



Agreement No. MN 02/2013

Study and Site Trial on Biodiversity Improvement

of Drainage Channels through Rehabilitation of Habitats

for Water-Related Organisms

Executive Summary



EXECUTIVE SUMMARY

- 1. Background on the Study and Site Trial** - construction of drainage channels would inevitably result in biodiversity loss. China is a contracting party to the “Convention on Biological Diversity” and the Convention was extended to Hong Kong on 9 May 2011. Drainage Services Department (DSD) manages large number of drainage channels and vast fresh water regimes and is obliged to take the initiative to conserve biodiversity. Presence of water-related organisms such as fireflies are good indicator of the high standard water quality. This couples with the increase of public awareness on the importance of ecological conservation and biodiversity. Therefore, there is a need to conduct site trial to restore the ecosystem in the drainage channels and to revitalize the drainage channels through rehabilitation of habitats for water-related organisms including focus insects like fireflies. Field Touch was commissioned by DSD in 2013 to undertake this Study and Site Trial.

- 2. The study site and programme** – after some land search and preliminary investigation, three trial sites were selected for the biodiversity improvement works: Kam Tin River - KN2 (KaTR), Ping Yuen River (PYR) and Kwan Tei River (KwTR), shown in Figure 1 to Figure 3.

- 3. Programme** - Pre-construction ecological survey was conducted from April 2014 to March 2015 covering both wet and dry seasons. After 13 months of river improvement works from April 2015 to April 2016, post-construction ecological survey was conducted from May 2016 to April 2017.

- 4. Restoration of river ecological system** - the river ecological system was rehabilitated and restored by trying different measures, through creating varying river flows, different riparian zones and river bed environments, and clutches of native vegetation.

- 5. Results of Ecological Restoration**
 - a. Kwan Tei River**
 - i.** The river bank and bed of Kwan Tei River are constructed of rock gabions with little vegetation. Before restoration, slow water flow and direct sunlight heated up water body and raised the temperature to over 35°C.

High water temperature prohibited the aquatic organisms to live here.

- ii. Under the study, 3 eco-ponds were constructed to maintain sufficient water depth all year round. The eco-ponds were overlain with mud and large rocks. Mud offers an area for firefly to pupate while the rocks provide hiding space. A screen was put at the upstream area to prevent large fish entering the trial site and eating up all plants and aquatic organisms.
- iii. Local aquatic plants were planted on site under the study. Emergent plants such as common reed grass can filter water and absorb pollutants. Floating plants such as four-leaf fern can enhance the level of dissolved oxygen in the water. The root of plants can also create a complex environment for organisms to hide.
- iii. 35 larvae of *Luciola terminalis* were released on site in April 2016. 11 larvae have transformed into adults in May. The population of fireflies increases from 2-5 individual before restoration to over 30 in October 2016.
- iv. A variety of species which were not recorded before the construction work were found on site. These species include dragonflies, damselflies, fireflies, mayflies, etc. They are very sensitive to water pollution. Firefly being one of the highly sensitive amphibians, the increase in firefly population and the presence of these pollution-sensitive species indicate improvement in the water quality at this Kwan Tei River site.

b. Kam Tin River

- i. There is wastewater discharge at the upstream area. The river is heavily polluted and white foam is found occasionally. Blood worm and slugs are the only species found in the river.
- ii. A 1-meter wide water channel was constructed under the study alongside with the main channel, which was transformed into an artificial surface flow wetland. Organic matters and pollutants can be settled and broken down by microorganisms. The plants can slow down water flow and enhance the biotic process by providing large surface area.
- iii. The ecological survey recorded several species of damselflies adult and larvae, water skaters, frogs and tadpoles, which show an increase in biodiversity on the site after the restoration.
- iv. No fireflies were recorded on the site in 2014 before restoration. After the restoration, 19 individual fireflies including adult female of *Pyrocoelia analis* were found. As we had not reintroduced firefly larvae in Kam Tin River, these fireflies grow on this site naturally. The appearance of fireflies is a significant indication of the success in ecological restoration and improvement of the habitat.

c. Ping Yuen River

- i. The stream bed of the PYR site is fairly natural. The site is over-shadowed by bamboo. There is an inflatable dam upstream where occasional flush would aggravate soil erosion downstream.
- ii. The ecological restoration method employs the construction of refuge compartments by driving wooden piles into the river channel. Fauna and flora would be attracted into these refuge compartments.
- iii. The fauna species and numbers recorded at Ping Yuen River before and after rehabilitation are fairly similar, indicating that the biodiversity improvement brought about by the ecological improvement measures is insignificant. This is mainly due to the site dominated by bamboo plants, which hinder the flora growth in their vicinity, and the presence of Red Fire Ants in the vicinity. No herpetofauna and firefly species were recorded both before and after restoration.

6. Conclusion and Way Forward - comparison of the pre-construction and post-construction surveys shows that the restoration of Kam Tin River and Kwan Tei River created and provided a better habitat for stream dependent species, including fireflies, dragonflies and herpetofauna. Although no obvious improvement was noted in Ping Yuen River, further monitoring may be needed to observe the effectiveness of the restoration works. Continuing ecological monitoring in the three rivers could reveal if the improved habitats could be self-sustained for the stream dependent species especially for fireflies. This study has demonstrated that restored river channels could provide an oasis for surrounding organisms and bring about increase in the ecological value. Through this study, we have tried out a few river restoration techniques applicable to rivers and drainage channels in Hong Kong conditions with positive biodiversity improvement. Rehabilitation works can be carried out in more rivers or channels to enhance biodiversity while ecologically friendly design and construction methods could be incorporated for new drainage channels.