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

POST-CONSTRUCTION ECOLOGICAL MONITORING ANNUAL REPORT 2014

Prepared By:

ALLIED ENVIRONMENTAL CONSULTANTS LTD.

For:

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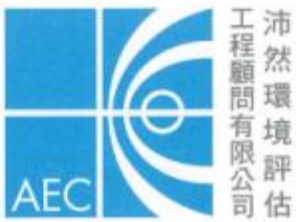

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Agreement No. CE65/2013(EP)
Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation

2014 Annual Report
Upper Lam Tsuen River

January 2015

Prepared by: Mike pang January 8, 2015

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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)

2014 Annual Report
Upper Lam Tsuen River

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1 Introduction

1.1 Agreement No. CE65/2013(EP) Post-Construction Ecological Monitoring of River Improvement Work in Upper Lam Tsuen River, She Shan River and Upper Tai Po River – Investigation required a post-construction ecological monitoring programme when the project completed. An annual report is required to be prepared for 2014 by using the collected data from surveys of January to November conducted by Contract NO. DC/2007/06 River Improvement Works in Upper Lam Tsuen River, She Shan River and Upper Tai Po River and survey of December conducted under the 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. This report aims to summaries and present findings of the post construction ecological monitoring carried out during 2014.

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 1 annual report for the project summarising monitoring results collected from January to December of 2014. It contents the following subsections:

- Summary of major points
- Monitoring Methods
- Monitoring Results
- Summary and Comments

2 Summary of Major Points

- Field ecological monitoring was undertaken during January to December 2014;
- Presentation of species abundance and species richness for fauna and flora using graphs;
- Aquatic and riparian vegetation re-established quickly after completion of drainage works;
- Adult, juvenile and eggs of Hong Kong Newt were commonly found during monitoring survey. Capture and release survey was undertaken in November 2014, the result showed that the abundance of Hong Kong Newt is increasing as better feeding and breeding habitats established;
- The collected data of the number of fish species did not show significant seasonal change. Whilst fish population or density/ numerical abundance were recorded as comparative low during wet season because the fishes were washed out by heavy rain and flood. However fish populations recovered quickly in late 2014;
- A big difference of species diversity of odonata between wet and dry season was due to seasonality;

- The species diversity and abundance of bird, and marco-invertebrate was in natural fluctuation ; and
- Measured water quality and physical characteristics showed no apparent change, overall water quality is defined as clean and retain in an acceptable level to fauna and flora in Lam Tsuen River.

3 Monitoring Methodology

3.1 Avifauna

Avifauna survey was conducted during post construction monitoring period. Special attention was given to the river channel and corridor area which birds use 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 and the other two located at the upper section of the river. 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.**

3.2 Fish and Newt

Fish community including target species Gobies fish *Rhinogobius* spp. and Hong Kong Newt *Paramesotriton hongkongensis* at the specified river channel was monitored by live trapping, hand netting and direct observation methods.

Sampling was conducted at four sampling locations along river channel, and covered major type of river habitats, e.g. river pool and riffle (**Figure 1**). The number of the captured or 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 Virginia et al (2004).

3.3 Aquatic Macro-invertebrates

Macro-invertebrates in the river channel were surveyed. Four sampling sites were designed 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 main 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 will follow those documented in the AFCD website (www.hkbiodiversity.net) and other

literatures such as Dudgeon (1994).

3.4 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1**). Binoculars, digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behaviour were recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiodiversity.net) and Keith (2003&2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

3.5 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 of the river channel and another two at the upper section 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 the AFCD website (http://herbarium.gov.hk/) and Hong Kong Herbarium (2012).

3.6 Abiotic Data Collection

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.

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.

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 wall/retaining wall along the Upper Lam Tsuen River and part of the river bed. Over 90 flora species were recorded within the survey transects along the river course in 2014. Most were wetland species with a few floating aquatic species such as *Lemna minor* 浮萍, *Pistia stratiotes* 大薸 and submerged plants such as *Hydrilla verticillata* 黑藻.

An aquatic plant, also a vegetable, Watercress *Nasturtium officinale* 西洋菜 was very abundant during the dry season when there was no flooding (see photograph below). The recorded floras were generally in good health indicating that the vegetation of the riverbed and banks was re-established quickly, and the height of the dominated riparian grass and herb species were in a range from 0.1m to over 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.

Photograph showing general view of Lam Tsuen River in March.

Photograph showing general view of Lam Tsuen River in June. In the wet season, most of the riverbed plants had been washed away by flood.

Photograph showing general view of Lam Tsuen River in September.

Photograph showing general view of Lam Tsuen River in January. An aquatic plant, also a vegetable, *Nasturtium officinale* 西洋菜 was very abundant during dry season in Upper Lam Tsuen River.

4.2 Fauna

4.2.1 Avifauna

Avifauna surveys were undertaken from January to December 2014 along survey transects and at four selected point count locations. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4-3.** There is no apparent change in the pattern or trend in bird abundance when comparing data recorded from the four bird count sites (PC1 to PC4) as shown in **Figure 4.1**. As most of the birds were foraging and feeding along riparian habitats can tolerate human disturbance, such as bulbuls, doves. There is no oblivious change in the species richness of avifauna recorded at the four point count sites during 2014. In total, over 50 species of birds were recorded from the bird surveys. The most common birds recorded included wetland birds found in the river include *Egretta garzetta* 小白鷺, *Egretta garzetta* 池鷺, *Motacilla alba* 白鶺鴒 and *Hirundo rustica* 家燕. Some commonly seen birds found in the upper Lam Tsuen River are shown in the photographs below.

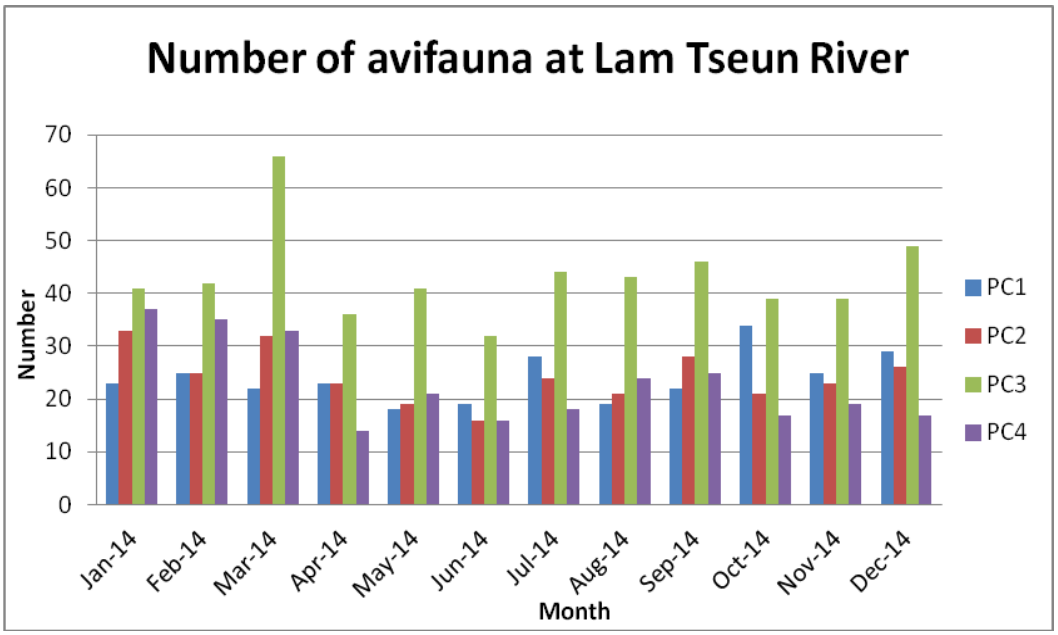


Figure 4.1. Bird abundance.

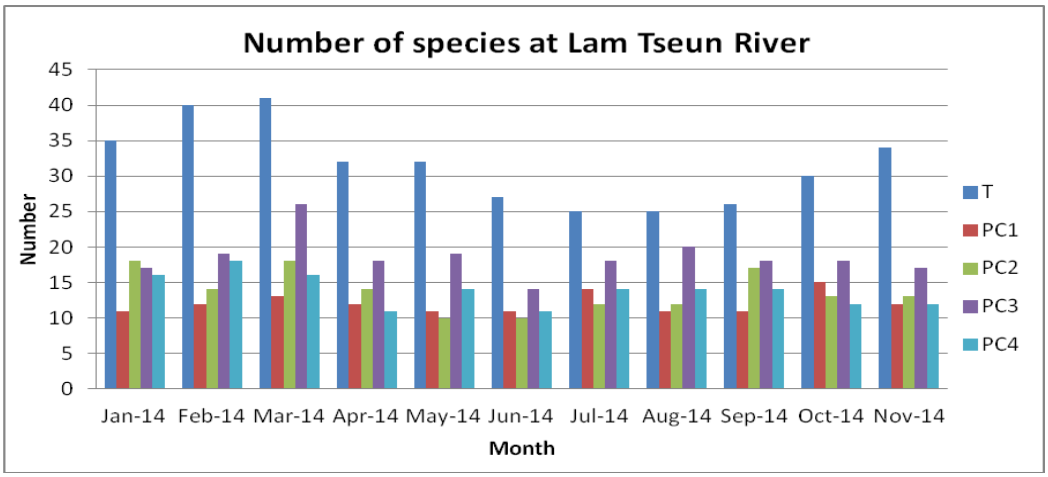
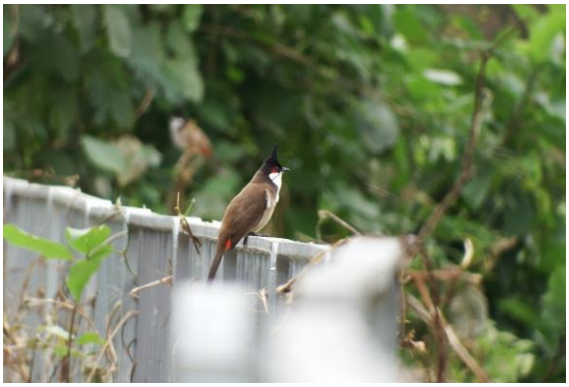


Figure 4.2. Species richness of avifauna.

	
Streptopelia chinensis 珠頸斑鳩	*Copsychus saularis* 鵲鴝
	
Amaurornis phoenicurus 白胸苦惡鳥	*Motacilla cinerea* 灰鶺鴒
	
Sturnus nigricollis 黑領椋鳥.	*Egretta garzetta* 小白鷺

	
Pycnonotus jocosus 紅耳鵯	*Acridotheres cristatellus* 八哥

4.2.2 Adult Odonata Survey

Records of Odonate along the Upper Lam Tsuen River from January to December of 2014 are presented in **Table 4-4**. A graph of odonatas species richness is shown in **Figures 4.3**, it indicates that species number of odonate was fluctuating along with different season. The maximum number of odonata species was recorded during wet season and a big contrast that significant low number of species was recorded during dry season. However, it was a normal phenomenon that most of dragonflies and damselflies were more likely reproducing during wet season. More species and higher abundance observed in wet season was due to seasonality (Keith, 2003&2011). In total, over 25 species of donate were recorded in the year. Sampling location was shown in **Figure 1**. Photographs of some of the recorded dragonfly and damselfly species are presented below.

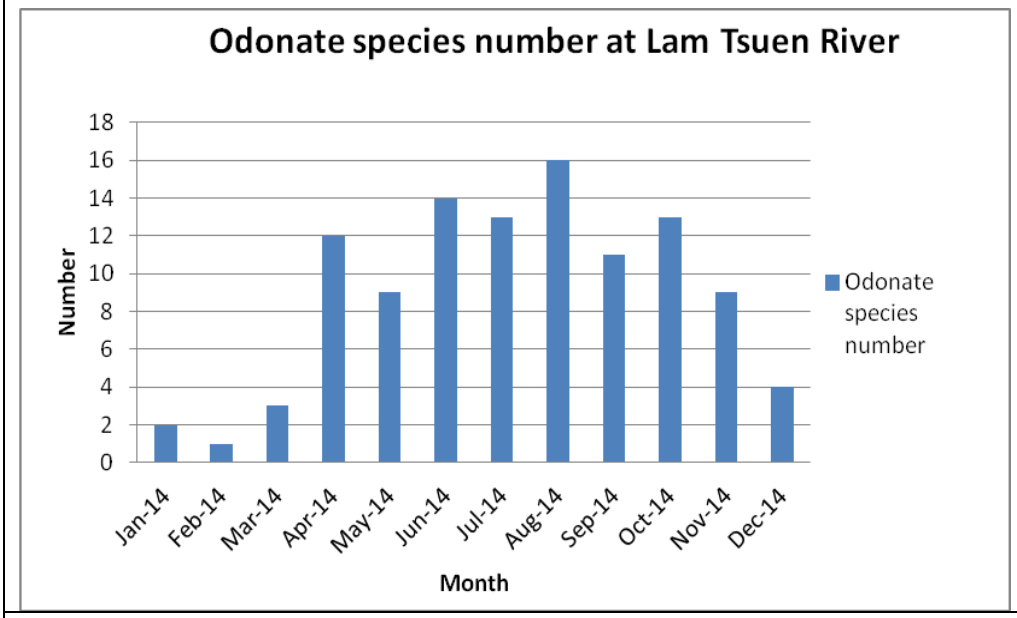


Figure 4.3 Species richness of Odonata.

	
Prodasineura autumnalis 烏齒原蟌	*Copera marginipes* 黃狹扇蟌
	
Pseudagrion rubriceps rubriceps 丹頂斑蟌	*Orthetrum pruinosum neglectum* 赤褐灰蜻
	
Neurobasis chinensis chinensis 華艷色蟌	*Pantala flavescens* 黃蜻

	
Trithemis aurora 曉褐蜻	*Crocothemis servilia servilia* 红蜻
	
Ischnura senegalensis 褐斑異痣蟌	*Ceriagrion auranticum ryukyuanum* 琉球橘黃蟌
	
Trithemis festiva 慶褐蜻	*Euphaea decorata* 方帶幽蟌

4.2.3 Aquatic Macro-invertebrates

Aquatic-net and kick sampling were performed at the Upper Lam Tseun River. Over 20 species were found during the ecology surveys undertaken in 2014 and no significant changes were observed on species composition, shown as **Figure 4.2.3**. The river benthic fauna collected was mainly comprised of insects, mollusks and crustaceans. Details of recorded of river benthic fauna refers to **Table 4-5.** Sampling location was shown on **Figure 1**.

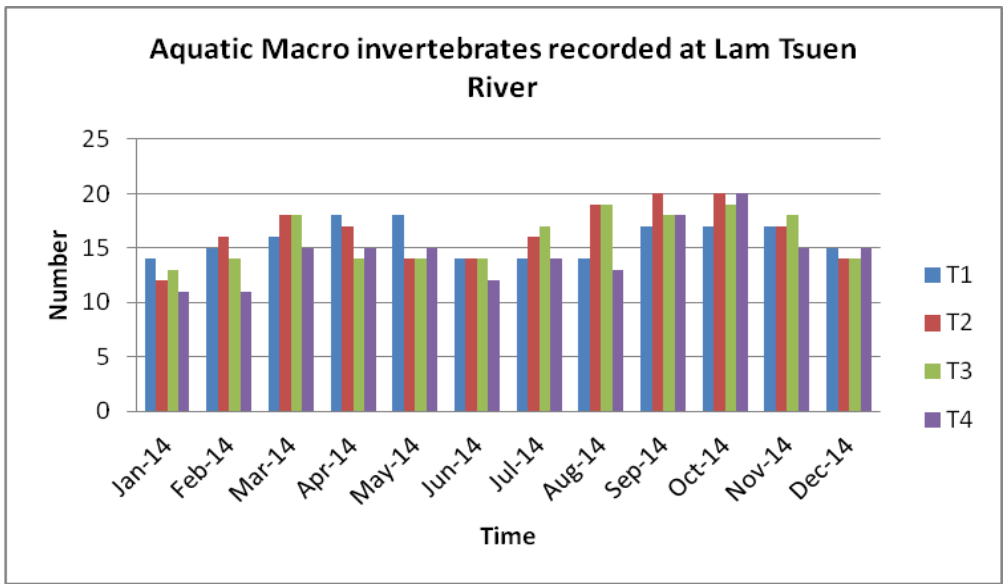


Figure 4.2.3. Species number of aquatic macroinvertebrate and other fauna at Lam Tsuen River during 2014.

