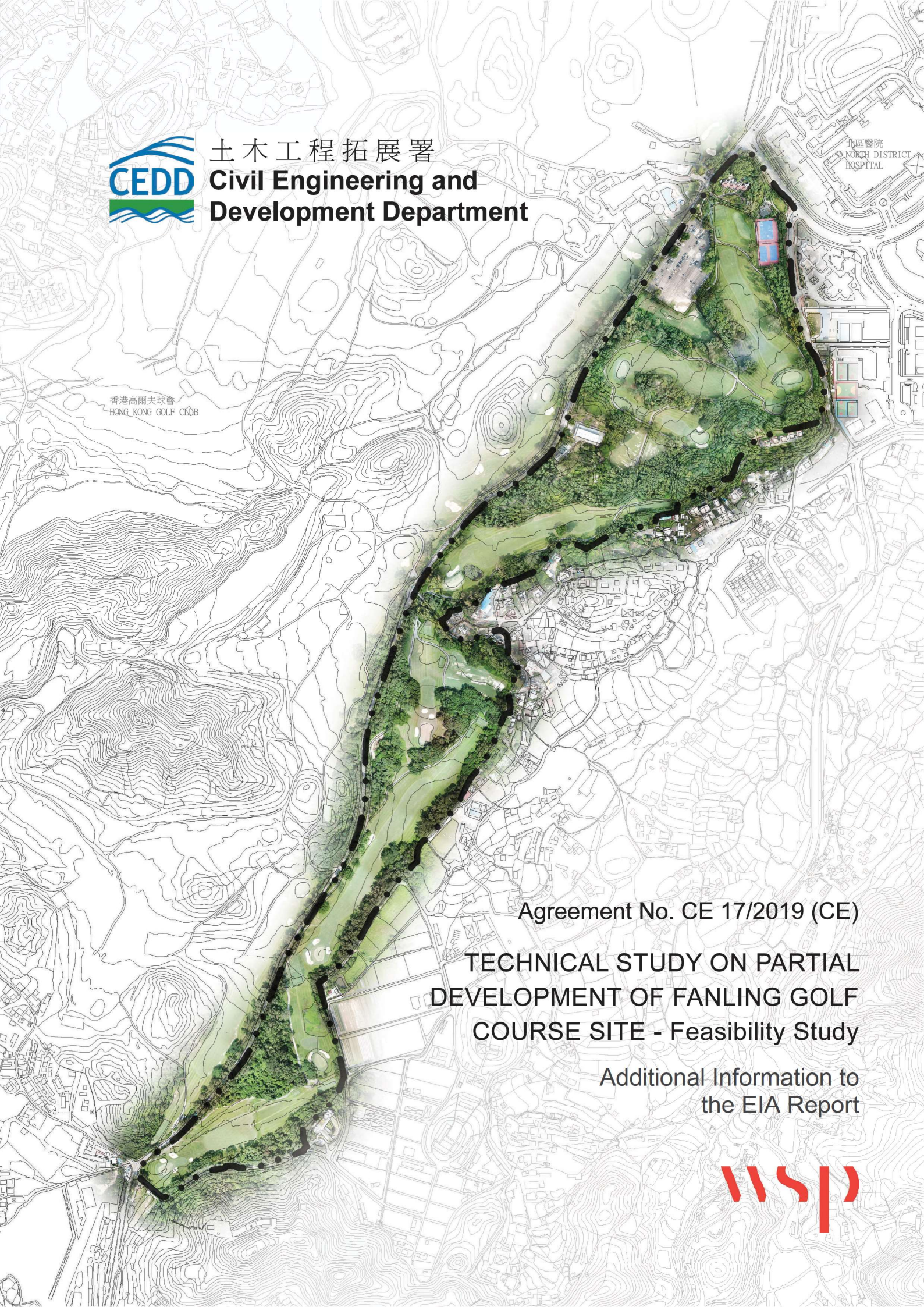


Agreement No. CE 17/2019 (CE)

TECHNICAL STUDY ON PARTIAL DEVELOPMENT OF FANLING GOLF COURSE SITE - Feasibility Study

Additional Information to the EIA Report

WSP

CONTENTS

1 INTRODUCTION & SUMMARY

1.1 Background

1.1.1 The EIA Report for this project was discussed on 8 and 19 August 2022. Subsequently, the Advisory Council on the Environment (ACE) gave their written comments to EPD on 24 August 2022. In view of ACE's concerns, EPD asked CEDD as the project proponent of this project to provide additional information under Section 8(1) of the EIAO on 31 August 2022. The EPD's letter is enclosed in **Appendix 1.1** of this document.

1.1.2 The purpose of this document is to provide the requested additional information in accordance with the EPD's letter for EPD to decide approval of EIA report under Section 8(3) of the EIAO.

1.2 Structure of this Report

1.2.1 This document consists of the following sections:

- Chapter 1 – Introduction & Summary
- Chapter 2 – Additional Bird Survey
- Chapter 3 – Additional Moth Survey
- Chapter 4 – Additional Information of Bat Survey
- Chapter 5 – Tree Compensation Plan and Management Plan
- Chapter 6 – Detailed Layout Plan (with consideration of 0.39ha Woodland preservation)
- Chapter 7 – Hydrological Impact Analysis
- Chapter 8 – Shading Impact to the Trees
- Chapter 9 – Existing Grave in Sub-Area 1

1.2.2 Chapters 2 to 9 cover the additional information requested.

1.3 Summary of Additional Information

1.3.1 **Table 1** below summarizes the list of requested Additional Information.

Table 1 – Summary of Additional Information

Additional Information Requested	Additional Information prepared by CEDD
(a) Additional Bird Survey covering early morning to evening (i.e. before sunrise to 10 pm) to be conducted twice a month from September 2022 to March 2023 (covering the wet and dry seasons) to reaffirm that the overall results of the bird survey conducted in the EIA report are valid. Details of the survey methodology including the types of device used, transect of the survey, qualifications of the personnel conducting the survey as well as the locations, frequency and duration of the survey shall be included	• Additional bird surveys covering the early morning period (1 hour before sunrise to 10 am) were carried out. The 7-months additional bird survey (i.e. September 2022 to March 2023) showed that all bird species recorded in the early morning session were also recorded in the daytime session survey (10 am to 10 pm). It is concluded that **survey effort at the rest of the day (i.e. 10 am – 10 pm), if intensive enough, could cover the lack of early morning bird survey**. • It is **reaffirmed** that the bird survey period adopted in the EIA report (i.e.10 am to 10 pm) is considered **representative**. • Details of the survey methodology adopted and qualifications of personnel for the bird survey have been provided.
(b) Additional Moth Survey covering both evening and mid-night to be conducted twice a month from September to October 2022 to reaffirm the overall result of the moth survey conducted in the EIA report. Two rounds of survey with a duration of two hours each (i.e. one at two hours after sunset and the other one at mid-night between 00:00 and 02:00) should be carried out each night. Details of the survey methodology including the types of device used, location/transect of the survey, qualifications of the personnel conducting the survey as well as the locations, frequency and duration of the survey shall be included	• Based on the 2-months additional moth survey (i.e. September 2022 to October 2022), it is concluded that there are more moths in the evening than at midnight. • It is **reaffirmed** that the moth survey period adopted in the EIA report (i.e. evening (2 hours after sunset)) is considered **representative**. • Details of the survey methodology adopted and qualifications of personnel for the moth survey have been provided.
(c) Details of the survey methodology adopted for the Bat Survey in the EIA report including the coordination of the transects of the surveys,	• Details of the survey methodology adopted and qualifications of personnel for the bat

Additional Information Requested	Additional Information prepared by CEDD
qualifications of the personnel conducting the survey as well as the locations, frequency and duration spent on each Sub-Area	survey have been supplemented to demonstrate that there were **adequate survey efforts** on bat survey during the EIA study.
(d) Tree compensation plan which shall include details of planting numbers with a compensation ratio of at least 1:1.5 having regard to the number of trees affected, locations and tree species to be compensated as well as a management plan taking into account the water demand of the compensatory trees	• It is appreciated that ACE's request arose from a concern that not all compensatory trees will survive after planting. ACE members are assured that the responsible departments will seek to keep the trees in satisfactory condition, and will replace trees not survived, hence fully and continuously complying with the established compensatory requirement of 1:1. • To address the particular concern on survival rate of initial trees being compensated, a tree compensation plan is prepared to require a longer than normal establishment period (i.e. 3 years) and proper following up with the tree management plan. • Over the above established tree compensation requirement of 1:1, trees will be planted following the established practice within the housing site at Sub-Area 1. • Water demand of compensatory trees have been calculated under hydrological impact analysis.
(e) A detailed layout plan of the proposed housing development which shall illustrate, with the help of an overlay plan of the proposed housing blocks, the preservation of an additional 0.39 hectares of secondary woodland in Sub-Area 1 (on top of those woodland, mixed woodland and Trees of Particular Interest (TPI) recommended for preservation in the EIA report), the locations of the trees to be retained, the location, disposition and design of the proposed housing blocks with a view to	• It is reconfirmed that the ecological value of the 0.39ha woodland is "**low to medium**". Its removal would not result in adverse ecological impact. • That said, considerations (i.e. relocating building blocks, further increasing of building height) were given to preserve an additional 0.39ha woodland.

Additional Information Requested	Additional Information prepared by CEDD
minimising adverse ecological impact	• It is concluded that there will be adverse impact on the scale of public housing and range of commercial and public facilities proposed for the development as presented in the detailed layout plan in the EIA report if the woodland in concern is to be preserved.
(f) A detailed analysis of the hydrological impact to show the flow of water, including available information on the profile of soil and bedrock conditions of the project site	• The analysis was carried out by HKU Professor May CHUI, supported with borehole and soil sampling in the Fanling Golf Course. The result reaffirmed that the main water source for the swampy woodland in Sub-Area 4 is not from Sub-Area 1 to Sub-Area 3. • Reclaimed water supply from the Shek Wu Hui Sewage Treatment Works (over 73,000m^3/day) is sufficient to provide irrigation water demand for the compensatory tree planting (about 37m^3/day) and supplement the surface water lost due to housing development in Sub-Area 1 (about 406m^3/day).
(g) Additional analysis on the shading impact of the proposed housing blocks to the trees in the potential development area taking into account the revised layout plan	• Shading impact analysis with sun-path analysis was carried out. It is considered that the impact of shading to the tree cluster to be preserved due to the proposed housing development would not be substantial.
(h) Elaborations on how the grave situated in Sub-Area 1 will be handled and whether the grave could be retained as far as possible	• Only 1 grave will be affected by the development. Consideration to retain the grave was given, but it was not considered practicable. • CEDD will identify and liaise with the offspring to properly remove the grave according to established procedure under Cap 130 Land Acquisition (Possessory Title) Ordinance.

Additional Information Requested	Additional Information prepared by CEDD

2 ADDITIONAL BIRD SURVEY

2.1 Additional Information Required

2.1.1 The additional information requested by EPD is recapped as follows: -

"Additional Bird Survey covering early morning to evening (i.e. before sunrise to 10 pm) to be conducted twice a month from September 2022 to March 2023 (covering the wet and dry seasons) to reaffirm that the overall results of the bird survey conducted in the EIA report are valid. Details of the survey methodology including the types of device used, transect of the survey, qualifications of the personnel conducting the survey as well as the locations, frequency and duration of the survey shall be included in the further information."

2.2 Background and Discussion at the ACE Meeting

2.2.1 The EIA bird survey within the golf course was carried out between 10:00 am and 10:00 pm. The 12-hours survey efforts at day time (from 10 am to 10 pm) covering the active period of the target species near sunset were considered adequate for the survey purpose.

2.2.2 However, some ACE members opined that the omission of early morning period in the EIA bird survey was a deviation from the conventional practice for bird watching, and requested for additional bird survey covering the early morning period before 10 am. In this additional survey, it is intended to, by comparing the survey results of the early morning period (i.e. before 10 am) and that of the 10 am to 10 pm period, verify if the survey results in the period of 10 am to 10 pm are representative.

2.3 Schedule and Methodology of Additional Bird Survey

2.3.1 With the cooperation of the Hong Kong Golf Club (HKGC) to conduct early morning survey within the Fanling Golf Course (FGC), the additional bird survey was conducted within the Potential Development Area (PDA) twice a month from September 2022 to March 2023 covering the wet and dry seasons. The survey programme is shown in **Table 2A**. The exact date and time of the survey are shown in **Appendix 2.1**. Weather forecast was checked prior to all survey dates to avoid adverse weather conditions.

Table 2A – Programme for the Additional Bird Survey

Year	2022				2023		
Season	Wet	Wet/ Transition	Dry				
Month	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Bird survey	twice a month						

2.3.2 The survey commenced about 1 hour before sunrise to 10:00 pm. All birds seen or heard in both sides of the transects (**Figure 2A**) were identified and counted. The birds were recorded by various habitats within the 4 Sub-Areas of the PDA and by different time sessions (i.e. before 10 am and after 10 am). The survey was aided with binoculars of 8x to 10x magnification. Ornithological nomenclature followed the latest Hong Kong Bird Watching Society List of Hong Kong Birds or Hong Kong Biodiversity Information Hub.

2.3.3 The survey within the PDA was conducted using transect count method (**Figure 2A** below). Diversity and abundance of birds in the 4 Sub-Areas were compared. As the birds were also recorded by different time sessions, temporal patterns of birds including species composition and abundance were analyzed, in particular the time sessions of early morning session (~1 hour before sunrise to 10:00 am) versus the daytime session (10:00 am to 10:00 pm).

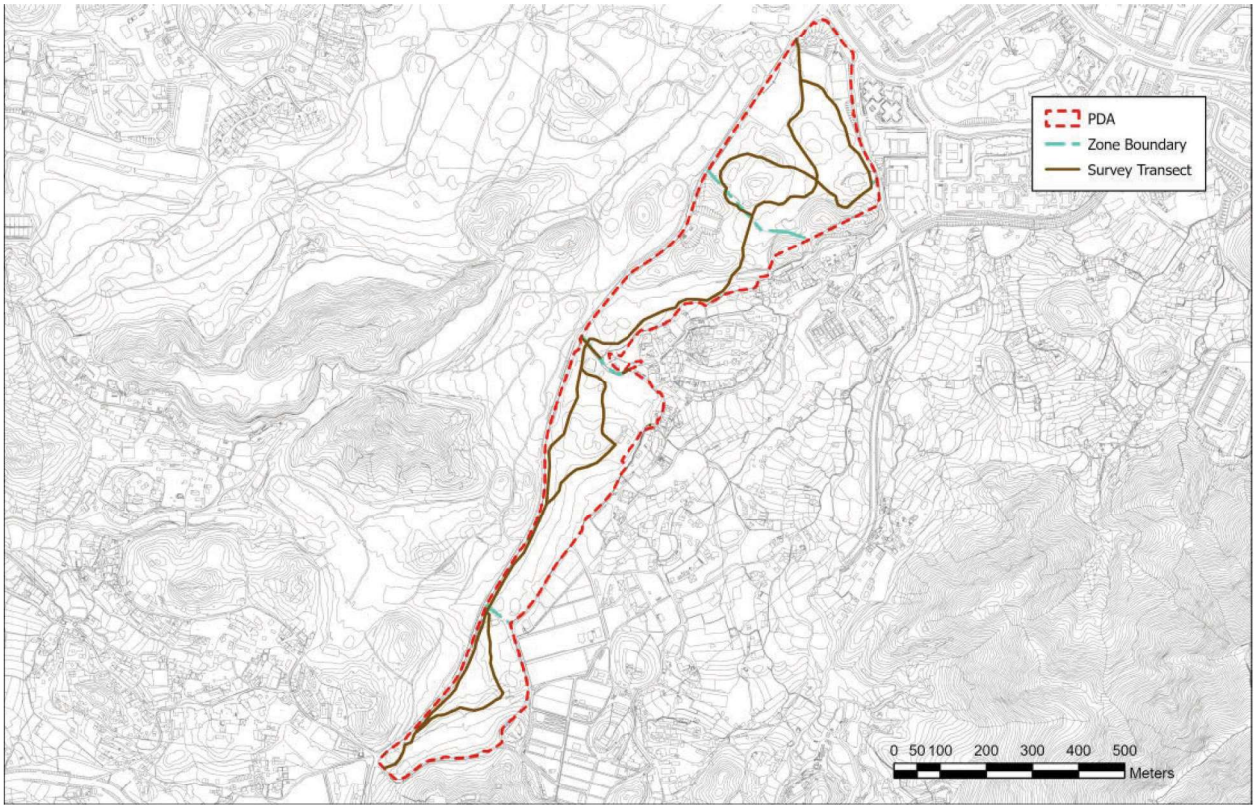


Figure 2A – Survey transects of the additional bird survey

2.3.4 The survey was conducted by two teams, with at least two surveyors per team. One team was responsible for Sub-Areas 1 and 2, and another team was responsible for Sub-Areas 3 and 4. The survey was conducted by both teams at the same time. The surveyors followed the survey transects and recorded the birds along the transects.

2.4 Findings in Additional Bird Survey

2.4.1 A total of 54 species of bird was recorded between September 2022 and March 2023 within the 4 Sub-Areas of the PDA. Please refer to **Table 2B** for details.

2.4.2 54 bird species were found in the daytime session (10:00 am and 10:00 pm) and 47 out of these 54 species were found in the early morning session. There were 7 species (i.e., Asian Barred Owlet, Black-naped Oriole, Brown-headed Thrush, Chestnut Bulbul, Dusky Warbler, Eastern Yellow Wagtail, and Yellow-legged Buttonquail) present in the daytime session but not recorded in the early morning session. The results reaffirm that the methodology adopted in the EIA bird survey, i.e. conducting survey from 10 am to 10 pm, is representative.

Table 2B – Species and Abundance of Bird Recorded in Early Morning (~1 hour before sunrise to 10:00 am) and in Daytime (10:00 am to 10:00 pm) for the Additional Survey

No.	Common Name	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)		
			Early morning (1 hr before sunrise to 10:00 am)	Day time (10:00 am-10:00 pm)
1	Arctic Warbler	PM	✓	✓
2	Asian Barred Owlet	PM	×	✓
3	Asian Brown Flycatcher	PM	✓	✓
4	Asian Koel	R	✓	✓
5	Black Drongo	OS	✓	✓
6	Black-collared Starling	R	✓	✓
7	Black-naped Oriole	PM	×	✓
8	Black-throated Laughingthrush	R	✓	✓
9	Brown-headed Thrush	PM, OW	×	✓
10	Chestnut Bulbul	R, OW	×	✓
11	Chestnut-collared Yuhina	OW, OS	✓	✓
12	Chinese Blackbird	PM, OW	✓	✓
13	Chinese Bulbul	R	✓	✓
14	Chinese Pond Heron	R	✓	✓
15	Cinereous Tit	R	✓	✓
16	Collared Scops Owl	R	✓	✓
17	Common Emerald Dove	R	✓	✓
18	Common Tailorbird	R	✓	✓
19	Crested Myna	R	✓	✓
20	Dark-sided Flycatcher	PM	✓	✓
21	Daurian Redstart	OW	✓	✓
22	Dusky Warbler	PM, OW	×	✓
23	Eastern Cattle Egret	R, PM	✓	✓
24	Eastern Yellow Wagtail	PM, OW	×	✓
25	Eurasian Tree Sparrow	R	✓	✓
26	Fork-tailed Sunbird	R	✓	✓
27	Great Egret	R, PM, OW	✓	✓
28	Grey Bush Chat	PM, OW	✓	✓
29	Grey Wagtail	PM, OW	✓	✓
30	Grey-backed Thrush	PM, OW	✓	✓
31	Grey-chinned Minivet	R	✓	✓
32	Hair-crested Drongo	PM, OW	✓	✓

No.	Common Name	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)		
			Early morning (1 hr before sunrise to 10:00 am)	Day time (10:00 am-10:00 pm)
33	Japanese White-eye	R	✓	✓
34	Little Egret	R, PM, OW	✓	✓
35	Little Grebe	R	✓	✓
36	Masked Laughingthrush	R	✓	✓
37	Mugimaki Flycatcher	PM, OW	✓	✓
38	Olive-backed Pipit	PM, OW	✓	✓
39	Oriental Magpie Robin	R	✓	✓
40	Pale-legged Leaf Warbler	PM	✓	✓
41	Pallas's Leaf Warbler	PM, OW	✓	✓
42	Red-billed Blue Magpie	R	✓	✓
43	Red-throated Flycatcher	R	✓	✓
44	Red-whiskered Bulbul	R	✓	✓
45	Scarlet Minivet	R	✓	✓
46	Scarlet-backed Flowerpecker	R	✓	✓
47	Spotted Dove	R	✓	✓
48	Velvet-fronted Nuthatch	R	✓	✓
49	White Wagtail	R, PM, OW	✓	✓
50	White-bellied Erpornis	R	✓	✓
51	White-breasted Waterhen	R	✓	✓
52	White's Thrush	PM, OW	✓	✓
53	Yellow-browed Warbler	PM, OW	✓	✓
54	Yellow-legged Buttonquail	PM, OW	×	✓
		Total Species	47	54

2.4.3 Comparison of the quantity of bird species and density among the 4 Sub-Areas for both the early morning session and the daytime session is in **Table 2C**.

