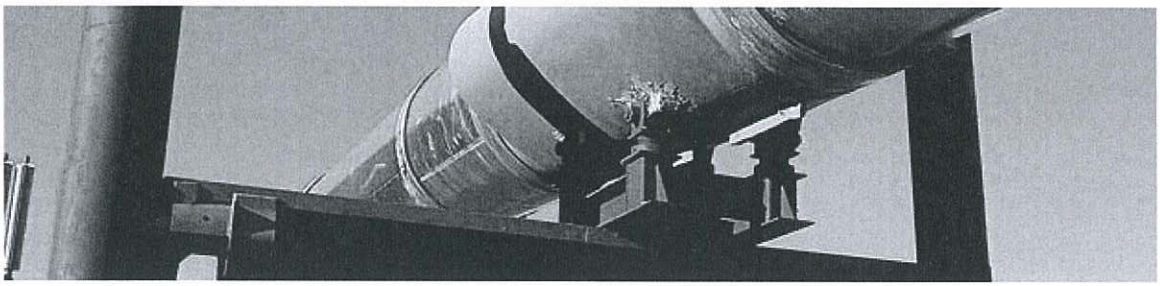

Independent Environmental Checker for Contract No. YL/2009/01 – Hang Hau Tsuen Channel at Lau Fau Shan

Post-Construction Mangrove Monitoring

1st Quarterly Mangrove Monitoring Report (June 2013)

Prepared for:

Civil Engineering and Development Department

Prepared by:

ENVIRON Hong Kong Limited

Date:

Jun 2013

Reference Number:

R3154_V1.1

ENVIRON

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1st Quarterly Mangrove Monitoring Report (June 2013)

Prepared by:

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1.0 INTRODUCTION

1.1 Project Background

1.1.1 Hang Hau Tsuen is situated at the southern part of Lau Fau Shan bordering the Hang Hau Tsuen stream. A channel improvement project under an Environmental Permit (EP no: EP-343/2009) has been carried out to alleviate flooding occurred in the catchment by converting the existing Hang Hau Tsuen stream between Deep Bay and Deep Bay Road to an engineered channel that will meet the required flood protection standards. Habitat restoration will be performed after finished the construction work in the channel. In accordance with Clause 2.16 of the EP and Section 6.4 of the Environmental Monitoring and Audit (EM&A) Manual (the EM&A Manual) under the EP, to mitigate the loss of 0.07 ha of mangrove patches, a total of 0.07 ha (1:1 ratio) area at tidal zone on northern side of the constructed channel will be planted with varies mangrove species. Monitoring was required to assess the growing condition of planted mangrove plants during the Operation Phase of the Project in accordance with Section 6.4 of the EM&A Manual.

1.1.2 The proposal and schedules for Operational Phase monitoring of compensatory mangrove planting had been submitted to AFCD on 14 May 2012. Comments on the proposal had been received from AFCD on 5 June 2012, and the revised proposal and schedules had been submitted to AFCD on 14 November 2012. No comment has been received from AFCD on 19 November 2012.

1.1.3 China-Hong Kong Ecology Consultants Co. (CHEC) has been appointed by ENVIRON Hong Kong Limited as ecologist to undertake the post-construction mangrove monitoring starting from June 2013 for 2 years.

1.1.4 Monitoring will be conducted once every quarter for two years after completion of the mangrove planting in accordance with Section 6.4 of the EM&A Manual.

1.1.5 This is the first monitoring report presents the findings of the initial monitoring survey that was undertaken on 4 June 2013.

2.0 MANGROVE MONITORING MEHTHODOLOGY

2.1 Monitoring Equipment

2.1.1 Monitoring was involved physical measurement and photo record. Thus, tape/metallic ruler, vernier caliper and camera were used for the monitoring.

2.2 Quadrate

2.2.1 Locations of five quadrates of 5m x 5m in size were chosen at representative plantation area. The locations of quadrates were selected based on tidal level, species and ground characteristics as well as accessibility by foot. The location for each quadrate was marked by setting up bamboo or similar material at each corner of quadrates. The species and number of mangrove individual were counted within each quadrate. The location of mangrove zone and quadrates within the channel was shown in **Annex A**.