4.2.4 Hong Kong Newt

Surveys of Hong Kong Newt were conducted at Upper Lam Tsuen River from January to December of 2014. Adults, juveniles, larvae and eggs of Hong Kong Newt *Paramesotriton hongkongensis* 香港瘰螈 was observed at the Lam Tsuen River where the habitat consisted of riparian vegetation during the survey (see photograph below). This amphibian species is commonly seen and captured by hand nets and the abundance was higher recorded in November 2014 than those recorded during the previous surveys. Riparian vegetation grown along the channel especially along water margin could provide shelter and breeding habitat for Hong Kong Newt. Record of Hong Kong Newts can be referred to **Table 4-6**. The surveys data show that the Newts were breeding and sustaining a viable population since construction work had stopped, refer to **Figure 4.2.4.**

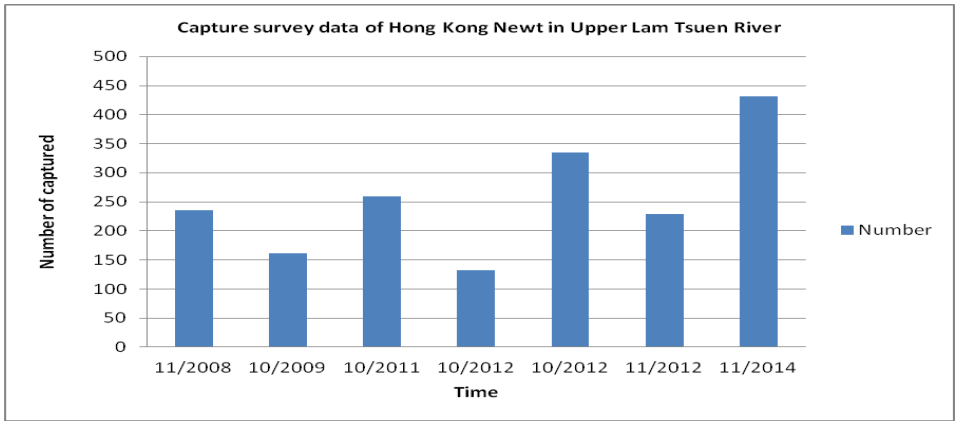
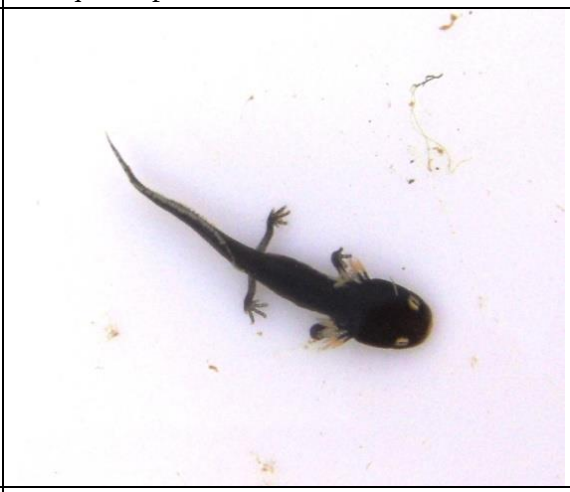


Figure 4.2.4. Capture survey data of Hong Kong Newt in Upper Lam Tsuen River 2008-2014.

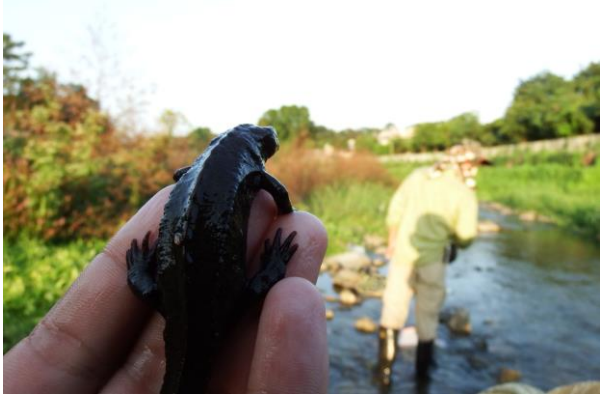
Hong Kong Newt 香港瘰螈 preferred river habitat .

Egg of Hong Kong Newt attached to roots of aquatic plant.

Larvae of the Hong Kong Newt.



Juvenile of the Hong Kong Newt.

	
Sub-adult of the Hong Kong Newt.	Adult of the Hong Kong Newt.
	
Ventral colour pattern of adult Hong Kong Newt.	Hong Kong Newt preferred foraging riverbed habitat.
	
Capture survey of Hong Kong Newt by hand netting.	Captured Hong Kong Newt together with the exotic fish, tilapia indicating that the newt co-exists with juvenile tilapia in the river.

4.2.5 River Fish Fauna

Fish surveys were performed at Upper Lam Tsuen River during field monitoring in 2014. At least 19 species of freshwater fish, including species recorded from reference site, were recorded. Details of recorded of fish fauna refers to **Table 4-6.** *Oreochromis niloticus* 羅非魚 and *Zacco platypus* 寬鰭鱲 were the dominated species in the river (see below photograph). *Acrossocheilus parallens* 側條光唇魚 were recorded at upper, middle and lower river sections.

A. parallens is a rare freshwater fish species in Hong Kong (see hkbiodiversity website) and it was observed a dominant species at a few locations along the surveyed river. The trend of the number of fish species are shown in **Figure 4.2.5a**. The data shows that there is no significant change on species composition of fish at Lam Tsuen River. Target species of Goby fish *Rhinogobius* spp. was found along the river with increasing abundance. Fish abundance in the 2x2 meter recording areas was significantly low during June to August 2014, it is assumed that low abundance of fish was caused by heavy rainfall and floods, fish population started to recovery following October 2014 (see **Figure 4.2.5b**). Sampling location was shown on **Figure 1**.

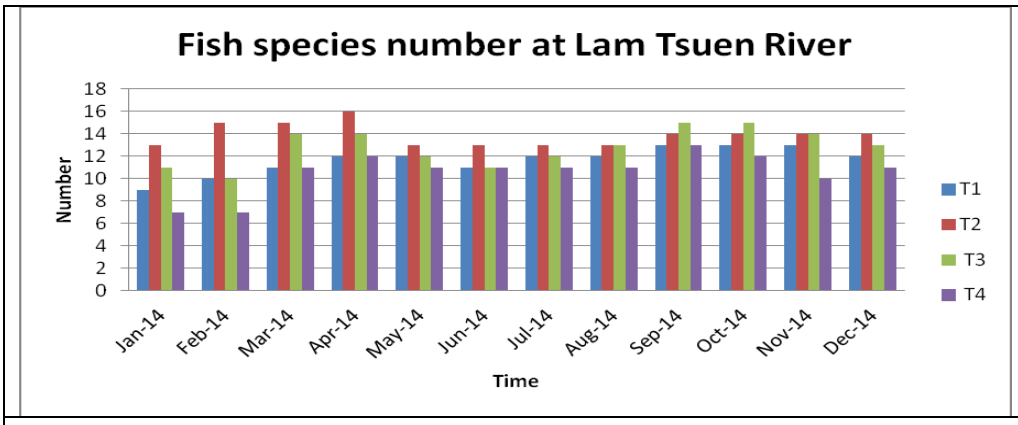
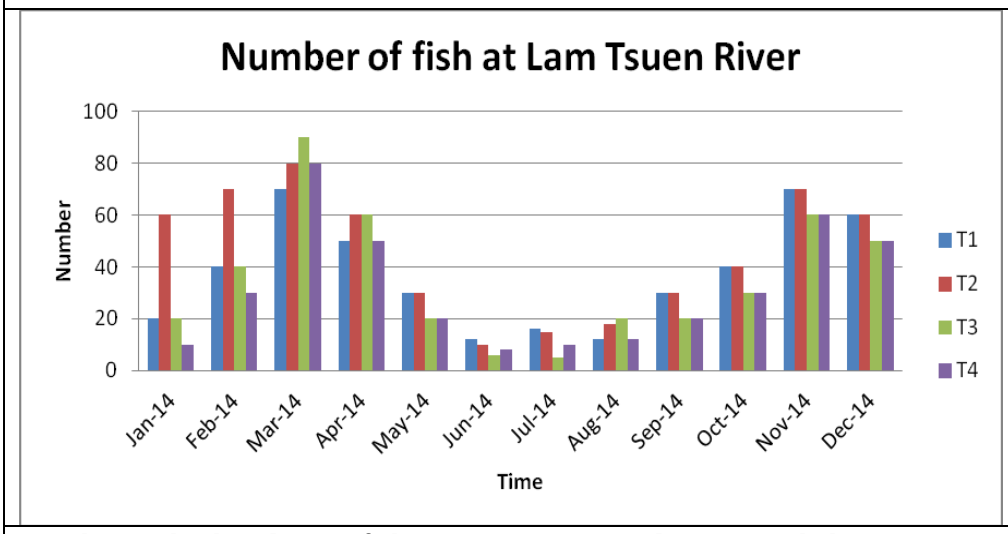


Figure 4.2.5a. Number of fish species recorded in upper Lam Tsuen River during 2014.



4.2.5b. Fish abundance (fish counts in 2x2m plots) recorded in upper Lam Tsuen River during 2014.

	
Fish sampling in upper Lam Tsuen River.	*Acrossocheilus hemispinus* 側條光唇魚, a locally rare fish recorded in the upper Lam Tsuen River .
	
A common native fish *Zacco platypus* 寬鰭鱲.	A native fish *Rhinogobius* sp. 鰕虎魚.
	
A native fish *Pterocryptis cochinchinensis* 黃鮠.	An exotic fish *Xiphophorus hellerii* 劍尾魚.

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.**

Dissolved oxygen and conductivity measured in Lam Tsuen River shows a slightly fluctuation along a year, shown as Figure 4.3a-b. However, the ranges of these two parameters were still satisfied to the river health. The rest of parameters were recorded in a stable level within a year that would not pose any adverse impact to the river.

The river substratum was comprised of over 75% stones or rocks in most of the river sections with moderate water flow (up to 0.2m/second at pool and 0.6m/second at riffle).

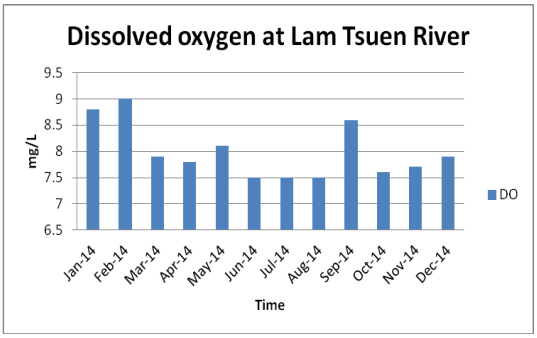


Figure 4.3a Dissolved oxygen recoded in Lam Tsuen River during 2014.

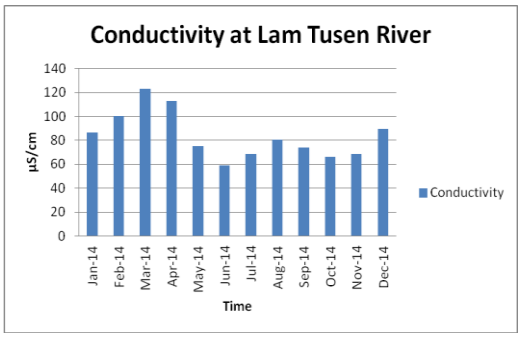


Figure 4.3b Conductivity recorded in Lam Tsuen River during 2014

5 Summary and Commentary

5.1 Data presented and analyzed in this report were derived from ecology surveys conducted during 2014. The post-construction ecological monitoring will be continued and it is expected that long term monitoring will reveal even more information on ecological recovery and habitat improvement.

5.2 Aquatic and riparian vegetation re-established quickly after the completion of the drainage works as demonstrated by the photographs in this report. Aquatic and marsh plants growing on the riverbed and along the water margins provide breeding and feeding habitat for a variety of aquatic life including insects, shrimps, fish and the Hong Kong Newt.

5.3 Records of the Hong Kong Newt *Paramesotriton hongkongensis* 香港瘰螈 through the capture and translocation programme showed that ecological mitigation was successful and that adverse impacts on this species was reduced. The adults, juveniles and eggs of the Hong Kong Newt were frequently recorded along the new river channel. Higher number of Newt was recorded during survey in November 2014 than those recorded in previous surveys as improved river channel provided better habitat to the Newt.

5.4 The fish species is recorded in a stable level during 2014. However, the fish abundance was observed significant low during wet season, it was assumed that fishes were affected by heavy rain and floods, and the population recovery was observed in late 2014. *Acrossocheilus parallens* 側條光唇魚, a rare freshwater fish species in Hong Kong, was the dominant species at a few locations in the river channel.

5.5 Abundance of the aquatic marco-invertebrates and avifauna were stable with no apparent seasonal change.

5.6 The data showing a big difference of species number of odonate recorded between wet and dry season was a normal phenomena of odonate life-cycle.

5.7 Measured water quality and physical characteristics showed no apparent change, however it is predicted the water quality will improve over the long term as flora and fauna continues to establish in the river channel .The water quality of the surveyed river was not polluted although low concentration of nutrients will discharge to the river from the nearby agriculture lands and resident houses.

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FIGURES

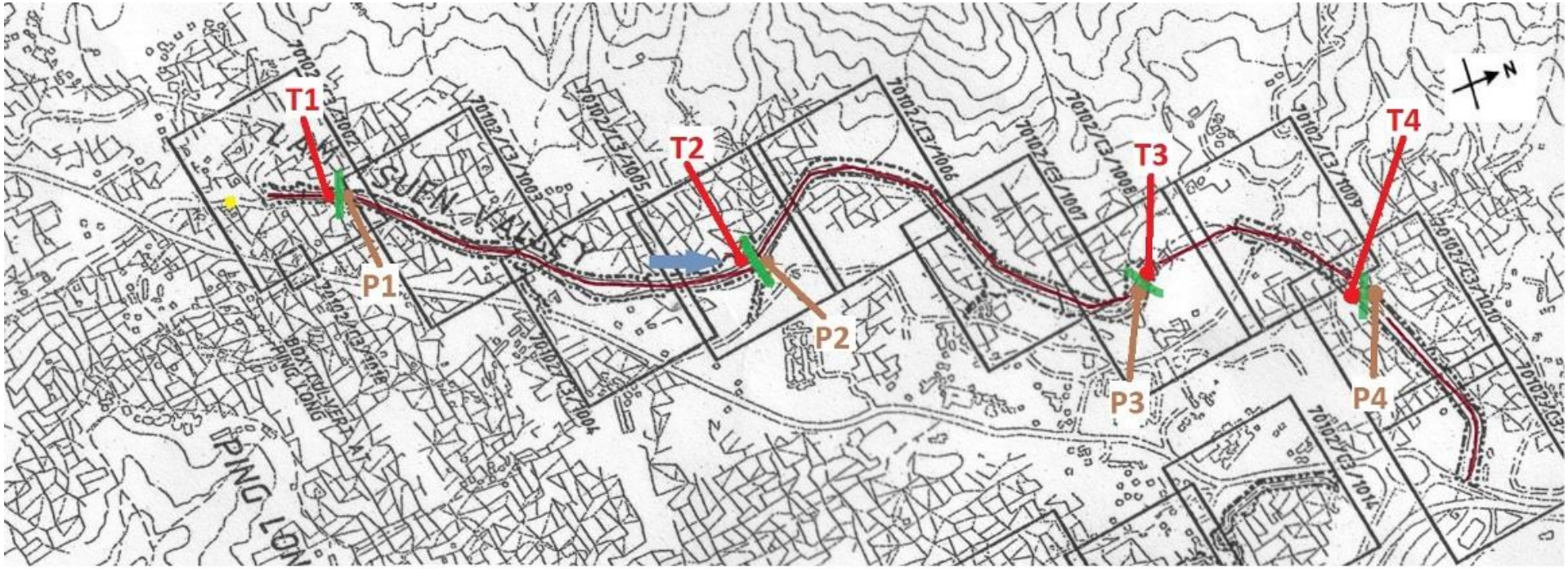

Figure1. Sampling Location of Ecological Survey and Monitoring at Upper Lam Tsuen River, Tai Po.

