7	0.2	20	0.4	30	0.4	10	0.2	25	0.4	35
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>	鋸齒菊																														
Asteraceae	<i>Bidens alba</i>	白花鬼針草	0.7	5			0.5	5	0.7	5			0.5	5	0.7	5			0.5	5	0.7	5			0.5	5	0.7	5		0.5	5	
Poaceae	<i>Panicum repens</i>	枯骨草	0.4	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			2.5	5	2	20			2	7	2	20			2	10	2	20			2	10	2	20			2	10	2	20
Poaceae	<i>Brachiaria mutica</i>	巴拉草			1.2	2	0.5	15			1.2	2	0.5	15			1.2	2	0.5	15			1.2	2	0.5	15			1.2	2	0.5	15
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			0.2	2					0.2	2					0.2	2					0.2	2					0.2	2		
Balsaminaceae	<i>Impatiens walleriana</i>	非洲鳳仙																														
Amaranthaceae	<i>Celosia argentea</i>	青葙	1.7	5					1.7	5					1.7	5					1.7	5					1.7	5				
Bare Ground			40		83		25		40		66		25		40		58		25		51		58		25		48		53		20	

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

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

Table 4.4. Odonate species recorded at the UpperTai Po River

Species	Common name	Chinese name	Status	Commonness	Baseline survey	Impact monitoring					Impact monitoring					Post construction monitoring									
					Oct-07	Jan-09	Jul-09	Jan-10	Jul-10	Jan-11	Jul-11	Jan-12	Jul-12	Mar-13	Jul-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14
<i>Macrodiplox cora</i>	Coastal Glider	高翔弄蝶	NP	C																					
<i>Ceriatrigon auranticum ryukyuenum</i>	Orange-tailed Sprite	琉球橘黃蝶	NP	VC															+	+					
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹尾蝶	NP	VC																		+	+	+	+
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC	+		+		+												+				
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蝶	NP	VC							+												+	+	
<i>Neurobasis chinensis</i>	Chinese Greenwing	華碧色蝶	NP	C					+									+	+	+				+	+
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC																					
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華麗灰蜻	NP	VC		+	+		+				+		+	+									
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC	+	+	+																		
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC											+										
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC																					
<i>Palpopleura sexmaculata sexmaculata</i>	Asian Widow	六斑曲線蜻	NP	C																					
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+		+	+	+	+	++	+	+	+	+										+
<i>Paracercion calamorum dyeri</i>	Dusky Lilyquatter	蒼尾蝶	P, LC	C																+					
<i>Prodasinieura autumnalis</i>	Black Threadtail	烏齒原蝶	NP	VC																					
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蝶	NP	C																				+	
<i>Rhinocypha perforata</i>	Common Blue Jewel	三斑鼻蝶	NP	VC						+														+	+
<i>Trithemis Aurora</i>	Crimson dropwing	曉靛蜻	NP	VC	+				+															+	+
<i>Trithemis festiva</i>	Indigo Dropwing	靛靛蜻	NP	VC											+	+		+	+	+	+	+	+	+	+
<i>Urothemis signata signata</i>	Scarlet Basket	赤斑曲鈞脈蜻	NP	C							+														
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩須紅蜻	P	P,PGC																				+	+
No of Species					4	2	4	1	6	1	5	1	5	1	4	2	1	3	4	4	2	5	7	8	9

Note: NP – Not protected in Hong Kong P- Protected in Hong Kong
 “VC” – Very Common; “UC” – Uncommon; “C” - Common
 “+” – Species exists in the study area
 “++” – Species common in the study area
 “+++” – Species abundance in the study area
 Commonness and status were decided according to AFCD biodiversity website (www.hkbiodiversity.net)
 LC- Local Concern - Fellowes *et al* (2002)
 PGC - Potential Global Concern - Fellowes *et al* (2002)