2.4.4 It is observed that more bird species were recorded in the daytime session than the early morning session for all the 4 Sub-Areas.

2.4.5 As the sizes of the 4 Sub-Areas are different, the bird abundance recorded in each Sub-Area is converted to density (bird abundance per hectare) for comparison. It is observed that bird density in the daytime session in all Sub-Areas was higher than or same as that in the early morning session.

Table 2C – Bird Species and Density among the 4 Sub-Areas in Different Sessions

		PDA Sub-Area				Overall
		1 (11ha)	2 (7ha)	3 (8.5ha)	4 (5ha)	
Bird species	Early morning	30	31	35	31	47
	Daytime	31	40	38	41	54
Bird abundance/ha (density)	Early morning	20	27	29	41	29
	Daytime	20	33	32	49	33

2.5 Clarification on Survey Methodology

2.5.1 Findings of the additional bird survey are in line with the research study (Robbins, C.S. 1981. Effect of Time of Day on Bird Activity. Studies in Avian Biology 6:275-286) that if the survey time cannot be conducted in the best timing (i.e., early morning as viewed by ACE members in the present case), more survey effort (such as slower walking or longer listening periods in the research, or longer survey time in our survey i.e., 10:00 am-10:00 pm) can compensate for decreased bird activity. Findings of the additional bird survey showed that more bird species were recorded in the daytime session than the early morning.

2.5.2 Besides, both the bird species and the bird density of Sub-Area 1 were lower than Sub-Areas 2 to 4, in both the early morning session and the daytime session. The same pattern was reported in the EIA Report, based upon the bird survey for the EIA conducted between 10:00 am and 10:00 pm.

2.5.3 The majority of the birds within the assessment area, especially within the FGC are land birds (referring to birds inhabiting land habitats such as woodland, shrubland or grassland). Land birds basically reside inside or stay close to their roosting habitats, and thus would not be only present at a specific time of a day. If the bird survey is carried out for a sufficiently long period, they could be recorded by the survey at different times of a day. Based on the above, bird survey within the FGC between 10:00 am and 10:00 pm and throughout the day, covering the morning, the afternoon, the dusk and night-time is adequate for establishing the ecological baseline of birds within the FGC, and meeting the requirement under the EIAO Technical Memorandum and the EIAO Guidance Note No. 10/2010.

2.5.4 In one of the references listed in the EIAO Guidance Note 10/2010, i.e., "Birds Census Techniques", it states that activity and song output (of bird) is also high in dusk. The bird survey during the EIA within the FGC carried out between 10:00 am and 10:00 pm has already well covered the high activity time of birds in the dusk.

2.6 Conclusion of Additional Survey

2.6.1 In conclusion, the 7-months additional bird survey (i.e. September 2022 to March 2023) results already illustrated that daytime session survey (10 am to 10 pm) could record all bird species in early morning session (sunrise to 10 am). It is concluded that more survey effort at the rest of the day (i.e. 10 am to 10 pm) could cover the lack of early morning bird survey, and reaffirmed that the bird survey period adopted in the EIA report (i.e. 10 am to 10 pm) is considered **representative**. The bird survey conducted under the EIA is **valid for assessment**.

2.7 Qualification of Surveying Staff

2.7.1 Both the EIA and the additional bird surveys were conducted by two teams in the 4 Sub-Areas. Each team consisted of a key surveyor who had at least 5 years of relevant experience, as well as a surveyor with relevant academic qualification, e.g., Biology, Environmental Science. Qualification and relevant experience of the key surveyors are shown in **Table 2D**.

Table 2D – Information of Key Surveyor for the EIA and the Additional Bird Surveys

Key surveyor	Qualification	Relevant experience	Year of relevant experience
1. Dr. HK Kwok	PhD in Ecology and Biodiversity (HKU)	Conducted a PhD study on woodland birds in Tai Po Kau Nature Reserve; published a number of academic papers and a book related to bird ecology; conducted bird surveys for different ecological impact assessment	28
2. Dr. Klinsmann Cheung	PhD in Environmental Science (CUHK)	Received advanced bird banding course in US; got awards in bird watching competition; reported birds of Hong Kong first record; conducted bird surveys for different ecological impact assessment	20
3. Mr. Alan Lam	Bird trainer for bird watching society (LU)	Provided bird training course for Hong Kong Bird Watching Society (HKBWS); Bird Surveyor of HKBWS, got awards in bird watching competition; conducted bird surveys for different ecological impact assessment	20

Key surveyor	Qualification	Relevant experience	Year of relevant experience
4. Mr. Anson Lai	BSc in Applied Science (OUHK/ HKMU)	Ecological Surveyor including bird survey for a project named Discovering Biodiversity in Hong Kong Wetlands, organized by WWFHK; Nature Interpreter (focus on bird) for Mai Po Wetland; Assistant Teacher, Ho Koon Nature Education cum Astronomical Centre; conducted bird surveys for different ecological impact assessment	12
5. Ms. Nicole Lau	MSc in Environmental Management (HKU)	Eco-tour guide (including bird); Nature Interpreter Training Program (focus on bird) for Mai Po Wetland (Nature with No Barriers) at Mai Po Nature Reserve, WWFHK; conducted bird surveys for different ecological impact assessment	6
6. Mr. Howard Chan	MSc in Ecology, Evolution and Conservation (Imperial College London)	M.Sc. research on the dispersal behaviour of bird species in UK; conducted bird surveys for different ecological impact assessment	5
7. Mr. Ernest Chiu	MSc in Environmental Management (HKU)	Took part in the reintroduction program for the critically endangered Yellow-breasted Bunting, bird ringing and tracking; conducting tern surveys, analysing data of the Hong Kong Sparrow Census, leading birdwatching tours for Hong Kong Bird Watching Society; conducted bird surveys for different ecological impact assessment	5
8. Mr. Oscar So	BSc in Applied Biology (CityU)	Eco-tour guide (including bird) volunteer, Green Hong Kong Green of The Conservancy Association (including bird); conducted bird surveys for different ecological impact assessment	5
9. Mr. Lau Chi Ki	BSc in Biodiversity and Ecology (HKU)	Outdoor fauna researcher at Wolong National Nature Reserve, Eco-tour guide at Mai Po Nature Reserve (focus on bird), WWFHK; conducted bird surveys for different ecological impact assessment	5

Key surveyor	Qualification	Relevant experience	Year of relevant experience
10. Mr. Tang Shun Long	BSc in Biodiversity and Ecology (HKU)	Ecological Surveyor of Waterbird Monitoring Programme at Mai Po Wetland, HKBWS; Young Scientist Surveyor, Lung Fu Shan Environmental Education Centre; conducted bird surveys for different ecological impact assessment	5

3 ADDITIONAL MOTH SURVEY

3.1 Additional Information Required

3.1.1 The additional information requested by EPD is recapped as follows: -

"Additional Moth Survey covering both evening and mid-night to be conducted twice a month from September to October 2022 to reaffirm the overall result of the moth survey conducted in the EIA report. Two rounds of survey with a duration of two hours each (i.e. one at two hours after sunset and the other one at mid-night between 00:00 and 02:00) should be carried out each night. Details of the survey methodology including the types of device used, location/transect of the survey, qualifications of the personnel conducting the survey as well as the locations, frequency and duration of the survey shall be included in the further information."

3.2 Background and Discussion at the ACE Meeting

3.2.1 Under the EIA moth survey, moth traps were set up to capture moth samples for two hours after sunset, which is considered as the active time of moth.

3.2.2 Given that it was the first moth survey in the EIA projects thus far, some ACE members had questions about the active time of moth. To help reaffirm that the moth survey period adopted in the EIA report (i.e. evening (2 hours after sunset)) is representative, the ACE requested for an additional moth survey, which should be carried out two rounds per night, one within two hours after sunset and another from midnight to 2:00 am. The ACE also requested for details of survey methodology and qualifications of personnel for the moth survey.

3.3 Schedule and Methodology of Additional Moth Survey

3.3.1 The additional moth survey was conducted within the PDA twice a month from September 2022 to October 2022. The additional moth survey programme is shown in **Table 3A** and the exact date and time of the survey are shown in **Appendix 3.1**.

Table 3A – Additional Moth Survey Programme

Year	2022	
Season	Wet	Wet/Transitional
Month	September	October
Moth survey	Twice a month	

3.3.2 Moth survey was conducted by deployment of UV light moth traps (using Compact 20W Actinic Skinner Moth Trap (12V)) driven by portable battery in the 4 Sub-Areas of the PDA. Two rounds of survey with a duration of two hours each, i.e., one at two hours after sunset and the other one between 12:00 midnight and 2:00 am were carried out each night.

3.3.3 For each Sub-Area, 1 moth trap was deployed at the same location for the two rounds of survey each night, i.e., 4 traps were deployed within the PDA each night for two rounds. In other words, total of eight rounds of survey per night and total of 32 rounds of survey between September 2022 and October 2022 were carried out.

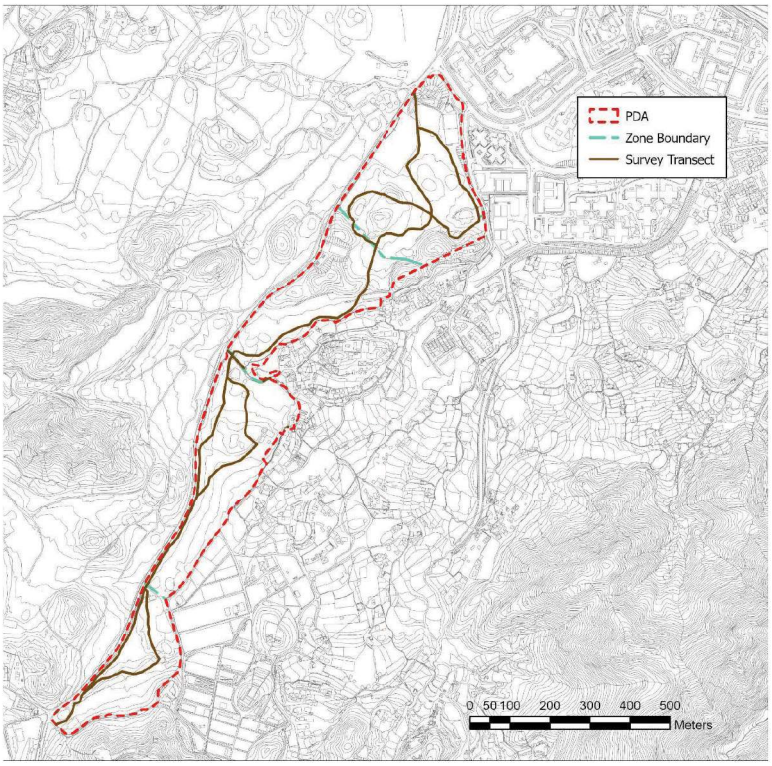


Figure 3A – Survey transect of the additional moth survey

3.3.4 The 4 moth traps deployed each night were operated by 2 teams (at least two personnel per team), one team was responsible for Sub-Areas 1 and 2, another team was responsible for Sub-Areas 3 and 4. Both teams conducted the survey at the same time. Besides deploying moth traps, active search for moth following a fixed transect, which was in line with the EIA moth survey, as shown in **Figure 3A** above, was also conducted for each round.

3.3.5 The moth specimens collected in the moth trap and from the active search were photographed for identification. All the moth specimens were identified by Professor Wang Min, who is a renowned moth expert of South China Agricultural University.

3.3.6 As the moths were recorded by the two sessions, i.e., one at two hours after sunset and the other one between 12:00 midnight to 2:00 am, temporal patterns of moths including species composition and abundance were analyzed.

3.4 Findings in Additional Moth Survey

3.4.1 Total of 28 species of moth was recorded within the 4 Sub-Areas of PDA as shown in **Appendix 3.2** and summarized in **Table 3B** below. Among the 28 species, 25 species could be found in the after sunset session, while 13 species could be found in the midnight session. Most of the species recorded in the midnight session were also recorded in the after sunset session, except 3 species that are not considered as species of conservation importance. On the other hand, 15 species of moth recorded in the after sunset session were not recorded in the midnight session.

3.4.2 **Table 3C** summarizes the moth species and density among the 4 Sub-Areas of the PDA as well as the comparison between after sunset and midnight sessions. Both moth species and density were higher for the after sunset session than the midnight session for all the Sub-Areas.

Table 3B – Species and Abundance of Moth Recorded After Sunset and Midnight within the PDA

No.	Species	Abundance	
		Sunset	Midnight
1	Arctiidae	✓	×
2	*Asota plaginota*	✓	✓
3	*Athetis bremusa*	×	✓
4	*Bocula marginata*	✓	×
5	*Cnaphalocrocis medinalis*	✓	✓
6	*Episteme lectrix*	✓	×
7	*Hamodes* sp.	✓	✓
8	*Herpetogramma* sp.	×	✓
9	*Homona coffearia*	✓	×
10	*Hyposidra talaca*	✓	×
11	*Lamoria* sp.	✓	×
12	*Laspeyria ruficeps*	✓	×
13	*Leucania designata*	✓	×
14	*Lophoruza lunifera*	✓	×
15	*Macroglossum* sp.	✓	×
16	*Meridemis* sp.	✓	×
17	*Nyctemera adversata*	✓	✓
18	*Pidorus gemina*	✓	✓
19	*Pleuroptya chlorophanta*	✓	✓
20	*Pleuroptya obfuscalis*	×	✓
21	*Problepsis vulgaris*	✓	×
22	Pterophoridae	✓	×
23	*Spodoptera litura*	✓	✓
24	*Spodoptera* sp.	✓	✓
25	*Spoladea recurvalis*	✓	✓
26	*Syntytispis* sp.	✓	×
27	*Ugia purpurea*	✓	✓
28	*Xenoplia trivalis*	✓	×
Total species number		**25**	**13**

Table 3C – Moth Species and Density among the 4 Sub-Areas After Sunset and Midnight

		PDA Sub-Area				Overall
		1 (11ha)	2 (7ha)	3 (8.5ha)	4 (5ha)	
Moth species	Evening	8	10	14	4	25
	Midnight	7	5	4	3	13
Moth abundance/ha (density)	Evening	4	7	9	12	8
	Midnight	2	3	3	4	3

3.5 Clarification on Survey Methodology

3.5.1 Methodology of moth survey, including moth trap types used, and time and duration for setting up the moth traps was based on the recommendation from Prof. Wang after his site visit in January 2020.

3.5.2 The additional moth survey showed that the number of moth species and abundance were higher after sunset than at midnight. As advised by Prof. Wang, most of the moths are active near sunset, which is a common commencing time for other moth studies, therefore it is appropriate to set up moth traps near the sunset. As the PDA is relatively open, moths inside the PDA can be attracted to the moth trap within a short period of time. The standardized sampling efforts of 2 hours for each trap used for sampling is sufficient to yield objective results for establishing the ecological baseline for the assessment according to Prof. Wang. Setting up moth traps for longer period however is not recommended, as moth species further away from the survey location, such as habitats outside the PDA, may also be attracted and the evaluation and impact assessment may be affected.

3.6 Conclusion of Additional Survey

3.6.1 Based on the 2-months additional moth survey (i.e. September 2022 to October 2022), it is concluded that more moths were found in the evening than at midnight, which revealed that evening is the active time of moth. It is reaffirmed that the moth survey period adopted in the EIA report (i.e. evening (2 hours after sunset)) is considered **representative**. The moth survey conducted under the EIA is **valid for assessment**.

3.7 Qualification of Surveying Staff

3.7.1 All surveyors for the EIA and additional moth survey attended an online briefing given by Prof. Wang, before commencement of the moth survey. Both the EIA and the additional moth surveys were conducted by two teams in the 4 Sub-Areas. Each team consisted of a key surveyor who had at least 5 years of relevant experience, as well as a surveyor with relevant academic qualification, e.g., Biology, Environmental Science. Qualification and relevant experience of the key surveyors are shown in **Table 3D**.

Table 3D – Information of Key Surveyor for the EIA and the Additional Moth Surveys

Key surveyor	Qualification	Relevant experience	Year of relevant experience
1. Dr. Klinsmann Cheung	PhD in environmental science (CUHK)	PhD studies related to insect recolonization and diversity; got awards in butterfly watching competition; conducted insect surveys for different ecological impact assessment	20
2. Mr. Alan Lam	Assistant manager at Fung Yuen (LU)	Conducted butterfly / insect studies at Fung Yuen; provided training to butterfly surveyor; conducted insect surveys for different ecological impact assessment	20
3. Mr. Anson Lai	BSc in Applied Science (OUHK/ HKMU)	Nature Interpreter for Mai Po Wetland; Assistant Teacher, Ho Koon Nature Education cum Astronomical Centre; conducted insect surveys for different ecological impact assessment	12
4. Mr. Howard Chan	MSc in Ecology, Evolution and Conservation (Imperial College London)	Fung Yuen Butterfly Reserve Baseline Butterfly Surveyor at Fung Yuen Butterfly; conducted insect surveys for different ecological impact assessment	5
5. Mr. Ken Mok	MSc in Biodiversity and Taxonomy of Plants (University of Edinburgh)	Completed Fung Yuen Butterfly Reserve Butterfly Baseline Survey Program for Tertiary Students; got awards in butterfly watching competition; conducted insect surveys for different ecological impact assessment	5

Key surveyor	Qualification	Relevant experience	Year of relevant experience
6. Mr. Ernest Chiu	MSc in Environmental Management (HKU)	MSc dissertation related to insect conservation; conducted butterfly / insect studies for Green Power and Lung Fu Shan Environmental Education Centre; conducted insect surveys for different ecological impact assessment	5
7. Mr. Oscar So	BSci in Applied Biology (CityU)	Conducted insect surveys for different ecological impact assessment	5

4 ADDITIONAL INFORMATION OF BAT SURVEY

4.1 Additional Information Required

4.1.1 The additional information requested by EPD is recapped as follows: -

"Details of the survey methodology adopted for the Bat Survey in the EIA report including the coordination of the transects of the surveys, qualifications of the personnel conducting the survey as well as the locations, frequency and duration spent on each Sub-Area."

4.2 Clarification on Survey Methodology

4.2.1 Below paragraphs summarize the methodology adopted for the bat survey in the EIA report. It is demonstrated that there were **adequate survey efforts** on bat survey during the EIA study.

4.2.2 It is a common practice to conserve bat roost as direct impact on bat roost would affect the species population level, as supported by international publications and research papers, e.g., 鄭錫奇等 1999; Sheffield et al. 1992. Hence, attention was paid on bat roost location in local EIA studies, e.g., EIA for NENT NDA, Mai Po Nature Reserve Infrastructure Upgrade Project etc.