TABLE

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

			Post Construction monitoring											
Family	Species name	Species name in Chinese	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
Riparian Plant														
Acanthaceae	*Ruellia coerulea*	蘭花草	+	+	+	+	+	+	+	+	+	+	+	+
Amaranthaceae	*Celosia argentea*	青葙	++	+	+	+	+	+	++	++	++	++	++	++
Amaranthaceae	*Amaranthus viridis*	野莧	++	++	++	++	++	++	++	++	++	++	+	+
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草	+	+	+	+	+	+	+	++	++	++	++	++
Amaranthaceae	*Alternanthera sessilis*	蓮子草												+
Anacardiaceae	*Rhus hypoleuca*	白背漆												
Annonaceae	*Uvaria macrophylla*	紫玉盤				+	+	+	+	+	+	+	+	+
Apiaceae	*Oenanthe javanica*	水芹				++	+	+	+	+	+			
Apiaceae	*Centella asiatica*	崩大碗				+	+	+	+	+	+	+	+	+
Araceae	*Alocasia odora*	海芋	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Colocasia esculenta*	芋	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Pistia stratiotes*	大薸		+	+				+	+	+	+	+	+
Arecaceae	*Rhapis excelsa*	棕竹			+	+	+	+	+	+	+	+	+	+
Asteraceae	*Bidens alba*	白花鬼針草	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	++	++
Asteraceae	*Mikania micrantha*	薇甘菊	++	++	++	++	++	++	++	++	+++	++	+++	+++
Asteraceae	*Ageratum conyzoides*	勝紅薊	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Emilia sonchifolia*	一點紅	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Wedelia chinensis*	蜈蚣菊	+	+	+	+	+	+	+	++	++	++	++	++
Asteraceae	*Erechtites hieraciifolia*	革命菜	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Conyza canadensis*	小蓬草	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Youngia japonica*	黃鵝菜				+	+	+	+	+	+	+	+	+
Asteraceae	*Eclipta prostrata*	鱧腸				+	+	+	+	+	+	+	+	+
Asteraceae	*Spilanthes paniculata*	金鈕扣				+	+	+	+	+	+	+	+	+
Athyriaceae	*Callipteris esculenta*	菜蕨						+	+	+	+	+	+	+
Blechnaceae	*Blechnum orientale*	烏毛蕨	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	*Cardamine flexuosa*	蔊菜屬	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	*Nasturtium officinale*	西洋菜	+++	+++	+++	+	+	+	+	+	++	++	++	++
Brassicaceae	*Rorippa indica*	蔊菜	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	*Capsella bursa-pastoris*	荸薺				+	+	+	+	+	+	+	+	+
Buddlejaceae	*Buddleja asiatica*	白背楓				+	+	+	+	+	+	+	+	+
Caesalpiniaceae	*Cassia alata*	翅荚決明	+	+	+	+	+	+	+	+	+	+	+	+
Caryophyllaceae	*Drymaria cordata*	荷蓮豆				+	+	+	+	+	+	+	+	+
Caryophyllaceae	*Myosoton aquaticum*	鵝腸菜				+	+	+	+	+	+	+	+	+
Commelinaceae	*Commelina diffusa*	節節草	+	+	+	+	+	+	+	++	++	++	++	++
Convolvulaceae	*Ipomoea cairica*	五爪金龍	+	+	++	++	++	++	++	++	++	++	++	++
Convolvulaceae	*Pharbitis nil*	牽牛	+	+	+	+	+	+	+	+	+	+	+	+
Convolvulaceae	*Ipomoea aquatica*	蕹菜	+	+	+	+	+	+	+	+	+	+	+	+
Cucurbitaceae	*Solena amplexicaulis*	茅瓜				+	+	+	+	+	+	+	+	+
Cuscutaceae	*Cuscuta australis*	南方菟絲子												
Cyperaceae	*Cyperus flabelliformis*	風車草			+	+	+	+	+	+	+	+	+	+
Cyperaceae	*Cyperus sp.*	莎草			+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Macaranga tanarius*	血桐	+	+	+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Bischofia javanica*	秋楓				+	+	+	+	+	+	+	+	+
Fabaceae	*Pueraria lobata*	野葛	+	+	+	+	+	+	+	+	+	+	+	+
Fabaceae	*Crotalaria pallida*	猪屎豆	+	+	+	+	+	+	+	+	+	+	+	+
Fabaceae	*Sesbania cannabina*	田菁	+	+	+	+	+	+	+	+	+	+	+	+
Fabaceae	*Pueraria lobata var.thomsonii*	粉葛												+
Magnoliaceae	*Michelia alba*	白蘭		+	+	+	+	+	+	+	+	+	+	+
Malvaceae	*Hibiscus rosa-sinensis*	大紅花				+	+	+	+	+	+	+	+	+
Mimosaceae	*Acacia confusa*	台灣相思		+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*Leucaena leucocephala*	銀合歡	+	+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*Mimosa pudica*	含羞草	+	+	+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus hispida*	對葉榕	+	+	+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus variegata*	青果榕												
Musaceae	*Musa paradisiaca*	大蕉	+	+	+	+	+	+	+	+	+	+	+	+
Myrtaceae	*Cleistocalyx nervosum*	水翁				+	+	+	+	+	+	+	+	+
Nyctaginaceae	*Bougainvillea spectabilis*	勒杜鵑			+	+	+	+	+	+	+	+	+	+
Oleaceae	*Ligustrum sinense*	山指甲												
Onagraceae	*Ludwigia erecta*	美洲水丁香	++	+	+	+	+	+	++	++	++	++	++	++
Oxalidaceae	*Oxalis corniculata*	酢漿草	+	+	+	+	+	+	+	+	+	+	+	+
Plantaginaceae	*Plantago major*	車前草				+	+	+	+	+	+	+	+	+
Poaceae	*Panicum repens*	枯骨草	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Pennisetum purpureum*	象草	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Pennisetum alopecuroides*	狼尾草												
Poaceae	*Rhynchelytrum repens*	紅毛草	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Microstegium ciliatum*	刚莠竹	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Brachiaria mutica*	巴拉草	++	++	++	++	++	++	+++	+++	+++	+++	+++	+++
Poaceae	*Miscanthus floridulus*	五節芒	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Arundinella nepalensis*	石珍芒	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Panicum maximum*	大黍	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Coix lacryma-jobi*	薏苡	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Arundo donax*	蘆竹				+	+	+	+	+	+	+	+	+
Poaceae	*Chloris virgata*	虎尾草				+	+	+	+	+	+	+	+	+
Polygonaceae	*Rumex trisetifer*	假蔥菜		+	+	++	++	++	++	++	++	++	++	++
Polygonaceae	*Polygonum chinense*	火炭母				+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum hydropiper*	水蓼				+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum glabrum*	光蓼												
Polygonaceae	*Polygonum perfoliatum*	杠板歸				+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum lapathifolium*	大尚蓼				+	+	+	+	+	+	+	+	+
Portulacaceae	*Portulaca oleracea*	馬齒莧							+	+	+	+	+	+
Ranunculaceae	*Ranunculus sceleratus*	石龍芮			+	++	+	+			+	+		
Rubiaceae	*Adina pilulifera*	水團花				+	+	+	+	+	+	+	+	+
Sapindaceae	*Dimocarpus longan*	龍眼		+	+	+	+	+	+	+	+	+	+	+
Scrophulariaceae	*Scoparia dulcis*	野甘草				+	+	+	+	+	+	+	+	+
Scrophulariaceae	*Lindernia anagallis*	長蕊母草				+	+	+	+	+	+	+	+	+
Solanaceae	*Solanum nigrum*	龍葵	+	+	+	+	+	+	+	+	+	+	+	+
Solanaceae	*Lycopersicon esculentum*	番茄	+	+	+	+								
Solanaceae	*Solanum torvum*	水茄				+	+	+	+	+	+	+	+	+
Sterculiaceae	*Sterculia lanceolata*	假蘋婆				+	+	+	+	+	+	+	+	+
Sterculiaceae	*Byttneria aspera*	刺果藤				+	+	+	+	+	+	+	+	+
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨				+	+	+	+	+	+	+	+	+
Thelypteridaceae	*Macrothelypteris torresiana*	普通針毛蕨				+	+	+	+	+	+	+	+	+
Ulmaceae	*Celtis sinensis*	朴樹		+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	*Trema orientalis*	異色山黃麻					+	+	+	+	+	+	+	+
Ulmaceae	*Trema tomentosa*	山黃麻	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	*Pilea microphylla*	透明草	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	*Duranta erecta*	假連翹												
Urticaceae	*Boehmeria nivea*	苧麻	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	*Lantana camara*	馬纓丹	+	+	+	+	+	+	+	+	+	+	+	+
Floating Plant														
Lemnaceae	*Lemna minor*	浮萍		+	+	+	+	+	+	+	+	+	+	+
Submerged Plant														
Hydrocharitaceae	*Hydrilla verticillata*	黑藻			+	+	+	+	+	+	+	+	+	+
No. of species			48	55	61	90	91	92	93	93	93	93	93	95

Note:

+, occurred; ++, common; +++, Species abundant/dominant in the the study area

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)

			Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring							
		Stream	Jan-14								Feb-14								Mar-14								Apr-14								May-14							
		Transect	T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4	
Family	Species	Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%
Poaceae	*Microstegium ciliatum*	刚秀竹																									0.3	2							0.3	2						
Fabaceae	*Pueraria lobata*	野葛							0.3	10							0.3	10							0.3	10					0.3	5	0.3	5					0.3	5	0.3	5
Poaceae	*Pennisetum purpureum*	象草							1.5	5							1.5	5							1.5	5																
Araceae	*Alocasia odora*	海芋																																								
Caesalpiniaceae	*Cassia alata*	翅荚决明																																								
Magnoliaceae	*Michelia alba*	白兰																																								
Poaceae	*Brachiaria mutica*	巴拉草	0.8	10	0.8	10					0.8	10	0.8	10					1	13	1	13					0.5	5	0.6	10			0.6	10	0.5	5	0.6	6			0.6	6
Moraceae	*Ficus hispida*	對葉榕																																								
Asteraceae	*Mikania micrantha*	薇甘菊	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10	0.4	10	0.5	10	0.5	5	0.5	10	0.4	10			0.3	5	0.3	15	0.3	5			0.3	5	0.3	15	0.3	5
Musaceae	*Musa paradisiaca*	大蕉																																								
Ulmaceae	*Celtis sinensis*	朴樹																																								
Araceae	*Pistia stratiotes L.*	大漂																																								
Urticaceae	*Boehmeria nivea*	苧麻																																								
Asteraceae	*Bidens alba*	白花鬼針草	0.4	5			0.5	10			0.4	5			0.5	10			0.4	5			0.5	10			0.5	20	0.5	10	0.7	15	0.6	10	0.5	20	0.5	10	0.7	15	0.6	10
Poaceae	*Coix lacryma-jobi*	薏苡																																								
Solanaceae	*Solanum nigrum*	龍葵																																								
Cyperaceae	*Cyperus flabelliformis*	風車草																																								
Poaceae	*Miscanthus floridulus*	五節芒																																								
Euphorbiaceae	*Macaranga tanarius*	血桐																																								
Asteraceae	*Wedelia chinensis*	蟛蜞菊																																								
Commelinaceae	*Commelina diffusa*	節節草					0.3	5							0.3	5							0.3	5			0.2	10			0.3	3			0.2	8			0.3	3		
Asteraceae	*Erechtites hieracifolia*	革命菜																																								
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨																																								
Convolvulaceae	*Pharbitis nil*	牽牛																																								
Verbenaceae	*Lantana camara*	馬纓丹																																								
Mimosaceae	*Leucaena leucocephala*	銀合歡																																								
Brassicaceae	*Nasturtium officinale*	西洋菜																											0.2	5	0.2	50	0.2	5			0.2	2	0.2	2	0.2	1
Onagraceae	*Ludwigia erecta*	美洲水丁香																																								
Poaceae	*Pennisetum alopecuroides*	狼尾草																																								
Amaranthaceae	*Celosia argentea*	青葙					1	2							1	2							1	2																		
Bare Gound				75		85		73		75		75		85		73		75		72		82		73		75		63		70		12		65		65		77		60		73

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)

			Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring								Post construction monitoring							
		Stream	Jun-14								Jul-14								Aug-14								Sep-14								Oct-14								Nov-14								Dec-14							
		Transect	T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4		T1		T2		T3		T4	
Family	Species	Chinese name	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%	Height(m)	%
Poaceae	*Microstegium ciliatum*	刚秀竹	0.3	2							0.5	4							0.7	5							0.7	5																														
Fabaceae	*Pueraria lobata*	野葛					0.3	5	0.3	5					0.3	5	0.3	5					0.3	5	0.3	5					0.3	5	0.3	5							0.6	10							0.6	10							0.6	10
Poaceae	*Pennisetum purpureum*	象草																																							0.6	10														
Araceae	*Alocasia odora*	海芋																																					1.8	1							1.8	1						
Caesalpiniaceae	*Cassia alata*	翅荚决明																																																					
Magnoliaceae	*Michelia alba*	白兰																																																				
Poaceae	*Brachiaria mutica*	巴拉草	0.5	5	0.6	8			0.6	6	0.6	10	0.8	10			0.8	6	0.6	10	0.8	12			0.8	8	0.6	10	0.8	12			0.8	8	1	10	1.5	15	1.3	30	1	5	1	10	1.5	15	1.3	30	1	5	1	10	1.5	15	1.3	30	1	5
Moraceae	*Ficus hispida*	對葉榕																																																					
Asteraceae	*Mikania micrantha*	薇甘菊			0.3	6	0.3	15	0.3	8			0.3	6	0.3	15	0.3	8			0.3	6	0.3	15	0.3	8			0.3	8	0.3	15	0.3	10	0.3	15	0.3	15	0.3	15	0.3	15	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18	0.3	18
Musaceae	*Musa paradisiaca*	大蕉																																																				
Ulmaceae	*Celtis sinensis*	朴樹																																																			
Araceae	*Pistia stratiotes L.*	大漂																																																			
Urticaceae	*Boehmeria nivea*	苧麻																																																			
Asteraceae	*Bidens alba*	白花鬼針草	0.5	20	0.5	10	0.7	15	0.6	10	0.5	20	0.5	12	0.7	18	0.6	10	0.5	20	0.6	12	0.7	15	0.6	10	0.5	20	0.6	12	0.7	15	0.6	10	0.5	5	0.8	12	0.7	10			0.5	5	0.8	12	0.7	10			0.5	5	0.8	12	0.7	10		
Poaceae	*Coix lacryma-jobi*	薏苡																																	2	5							2	5							2	5						
Solanaceae	*Solanum nigrum*	龍葵																																																			
Cyperaceae	*Cyperus flabelliformis*	風車草																																																			
Poaceae	*Miscanthus floridulus*	五節芒																																																		
Euphorbiaceae	*Macaranga tanarius*	血桐																																																		
Asteraceae	*Wedelia chinensis*	蟛蜞菊																																																		
Commelinaceae	*Commelina diffusa*	節節草	0.2	8			0.3	3			0.2	8			0.3	3			0.3	10			0.3	5			0.3	10			0.3	5			0.3	10	0.8	20			0.3	20	0.3	12	0.8	22			0.3	20	0.3	12	0.8	22			0.3	20
Asteraceae	*Erechtites hieracifolia*	革命菜																																																		
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨																																																		
Convolvulaceae	*Pharbitis nil*	牽牛																																																		
Verbenaceae	*Lantana camara*	馬纓丹																																																		
Mimosaceae	*Leucaena leucocephala*	銀合歡																																																		
Brassicaceae	*Nasturtium officinale*	西洋菜			0.2	2	0.2	2	0.2	1			0.3	1	0.3	1	0.3	1			0.3	1	0.3	1	0.3	1			0.3	1	0.3	2	0.3	1					0.3	2	0.1	1					0.3	2	0.1	1					0.3	2	0.1	1
Onagraceae	*Ludwigia erecta*	美洲水丁香																											2	30	2	15	2	10	1.8	5	2	25	2	13	2	10	1.8	5	2	25	2	13	2	10	1.8	5	2	25	2	13	2	10	1.8	5
Poaceae	*Pennisetum alopecuroides*	狼尾草																																																				
Amaranthaceae	*Celosia argentea*	青葙																																					1.5	15							1.5	15							1.5	15		
Bare Gound				65		74		60		70		58		71		58		70		55		69		59		68		55		67		58		66		25		23		18		43		25		20		15		40		25		20		15		40

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

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

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

					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring				
Common Name	**Species name**	**Chinese name**	**Status**	**Commonness**	Jan-14					Feb-14					Mar-14					Apr-14				
					Abundance					Abundance					Abundance					Abundance				
					C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4
Barn Swallow	*Hirundo rustica*	家燕	PM	C						+					+					+				1
Black Drongo	*Dicrurus macrocercus*	黑卷尾	Sv	C																				
Black Kite	*Milvus lineatus*	蠅鷹	R, RC, Cap.586	C						+					+									
Black-faced bunting	*Emberiza spodocephala*	灰頭鵐	WV&PM	C																				
Black-necked Starling	*Sturnus nigricollis*	黑領椋鳥	R	C	++		2	2	1	++		2		3	++	1		4	2	++		2	1	
Black-winged Cuckoo-shrike	*Coracina melaschistos*	暗灰鵑鵙	PM	C																				
Buzzard (Common Buzzard)	*Buteo buteo*	普通鵟	WV,Cap.586	C											+									
Chinese Bulbul	*Pycnonotus sinensis*	白頭鵯	R	C	+	1		2	3	+	3	1	2	2	+	2	2	4	3	+	2		3	1
Chinese Pond Heron	*Ardeola bacchus*	池鷺	R,RC	C	++	1	2	4	3	++		1	2	2	++	2	3	3	1	++	3	2	2	
Common Kingfisher	*Alcedo atthis*	普通翠鳥	R	C	+			1		+				1	+			1		+				
Common Koel	*Eudynamys scolopacea*	噪鵑	R	C	+					+	1				+	1		1		+	2		1	
Common Sandpiper	*Actitis hypoleucos*	磯鷸	WV&PM	C	+		1	2		+		2	2		+		2	2	1	+		2	1	
Common Tailorbird	*Orthotomus sutorius*	長尾縫葉鶯	R	C	++	2	1	3	2	++	1	1	2	1	++	1	2	1	2	++	1	1		1
Crested bulbul	*Pycnonotus jocosus*	紅耳鵯	R	C	+++	6	5	4	5	+++	4	3	3	4	+++	3	2	6	5	+++	2	3	4	2
Crested Goshawk	*Accipiter trivirgatus*	鳳頭鷹	R, CR, Cap.586	R																				
Crested Myna	*Acridotheres cristatellus*	八哥	R	C	++		3	2	3	++		2	4	2	++			6	3	++		1	3	2
Crested Serpent Eagle	*Spilornis cheela*	蛇鵰	R, VU, LC, Cap	R											+									
Daurian redstart	*Phoenicurus auroreus*	北紅尾鴝	WV	U	+		1	1		+		1		1	+		1	1						
Domestic pigeon	*Columba sp.*	鴿	R	C	+					+					+									
Dusky Warbler	*Phylloscopus fuscatus*	褐柳鶯	WV	U	+	1				+	1		1		+		1	1		+			1	
Eurasian tree sparrow	*Passer montanus*	麻雀	R	C	+					+					+					+	2			
Great Coucal	*Centropus sinensis*	褐翅鴉鵑	R,VU	C	+			1	1	+		1	1		+		1	1	1	+		1		1
Great Tit	*Parus major(commixtus)*	大山雀	R	C	+					+	1			2	+	1				+				
Green Sandpiper	*Tringa ochropus*	白腰草鷸	PM&WV	U	+		2			+			2		+		2	2		+		1	2	
Grey Heron	*Ardea cinerea*	蒼鷺	WV,PRC	C	+					+					+					+				
Grey Wagtail	*Motacilla cinerea*	灰鶺鴒	WV	C	++	2	2	4	1	++	2	1	2	2	++	2	1	2	1	+		1		
Japanese White Eye	*Zosterops japonica(simplex)*	暗綠繡眼鳥	R	C	+++	4	3	3	5	+++	5		4		++	4		5	3	++	2		3	
Jungle Crow	*Corvus macrorhynchus*	大嘴烏鴉	R	C						+.					+.					+				
Large Hawk Cuckoo	*Cuculus sparverioides*	鷹鵑	SV	U																				
Lesser Coucal	*Centropus bengalensis*	小鴉鵑	R, VU	C											+.									
Little Egret	*Egretta garzetta*	小白鷺	R, RC	C	+	1	2	3	2	+	2	2	3	3	++	1	3	4	2	++	3	2	2	1
Great Egret	*Ardea alba*	大白鷺	R,WV, RC	C																				
Little Swift	*Apus affinis*	小白腰雨燕	R,SpM	C	+					+			2	1	+		2	2						
Magpie	*Pica pica*	喜鵲	R	C	+					+					+			1		+				
Magpie Robin	*Copsychus saularis*	鵲鴝	R	C	++	2	1	3	1	++	1	2	1	2	++	1	1	2	2	++	1		2	1
Mandarin Duck	*Aix galericulata*	鴛鴦	WV	U																				
Masked Laughing Thrush	*Garrulax perspicillatus*	黑臉噪鸝	R	C	+					+			3	2	+		2	4	2	+		2		
Night Heron	*Nycticorax nycticorax*	夜鷺	R&WV, LC	C																				
Northern Shoveler	*Anas clypeata*	琵嘴鴨	WV	C																				
Olive Backed Pipit	*Anthus hodgsoni*	樹鷚	WV	C	++	2	1		2	+			1		+		1	2		+			2	
Plaintive Cuckoo	*Cacomantis merulinus*	八聲杜鵑	SV	C																				
Red-billed Blue Magpie	*Urocissa erythrorhyncha*	紅嘴藍鵲	R	C						+					+									
Red-flanked Bluetail	*Tarsiger cyanurus*	紅脇藍尾鴝	PM&WV	C	+		1		1	+				1	+									
Rufous Turtle Dove	*Streptopelia orientalis*	山斑鳩	R	C																				
Rufous-backed Shrike	*Lanius schach*	棕背伯勞	R	C	+					+					+					+			1	
Rufous-capped Babbler	*Stachyridopsis ruficeps*	紅頭穗鶥	R	C	+					+					+					+				
Scarlet Minivet	*Pericrocotus flammeus*	赤紅山椒鳥	R	C						+														
Siberian Stonechat	*Saxicola maurus*	黑喉石䳭	WV	U	+		1			+					+			1						
Sooty-headed Bulbul	*Pycnonotus aurigaster*	白喉紅臀鵯	R	C																				
Spotted Dove	*Streptopelia chinensis*	珠頸斑鳩	R	C	++	3	2	3	4	++	3	4	3	2	++	2	3	4	3	++	3	2	2	1
Spotted Munia	*Lonchura punctulata*	斑文鳥	R	U	++					++					++					++			4	
Velvet-fronted Nuthatch	*Sitta frontalis*	絨額鳾	R	U																				
White Wagtail	*Motacilla alba*	白鶺鴒	WV	C	++		2	1	2	++	1	2	3	2	++	1	2	2	1	++	1	2	1	2
White-breasted Waterhen	*Amaurornis phoenicurus*	白胸苦惡鳥	R	C	+					+					+			2		+				1
White-throated Kingfisher	*Halcyon smyrnensis*	白胸翡翠	R, LC	C	+					+										+				
Yellow Bellid Prinia	*Prinia flaviventris*	黃腹鷦鶯	R	C	+		1	2	1	+			1	2	+		1	2	1	+	1	1	1	
Yellow Wagtail	*Motacilla flava*	黃鶺鴒	WV&PM	U																				
Zitting cisticola	*Cisticola juncidis*	棕扇尾鶯	WV&PM	C																				
Number of birds						25	33	41	37		25	25	42	35		22	32	66	33		23	23	36	14
No. of species					35	11	18	17	16	40	12	14	19	18	41	13	18	26	16		12	14	18	11