2.3 Measurement

2.3.1 In order to collect data consistent and comparable in temporal scale, for each planted plant species, 5 selected plants in each quadrate was marked by color rope or ribbon. Color rope or ribbon was tied on tree branch for marking only. No damage or any adverse effect was anticipated on the growth of mangrove trees. There was a maximum of 25 plants for each species will be selected for measurements if the species presented in all 5 quadrates. Every planted species was selected for monitoring. It is expected that at least two mangrove species was planted in the planting area. Maximum height of the selected individual plant was measured to a nearest centimeter based on growing form of plant.

2.3.2 Stem diameter for 5 selected plants of each species in each quadrate was measured by vernier caliper. A mark such as rope/ribbon was made on stem where diameter measurement will be carried out. Same orientation for the vernier caliper will be maintained for each measurement. Measurement will be taken to the nearest millimeter.

2.3.3 The overall health condition was assessed for each species within quadrate. The assessment in some inaccessible location was aided by binocular. The following was the health scheme for the assessment. The rate of survival of the mangroves after planting was estimated by visual observation.

2.3.4 Health scheme:

Good: Low mortality rate. Green foliage color. Dense foliage. No damage from floating rubbish or high water flow.

Fair: Low to medium mortality rate. Less dense foliage. Some yellowish foliage color recorded. Some leave or branches were damaged by floating rubbish, water flow or insect.

Poor: High mortality rate. Highly sparse crown and most foliage were drying up. The plant may be seriously damaged.

2.4 Photo Record

2.4.1 Photos of overall view for mangrove compensation area and each quadrate was taken. For consistence, same photo location and angle for each measurement will try to be maintained but it may need adjustment due to site and plant change. Other site conditions and observations should also be recorded.

3.0 MONITORING RESULTS

3.1 Visual Inspection

3.1.1 The species and the initial total number of mangrove tree were counted within each quadrate. Three species (*Acanthus ilicifolius*, *Kandelia obovata*, *Sonneratia caseolaria*) were planted on the compensatory mangrove planting area. The overall health condition of each species within each quadrate was assessed and shown in **Table 1**. The initial total number and density of mangrove tree within each quadrate were shown in **Table 2**.

3.1.2 Generally, the overall health condition of *Acanthus ilicifolius* was Fair as green foliage color was observed during the monitoring survey. However, the overall health condition of *Kandelia obovata* & *Sonneratia caseolaria* was assessed as "Poor to Fair" in most quadrate due to sparse crown and dried up foliage, which indicated that the species *Kandelia obovata* & *Sonneratia caseolaria* were currently under stress after plantation, thus continuous monitoring of the health condition is recommended.

3.2 Measurement of selected plant individual

3.2.1 Maximum height and stem diameter of maximum 5 selected individual of each species in each quadrate was measured during the monitoring survey. Result of the measurement was shown in **Table 1**.

Table 1 Mangrove plant growth and health monitoring for each planted species

Date: 4 June 2013 Time: 14:30 Temperature: 29°C Tidal condition: Low

Quadrate 1	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Health (G/F/P)
Acanthus ilicifolius	75	12.46	110	14.61							Good
Kandelia obovata	55	13.11	49	13.64	53	12.58	59	21.1	41	12.32	Poor to Fair
Sonneratia caseolaria	133	11.54	149	9.95	108	8.7	85	8.22	134	11.83	Poor to Fair

Quadrate 2	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Health (G/F/P)
Acanthus ilicifolius	60	6.61	108	9.11	86	10.2	124	10.82	98	9.21	Fair
Kandelia obovata	59	12.53	73	14.37	56	15.42	67	15.6	40	13.3	Fair

Quadrate 3	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Health (G/F/P)
Acanthus ilicifolius	95	12.72	90	12.82	122	11.04	92	12.03	86	9.56	Fair
Kandelia obovata	110	12.62	96	16.46	113	13.88	144	16.39	102	10.81	Poor to Fair
Sonneratia caseolaria	103	11.28	125	10.04	158	12.84	65	7.57			Poor to Fair

Quadrate 4	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Health (G/F/P)
Acanthus ilicifolius	105	11.74	96	10.31	93	10.95	76	10.45	84	96.6	Fair

Quadrate 5	Individual 1		Individual 2		Individual 3		Individual 4		Individual 5		Overall health condition
	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)	Diameter (mm)	Health (G/F/P)
Acanthus ilicifolius	113	13.48	74	11.5	63	8.99	99	13.84			Fair
Kandelia obovata	71	16.46	111	17.57	42	10.54	109	13.6	51	12.88	Poor to Fair

Table 2 Record sheet for mangrove plant density and survival rate monitoring

Date	Parameter	Quadrate 1	Quadrate 2	Quadrate 3	Quadrate 4	Quadrate 5
4 Jun 2013	Initial total number of mangrove tree	18	24	31	20	18
	Initial density of mangrove tree (No. of mangrove tree / m^2)	0.72	0.96	1.24	0.8	0.72

3.3 Photographic record

3.3.1 The overall view of the mangrove compensation area and each quadrate was presented by a number of photos taken at specific location along the channel. The photos will be useful to illustrate and compare the mangrove plant condition with future record. The overall view of the mangrove compensation area and each quadrate was presented in **Annex B**, Photo 1-4 and Photo 5-9 respectively.

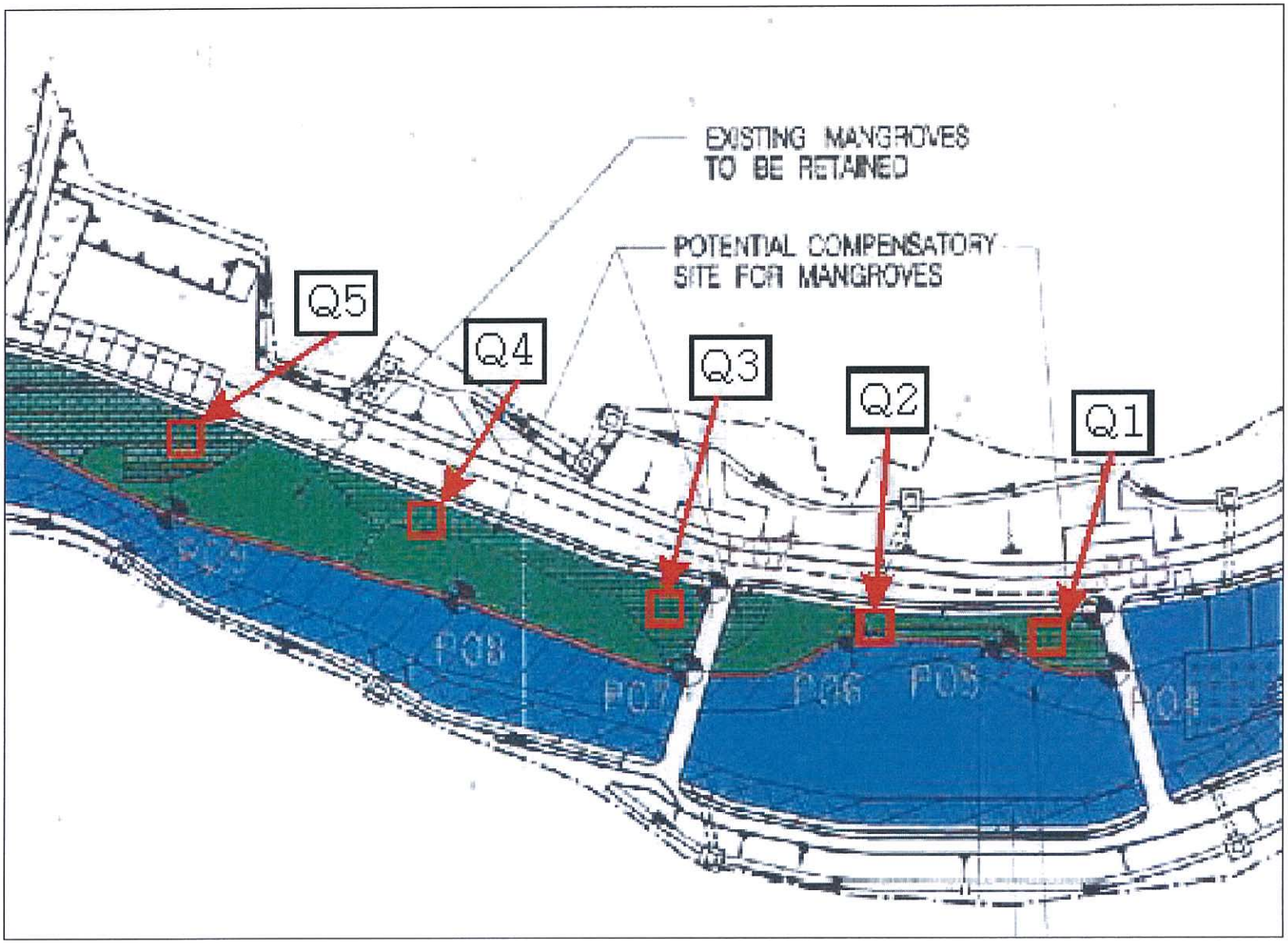
4.0 CONCLUSION

4.1.1 The post-construction mangrove monitoring survey was carried out on 4 June 2013. The species and the initial total number of mangrove tree were counted within each quadrate. The overall health condition of each species within each quadrate was assessed and shown in **Table 1**. The initial total number and density of mangrove tree within each quadrate were shown in **Table 2**.

4.1.2 Generally, the health condition of *Acanthus ilicifolius* was "Fair". However, the health condition of *Kandelia obovata* & *Sonneratia caseolaria* was assessed as "Poor to Fair" in most quadrate due to sparse crown and dried up foliage, which indicated that the species *Kandelia obovata* & *Sonneratia caseolaria* were currently under stress after plantation, thus continuous monitoring of the health condition is recommended.

4.1.3 Maximum height and stem diameter of maximum 5 selected individual of each species in each quadrate was measured; the result of the measurement was shown in **Table 1**. The overall view of the mangrove compensation area and each quadrate was presented in Photo 1-4 and Photo 5-9 respectively.

Annexes



Annex A: Location of mangrove zone and quadrates within Hang Hau Tsuen Channel

1

2

Post-construction mangrove monitoring - June 2013 Overall view of mangrove compensation area	Photo 1 - 2 Date 4th Jun 2013

3

4

Post-construction mangrove monitoring - June 2013 Overall view of mangrove compensation area	Photo 3 - 4 Date 4th Jun 2013

5 Quadrate 1

6 Quadrate 2

Post-construction mangrove monitoring - June 2013 Overall view of Quadrate 1 - 2	Photo 5 - 6 Date 4th Jun 2013

7 Quadrate 3

8 Quadrate 4

Post-construction mangrove monitoring - June 2013 Overall view of Quadrate 3 - 4	Photo 7 - 8 Date 4th Jun 2013

8

Quadrate 5

Post-construction mangrove monitoring - June 2013 Overall view of Quadrate 5	Photo 9 Date 4th Jun 2013

Annex III: Response to Comments

FROM: AGRICULTURE, FISHERIES AND CONSERVATION DEPARTMENT (AFCD) BY: LETTER (REF. IN AF EA 013/09 ANNEX A, DATED 12 JULY 2013)		
Comment No. / Section	**Comments**	**Consultant's Response**
1	Section 3.1.1 -It is noted that three mangrove species including *Acanthus ilicifolius*, *Kandelia obovata* and *Sonneratia caseolaria* were planted on the compensatory mangrove area. While planting of the first two species were recommended in the EM&A Manual (para. 6.5.7 refers), it is undesirable to plant the exotic invasive species, *S. caseolaria*, in the compensation area. The consultant/ CEDD should consider replacing individuals of this exotic species with the other two native species.	According to the joint inspection on 12 September 2013 with representatives of RE, IEC and Contractor, the exotic species, *Sonneratia caseolaria* were confirmed to be replaced with *Acanthus ilicifolius* and *Kandelia obovata* on 3 September 2013.
2	Section 3.1.2- It appears that the planting substrates in the compensatory mangrove area are rather sandy and interspaced with rocks and stones (construction debris?). This may be the reason why the mangrove condition was fair to poor. The consultant should keep monitoring the situation and advise remedial measure if necessary.	Noted. The condition of mangrove species would be kept in view.
3	Section 3.2- To investigate the successfulness of mangrove establishment over time, the consultant should compare the change of measurement parameters between the first and coming quarterly monitoring in the next reports.	Noted. The comparison of the mean height and diameter of the mangrove species would be provided in the subsequent monitoring reports.
4	Table 2 -The consultant should provide the overall survival rate of each mangrove species in the next report. In accordance with the EM&A Manual (para. 6.4.9 refers), replanting should be provided if the survival rate is lower than 75%.	Noted. The survival rate of each mangrove species would be provided in the subsequent monitoring reports.