Table 4.4. Odonate species recorded at the UpperTai Po River

Species	Common name	Chinese name	Status	Commonness	Post construction monitoring							Post construction monitoring							
					Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16
<i>Macrodiplox cora</i>	Coastal Glider	高翔萍蜻	NP	C									+	+					
<i>Ceriatrigon auranticum ryukyuanum</i>	Orange-tailed Sprite	琉球橘黃蝶	NP	VC	+								+	+	+	+			
<i>Copera marginipes</i>	Yellow Featherlegs	黃狹扇蝶	NP	VC									+	+	+	+			
<i>Crocothemis servilia servilia</i>	Crimson Darter	紅蜻	NP	VC										+	+	+	+	+	
<i>Euphaea decorata</i>	Black-banded Gossamerwing	方帶幽蝶	NP	VC															
<i>Neurobasis chinensis</i>	Chinese Greenwing	華幽色蝶	NP	C	+				+	+					+	+	+		
<i>Neurothemis fulvia</i>	Russet Percher	網脈蜻	NP	VC										+	+	+			
<i>Orthetrum chrysis</i>	Red-faced Skimmer	華羅灰蜻	NP	VC											+	+	+	+	
<i>Orthetrum glaucum</i>	Common blue skimmer	黑尾灰蜻	NP	VC													+	+	
<i>Orthetrum luzonicum</i>	Marsh Skimmer	呂宋灰蜻	NP	VC					+	+	+	+	+	+					
<i>Orthetrum pruinosum neglectum</i>	Common Red Skimmer	赤褐灰蜻	NP	VC								+	+	+					
<i>Palpopleura sexmaculata sexmaculata</i>	Asian Widow	六斑曲緣蜻	NP	C									+	+					
<i>Pantala flavescens</i>	Wandering Glider	黃蜻	NP	VC	+												+	+	+
<i>Paracercion calamorum dyeri</i>	Dusky Lilysquatter	蒼尾蝶	P, LC	C															
<i>Prodasineura autumnalis</i>	Black Threadtail	烏齒原蝶	NP	VC											+				
<i>Pseudagrion rubriceps rubriceps</i>	Orange-faced Sprite	丹頂斑蝶	NP	C									+	+					
<i>Rhinocypha perforata</i>	Common Blue Jewel	三斑鼻蝶	NP	VC									+	+	+	+	+		
<i>Trithemis Aurora</i>	Crimson dropwing	曉褐蜻	NP	VC	+	+	+										+	+	
<i>Trithemis festiva</i>	Indigo Dropwing	靛褐蜻	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+		+
<i>Urothemis signata signata</i>	Scarlet Basket	赤斑曲鈞脈蜻	NP	C															
<i>Zygonyx iris insignis</i>	Emerald Cascader	彩須紅蜻	P	P,PGC	+														
No of Species					6	2	2	1	3	6	7	9	11	10	8	8	5	1	2

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

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

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

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

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

Species	Chinese name	Sampling point	Baseline survey		Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring			Impact monitoring						
			Oct-07	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2			
Mollusca																													
<i>Biomphalaria sp.</i>	--	NP	VC			+				+				+	+						+								
<i>Brotia hainanensis</i>	--	NP	VC	++	+	++				++				++	+						+	+			+				
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC							+	+	+		+							+		+		+				
<i>Physella acuta</i>	尖膀胱螺	NP	VC																		+	+	++		+				
<i>Pomacea canaliculata</i>	蘋果螺	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>	孿幼虫	NP	VC	+	+	+				+				+	+	+	+	+	+	+	+	+	+	+	+				
<i>Ephemera sp.</i>		NP	VC																										
<i>Indobaetis sp.</i>	--	NP	VC	+		+				+				+	+						+				+				
<i>Mnais sp.</i>	--	NP	VC			+				+				+	+						+	+			+				
Odonate Larvae	--	NP	VC																										
<i>Orthetrum sp.</i>	--	NP	VC	+	+	+				+				+	+						+	+			+				
<i>Perla sp.</i>	--	NP	VC												+														
<i>Rhaphium sp.</i>	--	NP	VC																						+				
<i>Tipulidae spp.</i>	--	NP	VC												+										+				
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

Note:

"NP" – Not protected in Hong Kong

"+" – 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	Impact monitoring			Impact monitoring			Post construction monitoring						Post construction monitoring																		
			Mar-13			Jul-13			Jan-14			Feb-14			Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-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	
Mollusca																																	
<i>Biomphalaria sp.</i>	--	NP	VC																														
<i>Brotia hainanensis</i>	--	NP	VC	+			+			+	+	+				+	+	+														+	
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC	+	+		+	+		+	+	+	+			+	+	+	+														
<i>Physella acuta</i>	尖膀胱螺	NP	VC	+																													
<i>Pomacea canaliculata</i>	蘋果螺	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>	孿幼虫	NP	VC	+	+		+	+		+	+	+	+	+																			
<i>Ephemera sp.</i>		NP	VC																														
<i>Indobaetis sp.</i>	--	NP	VC				+			+	+		+	+																			
<i>Mnais sp.</i>	--	NP	VC	+			+			+	+		+	+	+																		
Odonate Larvae	--	NP	VC																														
<i>Orthetrum sp.</i>	--	NP	VC	+			+			+	+		+	+	+																		
<i>Perla sp.</i>	--	NP	VC																														
<i>Rhaphium sp.</i>	--	NP	VC	+														+															
<i>Tipulidae spp.</i>	--	NP	VC																														
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				14	2	0	13	4	1	13	7	4	14	10	8	17	11	9	18	13	9	15	9	7	15	9	5	18	10	6	18	9	8

Note:

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

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

Species	Chinese name	Sampling point	Post construction monitoring																		Post construction monitoring																				
			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15			Feb-15			Mar-15			Apr-15			May-15			Jun-15			Jul-15			Aug-15					
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2			
Mollusca																																									
<i>Biomphalaria sp.</i>	--	NP VC	+			+									+			+	+	+	+				+			+				+			+						
<i>Brotia hainanensis</i>	--	NP VC	+	+	+	+	+					+	+		+	+		+	+					+	+			+	+				+			+	+				
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP VC	+			+						+			+			+			+					+			+				+			+			+		
<i>Physella acuta</i>	尖膀胱螺	NP VC	+			+						+			+			+			+																				
<i>Pomacea canaliculata</i>	蘋果螺	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>	蠓幼虫	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Ephemera sp.</i>		NP VC	+	+		+	+					+			+			+			+	+																			
<i>Indobaetis sp.</i>	--	NP VC	+	+		+	+					+			+			+			+						+														
<i>Mnais sp.</i>	--	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Odonate Larvae	--	NP VC																																							
<i>Orthetrum sp.</i>	--	NP VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Perla sp.</i>	--	NP VC	+									+			+						+	+					+	+													
<i>Rhaphium sp.</i>	--	NP VC	+			+															+																				
<i>Tipulidae spp.</i>	--	NP VC																																							
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			19	12	8	19	13	7	19	11	6	16	10	5	19	10	5	18	7	4	19	7	5	20	7	4	15	7	4	15	7	4	15	7	4	15	7	4	16	6	4

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

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

Species	Chinese name	Sampling point	Post construction monitoring									Post construction monitoring						
			Sep-15			Oct-15			Nov-15			Dec-15			Jan-16			
			Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	
Mollusca																		
<i>Biomphalaria sp.</i>	--	NP	VC	+			+			+			+			+		
<i>Brotia hainanensis</i>	--	NP	VC	+	+		+	+		+	+		+	+		+	+	
<i>Melanoides tuberculata</i>	瘤擬黑螺	NP	VC	+		+	+		+	+		+		+	+		+	
<i>Physella acuta</i>	尖膀胱螺	NP	VC															
<i>Pomacea canaliculata</i>	蘋果螺	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>	孿幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Ephemera sp.</i>		NP	VC															
<i>Indobaetis sp.</i>	--	NP	VC	+			+			+			+			+		
<i>Mnais sp.</i>	--	NP	VC	+			+			+			+			+		
Odonate Larvae	--	NP	VC	+			+			+			+			+		
<i>Orthetrum sp.</i>	--	NP	VC	+	+		+	+		+	+		+	+		+	+	
<i>Perla sp.</i>	--	NP	VC	+			+			+			+			+		
<i>Rhaphium sp.</i>	--	NP	VC															
<i>Tipulidae spp.</i>	--	NP	VC															
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				16	6	3	16	6	3	16	6	3	16	6	3	16	6	3

Note:

"NP" – Not protected in Hong Kong

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

Species	Status	Commonness	Baseline survey		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Impact monitoring		Post construction monitoring												
			Oct-07	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							
			T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2							
<i>Cyprinus carpio var. viridivittatus</i>	錦鯉	NP	C																																						
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+	++			+						+	+++																										
<i>Glyptothorax pallozonum</i>	白線紋胸鮠	NP	R																																						
<i>Limparhomaloptera disparis</i>	擬平鰾	NP	C																																						
<i>Misgurnus anguillicaudatus</i>	泥鰟	NP	C			+																																			
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C	+																																					
<i>Parazacco spilurus</i>	鰻鯪	V and	C	++		+	+																																		
<i>Poecilia reticulata</i>	孔雀花魚	NP	C	++	+			++																																	
<i>Pseudobagrus trilineatus</i>	三線擬鱔	NP,GC	R																																						
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鰾	NP	C	+		+																																			
<i>Pterocryptis cochinchinensis</i>	越南隱鰻鯪	NP	C																																						
<i>Puntius semifasciolatus</i>	七星魚	NP	C	+		+	+																																		
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C	+		+	+																																		
<i>Schistura fasciolata</i>	橫紋南鰾	NP	C	+		+																																			
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C	++		+																																			
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C	+																																					
		2x2m fish		70	60	15	8	25	10	20	100	10	2	8	10	7	100	10	5	20	6	2	4	6	2	5	5	2	2	5	2	1	5	2	1	12	8	6	10	12	10
		No of Speices		10	2	7	3	2	7	4	4	7	5	5	7	9	7	8	5	3	11	2	7	10	3	5	8	2	2	9	2	1	9	4	1	9	4	3	8	5	4
Amphibian																																									
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC																																						

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

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

“+” – Species exists in the study area

“++” – Species common in the study area

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

V – Listed as vulnerable in China Fish Red Data Book

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

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

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

Species		Status	Commonness	Post construction monitoring																		Post construction monitoring																				
				Mar-14			Apr-14			May-14			Jun-14			Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14			Jan-15			Feb-15			Mar-15		
				Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2	Reference	T1	T2			
<i>Cyprinus carpio var. viridiviolaceus</i>	錦鯉	NP	C	+ + +	+ + +	+ + +																																				
<i>Gambusia affinis</i>	食蚊魚	NP	VC	+ + +	+ + +	+ + +																																				
<i>Glyptothorax pallozonum</i>	白線紋胸鮠	NP	R																																							
<i>Limiparhomaloptera disparis</i>	擬平鮫	NP	C																																							
<i>Misgurnus anguillicaudatus</i>	泥鰍	NP	C																																							
<i>Oreochromis niloticus</i>	尼羅口孵非鯽	NP	C																																							
<i>Parazacco spilurus</i>	鰻鱺	V and	C																																							
<i>Poecilia reticulata</i>	孔雀花魚將	NP	C																																							
<i>Pseudobagrus trilineatus</i>	三線擬鰻	NP,GC	R																																							
<i>Pseudogastromyzon myersi</i>	麥氏擬腹吸鮫	NP	C																																							
<i>Pterocryptis cochinchinensis</i>	越南隱鰻鮠	NP	C																																							
<i>Puntius semifasciolatus</i>	七星魚	NP	C																																							
<i>Rhinogobius spp.</i>	鰻虎魚	NP	C																																							
<i>Schistura fasciolata</i>	橫紋南鮫	NP	C																																							
<i>Xiphophorus hellerii</i>	劍尾魚	NP	C																																							
<i>Xiphophorus variatus</i>	雜色劍尾魚	NP	C																																							
		2x2m fish		16	10	8	16	10	8	12	4	2	12	4	2	15	5	4	20	8	5	30	10	10	40	15	20	50	20	30	60	30	30	50	20	20	40	20	20	50	20	20
		No of Speices		10	6	4	13	6	4	13	3	1	12	2	2	12	2	2	12	3	4	12	3	4	12	3	4	12	3	4	12	3	4	12	4	4	12	4	4	12	4	4
Amphibian																																										
<i>Paramesotriton hongkongensis</i>	香港瘰螈	P	UC																																							

Note: NP – Not protected in Hong Kong; P - Protected in Hong Kong
“VC” – Very Common; “UC” – Uncommon; “C” - Common
“+” – Species exists in the study area
“+++” – Species common in the study area
“++++” – Species abundance in the study areae
V – Listed as vulnerable in China Fish Red Data Book
GC- Global Concern - Fellowes *et al* (2002)
- Reference point was the sampling location outside the works area used to

Table 4.7 Abiotic data for Upper Tai Po River (T1- Upper stream sampling site and T2- Lower stream sampling site)

Parameters/ Date	Baseline survey		Impact monitoring												
	Oct-07	Jan-09		Jul-09		Jan-10		Jul-10		Jan-11		Jul-11		Jan-12	
Replicate	T1	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
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
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
Ammonia (mg/L)	<0.01	PO4-P (μ g 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
Salinity (ppt)	<0.1	<0.1	0.1	0	0	0	0	0	0	0	0	0	0	0	0
Conductivity (mS/cm)	40	40	190	34	118	42	72	49	43	50	60	50	60	65	74
BOD (mg/L)	< 2	< 2	12	< 2	< 2	< 2	2	< 2	2	2	< 2	< 2	2	< 2	3
Water flow at pool (m/s)	0.01-0.2	0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2		0.01-0.2	
Water flow at riffle (m/s)	0.2-0.5	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
Stone (%)	80	80		80	70	80	70	80	70	80	70	80	70	80	70
Mud (%)	5	5		5	5	5	5	5	5	5	5	5	5	5	5
Concrete(%)	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10