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; U – Uncommon

SpM – Spring migrant; Sv–Summer Visitor ; C – transect survey; P1 – Point count location 1; P4 – Point count location 4

+, occurred; ++, common; +++, abundant/dominant species in the the study area

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

All bird species are under protection of Wild Animals Protection Ordinance (Cap. 170)

Endangered Species of Animals and Plants Ordinance (Cap. 586)

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

PRC: Potential Regional Concern Fellowes *et al* (2002)

CR: Rare in China Red Data Book Status

VU: Vulnerable in China Red Data Book Status

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

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

					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring					Post construction monitoring				
Common Name	**Species name**	**Chinese name**	**Status**	**Commonness**	May-14					Jun-14					Jul-14					Aug-14					Sep-14					Oct-14					Nov-14					Dec-14									
					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance					Abundance									
					C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4	C	T1	T2	T3	T4
Barn Swallow	*Hirundo rustica*	家燕	PM	C	++	2	1	4	2	+		1	2	1	+			2															+														
Black Drongo	*Dicrurus macrocercus*	黑卷尾	Sv	C																																										
Black Kite	*Milvus lineatus*	麻鷹	R, RC, Cap.586	C																+									+					+					+									
Black-faced bunting	*Emberiza spodocephala*	灰頭鵐	WV&PM	C																																		+									
Black-necked Starling	*Sturnus nigricollis*	黑領椋鳥	R	C	++	1	2	2	1	++	2		3	2	++	2	3	2	1	++	1		3		++		2	2	1	++	2		3		++		2	2		++	2		3	2					
Black-winged Cuckoo-shrike	*Coracina melaschistos*	暗灰鵑鵙	PM	C																																										
Buzzard (Common Buzzard)	*Buteo buteo*	普通鵟	WV,Cap.586	C																																										
Chinese Bulbul	*Pycnonotus sinensis*	白頭鵯	R	C	+		1	2		+	2		2		+	1				+	2		1		+	2	2	1		+	3		2	1	+	2			1	++	2	2	3					
Chinese Pond Heron	*Ardeola bacchus*	池鷺	R,RC	C	++	1		2	1	++	2	1	1		++	4	2	3	2	++	2	1	2	2	++	3	2	3	1	++	4	1	1	2	++	3		2	1	+	2	1	3					
Common Kingfisher	*Alcedo atthis*	普通翠鳥	R	C	+					+					+					+					+					+			1	1	+				1	+		1						
Common Koel	*Eudynamys scolopacea*	噪鵑	R	C	+	1		1	1	+			1		+	1				+		1			+					+					+					+									
Common Sandpiper	*Actitis hypoleucos*	磯鷸	WV&PM	C	+			1		+					+					+					+					+					+					+									
Common Tailorbird	*Orthotomus sutorius*	長尾縫葉鶯	R	C	++	1		1	1	++	1	1	1	1	++	2		1		++	1	2	1	1	++	1	1	2	2	++	1	1		1	+		1			++		1			1			
Crested bulbul	*Pycnonotus jocosus*	紅耳鵯	R	C	+++	3	2	3	3	+++	2	3	4	2	+++	4	3	6	3	+++	3		4	2	+++	2	2	3	2	+++	3	3	4	2	+++		2	2	3	+++		4	3	2				
Crested Goshawk	*Accipiter trivirgatus*	鳳頭鷹	R, CR, Cap.586	R																																										
Crested Myna	*Acridotheres cristatellus*	八哥	R	C	+		2	1		++		3	5	2	++	1	2	5		++		2	3		++		4	3	2	++	1		2	3	++	3		4		++	2	3	5					
Crested Serpent Eagle	*Spilornis cheela*	蛇鵰	R, VU, LC, Cap	R																																										
Daurian redstart	*Phoenicurus auroreus*	北紅尾鴝	WV	U																										+		1			+		1	1		++		1	1	1				
Domestic pigeon	*Columba sp.*	鴿	R	C																					+					+					+					+								
Dusky Warbler	*Phylloscopus fuscatus*	褐柳鶯	WV	U	+			1	1	+			1		+		1	1		+			1	1	+			1		+					+			1		+	1	1						
Eurasian tree sparrow	*Passer montanus*	麻雀	R	C	+					+				2	+	2		3	1	+		1	2	2	+		1			+		3		1	+	2	2			++	3		2					
Great Coucal	*Centropus sinensis*	褐翅鴉鵑	R,VU	C	+	1		1	1	+			1	1	+	1		1	1	+			1	1	+		1	1	1	+			1		+	1		1		+		1			1			
Great Tit	*Parus major(commixtus)*	大山雀	R	C	+			2																																						
Green Sandpiper	*Tringa ochropus*	白腰草鷸	PM&WV	U	+					+																									+					+								
Grey Heron	*Ardea cinerea*	蒼鷺	WV,PRC	C																															+												
Grey Wagtail	*Motacilla cinerea*	灰鶺鴒	WV	C	+										+		1	1		+			1	1	+	2	1	3	1	+	1	2	2	1	+	1	1	1	2	+	1		2	1				
Japanese White Eye	*Zosterops japonica(simplex)*	暗綠繡眼鳥	R	C	++	4	3	5	2	++	2	2	3		++	5	2		2	++	3		4	3	++	2				++	3				++	2		3		++	3	4	5					
Jungle Crow	*Corvus macrorhynchus*	大嘴烏鴉	R	C	+					+										+					+					+																	
Large Hawk Cuckoo	*Cuculus sparverioides*	鷹鵑	SV	U	+					+																																					
Lesser Coucal	*Centropus bengalensis*	小鴉鵑	R, VU	C																																										
Little Egret	*Egretta garzetta*	小白鷺	R, RC	C	++	1	2	3	2	++	1	1	2	1	++	1	2	3	1	++	2	3	4	2	++	1	2	4	2	++	2	1	3	1	++	3	2	4	2	++	2	1	3	1				
Great Egret	*Ardea alba*	大白鷺	R,WV, RC	C																																										
Little Swift	*Apus affinis*	小白腰雨燕	R,SpM	C																																										
Magpie	*Pica pica*	喜鵲	R	C																					+					+			1		+					+								
Magpie Robin	*Copsychus saularis*	鵲鴝	R	C	++	1	1	1		++	1	2		1	++		1	3	1	++	1	2	2	1	++	2	1	2	1	++	1	2	2		++	1	1	2	1	++	1	1	2	2				
Mandarin Duck	*Aix galericulata*	鴛鴦	WV	U																																										
Masked Laughing Thrush	*Garrulax perspicillatus*	黑臉噪鶥	R	C	+		2	4	2	+	2		3		+			2	1	+		3	2	3	+		2	4	2	+		2			+	3		3		++			2	2				
Night Heron	*Nycticorax nycticorax*	夜鷺	R&WV, LC	C																																										
Northern Shoveler	*Anas clypeata*	琵嘴鴨	WV	C																															+												
Olive Backed Pipit	*Anthus hodgsoni*	樹鷚	WV	C	+																																			+								
Plaintive Cuckoo	*Cacomantis merulinus*	八聲杜鵑	SV	C	+					+																																					
Red-billed Blue Magpie	*Urocissa erythrorhyncha*	紅嘴藍鵲	R	C											+																					+												
Red-flanked Bluetail	*Tarsiger cyanurus*	紅脇藍尾鴝	PM&WV	C																																										
Rufous Turtle Dove	*Streptopelia orientalis*	山斑鳩	R	C																																										
Rufous-backed Shrike	*Lanius schach*	棕背伯勞	R	C	+					+					+			1	1	+			1		+		1			+	1		1		+				1	+	1		1					
Rufous-capped Babbler	*Stachyridopsis ruficeps*	紅頭穗鶥	R	C	+																				+					+										+								
Scarlet Minivet	*Pericrocotus flammeus*	赤紅山椒鳥	R	C																																											
Siberian Stonechat	*Saxicola maurus*	黑喉石鵐	WV	U																															+		1			++			1		1			
Sooty-headed Bulbul	*Pycnonotus aurigaster*	白喉紅臀鵯	R	C																																										
Spotted Dove	*Streptopelia chinensis*	珠頸斑鳩	R	C	++	2	3	5	2	++	3	1	3	2	++	2	3	5	1	++	1	2	4	2	++	3	2	4	3	++	4	2	3	2	++	3	3	5	3	+++	2	3	3	2				
Spotted Munia	*Lonchura punctulata*	斑文鳥	R	U	++					++					+					+					5		++	5		8			++		4	5		+++	5		7						
Velvet-fronted Nuthatch	*Sitta frontalis*	絨額鳾	R	U																																										
White Wagtail	*Motacilla alba*	白鶺鴒	WV	C	+					+					++	1	2	3	1	++	2	1	2	2	++	3	2	3	4	++	2	1	2	1	++	1	2	1	2	++	1	1	2	1				
White-breasted Waterhen	*Amaurornis phoenicurus*	白胸苦惡鳥	R	C	+			1	1	+		1			+			1	1	+		1	1		+		1	2	1	+			1	1	+			1	1	+			1					
White-throated Kingfisher	*Halcyon smyrnensis*	白胸翡翠	R, LC	C	+																									+					+												
Yellow Bellid Prinia	*Prinia flaviventris*	黃腹鷦鶯	R	C	+			1	1	+	1			1	+	1	2	1	1	+	1	2	2	1	+	1	1	2	2	+	1		1		+		1	1	1	+	1		1					
Yellow Wagtail	*Motacilla flava*	黃鶺鴒	WV&PM	U																																										
Zitting cisticola	*Cisticola juncidis*	棕扇尾鶯	WV&PM	C																																					+								
Number of birds						18	19	41	21		19	16	32	16		28	24	44	18		19	21	43	24		22	28	46	25		34	21	39	17		25	23	39	19		29	26	49	17				
No. of species						11	10	19	14		11	10	14	11		14	12	18	14		11	12	20	14		11	17	18	14		15	13	18	12		12	13	17	12		15	15	18	12				

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; U – Uncommon

SpM – Spring migrant; Sv–Summer Visitor ; C – transect survey; P1 – Point count location 1; P4 – Point count loca

+, occurred; ++, common; +++, abundant/dominant species in the the study area

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PRC: Potential Regional Concern Fellowes *et al* (2002)

CR: Rare in China Red Data Book Status

VU: Vulnerable in China Red Data Book Status

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

					Post construction monitoring											
Species	Common name	Chinese name	Status	Common-ness	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
Acisoma panorpoides panorpoides	Asian Pintail	錐腹蜻	NP	VC						+						
Brachythemis contaminata	Asian Amberwing	黃翅蜻	NP	VC												
Ceriagrion auranticum ryukyuanum	Orange-tailed Sprite	琉球橘黃蟌	NP	VC				+	+	+	+	+	+	+	+	
Coeliccia cyanomelas	Blue Forest Damsel	黃紋長腹蟌	NP	VC				+								
Copera marginipes	Yellow Featherlegs	黃狹扇蟌	NP	VC				+		+	+	+	+	+		
Crocothemis servilia servilia	Crimson Darter	红蜻	NP	VC			+	+	+	+	+	+		+	+	+
Euphaea decorata	Black-banded Gossamerwing	方帶幽蟌	NP	VC				+		+						
Ictinogomphus pertinax	Common Flangetail	霸王葉春蜓	NP	C							+					
Ischnura senegalensis	Common Blue Jewel	褐斑異痣蟌	NP	VC				+	+	+						
Mnais lacteola	Indochinese Copperwing	煙翅綠色蟌	P, LC	C				+								
Nannophya pygmaea	Scarlet Dwarf	侏紅小蜻	P, LC	C				+								
Neurobasis chinensis	Chinese Greenwing	華艷色蟌	NP	VC			+	+	+	+	+	+	+	+	+	+
Neurothemis fulvia	Russet Percher	網脈蜻	NP	VC							+	+	+	+		
Neurothemis tullia tullia	Pied Percher	截斑脈蜻	NP	C								+				
Orthetrum chrysis	Red-faced Skimmer	華麗灰蜻	NP	VC												
Orthetrum glaucum	Common blue skimmer	黑尾灰蜻	NP	VC								+				
Orthetrum luzonicum	Marsh Skimmer	呂宋灰蜻	NP	VC												
Orthetrum pruinosum neglectum	Common Red Skimmer	赤褐灰蜻	NP	VC					+	+	+	+	+	+		
Orthetrum sabina sabina	Green Skimmer	狹腹灰蜻	NP	VC								+				
Pantala flavescens	Wandering Glider	黃蜻	NP	VC	+				+					+	+	+
Paracercion calamorum duyeri	Dusky Lilysquatter	葦尾蟌	P, LC	C				+								
Prodasineura autumnalis	Black Threadtail	烏齒原蟌	NP	VC				+	+	+	+	+	+	+		
Pseudagrion rubriceps rubriceps	Orange-faced Sprite	丹頂斑蟌	NP	UC					+	+	+	+	+	+	+	
Rhinocypha perforata perforata	Common Blue Jewel	三斑鼻蟌	NP	VC				+			+	+	+	+	+	
Rhyothemis variegata arria	Variegated Flutterer	斑麗翅蜻	NP	C						+	+	+	+	+	+	
Trithemis aurora	Crimson Dropwing	曉褐蜻	NP	VC	+	+	+		+	+	+	+	+	+	+	+
Trithemis festiva	Indigo Dropwing	慶褐蜻	NP	VC						+	+	+	+	+	+	
Zygonyx iris insignis	Emerald Cascader	彩虹蜻	P,PGC	VC						+						
No. of species					2	1	3	12	9	14	13	15	11	13	9	4

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 accroding 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																						
Species	Chinese name	Sampling point		Jan-14					Feb-14					Mar-14					Apr-14					May-14				
		Status	Common	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4
Molluscs																												
Biomphalaria sp.	--	NP	VC	+	+				+	+	+			+	+	+		+	+	+			+	+	+			
Brotia hainanensis	--	NP	VC	++	+	+	+		++	+	+	+		++	+	+	+	+	++	+	+	+	+	++	+	+	+	+
Melanoides tuberculata	瘤擬黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pomacea canaliculata	蘋果螺	NP	VC			+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	田螺	NP	VC	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+
Insects																												
Baetis sp.	--	NP	VC	+			+		+		+	+		+		+	+		+		+					+		
Caenis sp.	--	NP	VC																+										
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Electrogenas sp.	--	NP	VC	+					+	+	+			+	+	+			+	+				+	+			
Hydropsyche sp.	--	NP	VC	+	+				+	+				+	+				+	+	+				+			
Indobaetis sp.	--	NP	VC	+			+		+			+		+	+	+	+		+	+	+		+	+	+			+
Mnais sp.	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Orthetrum sp.	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Crustaceans																												
Caridina cantanensis	廣東米蝦	NP	VC	+	++	++	++	+	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++
Cryptopotamon anacoluthon	鰓刺溪蟹	NP	VC	+	+				+	+				+	+				+	+	+				+			
Macrobrachium hainanense	海南沼蝦	NP	VC	+					+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Somanniathelphusa zanklon	束腰蟹	NP	VC																									
No. of species				15	11	9	10	8	16	13	13	11	8	16	14	14	12	11	17	15	16	13	12	13	15	10	10	10

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

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

Species	Chinese name	Sampling point		Post construction monitoring																								Post construction monitoring					Post construction monitoring				
				Jun-14					Jul-14					Aug-14					Sep-14					Oct-14					Nov-14					Dec-14				
		Status	Common	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4	Reference point	T1	T2	T3	T4
Molluscs																																						
Biomphalaria sp.	--	NP	VC	+	+				+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Brotia hainanensis	--	NP	VC	++	+	+	+	+	++	+	+	+	+	++	+	+	+		++	+	+	+		++	+	+	+		++	++	+	+	+	++	++	+	+	+
Melanoides tuberculata	瘤擬黑螺	NP	VC				+	+				+	+			+	+	+			+					+	+	+				+				+	
Pomacea canaliculata	蘋果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	羅白螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	田螺	NP	VC	+	+			+	+	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Insects																																						
Baetis sp.	--	NP	VC			+			+		+			+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+
Caenis sp.	--	NP	VC																	+																		
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Electrogenas sp.	--	NP	VC	+	+				+	+				+	+	+			+	+	+			+	+	+			+	+	+	+	+	+	+	+	+	
Hydropsyche sp.	--	NP	VC			+	+		+		+	+		+		+	+		+		+	+	+	+		+	+		+			+			+		
Indobaetis sp.	--	NP	VC	+	+		+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mnais sp.	--	NP	VC			+					+	+			+	+	+			+	+	+	+		+	+	+			+	+	+			+	+	
Orthetrum sp.	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+
Crustaceans																																						
Caridina cantanensis	廣東米蝦	NP	VC	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++	+	++	++	++	++
Cryptopotamon anacoluthon	鰓刺溪蟹	NP	VC		+	+					+	+				+	+				+	+			+	+	+			+		+					+	
Macrobrachium hainanense	海南沼蝦	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+
Somanniathelphusa zanklon	束腰蟹	NP	VC																																			
No. of species				11	12	11	10	9	13	11	13	13	10	13	13	15	15	9	13	14	16	14	12	13	14	16	15	11	13	14	15	14	12	13	12	12	13	11

Note: NP – Not protected in Hong Kong; P - Protected in Hong
"VC" – Very Common; "UC" – Uncommon; "C" - Common; "I
+, occurred; ++, common; +++, abundant/dominant Species ir

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)

				Post construction monitoring																								
				Jan-14					Feb-14					Mar-14					Apr-14					May-14				
			Sampling point	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
Species	Chinese name	Status	Commonness																									
Fish																												
Acrossocheilus parallens	側條光唇魚	P, PGC	R	+	+	+	+		+	+	++	+++	+	+	++	++	+++	++		++	++	+++	++		+	+	+	+
Channa maculate	斑鱧	NP	C																									
Cirrhina molitorella	鯪魚	NP	C																	+								
Clarias fuscus	胡子鯰	NP	C	+		+			+		+			+			+	+				+	+					+
Cyprinus carpio var. viridiviolaceus	錦鯉	NP	C			+					+					+					+							
Gambusia affinis	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Liniparhomaloptera disparis	擬平鰍	NP	C											+	+	+	+		+	+	+	+		+	+	+	+	
Misgurnus anguillicaudatus	泥鰍	NP	C	+					+		+			+		+	+	+	+	+	+	+	+	+	+	+	+	+
Oreochromis niloticus	尼羅口孵非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Parazacco spilurus	異鱲	V and	C	+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poecilia reticulate	孔雀花魚將	NP	VC			+	+				+	+				+	+	+			+	+	+			+	+	+
Pseudogastromyzon myersi	麥氏擬腹吸鰍	NP	C	+					+	+	+			+	+	+				+	+			+	+			
Pterocryptis cochinchinensis	黃鯰	NP	C	+			+		+			+		+			+		+			+		+				
Puntius semifasciolatus	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhinogobius spp.	鰕虎魚	NP	C/UN/R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Schistura fasciolata	橫紋南鰍	NP	C	+	+	+			+	+	+			+	+	+			+	+	+			+	+	+		
Xiphophorus hellerii	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus variatus	雜色劍尾魚	NP	C	+		+	+		+		+	+		+		+	+				+	+	+			+	+	
Zacco platypus	寬鰭鱲	NP	C	+	+	++	++	++	+	+	++	+++	++	+	+	++	+++	++	+	+	++	+++	++	+	+	++	++	++
2x2m fish counting		No. of fish		6	20	60	20	10	16	40	70	40	30	60	70	80	90	80	40	50	60	60	50	20	30	30	20	20
No. of species				14	10	13	11	6	14	10	15	11	7	15	11	16	14	11	11	12	16	14	12	13	13	13	12	11
Amphibian																												
Paramesotriton hongkongensis	香港瘰螈	P (Cap 170, NT, PGC)	R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Fejervarya limnocharis	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
"Cap 170" - List in Wild Animials Protcetion Ordinance (Cap.170)
"NT" - Near Treatened in IUCN Red List Status
"PGC"-Potential Golal Concern by Fellowes *et al* (2002)

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)

				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				
			Sampling point	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4	Reference	T1	T2	T3	T4
Species	Chinese name	Status	Commonness																																			
Fish																																						
Acrossocheilus parallens	側條光唇魚	P, PGC	R		+	+	+	+		+	++	++	+		++	++	++	+		++	++	++	+		++	++	++	+		++	++	++	++		++	++	++	++
Channa maculate	斑鱧	NP	C																																			
Cirrhina molitorella	鯪魚	NP	C																																			
Clarias fuscus	胡子鯰	NP	C					+					+					+					+					+					+					+
Cyprinus carpio var. viridiviolaceus	錦鯉	NP	C																																		
Gambusia affinis	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Liniparhomaloptera disparis	擬平鰍	NP	C	+	+	+			+	+	+			+	+	+			+	+	+	+		+	+	+	+		+	+	+			+	+	+	+	
Misgurnus anguillicaudatus	泥鰍	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
Oreochromis niloticus	尼羅口孵非鯽	NP	C			+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+
Parazacco spilurus	異鱲	V and	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poecilia reticulate	孔雀花魚將	NP	VC			+		+			+		+			+	+	+			+	+	+			+	+	+			+	+			+	+	
Pseudogastromyzon myersi	麥氏擬腹吸鰍	NP	C	+	+				+	+				+	+	+			+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	
Pterocryptis cochinchinensis	黃鯰	NP	C	+					+			+		+			+		+	+	+	+		+	+	+	+		+	+	+			+	+	+		
Puntius semifasciolatus	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+
Rhinogobius spp.	鰕虎魚	NP	C/UN/R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	++	++	+	+	++	++	++	+
Schistura fasciolata	橫紋南鰍	NP	C	+	+	+	+		+	+	+	+		+	+	+	+		+	+	+	+	+	+	+	+	+		+	+	+	+		+	+	+	
Xiphophorus hellerii	劍尾魚	NP	C		+	+	+	+		+	+	+	+		+	++	++	+		+	++	++	+		+	++	++	+		+	++	++	+		+	++	++	+
Xiphophorus variatus	雜色劍尾魚	NP	C			+	+				+	+					+				+	+				+	+				+	+				+	+
Zacco platypus	寬鰭鱲	NP	C	+	+	+	+	+	+	+	+	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+	+	++	++	+	+
2x2m fish counting		No. of fish		6	12	10	6	8	8	16	15	5	10	10	12	18	10	12	20	30	30	20	20	30	40	40	30	30	50	70	70	60	60	60	60	60	50	50
No. of species				10	12	13	11	11	11	12	13	12	11	10	12	13	13	11	11	13	14	15	13	11	13	14	15	12	11	13	14	13	11	11	13	14	14	11
Amphibian																																						
Paramesotriton hongkongensis	香港瘰螈	P (Cap 170, NT, PGC)	R	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Fejervarya limnocharis	澤蛙	NP	VC																																			
No. of species				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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
"Cap 170" - List in Wild Animials Protcetion Ordinance (Cap.170)
"NT" - Near Treatened in IUCN Red List Status
"PGC"-Potential Golal Concern by Fellowes *et al* (2002)

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

	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
Parameter / date	Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-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
DO (mg/L)	9.1	9.0	8.6	8.5	7.8	8.7	9.8	9.8	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
pH	6.2	6.9	7.1	7.1	8.2	8.5	8	7.8	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
Nitrate (mg N/L)	0.9	0.8	1.3	1.26	1.3	1.8	1.6	2.1	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
Ammonia (mg/L)	0.04	0.1	0.12	0.15	0.05	0.04	0.1	0.12	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
Salinity (ppt)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.02	0.03	0.03	0.01	0.02	0.03	0.03
Conductivity (µS/cm)	72	78	88	108	78	87	118	119	120	123	125	123	96	114	120	122	82	80	72	66	39	58	69	70
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)	0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				0.01-0.2				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			
Sand (%)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	10	5	5	5	10	5	5	5	10
Stone (%)	90	85	85	85	90	85	85	85	90	85	85	80	90	85	85	75	90	85	85	75	93	90	90	75
Mud (%)	5	10	10	10	5	10	10	10	5	10	10	15	5	10	10	15	5	10	10	15	2	5	5	15

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

	Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
Parameter / date	Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-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
DO (mg/L)	7.6	7.2	7.6	7.5	7.6	7.4	7.3	7.6	8.7	8.7	8.4	8.6	7.2	7.3	8.1	7.6	7.3	7.3	8.2	7.8	7.2	8.1	8.2	8.2
pH	7.6	7.7	7.8	8	7.8	7.5	7.6	7.8	8.4	8.1	8.4	8.0	8.4	8.2	8.1	8.0	8.1	8.3	8.1	8.3	8.5	8.4	8.2	8.2
Nitrate (mg N/L)	0.8	1.1	1.1	0.8	1.2	1.1	0.9	1.1	1.2	1.3	1.2	1.2	0.9	1	0.9	1	1	1	0.9	0.9	0.9	1	0.9	0.9
Ammonia (mg/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	0	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
Conductivity (µS/cm)	43	85	72	75	75	78	82	86	73	77	74	72	47	50	80	88	52	56	82	84	112	92	86	67
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)	0.03-0.2				0.03-0.2				0.03-0.2				0.03-0.2				0.03-0.2				0.03-0.2			
Water flow at riffle (m/s)	0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.6				0.2-0.5			
Sand (%)	5	5	5	10	5	5	8	10	5	5	8	10	5	5	8	10	5	5	8	10	5	5	8	10
Stone (%)	93	90	90	75	93	90	90	75	93	90	90	75	93	90	90	75	93	90	90	75	93	90	90	75
Mud (%)	2	5	5	15	2	5	2	15	2	5	2	15	2	5	2	15	2	5	2	15	2	5	2	15

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

2014 Annual Report
She Shan River

January 2015

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

Agreement No. CE65/2013(EP
2014 Annual Report
She Shan River

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TABLE

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. An annual report is required to be prepared for 2014 by using the collected data from surveys of January to November conducted by Contract NO. DC/2007/06 River Imporvement Works in Upper Lam Tsuen River, She Shan River and Upper Tai Po River and survey of December conducted under the 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. This report aims to summaries and present findings of the post construction ecological monitoring carried out during 2014.

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 1 annual report for the project summarising monitoring results collected from January to December of 2014. It contents the following subsections:

- Summary of major points
- Monitoring Methods
- Monitoring Results
- Summary and Comments

2 Summary of Major Points

- Field ecological monitoring were undertaken during January to December 2014;
- Presentation of species abundance and species richness for fauna and flora using graphs;
- Fauna and flora along the drainage project sections is in a process of re-establishing or restoration;
- Hong Kong Newt was recorded with a low abundance near the habitat with abundant vegetation at She Shan River.
- The species richness and abundance of marco-invertebrate , odonata and avifauna were in natural fluctuation;
- A significant low number of fish was observed during wet season as large amount of fishes were affected by heavy rain or flooding; and
- The measured water quality parameters showed that the river water was not eutrophicated although moderate nutrient levels were recorded in early 2014 .

3 Monitoring Methodology

3.1 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 follows in the AFCD website (www.hkbiodiversity.net) and Carey et al (2001). The point count was conducted at three locations located at the lower, middle and upper portion of the river channel. 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.**

3.2 Fish Population and Hong Kong Newt

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

Sampling was conducted at three proposed sampling locations, i.e. upper, middle and lower river sections, and was cover major type of stream habitats, e.g. river pool and riffle (**Figure 1**). The number of the captured or observed fish was estimated and recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiodiversity.net) and Virginia et al (2004).

3.3 Aquatic Macro-invertebrates

Macro-invertebrates in the riverbed were surveyed. Three sampling sites were designed to collect necessary macro-invertebrate fauna for ecological monitoring information (**Figure 1**). Five replicates were taken at each sampling point and pool together for further sample process. Kick sampling and hand netting were the main 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 will follow those documented in the AFCD website (www.hkbiodiversity.net) and other literatures such as Dudgeon (1994).

3.4 Adult Odonata Survey

Adult Odonata survey was conducted along transects (**Figure 1**). Binoculars,

digital camera and hand net were utilized to aid identification. Numerical abundance, species identity and other notable behaviour were recorded. Nomenclature and protection status of the species followed those documented in the AFCD website (www.hkbiodiversity.net) and Keith (2003&2011). Adult Odonata survey was conducted along line transects in parallel with river channel within the works area where access was permitted.

3.5 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, middle and lower portion of the river channel (**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 followed those documented in the AFCD website (http://herbarium.gov.hk/) and Hong Kong Herbarium (2012).

3.6 Abiotic Data Collection

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.

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.

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

Over 80 flora species was recorded within the survey transects along the river course within 2014. Most of the recorded floras were comprised of marsh species with few floating aquatic species such as *Lemna minor* 浮萍 and submerged plant such as *Hydrilla verticillata* 黑藻. The height of the dominated riparian grass and herb species were in a range from 0.3m to 3m 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 riparian habitat in upper sections and part of the riverbed.

Aquatic plants *Brachiaria mutica* 巴拉草 and *Commelina diffusa* 節節草 were the most abundant plants found at most section of the river channel all of the years. An aquatic plant, which is also a vegetable, *Nasturtium officinale* 西洋菜 were recorded especially high in abundance during dry season when there was no flooding occurred (see photograph below). The recorded floras were generally in good health indicating that the vegetation of the riverbed and banks is in a process of re-establishing or restoration. 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.

Photograph showing general view of She Shan River in March

Photograph showing general view of She Shan River in June. In the wet season, most of the plants in riverbed had been washed away by flood.

Photograph showing general view of She Shan River in September

Photograph showing general view of She Shan River in January. An aquatic plant, also a vegetable, *Nasturtium officinale* 西洋菜 was very abundant during dry season in She Shan River.

4.2 Fauna

4.2.1 Avifauna

An avifauna surveys were undertaken from January to December 2014 along survey transects and at three selected point count locations. Transect and Point Count locations were shown on **Figure 1**. Result of bird survey was presented in the **Table 4-3**. .The summarised results showed that there was

no obvious change on species richness of avifauna at She Shan River and the number of avifauna was presenting a natural fluctuation, shown as **Figure 4.1** and **Figure 4.2.** In total, over 35 species of birds were recorded during the bird surveys within project area within 2014. 9 species of total recorded were wetland dependent species such as *Egretta garzetta, Motacilla alba,Ardeola bacchus* and *Actitis hypoleucos* commonly found forging in the river channel. The most common terrestrial birds recorded included – *Pycnonotus jocosus* 紅耳鵯, *Sturnus nigricollis* 黑領椋鳥, *Copsychus saularis* 鵲鴝, and *Streptopelia chinensis* 珠頸斑鳩. Below photographs are showing the common species recorded at She Shan River.

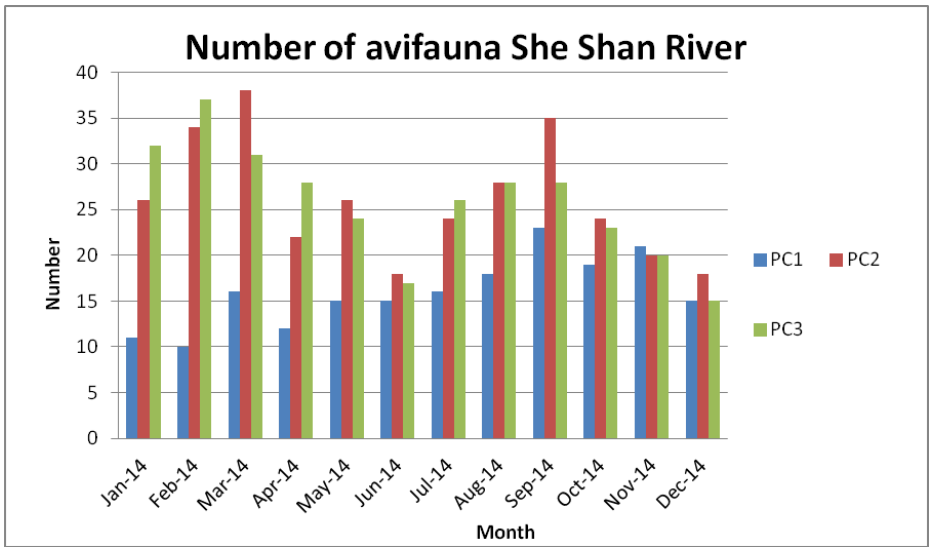


Figure 4.1. Bird abundance.

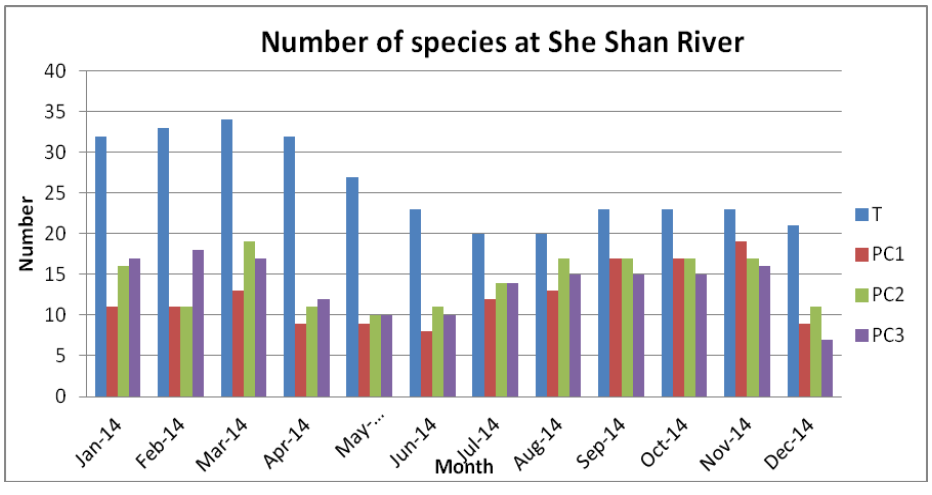


Figure 4.2. Species richness of avifauna.

	
Motacilla alba 白鶺鴒	*Pycnonotus jocosus* 紅耳鵯
	
Ardeola bacchus 池鷺	*Motacilla cinerea* 灰鶺鴒
	
Egretta garzetta 小白鷺	Munia *Lonchura punctulata* 斑文鳥

	
Lanius schach 棕背伯勞	*Sturnus nigricollis* 黑領椋鳥.

4.2.2 Adult Odonata Survey

Odonata surveys were performed from January to December 2014 and a list of recorded odonata species in She Shan River is shown in **Table 4-4**. A graph of odonata species richness is shown in **Figures 4.3**, it indicates that species number of odonata fluctuated among seasons. The maximum number of odonata species was recorded during wet season and a big contrast showing species number of odonata in dry season is significant low. More species and higher abundance observed in wet season was due to seasonality (Keith, 2003&2011). In total, 23 species of odonata were recorded in a year. Sampling location was shown on **Figure 1**. Photographs of some of the recorded dragonfly and damselfly species are presented below.

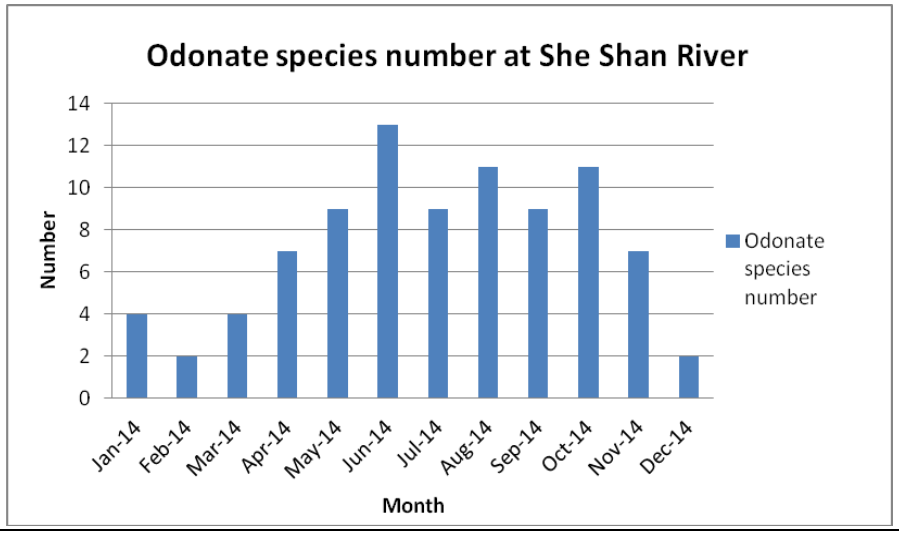


Figure 4.3 Species richness of Odonata.

	
Ceriagrion auranticum ryukyuanum 琉球橘黃蟌.	Dragonfly *Ictinogomphus pertinax* 霸王葉春蜓
	
Orthetrum pruinosum neglectum 赤褐灰蜻	*Neurothemis fulvia*. 網脈蜻
	
Trithemis festiva 慶褐蜻	*Orthetrum sabina* 狹腹灰蜻

	
Tholymis tillarga 華斜痣蜻	*Trithemis aurora*.曉褐蜻
	
Rhinocypha perforata 三斑鼻蟌	*Neurobasis chinensis chinensis* 華艷色蟌
	
Pseudagrion rubriceps 丹頂斑蟌	*Orthetrum luzonicum* 呂宋灰蜻

4.2.3 Aquatic Macro-invertebrates

The river benthic fauna collected was mainly comprised of insects, mollusks and crustaceans. Over 20 species were recorded during ecology surveys undertaken from January to December 2014. The species richness was observed with no significant change, shown as **Figure 4.2.3**. Details of recorded benthic fauna refer to **Table 4-5**. Sampling location was shown on **Figure 1**.

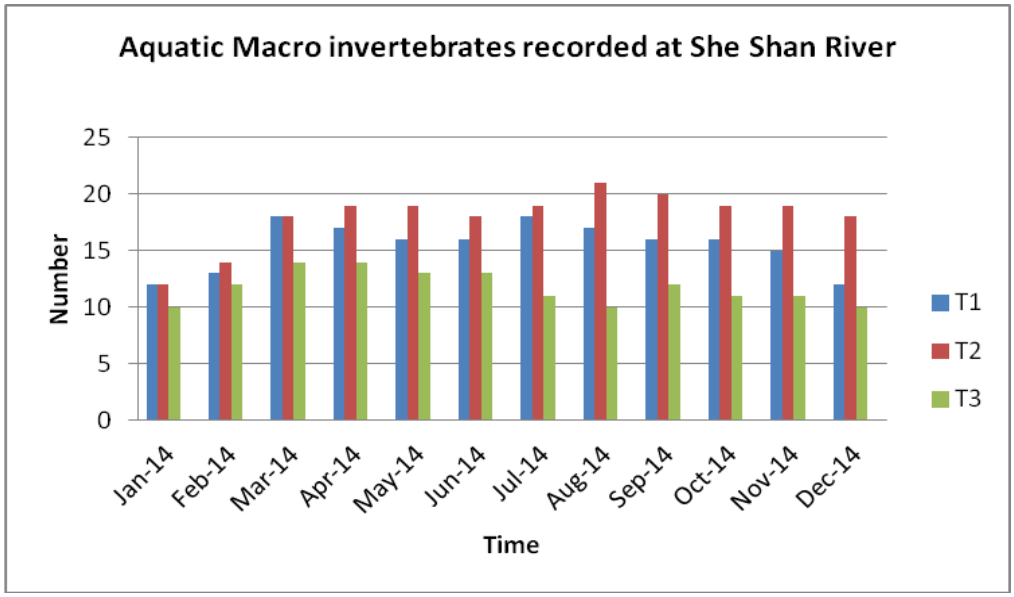


Figure 4.2.3. Species number of aquatic macroinvertebrate and other fauna at She Shan River during 2014.

4.2.4 Hong Kong Newt

Survey of Hong Kong Newt was conducted at She Shan River from January to December of 2014. Adult Hong Kong Newt *Paramesotriton hongkongensis* 香港瘰螈 was observed in every survey conducted during 2014 at the river channel (See below Photographs). The abundance of Hong Kong Newt at She Shan River is low. Record of Hong Kong Newts can be referred to **Table 4-6.**

Hong Kong Newt 香港瘰螈 preferred river.

Larvae of Hong Kong Newt.

	
Juvenile of the Hong Kong Newt.	Adult of the Hong Kong Newt.

4.2.5 Fish Fauna

Fish surveys were performed at She Shan River from January to December 2014 and total 13 species of freshwater fish were recorded. Native fish *Zacco platypus* 寬鰭鱲 was one of the dominant fish in the river channel (see below photograph). During wet season, heavy rain and flooding affected fish abundance counted at the 2x2 meter recording area, **Figure 4.2.5b**. There was no apparent change on the species number and composition at She Shan River within 2014, shown as **Figure 4.2.5a**. Details of recorded of fish fauna refers to **Table 4-6.** Sampling location was shown on **Figure 1**.

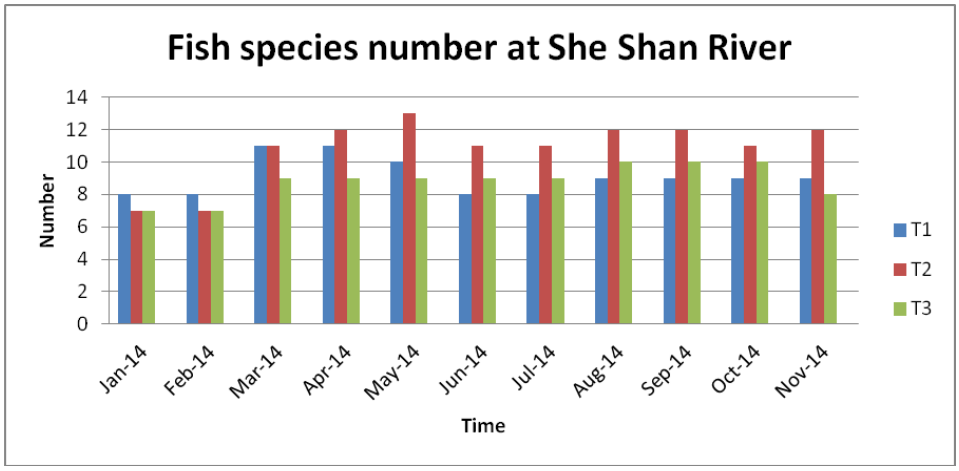
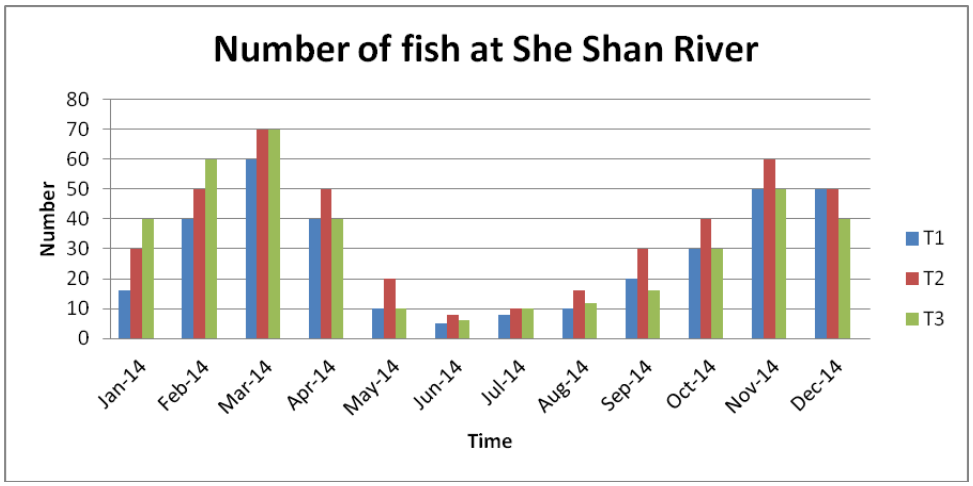


Figure 4.2.5a. Number of fish species recorded in She Shan River during 2014.



4.2.5b. Fish abundance (fish counts in 2x2m plots) recorded in She Shan River during 2014.

Fish sampling in upper Lam Tsuen River.

Zacco platypus 寬鰭鱲.

A native fish *Rhinogobius* sp. 鰕虎魚.

Channa maculata 斑鱧.

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.**

Water quality parameters measured at She Shan River showed low nutrient level of the river water and no eutrophication problem, refer to **Figure 4.3a**. Results of water test are presented in the **Table 4.7.**

The river substratum was comprised of over 20-80% 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).

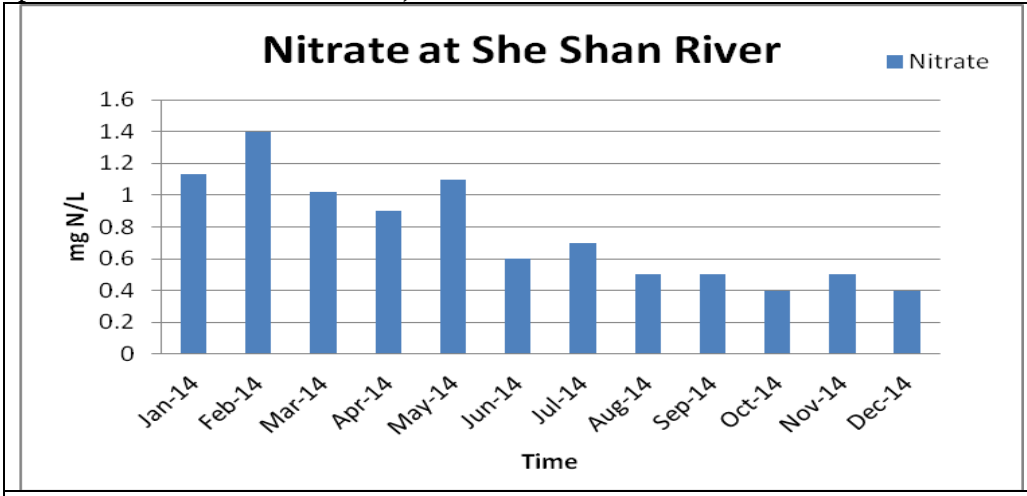


Figure 4.3a Nitrate recoded in She Shan River during 2014.

5 Summary and Commentary

5.1 Data presented and analyzed in this report were derived from ecology surveys conducted during 2014. The post-construction ecological monitoring will be continued and it is expected that long term monitoring will reveal even more information on ecological recovery and habitat improvement.

5.2 Aquatic and riparian vegetation re-established quickly after the completion of the drainage works as demonstrated by the photographs in this report. Aquatic and marsh plants growing on the riverbed and along the water margins provide breeding and feeding habitat for a variety of aquatic life including insects, shrimps, fish and the Hong Kong Newt.

5.3 *Paramesotriton hongkongensis* 香港瘰螈 were frequently recorded during ecological surveys in 2014, but its abundance was low, especially in wet season.

5.4 The species richness of fish was recorded in a stable level during 2014. However, the fish abundance was observed significant low during wet season, it was believed that fishes were affected by heavy rain and floods. Native fish *Zacco platypus* 寬鰭鱲 was one of the dominant species in the river channel.

5.5 Abundance of the aquatic marco-invertebrates and avifauna were stable with no apparent seasonal change.

5.6 The species richness of odonata fluctuates sharply along with different season, maximum species number was recorded during wet season due to seasonality.

5.7 Measured water quality parameters and physical characteristics showed only minor monthly fluctuation. It is predicted that the water quality will improve over the long term as flora and fauna continues to establish in the river channel.

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FIGURE

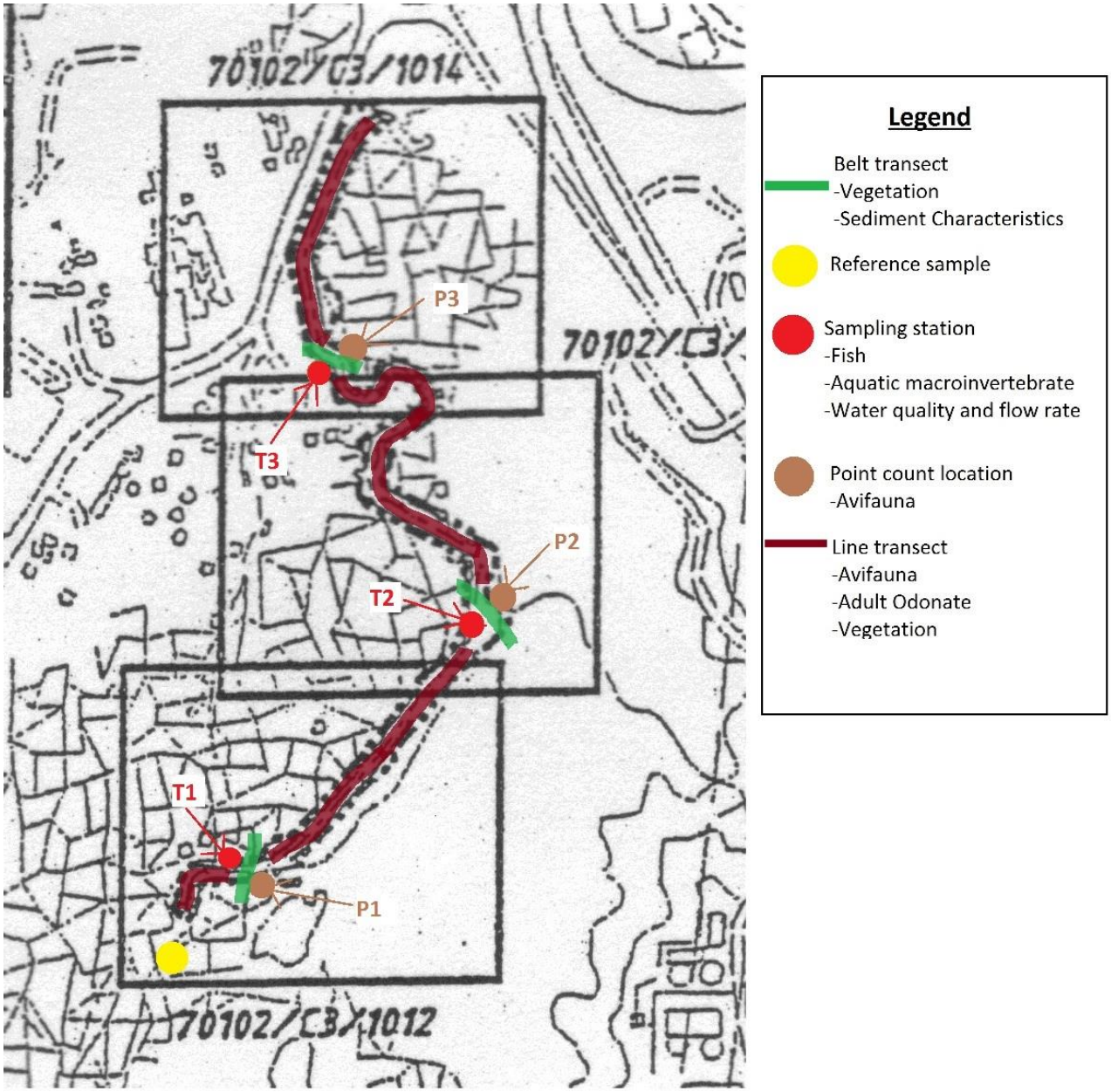

Figure 1. Sampling Location of Ecological Survey and Monitoring at She Shan River, Tai Po.

TABLE

Table 4.1. Flora species recorded along the She Shan River including riparian habitat.

			Post construction monitoring											
Family	Species name	Species name in Chinese	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
Riparian Plant														
Acanthaceae	*Dicliptera chinensis*	狗肝菜				+	+	+	+	+	+	+	+	+
Acoraceae	*Acorus gramineus*	金錢蒲				+	+	+	+	+	+	+	+	+
Amaranthaceae	Altremanthera philoxeroides	空心蓮子草	+	+	+	+	+	+	+	+	+	+	+	+
Amaranthaceae	*Celosia argentea L.*	青葙	+	+	+	+	+	+	+	+	+	+	+	+
Apiaceae	*Oenanthe javanica*	水芹				+	+	+	+	+	+	+		
Aquifoliaceae	*Ilex rotunda*	鐵冬青												
Araceae	*Alocasia odora*	海芋	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Colocasia esculenta*	芋	+	+	+	+	+	+	+	+	+	+	+	+
Araceae	*Syngonium podophyllum*	合果芋							+	+	+	+	+	+
Araceae	*Pistia stratiotes*	大漂												
Asteraceae	*Bidens alba*	白花鬼針草	+	+	+	+	++	++	++	++	++	++	++	++
Asteraceae	*Synedrella nodiflora*	金腰箭		+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Mikania micrantha*	薇甘菊	+	+	+	+	++	++	++	++	++	++	++	++
Asteraceae	*Erigeron karvinskianus*	加勒比飛蓬	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Eclipta prostrata*	鱧腸	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Gynura divaricata*	白子菜		+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Ageratum conyzoides*	勝紅薊	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*Emilia sonchifolia*	一點紅	+	+	+	+	+	+	+	+	+	+	+	+
Asteraceae	*E rechsites hieraciifolius*	梁子菜				+	+	+	+	+	+	+	+	+
Asteraceae	*Y oungia japonica*	黃鵝菜				+	+	+	+	+	+	+	+	+
Asteraceae	*S pilanthes paniculata*	金鈕扣				+	+	+	+	+	+	+	+	+
Athyriaceae	*Callipteris esculenta*	菜蕨	+	+	+	++	++	+	+	+	+	+	+	+
Begoniaceae	*Begonia cucullata var.hookeri*	四季秋海棠				+	+	+	+	+	+	+	+	+
Blechnaceae	*Blechnum orientale*	烏毛蕨	+	+	+	+	+	+	+	+	+	+	+	+
Brassicaceae	*Nasturtium officinale*	西洋菜	+++	+++	+++	+	+	+	+	+	+	+	+	+
Brassicaceae	*R oripa indica*	蔊菜菜				+	+	+	+	+	+	+	+	+
Brassicaceae	*C apsella bursa-pastoris*	荠菜				+	+	+	+	+	+	+	+	+
Caesalpiniaceae	*Bauhinia championii*	缺葉藤												
Caryophyllaceae	*Drymaria diandra*	荷蓮豆		+	+	+	+	+	+	+	+	+		
Caryophyllaceae	*Myosoton aquaticum*	鵝腸菜	+	+	+	+	+	+	+	+	+	+	+	+
Chenopodiaceae	*Chenopodium ficifolium*	小藜				+	+	+	+	+	+	+	+	+
Commelinaceae	*Commelina diffusa*	節節草	+++	+++	+++	+++	++	++	++	++	+++	+++	+++	+++
Convolvulaceae	*Pharbitis nil*	牽牛	+	+	+	+	+	+	+	+	+	+	+	+
Convolvulaceae	*Ipomoea cairica*	五爪金龍	+	+	+	+	+	+	+	+	+	+	+	+
Cucurbitaceae	*Solena amplexicaulis*	羅弓												
Cuscutaceae	*Cuscuta australis*	南方菟絲子												
Cyperaceae	*Cyperus sp.*	莎草	+	+	+	+	+	+	+	+	+	+	+	+
Cyperaceae	*Cyperus involucratus*	風車草			+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Macaranga tanarius*	血桐			+	+	+	+	+	+	+	+	+	+
Euphorbiaceae	*Aporusa dioica*	銀柴												
Fabaceae	*Puarria lobata*	野葛	+	+	+	+	++	++	++	++	++	++	++	++
Fabaceae	*Sesbania cannabina*	田菁	+	+	+				+	+	+	+	+	+
Lauraceae	*Cinnamomum burmannii*	陰香		+	+				+	+	+	+	+	+
Lygodiaceae	*Lygodium japonicum*	海金沙				+	+	+	+	+	+	+	+	+
Magnoliaceae	*Michelia alba*	白蘭		+	+		+	+	+	+	+	+	+	+
Malvaceae	*Hibiscus rosa-sinensis*	大紅花												
Mimosaceae	*Mimosa pudica*	含羞草	+	+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*Leucaena leucocephala*	銀合歡	+	+	+	+	+	+	+	+	+	+	+	+
Mimosaceae	*C alliandra haematocephala*	紅絨球				+	+	+	+	+	+	+	+	+
Moraceae	*Broussonetia papyrifera*	構樹		+	+									
Moraceae	*Ficus hispida*	對葉榕	+	+	+	+	+	+	+	+	+	+	+	+
Moraceae	*Ficus pumila*	薜荔							+	+	+	+	+	+
Moraceae	*Ficus variolosa*	變葉榕												
Moraceae	*Ficus variegata*	青果榕												
Musaceae	*Musa paradisiaca*	大蕉		+	+	+	+	+	+	+	+	+	+	+
Myrsinaceae	*Maesa perlarius*	鯽魚胆												
Myrtaceae	*Clerstocalyx operculatus*	水翁		+	+	+	+	+	+	+	+	+	+	+
Onagraceae	*Ludwigia hyssopidolia*	草龍	+	+	+	+	+	+	+	+	+	+	+	+
Onagraceae	*Ludwigia erecta*	美洲水丁香	+	+	+	+	+	+	++	+++	+++	++	++	++
Oxalidaceae	*Averrhoa carambola*	楊桃												
Oxalidaceae	*Oxalis corniculata*	酢醬草	+	+	+	+	+	+	+	+	+	+		
Plantaginaceae	*Plantago major*	車前草								+	+	+	+	+
Poaceae	*Panicum maximum*	大黍	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Panicum repens*	枯骨草	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Brachiaria mutica*	巴拉草	++	++	++	++	++	+++	+++	+++	+++	+++	+++	+++
Poaceae	*Pennisetum purpureum*	象草	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Coix lacryma-jobi*	薏苡	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Microstegium ciliatum*	刚秀竹	+	+	+	+	+	+	++	++	++	++	++	++
Poaceae	*Miscanthus floridulus*	五節芒	+	+	+	+	+	+	+	+	+	+	+	+
Poaceae	*Pennisetum alopecuroides*	狼尾草				+	+	+	+	+	+	+	+	+
Poaceae	*Digitaria radicosa*	紅尾馬												
Polygonaceae	*Polygonum hydropiper*	水蓼	+	+	+	+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum glabrum*	光蓼												
Polygonaceae	*Polygonum chinense*	火炭母	+	+	+	+	+	+	+	+	+	+	+	+
Polygonaceae	*Rumex trisetifer*	假蒟菜				+	+	+	+	+	+	+	+	+
Polygonaceae	*Polygonum lapathifolium*	大馬蓼				+	+	+	+	+	+	+	+	+
Rubiaceae	*Hedyotis hedyotidea*	牛白藤												
Sapindaceae	*Dimocarpus longan*	龍眼												
Solanaceae	*Solanum torvum*	水茄		+	+	+	+	+	+	+	+	+	+	+
Solanaceae	*Solanum americanum*	少花龍葵				+	+	+	+	+	+	+	+	+
Thelypteridaceae	*Cyclosorus parasiticus*	華南毛蕨												
Ulmaceae	*Celtis sinensis*	朴樹		+	+	+	+	+	+	+	+	+	+	+
Ulmaceae	*Celtis timoremsis*	棒葉朴												
Ulmaceae	*Trema orientalis*	黃色山黃麻					+	+	+	+	+	+	+	+
Ulmaceae	*Trema tomentosa*	山黃麻	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	*Boehmeria nivea*	苧麻	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	*Pilea microphylla*	透明草	+	+	+	+	+	+	+	+	+	+	+	+
Urticaceae	*Pouzolzia zeylanica*	露水葛	+	+	+	+	+	+	+	+	+	+	+	+
Verbenaceae	*Vitex quinata*	山牡荊												
Polygonaceae	*Polygonum perfoliatum*	紅板歸				+	+	+	+	+	+	+	+	+
Verbenaceae	*Lantana camara*	馬櫻丹	+	+	+	+	+	+	+	+	+	+	+	+
Floating Plant														
Lemnaceae	*Lemna minor*	浮萍	+	+	+	+	+	+	+	+	+	+	+	+
Submerged Plant														
Hydrocharitaceae	*Hydrilla verticillata*	黑藻			+	+	+	+	+	+	+	+	+	+
No. of Species			41	51	54	67	69	69	73	74	74	74	74	74

Note:

"+" – Species exists in the study area

"++" – Species common in the study area

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

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)

			Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
		Stream	Jan-14						Feb-14						Mar-14						Apr-14						May-14						Jun-14					
		Transect	T1		T2		T3		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(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)	%
Commelinaceae	*Commelina diffusa*	節節草	0.2	15	0.5	30	0.2	1	0.2	20	0.5	30	0.2	5	0.3	20	0.5	35	0.3	6			0.5	30					0.5	20					0.5	25		
Poaceae	*Panicum repens*	枯骨草					0.2	1					0.2	1					0.4	1																		
Asteraceae	*Mikania micrantha*	薇甘菊	0.1	10			0.2	1	0.1	10			0.2	1	0.1	10			0.2	1	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	1	0.3	10	0.3	10	0.3	1
Brassicaceae	*Nasturtium officinale*	西洋菜																			0.3	20			0.3	5	0.3	5			0.3	5	0.3	5			0.3	5
Moraceae	*Ficus microcarpa*	細葉榕																																				
Moraceae	*Ficus hispida*	對葉榕																																				
Poaceae	*Microstegium ciliatum*	蜘秀竹																																				
Fabaceae	*Pueraria lobata*	野葛																																				
Araceae	*Colocasia esculenta*	芋																																				
Urticaceae	*Boehmeria nivea*	苧麻																																				
Asteraceae	*Bidens alba*	白花鬼針草					0.3	1					0.4	1					0.4	1			0.3	5	0.8	1			0.3	5	0.8	1			0.3	5	0.8	1
Poaceae	*Pennisetum purpureum*	象草	1.5	10	1.5	10			1.5	10	1.5	10			1.5	5	1.5	5																				
Poaceae	*Coix lacryma-jobi*	薏苡																							0.8	1					0.8	1					0.8	1
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草																																				
Poaceae	*Panicum maximum*	大黍																																				
Moraceae	*Broussonetia papyrifera*	構樹																																				
Polygonaceae	*Polygonum chinense*	火炭母																																				
Onagraceae	*Ludwigia hyssopidolia*	草龍					0.3	2					0.4	1					0.4	1																		
Cyperaceae	*Cyperus sp.*	莎草																																				
Poaceae	*Miscanthus floridulus*	五節芒																																				
Poaceae	*Brachiaria mutica*	巴拉草	1.5	60	0.8	20			1.5	55	0.8	25			1.5	60	0.8	30			1.5	50	1	50			1.5	40	1	40			1.5	45	1	45		
Blechnaceae	*Blechnum orientale*	烏毛蕨																																				
Poaceae	*Pennisetum alopecuroides*	狼尾草																			2	20					2	15					2	15				
Araceae	*Alocasia macrorrhizos*	海芋																							0.8	1					0.8	1					0.8	1
Lemnaceae	*L emna minor*	浮萍																							N.A	5					N.A	5					N.A	5
Polygonaceae	*Polygonum hydropiper*	水蓼																																				
Cyperaceae	*Cyperus involucratus*	風車草																																				
Onagraceae	*Ludwigia erecta*	美洲水丁香			0.8	30					0.8	30					0.8	25							1	2					1	2					1	2
Convolvulaceae	*Ipomoea cairica*	五爪金龍																																				
Bare Gound				5		10		94		5		5		91		5		5		90		0		5		84		30		25		84		25		15		84

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

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

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

			Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring						Post construction monitoring					
		Stream	Jul-14						Aug-14						Sep-14						Oct-14						Nov-14						Dec-14					
		Transect	T1		T2		T3		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(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)	%
Commelinaceae	*Commelina diffusa*	節節草			0.5	25					0.5	25					0.5	25			1	10	1	50	0.1	2	1	10	1	50	0.1	2	1	10	1	50	0.1	2
Poaceae	*Panicum repens*	枯骨草																																				
Asteraceae	*Mikania micrantha*	薇甘菊	0.3	10	0.3	10	0.3	2	0.3	12	0.3	12	0.3	5	0.3	12	0.3	12	0.3	5	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2	0.3	5	1	15	0.3	2
Brassicaceae	*Nasturtium officinale*	西洋菜	0.3	2			0.3	2	0.3	1			0.3	1	0.3	1			0.3	1																		
Moraceae	*Ficus microcarpa*	細葉榕																																				
Moraceae	*Ficus hispida*	對葉榕																																				
Poaceae	*Microstegium ciliatum*	蒯秀竹																																				
Fabaceae	*Pueraria lobata*	野葛																																				
Araceae	*Colocasia esculenta*	芋																																				
Urticaceae	*Boehmeria nivea*	苧麻																																				
Asteraceae	*Bidens alba*	白花鬼針草			0.3	5	0.8	2			0.3	5	0.8	5			0.5	5	0.8	5	1	2	0.5	5	0.8	10	1	2	0.5	5	0.8	10	1	2	0.5	5	0.8	10
Poaceae	*Pennisetum purpureum*	象草																																				
Poaceae	*Coix lacryma-jobi*	薏苡					0.8	1					1.2	1					1.5	1					1..5	1					1..5	1					1..5	1
Amaranthaceae	*Alternanthera philoxeroides*	空心蓮子草																																				
Poaceae	*Panicum maximum*	大黍																																				
Moraceae	*Broussonetia papyrifera*	構樹																																				
Polygonaceae	*Polygonum chinense*	火炭母																																				
Onagraceae	*Ludwigia hyssopidolia*	草龍																																				
Cyperaceae	*Cyperus sp.*	莎草																																				
Poaceae	*Miscanthus floridulus*	五節芒																																				
Poaceae	*Brachiaria mutica*	巴拉草	1.5	45	1	45			1.5	50	1	50			1.5	50	1	50			1.8	65	1.8	20	1.5	5	1.8	70	1.8	25	1.5	8	1.8	70	1.8	25	1.5	8
Blechnaceae	*Blechnum orientale*	烏毛蕨																																				
Poaceae	*Pennisetum alopecuroides*	狼尾草	2	12					2	10					2	10					2	15	3	5			2	10	3	2			2	10	3	2		
Araceae	*Alocasia macrorrhizos*	海芋					0.8	1					0.8	1					0.8	1																		
Lemnaceae	*L emna minor*	浮萍					N.A	1					N.A	1					N.A	1																		
Polygonaceae	*Polygonum hydropiper*	水蓼																					1	3					1	1					1	1		
Cyperaceae	*Cyperus involucratus*	風車草																					1.7	2					1.7	1					1.7	1		
Onagraceae	*Ludwigia erecta*	美洲水丁香					1	4					1	6					1	6	1.5	1			2	5	1.5	1			2	5	1.5	1			2	5
Convolvulaceae	*Ipomoea cairica*	五爪金龍																																				
Bare Gound				31		15		87		27		8		80		27		8		80		2		0		75		2		1		72		2		1		72

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

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

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

Common Name	Species name	Chinese name	Status	Commonness	Post construction monitoring																																							
					Jan-14				Feb-14				Mar-14				Apr-14				May-14				Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14			
					Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance				Abundance			
					C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3	C	T1	T2	T3
Barn Swallow	*Hirundo rustica*	家燕	PM	C	+				+		2		+	2	2	1	++	1	3	4	++	3	4	4	+	2		1																				
Black Drongo	*Dicrurus macrocercus*	黑卷尾	Sv	C																																												
Black Kite	*Milvus lineatus*	麻鷹	R, RC, Cap.586	C					+				+																								+								+				+			
Black-necked Starling	*Sturnus nigricollis*	黑領椋鳥	R	C	+				+				+		2		+			2	+		1	2	+	2		1	+	2	1	2	+	2		2	+	1	2	2	+	2		1	+		2		+	2		
Black-throated Laughingthrush	*Garrulax chinensis*	黑喉噪鹛	R	C																																												
Buzzard (Common Buzzard)	*Buteo buteo*	普通鵟	WV, Cap	U									+																																			
Chinese Bulbul	*Pycnonotus sinensis*	白頭鵯	R	C	+	1		2	+	2	3	4	++		2	3	+			2	+				+				+			1	+			2	+	2		3	+			2	+	1		3	+		2	2
Chinese Pond Heron	*Ardeola bacchus*	池鷺	R,RC	C	+	1	3	2	+	1	2	3	+	1	3	2	+	1	2	1	+	1	1		+	1	2		+	2	2	1	++	1	2	2	++	2	1	1	++	2	2		++	1			+		1	
Common Emerald Dove	*Chalcophaps indica*	綠翅金鳩	R,VU	S																																											
Common Kingfisher	*Alcedo atthis*	普通翠鳥	R	C	+				+				+				+				+				+												+				+				+			
Common Koel	*Eudynamys scolopacea*	噪鵑	R	C	+				+				+				+				+				+								+								+							
Common Sandpiper	*Actitis hypoleucos*	磯鷸	WV& PM	C	+				+				+				+				+				+																							
Common Tailorbird	*Orthotomus sutorius*	長尾縫葉鶯	R	C	+	1	1	1	+	1		1	+	1	2	1	+	1	1		+	1	2	1	+		1		+	1	1	1	+	1	1		+	1	2	1	+		1	1	+		1		++	1	1	
Crested bulbul	*Pycnonotus jocosus*	紅耳鵯	R	C	++	2	4	6	++	2	2	8	++	3	4	6	++	2	2	5	++	2		4	++	3	2	3	++	2	4	5	++	3	2	4	++	2	4	3	++	3	1	4	++	2	1	3	+++	2	3	2
Crested Goshawk	*Accipiter trivirgatus*	鳳頭鷹	R, CR, Cap.586	R																																											
Crested Myna	*Acridotheres cristatellus*	八哥	R	C	+		3	2	+			3	+		2		+				+				+			2	+		3	2	+	2	2	3	+		3	2	+		2	4	+	3	2		+	1		
Crested Serpent Eagle	*Spilornis cheela*	蛇鵰	R, VU	R									+																																			
Domestic pigeon	*Columba sp.*	鴿	R	C																																										++			
Dusky Warbler	*Phylloscopus fuscatus*	褐柳鶯	WV	U	+		1	1	+		2	1	+	1	1		+		1		+				+				+				+		1		+	1	1		+	1		1	++			
Eurasian tree sparrow	*Passer montanus*	麻鷓	R	C	+				+				+		2		+				+	2			+		2	1	+	2		1	+		3	2	+	3	2		+	2		3	+			2	+++		5	3
Fork-tailed Sunbird	*Aethopyga christinae*	叉尾太陽鳥	R	C																																											
Great Coucal	*Centropus sinensis*	褐翅鴉鵑	R,VU	C	+				+				+				+				+				+				+				+		1		+	1			+				+			
Great Egret	*Ardea alba*	大白鷺	R,RC	U	+			1	+			1	+			1	+																														
Great Tit	*Parus major(commixtus)*	大山雀	R	C	+				+				+				+																														
Green Sandpiper	*Tringa ochropus*	白腰草鷸	PM& WV	U	+		2		+				+				+				+				+																						
Grey Heron	*Ardea cinerea*	蒼鷺	WV,PRC	C																																											
Grey Wagtail	*Motacilla cinerea*	灰鶺鴒	WV	C	++	2	3	3	++		2	2	++	1	3	2	+		1	1	+								+				+		1	1	+	1	2	1	+		1	1	+				+		1	
Japanese White Eye	*Zosterops japonica(simplex)*	暗綠繡眼鳥	R	C	++			5	++			3	++			6	+	3		4	+			6	++	4	2	3	++			4	++	2	2	5	+			3	+				+				+			3
Large Hawk Cuckoo	*Cuculus sparverioides*	鷹鵑	SV	U																	+																										+			
Little Egret	*Egretta garzetta*	小白鷺	R,RC	C	+		2	3	+	1	2	2	+	1	1	2	+		1	1	+	1	2	1	+		2	2	+	1	2	1	+	1	2	2	+	2	3	2	+	1	2	1	+	1	2	2	+	2	1	1
Magpie Robin	*Copsychus saularis*	鵲鴝	R	C	+		1	1	+		2		+	1	2	1	+	1	1	2	+	1	1	1	+	1	2	2	+	1	1	1	+	1	1	2	+	1		1	+	1	1	1	+		1	
Night Heron	*Nycticorax nycticorax*	夜鷺	R,LC	U																																											
Olive Backed Pipit	*Anthus hodgsoni*	樹鷚	WV	C	+		1		+				+																																		
Oriental Dollarbird	*Eurystomus orientalis*	三寶鳥	PM	U																																										
Plaintive Cuckoo	*Cacomantis merulinus*	八聲杜鵑	SV	C									+				+				+				+																						
Rufous-backed Shrike	*Lanius schach*	棕背伯勞	R	C	+				+				+				+				+				+				+					1		+			1		+	1			+			
Rufous-capped Babbler	*Stachyridopsis ruficeps*	紅頭穗鹛	R	C	+				+				+				+				+												+				+				+				+			
Scarlet Minivet	*Pericrocotus speciosus*	赤紅山椒鳥	R	C																																											
Sooty-headed Bulbul	*Pycnonotus aurigaster*	白喉紅臀鵯	R	C																																											
Spotted Dove	*Streptopelia chinensis*	珠頸斑鳩	R	C	++	3	2	4	++	2	6	5	++	3	4	4	++	2	3	4	++	3	4	3	++	2	3	1	++	3	4	4	++	2	3	3	++	3	3	5	++	4	2	3	++	3	3	4	+	1	2	2
Spotted Munia	*Lonchura punctulata*	斑文鳥	R	U	++				++		7		++		4		++		6		++		8						+		2		+		3		+		6		+		7		+	6	5		+	5		
White Wagtail	*Motacilla alba*	白鶺鴒	WV	C	+		2	1	+		1	2	+	1	2	1	+		1	1	+		2	1	+		1		+	1	2	2	+	2	2	1	+	1	2	2	++	1	2	2						
White-breasted Waterhen	*Amaurornis phoenicurus*	白胸苦惡鳥	R	C	+				+				+				+				+				+				+				+				+				+							
Yellow Bellid Prinia	*Prinia flaviventris*	黃腹鵐鶯	R	C	+	1	1		+	1	3	2	+	1	2	1	+	1		1	+	1	1	1	+		1	1	+	1	1	1	+	1	1		+	1	2	1	+	1	1	1	+		1	1				
Number of birds						11	26	32		10	34	37		16	38	31		12	22	28		15	26	24		15	18	17		16	24	26		18	28	28		23	35	28		19	24	23		21	20	20		15	19	15
No. of species					32	11	16	17	33	11	18	18	34	13	19	17	32	9	11	12	27	9	10	10	23	8	11	10	20	12	14	14	20	13	17	15	23	17	17	15	23	17	17	15	23	19	17	16	21	9	11	7

Note: R – Resident; WV – Winter visitor; PM – Passage migrant; C – Common; U – Uncommon

SpM – Spring migrant; Sv - Summer visitorC – transect count; P1 – Point count location 1; P3 – Point count location 3

+, occurred; ++, common; +++, abundant/dominant species in the the study area

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

All bird species are under protection of Wild Animals Protection Ordinance (Cap. 170)

Endangered Species of Animals and Plants Ordinance (Cap. 586)

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

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

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

CR: Rare in China Red Data Book Status

VU: Vulnerable in China Red Data Book Status

Table 4.4. Odonate species recorded at the She Shan River

					Post construction monitoring											
Species	Common name	Chinese name	Status	Commo--nness	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14
Agriocnemis pygmnalis	Wandering Midget	黃尾小蟌	NP	VC				+								
Brachythemis contaminata	Asian Amberwing	黃翅蜻	NP	VC												
Ceriagrion auranticum ryukyuanum	Orange-tailed Sprite	琉球橘黃蟌	NP	VC				+	++	+		+				
Copera ciliata	Black-knees Featherlegs	白狹扇蟌	NP	VC				+								
Copera marginipes	Yellow Featherlegs	黃狹扇蟌	NP	VC				+		+		+	+	+		
Crocothemis servilia servilia	Crimson Darter	红蜻	NP	VC	+				+	+	+	+	+	+	+	+
Diplacodes trivialis	Blue Percher	紋藍小蜻	NP	VC	+	+	+									
Ictinogomphus pertinax	Common Flangetail	霸王葉春蜓	NP	C	+	+	+			+	+	+	+	+		
Ischnura senegalensis	Common Bluetail	褐斑異痣蟌	NP	VC				+	+	+						
Nannophya pygmaea	Scarlet Dwarf	侏紅小蜻	NP	C												
Neurobasis chinensis chinensis	Chinese Greenwing	華艷色蟌	NP	VC			+							+	+	
Neurothemis fulvia	Russet Percher	網脈蜻	NP	VC						+	+					
Orthetrum chrysis	Red-faced Skimmer	華麗灰蜻	NP	VC												
Orthetrum glaucum	Common blue skimmer	黑尾灰蜻	NP	VC					+							
Orthetrum luzonicum	Marsh Skimmer	呂宋灰蜻	NP	VC					+	+						
Orthetrum pruinosum neglectum	Common Red Skimmer	赤褐灰蜻	NP	VC					++	++	+	+	+	+		
Orthetrum Sabina sabina	Green Skimmer	狹腹灰蜻	NP	C					+				+	+		
Pantala flavescens	Wandering Glider	黃蜻	NP	VC	+									+	+	
Prodasineura autumnalis	Black Threadtail	烏齒原蟌	NP	VC				+	+							
Pseudagrion pruinosum fraseri	Ferruginous-faced Sprit	赤斑蟌	NP	C												
Pseudagrion rubriceps rubriceps	Orange-faced Sprite	丹頂斑蟌	NP	UC				+	+	+	+	+	+	+	+	
Rhinocypha perforata perforata	Common Blue Jewel	三斑鼻蟌	NP	VC								+	+	+	+	
Rhyothemis variegata arria	Variegated Flutterer	斑麗翅蜻	NP	C						+	+	+				
Trithemis aurora	Crimson Dropwing	曉褐蜻	NP	VC						+	+	+	+	+	+	+
Trithemis festiva	Indigo Dropwing	慶褐蜻	NP	VC			+			+	+	+	+	+	+	
Zygonyx iris insignis	Emerald Cascader	彩虹蜻	P,PG C	VC						+	+	+				
No of Species					6	6	8	7	9	13	9	11	9	11	7	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 accroding 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 Rive

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

				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
Species	Chinese name	Sampling location		Jan-14				Feb-14				Mar-14				Apr-14				May-14			
		Status	Common-ness	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Mollusks																							
Anodonta woodiana	背角無齒蚌	NP	VC																			+	
Biomphalaria sp.	--	NP	VC					+				+	+	+		+	+	+		+	+	+	
Brotia hainanensis	--	NP	VC	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Corbicula fluminea	河蜆	NP	VC	+				+				+						+				+	
Melanoides tuberculata	瘤擬黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pomacea canaliculata	蘋果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	田螺	NP	VC	+	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	+	+	+	+
Insects																							
Baetis sp.		NP	VC	+				+	+			+	+	+		+		+		+		+	
Caenis sp.	--	NP	VC													+							
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Euphaea sp.		NP	VC																				
Indobaetis sp.	--	NP	VC	+				+	+	+		+	+	+	+	+	+	+	+	+	+	+	+
Odonate larvae		NP	VC																				
Orthetrum spp.	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudagrion spp.	--	NP	UC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudocloeon sp.	--	NP	VC									+				+	+						
Serratella sp.		NP	VC					+				+	+	+		+	+	+			+		
Crustaceans																							
Caridina cantanensis	廣東米蝦	NP	VC																				
No of Species				11	8	8	7	13	10	9	8	14	12	12	9	14	12	13	9	11	11	13	8

Note: NP – Not protected in HKP - 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

Table 4.5 Aquatic Macro invertebrates recorded at She Shan Rive

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

				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
Species	Chinese name	Sampling location		Jun-14				Jul-14				Aug-14				Sep-14				Oct-14				Nov-14				Dec-14			
		Status	Common-ness	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Mollusks																															
Anodonta woodiana	背角無齒蚌	NP	VC																												
Biomphalaria sp.	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+				+		
Brotia hainanensis	--	NP	VC	+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+		+	+	+	
Corbicula fluminea	河蜆	NP	VC			+				+	+			+	+			+	+			+				+				+	
Melanoides tuberculata	瘤擬黑螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pomacea canaliculata	蘋果螺	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Radix plicatulus	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sinotaia quadrata	田螺	NP	VC	+	+	+	+	+	+	+	+	+	+	++	+	+	+	++	+	+	+	++	+	+	+	+	+	+	+	+	+
Insects																															
Baetis sp.		NP	VC		+				+	+			+	+		+	+	+		+	+	+		+	+	+				+	
Caenis sp.	--	NP	VC																												
Chironomus sp.	蠓幼虫	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Euphaea sp.		NP	VC			+				+				+				+								+				+	
Indobaetis sp.	--	NP	VC	+	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+	+		+	+	+		+		+	
Odonate larvae		NP	VC																												
Orthetrum spp.	--	NP	VC	+	+	+	+	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pseudagrion spp.	--	NP	UC	+	+	+	+	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+		+	
Pseudocloeon sp.	--	NP	VC											+		+	+	+		+	+	+		+		+		+		+	
Serratella sp.		NP	VC		+	+				+			+	+																	
Crustaceans																															
Caridina cantanensis	廣東米蝦	NP	VC																												
No of Species				10	12	13	8	10	11	14	7	10	12	15	6	12	12	14	8	12	12	13	7	12	11	13	7	10	8	13	6

Note: NP – Not protected in HK 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

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)

				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring				Post construction monitoring			
				Jan-14				Feb-14				Mar-14				Apr-14				May-14			
Species		Status	Commonness	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3	Reference	T1	T2	T3
Channa maculata	斑鱧	NP	C					+				+	+	+		+	+	+		+	+	+	
Clarias gariepinus	革胡子鯰	NP	VC					+				+				+						+	
Gambusia affinis	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Misgurnus anguillicaudatus	泥鰍	NP	C	+				+				+	+	+		+	+	+		+	+	+	
Oreochromis niloticus	尼羅口孵非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Parazacco spilurus	異鱲	NP, V	C	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poecilia reticulata	孔雀花魚將	NP	VC					+				+	+	+	+	+	+	+	+	+	+	+	+
Pterocryptis cochinchinensis	越南隱鰭鯰	NP	C					+				+				+		+				+	
Puntius semifasciolatus	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhinogobius spp.	鰕虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus hellerii	劍尾魚	NP	C	+	+	++	++	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus variatus	雜色劍尾魚	NP	C		+				+				+	+			+	+	+			+	+
Zacco platypus	寬鰭鱲	NP	C	+	+	++	+	+	+	++	++	+	+	++	++	+	+	++	++	+	+	+	+
		2x2m fish number		12	16	30	40	30	40	50	60	60	60	70	70	40	40	50	40	20	10	20	10
No of Species				8	8	7	7	12	8	7	7	12	11	11	8	12	11	12	9	10	10	13	9
Amphibian																							
Paramesotriton hongkongensis	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 Animials Protcetion Ordinance (Cap.170)

"NT" - Near Treatened in IUCN Red List Status

"PGC"-Potential Golal Concern by Fellowes *et al* (2002)

'V" - Vulerable - 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)

				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			
Species		Status	Commonness	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
Channa maculata	斑鱧	NP	C	+	+			+	+			+	+	+		+	+	+			+	+			+	+					
Clarias gariepinus	革胡子鯰	NP	VC			+				+	+			+	+			+	+			+	+							+	
Gambusia affinis	食蚊魚	NP	VC	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+
Misgurnus anguillicaudatus	泥鰍	NP	C	+		+	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				+	
Oreochromis niloticus	尼羅口孵非鯽	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Parazacco spilurus	異鱲	NP, V	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Poecilia reticulata	孔雀花魚將	NP	VC	+			+				+				+				+				+				+				+
Pterocryptis cochinchinensis	越南隱鰭鯰	NP	C			+				+				+				+				+				+				+	
Puntius semifasciolatus	七星魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Rhinogobius spp.	鰕虎魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Xiphophorus hellerii	劍尾魚	NP	C	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
Xiphophorus variatus	雜色劍尾魚	NP	C			+				+				+				+						+						+	
Zacco platypus	寬鰭鱲	NP	C	+	+	+	+	+	+	+	+	+	+	++	+	+	++	++	+	+	++	++	+	+	++	++	+	+	++	++	+
		2x2m fish number		12	5	8	6	16	8	10	10	12	10	16	12	20	20	30	16	40	30	40	30	50	50	60	50	60	50	50	40
No of Species				10	9	11	9	9	8	11	10	9	9	12	10	9	9	12	10	8	9	11	10	8	9	12	8	7	6	11	9
Amphibian																															
Paramesotriton hongkongensis	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

"Cap 170" - List in Wild Animials Protcetion Ordinance (Cap.170)

"NT" - Near Treatened in IUCN Red List Status

"PGC"-Potential Golal Concern by Fellowes *et al* (2002)

'V" - Vulerable - 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)

	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
Stream	Jan-14			Feb-14			Mar-14			Apr-14			May-14			Jun-14		
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	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	7.6	7.8	7.4
pH	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	7.5	7.5	7.4
Nitrate (mg N/L)	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	0.5	0.6	0.6
Ammonia (mg N/L)	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	< 0.1	< 0.1	< 0.1
Salinity (ppt)	0	0	0	0	0	0	0	0	0	0	0	0	0.04	0.04	0.06	0.04	0.05	0.05
Conductivity (µS/cm)	124	118	132	128	113	132	123	136	140	112	116	120	124	121	123	118	115	119
BOD (mg/L)	<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	0.1	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	0.1-0.2	0.1-0.2	0.1-0.2
Water flow at riffle (m/s)	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	0.2-0.5	0.2-0.5	0.2-0.5
Sand (%)	15	10	5	15	10	5	15	10	5	10	10	5	5	5	5	5	5	5
Stone (%)	65	80	20	65	80	20	65	80	20	70	80	30	80	80	30	80	80	30
Mud (%)	10	10	5	10	10	5	10	10	5	10	10	5	5	5	2	5	5	2
Concrete (%)	10	0	70	10	0	70	10	0	70	10	0	60	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)

	Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring			Post construction monitoring		
Stream	Jul-14			Aug-14			Sep-14			Oct-14			Nov-14			Dec-14		
Replicate	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
DO (mg/L)	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
pH	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
Nitrate (mg N/L)	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
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
Salinity (ppt)	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
Conductivity (µS/cm)	110	113	111	120	116	108	125	125	123	113	114	116	110	96	106	127	132	121
BOD (mg/L)	<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
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
Sand (%)	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
Mud (%)	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