4.2.3 Based on the reviewed literature, including the EIA for NENT NDA, and the report submitted by HKGC to the Task Force on Land Supply in 2018, 8 species of bat were found within the FGC. However, both the EIA for NENT NDA, and the 2018 HKGC's Report do not include any information of the presence of bat roosting/breeding sites. As protection of their roosting sites is the major approach from bat conservation perspective, investigation of whether there are any bat roosting/breeding sites within the assessment area, especially the PDA, is important for assessment of the ecological value of the PDA. An important target of the bat survey was to find out if any bat roosting/breeding sites were present within the PDA and their locations, if any. Bat assessment focusing on searching for roosting/breeding sites is also adopted in other EIA studies, such as Mai Po Extension, and NENT NDA EIAs. During the bat survey for the EIA, bat roosting/breeding sites were searched actively in habitats (including different types of woodlands) along the transects monthly in the 4 Sub-Areas between January 2020 and October 2020 during the daytime between ~10:00 am to ~5:00 pm. More attention was paid to the preferred roosting habitats along the transects for those species listed in the reviewed literature, please refer to **Table 4A** for details. In addition, potential commuting, foraging, and drinking sites of bats were searched, if any. The survey was conducted by two teams (at least two personnel per team), one team was responsible for Sub-Areas 1 and 2, another team was responsible for Sub-Areas 3 and 4. Both teams conducted the survey at the same time. The survey transects and the locations of the preferred habitats within the PDA are shown in **Figure 4A**.

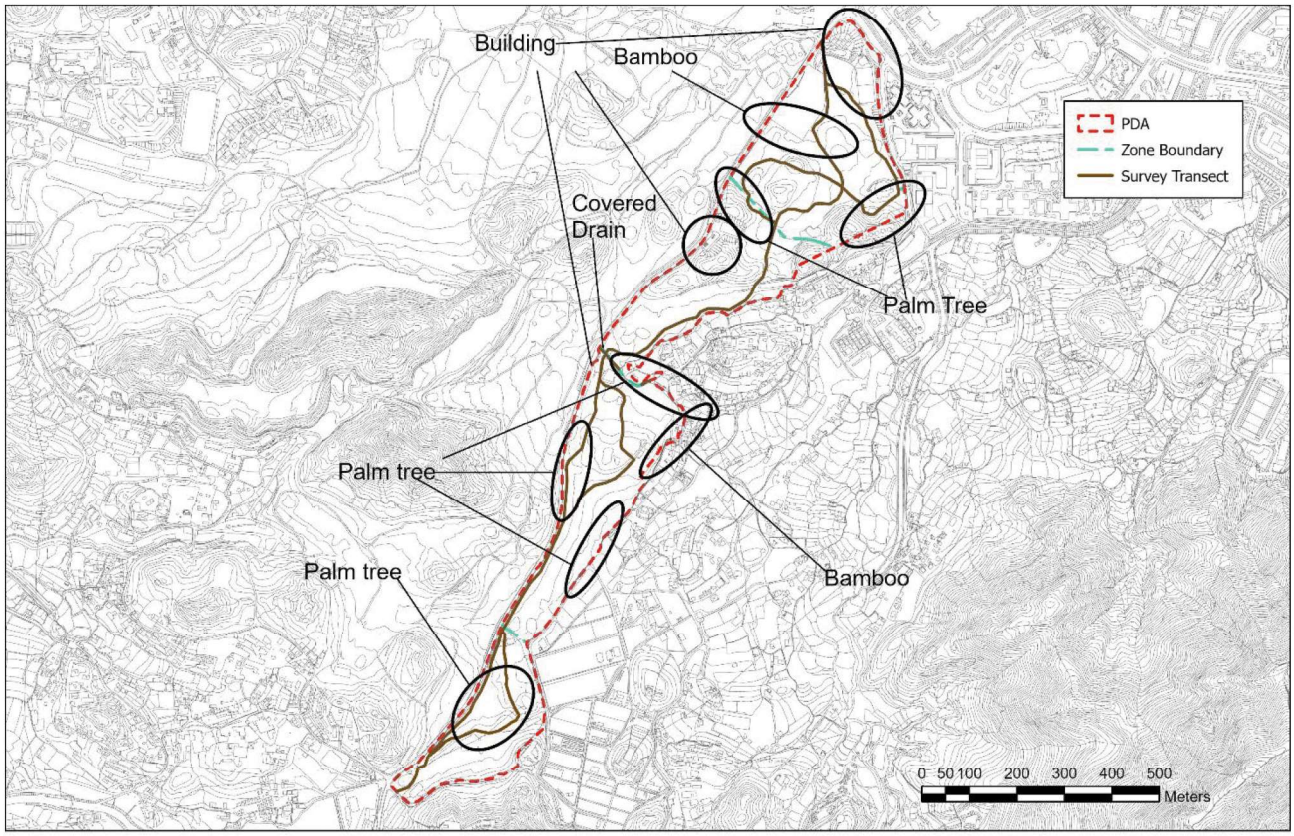


Figure 4A – Bat survey location under the EIA Report (woodlands covered by the survey transects were also actively searched)

4.2.4 Additionally, handheld bat detector (Wildlife Acoustic EM3+, also adopted by AFCD) was used to detect bat emerging from potential habitats in the evening according to their emerging time from roosts, i.e., between ~5:00 pm and ~10:00 pm. The emergence times (included active times) for all bat species are all close to and within a short time after sunset. No late emergence bat was reported based on the reviewed literature as shown in **Table 4A**. The survey with handheld bat detector was also conducted monthly between January 2020 and October 2020 by two teams.

Table 4A – Roosting Habitats and Emergence Time of the Bat Species from Reviewed Literature

Name	Major Roosting habitats[1,2]	Emergence time
Short-nosed Fruit Bat	Chinese Fan-palm, Petticoat Palm, building	Become active within 2-3 hours after sunset
Lesser Bamboo Bat	Bamboo forest	
Lesser Yellow Bat	Building	
Intermediate Horseshoe Bat	Cave, mine, tunnel, abandoned building	
Himalayan Leaf-nosed Bat	Abandoned building, cave, mine, tunnel	
Chinese Noctule/ Brown Noctule	Building, woodland	
Japanese Pipistrelle	Building, woodland	
Myotis sp.	Cave, mine, tunnel	

4.2.5 As all bat species concerned should start their activities and be most active in the evening and after sunset, the survey within the PDA has already covered their most active duration of a day.

4.3 Qualification of Surveying Staff

4.3.1 The bat survey for the EIA was conducted by two teams in the 4 Sub-Areas. Each team consisted of a key surveyor who had at least 5 years of relevant experience, as well as a surveyor with relevant academic qualification, e.g., Biology, Environmental Science. Qualification and relevant experience of the key surveyors are shown in **Table 4B**.

[1]Shek, C.T. A Field Guide to the Terrestrial Mammals of Hong Kong. AFCD
[2] Kadoorie Farm & Botanic Garden (KFBG) (2006). *Focus on Hong Kong Bats: Their Conservation and the Law*. Retrieved June 20022 from http://www.bio.bris.ac.uk/research/bats/China%20bats/Focus%20on%20Hong%20Kong%20Bats%20%5BA5%20format%5D.pdf

Table 4B – Information of Key Surveyor for the EIA Bat Survey

Key surveyor	Qualification	Relevant experience	Year of relevant experience
1. Dr. HK Kwok	PhD in ecology and biodiversity (HKU)	Conducted mammal surveys including bat for different ecological impact assessment; conducted bat exclusion and design of bat box as mitigation measure for bat	22
2. Dr. Klinsmann Cheung	PhD in environmental science (CUHK)	Conducted mammal surveys including bat for different ecological impact assessment; assisted in mist netting for bat in Hong Kong Wetland Park; conducted bat exclusion and design of bat box as mitigation measure for bat; conveyed bat ecological information to visitors in Mai Po Nature Reserve	17
3. Mr. Alan Lam	Bird Trainer for Hong Kong Bird Watching Society, Assistant manager at Fung Yuen (LU)	Conducted mammal surveys including bat for different ecological impact assessment	12
4. Mr. Anson Lai	BSc in Applied Science (OUHK/ HKMU)	Ecological Surveyor for a project named Discovering Biodiversity in Hong Kong Wetlands, organized by WWFHK; Nature Interpreter for Mai Po Wetland; Assistant Teacher, Ho Koon Nature Education cum Astronomical Centre; conducted mammal surveys for different ecological impact assessment	10
5. Mr. Ernest Chiu	MSc in Environmental Management (HKU)	Assisted AFCD to conduct mammal survey; led ecotours for the Kadoorie Farm and Botanic Garden, Green Sense and LFSEEC.	5
6. Mr. Oscar So	BSc in Applied Biology (CityU)	Conducted mammal surveys including bat for different ecological impact assessment	5

5 TREE COMPENSATION PLAN AND MANAGEMENT PLAN

5.1 Additional Information Required

5.1.1 The additional information requested by EPD is recapped as follows: -

"Tree compensation plan which shall include details of planting numbers with a compensation ratio of at least 1:1.5 having regard to the number of trees affected, locations and tree species to be compensated as well as a management plan taking into account the water demand of the compensatory trees."

5.2 Background and Discussion at the ACE Meeting

5.2.1 There would be 996 trees to be removed based on the proposed housing development in Sub-Area 1. With a view of compensating the trees to be removed, 996 compensatory trees is proposed to be planted in Sub-Area 3 or other suitable locations in a ratio of 1:1 under the EIA.

5.2.2 Some ACE members concerned that survival rate of compensatory tree planting would be about 50% and suggested increasing the compensatory tree planting ratio to 1:1.5 to compensate the compensatory trees non-survived.

*[Extract from para. 33 of the ACE minutes of meeting: "One of the above Members opined that the total area of tree compensation should be no less than that of the woodland lost. Pointing out that **the survival rate of trees planting would be about 50%**, the Member suggested that the compensation ratio in terms of area should be more than 1:1 unless the compensatory tree planting in Sub-Areas 2 to 3 would have adverse impact on the Chinese Swamp Cypress."*

*[Extract from paragraph 34 of the ACE minutes of meeting: "A Member echoed with another Member that tree compensation in terms of number and area should be further increased **considering the survival rate of compensatory trees**. The Chairman and one of the two Members considered that there would be enough spaces in Sub-Areas 2 and 3 to increase the number of trees to be compensated. The Member furthered that there should be a longer tree maintenance period. **In view of one of the above Members' view on the survival rate of planted trees**, the Chairman enquired whether it would suffice to impose a condition for the project proponent to increase the tree compensation ratio up to 1:1.5."]*

5.3 Tree Compensation Plan

(i) Measures to enhance tree survival

5.3.1 As mentioned in section 5.2.2 above, the ACE Members concerned that the survival rate of the compensatory tree planting would be about 50%. Hence, additional compensatory tree planting was suggested to offset non-survived compensatory trees. In fact, according to the relevant Government policy and guidelines with respect to compensatory tree planting as explained in the following sections, any compensatory trees not survived after planting would be replaced, and therefore the actual compensatory ratio will not be

affected by the survival rate of compensatory trees.

5.3.2 The life cycle of a compensatory tree planting includes: -

- the Construction Stage,
- the Post-Construction Stage during the Establishment Period, and
- the Operation Stage.

5.3.3 Approved specialist contractor for landscaping works will be engaged by the project department for maintenance of the compensatory trees during the Construction Stage and the Establishment Period, whereas the maintenance department will be responsible for maintenance of the compensatory trees during the Operation Stage. By maintenance of the compensatory trees, the approved specialist contractor or the maintenance department as appropriate will be responsible for: -

- Keeping the compensatory trees in satisfactory condition;
- Replacement of any compensatory trees not survived.

5.3.4 Based on the established procedure as discussed above, the ACE Members could be reassured of a full and continuous compliance with the tree compensatory requirement without being affected by the tree survival rate after planting, as: -

- The project department and the maintenance department should ensure that the compensatory tree planting is carried out in accordance with the Tree Preservation and Removal Proposal (TPRP) agreed by the authority.
- The project department and the maintenance department should keep the compensatory trees in satisfactory condition;
- The project department and the maintenance department should replace any compensatory trees not survived.

(ii) Larger area for tree compensation

5.3.5 According to the EIA Report, habitat lost (about 4.11ha of woodland and mixed woodland) including the 996 number of existing trees affected by the housing development would be compensated by a compensation woodland planting area in Sub-Area 3 or other suitable areas.

5.3.6 According to DEVB TC(W) No. 4/2020, compensatory tree planting shall be implemented of a ratio not less than 1:1 in terms of number as far as practical. The relevant clause of the technical circular is extracted in **Figure 5A** below.

b. Quantity of compensation

1. As far as practicable, implementation of compensatory tree planting should be of a ratio not less than 1:1 in terms of number, i.e. the number of compensatory trees onsite and offsite not be lower than that of the number of trees removed including dead trees, but excluding trees of undesirable species. In principle, size of compensatory trees at their maturity, should be appropriate to the location and function. For slope works, the ratio of 1:1 by number requirement may not apply due to site constraints; and the planting of whips or seedlings as a woodland mix would be more appropriate. Sufficient space should be provided for the compensatory trees from establishment to maturity to maximise tree health and stability. Proposals which deviate from the above requirements should be supported with full justifications and an alternative proposal in quantity and quality.

Figure 5A – Relevant clause of compensatory tree planting under DEVB TC(W) No. 4/2020

5.3.7 Sub-Area 4 is highly ecologically sensitive due to the presence of the swampy woodland. To avoid the compensatory trees affecting the existing hydrology which is important to the swampy woodland, planting compensatory trees in Sub-Area 4 is not suitable.

Figure 5B – Compensatory tree planting plan of the 996 trees

(iii) Consideration of additional compensation

5.3.8 Planting of the compensatory trees in Sub-Area 3 is shown in **Figure 5B**. Sub-Areas 2 to 4 are being zoned as "Other Special Uses (Recreation cum Conservation)". The Government is still considering the best use of Sub-Areas 2 to 4 based on the planning intention, the permitted usage, and the future operation arrangement. Further extension of compensatory planting areas at Sub-Areas 2 and 3 on top of the compensatory planting area as recommended in the EIA report may impose unnecessary additional constraints and limitations to the planned use of the Sub-Areas. In any case, in terms of number of compensatory trees, the requirements laid down in DEVB TC(W) No. 4/2020 will be fully met.

5.4 Tree Management Plan

(i) Longer Establishment Period

5.4.1 The Establishment Period for compensatory trees is normally 12 months. With a view of enhancing the survival rate of the compensatory trees and ensuring that the compensatory trees are fully established before handing over to the relevant maintenance department, the Establishment Period for the compensatory trees under this project is proposed to be extended to 3 years.

(ii) Retained Trees and Transplanted Trees

5.4.2 According to the EIA Report, eleven (11) existing trees of particular interest (TPI) with trunk diameter, i.e., DBH > 1m within Sub-Area 1 will be preserved based on the development layout of the proposed housing development. Various measures, including but not limiting to the following will be undertaken to ensure that the existing trees to be preserved will be sustainable.

- The housing blocks will be set back from the TPIs in concern by at least 3m, if technically feasible, in addition to the required tree protection zone, which is defined as the drip line of the tree crown in accordance with "Guidelines on Tree Preservation during Development" published by Greening, Landscape and Tree Management Section of Development Bureau. Please refer to **Figure 5C** below for illustration.

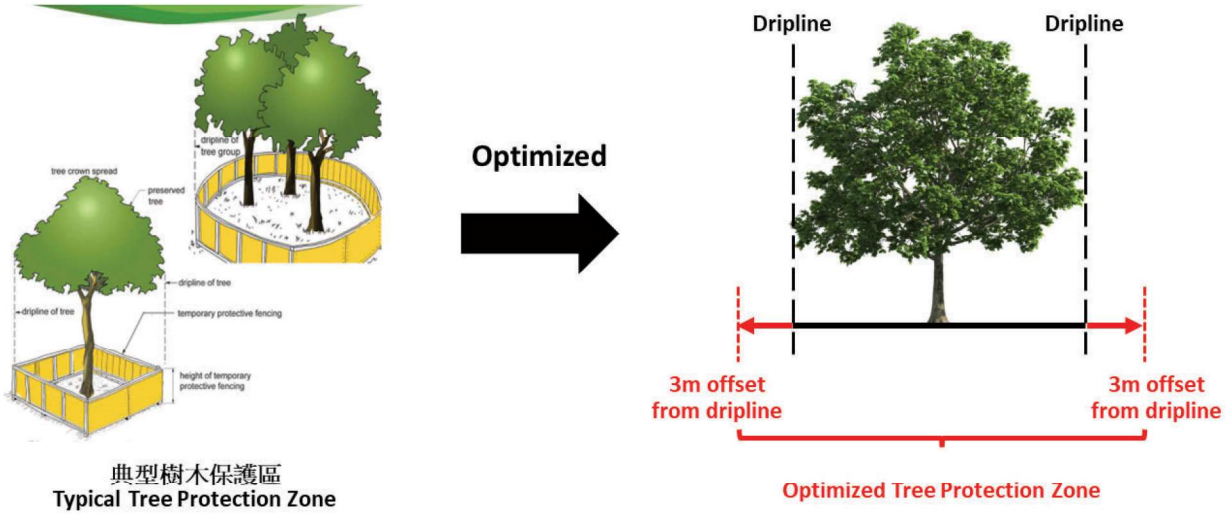


Figure 5C – Additional set back from the tree protection zone

- If technically feasible, the planter for the preserved tree will be well designed to accommodate the extended tree protection zone. Please refer to **Figure 5D** below for good example.

Figure 5D – Good example of planter for the preserved tree with additional buffer zone

- If technically feasible, tree well or tree island will be considered to avoid affecting ground level of the tree protection zone of the preserved trees, in case ground level outside the tree protection zone shall be raised or lowered to suit the site formation and the development layout of the proposed housing development. Examples of tree well and tree island are shown in **Figure 5E** below.

Figure 5E – Example of tree island and tree well for the preserved tree to cater for the level difference of the development and the ground level of the preserved tree (Photos taken from the housing development in Queen's Hill)

5.4.3 Housing Department (HD) is well experienced in tree management and maintenance. In addition to the case of Queen's Hill as illustrated in **Figure 5E** above, there are abundant cases of OVT being maintained within the existing housing developments of HD as shown in **Figures 5F to 5H** below.

Figure 5F – HD KT/1 Albizia julibrissin (合歡) in Sau Mau Ping Estate

Figure 5G HD WTS/1 Ficus altissima (高山榕) in Choi Hung Estate

Figure 5H – HD TM/1 Ficus elastica (印度榕) in Tai Hing Estate

5.4.4 It is also proposed in the EIA Report that two existing trees shall be transplanted. Tree transplanting is not uncommon in Hong Kong, including for housing development. Examples of successful transplanting are presented below.

Example 1 – Transplanting of a Ficus microcarpa (細葉榕) in Kwai Tsui Estate

5.4.5 The transplanting was carried out in 2014. Please refer to the video of HD recording the process of the transplanting via the following link. The screen clipped from the video is shown in **Figure 5I** below.

https://www.youtube.com/watch?v=teUQl11bleA

Figure 5I – Screen clipped from the video recording the tree transplanting in Kwai Tsui Estate

5.4.6 A recent photo taken for the transplanted tree at Kwai Tsui Estate is shown in **Figure 5J** below. Condition of the transplanted tree is good based on our recent site visit in January 2023.

Figure 5J – Condition of the transplanted tree in Kwai Tsui Estate in January 2023

Example 2 – Transplanting of a Ficus microcarpa (細葉榕) in Pak Tin Estate

5.4.7 The transplanting was carried out in 2001. A recent photo taken for the transplanted tree at Pak Tin Estate is shown in **Figure 5K** below. Condition of the transplanted tree is good based on our recent site visit in January 2023.

Figure 5K – Condition of the transplanted tree in Pak Tin Estate in January 2023

Example 3 – Transplanting of a Ficus virens (大葉榕) in Queen's Hill Estate

5.4.8 The transplanting was carried out during the development of Queen's Hill Estate in recent years as shown in **Figure 5L** below. Condition of the transplanted tree is good in 2021.

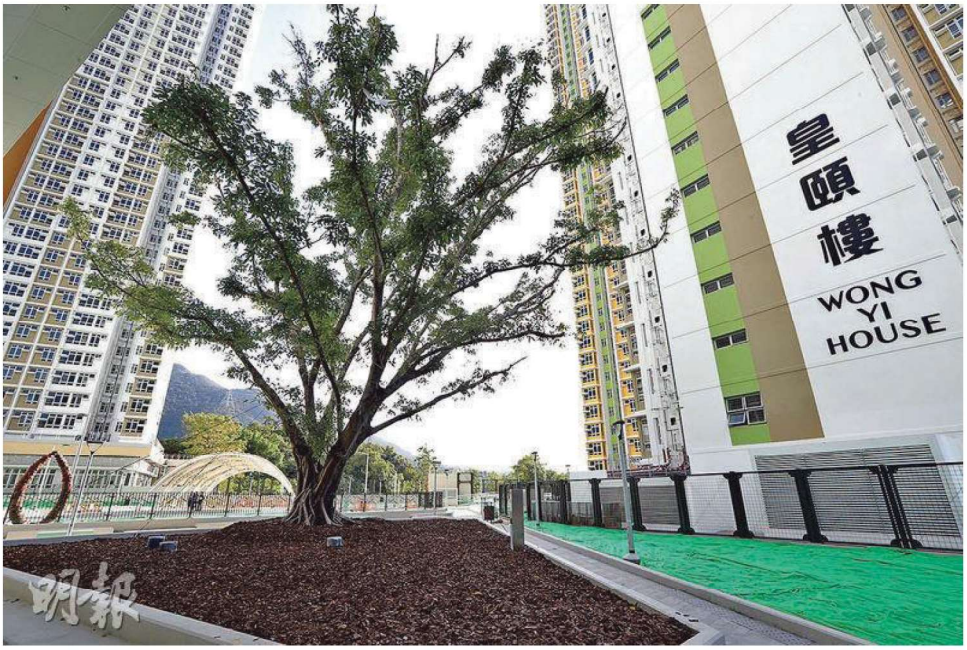
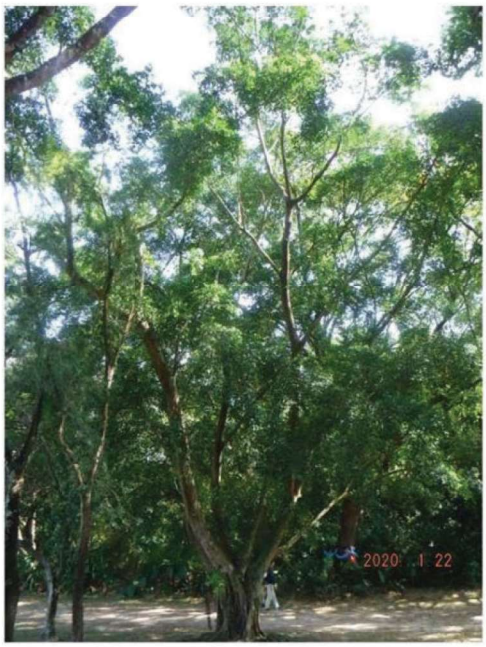


Figure 5L – Condition of the transplanted tree in Queen's Hill Estate in 2021

5.4.9 The above successful transplanting examples show that the technique of transplanting in Hong Kong is well established.

5.4.10 The trees to be affected by the proposed housing development in Sub-Area 1 and to be transplanted are shown in **Figure 5M** below. DBH and height of the *Ficus microcarpa* are 1 m and 9m respectively; DBH and height of the *Adenanthera microsperma* are 1m and 13m respectively.



Ficus microcarpa 細葉榕

Adenanthera microsperma 海紅豆

Figure 5M – Existing trees within Sub-Area 1 proposed to be transplanted for the proposed housing development

5.4.11 As noted in **Figure 5M**, both trees to be transplanted are not extraordinarily large and tall. Taking account of the successful experience, the tree transplanting of this project would not be particularly challenging.

(iii) Estimation of Water Demand

5.4.12 Estimation of the water demand for the compensatory trees will be covered under hydrological impact analysis under Chapter 7 of this document.

5.5 Conclusion

5.5.1 As discussed in **(5.3)** above, the project department and the maintenance department would carry out the compensatory trees according to the TPRP, which is prepared in accordance with the EIA Report. The project department and the maintenance department would properly maintain the compensatory trees during the entire life cycle, including the Construction Stage, the Post-Construction Stage during the Establishment Period, and the Operation Stage, and replace any non-survived compensatory trees if necessary.

5.5.2 In view of the concern of the ACE Members, the Establishment Period for the compensatory trees for this project is proposed to be extended to 3 years from the nominal 1 year under the common practice.

5.5.3 High tree survival rate could be effectively achieved with longer establishment period (i.e. 3 years) and proper follow up with tree management plan. The concern of ACE members on the tree survival rate of compensatory trees could be addressed with the above measures. Furthermore, trees will be planted within the housing site at Sub-Area 1 following the established practice, though the numbers of trees are to be explored at detailed design stage. Considering the above discussions, trees to be planted under this project will be over and above the tree compensation proposal for meeting the established requirement.

6 DETAILED LAYOUT PLANS (WITH CONSIDERATION OF 0.39HA WOODLAND PRESERVATION)

6.1 Additional Information Required

6.1.1 The additional information requested by EPD is recapped as follows: -

"A detailed layout plan of the proposed housing development which shall illustrate the preservation of an additional 0.39 hectares of secondary woodland in Sub-Area 1 (Annex 1) (on top of those woodland, mixed woodland and Trees of Particular Interest (TPI) recommended for preservation in the EIA report), the locations of the trees to be retained, the location, disposition and design of the proposed housing blocks with a view to minimising adverse ecological impact."

6.2 Background and Discussion at ACE meeting

6.2.1 Some ACE members suggested preservation of this woodland, as: -

- The ecological value of this woodland was considered to be moderate;
- The ecological value of this woodland is considered to be higher than that of the mixed woodland in the south-east side of Sub-Area 1.

[Extract from paragraph 27 of the ACE minutes of meeting: "The Member opined that the woodland should be of moderate ecological value and the ACE should recommend preserving it."]

[Extract from paragraph 28 of the ACE minutes of meeting: "Recapping the project proponent's previous advice on the higher ecological value of woodland than mixed woodland, a Member suggested with the support of five other Members that the V-shaped woodland adjacent to the car park in Sub-Area 1 should be retained."]

6.3 Brief Summary of the Woodland in Concern

6.3.1 The woodland in concern is shown in **Figure 6A** below.

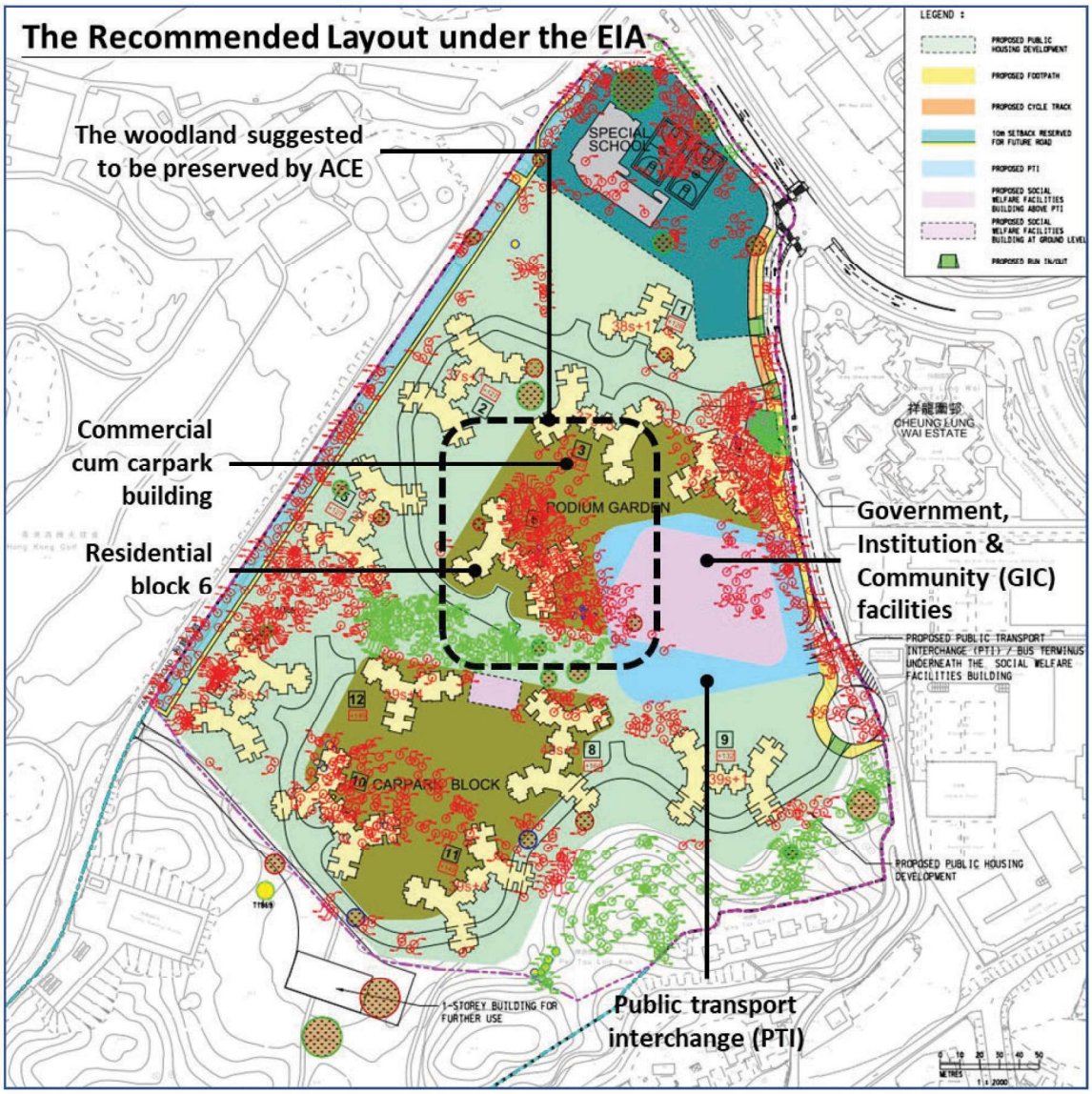


Figure 6A - Location of the woodland suggested by ACE to be preserved

6.3.2 The woodland in concern is 0.39ha. approximately and consists of 186 trees of various species. According to EIA findings, the ecological value of this 0.39ha woodland is "**low to medium**". The most dominant tree species are as follows: -

- 38 *Melaleuca cajuputi* subsp. *cumingiana* (白千層) – Exotic species; Recommended to be removed under the EIA, and to be fully compensated by compensatory trees;
- 30 *Cratoxylum cochinchinense* (黃牛木) – Native species; Recommended to be removed under the EIA, and to be fully compensated by compensatory trees;
- 19 *Aquilaria sinensis* (土沉香) – Native species, amongst which, only 2 are trees and the remaining 17 are seedlings – Native species; Recommended to be transplanted under the EIA;

6.3.3 Amongst all the trees/tree species: -

- There are 121 trees of native species, 62 trees of exotic species; 3 dead trees;
- Only *Aquilaria sinensis* (土沉香) is a species of conservation importance. All the *Aquilaria sinensis* (土沉香), including the seedlings will be transplanted.

6.4 Assessment of Ecological Impact for the Woodland in Concern

6.4.1 During the ACE meeting, some members of ACE suggested that the woodland in concern shall be preserved as the "Naturalness" of this woodland is appeared to be higher than the mixed woodland in the southern side of Sub-Area 1.

6.4.2 It should be clarified that (i) Naturalness is only one of the 11 criteria for assessment of the ecological value of an area based on the Technical Memorandum of EIAO. The other 10 criteria include: - (ii) Size, (iii) Diversity, (iv) Rarity, (v) Recreatability: (vi), Fragmentation, (vii) Ecological Linkage, (viii) Potential Value, (ix) Nursery/breeding ground, (x) Age, (xi) Abundance/Richness of Wildlife. Our assessment of this woodland based on the criteria is as follows.

6.4.3 **Naturalness:** The woodland is man-made after World War II. It is not a natural woodland. Although dominated by native species (2/3), this woodland also consists of a substantial proportion of exotic species (1/3).

6.4.4 **Size:** The size of the woodland, which is 0.39 ha. only, is relatively small, as compared with other existing woodlands within the PDA, including the nearest mixed woodland in the southern side of Sub-Area 1 and the northern side of Sub-Area 2.

6.4.5 **Diversity:** The woodland is dominant by both native *Cratoxylum cochinchinense* (黃牛木) and exotic *Melaleuca cajuputi* subsp. *cumingiana* (白千層). Diversity of flora is considered as low due to its small area size (usually the larger the area size, the higher the diversity). Diversity of fauna is low in consideration of the survey result for the whole Sub-Area 1.

6.4.6 **Rarity:** Though this woodland contains some *Cratoxylum cochinchinense* (黃牛木), which is a native species, *Cratoxylum cochinchinense* (黃牛木) is not a protected species in Hong Kong, nor it is under the International Union for Conservation of Nature Red List of Threatened Species, also known as the IUCN Red List. *Cratoxylum cochinchinense* (黃牛木) is common in woodlands in Hong Kong. Only 19 individuals of *Aquilaria sinensis* (土沉香) and one individual of *Ilex graciliflora* (纖花冬青) recorded in the woodland are considered as plant species of conservation importance that will be transplanted. No other fauna species of conservation importance is recorded in this woodland.

6.4.7 **Recreatability:** Though *Cratoxylum cochinchinense* (黃牛木) is native species in Hong Kong, the woodland was only rebuilt after World War II. In fact, it is our intention to compensate the woodland loss in Sub-Area 3. The lost of woodland (including this 0.39ha woodland) would be compensated by 5.1ha compensation planting area in Sub-Area 3, which would also consists of about 100 numbers of *Cratoxylum cochinchinense* (黃牛木). All the *Aquilaria sinensis* (土沉香), including both trees and seedlings as well as one individual of *Ilex graciliflora* (纖花冬青) would be transplanted. *Melaleuca cajuputi* subsp. *Cumingiana* (白千層) is one of the most dominant species within the PDA. As it is also an exotic species, *Melaleuca cajuputi* subsp. *Cumingiana* (白千層) is not a recommended species of compensatory trees.

6.4.8 **Fragmentation and Ecological Linkage:** The woodland in concern is mostly surrounded by man-made habitats. It is relatively fragmented from the other woodlands within the PDA. The ecological linkage of this woodland with the other woodlands within the PDA is not strong.

6.4.9 **Potential Value:** Potential Value is low due to the whole Sub-Area 1 is mostly surrounded by developed area.

6.4.10 **Nursery/breeding ground:** Important nursery and breeding ground are not identified in the woodland in concern.

6.4.11 **Age:** Based on the historical aerial photos, most of the woodlands within the PDA, including the woodland in concern, was rebuilt after World War II. The woodland is not older than the other woodlands within the PDA.

6.4.12 **Abundance/Richness of Wildlife:** Low abundance of terrestrial fauna as confirmed in past ecological survey result.

6.4.13 Taking into account the above, the ecological value of this 0.39ha woodland (i.e. "**low to medium**") as presented in the EIA report is reaffirmed.

6.5 Rationales of Our Proposal of Removal of the Woodland

6.5.1 The woodland is proposed to be removed under the EIA, as it is not feasible to accommodate all the proposed public housing and range of commercial and public facilities under the development together with the woodland.

Consideration of relocating building blocks

6.5.2 As shown in **Figure 6A**, the woodland in concern is in conflict with: -

- The integrated commercial cum carpark building and the PTI cum GIC building;
- One of the residential blocks, i.e., Block 6, above the commercial cum carpark building.

6.5.3 Preserving the woodland would displace a residential block, the integrated commercial cum carpark building and part of the PTI cum GIC building. It would be difficult for the affected housing block as well as commercial and public facilities to be relocated elsewhere within the proposed development, as sufficient space in other area of Sub-Area 1 would not be available.

Consideration of further increase of building height

6.5.4 We have considered the merits of increasing the building height of the proposed housing development to provide more developable space. As a general principle, the maximum building height shall be set to avoid adverse visual impact. In determining the height limit for the proposed housing development, reference has been made to the building height of the existing and planned developments nearby, e.g. +130mPD approximately for the existing Cheung Lung Wai Estate and Ching Ho Estate, +133mPD approximately for the planned Fanling Area Phase 4 (Ching Ho Extension), +140mPD approximately for the existing Glorious Peak and the planned Ching Hiu Road housing development, +160mPD approximately for the planned Choi Shun Street housing development. Height limit of the proposed housing development is set to be +170mPD, which is in line with other new public housing developments with comparable scale in the North District, such as Fanling Area 17, Fanling Area 48 and Queen's Hill Extension. Given that the proposed housing development would be locating in the outer edge of the existing developments and would become very prominent to the areas nearby, further increasing the building height is undesirable and would result in adverse visual impact to the surrounding environment.

6.6 Conclusion

6.6.1 As discussed above, the scale of proposed public housing and range of commercial and public facilities to be provided under the development will be affected if the woodland in concern is to be preserved.

6.6.2 Further increasing the height limit of the proposed housing development with a view to providing more developable space whilst preserving the woodland in concern is not recommended, as the height limit of the proposed housing development has already been set to be higher than all the existing and planned housing developments nearby. Further increasing the height limit may impose adverse visual impact.

6.6.3 On the other hand, the ecological value of the woodland in concern is not very high, as the woodland is small in size; the woodland is surrounded by developed areas such as carpark and golf fairway; and the dominant species of *Cratoxylum cochinchinense* (黃牛木) is not a species of conservation importance. After all, the woodland lost due to the proposed housing development would be compensated in Sub-Area 3. *Cratoxylum cochinchinense* (黃牛木) is one of the proposed species of compensatory planting. The size of the woodland compensation would be larger than the total woodland lost due to the proposed housing development. Therefore, removal of the woodland in concern would unlikely cause adverse ecological impact.

6.6.4 Taking account of the adverse impact on the scale of proposed public housing and range of commercial and public facilities to be provided under the development, as well as the limited ecological impact for removal of the woodland, preservation of the woodland in concern is not recommended.

7 HYDROLOGICAL IMPACT ANALYSIS

7.1 Additional Information Required

7.1.1 The additional information requested by EPD is recapped as follows: -

"A detailed analysis of the hydrological impact to show the flow of water, including available information on the profile of soil and bedrock conditions of the project site."

7.2 Engagement of Dr. Ting Fong May Chui from The University of Hong Kong

7.2.1 The hydrological impact analysis was carried out by Dr. Ting Fong May Chui of The University of Hong Kong.

7.2.2 Dr. Chui is a local hydrology and sustainable water resources engineering expert. Dr. Chui has developed various innovative numerical modeling techniques for coupled hydrological and ecological processes.

7.2.3 Dr. Chui has been an executive committee member of the IAHR-APD since 2015. Dr. Chui is currently the Chairlady of IAHR's Hong Kong Chapter since 2014. Dr. Chui is also the associate editor of "*Journal of Hydro-Environmental Research*, Elsevier" and is the editorial board member of "*Environmental Modeling and Assessment*, Springer".

7.2.4 Taking account of the additional information requested by ACE, the hydrological impact analysis consists of the following sections.

- Analyze if the proposed housing development will affect the surface water sources of the swampy woodland in Sub-Area 4;
- Analyze if the proposed housing development will affect the ground water sources of the swampy woodland in Sub-Area 4;
- Quantify the potential loss of surface water infiltrating into ground due to the proposed housing development in Sub-Area 1;
- Quantify the potential additional water demand for the compensatory tree planting in Sub-Area 3.

7.3 Surface Water Sources of the Swampy Woodland in Sub-Area 4

(i) Approach and Methodology

7.3.1 Surface water flow direction analysis is to determine the surface water flow paths of a given area under rainfall conditions according to topographical information. This analysis facilitates the understanding of whether the proposed housing development in Sub-Area 1 and the compensatory tree planting in Sub-Area 3 will affect the quantity of surface water received by the swampy woodland of Sub-Area 4 where the Chinese Swamp Cypress grows.

7.3.2 The digital elevation model (DEM) of the FGC and the surrounding areas is used in the analysis. The land surface elevation in DEM is represented using a set of grid cells with each cell specifying the elevation of a given location. The DEM used in the analysis has a spatial resolution of 0.5 meters.

7.3.3 For a given cell of a DEM, its drainage area (i.e., all the cells that drain to it) can be identified using catchment delineation methods. Here, a catchment refers to an area of land where surface runoffs resulting from rainfall converge to a single point. Therefore, a catchment area that encompasses the swampy woodland of Sub-Area 4 specifies the maximum extent of the land surface that can drain to the area. Note the extent of a catchment is defined by the choice of outlet, and it is the upper bound of the drainage area of any subarea within the catchment.

7.3.4 If a catchment area that encompasses the swampy woodland of Sub-Area 4 does not include the proposed housing development and the compensatory tree planting of Sub-Areas 1 to 3, it means that this project will not affect the surface water received by the swampy woodland. Therefore, in this study, the smallest catchment area that encompasses the swampy woodland is first identified, and whether the catchment area intersects the concerned development areas in Sub-Areas 1 to 3 is then evaluated. Note that the smallest catchment area that encompasses an area of interest defines the smallest upper bound of the drainage area.

7.3.5 The D8 algorithm is used in this study to determine the flow directions of each cell, where a cell drains its surface runoff to its steepest downslope neighbor, as illustrated in **Figure 7A**. The D8 algorithm is the most widely used algorithm for determining surface flow direction. The catchment area of a given point can be derived once the flow direction of each cell has been determined.

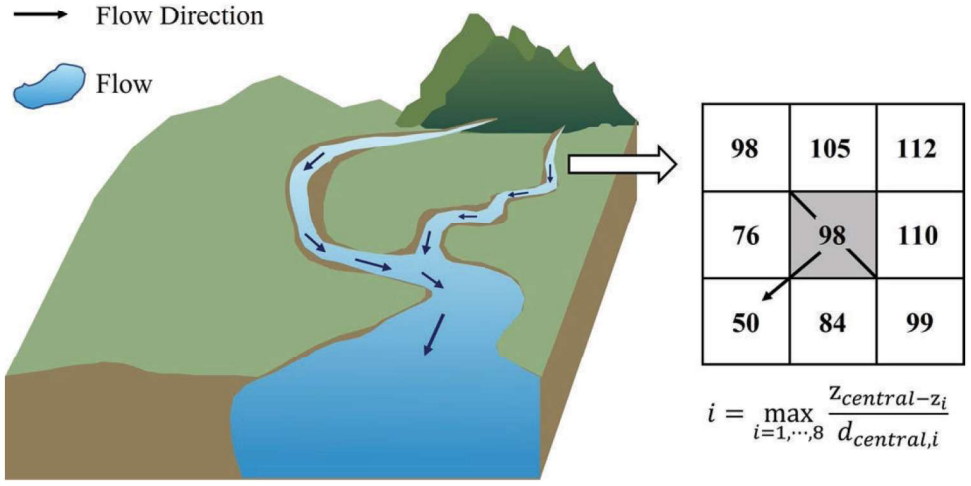


Figure 7A – Illustration of the D8 algorithm for determining flow direction.

7.3.6 The smallest catchment area that encompasses the swampy woodland of Sub-Area 4 is determined by iteratively selecting catchment outlet locations on the DEM. The computations in this study are performed using the WhiteboxTools in the R programming language environment. WhiteboxTools is a well-recognized geospatial analysis platform. After the smallest catchment area has been determined, whether the area intersects with the PDA is evaluated.

(ii) Results and Assessment

7.3.7 The smallest catchment that encompasses the swampy woodland of Sub-Area 4 is shown in **Figure 7B**. The catchment has an area of 195,765 m^2, which is around 14 times of the area of the swampy woodland. The catchment intersects the PDA mostly at Sub-Area 4.

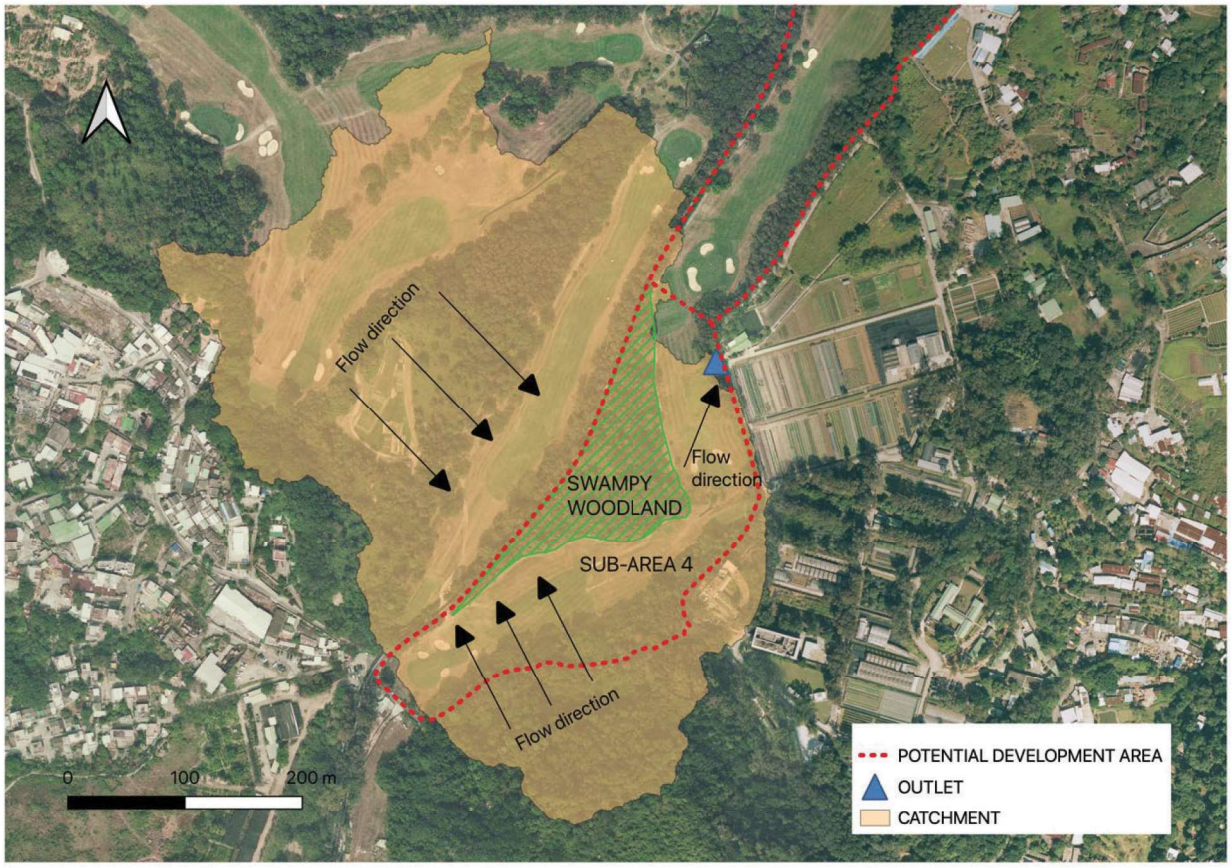


Figure 7B – The catchment area that encompasses the swampy woodland of Sub-Area 4. Flow directions and catchment outlet are shown.

7.3.8 The flow directions within the catchment are shown in **Figure 7B**. The triangular swampy woodland collects water from its two sides and drains through the remaining side. It does not receive water from the proposed housing development and the compensatory tree planting in Sub-Areas 1 to 3.

7.3.9 The proposed housing development in Sub-Area 1 and the compensatory tree planting in Sub-Area 3 will not influence the surface water flow conditions and will not reduce the inflow volume of the swampy woodland in Sub-Area 4.

7.4 Underground Water Sources of the Swampy Woodland in Sub-Area 4

(i) Approach and Methodology

7.4.1 The groundwater flow direction of the PDA was analyzed to study the potential impact of this project on the groundwater resources of the PDA, particularly in the regions around the swampy woodland in Sub-Area 4. Six boreholes were drilled inside the PDA to obtain the groundwater table. A map of the borehole locations is shown in **Figure 7C**. Groundwater levels were measured using piezometers and standpipes. The borehole logs also provided important information about the physical properties of the soils at different depths, such as soil type and degree of compaction, and this information was used to infer the conditions of the aquifer.

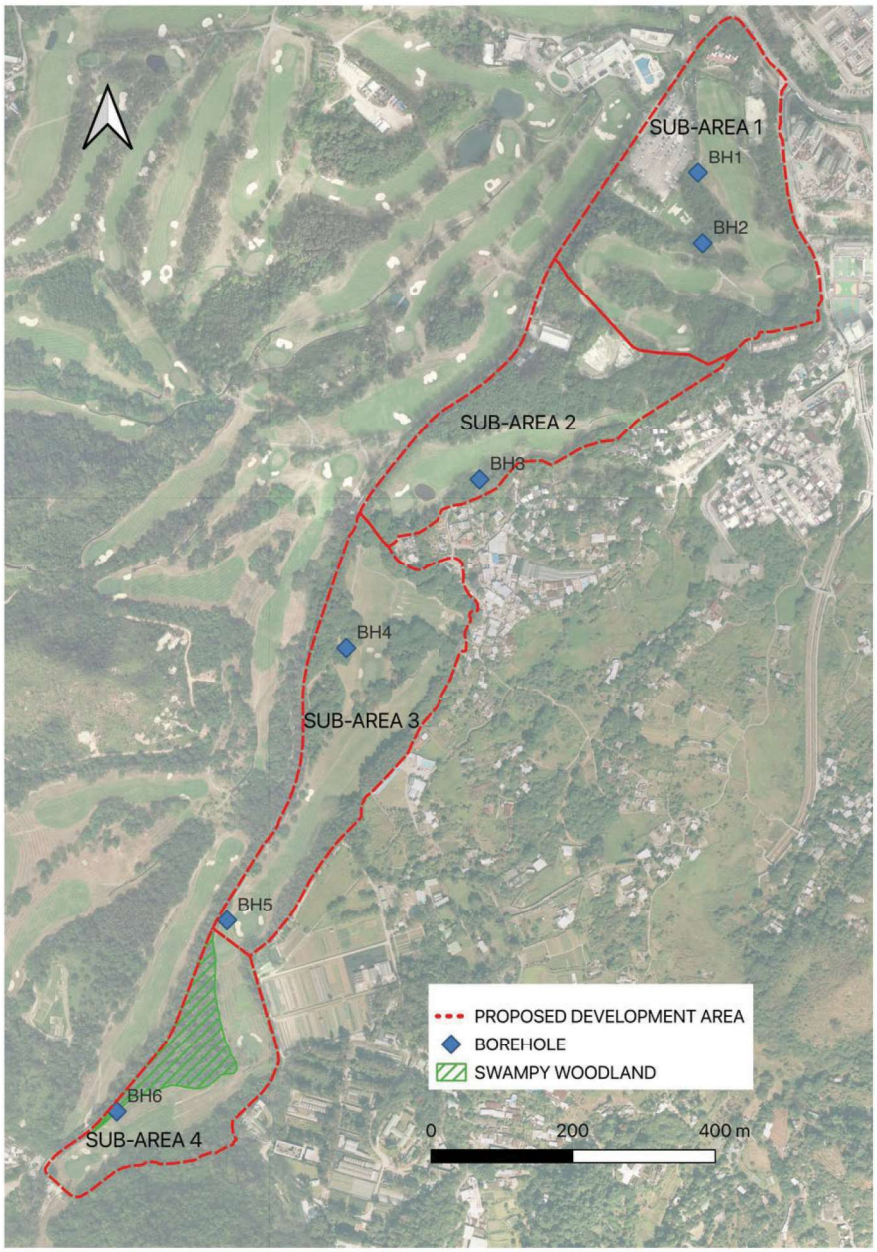


Figure 7C – Location of the boreholes

7.4.2 The point groundwater table measurements were used to infer the spatial distribution of groundwater table over the PDA. The inverse distance weighting (IDW) method was used in the interpolation, in which the groundwater level at a specific location is a weighted sum of the groundwater levels measured at different boreholes. The weight is the inverse distance of the location to a borehole.

7.4.3 Equipotential lines, i.e., contours of equal groundwater tables, can be created from the inferred groundwater table distribution map of the PDA, for which locations that have the same groundwater table are connected. For isotropic and homogeneous unconfined aquifers, the groundwater flow direction is perpendicular to the equipotential lines from regions with high groundwater levels to regions with low groundwater levels. Under the isotropic and homogeneous unconfined aquifer assumption, the groundwater flow directions were estimated, and the groundwater flow conditions around the swampy woodland in Sub-Area 4 were examined.

(ii) Results and Assessment

7.4.4 The groundwater levels measured using piezometers and standpipes are presented in **Table 7A**. The groundwater levels at the six boreholes were between 3 and 6 meters below the ground surface. According to the borehole logs, the soils above the water table were mostly sand and sandy silt type, and no rock layers were detected above the upper water surface (water table). These results indicate that the PDA is an unconfined aquifer, where groundwater flows above the underlying rock and can be recharged directly by rainwater, and the water table is at atmospheric pressure. Groundwater levels measured between 28 February 2023 and 8 March 2023 were similar, with the difference typically less than 10 cm, indicating that groundwater levels were relatively stable.

Table 7A – Groundwater evaluation and depth of the six boreholes measured using piezometers and standpipes on 1 March 2023.

Soil sampling point	Surface elevation	Groundwater elevation (piezometers)	Groundwater elevation (standpipes)	Depth of water table (distance from groundwater table to ground surface; piezometers)	Depth of water table (distance from groundwater table to ground surface; standpipes)
BH1	15.46	9.85	9.79	5.61	5.67
BH2	17.49	10.24	10.19	7.25	7.30
BH3	18.88	15.32	15.27	3.56	3.61
BH4	27.96	18.16	18.54	9.80	9.42
BH5	26.12	21.57	21.6	4.55	4.52
BH6	29.52	26.18	26.13	3.34	3.39

7.4.5 The general trend of groundwater elevations and flow directions across the PDA is shown in **Figure 7D**, which was determined using the IDW method and the piezometer groundwater level measurements. As shown in the figure, the groundwater flows from south to north, i.e., from Sub-Area 4 to Sub-Area 1. The groundwater flow directions and elevations shown in **Figure 7D** were obtained under the assumption of an isotropic and homogeneous aquifer. The groundwater flow directions and elevations shown in **Figure 7D** represent the general groundwater distribution patterns. The results obtained using the standpipe groundwater measurement were generally similar.

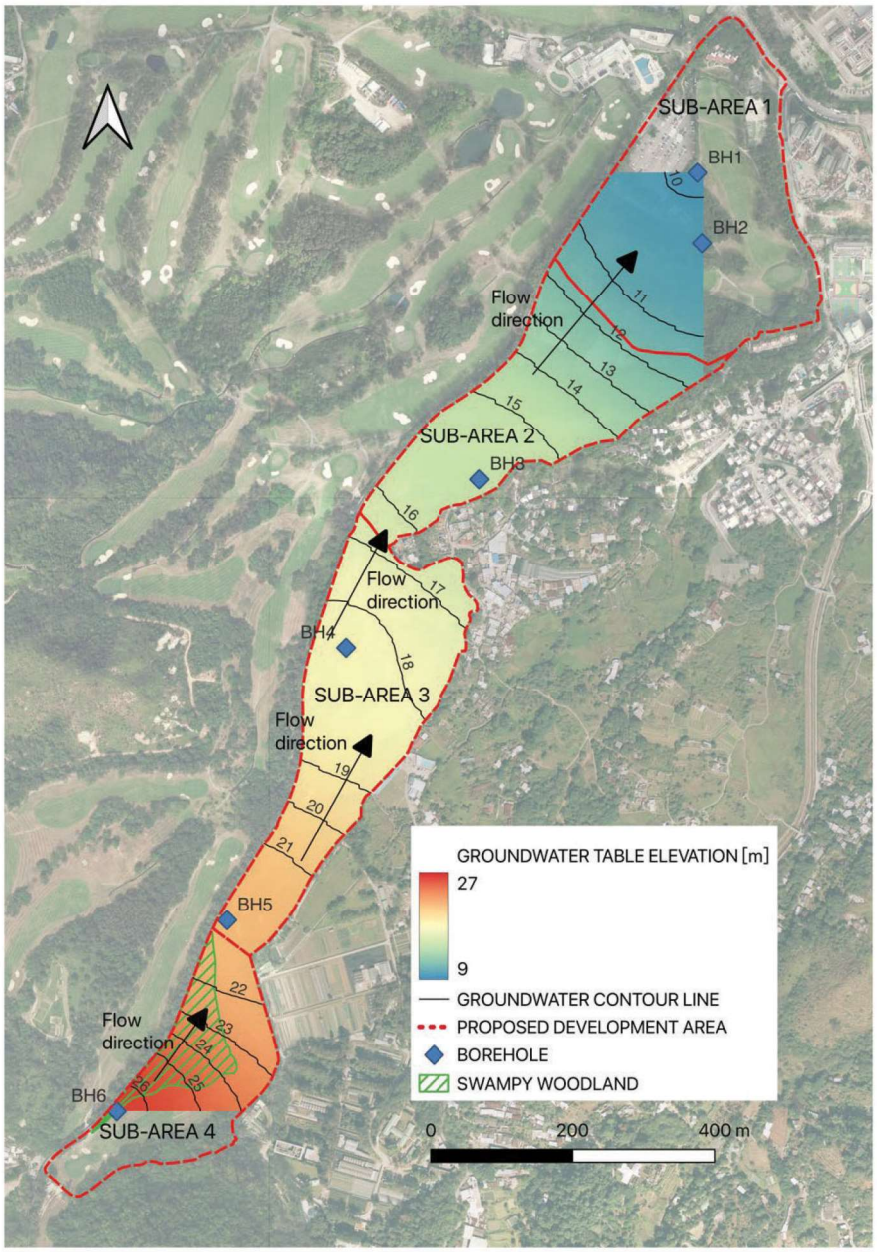


Figure 7D – Groundwater elevation and flow direction of the PDA inferred from piezometer groundwater level measurements, assuming isotropic and homogeneous aquifer conditions. This figure is used to illustrate the general trend of groundwater elevations and flow directions across the PDA.

7.4.6 According to the results of the groundwater elevation and flow direction analysis, the proposed housing development area in Sub-Area 1 and the compensatory tree planting areas in Sub-Area 3 are not the sources of groundwater for the swampy woodland in Sub-Area 4.

7.5 Potential Loss of Surface Water Infiltrating into Ground due to the Proposed Housing Development in Sub-Area 1

(i) Approach and Methodology

7.5.1 The infiltration capacity of Sub-Area 1 is expected to decrease due to increased impervious land covers introduced by the proposed housing development. The infiltration capacity of the soils at different locations of the PDA was measured on-site. The field measurement data are then used to estimate parameters required by the numerical soil infiltration models, which are then applied to estimate the infiltrated rainwater depth over different years.

7.5.2 The saturated hydraulic conductivity of in-situ soils was measured at ten selected locations of the PDA, six of which are inside Sub-Area 1. A map of the ten selected locations can be found in **Figure 7E**. The saturated hydraulic conductivity of a soil refers to its ability to transmit water at saturated conditions. A Guelph infiltrometer was used in the measurements.

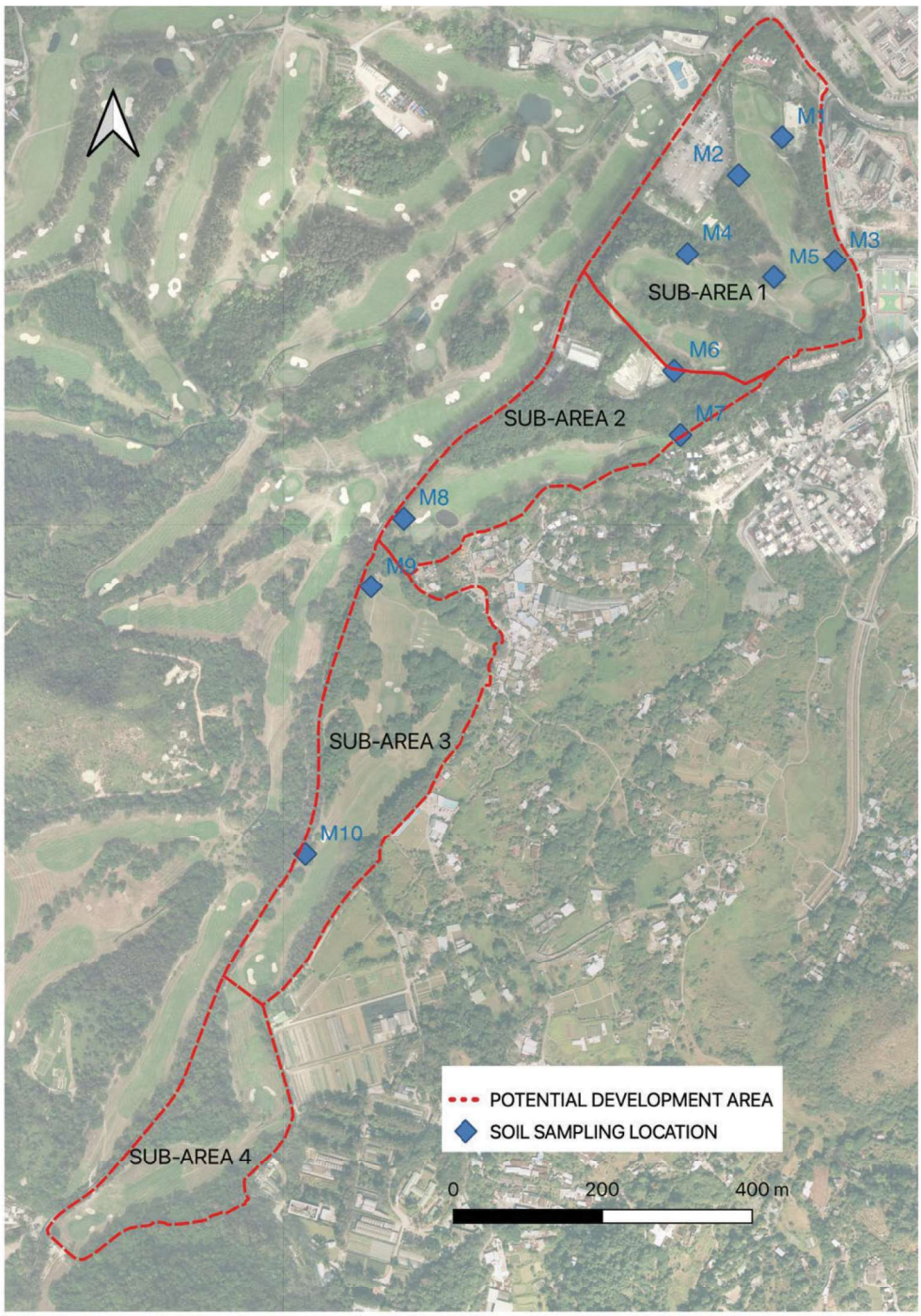


Figure 7E – Locations of the ten soil sampling points.

7.5.3 Soil samples were taken from the ten selected locations and analyzed at the Croucher Laboratory of Environmental Hydraulics at The University of Hong Kong. The soil texture of the soil samples was analyzed by performing the Mason Jar Soil Test. The soil texture was then used to infer soil types and soil hydraulic properties, which are used in numerical modeling.

7.5.4 The depth of infiltrated rainwater for different types of soils was modeled using the Green-Ampt infiltration method implemented in the Storm Water Management Model (SWMM). SWMM is a commonly used stormwater management model developed by the U.S. Environmental Protection Agency. This analysis is to assess the ability of different types of soils in the PDA in infiltrating rainwater. The Green-Ampt infiltration method requires Initial Deficit, Wetting Front Suction Head, and Saturated Hydraulic Conductivity as its parameters. The first two parameters were inferred based on the soil texture analysis results, and the last one was measured on site. The soil surfaces were assumed to be flat with a slope of 2%, which is a typical slope value used for flat surfaces in urban stormwater drainage designs. The other parameters used in SWMM, such as depression storage depth and surface roughness, were estimated based on the local geographical conditions.

7.5.5 The data used to drive SWMM simulations was a 5-minute resolution rainfall time series recorded between 2007 and 2021 (15 years) at Sheung Shui Automatic Weather Station. The rainfall data was obtained from the Hong Kong Observatory. A monthly protentional evapotranspiration time series was also used in the simulation. The depth of infiltrated rainwater of each year was computed for each type of soil, and the mean values were then derived.

7.5.6 A hydrological model of Sub-Area 1 and the areas draining to Sub-Area 1 was built using SWMM to evaluate the infiltration capacity of Sub-Area 1 before and after development. This model considered the exchange of stormwater runoff between different parts of the study area. The study area was divided into several subcatchments, and each subcatchment was assigned a set of parameters describing its drainage characteristics. The subcatchments were defined based on drainage paths indicated on the drainage map, the DEM, and the habitat management map showing different land cover types. The exchange of rainwater between different subcatchments was modeled by setting the flow directions of each subcatchment.

7.5.7 Each subcatchment was conceptualized as a rectangular area in SWMM. In this project, the slope and width of the subcatchments were determined based on geographical information. The Green-Ampt infiltration method was used for modeling the infiltration process in SWMM. The subsurface drainage systems and stormwater inlets in Sub-Area 1 were not explicitly modeled because their detailed design configurations and operating conditions were not available. The modeling results, therefore, correspond to a case where only surface drainage systems are available, which define an upper limit to the soil infiltration capacity.

7.5.8 The 15-year rainfall time series recorded at the Sheung Shui Automatic Weather Station was used to drive the model simulation. The infiltration volume of rainfall in different years in the pre- (i.e., the current condition) and post-development scenarios were derived. The contributing drainage area of Sub-Area 1 does not include the tree compensation areas in the other Sub-Areas, and it is assumed that the housing development of Sub-Area 1 will not affect the surface water flow patterns outside the housing development area. The upper limit of the reduced infiltration volume is estimated by assuming that there is no infiltration from the housing development area to the native soil.

7.5.9 In the post-development scenario, 30% of the area of the proposed housing development is reserved for greening according to the design. The infiltrated volume of the 30% green area can be estimated based on the results of the soil infiltration modeling presented in **(7.5.6)**, assuming that the infiltration capacity of the native soil is preserved in these areas. Thus, in the case where the infiltration capacity of the native soil is preserved at the 30% green area, the reduced infiltration volume was calculated as the difference between the upper limit and the infiltration volume of the green area.

7.5.10 To study the hydrological characteristics of the soils, the first field trip was conducted on 29 November 2022. The existing drainage facilities in the PDA including sewers, drainage ditch, canal, etc., were visited to understand the existing drainage systems in the PDA and photos were taken for records.

7.5.11 During the first field trip, soil samples at 10 locations were taken for soil texture analysis. The locations of the soil sampling points are shown in **Figure 7E**. At each of the 10 locations, a soil auger was used to dig a hole with a diameter of about 5 cm and a depth of about 30 cm to obtain soil samples. The soil samples were preserved in ten numbered plastic bags and delivered to the lab of The University of Hong Kong for the soil texture measurements. Besides, at each location that the soil samples were taken, a mark was set for records and hydraulic conductivity measurements were conducted nearby.

7.5.12 The saturated hydraulic conductivity of the top-layer soils were measured in-situ using a Geulph permeameter as shown in **Figure 7F** near the 10 locations where soil samples were taken, including six locations in Sub-Area 1, two locations in Sub-Area 2, and two locations in Sub-Area 3, respectively as shown in **Figure 7E**.

Figure 7F – In-situ measurement of the saturated hydraulic conductivity of the top-layer soils using a Geulph permeameter.

7.5.13 As mentioned in **(7.5.3)**, the soil texture measurements were conducted in the laboratory. As a common and standard method, the Mason Jar Soil Test method was adopted, as shown in **Figure 7G**. During the test, the soil sample was well mixed in a jar with some water. The mixture was left for one minute, two hours, and 24 hours, respectively, and at each time, a mark was placed on the jar to show the settled layer. The heights of each layer were measured to determine the relative percentages of sand, silt, and clay. Based on these results, the soil type can then be determined using the soil textural triangle. The test was performed for all 10 soil samples.

Figure 7G – Mason Jar Soil Test to determine the soil type

(ii) Results and Assessment

7.5.14 The soil texture and on-site infiltration test results are shown in **Table 7B**. The soil texture and saturated hydraulic conductivity varied considerably at different locations of the PDA, indicating significant variations in the physical properties of the soils. The soils of the golf course turf (i.e., the golf-playing areas) generally have high infiltration capacity, while the soils in the other areas, which are mostly native soils, vary from impermeable to highly permeable conditions.

Table 7B – Soil texture analysis and on-site infiltration test results

Soil sampling point	Sand %	Silt %	Clay %	Soil Type	Saturated hydraulic conductivity (mm/h)	Soil type
M1	27	73	0	silt loam	11	Native soil
M2	40	58	2	silt loam	7	Native soil
M3	88	12	0	sand	62	Golf course turf
M4	40	59	1	silt loam	399	Native soil
M5	57	43	0	sandy loam	7	Native soil
M6	80	20	0	loamy sand	119	Golf course turf
M7	88	12	0	sand	141	Golf course turf
M8	44	56	0	silt loam	1	Native soil
M9	0	0	100	clay	0	Native soil
M10	74	14	12	sandy loam	16	Native soil

7.5.15 Data of 5-min resolution continuous rainfall time series from 2007 to 2021 measured by the Hong Kong Observatory (HKO) at Sheung Shui Automatic Meteorological Station was used to derive the annual infiltration volume, and the results are shown in **Figure 7H**. All types of soils, except those derived from the soil sampling points of M8 and M9, are found to have a relatively high ability to infiltrate rainwater. The mean annual rainwater infiltration depth of the highly permeable soils exceeds 1,500 mm/year, as shown in **Table 7C**.

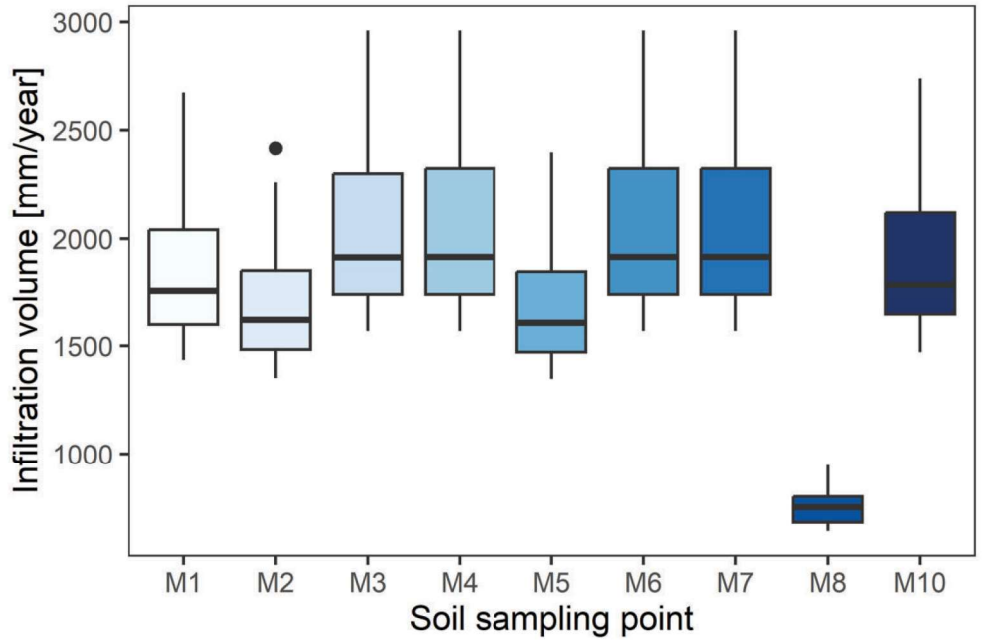


Figure 7H – Boxplot of the annual infiltration volume of the soils sampled at different locations of the PDA. The soil at M9 is impermeable and is not shown. The bottom and top sides of each box give the first and the third quartiles, and the middle line shows the median value. The vertical line gives the maximum and minimum values excluding the outliers, and the dots are the outliers.

Table 7C – Mean annual infiltration depth and mean infiltration ratio of the soils sampled at different locations of the PDA

Soil sampling point	Mean annual infiltration depth	Mean infiltration ratio
M1	1890	0.91
M2	1733	0.84
M3	2081	1.00
M4	2085	1.00
M5	1725	0.83
M6	2085	1.00
M7	2085	1.00
M8	763	0.37
M9	0	0
M10	1945	0.94

7.5.16 The infiltration ratio of the soils sampled at different locations of the PDA is shown in **Figure 7**I, where the infiltration ratio is defined as the ratio of rainwater that is infiltrated into the soil. The infiltration ratio of a sampling point was computed on an annual basis, i.e., a value was computed for each year. For the sampling points M1, M2, M5, M8, and M10, the infiltration ratio varies among different years, while the infiltration ratio of the soils at the sampling points M3, M4, M6, and M7 is equal or close to 1. It indicates that the infiltration ability of the soils at the sampling points M1, M2, M5, M8, and M10 can be affected by the different rainfall patterns that occurred in different years. In general, the golf course turfs at the sampling points M1, M6, and M7 are able to infiltrate all the rainwater that falls onto them. The mean infiltration ratio of different types of soils is shown in **Table 7C**.

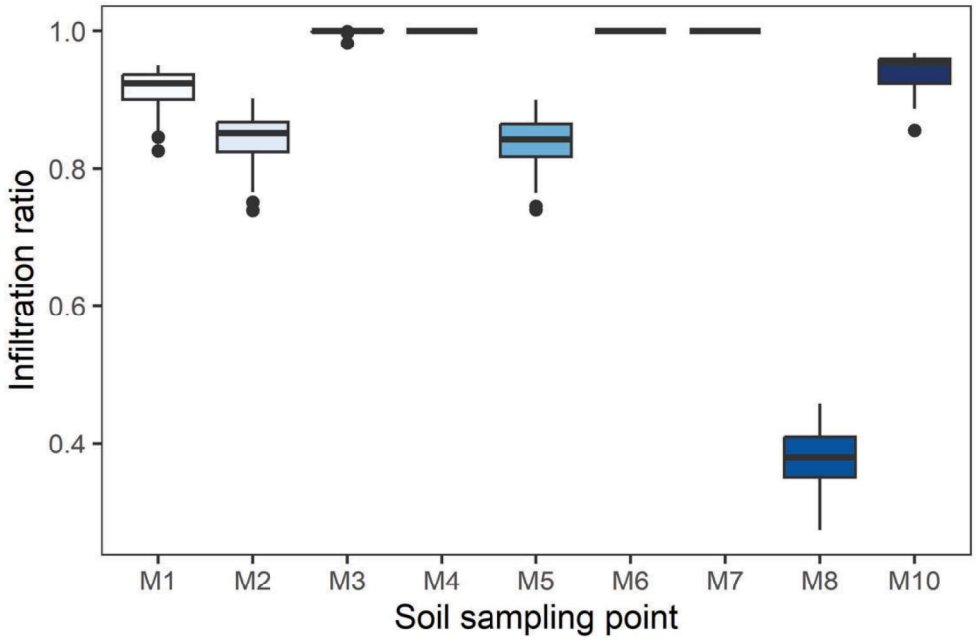


Figure 7I – Infiltration ratio of the soils sampled at different locations of the PDA. The infiltration ratio of each point is computed on an annual basis. The soil at M8 is impermeable and is not shown.

7.5.17 The surface areas draining to Sub-Area 1 were divided into 26 subcatchments according to the land cover, drainage system configurations, and topographical information, as shown in **Figure 7J,** where the flow directions are also shown.

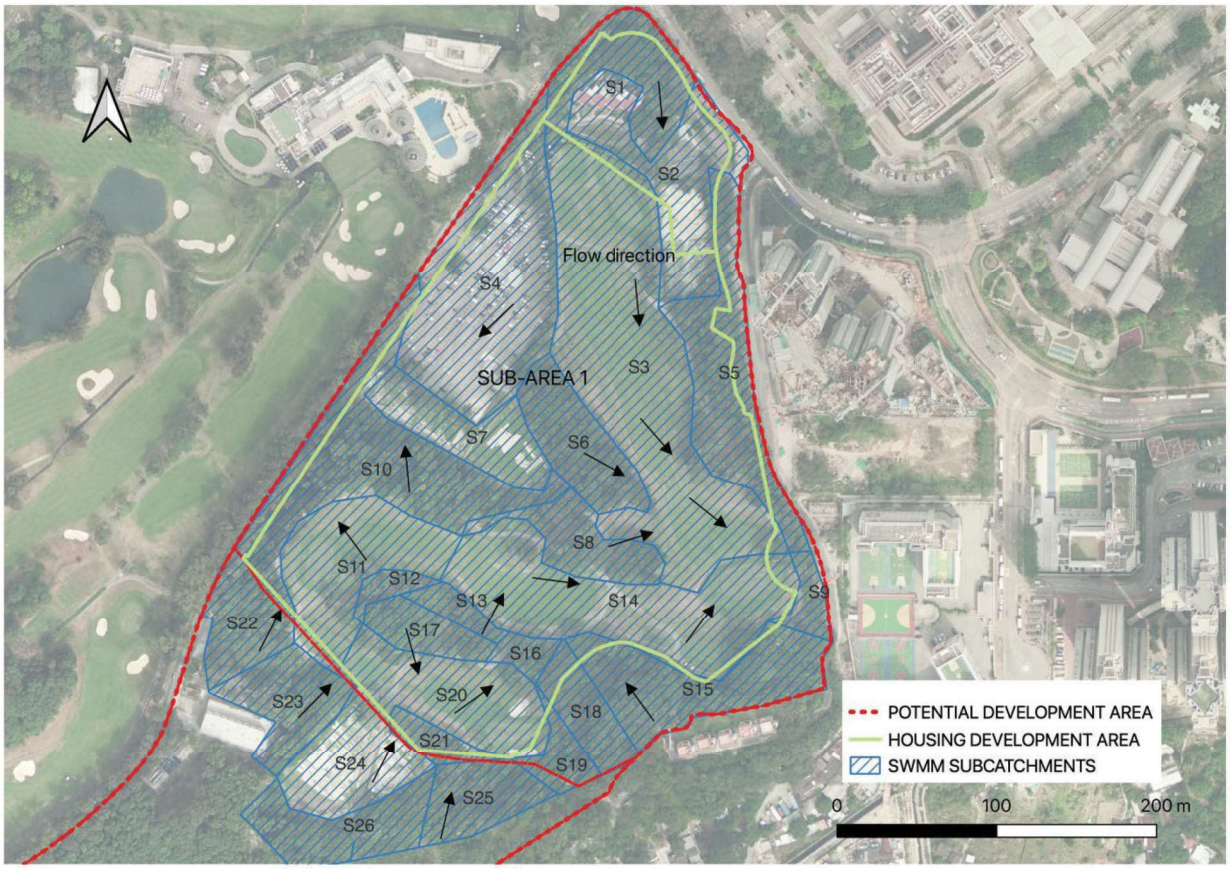


Figure 7J – Subcatchments used in SWMM, and the arrows indicate flow directions

7.5.18 The 5-min resolution continuous rainfall time series from 2007 to 2021 measured by the Hong Kong Observatory (HKO) at the Sheung Shui Automatic Meteorological Station was used to drive the SWMM model simulation. The modeling results of the infiltration depth and daily infiltration volume of stormwater in Sub-Area 1 for different years are shown in **Table 7D**. As explained in **(7.5.7)**, these values define an upper limit of the infiltration capability of Sub-Area 1. The upper limit of the mean daily infiltration volume of rainwater of Sub-Area 1 is estimated to be 503 m^3/day.

Table 7D – The SWMM modeling results for the infiltration depth and daily rainwater infiltration volume of the pre-development (i.e., current condition) and post-development cases. The pre-development case values define an upper limit on the infiltration capacity of the area, and the post-development values were obtained by assuming no infiltration from the development area to the native soils

year	Rainfall depth [mm/year]	Infiltration depth of Sub-Area 1 before development [mm/year]	Daily infiltration volume of Sub-Area 1 before development [m^3/day]	Infiltration depth of Sub-Area 1 after development [mm/year]	Daily infiltration volume of Sub-Area 1 after development [m^3/day]	Loss in daily infiltration volume of Sub-Area 1 due to development [m^3/day]
2007	1654	1357	402	267	79	323
2008	2961	2393	708	442	131	577
2009	1855	1525	452	299	89	364

year	Rainfall depth [mm/year]	Infiltration depth of Sub-Area 1 before development [mm/year]	Daily infiltration volume of Sub-Area 1 before development [m^3/day]	Infiltration depth of Sub-Area 1 after development [mm/year]	Daily infiltration volume of Sub-Area 1 after development [m^3/day]	Loss in daily infiltration volume of Sub-Area 1 due to development [m^3/day]
2010	1569	1279	379	250	74	305
2011	1748	1429	424	274	81	343
2012	1809	1483	438	290	86	353
2013	2594	2130	632	417	124	508
2014	1915	1556	461	298	88	373
2015	1735	1410	418	274	81	337
2016	2872	2358	697	456	135	562
2017	2255	1850	548	358	106	442
2018	2356	1897	562	355	105	457
2019	1924	1576	467	313	93	374
2020	1729	1418	419	276	82	338
2021	2294	1814	538	341	101	437
Mean value	2085	1698	503	327	97	406

7.5.19 The rainwater infiltration volume of Sub-Area 1 after development is estimated to be 97 m^3/day, as listed in **Table 7D**. As explained in **(7.5.8)**, this value has been obtained by assuming that there is no infiltration from the housing development area into the native soil, which defines an upper limit to the infiltration volume. Thus, if there is no infiltration from the housing development area to the native soils, the loss of infiltration volume of Sub-Area 1 caused by the development is estimated to be 406 m^3/day.

7.5.20 The infiltration ratio of the native soils in Sub-Area 1 ranges from 0.83 to 1, as shown in **Table 7C**. Assuming that the infiltration capacity of the native soils is preserved at 30% of the housing development area, the infiltrated rainfall from these areas will be between 126 m^3/day and 152 m^3/day. The reduced infiltration volume of Sub-Area 1 can be derived by subtracting these values from the upper limit of the infiltration volume. Thus, if the infiltration capacity of the native soils is preserved at 30% of the area of the proposed housing development, the reduced infiltration volume caused by the development is estimated to be between 254 m^3/day and 280 m^3/day.

7.6 Potential Additional Water Demand for the Compensatory Tree Planting in Sub-Area 3

(i) Approach and Methodology

7.6.1 Plant water use model can derive the water requirement of trees according to hydrologic information and plant type. The model can calculate the plant water requirements for the compensated trees within Sub-Area 3, thereby assessing whether there are sufficient water resources for supporting the tree compensation plan.

7.6.2 The plant water requirements for the compensated trees within Sub-Area 3 was estimated using the SLIDE (Simplified Landscape Irrigation Demand Estimation) Model, which can be formulated as follow, Plant water requirements for the compensated trees = $RET_O \times PF \times LA$, where RET_O represents the reference evapotranspiration of the woodland with the planted compensated trees within Sub-Area 3 for the period of interest, PF is plant factor, which is determined by the general trees type, and LA is the planted area.

7.6.3 The reference evapotranspiration, RET_O, of the compensated trees within Sub-Area 3 is defined as the amount of evapotranspiration that would occur if the compensated trees were well-watered. It was estimated by using the FAO Penman-Monteith Equation. The FAO Penman-Monteith method, as a new standard for reference evapotranspiration, is widely used in computing landscape water demand.

7.6.4 The SLIDE method requires maximum and minimum daily temperature and relative humidity, air pressure, wind speed at 2-meters above the ground, daily solar radiation, surface albedo, latitude and calculating date as its parameters. The first five parameters were obtained from the Hong Kong Observatory. The data of daily temperature, relative humidity and air pressure used to the RET_O calculation was the relevant daily temperature, relative humidity and air pressure time series recorded between 2005 and 2021 (17 years) at Sheung Shui Automatic Weather Station. The data of wind speed and solar radiation were from the 2005-2021 daily time series records of the wind speed at 13-meters above the ground and the global solar radiation at Ta Kwu Ling and King's Park Automatic Weather Station, respectively. The data of surface albedo was obtained from the relevant literatures, and the general surface albedos ranges of woodland were used to estimate the possible ranges of the RET_O of the woodland with the compensated trees. The latitude parameter was obtained from the spatial location of the compensated trees within Sub-Area 3.

7.6.5 The plant factor, PF, is used to adjust the average peak season RET_O to predict the amount of water needed for the landscape, and the classification is based on the water use and temperature response properties of general plant types rather than specific plant species. The PF for estimating the water demand of the compensated trees within Sub-Area 3 was determined by the relevant literature about plant factor classification. It was set as the general parameter value of 0.5. Besides, the planted area, LA, for the compensated trees within Sub-Area 3 was estimated based on the spatial distributions of the compensated trees within Sub-Area 3.

(ii) Results and Assessment

7.6.6 The ranges of the mean daily plant water requirements in each month for the compensated trees within Sub-Area 3 during 2005-2021 are shown in **Figure 7K(a)**, which correspond to the cases when different surface albedo values were used. The woodland area planted with the compensated trees within Sub-Area 3 is about 20,452 m^2. As **Figure 7K(a)** shows, for different periods of a year, the ranges of the maximum and minimum mean daily plant water requirements for the compensated trees are about 45 m^3/day - 50 m^3/day (in July) and 25 m^3/day - 27 m^3/day (in January and February), respectively. The average magnitudes of the mean daily plant water requirements for the compensated trees are between 34 m^3/day and 37 m^3/day.

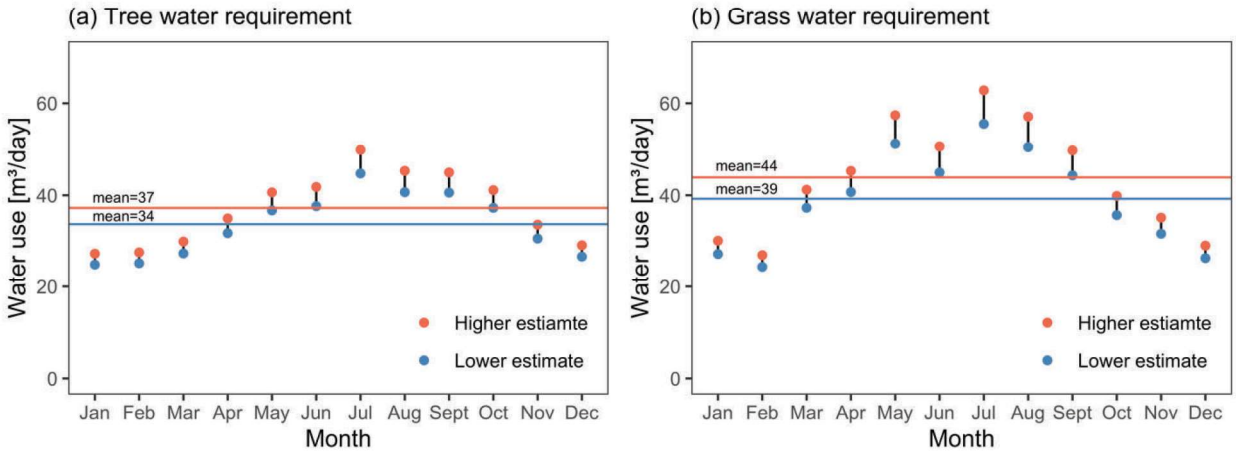


Figure 7K – Estimated daily water use for trees and grass of the compensation planting areas in Sub-Area 3

7.6.7 The estimated daily plant water requirement of the grasses in the compensation planting area (i.e., the current condition) is compared to that of the compensation trees in **Figure 7K(b)**. The results show that the grasses demand more water than trees within the compensation area. The average daily plant water demand for grass is between 39 m^3/day and 44 m^3/day, which is up to 10 m^3/day higher than that required by the trees. Thus, it is expected the extra planting area will have less plant water requirement compared to that required by the grasses.

7.6.8 The fluctuation of monthly water demands of grasses is greater than that of trees. The ranges of the maximum and minimum mean daily plant water requirements for the current grassland are about 56 m^3/day - 63 m^3/day (in July) and 24 m^3/day - 27 m^3/day (in February), respectively, and its difference between the maximum and the minimum values is about 10 m^3/day higher than that of the compensation trees. So, this means that the irrigation schedule for the woodland in the compensation planting area can be set more easily than that for the current grassland.

7.7 Conclusion

7.7.1 The proposed housing development in Sub-Area 1 and the compensatory tree planting in Sub-Area 3 would not affect the surface water sources of the swampy woodland in Sub-Area 4.

7.7.2 The proposed housing development area in Sub-Area 1 and the compensatory tree planting areas in Sub-Area 3 are not the sources of groundwater for the swampy woodland in Sub-Area 4.

7.7.3 Assuming that the area of the proposed housing development in Sub-Area 1 would be entirely hard paved, the potential loss of surface water infiltrating into ground due to the proposed housing development is estimated to be less than 406m^3/day in average, which is only 13.5% of the 3,000 m^3/day in average of reclaimed water provided by Shek Wu Hui Sewage Treatment Works (SWHSTW) currently being used for irrigation in the FGC.

7.7.4 The potential additional water demand for the compensatory tree planting in Sub-Area 3 is estimated to be less than 37m^3/day in average, which is only 1% of the 3,000 m^3/day in average of reclaimed water provided by SWHSTW currently being used for irrigation in the FGC.

7.7.5 The total volume of water required by Sub-Areas 1 and 3 for compensating the loss of surface water infiltration and supporting compensatory tree planting is estimated to be 443 m^3/day. Reclaimed water produced by SWHSTW is over 73,000 m^3/day, which is 165 times of the potential groundwater loss due to the housing development and compensated trees. Hence, SWHSTW's capacity is well sufficient to supplement the potential groundwater loss due to the housing development in Sub-Area 1 and provide the irrigation water for the compensated trees in Sub-Area 3, if necessary.

8 SHADING IMPACT TO THE TREES

8.1 Additional Information Required

8.1.1 The additional information requested by EPD is recapped as follows: -

"Additional analysis on the shading impact of the proposed housing blocks to the trees in the potential development area taking into account the revised layout plan."

8.2 Impact Assessment

8.2.1 A mixed woodland adjacent to the existing carpark of HKGC within Sub-Area 1 is proposed to be retained under the EIA. Location of this woodland is shown in **Figure 8A** below.

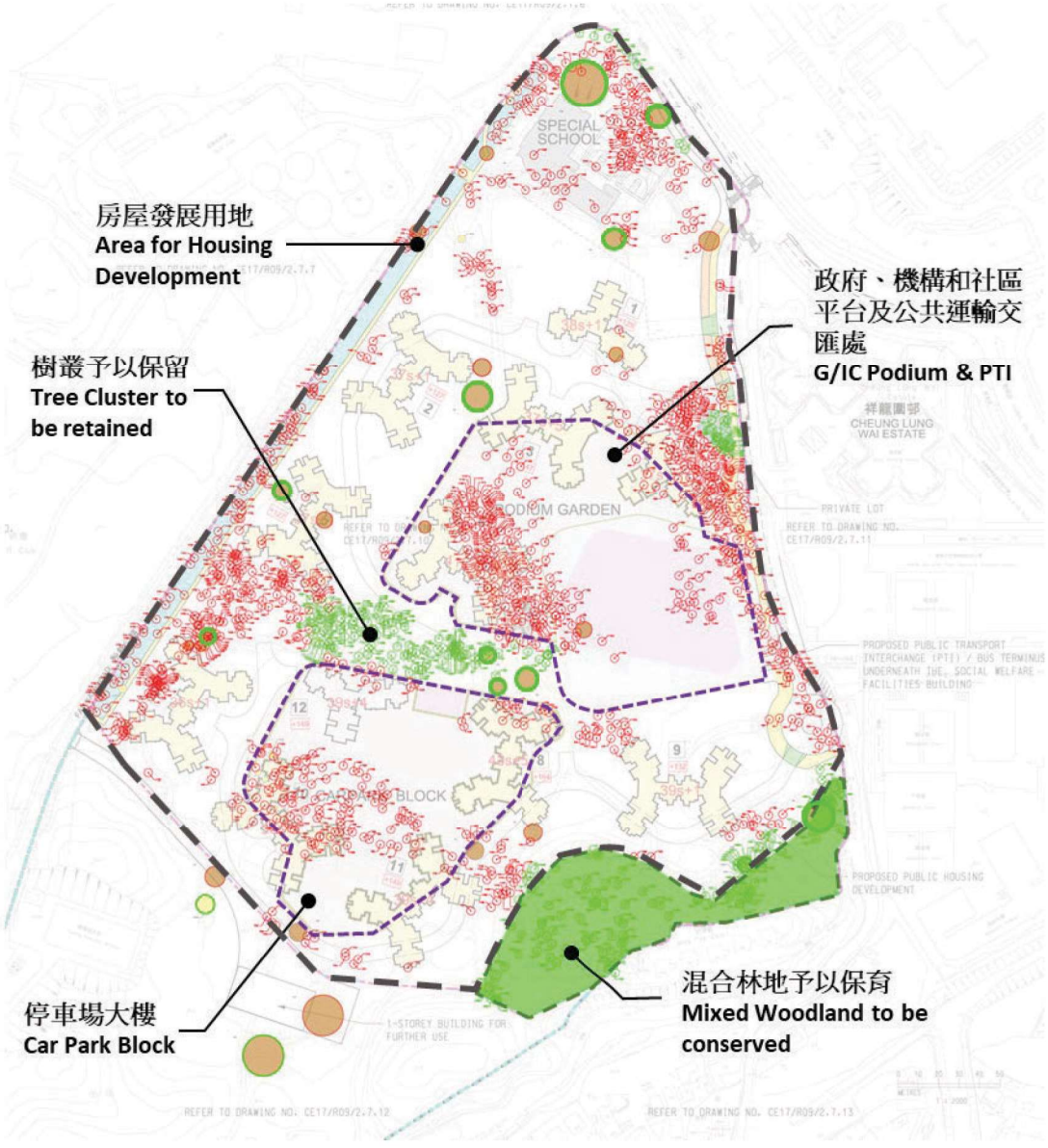


Figure 8A – Location of the preserved woodland adjacent to the existing carpark in Sub-Area 1

8.2.2 There are 116 trees in the tree cluster to be retained. The most dominant species include: -

- 40 *Lophostemon confertus* (紅膠木) – Exotic species;
- 14 *Cratoxylum cochinchinense* (黃牛木) – Native species;
- 11 *Macaranga tanarius var. tomentosa* (血桐) – Native species;
- 11 *Melaleuca cajuputi subsp. cumingiana* (白千層) – Exotic species.

8.2.3 All of these trees have been grown to maturity.

8.2.4 A sun-path analysis has been carried out based on the proposed housing block layout incorporated into the EIA Report in spring equinox (春分) representing the spring season, summer equinox (夏至) representing the summer season, autumn equinox (秋分) representing the autumn season, winter equinox (冬至) representing the winter season. Snap shots of the sun-path analysis at 8:00 am, 12:00 noon, and 2:00 pm for each of the 4 days representing the 4 seasons are extracted in **Figure 8B to 8E** below.

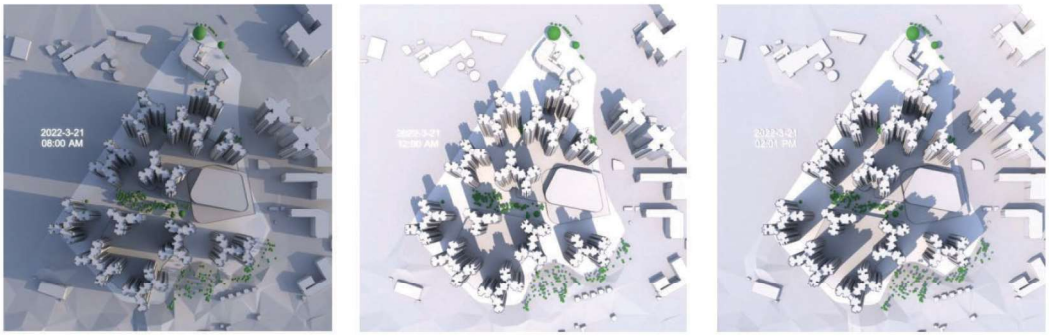


Figure 8B – From left to right, at 8:00 am, 12:00 noon, and 2:00 pm in Spring Equinox (春分)

Figure 8C – From left to right, at 8:00 am, 12:00 noon, and 2:00 pm in Summer Equinox (夏至)

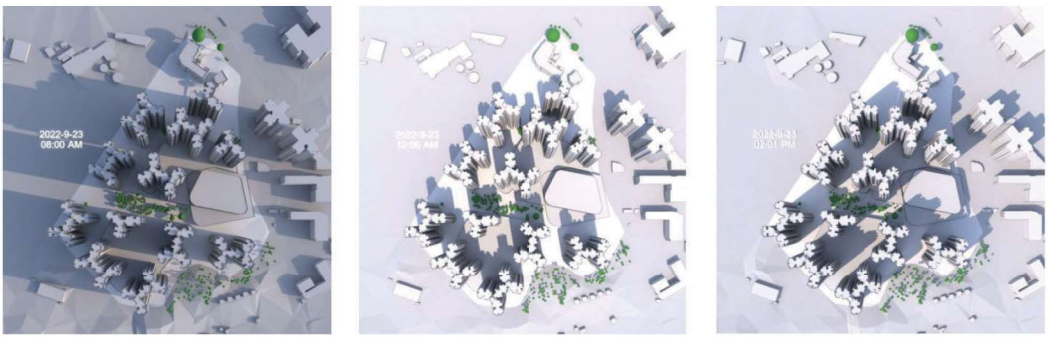


Figure 8D – From left to right, at 8:00 am, 12:00 noon, and 2:00 pm in Autumn Equinox (秋分)

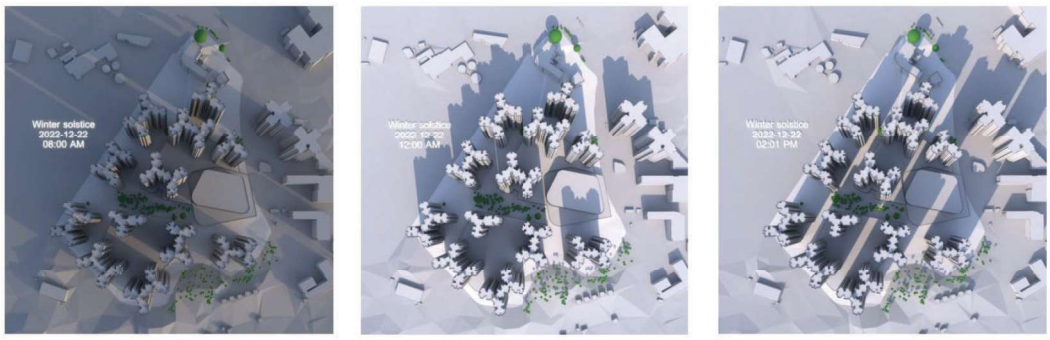


Figure 8E – From left to right, at 8:00 am, 12:00 noon, and 2:00 pm in Winter Equinox (冬至)

8.2.5 In spring equinox (春分), summer equinox (夏至), autumn equinox (秋分), the retained tree clusters would be able to receive direct sunlight, although in some time of a day, the trees may be shaded by the proposed housing development. The shading impact is not significant. In winter equinox (冬至), the retained tree cluster would only be subject to indirect sunlight throughout the day for approximately two to three months. There is no shading impact to the compensatory trees at Sub-Area 3.

8.2.6 Based on the sun-path analysis as described above, advice from Dr. Kuo Yau-lun (郭耀綸博士) of National Pingtung University of Science and Technology (國立屏東科技大學) has been sought. Dr. Kuo got his PhD degree in University of Georgia's Warnell School of Forestry and Natural Resources. Dr. Kuo is currently the honorable professor of the Department of Forestry of National Pingtung University of Science and Technology in Taiwan.

8.2.7 Dr. Kuo has carried out extensive studies on shade and drought tolerance in Taiwan's native tree species. He and his research team have produced a peer-previewed journal article 'Photosynthetic Characteristics and Shade Tolerance of 440 Native Woody Species in Taiwan' (2021) which was published in *Taiwan Journal of Forest Science*. Please refer to the synopsis of the paper extracted in **Figure 8F**.

臺灣原生440種木本植物的光合作用性狀及耐陰性

郭耀綸[1,3] 林倉億[1] 楊宜穎[1] 陳海琳[1] 楊智凱[1] 余尚鈺[2]

摘 要

耐陰性是森林生態學及育林學的基礎概念，但卻少有樹種耐陰性的量化資訊。本研究藉光合潛力此生理功能性狀，判斷臺灣原生木本植物的耐陰等級。共測定了440種木本植物，包含434種雙子葉、1種單子葉、5種裸子植物的光合作用性狀。結果發現供試物種的光合潛力在7.8~37.2 μmol CO_2 m^{-2} s^{-1}範圍，光合潛力≥ 30.0 μmol CO_2 m^{-2} s^{-1}有10種，最高者為蘭嶼鐵莧(*Acalypha caturus*)；光飽和點範圍為740~1800 μmol photon m^{-2} s^{-1}；光補償點分布於7.9~34.6 μmol photon m^{-2} s^{-1}；暗呼吸率則在0.85~3.09 μmol CO_2 m^{-2} s^{-1}。供試434種雙子葉類判斷為耐陰等級I (極不耐陰)、II、III、IV、V (極耐陰)者，分別有28、81、138、107、80種，顯示臺灣原生木本植物以中等耐陰之物種較多。所有物種4項光合性狀間都呈極顯著正相關，且光合潛力與光補償點兩者為接近1:1的關係。在屬的分類群，很少有同屬的不同物種全都歸類在同一個耐陰等級。在科的分類群，經計算全科物種耐陰性指標值，發現親緣關係較接近的幾個科，耐陰等級會相同或近似。此外，所有440物種只有17%為落葉性，耐陰等級I、II兩級分別有46及42%為落葉物種，而耐陰等級V者均為常綠性。本研究已完成台灣原生種喬木類63%及灌木類15%，共計43%原生木本植物的耐陰等級歸類，可供園藝景觀設計、林業種苗培育、造林樹種選擇、生態復育等實務工作參考，也可供量化林分演替階段之用。

關鍵詞：葉習性、光合潛力、親緣關係、生理功能性狀、耐陰等級。

郭耀綸、林倉億、楊宜穎、陳海琳、楊智凱、余尚鈺。2021。臺灣原生440種木本植物的光合作用性狀及耐陰性。台灣林業科學36(3):189-220。

Figure 8F – Extract of a study of Dr. Kuo of the Department of Forestry of National Pingtung University of Science and Technology

8.2.8 Dr. Kuo's advice on shading impact to the retained trees of this project has been sought.

8.2.9 Dr. Kuo advised that mature trees being periodically shaded for two months in winter, while receiving direct sunlight in other time of the year, would not be significantly impacted in health. *"血桐及白千層皆為喜高光的陽性樹種，大樹若只有冬天兩個月全日被遮陰，其他月份可照到直射光，則對植株健康應不會有重大影響。黃牛木和紅膠木若較耐陰，則遮陰的負面影響更輕微。" (Advice by Dr. Kuo)*

8.2.10 Dr. Kuo advised that in the lack of scientific support, trees' growing environment and condition could be used to reasonably speculate the species' shade-tolerance level. *"可以根據野外現地樹木生長的環境條件，做樹種耐陰性的推測。 出現在lower tree layer的會是耐陰的樹種，至少是中等耐陰等級。"* *Cratoxylum cochinchinense* (黃牛木) and *Macaranga tanarius* var. *tomentosa* (血桐) are commonly found in the understory and lower tree layer of secondary forests in Hong Kong. Based on the above consideration, Dr. Kuo supports that *Cratoxylum cochinchinense* (黃牛木) and *Macaranga tanarius* var. *tomentosa* (血桐) are considered as shade-tolerant species, or at least moderately shade-tolerant species.

8.2.11 We have also made reference to other overseas research studies.

8.2.12 From research of Clark et al. (1991), the relative photosynthetic tissues to non-photosynthetic tissues would decrease as trees mature and grow in size. This was verified by various studies which also have shown that photosynthetic activity and stomal conductance of trees would reduce as they age (Bond, 2000).

8.2.13 All the existing trees to be preserved in Sub-Area 1 are mature. Demand on sunlight for the preserved trees shall not be very high.

8.2.14 In another study on winter photosynthesis on 10 evergreen broadleaf tree species in the subtropical China carried out by Zhang et al. (2013) that all species showed decrease in photosynthesis rate by 13% to 53% in winter.

8.2.15 The study indicates that trees will be adapted to less sunlight in winter by reducing photosynthesis.

8.3 Conclusion

8.3.1 Shading impact analysis with sun-path analysis have been carried out. Taking account of (i) the advice of Dr. Kuo as detailed above, (ii) demand on sunlight normally reduces with age and the existing trees to be preserved are mature in nature, and (iii) the tree cluster would only be shaded throughout the day by the proposed housing development for two to three months in winter only when the photosynthesis of most of the tree would reduce, it is considered that both the impact of shading to the tree cluster to be preserved due to the proposed housing development and shading impact to compensatory trees at Sub-Area 3 would not be substantial.

Reference:

Bond, B.J., (2000), Age-related changes in photosynthesis of woody plants, *Trends in Plant Science*, **Vol 5**, Issue 8, p349-353

Clarke J.R., and Matheny N., (1991) Management of Mature Trees, *Journal of Arboriculture* **Vol. 17** No.7 pp173-184

Kuo, Y.L., Lin, T.Y., Yng, Y.Y., Chen, H.L., Yang, C.K., and Yu, S.Y., (2021) Photosynthetic Characteristics and Shade Tolerance of 440 Native Woody Species in Taiwan, *Taiwan Journal of Forest Science* **36**(3):189-220

Zhang, Y., Cao, K., and Goldstein, G., (2013) Winter Photosynthesis of Evergreen Broadleaf Trees from a Montane Cloud Forest in Subtropical China, *Photosynthesis: Research for Food, Fuel and Future* pp 812-817

9 EXISTING GRAVE IN SUB-AREA 1

9.1 Additional Information Required

9.1.1 The additional information requested by EPD is recapped as follows: -

"Further information on how the grave situated in Sub-Area 1 will be handled, with consideration of the view that many members of the Council have recommended to retain the grave as far as possible."

9.2 Recommendation for the Existing Grave within Sub-Area 1

9.2.1 The existing grave will be in conflict with the housing block and the carpark building. The existing grave is proposed to be removed.

9.2.2 The existing grave as shown in **Figure 9A** below is located on the existing undulating surface of the golf course. If the existing grave shall be retained: -

- Retaining wall shall be constructed to maintain the grave. As the grave will be sensitive to settlement and disturbance, the retaining wall shall be set back from the existing grave by at least 3 m to avoid the potential impact;
- Access shall be maintained to facilitate the visitors to visit the grave, not only after the proposed housing development, but also during the construction of the site formation works and the proposed housing development;
- The block layout and the landscape design of the open space of the proposed housing development shall take account of the retaining wall and the access.

Figure 9A – The existing grave within Sub-Area 1

9.2.3 Substantial construction works will be carried out for the site formation works and the proposed housing development. The construction works would last for a few years. If the grave shall be retained, the construction works shall be set back accordingly to avoid impact to the existing grave. Even though various mitigation would be adopted, there is risk that the existing grave may be disturbed by the construction works. The environmental condition of the retained grave is difficult to be maintained in good condition during the construction works.

9.2.4 Taking account of the difficulty to maintain the existing grave in good condition and the impact of retaining the grave to the proposed housing development, retaining the exiting grave is considered to be not practical.

9.2.5 In general, for grave with a history of 60 years or more, Cap 130 Land Acquisition (Possessory Title) Ordinance shall apply. We will identify and liaise with the offspring for handling the grave removal in accordance with the Ordinance.

Appendix 1.1

EPD's Letter Requesting for Additional Information

Appendix 1.1

本署檔號
OUR REF: (2) in EP2/N7/S3/100 Pt.7
來函檔號
YOUR REF:
電話
TEL. NO.: 2835 1868
圖文傳真
FAX NO.: 2591 0558

Hong Kong Government
Environmental Protection Department
Branch Office
27th Floor, Southorn Centre,
130 Hennessy Road,
Wan Chai, Hong Kong

環境保護署
香港灣仔
軒尼詩道
130號
修頓中心27樓

31 August 2022

By Registered Post & Fax [redacted]

Civil Engineering and Development Department
[redacted]

Environmental Impact Assessment (EIA) Ordinance, Cap. 499
Application for Approval of EIA Report
Request for Information under Section 8(1) of the EIA Ordinance

Project Title: Technical Study on Partial Development of Fanling Golf Course Site – Feasibility Study
(Application No. EIA-282/2022)

I refer to your application received on 22 April 2022 for approval of the subject EIA report under Section 6(2) of the EIA Ordinance.

Pursuant to Section 8(1) of the EIA Ordinance, you are asked, in connection with the comments received from the ACE, to give us the following information for us to decide whether to approve the EIA Report under Section 8(3) of the EIA Ordinance:

(a) Additional Bird Survey covering early morning to evening (i.e. before sunrise to 10 pm) to be conducted twice a month from September 2022 to March 2023 (covering the wet and dry seasons) to reaffirm that the overall results of the bird survey conducted in the EIA report are valid. Details of the survey methodology including the types of device used, transect of the survey, qualifications of the personnel conducting the survey as well as the locations, frequency and duration of the survey shall be included;

(b) Additional Moth Survey covering both evening and mid-night to be conducted twice a month from September to October 2022 to reaffirm the overall result of the moth survey conducted in the EIA report. Two rounds of survey with a duration of two hours each (i.e. one at two hours after sunset and the other one at mid-night between 00:00 and 02:00) should be carried out each night. Details of the survey methodology including the types of device used, location/transect of the survey, qualifications of the personnel conducting the survey as well as the locations, frequency and duration of the survey shall be included;

(c) Details of the survey methodology adopted for the Bat Survey in the EIA report including the coordination of the transects of the surveys, qualifications of the personnel conducting the survey as well as the locations, frequency and duration spent on each Sub-Area;

(d) Tree compensation plan which shall include details of planting numbers with a compensation ratio of at least 1:1.5 having regard to the number of trees affected, locations and tree species to be compensated as well as a management plan taking into account the water demand of the compensatory trees;

(e) A detailed layout plan of the proposed housing development which shall illustrate, with the help of an overlay plan of the proposed housing blocks, the preservation of an additional 0.39 hectares of secondary woodland in Sub-Area 1 (on top of those woodland, mixed woodland and Trees of Particular Interest (TPI) recommended for preservation in the EIA report), the locations of the trees to be retained, the location, disposition and design of the proposed housing blocks with a view to minimising adverse ecological impact;

(f) A detailed analysis of the hydrological impact to show the flow of water, including available information on the profile of soil and bedrock conditions of the project site;

(g) Additional analysis on the shading impact of the proposed housing blocks to the trees in the potential development area taking into account the revised layout plan; and

(h) Elaborations on how the grave situated in Sub-Area 1 will be handled and whether the grave could be retained.

Please note that the information provided to us will form part of the EIA report and will be uploaded onto our EIA Ordinance website for the public to access. Please provide us the information in both hard and soft copies to facilitate dissemination.

Should you have any queries concerning the above, please contact my colleague Mr. Billy MA at 2835 1142.

Yours sincerely,

(Stanley C.F. LAU)
Principal Environmental Protection Officer
for Director of Environmental Protection

c.c:
Secretary of ACE EIA Subcommittee (Attn. : Ms. Karen CHEK) Fax: 2872 0603

Appendix 2.1

Actual Date and Time of the Additional Bird Survey

Date	Location	Time
13 September 2022	PDA	0500 to 2200
21 September 2022	PDA	0500 to 2200
11 October 2022	PDA	0500 to 2200
25 October 2022	PDA	0500 to 2200
4 November 2022	PDA	0520 to 2200
14 November 2022	PDA	0520 to 2200
12 December 2022	PDA	0600 to 2200
20 December 2022	PDA	0600 to 2200
6 January 2023	PDA	0600 to 2200
13 January 2023	PDA	0600 to 2200
7 February 2023	PDA	0600 to 2200
15 February 2023	PDA	0600 to 2200
1 March 2023	PDA	0540 to 2200
6 March 2023	PDA	0540 to 2200

Appendix 2.2

Bird Species Recorded in Early Morning and in the Daytime within the PDA during the Additional Bird Survey

No.	Common Name	Conservation Importance [Notes]	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
				Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm
1	Arctic Warbler	-	PM			1	1				
2	Asian Barred Owlet	Class 2 Protected Animal of China; Appendix 2 of CITES; (Cap. 586)	PM						1		
3	Asian Brown Flycatcher	-	PM	2	5	2	1	1	3		1
4	Asian Koel	-	R	1	2	2	2	1	3	1	1
5	Black Drongo	-	OS			2	1	15	4		9
6	Black-collared Starling	-	R	3	5	3	4		4		4
7	Black-naped Oriole	Fellowes et al. (2002): LC	PM				2				
8	Black-throated Laughingthrush	Class 2 Protected Animal of China;	R				4	1	4	2	1
9	Brown-headed Thrush	Fellowes et al. (2002): LC	PM, OW				3				
10	Chestnut Bulbul	-	R, OW								6

No.	Common Name	Conservation Importance [Notes]	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
				Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm
11	Chestnut-collared Yuhina	Fellowes et al. (2002): (LC)	OW, OS				30	15	15	20	20
12	Chinese Blackbird	-	PM, OW	2	4	2	1				
13	Chinese Bulbul	-	R	35	21	20	12	20	24	41	20
14	Chinese Pond Heron	Fellowes et al. (2002): PRC	R	3	4	2	5	3	4	6	3
15	Cinereous Tit	-	R	20	10	15	10	20	12	10	10
16	Collared Scops Owl	Class 2 Protected Animal of China; Appendix 2 of CITES; (Cap. 586)	R	1	1	1	1	2	1		1
17	Common Emerald Dove	China Red Data Book Status: (Vulnerable)	R			1	1				
18	Common Tailorbird	-	R	10	8	4	4	10	13	10	5
19	Crested Myna	-	R			4	1				7
20	Dark-sided Flycatcher	-	PM							1	1

No.	Common Name	Conservation Importance [Notes]	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
				Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm
21	Daurian Redstart	-	OW	2	6	3	3	5	4	2	2
22	Dusky Warbler	-	PM, OW								1
23	Eastern Cattle Egret	Fellowes et al. (2002): LC	R, PM	8	4	13	6	7	3	6	7
24	Eastern Yellow Wagtail	-	PM, OW						3		1
25	Eurasian Tree Sparrow	-	R	10	6	10	3	2	4		18
26	Fork-tailed Sunbird	-	R	5	2		1	2	5	3	1
27	Great Egret	Fellowes et al. (2002): PRC	R, PM, OW						1	1	
28	Grey Bush Chat	Fellowes et al. (2002): LC	PM, OW							1	1
29	Grey Wagtail	-	PM, OW	2	2				5		3
30	Grey-backed Thrush	-	PM, OW	6	3		15	4	1	1	3
31	Grey-chinned Minivet	Fellowes et al. (2002): LC	R					10	1		

No.	Common Name	Conservation Importance [Notes]	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
				Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm
32	Hair-crested Drongo	-	PM, OW			1	8	9		3	
33	Japanese White-eye	-	R	30	35	40	20	50	34	50	38
34	Little Egret	Fellowes et al. (2002): PRC	R, PM, OW			1	6		1	1	1
35	Little Grebe	Fellowes et al. (2002): LC	R							1	1
36	Masked Laughingthrush	-	R	9	12	12	12	3	7	2	5
37	Mugimaki Flycatcher	-	PM, OW	1	2			3			
38	Olive-backed Pipit	-	PM, OW	7	21	4	5	10	10	4	10
39	Oriental Magpie Robin	-	R	3	6	4	5	2	4	3	5
40	Pale-legged Leaf Warbler	-	PM			5	2				
41	Pallas's Leaf Warbler	-	PM, OW	1	4	2	3	2	4	1	2
42	Red-billed Blue Magpie	-	R	2	3		6	2	2		4

No.	Common Name	Conservation Importance [Notes]	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
				Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm
43	Red-throated Flycatcher	-	R					2	1		
44	Red-whiskered Bulbul	-	R	13	14	12	11	10	31	10	12
45	Scarlet Minivet	-	R	3	2	3	6	1	12	3	4
46	Scarlet-backed Flowerpecker	-	R	10	2	2	1	3	3	1	1
47	Spotted Dove	-	R	12	16	8	13	8	18	6	8
48	Velvet-fronted Nuthatch	-	R	3	2		2	1	2	2	3
49	White Wagtail	-	R, PM, OW	10	8	6	10	11	18	7	15
50	White-bellied Erpornis	Fellowes et al. (2002): LC	R					3			1
51	White-breasted Waterhen	-	R			1	2	1	1	2	1
52	White's Thrush	-	PM, OW	1	1		3	1	1	1	1
53	Yellow-browed Warbler	-	PM, OW	6	4	6	3	7	6	4	7

No.	Common Name	Conservation Importance [Notes]	Overwintering (OW) Oversummering (OS) Passage migrant (PM) Resident (R)	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
				Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm	Early morning	10am-10pm
54	Yellow-legged Buttonquail	-	PM, OW		1						

Notes

1. All wild birds in Hong Kong are protected under the Wild Animals Protection Ordinance (Cap. 170).
2. Convention on International Trade in Endangered Species of Wild Fauna and Flora. (2023). Appendices I, II and III.
3. Fellowes *et al*. (2002). Wild animals to watch: Terrestrial and freshwater fauna of conservation concern in Hong Kong.
   - LC: local concern; PRC: potential regional concern;
   - Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence
4. Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).
5. State Forestry Administration & Ministry of Agriculture (1989). List of Wild Animals under State Protection.
6. Zheng and Wang (1998). China Red Data Book of Endangered Animals: Aves.

Appendix 3.1

Actual Date and Time of Additional Moth Survey

Date	Location	Time	
		Evening	Midnight
13 September 2022	PDA	1900 to 2100	1200 to 0200
21 September 2022	PDA	1900 to 2100	1200 to 0200
11 October 2022	PDA	1830 to 2030	1200 to 0200
25 October 2022	PDA	1830 to 2030	1200 to 0200

Appendix 3.2

Moth Species and Abundance Recorded in the Sunset and Midnight of the 4 Sub-Areas of PDA during the Additional Moth Survey

No.	Species Name	Conservation Importance	Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4	
			Evening	Midnight	Evening	Midnight	Evening	Midnight	Evening	Midnight
1	Arctiidae	-							6	
2	*Asota plaginota*	-			4		26	15	31	9
3	*Athetis bremusa*	-				1				
4	*Bocula marginata*	-			3					
5	*Cnaphalocrocis medinalis*	-	8	4	20	13			8	6
6	*Episteme lectrix*	-	4							
7	*Hamodes* sp.	-	3	2			5			
8	*Herpetogramma* sp.	-						1		
9	Homona coffearia	-			2					
10	*Hyposidra talaca*	-					1			
11	Lamoria sp.	-			3					
12	*Laspeyria ruficeps*	-					1			
13	*Leucania designata*	-					1			
14	*Lophoruza lunifera*	-			2					
15	*Macroglossum* sp.	-					1			
16	*Meridemis* sp.	-			2		9			
17	*Nyctemera adversata*	-					6		15	5
18	*Pidorus gemina*	-	6	2			10			
19	*Pleuroptya chlorophanta*	-	2	3						
20	*Pleuroptya obfuscalis*	-				1				
21	*Problepsis vulgaris*	-					1			
22	Pterophoridae	-			1					
23	*Spodoptera litura*	-	7	3				6		
24	*Spodoptera* sp.	-	3	3			1			
25	*Spoladea recurvalis*	-	11	5	8	4	13			
26	*Syntytispis* sp.	-					1			
27	*Ugia purpurea*	Provisional IUCN Near Threatened			4	2		4		
28	*Xenoplia trivalis*	-					1			
Total species number			8	7	10	5	14	4	4	3
Total abundance			44	22	49	21	77	26	60	20

Appendix 7.1

Photos of the Soil Sampling Points

Figure A7.1A – Soil sampling at point M1

Figure A7.1B – Soil sampling at point M2

Figure A7.1C – Soil sampling at point M3

Figure A7.1D – Soil sampling at point M4

Figure A7.1E – Soil sampling at point M5


Figure A7.1F – Soil sampling at point M6

Figure A7.1G – Soil sampling at point M7

Figure A7.1H – Soil sampling at point M.8

Figure A7.1I – Soil sampling at point M9

Figure A7.1J – Soil sampling at point M10