Specialist Consultancy Services for Environmental Baseline Study (EBS) on Choa Chu Kang N1

Final Report

Housing & Development Board (HDB)

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List of Acronyms

Acronym	Definition
AECOM	AECOM Singapore Pte. Ltd.
BIA	Biodiversity Impact Assessment
CCK	Choa Chu Kang
DGPS	Differential Global Positioning System
DO	Dissolved Oxygen
EBS	Environmental Baseline Survey
GPS	Global Positioning System
HDB	Housing & Development Board
IUCN	International Union for Conservation of Nature
KJE	Kranji Expressway
KTM	Keretapi Tanah Melayu
LOEL	Lowest Observed Effect Level
m bgs	Meters Below Ground Surface
MLS	Marchwood Laboratory Services Pte Ltd
NAS	National Archives of Singapore
NBSAP	National Biodiversity Strategy and Action Plan
NEA	National Environment Agency
NParks	National Parks Board
NTU	Nephelometric Turbidity Units
NUS	National University of Singapore
NUSLHMSG	NUS Libraries Historical Maps of Singapore
PHILMINAQ	Mitigating Impact from Aquaculture in the Philippines
PSU	Practical Salinity Unit
PUB	Public Utilities Board
SLA	Singapore Land Authority
SRDB	Singapore Red Data Book
TDS	Total dissolved solids
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
TSS	Total suspended solids
UNECE	United Nations Economic Commission for Europe
URA	Urban Redevelopment Authority
US	United States of America
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation

List of Glossary

Term	Definition	References for Definition
Casual	Exotic species that do not form self-replacing populations and rely on repeated introductions or limited asexual reproduction for persistence	Chong et al., 2009 [P-7] Pyšek et al., 2004 [P-42]
Common	**(Flora)** Native species that have more than 1000 mature individuals locally	Chong et al., 2009 [P-7]; SRDB [P-9]
Critically Endangered	Species facing an extremely high risk of extinction in the wild/in Singapore (with <50 mature individuals or <250 total individuals)	SRDB [P-9]; IUCN [P-15]
Cryptogenic	Plant of uncertain origin. Species without biogeographical or historical evidence of being non-native, but are restricted to only human-modified or human disturbed habitats	Chong et al., 2009 [P-7]; Pyšek et al., 2004 [P-42]
Cultivated Only	**(Flora)** Exotic species that persist locally as a result of cultivation or other direct human care	Chong et al., 2009 [P-7]; Pyšek et al., 2004 [P-42]
Endangered	Species facing a very high risk of extinction in the wild/in Singapore (with <250 mature individuals)	SRDB [P-9]; IUCN [P-15]
Exotic	Species whose presence is a result of either intentional or unintentional human involvement	Chong et al., 2009 [P-7] Pyšek et al., 2004 [P-42]
Keystone	Keystone species is defined as “important plants that other animal in the community depend heavily on”.	Lok et al., 2013 [P-24]
Native	Species that have originated in a given area without human involvement or have arrived there without intentional or unintentional intervention of humans from an area in which they are native	Chong et al., 2009 [P-7] Pyšek et al., 2004 [P-42]
Naturalised	Exotic species that form self-replacing, usually sexually reproducing populations	Chong et al., 2009 [P-7] Pyšek et al., 2004 [P-42]
Presumed Nationally Extinct (NE)	**(Flora)** Species that has not been recorded within Singapore for the last 30 years	SRDB [P-9]
	(Fauna) Species that has not been recorded within Singapore for the last 50 years	SRDB [P-9]
Probable	A list of faunal species that are likely to occur at the site (termed thereafter in the report as “species of probable occurrence”)	-
Rarity	This definition differs for each faunal taxon. The rarity for each taxa are reference to those listed in Singapore Red Data Book (SRDB), and other more updated local checklists, where available, such as Soh et al. 2019 for odonates and Jain et al. 2018 for butterflies. The global conservation status references the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN, 2021).	SRDB [P-9]; Soh et al. 2019 [P-34] Jain et al. 2018 [P-16]; IUCN, 2021 [P-15]
Threatened	**Flora**	
	Flora species that were listed as nationally Vulnerable, Endangered, Critically Endangered, or Presumed Nationally Extinct (which indicates a rediscovery). **Vulnerable (VU):** More than 250 but fewer than 1000 mature individuals **Endangered (EN):** Fewer than 250 mature individuals **Critically Endangered (CR)**: Fewer than 50 mature individuals or more than 50, but fewer than 250 mature individuals **Presumed Nationally Extinct (NE):** No record of fauna species within the last 30 years since its last record.	SRDB [P-9]; Chong et al., 2009 [P-7]
	Fauna	

Term	Definition	References for Definition
	Threatened species of fauna are those listed as nationally or globally Vulnerable, Endangered, Critically Endangered, or Extinct. **National Status** **Vulnerable (VU):** Species with <1000 mature individuals and >250 total individuals **Endangered (EN):** Species with <250 mature individuals **Critically Endangered (CR)**: Species with <50 mature individuals or <250 total individuals **Presumed Nationally Extinct (NE):** No record of fauna species within the last 50 years since its last record **Global IUCN List** **Vulnerable (VU):** Species facing a high risk of extinction in the wild **Endangered (EN):** Species facing a very high risk of extinction in the wild **Critically Endangered (CR):** Species facing an extremely high risk of extinction in the wild **Extinct in the Wild (EW)**: Species that only survives through cultivation, captivity or as a naturalized population(s) outside its natural range **Globally Extinct (EX):** Globally extinct, including in captivity or through cultivation	SRDB [P-9]; Jain et al. 2018 [P-16];
Uncommon	This definition differs for each faunal taxon. The rarity for each taxa are reference to those listed in Singapore Red Data Book (SRDB), and other more updated local checklists, such as Soh et al. 2019 for odonates and Jain et al. 2018 for butterflies. The global conservation status references the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN, 2021).	SRDB [P-9]; Soh et al. 2019 [P-34]; Jain et al. 2018 [P-16]; IUCN, 2021 [P-15]

1 Executive Summary

Project Description & Objectives

AECOM Singapore Pte Ltd was appointed by the Housing & Development Board (HDB) to carry out an Environmental Baseline Study ('EBS') on Choa Chu Kang N1, zoned "Residential (Subject to Detailed Planning)" in Urban Redevelopment Authority (URA)'s gazetted Master Plan 2019 (hereinafter referred to as 'the Project'). Choa Chu Kang N1 (hereafter referred as "CCK N1") site is bounded by Woodlands Road in the east and Kranji Expressway in the north, with an estimated area of approximately 21.7 ha (hereafter referred to as "Study Area"). Majority of the Study Area is covered by managed vegetation, while the Pang Sua Canal is located along the western and southern edges.

This Study aims to understand the baseline environmental (i.e. biodiversity, hydrology, water quality and groundwater level) conditions and ecological connectivity of the CCK N1 Study Area in order to inform the ecological value of this site, which in turn serves to guide detailed planning for this site.

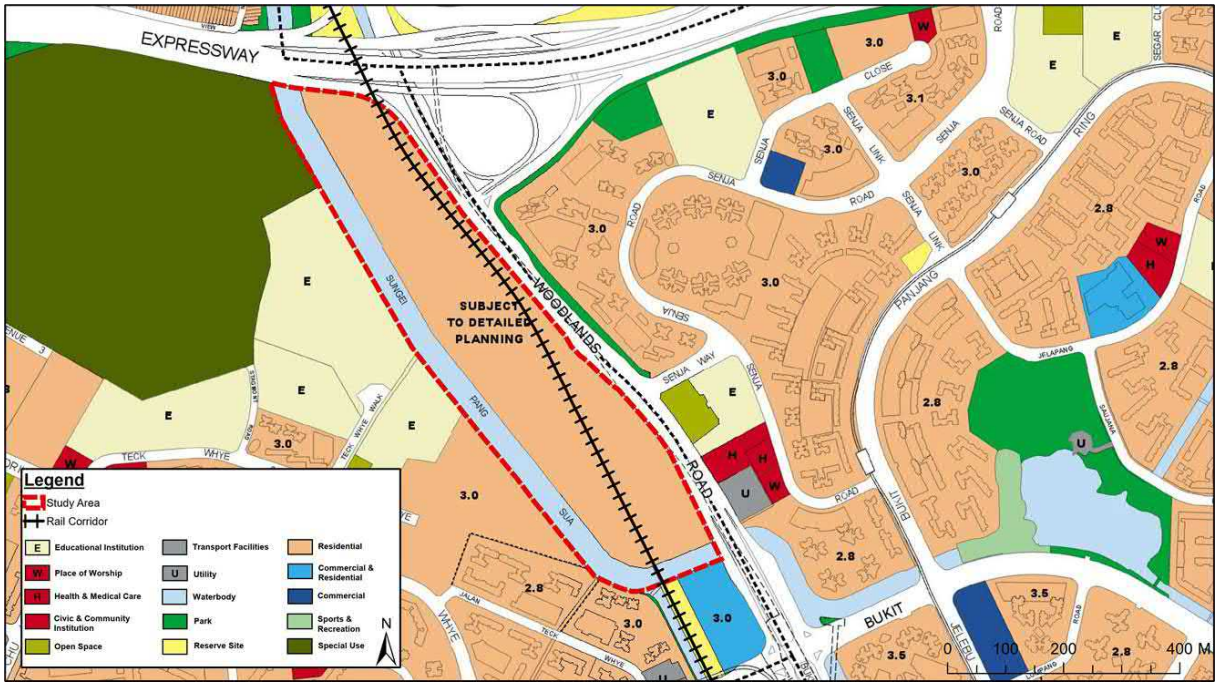

Figure 1-1 Proposed Land Use of Study Area and its surroundings (Source: URA's gazetted Master Plan 2019 [M-3])

Environmental Baseline Findings

Baseline studies on biodiversity, hydrology and water quality were conducted for the Study Area, and an overview of the findings is provided below. More information can be found below as well as from Sections 7 and 8 of the report.

The flora baseline survey helped to identify and map the various vegetation types, while the fauna study set out to determine the current faunal diversity and distribution within the site. Both surveys also served to identify species of conservation significance present in the area (refer to Table 1-1 and Table 1-2 for the technical definitions of the conservation status used to derive the conservation significance of the species recorded). The biodiversity baseline surveys revealed that the Study Area is characterised largely by managed vegetation, comprising clusters of trees planted for landscape purposes, and turf area. As such, this supports the presence of fauna species that are adapted to disturbed habitats. There were also records of a few uncommon and rare fauna species within the Study Area. The Study Area consists of mostly exotic plant species and does not have a large number of species of conservation significance (see Table 1-1). However, the presence of large mature trees, such as Senegal mahogany (*Khaya senegalensis*) and raintree (*Samanea saman*), could provide a conducive shelter for the fauna species. Although the Study Area may not be rich in its wildlife generally, its geographical location serves as a

conduit for wildlife dispersal and/or movement to other larger forest patches and surrounding green space in proximity [P-10].

Table 1-1 Definition of Each National Conservation Status for Flora (Davison et al., 2008 [P-9]; Chong et al., 2009 [P-7]).

National conservation status	Definition
Vulnerable	More than 250, but fewer than 1,000 mature individuals
Endangered	Fewer than 250 mature individuals
Critically Endangered	Fewer than 50 mature individuals or more than 50, but fewer than 250 mature individuals
Presumed Extinct	Not recorded within the last 30 years

Table 1-2 Definition of Each National and Global Conservation Status for Fauna (Davison et al., 2008 [P-9]; Soh et al., 2019 [P-34]; Jain et al., 2018 [P-16]; IUCN, 2012 [P-15]).

Conservation status	Definition
National	
Vulnerable	More than 250 individuals in total, but fewer than 1,000 mature individuals
Endangered	Fewer than 250 mature individuals
Critically Endangered	Fewer than 250 individuals in total or fewer than 50 mature individuals
Presumed Nationally Extinct	Not recorded within the last 50 years
Global	
Vulnerable	Faces a high risk of extinction in the wild
Endangered	Faces a very high risk of extinction in the wild
Critically Endangered	Faces an extremely high risk of extinction in the wild
Extinct in the Wild	Only survives through cultivation, captivity or as a naturalized population(s) outside its natural range
Extinct	Globally extinct, including those in captivity or through cultivation

The hydrological baseline study aimed to identify and map the watercourses present in the Study Area, and to study their water flow conditions and bank characteristics. Baseline water quality surveys also determined the water quality of these watercourses. Based on the hydrological studies, there are four (4) catchment areas within the Study Area which feeds into the surrounding four (4) watercourses. Both Pang Sua Canal (D1) and concrete drain at the northeast of site (D2) have relatively poor water quality for survival of aquatic life. This aligns with biodiversity findings which noted that Pang Sua Canal supported poor aquatic life at the time of survey.

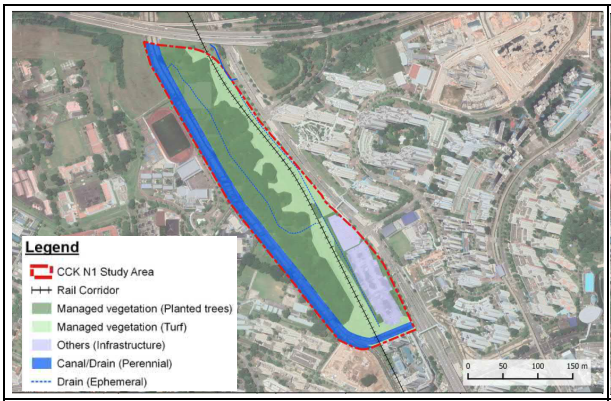

Figure 1-2 Vegetation distribution in the Study Area

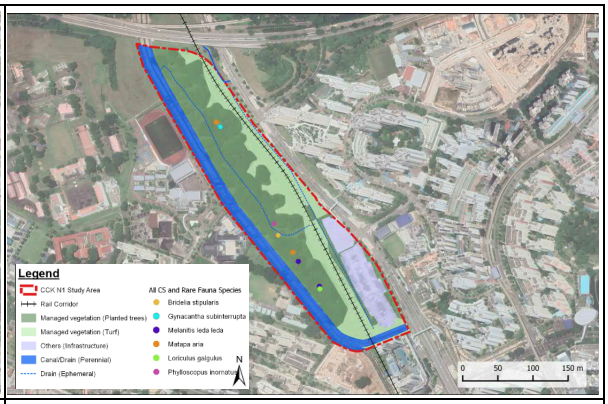

Figure 1-3 Distribution of flora and fauna species of conservation significance in the Study Area

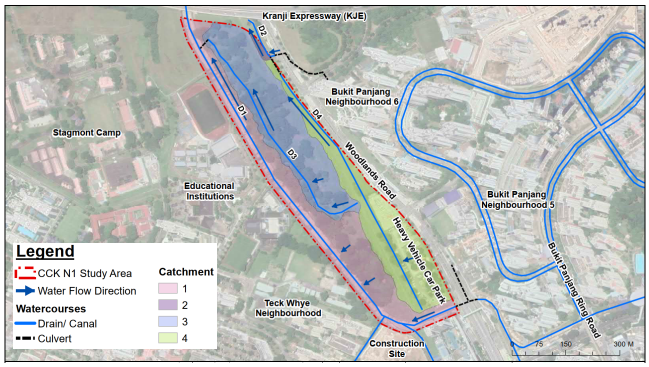

Figure 1-4 Existing waterbodies in the Study Area

- **Vegetation Distribution** (see Figure 1-2) – CCK N1 mainly constitutes managed vegetation, comprising clusters of tree species planted for landscaping purposes (9.62 ha; 45.2%) which occupies about half of the Study Area, and turf area (5.36 ha; 25.2%). Existing canal and infrastructure, such as the heavy vehicle carpark and defunct bus terminal take up 6.32 ha (29.6%) of the Study Area.
- **Biodiversity, Flora** (see Figure 1-3) – The floristic assessment identified a total of 115 species from 45 families, of which, majority are exotic (77 species; 67.0%), only 27 species are native (23.5%), and 11 (9.5%) are cryptogenic (i.e., species that has unknown or uncertain origins). Only one nationally Vulnerable climber species, *Bridelia stipularis*, is considered to be a species of conservation significance.
- **Biodiversity, Large Plant Specimens and Other Specimens of Values** – Ninety-one large plant specimens were recorded in the Study Area, largely dominated by Senegal mahogany (*Khaya senegalensis*) and raintree (*Samanea saman*). Other specimens of value consist of two keystone species with two specimens respectively: Malayan banyan (*Ficus microcarpa*) and weeping fig (*F. benjamina),* with a spread that ranges from 3-8 m. In addition, a bamboo cluster, *Bambusa* cf. *heterostachya* with a spread of 2.5 m, were also identified to be possible roosting habitat for bamboo bats.
- **Biodiversity, Fauna** (see Figure 1-3) – The field assessment recorded 89 species, with more than half of the assemblage dominated by birds (36 species) and butterflies (18 species). Only one species of conservation significance (Table 1-2), the nationally Endangered blue-crowned hanging-parrot (*Loriculus galgulus*), which is now considered locally widespread and common, was observed within the Study Area.

  While not considered of conservation significance, several other uncommon faunas were also recorded. These include the uncommon dingy duskhawker (*Gynacantha subinterrupta*) that is usually found in forested areas, and two moderately rare butterflies: evening brown (*Melanitis leda leda*), which is usually sighted in grasslands, thickets, or among dense vegetation, and common redeye (*Matapa aria*), which is usually sighted in various habitat types where bamboo clusters are present in urban parks, wastelands and nature reserves. [W-10].

  Nine migratory bird species were also recorded, including the rare yellow-browed warbler (*Phylloscopus inornatus*) and uncommon migrant species, yellow-rumped flycatcher (*Ficedula zanthopygia*). These records show the value of the Study Area in supporting these uncommon species and migratory birds.

Other species of conservation significance that may utilise the Study Area to move between habitats include the globally Critically Endangered and nationally Endangered straw-headed bulbul (*Pycnonotus zeylanicus*), the globally Vulnerable smooth-coated otter (*Lutrogale perspicillata*), and the globally and nationally Critically Endangered Sunda pangolin (*Manis javanica*) [P-10; P-11]. These species have been recorded in surrounding green spaces and may disperse to the Study Area. The watercourse within the Study Area is poor in aquatic life and is more likely to be used by fauna to move between habitats.

- **Hydrological Conditions** (see Figure 1-4) – Four (4) water catchment areas within the vicinity of the Project mainly contribute to four (4) watercourses within the Study Area. The perennial Pang Sua Canal D1 is located along the western and southern lengths of the Study Area. Perennial concrete drain D2 is located at the northeast corner of the site. Ephemeral concrete drain D3 cuts across the centre of the site, discharging into Pang Sua Canal D1 through a culvert. Ephemeral concrete drain D4 located along the eastern section of the Study Area.
- **Water Quality** – Six (6) sampling stations were identified for the Study Area. Generally, water quality findings in Canal D1 and drain D2 had exceeded the aquatic life criteria, aligning with biodiversity findings in Section 7 which showed the poor aquatic life along Pang Sua Canal during the time of field survey. pH in Pang Sua Canal D1 and concrete drain D2 exceeded the NEA guidelines and aquatic life criteria[1], likely due to the concrete surfaces of the surrounding urbanized area (especially from a nearby construction site), as chemicals washed off from concrete could lead to the increased pH. Relatively high Total Suspended Solids and turbidity was observed in Pang Sua Canal D1 and concrete drain D2, which was likely due to flushing from surrounding urban areas (including a nearby construction site). The relatively high nutrient (nitrogen and phosphorus) concentrations in Pang Sua Canal D1 and concrete drain D2 indicated that both watercourses had higher eutrophication potential, which was consistent with the greenish water with algae observed during site survey. Elevated enterococcus counted observed along the Pang Sua Canal D1 and concrete drain D2 were also likely due to stormwater carrying faecal contaminants from the surrounding residential or vegetated area.

[1] The aquatic life criteria indicate the threshold concentration of contaminants that can be present in surface waterbodies before it is likely to harm on the aquatic flora and fauna within it.

Ecological Significance and Connectivity

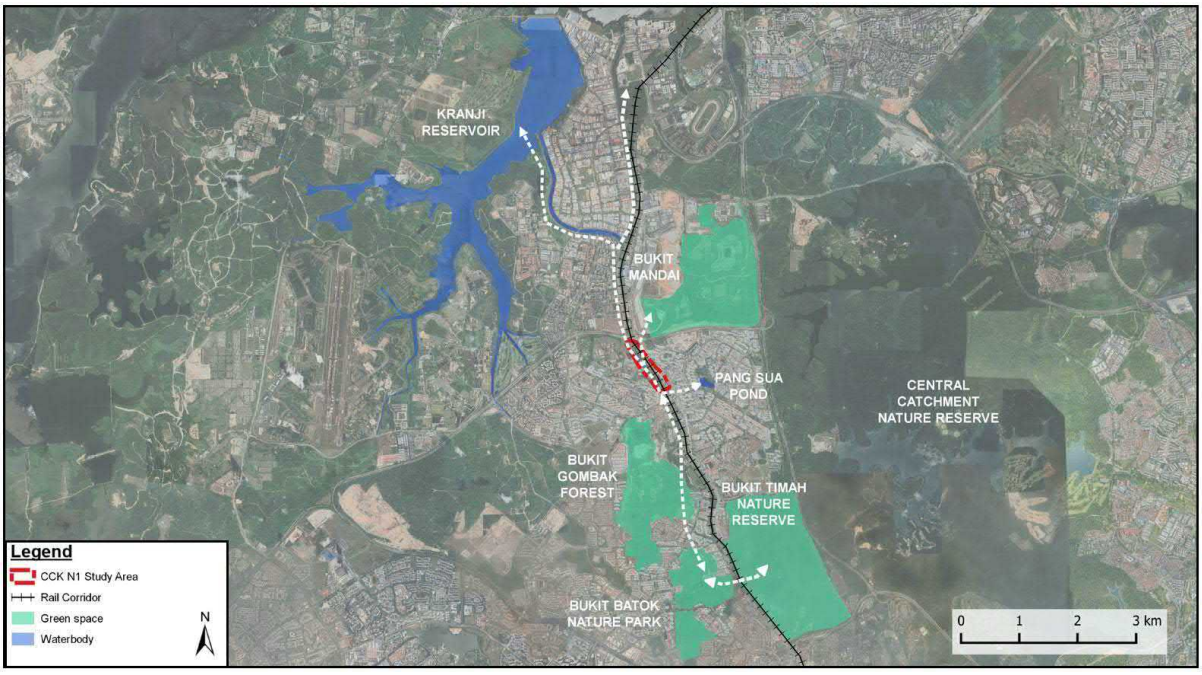

Figure 1-5 Site Context and potential connectivity between Study Area and other green patches in proximity

The 21.7 ha Study Area, Choa Chu Kang N1, is also known as the Sungei Pang Sua Woodland [P-10; P-11]. It is "an important part of the Green Rail Corridor between Hill View in the south and Stagmont Ring in the north, as it is the only wooded area in-between" [P-11]. The Study Area is also considered as "a conducive stepping stone" [P-10] (i.e., habitat patches in a landscape that facilitates movement of species between other forested patches [P-33]) and "a conduit for wildlife dispersal or movement" [P-10] that could facilitate the dispersal of fauna to the surrounding green spaces, such as Bukit Mandai forest to the northeast and Bukit Gombak forest to the south (Figure 1-5), and to other larger fragmented habitats, including Bukit Timah Nature Reserve (BTNR) in the southeast, and Mandai Mangrove and Mudflats in the north [P-10], hence, enhancing the ecological connectivity across the landscape.

Species residing in adjacent areas, particularly volant species, can use the Study Area as a stepping stone to disperse to surrounding green spaces. An example is the globally Critically Endangered straw-headed bulbul (*Pycnonotus zeylanicus*) that was recorded at the adjacent Bukit Mandai Forest, Bukit Batok Nature Park (BBNP), and Toh Tuck Forest [P-36; P-39]. Species adapted to using canals can also use the canal to move through the Study Area. According to Guttensohn & Leong (2021), the globally Vulnerable and nationally Endangered smooth-coated otter (*Lutrogale perspicillata*), as well as the globally Critically Endangered Sunda pangolin (*Manis javanica*) that have been observed to move within the canal in the vicinity of the Study Area [P-10]. In the publication, it was also highlighted that there was a recent sighting of the Sunda pangolin (*Manis javanica*) in adjacent areas, such as in the canal south of the Study Area [P-10]. The presence of species of conservation significance, forest-associated species, and migrants demonstrates the value of the Study Area as a stepping stone to surrounding green spaces, such as the Bukit Mandai forest to the northeast and Bukit Gombak forest to the south.

The Sunda pangolin (*Manis javanica*) can be found in areas, such as in nature reserves and degraded forest fragments of Singapore [P-25]. According to Nash et al., (2020), an unpublished data by ACRES showed that this species has also been seen in public areas as some individuals, especially sub-adult males, disperse in search of a home range [P-25]. Hence, this explains their possible presence at the Study Area. Notably, Singapore is a global stronghold for this species and is crucial in contributing to the global conservation of pangolins due to the lack of local poaching pressures, unlike in other countries where it ranges [P-25; P-21]. However, the viability of the local population is still threatened by habitat loss, degradation and fragmentation, and road-related mortality [P-25]. Increasing sustainability and connectivity between habitats is considered a key measure for the conservation of this species [P-25]. Therefore, the Study Area may provide connectivity for this species to safely travel between fragmented habitats. Other mitigating measures, such as wildlife culverts and overpass, can be implemented to help reduce road-related mortality, and contribute to the overall conservation of this species.

General Recommendations

Based on the key findings and potential for the site to support ecological connectivity, an ecological corridor is recommended to be implemented on the east of the Pang Sua Canal adjacent to the proposed residential development, so that wildlife can continue to use the area as a stepping stone to move between the surrounding green spaces. The proposed corridor will potentially help to facilitate the movement of faunal species, such as small mammals and volant species, even after the proposed development is established. The corridor should be of a reasonable width to ensure the survival of small to medium-sized mammals and for them to utilize the corridor, especially within an urban landscape where limited habitats are available [P-44; W-20], in this case, a larger corridor is recommended [W-20].

Further studies could also be carried out to explore the possibility of localised widening of the ecological corridor to conserve clusters of mature trees, such as the cluster of rain trees located south of the Study Area, which have denser tree canopies that could provide a more conducive microclimate allowing for profusion of ferns and other epiphytic plants and for fauna species. Floral species of conservation significance – *Bridelia stipularis* – would be retained. Keystone species including a specimen of *Ficus microcarpa* and *Ficus benjamina* respectively, with spread of 3 – 8 m and *Bambusa* cf. *heterostchya* of 2.5m spread – will also be studied for retention.

The greening of the canal will need to be studied together with the design of this ecological corridor to explore the possibility of an optimal and integrated design, taking into consideration the ecological aspects of the corridor, the proposed residential development and infrastructure requirements.

It is expected that the proposed development will result in the loss of some of the existing mature trees within the Study Area. As such, enhancement planting strategies (i.e., planting of keystone species, tiered planting of different layers of vegetation to emulate a forest-like structure that has large trees with close canopy etc.) could be incorporated. However, the planting of new vegetation will require some time for it to mature and to reconstitute a forest-like structure.

Other general recommended features of the proposed ecological corridor, such as strategic placement of light features within the proximity of the ecological corridor, could also be incorporated. Mitigating measures, such as wildlife culverts and overpass across Pang Sua Canal to facilitate safe movements by fauna species could also be considered.

2 Introduction

AECOM Singapore Pte Ltd (AECOM) was appointed by Housing & Development Board (HDB), through the Letter of Acceptance dated 29 January 2021, to carry out Environmental Baseline Studies ('EBS') on Choa Chu Kang N1, zoned "Residential (Subject to Detailed Planning)" in Urban Redevelopment Authority (URA)'s gazetted Master Plan 2019 [M-3] (hereinafter referred to as 'the Project'). Choa Chu Kang N1 (hereafter referred as "CCK N1") site is bounded by Woodlands Road in the east and Kranji Expressway in the north, with an estimated area of approximately 21.7 ha (hereafter referred to as "Study Area"). Majority of the Site has trees and vegetation, while PUB's Drainage Reserve is located along the western and southern portions of the Site.

This Final report provides the completed baseline findings on the biodiversity, hydrology and water quality, as well as groundwater level baseline. Additional migratory bird surveys were conducted from October to November 2021 for comprehensiveness, and the findings were incorporated in this Final Report.

2.1 Scope of Work

The key objective of the Environmental Baseline Study ('EBS') for CCK N1 is to provide information on the biodiversity, topographic condition, hydrology status, surface water quality and groundwater level within the Study Area. The EBS is to be conducted in the least environmentally intrusive manner.

As per tender specifications, the objectives of the EBS are as follows:

- To conduct a topographical survey within the Study Area which will provide an information of the Study Area's terrain, elevation changes and natural and manmade features of interest found on the Study Area;
- To identify, document and describe existing natural watercourses in the Study Area including their location, dimensions, indicative flow conditions and water quality;
- To understand and describe the hydrological cycle of the Study Area with special emphasis to the crucial hydrological parameters which support the current hydrological conditions;
- To identify, document and describe the existing flora of the Study Area, including the location and distribution of different habitats, key floral species and vegetation types;
- To identify, document and describe the existing terrestrial and freshwater fauna of the Study Area, including birds, butterflies, odonates, reptiles, amphibians, mammals, fishes and aquatic invertebrates;
- To understand and describe the ecological connectivity of the Study Area with surrounding habitats and identify key ecological parameters crucial for maintaining the current biodiversity;

This Study aims to understand the baseline environmental (i.e. biodiversity, hydrology, water quality and groundwater level) conditions and ecological connectivity of the CCK N1 Study Area in order to inform the ecological value of this site.

2.2 Report Structure

The subsequent structure of the Final report is as follows:

- **Section 3** – Description of the duration and schedule of this Study;
- **Section 4** – Description of the Project provides a general description of the Project components;
- **Section 5** – Environment Legislation, Polices, Plans, Standards and Criteria provides the legislative requirements relevant to the Project;
- **Section 6** – Description of Methodologies provides the overview of the methodology used for the EBS;
- **Section 7** – Biodiversity presents the methodology and baseline environment within the Study Area; and
- **Section 8** – Hydrology and Surface Water Quality presents the methodology and baseline environment within the Study Area.

2.3 Study Limitations

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This document was prepared by AECOM in accordance with generally accepted engineering and scientific practice in effect at the time of the study. The study is based on reviews of publicly available publications and literature, as well as information collected on-site.

For the biodiversity baseline study, there were inherent limitations associated with data acquisition in flora surveys due to the variability of vegetation communities across a site and changes to the detectability and presence of species with time. Therefore, it may be possible that some flora species occurring within the Study Area, or perhaps not visibly present during the survey period, were not recorded. However, the surveys were considered to be comprehensive as survey routes were strategically planned to cover ecologically and geographically representative samples of the Study Area, and all plant species sighted were identified and recorded to the best of the team members' abilities. Project team members who carried out the survey and identified the species post-survey have prior experience in conducting such flora assessments in Singapore.

As for the fauna surveys conducted, not all species present within the site could be captured via fauna field surveys due to the rapid nature of this study, as well as the activity patterns, weather conditions, seasonal variations and other factors. Species returned by the literature review were therefore considered to be potentially present in the site and were considered in the baseline assessment. Professionals who carried out the fauna surveys are experienced field biologists and familiar with the local fauna.

To supplement the faunistic baseline surveys which was conducted only at the end of the bird migratory season (i.e., September to February), two additional migratory bird surveys were conducted in October and November 2021, of which, the findings have been included in this EBS report.

Due to the above, the statements, conclusions and opinions contained in this report are approximations of the existing environmental conditions within the Study Area, based on available literature, expert observations and opinion at the time of reporting. Reliance on the report after the date of issuance as an accurate representation of current site conditions shall be at the user's sole risk.

Groundwater baseline study has been carried out based on the review of publicly available secondary data. Site-specific groundwater data is not available. Intrusive work (i.e. drilling of boreholes and/or installation of groundwater monitoring wells) were not performed as part of the EBS as per tender specifications.

Government agencies will not be held liable for any claims arising from the conduct of the study.

3 Duration and Schedule of the Study

- The **Inception Report** was submitted to HDB on 19 February 2021 and presented to HDB on 26 February 2021;
- The **Interim Report** was submitted to HDB on 29 March 2021 with preliminary EBS findings presented to HDB on 14 May 2021;
- The **field survey findings** were submitted to HDB on 28 May 2021;
- The **Draft Final Report** was submitted and presented to HDB on 28 June 2021; and
- The **Final Report** was submitted to HDB on 15 September 2021.

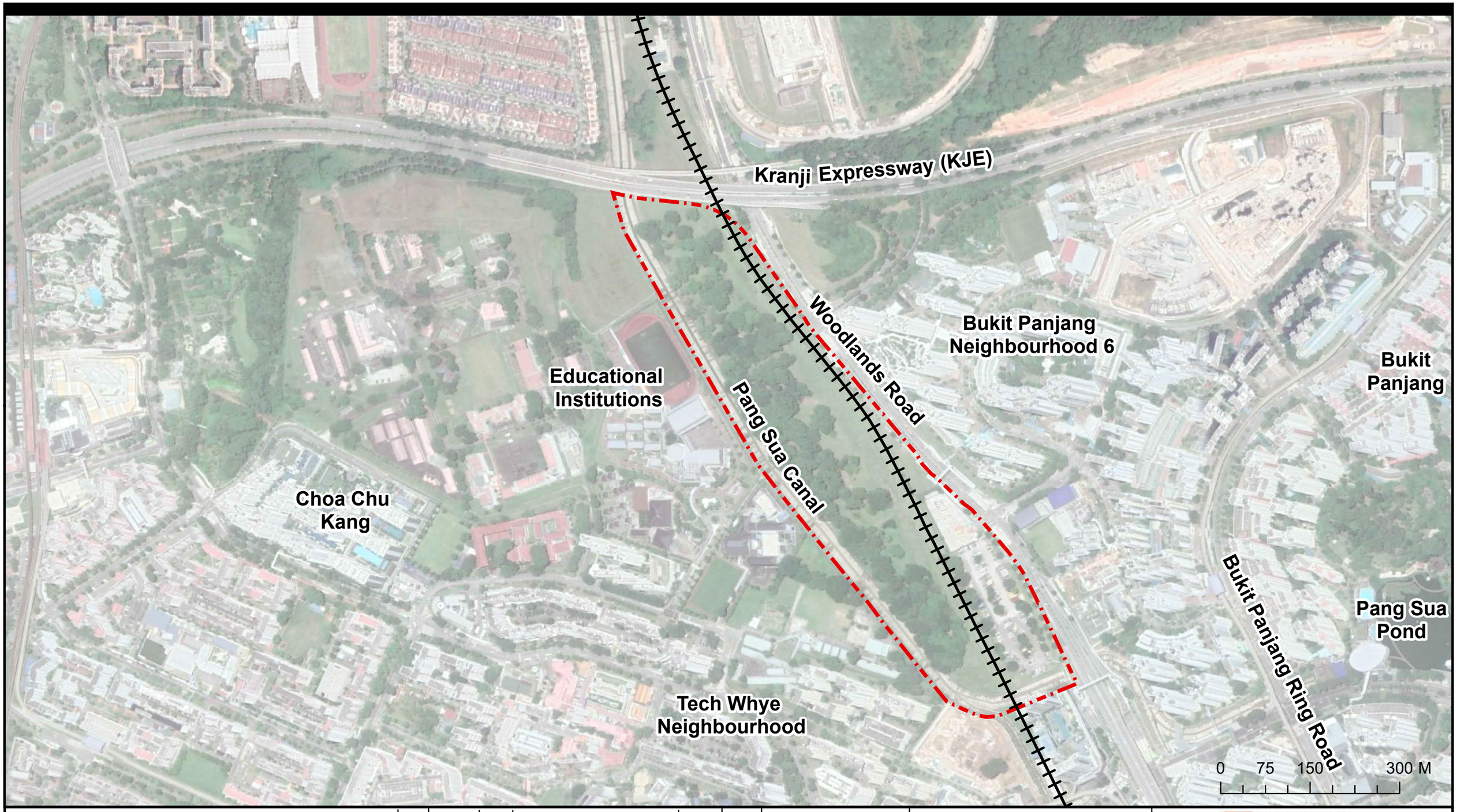
4 General Description

The purpose of this section is to familiarise the reader with the Study Area and its background. Therefore, this section shall provide a description of the Study Area in terms of its location, historical land use and geology of the area. Where appropriate, this section makes use of maps to support its findings and explain the situation.

4.1 Location of Study Area

The Study Area of Choa Chu Kang N1 is located in the northwest of Singapore. The Study Area is bounded by Kranji Expressway (KJE) in the north, Woodlands Road in the east, and Pang Sua Canal running all along the western and southern edge (as shown in Figure 4-1). It is estimated to be 21.7 hectares (ha) and is surrounded by residential developments (e.g., Bukit Panjang Neighbourhood 6, Teck Whye Neighbourhood) and educational institutions (e.g., Jurong-Pioneer Junior College, Teck Whye Primary School and Teck Whye Secondary School).

A section of the Rail Corridor alignment is located within the Study Area. The Rail Corridor alignment runs through the whole the Study Area lengthwise. The Study Area is “an important part of the Green Rail Corridor between Hill View in the south and Stagmont Ring in the north, as it is the only wooded area in-between” (Figure 4-1) [P-11].



Legend

- CCK N1 Study Area
- Rail Corridor

N

Rev.	Date	By	Description	Chk'd	App'd
05	MAR 2022	LAL	Final Report	NHT	JAG
-	SEP 2021	LAL	Final Report	NHT	JAG

Qualified Person Endorsement : NA

HDB Endorsement : NA

Consultant : AECOM

Client: HOUSING & DEVELOPMENT BOARD

Project Title :

CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Choa Chu Kang N1 Study Area

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LAL	NHT	JAG
	Drawn: LAL	Date: MAR 2022

Figure No. : 4 - 1 | Rev. 05 | Sheet 1 of 1

CAD File Name : NA | A3

Note: Source of basemap - Google Earth Map

4.2 Historical Land Use

As far as possible, a chronological account of the changes in land use of the Study Area is provided below, with inferences drawn from historical resources (maps, sea charts, and aerial photographs) contained within the NUS Libraries Historical Maps of Singapore (NUSLHMSG), unless otherwise mentioned.

The earliest available map of the Study Area dates back to 1873 and reveals a relatively untouched area with a seemingly natural stream passing through it. In the early 1900s, the original vegetation at the Study Area was likely to be mangrove swamp forest which was subsequently cleared for rubber plantations (Figure 4-2A). The Keretapi Tanah Melayu (KTM) railway track that runs towards Malaysia was later constructed across the Study Area and village settlement was developed with increased public housing.

From 1958 to 1969, there seemed to be an accelerated rate of development accompanied by continuous disturbance and clearing of vegetation. Several smaller fair-weather roads were also constructed around the Study Area and linked to the railway. Within the Study Area itself, although the vegetation coverage was reduced, still a large portion was used for sundry cultivation (Figure 4-2B). There is also mapped evidence of enhanced water bodies passing through the Study Area that were not present in previous maps.

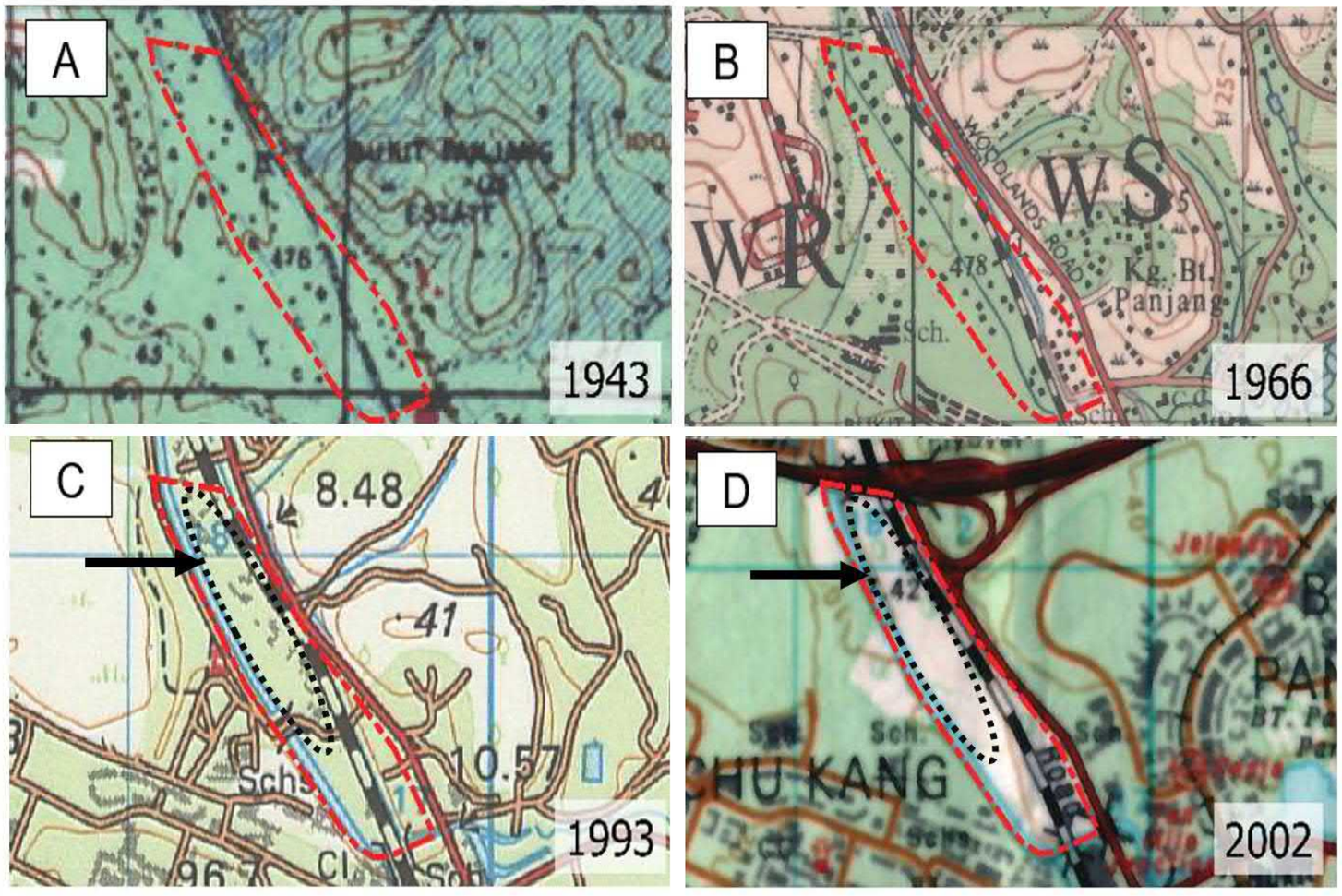
By 1974 the surrounding area had become much more inter-connected, with many motor roads passing through and linking with the railway and surrounding area. Settlements and buildings were now more organised, likely the influence of a roadmap and urban planning set forth by the government.

Around the 1980s, the watercourses that originally cut through the Study Area were widened to form concrete drains, white the concrete canal (also currently known as Pang Sua Canal) was in the process of construction. The completed concrete canal was reflected in the map dated in 1993, as seen in Figure 4-2C. After which, the KJE was completed in 1994, north of the Study Area.

Towards the early 2000s, remnants of buildings were removed (Figure 4-2D),except the KTM railway track, and the area continued to regenerate into spontaneous vegetation in less than 10 years. In 2011, the KTM railway track was dismantled and converted into the Rail Corridor [P-23].

Currently in the Study Area, 12 ha of the Study Area has trees and vegetation occupying the western side of the Rail Corridor. The southern half of the woodlands consist of mixed vegetation such as rain trees (*Samanea saman*), and other fruit trees, such as mango (*Mangifera indica*) and breadfruit (*Artocarpus altilis*). Over at the northern half, the area is occupied by mature trees of Senegal mahogany (*Khaya senegalensis*) and several trumpet trees (*Tabebuia rosea*). