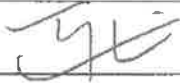
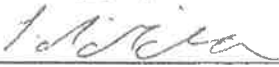


Agreement No. DP 04/2012
Post-Construction Ecological Monitoring
of Drainage Improvement Works in Southern Lantau
Implemented under 4128CD in Contract DC/2006/11

Monthly EM&A Report – February 2016

March 2016

| | Name | Signature |
|----------------------|--|---|
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| Version: | 2 | Date: 15 March 2016 |


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Pursuant to Condition 4.4 of Environmental Permit No. EP-237/2005/B (amended by EP-237/2005/C), this monthly EM&A Report for post-construction ecological monitoring and ecological water monitoring during February 2016 has been certified by the Environmental Team Leader (ETL) and verified by the Independent Environmental Checker (IEC)

Certified by:

Signature: 

Ms. Sharne McMillan
Environmental Team Leader (ETL)
AECOM Asia Co. Ltd

Date: 16 March 2016

Verified by:

Signature: 

Mr. Roger Leung
Independent Environmental Checker (IEC)
Ramboll Environ Hong Kong Limited

Date: 16-3-2016

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EXECUTIVE SUMMARY

This is the twenty first bi-monthly post-construction ecological monitoring and audit exercise for “Drainage Improvement in Southern Lantau” conducted by AECOM. This report concludes the post-construction phase ecological monitoring and audit requirement for the activities undertaken during the period of 1 February 2016 to 29 February 2016.

Ecological monitoring and ecological water quality monitoring were performed on 19 February 2016 and 25 February 2016, respectively. Results obtained are presented in this report.

The Environmental Team (ET) will continue to implement the environmental monitoring & audit (EM&A) programme in accordance with the EM&A Manual and Environmental Permit requirement. The report is available for public inspection and will be uploaded to the dedicated project website (<http://www.envproject.com/sldiwema.htm>).

1. INTRODUCTION

1.1. Background

1.1.1. The Drainage Services Department (DSD) has implemented Contract No. DC/2006/11 “Drainage Improvement in Southern Lantau and Construction of Mui Wo Village Sewerage Phase 1”. The monitoring requirements of the drainage improvement works are subject to the conditions specified in Environmental Permit (EP) No. EP-237/2005/B issued by the Environmental Protection Department (25 January 2006). In response to the latest approval to Variation of an Environmental Permit (VEP) application (VEP-465/2015) regarding Drainage Improvement in Southern Lantau (17 February 2015), the former EP-237/2005/B has been amended to EP-237/2005/C; however, this has not changed the original monitoring requirements. In compliance with the EP, an Environmental Monitoring and Audit (EM&A) programme was established during the construction and post-construction phases of the project. The operation of the project is subject to the conditions in EP No. EP-434/2012. In response to the latest approval to VEP application (VEP-464/2015), the former EP-434/2012 has been amended to EP-434/2012/A.

1.1.2. The Post-Construction Ecological Monitoring and Audit of Drainage Improvement Works in Southern Lantau under Agreement No. DP 04/2012, commenced in January 2012. AECOM Asia Co. Ltd. was appointed by DSD as the Environmental Team (ET) to conduct the above captioned monitoring project from October 2012 onwards. This is the twenty-first bi-monthly post-construction ecological monitoring and audit report under that appointment.

1.2. Project Description

1.2.1. Under Contract No. DC/2006/11, the improvement works were undertaken at Pak Ngan Heung River (PNH), Luk Tei Tong River (LTT) and Tai Tei Tong River (TTT) in Southern Lantau, west of Mui Wo. The works for which the post-construction ecological monitoring required by EP No. EP-237/2005/B (amended to EP-237/2005/C) included:

- the drainage channel and a three-cell box culvert at PNH;
- the drainage channel at LTT; and
- the bypass channel at LTT.

1.2.2. No ecological monitoring and ecological water monitoring was required following the drainage improvement works at TTT and village sewerage works in Mui Wo.

1.2.3. Both PNH and LTT are part of the Mui Wo River (also named as Silver River) in Lantau Island. These two tributaries of Mui Wo River, together with Tai Tei Tong River, then joined and connected to Silver Mine Bay next to Mui Wo.

1.3. Report Objectives

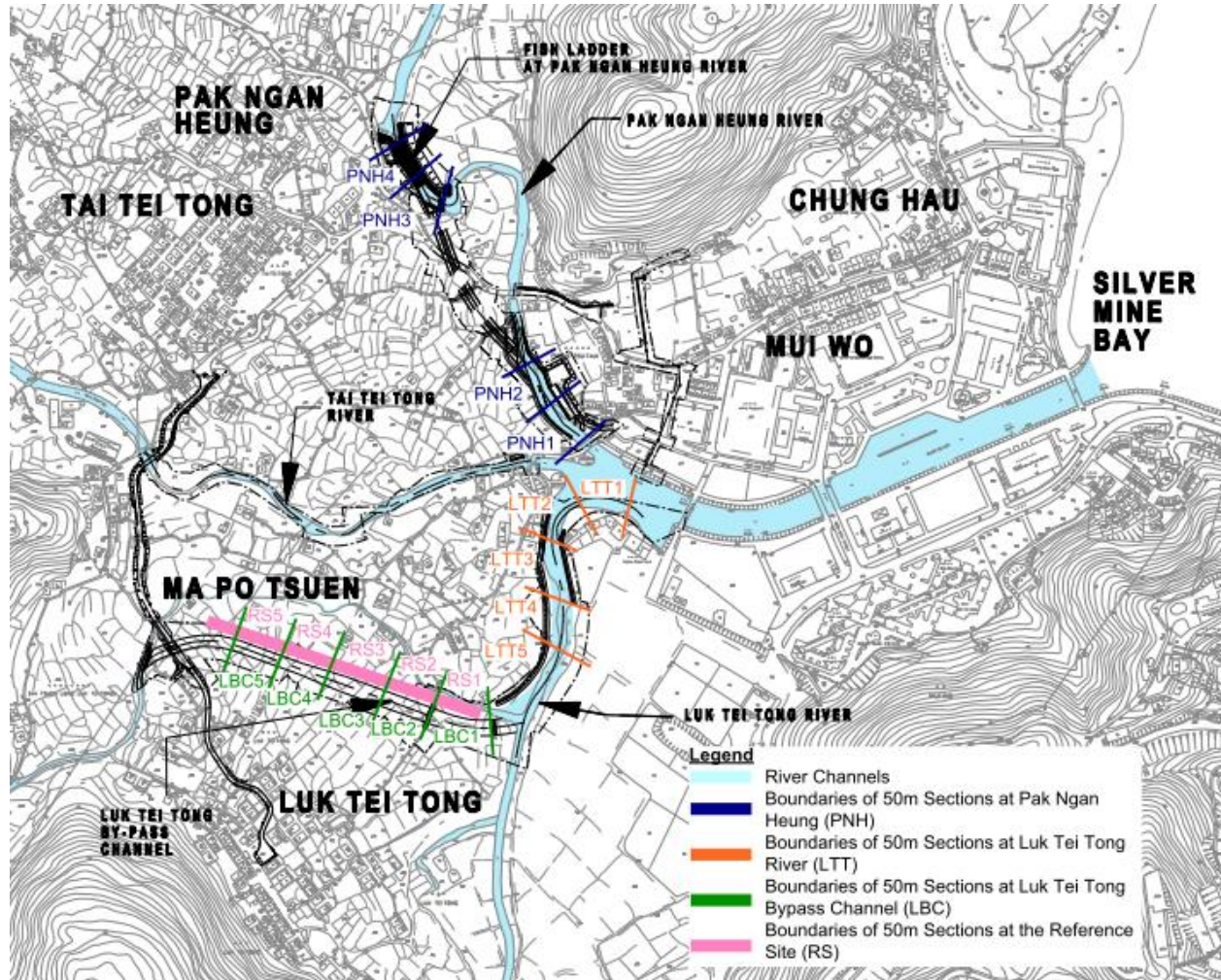
1.3.1. This report presents the findings of the ecological monitoring and the ecological water monitoring conducted in February 2016.

2. ECOLOGICAL MONITORING PARAMETERS

2.1. Ecological Surveys

2.1.1. Details of the monitoring parameters and survey methodology are described below. According to the Final EM&A Manual, a specific ecological monitoring programme of the improved section of PNH, LTT, LTT Bypass Channel (LBC) and its Reference Site (RS) is recommended.

Figure 1 Ecological Monitoring Locations at Pak Ngan Heung River, Luk Tei Tong River, Luk Tei Tong Bypass Channel and the Reference Site



Pak Ngan Heung River and Luk Tei Tong River

2.1.2. The ecological survey for these two rivers was divided into nine 50 m sections and comprised the following:

- Two sections for downstream of PNH (PNH1 and 2), two sections for upstream of PNH (PNH3 and 4);
- Five sections for LTT (LTT1 to 5).

2.1.3. The location plan is shown in **Figure 1** for reference.

2.1.4. The monitoring parameters and survey methodology for each section are described below:

- (a) Bird species in each 50 m section were surveyed quantitatively using transect count method. Birds within the river channel and on the riverbank were identified to species and their abundance was recorded. Birds that flew over/across the river channel without landing were not considered to be utilising the area and thus excluded from the records. This does not apply to species that rarely land and are associated with specific habitats (e.g. Barn Swallow).
- (b) Surveys on aquatic macroinvertebrate focused on determination of the diversity and abundance. Sampling methods included active searching, direct observation, hand netting and kick sampling. In each section, the macroinvertebrate species composition was identified and their relative abundance was recorded.
- (c) Surveys on fish focused on determination of the diversity and abundance of fish communities. Sampling methods included active searching, direct observation, and hand netting, and were determined in accordance with site conditions. In each section, the fish species composition was identified and their relative abundance was recorded.
- (d) Adult odonate community in each 50 m section were surveyed quantitatively by transect count method. Adult odonates within the river channel and on the riverbank were identified to species and their abundance was recorded. Species requiring close examination were netted.
- (e) Aquatic, emergent and riparian vegetation community was recorded by walk-through survey. Plant species composition and their relative abundance were recorded.

Luk Tei Tong Bypass Channel

2.1.5. The ecological survey for the Luk Tei Tong Bypass Channel (LBC) and its Reference Sites (RS) were carried out in every 50 m section and comprised the following:

- Five sections for LBC (LBC1 to 5);
- Five sections for RS (RS1 to 5).

2.1.6. The location plan is shown in **Figure 1** for reference.

2.1.7. The monitoring parameters and survey methodology are described below:

- (a) Bird species in each 50 m section were surveyed quantitatively using transect count method. Birds within the river channel and on the riverbank were identified to species and their abundance was recorded. Birds that flew over/across the river channel without landing were not considered to be utilising the area and thus excluded from the records. This does not apply to species that rarely land and are associated with specific habitats (e.g. Barn Swallow).
- (b) Where/when water was present, surveys of aquatic macroinvertebrate focused on determination of their diversity and abundance of stream aquatic communities. Sampling

methods included active searching, direct observation, hand netting and kick sampling. In each section, macroinvertebrate species composition was identified and their relative abundance was recorded.

- (c) Where/when water was present, surveys of fish focused on determination of their diversity and abundance. Sampling methods included active searching, direct observation, and hand netting, were determined in accordance with site conditions. In each section, fish species composition was identified and their relative abundance was recorded.
 - (d) Adult odonate community in each 50 m section were surveyed quantitatively by transect count method. Adult dragonflies within the river channel and on the riverbank were identified to species and their abundance was recorded. Species requiring close examination were netted.
 - (e) Line-intercept method was adopted to determine the relative plant cover of aquatic, emergent and riparian vegetation. One line transect of 10 m was set perpendicular to the stream channel at each section, and five 1 m x 1 m quadrats were placed along the transect. Relative coverage and plant species intercepting the transect line was recorded. Percentage cover of each species within the quadrat was recorded to the nearest 10% (except "1" = present but insignificant cover, normally 1 to 2 individuals, and 5% = up to 5%). The conditions of vegetation were described.
 - (f) Herpetofauna community within LBC and RS were surveyed by active searching in potential habitats. Reptiles were identified and their abundance was recorded. Amphibians were identified by their calls and the number of calling males in each section was recorded.
- 2.1.8. For all surveys, identification of plant species and distribution status in Hong Kong were made with reference to Corlett *et al.* (2000), Hu *et al.* (2003), Hong Kong Herbarium (2012), and Hong Kong Herbarium and South China Botanical Gardens (2007; 2008; 2009; 2011).
- 2.1.9. In terms of assessing geographical distribution, published references specializing in the distribution of specific faunal groups in Hong Kong have been utilized. For general status, these have included Fellowes *et al.* (2002) and the Hong Kong Biodiversity Database (AFCD, 2015), and for specific faunal groups, these have included: Avifauna – Carey *et al.* (2001), Viney *et al.* (2005); Dragonflies – Tam *et al.* (2011); Butterflies – Lo (2005); and Chan *et al.* (2011); Amphibians – Chan *et al.* (2005); Reptiles – Chan *et al.* (2006), Chan *et al.* (2009), and Karsen *et al.* (1998); Terrestrial Mammals – Shek (2006); Freshwater Fish – Lee *et al.* (2004); and Freshwater Community – Dudgeon (2003). The status and rarity of vascular plants has been based on Hu *et al.* (2003) and Corlett *et al.* (2000).

2.2. Ecological Water Quality Monitoring

2.2.1. Ecological water quality monitoring along PNH, LTT, LBC, and RS was carried out. Ten locations were selected and comprised the following:

- Three locations for existing PNH (WE1 to 3);
- Three locations for existing LTT (WE4 to 6);
- Two locations for RS (WE7 to 8);
- Two locations for existing LBC (WE9 to 10).

2.2.2. The location plan for ecological water quality monitoring is shown in **Figure 2**.

2.2.3. Water Quality Monitoring along PNH, LTT, LBC and RS included the monitoring parameters shown below:

- Biochemical Oxygen Demand (BOD₅)
- Dissolved Oxygen (DO)
- Nitrate
- Water Depth* and Water Flow Rate
- Ammonia
- Conductivity

- Reactive Phosphorus
- Total Suspended Solids (SS)
- Temperature
- pH
- Salinity
- Sediment Characteristics

Note:

*As referred to in the Final EM&A Manual, Water Depth is required only for LBC.

2.2.4. The DO, water depth and water flow rate, conductivity, pH, temperature, salinity and sediment characteristics were measured in-situ while the other water samples were analyzed in a HOKLAS accredited laboratory and the analyses followed the standard methods according to APHA Standard Methods for the Examination of Water and Wastewater, 20th Edition, or equivalent. The limit of reporting for the laboratory analysis is summarized in **Table 2.1**.

Table 2.1 Limit of Reporting for Water Quality Parameters

| Parameters | Limit of Reporting (mg/L) |
|---|---------------------------|
| Total Suspended Solids | 2 |
| Biochemical Oxygen Demand (BOD ₅) | 2 |
| Nitrate | 0.01 |
| Ammonia | 0.01 |
| Reactive Phosphorus | 0.01 |

2.2.5. The instrument for in-situ measurement of pH, temperature, DO, salinity and conductivity is a portable and weather proof Multifunctional Meter complete with cable and uses a DC power source. Calibration certificates are attached in **Appendix 1**. The instruments are capable of measuring:

- pH in the range of 0 to 14
- Temperature of -5 to +65°C
- DO in the range of 0 to 20 mg/L and 0 to 200% saturation
- Salinity in the range of 0-80ppt
- Conductivity in the range of 0 to 4999 µS/cm

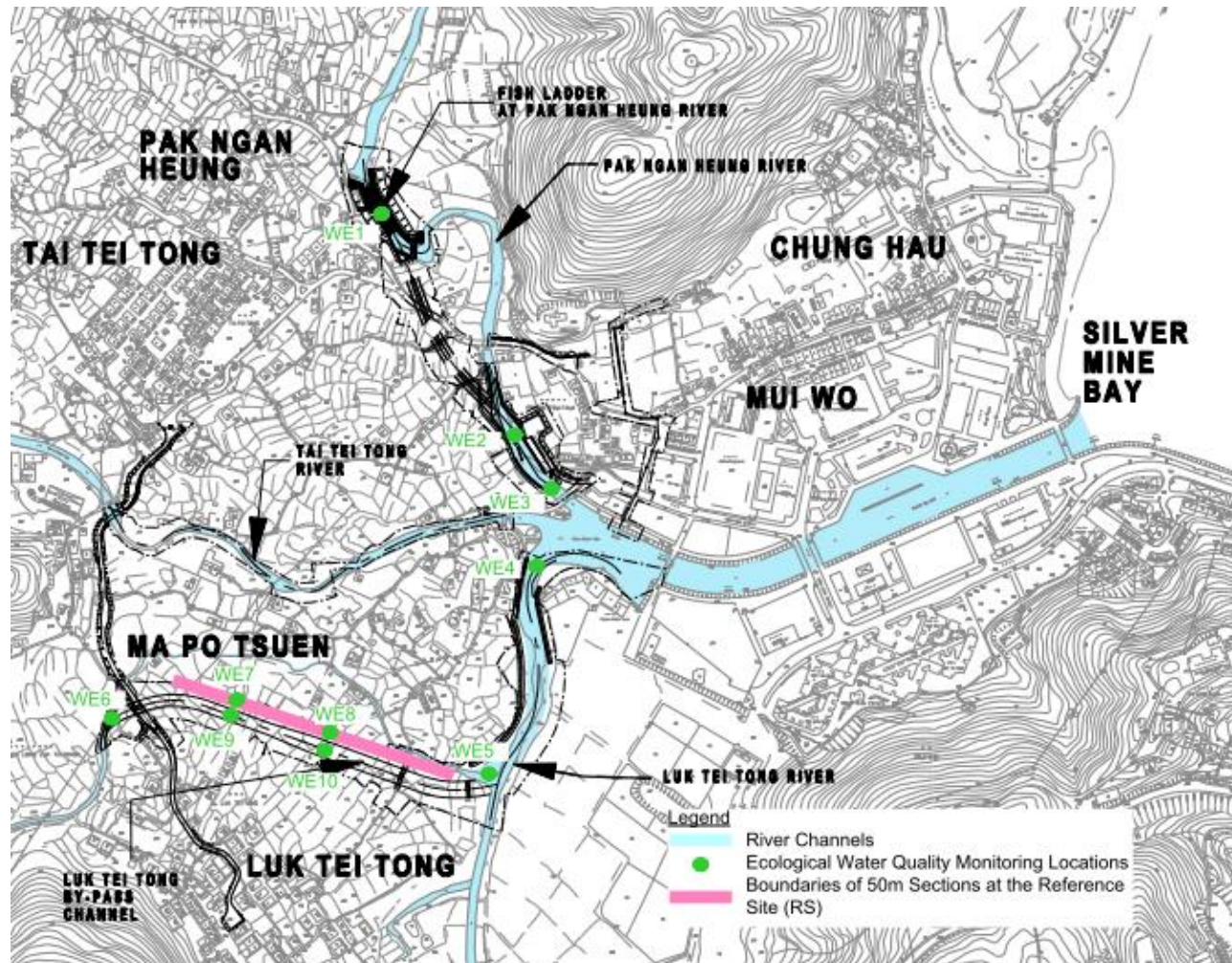
2.2.6. According to the requirement of the Final EM&A Manual, two consecutive measurements for parameters of DO concentration, and DO saturation are required to be taken at each monitoring location. When the difference in value between the first and second reading of DO is more than 25%, the reading was discarded and a further reading taken.

2.3. Limitations

2.3.1. No water was present at LBC2 to LBC5 at the time of ecological survey (19 February 2016), therefore aquatic fauna surveys were not undertaken in these locations.

2.3.2. No water was present at WE7 to WE10 at the time of water quality monitoring (25 February 2016), therefore water quality monitoring was not undertaken at these locations.

Figure 2 Ecological Water Quality Monitoring Locations at Pak Ngan Heung River, Luk Tei Tong River, Luk Tei Tong Bypass Channel and the Reference Site



3. MONITORING RESULTS

3.1. Ecological Survey Findings

Pak Ngan Heung River (PNH)

- 3.1.1. The lower stream of PNH (PNH1 and PNH2) is subject to tidal influence from Silver Mine Bay. Vertical concrete retaining wall formed the banks of the river channel. The two sections were located at the mouth of the PNH. PNH1 and PNH2 were adjacent to each other. The bridge formed the southern boundary of PNH1 whereas the box-culvert formed the northern boundary of PNH2. Small boulders and sandy substrate formed the main component of the streambed.
- 3.1.2. Rock-filled gabion formed the eastern bank and the gabion and a vertical concrete retaining wall formed the western bank of the upper stream (PNH3 and PNH4). PNH3 and PNH4 are adjacent to each other. PNH4 comprised a man-made cascade, including a fish ladder, while PNH3 comprised a pool below the cascade and was bounded by a bridge at its downstream end. Small boulders and sandy substrate were the main component in the middle streambed which allowed water flow and pool formation, whereas big boulders were scattered on both sides of the streambed and had an absence of water. The width of the fish ladder at PNH4 is approximately 7 m.
- 3.1.3. The cascade/fish ladder at PNH4 was designed to allow open water flow and should be free of vegetation in order to allow fish movement.

Vegetation

- 3.1.4. At PNH1, no plant species were recorded within the river channel. The vegetation recorded on the vertical wall included *Wedelia trilobata* and Opposite-leaved Fig (*Ficus hispida*) at PNH1. At PNH2, one seedling of *Kandelia obovata* was recorded. No significant changes to the plant species were observed compared with last monitoring in December 2015. During the monitoring, the water level at lower PNH was approximately 40 cm during ebbing tide.
- 3.1.5. At PNH3 and PNH4, a total of 19 plant species were recorded. Exotic Mile-a-minute (*Mikania micrantha*) remained the dominant species on the banks of the PNH3 pool, the gabion of the PNH4 and the two edges of the cascade/fish ladder. In addition, herb species such as *Bidens alba*, Diffuse Day-Flower (*Commelina diffusa*) and *Wedelia trilobata* were also commonly recorded along the gabion of the PNH3, the sides of PNH3 pool and PNH4 cascade. The overgrown Mile-a-minute along the fish ladder that previously blocked the water flow had been cleared since the last monitoring period. Although vegetation started to overgrow at the edges of the PNH4 cascade/fish ladder, water could still flow freely along the fish ladder (refer to **Appendix 5**).
- 3.1.6. The list of plant species is presented in **Appendix 2a**.

Terrestrial Fauna

- 3.1.7. Nine avifauna species were recorded at PNH, all of which are common or abundant in Hong Kong (AFCD, 2015) (**Table 3.1**). One individual of the avifauna species of conservation importance, Grey Heron (*Ardea cinerea*), was recorded at PNH1 (refer to **Appendix 6**). It is listed as "Potential Regional Concern" by Fellowes *et al.* (2002).
- 3.1.8. Three avifauna species were recorded at lower PNH (PNH1 and PNH2), two of which were waterbird species, i.e. Grey Heron and Common Sandpiper (*Actitis hypoleucos*). There was no evidence of breeding or nesting activities during the monitoring period.
- 3.1.9. Six avifauna species were recorded at upper PNH (PNH3 and PNH4), all of which were generalists (e.g. Red-whiskered Bulbul *Pycnonotus jocosus* and Barn Swallow *Hirundo rustica*). There was no evidence of breeding or nesting activities during the monitoring period.
- 3.1.10. No odonata were recorded at PNH during the monitoring.
- 3.1.11. No herpetofauna were recorded at PNH during the monitoring.

Aquatic Macroinvertebrate and Fish

- 3.1.12. A total of nine macroinvertebrate species, including worms, snails and insects, were recorded within the PNH river (**Table 3.2**); no fish were recorded. No aquatic macroinvertebrate species of conservation importance were recorded.

Table 3.1 Number of Avifauna Recorded at Pak Ngan Heung River (PNH)

| Common Name ⁽¹⁾ | Scientific Name | Distribution in Hong Kong ⁽²⁾ | Principal Status ⁽³⁾ | Level of Concern ⁽⁴⁾ | Protection Status in China ⁽⁵⁾ | China Red Data Book ⁽⁶⁾ | IUCN Red List ⁽⁷⁾ | PNH1 | PNH2 | PNH3 | PNH4 |
|----------------------------------|------------------------------|--|---------------------------------|---------------------------------|---|------------------------------------|------------------------------|------|------|------|------|
| Grey Heron ⁽⁸⁾ | <i>Ardea cinerea</i> | Common | W | PRC | - | - | - | 1 | | | |
| Common Sandpiper ⁽⁸⁾ | <i>Actitis hypoleucos</i> | Common | M,W | - | - | - | - | | 2 | | |
| Red-whiskered Bulbul | <i>Pycnonotus jocosus</i> | Abundant | R | - | - | - | - | | | | 2 |
| Barn Swallow | <i>Hirundo rustica</i> | Abundant | SpM,Su | - | - | - | - | | | 4 | 4 |
| Black-collared Starling | <i>Gracupica nigricollis</i> | Common | R | - | - | - | - | | 1 | | |
| Oriental Magpie Robin | <i>Copsychus saularis</i> | Abundant | R | - | - | - | - | | | | 1 |
| Fork-tailed Sunbird | <i>Aethopyga christinae</i> | Common | R | - | - | - | - | | | 1 | |
| Eurasian Tree Sparrow | <i>Passer montanus</i> | Abundant | R | - | - | - | - | | | | 2 |
| White Wagtail | <i>Motacilla alba</i> | Common | W,R | - | - | - | - | | | | 1 |

Note:

(1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).

(2) AFCD (2015). Hong Kong Biodiversity Database.

(3) R=resident; SpM=spring migrant; Su=summer visitor; W=winter visitor; M=migrant.

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

(5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(6) Zheng and Wang (1998).

(7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

(8) Wetland-dependent species (including wetland-dependent species and waterbirds).

Species of conservation importance is noted in bold type face.

Table 3.2 Relative Abundance of Aquatic Macroinvertebrate and Fish Recorded at Pak Ngan Heung River (PNH)

| Fauna Group | Common name | Scientific Name | Distribution in Hong Kong (1)(2)(3) | Level of Concern (4) | Protection Status in China (5) | China Red Data Book (6) | IUCN Red List (7) | PNH1 | PNH2 | PNH3 | PNH4 |
|-------------|-------------|-----------------------------------|--|-------------------------|--------------------------------|----------------------------|----------------------|------|------|------|------|
| Worms | - | Polychaetes | - | - | - | - | - | + | ++ | | |
| Snails | - | <i>Clithon</i> sp. | - | - | - | - | - | +++ | | | |
| Snails | - | <i>Nerita chamaeleon</i> | Common | - | - | - | - | | +++ | | |
| Snails | - | <i>Cerithidea cingulata</i> | Very common | - | - | - | - | | + | | |
| Insects | Caddisflies | Trichoptera | - | - | - | - | - | | | + | |
| Insects | Mayfly | Baetidae | - | - | - | - | - | | | + | + |
| Insects | Mayfly | Caenidae | - | - | - | - | - | | | + | |
| Insects | Mayfly | Ephemeroptera (Other families) | - | - | - | - | - | | | + | |
| Worms | Water-mites | Hydrachnidia | - | - | - | - | - | + | ++ | | |

Note:

- (1) AFCD (2015). Hong Kong Biodiversity Database.
- (2) Williams, G. (2003). Hong Kong Field Guides – Rocky Shores.
- (3) Chan *et al.* (2003). Hong Kong Field Guides – Sandy Shores.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

Relative abundance: + = occasional, less than 5 individuals were found; ++ = common, 5-20 individuals were found; +++ = abundant, more than 20 individuals were found.
 Species of conservation importance is noted in bold type face.

Luk Tei Tong River (LTT)

- 3.1.13. The LTT is subject to tidal influence from Silver Mine Bay and is estuarine in nature. It is a south-north running river. A vertical concrete retaining wall formed the riverbank of the LTT1 whereas rock-filled gabion formed the riverbank of LTT2 to LTT5. LTT1 was located at the confluence with Pak Ngan Heung River, Tai Tei Tong River and Luk Tei Tong River. Since it is subject to tidal flow, water flowed from south to north during the survey when the tide was going out. LTT1 and LTT2 had sandy substrate whilst LTT3 to LTT5 had muddy substrate. Clusters of boulders were present at both sides of the river channel. The width of the river channel was approximately 8-10 m.
- 3.1.14. No evidence of maintenance works (including those relevant to Conditions 2.1 to 2.4 of EP No. EP-434/2012 (amended to EP-434/2012/A) was observed during the monitoring period.

Vegetation

- 3.1.15. A total of 15 plant species were recorded in LTT. Seven out of the 15 recorded species were exotic. The majority of the recorded species were herbs or climbers scattered along the gabion such as *Bidens alba*, Burma-reed (*Neyraudia reynaudiana*), Many-flowered Silvergrass (*Miscanthus floridulus*), Chinese Silvergrass (*Miscanthus sinensis*) and *Wedelia trilobata*. In addition to the mangrove stand supporting Spiny Bears Breech (*Acanthus ilicifolius*) and *Kandelia obovata* that have colonized the inside of the river channel at LTT2 and LTT3, several seedlings of *Kandelia obovata* were observed to have regenerated naturally at LTT1, LTT2, LTT3 and LTT5.
- 3.1.16. The list of plant species is presented in **Appendix 2a**.

Terrestrial Fauna

- 3.1.17. A total of seven avifauna species were recorded at LTT, all of them are either common or abundant in Hong Kong (AFCD, 2015) (**Table 3.3**). Two species of conservation importance, including Grey Heron and Little Egret (*Egretta garzetta*), were recorded at LTT. One individual of Little Egret and Grey Heron were recorded at LTT1, LTT2, LTT4 and LTT5 during the monitoring (refer to **Appendix 6**).
- 3.1.18. No odonata were recorded at LTT during the monitoring.
- 3.1.19. No herpetofauna species were recorded at LTT during the monitoring.

Aquatic Macroinvertebrate and Fish

- 3.1.20. A total of eight aquatic species, including one fish species, one crustacean species and six species of other aquatic macroinvertebrates such as snails, insects, bivalves and amphipods were recorded from LTT (**Table 3.4**). Most of the recorded species are either common or very common in river mouth or estuarine habitats in Hong Kong (Chan *et al.*, 2003; Williams, 2003; AFCD, 2015). No fish or aquatic macroinvertebrates species of conservation importance were recorded during the monitoring.

Table 3.3 Number of Avifauna Recorded at Luk Tei Tong River (LTT)

| Common Name ⁽¹⁾ | Scientific Name | Distribution in Hong Kong ⁽²⁾ | Principal Status ⁽³⁾ | Level of Concern ⁽⁴⁾ | Protection Status in China ⁽⁵⁾ | China Red Data Book ⁽⁶⁾ | IUCN Red List ⁽⁷⁾ | LTT1 | LTT2 | LTT3 | LTT4 | LTT5 |
|-------------------------------------|--------------------------------|--|---------------------------------|---------------------------------|---|------------------------------------|------------------------------|------|------|------|------|------|
| Eastern Cattle Egret ⁽⁸⁾ | <i>Bubulcus coromandus</i> | Common | P | (LC) | - | - | - | 1 | | | | |
| Grey Heron⁽⁸⁾ | <i>Ardea cinerea</i> | Common | W | PRC | - | - | - | 1 | 1 | | 1 | 1 |
| Little Egret⁽⁸⁾ | <i>Egretta garzetta</i> | Common | P | PRC (RC) | - | - | - | 1 | 1 | | 1 | 1 |
| House Swift | <i>Apus nipalensis</i> | Common | R,SpM | - | - | - | - | 1 | | | | |
| Barn Swallow | <i>Hirundo rustica</i> | Abundant | SpM,Su | - | - | - | - | 1 | | 1 | | |
| Yellow-bellied Prinia | <i>Prinia flaviventris</i> | Common | R | - | - | - | - | | | 1 | | |
| Black-collared Starling | <i>Gracupica nigricollis</i> | Common | R | - | - | - | - | | | 1 | | 1 |

Note:

(1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).

(2) AFCD (2015). Hong Kong Biodiversity Database.

(3) R=resident; SpM=Spring migrant; Su=summer visitor; W=winter visitor; P=present all year, exact composition unknown.

(4) Fellowes *et al.* (2002): PRC=Potential Regional Concern; RC=Regional Concern; LC=Local Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in nesting and/or roosting sites rather than in general occurrence.

(5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(6) Zheng and Wang (1998).

(7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

(8) Wetland-dependent species (including wetland-dependent species and waterbirds).

Species of conservation importance is noted in bold type face.

Table 3.4 Relative Abundance of Aquatic Macroinvertebrate and Fish Recorded at Luk Tei Tong River (LTT)

| Fauna Groups | Common Name | Scientific Name | Distribution in Hong Kong ⁽¹⁾⁽²⁾⁽³⁾ | Level of Concern ⁽⁴⁾ | Protection Status in China ⁽⁵⁾ | China Red Data Book ⁽⁶⁾ | IUCN Red List ⁽⁷⁾ | LTT1 | LTT2 | LTT3 | LTT4 | LTT5 |
|------------------------|---------------------|-----------------------------|--|---------------------------------|---|------------------------------------|------------------------------|------|------|------|------|------|
| Fish | Common Silver-biddy | <i>Gerres oyena</i> | Records from estuaries throughout Hong Kong | - | - | - | - | | | + | | |
| Worms | - | Polychaetes | - | - | - | - | - | + | | | | |
| Snails | - | <i>Clithon sp.</i> | - | - | - | - | - | + | + | | | |
| Bivalves | Rock oyster | <i>Saccostrea cucullata</i> | Very common | - | - | - | - | + | + | | | |
| Crustacean (Barnacles) | - | <i>Balanus amphitrite</i> | Very common | - | - | - | - | | + | | | |
| Amphipod | - | Amphipoda | - | - | - | - | - | + | + | | | + |
| Insects | Non-Biting Midges | Chironomidae | - | - | - | - | - | | | + | | + |
| Insects | Water-mites | Hydrachnidia | - | - | - | - | - | | | + | | |

Note:

(1) AFCD (2015). Hong Kong Biodiversity Database.

(2) Williams, G. (2003). Hong Kong Field Guides – Rocky Shores.

(3) Chan *et al.* (2003). Hong Kong Field Guides – Sandy Shores.

(4) Fellowes *et al.* (2002).

(5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).

(6) Zheng and Wang (1998).

(7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

Relative abundance: + = occasional, less than 5 individuals were found; ++ = common, 5-20 individuals were found; +++ = abundant, more than 20 individuals were found.

Luk Tei Tong Bypass Channel (LBC) and Reference Site (RS)

3.1.21. The LBC links to the end of LTT5 and runs east to west but the connection with LTT5 is blocked by a layer of gabion wall approximately 1 m in height, which allows water flow between LBC and LTT when water level is higher than the height of the gabion. It is located in the Luk Tei Tong Marsh to the west of the original LTT. Gabion walls formed both sides of the channel bank. A small pool of approximately 60 m² in size was located at the western end of LBC1. The pool was separated from the LTT by a weir constructed from a single layer of rock-filled gabion. The substrate comprised soil, which was translocated from the marsh area prior to construction of the bypass. The width of the bypass channel was approximately 15 m.

3.1.22. The RS was located parallel to the northern side of the LBC. Next to the RS was village housing. The site was vegetated and did not have any freestanding water at the time of survey.

Vegetation

3.1.23. Re-establishment of the majority of vegetation has still been observed since the vegetation removal works in October 2015 when compared to the last monitoring period (December 2015) from LBC1 to LBC5. The vegetation coverage in LBC increased from 7% to 84% compared to the last monitoring. A total of 34 plant species were recorded in LBC, of which 16 species were recorded in the quadrats sampled. The list of plant species is presented in **Appendix 2b**. Among all the recorded species, about 38% were exotic species (**Table 3.5**). Similar to the last monitoring survey in December, half of the LBC1 section included a patch of open water. Other sections were dry.

3.1.24. The habitat at LBC1 is different from the remaining LBC sections in terms of vegetation type. It adjoined LTT5 and had a pool of open water at the eastern tip. LBC1 may be subject to tidal influence during high tide because it is located immediately next to LTT. The sedge Ferruginous-scale Fimbristylis (*Fimbristylis sieboldii*) was re-established and became dominated at LBC1. Native Leather Fern (*Acrostichum aureum*), Reed (*Phragmites vallatorius*) and *Ruellia coerulea* were also common at the dry section west to the open water at LBC1. Four saplings of *Kandelia obovata* were recorded at the open water at LBC1.

3.1.25. LBC2 and LBC3 were dominated by the exotic *Wedelia trilobata* while LBC4 and LBC5 were dominated by the native Gluten-rice Grass (*Apluda mutica*). Other herbaceous species commonly encountered along the transects from LBC2 to LBC5 included *Bidens alba*, Reed and Interrupted Tri-vein Fern (*Cyclosorus interruptus*). Tree species such as Chinese Tallow Tree (*Sapium sebiferum*) and Chinese Hackberry (*Celtis sinensis*) were occasionally recorded near the gabion at LBC2 and LBC4. Wetland species such as Taro (*Colocasia esculenta*), Spiny Knotweed (*Polygonum perfoliatum*) and Ginger Lily (*Hedychium coronarium*) were occasionally recorded along LBC2 to LBC5.

3.1.26. A total of 46 plant species were recorded in the RS, of which 13 species were found in the quadrats (**Table 3.5**). Among all the recorded species, about 43% were exotic species. The list of plant species is presented in **Appendix 2b**. All sections were dry and were located next to the village housing. The exotic *Wedelia trilobata* was the dominant species. The exotic Hilo Grass (*Paspalum conjugatum*) and Rose Mallow (*Urena lobata*) were also commonly recorded along the RS sections. The majority of vegetation recorded at RS are typical in disturbed land. Records of wetland species such as Taro and Ginger Lily were occasional.

Table 3.5 Vegetation Coverage at Luk Tei Tong Bypass Channel (LBC) and Reference Site (RS)

| | LBC | RS |
|-------------------------------------|-----|-----|
| No. of species recorded in quadrats | 34 | 13 |
| Total No. of species | 16 | 46 |
| Total No. of exotic species | 13 | 20 |
| Average vegetation coverage | 84% | 78% |

| | LBC | RS |
|----------------------|-----|-----|
| Bare ground coverage | 16% | 22% |

Note:

(1) The transect was not laid along any open water, thus open water coverage was not provided in this table.

Terrestrial Fauna

3.1.27. Three species of avifauna were recorded at the LBC (**Table 3.6**) and five species of avifauna were recorded at the RS (**Table 3.7**). All recorded species are common or abundant in Hong Kong (AFCD, 2015). The recorded avifaunal species in LBC and RS were generalists, e.g. Crested Myna (*Acridotheres cristatellus*) and Red-whiskered Bulbul (*Pycnonotus jocosus*). No species of conservation importance were recorded at LBC or RS.

3.1.28. No odonata were recorded at LBC during the monitoring.

3.1.29. No herpetofauna species were recorded at LBC during the monitoring.

Aquatic Macroinvertebrate and Fish

3.1.30. A total of five aquatic species, including one fish species, two crustacean species and two aquatic macroinvertebrates species were recorded at LBC1 (**Table 3.8**). No fish and aquatic macroinvertebrate species of conservation importance were recorded during the monitoring.

3.1.31. No aquatic fauna was recorded at the RS or the remaining sections of the LBC2 to LBC5 as they were dry during the monitoring.

Table 3.6 Number of Avifauna Recorded at Luk Tei Tong Bypass Channel (LBC)

| Common Name ⁽¹⁾ | Scientific Name | Distribution in Hong Kong ⁽²⁾ | Principal Status ⁽³⁾ | Level of Concern ⁽⁴⁾ | Protection Status in China ⁽⁵⁾ | China Red Data Book ⁽⁶⁾ | IUCN Red List ⁽⁷⁾ | LBC1 | LBC2 | LBC3 | LBC4 | LBC5 |
|----------------------------|----------------------------------|--|---------------------------------|---------------------------------|---|------------------------------------|------------------------------|------|------|------|------|------|
| Red-whiskered Bulbul | <i>Pycnonotus jocosus</i> | Abundant | R | - | - | - | - | | | | 2 | |
| Crested Myna | <i>Acridotheres cristatellus</i> | Common | R | - | - | - | - | | | | 2 | |
| White Wagtail | <i>Motacilla alba</i> | Common | W,R | - | - | - | - | 1 | | | | |

Note:

- (1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).
- (2) AFCD (2015). Hong Kong Biodiversity Database.
- (3) R=resident; W=winter visitor.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

Table 3.7 Number of Avifauna Recorded at Reference Site (RS)

| Common Name ⁽¹⁾ | Scientific Name | Distribution in Hong Kong ⁽²⁾ | Principal Status ⁽³⁾ | Level of Concern ⁽⁴⁾ | Protection Status in China ⁽⁵⁾ | China Red Data Book ⁽⁶⁾ | IUCN Red List ⁽⁷⁾ | RS1 | RS2 | RS3 | RS4 | RS5 |
|----------------------------|-----------------------------|--|---------------------------------|---------------------------------|---|------------------------------------|------------------------------|-----|-----|-----|-----|-----|
| Black Drongo | <i>Dicrurus macrocercus</i> | Common | M,Su | - | - | - | - | 1 | | | | |
| Large-billed Crow | <i>Corvus macrorhynchos</i> | Common | R | - | - | - | - | 1 | | | | |
| Red-whiskered Bulbul | <i>Pycnonotus jocosus</i> | Abundant | R | - | - | - | - | | | 4 | | |
| Japanese White-eye | <i>Zosterops japonicus</i> | Abundant | R,?W | - | - | - | - | | | | | 2 |
| Black Drongo | <i>Dicrurus macrocercus</i> | Common | M,Su | - | - | - | - | 1 | | | | |

Note:

- (1) All wild birds are protected under Wild Animals Protection Ordinance (Cap. 170).
- (2) AFCD (2015). Hong Kong Biodiversity Database.
- (3) R=resident; M=migrant; Su=summer visitor; ?W=the extent of immigration in winter is unclear.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

Table 3.8 Relative Abundance of Aquatic Macroinvertebrate and Fish Recorded at Luk Tei Tong Bypass Channel (LBC)

| Fauna Groups | Common Name | Scientific Name | Distribution in Hong Kong ⁽¹⁾⁽²⁾⁽³⁾ | Level of Concern ⁽⁴⁾ | Protection Status in China ⁽⁵⁾ | China Red Data Book ⁽⁶⁾ | IUCN Red List ⁽⁷⁾ | LBC1 | LBC2 | LBC3 | LBC4 | LBC5 |
|--------------|-------------------|-------------------------------|--|---------------------------------|---|------------------------------------|------------------------------|------|------|------|------|------|
| Fish | Bald Glassy | <i>Ambassis gymnocephalus</i> | Common | - | - | - | Least Concern | ++ | | | | |
| Crustacean | - | Crab larvae | - | - | - | - | - | + | | | | |
| Crustacean | - | <i>Caridina cantonensis</i> | - | - | - | - | - | + | | | | |
| Insects | Non-Biting Midges | Chironomidae | - | - | - | - | - | + | | | | |
| Insects | Water-mites | Hydrachnidia | - | - | - | - | - | ++ | | | | |

Note:

- (1) AFCD (2015). Hong Kong Biodiversity Database.
- (2) Williams, G. (2003). Hong Kong Field Guides – Rocky Shores.
- (3) Chan *et al.* (2003). Hong Kong Field Guides – Sandy Shores.
- (4) Fellowes *et al.* (2002).
- (5) List of Wild Animals Under State Protection (promulgated by State Forestry Administration and Ministry of Agriculture on 14 January, 1989).
- (6) Zheng and Wang (1998).
- (7) IUCN (2015). IUCN Red List of Threatened Species. Version 2015-4.

Relative abundance: + = occasional, less than 5 individuals were found; ++ = common, 5-20 individuals were found; +++ = abundant, more than 20 individuals were found.

3.2. Ecological Water Quality Monitoring (EWQM)

- 3.2.1. The post-construction phase EWQM was conducted on 25 February 2016. The monitoring results are presented in **Appendix 3** and summarised in **Table 3.9**, which includes reference to the key Water Quality Objectives (WQOs). Baseline surveys were conducted in 2007 prior to the start of the drainage improvement works. The baseline survey results are presented in **Table 3.10**.
- 3.2.2. The water quality monitoring results are discussed in **Section 5**.

Table 3.9 Summarized Ecological Water Quality Monitoring Results (February 2016)

| Parameters | Key Water Quality Objectives ⁽¹⁾ | WE1 | WE2 | WE3 | WE4 | WE5 | WE6 |
|--|---|-------|-------|-------|-------|-------|-------|
| Suspended Solids (mg/L) | <20 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Nitrogen (Ammonia) (mg/L) | - | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 |
| Nitrogen (Nitrate) (mg/L) | - | 0.32 | 0.31 | 0.31 | 0.31 | 0.32 | 0.33 |
| Reactive Phosphorous (mg/L) | - | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 |
| 5-day Biochemical Oxygen Demand (BOD ₅) (mg/L) | <5 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Dissolved Oxygen (mg/L) | >4 | 7.28 | 8.04 | 7.71 | 7.04 | 7.88 | 7.13 |
| Temperature (°C) | - | 17.1 | 17.3 | 17.2 | 17.6 | 17.3 | 17.2 |
| pH | 6.5 – 8.5 | 6.5 | 6.5 | 6.8 | 6.7 | 6.6 | 6.6 |
| Salinity (ppt) | - | 0.07 | 0.06 | 0.10 | 0.20 | 0.07 | 0.05 |
| Conductivity (µs/cm) | - | 123.6 | 756.0 | 450.2 | 378.9 | 522.8 | 117.4 |
| Water Flow (m/s) | - | 0.14 | 0.08 | 0.08 | 0.10 | 0.06 | 0.01 |
| Water Depth (cm) | - | 17.0 | 14.5 | 11.5 | 20.5 | 14.0 | 30.0 |

Note:

- (1) The available key Water Quality Objectives (WQOs) for River Monitoring Stations at Mui Wo River on Lantau Island (EPD, 2015).

Table 3.10 Baseline of Ecological Water Quality Monitoring Results (September 2007)

| Parameters | WE1 | WE2 | WE3 | WE4 | WE5 | WE6 |
|--|------|------|------|------|------|------|
| Suspended Solids (mg/L) | 1.0 | 2.0 | 3.0 | 3.0 | <1.0 | <1.0 |
| Nitrogen (Ammonia) (mg/L) | 0.07 | 0.12 | 0.11 | 0.23 | 0.03 | 0.02 |
| Nitrogen (Nitrate) (mg/L) | 0.12 | 0.13 | 0.13 | 0.31 | 0.04 | 0.05 |
| Reactive Phosphorous (mg/L) | 0.04 | 0.06 | 0.06 | 0.09 | 0.06 | 0.05 |
| 5-day Biochemical Oxygen Demand (BOD ₅) (mg/L) | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| Dissolved Oxygen (mg/L) | 6.58 | 6.82 | 6.37 | 7.61 | 6.87 | 5.70 |
| pH | 6.4 | 7.1 | 7.0 | 6.8 | 6.6 | 6.1 |
| Salinity (ppt) | <0.1 | 0.1 | 0.3 | 7.6 | 0.1 | <0.1 |

4. ECOLOGICAL MONITORING SCHEDULE

- 4.1. The next ecological surveys and ecological water quality monitoring are tentatively scheduled for mid-April 2016.

5. DISCUSSION AND RECOMMENDATIONS

- 5.1. The aim of the monitoring programme is to provide data on the re-establishment of aquatic/riparian communities in the PNH and LTT, and allow an assessment of the relative success of the mitigation measures to be made. In addition, monitoring of the LBC will assess whether the proposed channel design has provided suitable compensation for the impacts to the Luk Tei Tong Marsh.
- 5.2. Key observations made during the February 2016 monitoring period in relation to the implemented mitigation measures are presented in **Table 5.1**. Where applicable, recommendations for improving the functionality of the mitigation measures have been made for DSD's consideration.
- 5.3. Vegetation has re-established along LBC1 to LBC5 since the vegetation clearance in the October 2015 (refer to **Appendix 5**). The vegetation coverage in LBC increased from 7% to 84% compared to the last monitoring in December 2015. The dominant species at LBC2 and LBC3 were the exotic *Wedelia trilobata* while that at LBC4 and LBC5 were the native Gluten-rice Grass.
- 5.4. Wetland species including Hairy Knotweed, Taro and Ginger Lily were occasionally recorded at LBC2 to LBC5 (refer to **Appendix 5**). Although these species have been re-established at LBC2 to LBC5, the limited occurrence of these species suggested that the water levels/availability within the channel might not be adequate to sustain a marsh habitat.
- 5.5. LBC1 differed from LBC2 to LBC5 in terms of vegetation composition in that it was dominated by wetland native species Ferruginous-scale Fimbristylis and Leather Fern. Four saplings of *Kandelia obovata* were also recorded at LBC1 (refer to **Appendix 5**). It was the best representation of re-established marsh habitat in LBC1 as LBC2 to LBC5 supported only limited marsh species and was dominated by flora and perennial species which typically occur in dry land habitats such as *Wedelia trilobata*. Any vegetation clearance at LBC1 results in the removal of the established marsh habitat, therefore it is recommended that future vegetation clearance work should avoid at LBC1 to protect and maintain the re-established marsh habitat.
- 5.6. Trees (such as Chinese Hackberry and Chinese Tallow Tree) were recorded near the gabion at LBC2 and LBC4 (refer to **Appendix 5**). Such tree species may hinder the re-establishment of marsh habitat.
- 5.7. Significant coverage of exotic Mile-a-minute (*Mikania micrantha*) is observed at the banks of the PNH3 pool, the gabion of the PNH4 and the two edges of the cascade/fish ladder (refer to **Appendix 5**). The overgrown Mile-a-minute along the fish ladder that previously blocked the water flow had been cleared since the last monitoring period. While vegetation continued to grow at the edges of the PNH4 cascade/fish ladder, water could still flow freely. The presence of vegetation growing on the fish ladder can hinder the use and movement by fish or freshwater community along PNH3 and PNH4, therefore regular weed removal is recommended to keep the fish ladder free from vegetation.
- 5.8. As any vegetation clearance of the cascade/fish ladder upstream of PNH3 has the potential to result in water quality impacts downstream (e.g. leakage of diesel from trimming machine), hand removal of vegetation is recommended at areas adjacent to the fish ladder and pools. In addition, the removed plants should be disposed properly (i.e. no trimmed/removed vegetation should be allowed to be washed downstream).
- 5.9. Mangrove stands of Spiny Bears Breech and *Kandelia obovata* were observed inside the river channel at LTT2 and LTT3 (refer to **Appendix 5**). Several *Kandelia obovata* seedlings were also observed at LTT1, LTT2, LTT3, and LTT5 and LBC1, indicating a natural re-colonization of mangrove at those sites.
- 5.10. Whilst there are some differences in the suspended solid and nitrogen level between the original 2007 water quality baseline surveys and the February 2016 water quality monitoring surveys, findings from water monitoring could be attributed to an array of factors including

seasonal variations, climatic conditions and/or the influence of tidal status at the time of survey. Taking this into account, the key Water Quality Objectives (WQOs) for River Monitoring Stations at Mui Wo River (EPD, 2015) have been included to provide a comparison with standard water quality goals applicable to the area (refer to **Table 3.13**).

- 5.11. The Environmental Protection Department (EPD) analyses and presents data from its annual water monitoring programme to express the level of compliance with the statutory WQOs including pH, Suspended Solids (SS), 5-day Biochemical Oxygen Demand (BOD₅), and Dissolved Oxygen (DO). These WQOs specify the long-term water quality goals that the Government is to achieve and maintain for individual rivers in Hong Kong, including the Mui Wo River. As part of the programme five locations are sampled from the Mui Wo River, three of which are associated with the monitoring area for the drainage improvement works (MW1, MW2 and MW4). The objectives related to these sampling locations, have been used in this report. Water quality of the subject watercourses has met the WQOs during the survey.
- 5.12. No observable evidence of environmental changes such as odour, or discharge within the surveyed areas were recorded. When compared with the EPD key water quality objectives for river monitoring (2014), all parameters (SS, DO, BOD₅ and pH) complied with the statutory WQOs. When compared to the last monitoring period, suspended solid concentration and nitrogen (ammonia) concentration decreased significantly at all monitoring stations, except the suspended solid concentration at WE2 which showed minimal changes. Nitrogen (nitrate) concentration at all monitoring stations slightly decreased. Conductivity at WE5 showed a significant increase while that at WE3, WE5 and WE6 showed significant decreases. Likewise, the dissolved oxygen level, salinity level, reactive phosphorus, pH value, flow rate and BOD₅ concentration at sites also demonstrated slight fluctuations.
- 5.13. Despite the fluctuations in water quality, no deteriorating trend has been detected over the monitoring period. The water quality monitoring will continue and findings will be presented in subsequent reports as additional information becomes available.

Table 5.1 Key Observations/Comments and Recommendations Arising from the February 2016 Monitoring Period

| Location | Mitigation Measure | Observations/Comments | Recommendations |
|-------------|--|---|--|
| PNH and LTT | Construction of a small fish ladder at the upstream end of the PNH | Mile-a-minute (<i>Mikania micrantha</i>) is the dominant plant species at upper PNH. Vegetation is overgrown at the fish ladder, but water could still flow freely (refer to Appendix 5). | On-going, regular weed management is recommended, as required, to maintain the open nature of the fish ladder. Hand removal of vegetation is recommended at areas adjacent to the fish ladder and pools. In addition, the removed plants should be disposed properly (i.e. no trimmed/removed vegetation should be allowed to be washed downstream). Continued retention of native species, particularly at the edges of the river channel, during any future maintenance activities is recommended to maintain the existing habitat and minimize the re-colonization of exotic species. |

| Location | Mitigation Measure | Observations/Comments | Recommendations |
|------------|---|---|---|
| | | | <p>Some pits have been incorporated into the gabion banks, but do not appear to have been planted up. Planting of riparian vegetation, preferably with native species suggested in the EIA report Section 7.8.17 and Table 2.6 (e.g. <i>Albizia lebbbeck</i>, <i>Sterculia lanceolata</i>, <i>Cinnamomum camphora</i>, <i>Polyspora axillaris</i>, and <i>Rhaphiolepis indica</i>) is recommended.</p> |
| | | <p>The fish ladder does not meet the lip of the weir at the up-stream end of PNH4 due to a drop of approximately 30 cm. This could limit the overall function of the fish ladder for fish passage/movement up and downstream.</p> | <p>As per the current design of the fish ladder, the gap from the top of the fish ladder and the bottom of the weir is 30 - 40 cm presenting an obstacle to fish passage. Some improvement may be achieved by stacking additional boulders resembling that in PNH4 to form pools at the top of the fish ladder, which could facilitate fish movement.</p> |
| | <p>Re-establishment of aquatic / riparian communities</p> | <p>No fish species of conservation importance were recorded during the current monitoring in February 2016.</p> | <p>The presence of fish species of conservation importance in both PNH and LTT including relative abundance will continue to be monitored.</p> |
| <p>LBC</p> | <p>Provision of suitable habitat compensation</p> | <p>Vegetation clearance was carried out at LBC in October 2015. Re-establishment of marsh vegetation was observed at LBC1 including native species Ferruginous-scale Fimbristylis and Leather Fern. Four saplings of <i>Kandelia obovata</i> were recorded at LBC1 (refer to Appendix 5).</p> <p>The presence of regenerating trees at LBC2 and LBC4 (Chinese Hackberry and Chinese Tallow Tree) may hinder the re-establishment of a marsh habitat (refer to Appendix 5).</p> <p>Re-establishment of vegetation was observed. However, only limited marsh species were recorded along LBC2 to LBC5 (refer to Appendix 5).</p> | <p>Future vegetation clearance should be avoided at LBC1 to protect and maintain the marsh habitat.</p> <p>The establishment and the coverage of Leather Fern and <i>Kandelia obovata</i> species will continue to be monitored.</p> <p>Removal of tree seedlings is suggested at LBC2 and LBC4.</p> <p>The regeneration of marsh species in the LBC will to be monitored.</p> <p>Continued retention of native species from LBC2 to LBC5 during any future maintenance activities are recommended to maintain the existing habitat and minimize the re-colonization of exotic species.</p> |

| Location | Mitigation Measure | Observations/Comments | Recommendations |
|----------|--------------------|--|--|
| | | The limited occurrence of typical marsh plant species (although this was also limiting in the RS) suggests that the water levels/availability within the channel may not be adequate to sustain a marsh habitat. | On-going monitoring of water levels and species composition within the channel are required. Further assessment should take into account the timing of the surveys (wet/dry season). |

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Appendix 1. Calibration Certificate of the Instrument (Multifunctional Meter)



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T: +852 2610 1044
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www.alsglobal.com

REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION

| | | | |
|-----------------|---|-----------------------|------------|
| CONTACT: | MR MIKE SHEK | WORK ORDER: | HK1604612 |
| CLIENT: | AECOM ASIA COMPANY LIMITED | SUB-BATCH: | 0 |
| ADDRESS: | 1501-10, 15/F, TOWER 1, GRAND CENTRAL PLAZA, 138 SHATIN RURAL COMMITTEE ROAD, SHATIN, NEW TERRITORIES, HONG KONG | LABORATORY: | HONG KONG |
| | | DATE RECEIVED: | 02/02/2016 |
| | | DATE OF ISSUE: | 05/02/2016 |

COMMENTS

The performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.
The "Tolerance Limit" quoted is the acceptance criteria applicable for similar equipment used by the ALS Hong Kong laboratory or quoted from relevant international standards.
The "Next Calibration Date" is recommended according to best practice principals as practised by the ALS Hong Kong laboratory or quoted from relevant international standards.

Scope of Test: Conductivity, Temperature, Dissolved Oxygen, Salinity, pH and Turbidity
Description: Multifunctional Meter
Brand Name: YSI
Model No.: 6820 V2
Serial No.: 12D100972
Equipment No.: W.026.36
Date of Calibration: 02 February, 2016

NOTES

This is the Final Report and supersedes any preliminary report with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.


Mr Fung Lim Chee, Richard
General Manager -
Greater China & Hong Kong

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Page 1 of 3

REPORT OF EQUIPMENT PERFORMANCE CHECK/CALIBRATION

Work Order: HK1604612
Sub-batch: 0
Client: AECOM ASIA COMPANY LIMITED
Date of Issue: 05/02/2016



Description: Multifunctional Meter
Brand Name: YSI
Model No.: 6820 V2
Serial No.: 12D100972
Equipment No.: W.026.36
Date of Calibration: 02 February, 2016

Date of next Calibration: 02 May, 2016

Parameters:

Conductivity

Method Ref: APHA (21th edition), 2510B

| Expected Reading (uS/cm) | Displayed Reading (uS/cm) | Tolerance (%) |
|--------------------------|---------------------------|---------------|
| 146.9 | 144.0 | -2.0 |
| 6667 | 6740 | +1.1 |
| 12890 | 12810 | -0.6 |
| 58670 | 58720 | +0.1 |
| Tolerance Limit (%) | | ±10.0 |

Dissolved Oxygen

Method Ref: APHA (21st edition), 4500O: G

| Expected Reading (mg/L) | Displayed Reading (mg/L) | Tolerance (mg/L) |
|-------------------------|--------------------------|------------------|
| 3.47 | 3.43 | -0.04 |
| 5.60 | 5.62 | +0.02 |
| 7.85 | 7.86 | +0.01 |
| Tolerance Limit (mg/L) | | ±0.20 |

Temperature

Method Ref: Section 6 of International Accreditation New Zealand Technical

Guide No. 3 Second edition March 2008: Working Thermometer Calibration Procedure.

| Reading of Ref. thermometer (°C) | Displayed Reading (°C) | Tolerance (°C) |
|----------------------------------|------------------------|----------------|
| 10.0 | 10.11 | +0.1 |
| 21.5 | 21.47 | -0.0 |
| 38.0 | 37.80 | -0.2 |
| Tolerance Limit (°C) | | ±2.0 |

Remark: "Displayed Reading" presents the figures shown on item under calibration / checking regardless of equipment precision or significant figures.


 Mr Fung Lim Chee, Richard
 General Manager -
 Greater China & Hong Kong

REPORT OF EQUIPMENT PERFORMANCE CHECK / CALIBRATION

Work Order: HK1604612
Sub-Batch: 0
Client: AECOM ASIA COMPANY LIMITED
Date of Issue: 05/02/2016



Description: Multifunctional Meter
Brand Name: YSI
Model No.: 6820 V2
Serial No.: 12D100972
Equipment No.: W.026.36
Date of Calibration: 02 February, 2016

Date of next Calibration: 02 May, 2016

Parameters:

Salinity

Method Ref: APHA (21st edition), 2520B

| Expected Reading (g/L) | Displayed Reading (g/L) | Tolerance (%) |
|------------------------|-------------------------|---------------|
| 0 | 0.00 | -- |
| 10 | 10.01 | +0.1 |
| 20 | 20.06 | +0.3 |
| 30 | 30.10 | +0.3 |
| Tolerance Limit (%) | | ±10.0 |

Turbidity

Method Ref: APHA (21st edition), 2130B

| Expected Reading (NTU) | Displayed Reading (NTU) | Tolerance (%) |
|------------------------|-------------------------|---------------|
| 0 | 0.0 | -- |
| 4 | 3.8 | -5.0 |
| 10 | 9.6 | -4.0 |
| 20 | 19.4 | -3.0 |
| 50 | 49.5 | -1.0 |
| 100 | 100.6 | +0.6 |
| Tolerance Limit (%) | | ±10.0 |

pH Value

Method Ref: APHA (21st edition), 4500H:B

| Expected Reading (pH Unit) | Displayed Reading (pH Unit) | Tolerance (pH unit) |
|----------------------------|-----------------------------|---------------------|
| 4.0 | 4.01 | +0.01 |
| 7.0 | 7.04 | +0.04 |
| 10.0 | 10.03 | +0.03 |
| Tolerance Limit (pH Unit) | | ±0.20 |

Remark: "Displayed Reading" presents the figures shown on item under calibration / checking regardless of equipment precision or significant figures.

Mr Fung Lim Chee, Richard
 General Manager
 Greater China & Hong Kong

Appendix 2a: Plant Species Recorded in Pak Ngan Heung River and Luk Tei Tong River in February 2016

| Scientific Name | Growth Form | Native / Exotic to Hong Kong | Distribution in Hong Kong | PNH1 | PNH2 | PNH3 | PNH4 | LTT1 | LTT2 | LTT3 | LTT4 | LTT5 |
|------------------------------------|---------------------------|------------------------------|---------------------------|------|------|------|------|------|------|------|------|------|
| <i>Acanthus ilicifolius</i> | shrub | native | common | | | | | | + | + | | |
| <i>Alocasia odora</i> | perennial herb | native | very common | | | + | + | | | | | |
| <i>Bidens alba</i> | herb | exotic | very common | | | ++ | ++ | | + | | + | + |
| <i>Bidens pilosa</i> | herb | exotic | very common | | | + | | | | | | |
| <i>Canavalia maritima</i> | climber | native | common | | | | | | + | | | |
| <i>Coix lacryma-jobi</i> | herb | native | common | | | | + | | | | | |
| <i>Colocasia esculenta</i> | herb | native | - | | | + | + | | | | | |
| <i>Commelina diffusa</i> | herb | native | common | | | ++ | ++ | | | | | |
| <i>Cyperus alternifolius subsp</i> | herb | exotic | - | | + | | | | | | | |
| <i>Cyperus spp.</i> | herb | - | - | | | | | + | | | | |
| <i>Ficus hispida</i> | tree | native | very common | + | | + | + | | | | | |
| <i>Ficus variegata</i> | shrub | native | common | | | + | | | | | | |
| <i>Hedychium coronarium</i> | shrub | exotic | - | | | + | + | | | | | |
| <i>Ipomoea cairica</i> | climber | exotic | very common | | | + | | | | | + | + |
| <i>Ipomoea pes-caprae</i> | perennial herb | native | common | | | | | | + | + | | |
| <i>Kandelia obovata</i> | shrub or small tree | native | common | | + | | | + | ++ | + | | + |
| <i>Lantana camara</i> | shrub | exotic | very common | | | | | | + | + | + | + |
| <i>Microstegium ciliatum</i> | perennial procumbent herb | native | very common | | | + | + | | | | | |
| <i>Mikania micrantha</i> | climber | exotic | very common | | | ++ | ++ | | | | | |
| <i>Miscanthus floridulus</i> | perennial herb | native | common | | | + | + | | | + | + | + |
| <i>Miscanthus sinensis</i> | perennial herb | native | very common | | | | | + | | | | + |
| <i>Neyraudia reynaudiana</i> | herb | native | very common | | | | | | | + | + | |
| <i>Panicum maximum</i> | herb | exotic | very common | | | + | + | | | + | | |
| <i>Polygonum barbatum</i> | herb | native | common | | | + | | | | | | |
| <i>Pueraria phaseoloides</i> | climber | native | very common | | | | + | | + | + | | + |
| <i>Rhus hypoleuca</i> | shrub | native | common | | | + | | | | | | |
| <i>Saccharum arundinaceum</i> | perennial herb | native | common | | | + | | | | + | + | |
| <i>Wedelia trilobata</i> | perennial herb | exotic | common | + | | ++ | ++ | | | + | + | + |

Note:

Code for Abundance: +++=abundant; ++=occasional; +=scarce

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in February 2016

LTT Bypass Channel (LBC)

| Scientific Name | Growth Form | Native / Exotic to Hong Kong | Distribution in Hong Kong | LBC1 | LBC2 | LBC3 | LBC4 | LBC5 | Average |
|---|---------------------|------------------------------|---------------------------|---------------------------------|------|------|------|------|---------|
| Species recorded in the quadrats along the transects | | | | Average Percentage Cover | | | | | |
| <i>Acrostichum aureum</i> | herb | native | restricted | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| <i>Apluda mutica</i> | herb | native | very common | 0.00 | 0.10 | 0.23 | 0.39 | 0.35 | 0.21 |
| <i>Bidens alba</i> | herb | exotic | very common | 0.00 | 0.02 | 0.22 | 0.10 | 0.14 | 0.10 |
| <i>Colocasia esculenta</i> | herb | native | - | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 |
| <i>Cyclosorus interruptus</i> | herb | native | common | 0.00 | 0.00 | 0.15 | 0.06 | 0.00 | 0.04 |
| <i>Fimbristylis sieboldii</i> | herb | native | common | 0.53 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 |
| <i>Ipomoea cairica</i> | climber | exotic | very common | 0.00 | 0.03 | 0.00 | 0.00 | 0.03 | 0.01 |
| <i>Oxalis corymbosa</i> | perennial herb | exotic | common | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| <i>Panicum maximum</i> | herb | exotic | very common | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 |
| <i>Panicum repens</i> | perennial herb | native | very common | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| <i>Paspalum conjugatum</i> | perennial herb | exotic | common | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 |
| <i>Phragmites vallatorius</i> | herb | native | very common | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| <i>Polygonum chinense</i> | herb | native | very common | 0.00 | 0.00 | 0.00 | 0.06 | 0.01 | 0.01 |
| <i>Polygonum perfoliatum</i> | climbing herb | native | common | 0.00 | 0.00 | 0.11 | 0.01 | 0.00 | 0.02 |
| <i>Ruellia coerulea</i> | herb | exotic | - | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| <i>Wedelia trilobata</i> | perennial herb | exotic | common | 0.00 | 0.77 | 0.22 | 0.26 | 0.22 | 0.29 |
| <i>Acacia confusa</i> | tree | exotic | - | | + | | | | |
| <i>Acrostichum aureum</i> | herb | native | restricted | + | | | | | |
| <i>Aeschynomene americana L.</i> | herb | exotic | - | + | | + | | | |
| <i>Alocasia odora</i> | perennial herb | native | very common | | | | + | + | |
| <i>Apluda mutica</i> | herb | native | very common | | + | + | + | + | |
| <i>Bidens alba</i> | herb | exotic | very common | | + | + | + | + | |
| <i>Celtis sinensis</i> | tree | native | common | | | | + | + | |
| <i>Colocasia esculenta</i> | herb | native | - | | | + | + | + | |
| <i>Commelina diffusa</i> | herb | native | common | + | | | | | |
| <i>Cyclosorus interruptus</i> | herb | native | common | | | + | + | | |
| <i>Cynodon dactylon</i> | perennial herb | native | very common | | | + | + | + | |
| <i>Cyperus flabelliformis</i> | herb | - | - | + | | | | | |
| <i>Fimbristylis sieboldii</i> | herb | native | common | + | | | | | |
| <i>Hedychium coronarium</i> | shrub | exotic | - | | | | + | + | |
| <i>Ipomoea cairica</i> | climber | exotic | very common | | + | + | + | + | |
| <i>Kandelia obovata</i> | shrub or small tree | native | common | + | | | | | |
| <i>Lantana camara</i> | shrub | exotic | very common | + | | | | | |
| <i>Ludwigia octovalvis</i> | perennial herb | native | common | | | + | + | + | |

Note:

Code: +=occurrence of the species

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in February 2016

LTT Bypass Channel (LBC)

| Scientific Name | Growth Form | Native / Exotic to Hong Kong | Distribution in Hong Kong | RS1 | RS2 | RS3 | RS4 | RS5 |
|---|---------------------------|------------------------------|---------------------------|----------------------------------|-----|-----|-----|-----|
| Other species recorded during the walk-through survey (Continue) | | | | Occurrence of the Species | | | | |
| <i>Microstegium ciliatum</i> | perennial procumbent herb | native | very common | | + | + | + | + |
| <i>Mimosa diplotricha</i> ⁽¹⁾ | herb | exotic | rare | | + | | | |
| <i>Mimosa pudica</i> | herb | exotic | very common | | + | + | | |
| <i>Oxalis corymbosa</i> | perennial herb | exotic | common | | | | | + |
| <i>Panicum maximum</i> | herb | exotic | very common | | + | + | + | + |
| <i>Panicum repens</i> | perennial herb | native | very common | | + | + | | + |
| <i>Paspalum conjugatum</i> | perennial herb | exotic | common | + | + | + | + | + |
| <i>Phragmites vallatorius</i> | herb | native | very common | + | + | | | |
| <i>Polygonum barbatum</i> | herb | native | common | | | + | | |
| <i>Polygonum chinense</i> | herb | native | very common | | | + | + | + |
| <i>Polygonum perfoliatum</i> | climbing herb | native | common | | | + | + | |
| <i>Pueraria phaseoloides</i> | climber | native | very common | | + | + | + | + |
| <i>Pycnus polystachyus</i> | herb | native | common | + | | | | |
| <i>Ruellia coerulea</i> | herb | exotic | - | + | | | | |
| <i>Sapium sebiferum</i> | tree | native | common | | + | | + | |
| <i>Wedelia trilobata</i> | perennial herb | exotic | common | | + | + | + | + |

Note:

Code: +=occurrence of the species

(1) This species is listed as "rare" by Corlett *et al.* (2000); but it is an exotic species in Hong Kong.

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in February 2016

Reference Site (RS)

| Scientific Name | Growth Form | Native / Exotic to Hong Kong | Distribution in Hong Kong | RS1 | RS2 | RS3 | RS4 | RS5 | Average |
|--|---------------------------|------------------------------|---------------------------|----------------------------------|------|------|------|------|---------|
| Species recorded in the quadrats along the transects | | | | Average Percentage Cover | | | | | |
| <i>Hedychium coronarium</i> | shrub | exotic | - | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.03 |
| <i>Lantana camara</i> | shrub | exotic | very common | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| <i>Lophatherum gracile</i> | herb | native | common | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.01 |
| <i>Microstegium ciliatum</i> | perennial procumbent herb | native | very common | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| <i>Mimosa pudica</i> | herb | exotic | very common | 0.02 | 0.00 | 0.00 | 0.00 | 0.08 | 0.02 |
| <i>Miscanthus floridulus</i> | perennial herb | native | common | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| <i>Paspalum conjugatum</i> | perennial herb | exotic | common | 0.08 | 0.00 | 0.10 | 0.10 | 0.00 | 0.06 |
| <i>Pueraria phaseoloides</i> | climber | native | very common | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 |
| <i>Saccharum arundinaceum</i> | herb | native | - | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| <i>Sapium sebiferum</i> | tree | native | common | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| <i>Sida rhombifolia</i> | herb | native | common | 0.02 | 0.03 | 0.04 | 0.00 | 0.02 | 0.02 |
| <i>Urena lobata</i> | shrub | native | common | 0.04 | 0.13 | 0.10 | 0.02 | 0.00 | 0.06 |
| <i>Wedelia trilobata</i> | perennial herb | exotic | common | 0.62 | 0.57 | 0.47 | 0.65 | 0.49 | 0.56 |
| Other species recorded during the walk-through survey | | | | Occurrence of the Species | | | | | |
| <i>Acacia confusa</i> | tree | exotic | - | + | + | | | | |
| <i>Aeschynomene americana</i> L. | herb | exotic | - | + | + | + | + | | |
| <i>Alocasia odora</i> | perennial herb | native | very common | + | + | + | + | | |
| <i>Apluda mutica</i> | herb | native | very common | + | + | + | + | | |
| <i>Bambusa ventricosa</i> | bamboo | exotic | - | | | | | + | |
| <i>Bidens alba</i> | herb | exotic | very common | + | + | + | + | + | |
| <i>Bidens pilosa</i> | herb | exotic | very common | | | + | | | |
| <i>Breynia fruticosa</i> | shrub | native | very common | | | | + | | |
| <i>Bridelia tomentosa</i> | tree | native | very common | | | | + | | |
| <i>Canna indica</i> | herb | exotic | - | | | + | + | | |
| <i>Celosia argentea</i> | herb | native | very common | | | + | + | | |
| <i>Celtis sinensis</i> | tree | native | common | + | | | + | | |
| <i>Colocasia esculenta</i> | herb | native | - | | | | + | | |
| <i>Conyza canadensis</i> | herb | exotic | very common | | | | + | | |
| <i>Crotalaria pallida</i> | herb | exotic | common | + | + | | | | |
| <i>Cynodon dactylon</i> | perennial herb | native | very common | + | | + | + | | |
| <i>Dactyloctenium aegyptium</i> | herb | native | common | + | | | | | |
| <i>Desmodium heterocarpon</i> | herb | native | very common | | | + | | | |
| <i>Duranta erecta</i> | shrub | exotic | common | | | | + | | |
| <i>Eucalyptus robusta</i> | tree | exotic | - | + | | | | | |

Note:

Code: + = the occurrence of the species

Appendix 2b: Plant Species Recorded in Luk Tei Tong Bypass Channel and Reference Site in February 2016

Reference Site (RS)

| Scientific Name | Growth Form | Native / Exotic to Hong Kong | Distribution in Hong Kong | RS1 | RS2 | RS3 | RS4 | RS5 |
|---|---------------------------|------------------------------|---------------------------|----------------------------------|-----|-----|-----|-----|
| Other species recorded during the walk-through survey (Continue) | | | | Occurrence of the Species | | | | |
| <i>Ficus hispida</i> | tree | native | very common | + | + | + | + | |
| <i>Ficus variegata</i> | shrub | native | common | | | + | | |
| <i>Hedychium coronarium</i> | shrub | exotic | - | | | + | + | |
| <i>Hymenocallis littoralis</i> | herb | exotic | - | | | + | | |
| <i>Ipomoea cairica</i> | climber | exotic | very common | | + | | + | |
| <i>Ipomoea pes-caprae</i> | perennial herb | native | common | + | + | | | + |
| <i>Lantana camara</i> | shrub | exotic | very common | + | + | + | + | + |
| <i>Ligustrum sinense</i> | tree | native | common | | | | + | + |
| <i>Livistona chinensis</i> | tree | exotic | cultivated | | | | + | |
| <i>Lophatherum gracile</i> | herb | native | common | | | | + | |
| <i>Mallotus paniculatus</i> | tree | native | very common | | | | | + |
| <i>Microstegium ciliatum</i> | perennial procumbent herb | native | very common | + | + | + | + | + |
| <i>Mimosa diplotricha</i> ⁽¹⁾ | herb | exotic | rare | | | + | + | + |
| <i>Mimosa pudica</i> | herb | exotic | very common | + | + | + | | + |
| <i>Miscanthus floridulus</i> | perennial herb | native | common | + | | | | + |
| <i>Panicum maximum</i> | herb | exotic | very common | + | + | + | + | + |
| <i>Panicum repens</i> | perennial herb | native | very common | | | + | | |
| <i>Paspalum conjugatum</i> | perennial herb | exotic | common | + | + | + | + | + |
| <i>Pueraria phaseoloides</i> | climber | native | very common | + | + | + | + | + |
| <i>Saccharum arundinaceum</i> | herb | native | - | | + | + | | + |
| <i>Sageretia thea</i> | shrub | native | very common | | | | | + |
| <i>Sapium sebiferum</i> | tree | native | common | + | + | + | | |
| <i>Sida rhombifolia</i> | herb | native | common | + | | | + | + |
| <i>Urena lobata</i> | shrub | native | common | + | + | + | + | + |
| <i>Wedelia trilobata</i> | perennial herb | exotic | common | + | + | + | + | + |
| <i>Artemisia indica</i> | herb | native | - | | | | | + |

Note:

Code: +=occurrence of the species

(1) This species is listed as "rare" by Corlett *et al.* (2000); but it is an exotic species in Hong Kong.

Appendix 3: Ecological Water Quality Monitoring Raw Data (February 2016)

Date of Monitoring: 25 February 2016

Weather : Cloudy

| Monitoring Location ⁽¹⁾ | Suspended Solids (mg/L) | Nitrogen (Ammonia) (mg/L) | Nitrogen (Nitrate) (mg/L) | Reactive Phosphorous (mg/L) | 5-day Biochemical Oxygen Demand (BOD ⁵) (mg/L) | Dissolved Oxygen (mg/L) | |
|------------------------------------|-------------------------|---------------------------|---------------------------|-----------------------------|--|-------------------------|------|
| | | | | | | M1 | M2 |
| WE1 | <2.0 | 0.02 | 0.32 | 0.03 | <2.0 | 7.32 | 7.24 |
| WE2 | <2.0 | 0.02 | 0.31 | 0.03 | <2.0 | 8.08 | 8.00 |
| WE3 | <2.0 | 0.03 | 0.31 | 0.03 | <2.0 | 7.78 | 7.64 |
| WE4 | <2.0 | 0.02 | 0.31 | 0.03 | <2.0 | 7.08 | 7.00 |
| WE5 | <2.0 | 0.02 | 0.32 | 0.03 | <2.0 | 7.94 | 7.81 |
| WE6 | <2.0 | 0.02 | 0.33 | 0.02 | <2.0 | 7.16 | 7.09 |
| WE7 | No water - Not sampled | | | | | | |
| WE8 | No water - Not sampled | | | | | | |
| WE9 | No water - Not sampled | | | | | | |
| WE10 | No water - Not sampled | | | | | | |

| Monitoring Location ⁽¹⁾ | Temperature (°C) | | pH | Salinity (ppt) | | Conductivity (µs/cm) | | Water Flow (m/s) | | Water Depth (cm) |
|------------------------------------|------------------------|------|-----|----------------|------|----------------------|-------|------------------|-------|------------------|
| | M1 | M2 | | M1 | M2 | M1 | M2 | M1 | M2 | |
| WE1 | 17.0 | 17.1 | 6.5 | 0.07 | 0.06 | 126.2 | 121.0 | 0.134 | 0.144 | 17.0 |
| WE2 | 17.3 | 17.3 | 6.5 | 0.05 | 0.07 | 754.0 | 758.0 | 0.072 | 0.079 | 14.5 |
| WE3 | 17.2 | 17.1 | 6.8 | 0.09 | 0.10 | 426.1 | 474.2 | 0.084 | 0.075 | 11.5 |
| WE4 | 17.6 | 17.5 | 6.7 | 0.22 | 0.18 | 382.6 | 375.2 | 0.097 | 0.106 | 20.5 |
| WE5 | 17.3 | 17.3 | 6.6 | 0.08 | 0.06 | 526.2 | 519.4 | 0.064 | 0.048 | 14.0 |
| WE6 | 17.2 | 17.1 | 6.6 | 0.05 | 0.04 | 114.2 | 120.6 | 0.009 | 0.014 | 30.0 |
| WE7 | No water - Not sampled | | | | | | | | | |
| WE8 | No water - Not sampled | | | | | | | | | |
| WE9 | No water - Not sampled | | | | | | | | | |
| WE10 | No water - Not sampled | | | | | | | | | |

Note:

* Where more than one measurement was taken, the data is represented by Measurement M1 and M2.

⁽¹⁾ As no water was present at WE7 to WE10 at the time of survey, no water quality monitoring was undertaken at these water quality monitoring stations.



PNH1 and PNH2



PNH3 and PNH4



LTT1



LTT2



LTT3 and LTT4



LTT5



LBC1



LBC2 and LBC3



Post-Construction Ecological Monitoring
of Drainage Improvement Works in Southern Lantau

Representative Photographs Taken during
the Ecological Monitoring

SCALE

N.T.S.

DATE

Feb-16

CHECK

McmillanSE

DRAWN

TSOIWYC

JOB NO.

60278381

DRAWING NO.

Appendix 4



LBC4 and LBC5



RS1



RS2



RS3 and RS4



RS5



Post-Construction Ecological Monitoring
of Drainage Improvement Works in Southern Lantau

**Representative Photographs Taken during
the Ecological Monitoring**

SCALE

N.T.S.

DATE

Feb-16

CHECK

McmillanSE

DRAWN

TSOIWYC

JOB NO.

60278381

DRAWING NO.

Appendix 4




Vegetation was overgrown, but water can still freely flow along the fish ladder



Re-establishment of vegetation along LBC



Wetland species were occasionally recorded at LBC2 to LBC5

| | | | | | |
|---|--|---------|------------|-------------|------------|
|  | Post-Construction Ecological Monitoring of Drainage Improvement Works in Southern Lantau | SCALE | N.T.S. | DATE | Feb-16 |
| | Representative Photographs of Site Observations Taken during the Ecological Monitoring | CHECK | McmillanSE | DRAWN | TSOIWYC |
| | | JOB NO. | 60278381 | DRAWING NO. | Appendix 5 |



Saplings of *Kandelia obovata* were recorded at LBC1



Trees recorded at LBC2 and LBC4 may hinder the re-establishment of marsh habitat



Mangrove stands inside the river channel at LTT2 and LTT3

| | | | | | |
|--------------|---|---------|------------|-------------|------------|
| AECOM | Post-Construction Ecological Monitoring of Drainage Improvement Works in Southern Lantau | SCALE | N.T.S. | DATE | Feb-16 |
| | Representative Photographs of Site Observations Taken during the Ecological Monitoring | CHECK | McmillanSE | DRAWN | TSOIWYC |
| | | JOB NO. | 60278381 | DRAWING NO. | Appendix 5 |



Foraging Grey Heron (*Ardea cinerea*) at PHN1



Foraging Little Egret (*Egretta garzetta*) at LTT1

| | | | | | |
|--------------|--|---------|------------|-------------|------------|
| AECOM | Post-Construction Ecological Monitoring of Drainage Improvement Works in Southern Lantau | SCALE | N.T.S. | DATE | Feb-16 |
| | Representative Photographs of Species of Conservation Importance Taken during the Ecological Monitoring | CHECK | McmillanSE | DRAWN | TSOIWYC |
| | | JOB NO. | 60278381 | DRAWING NO. | Appendix 6 |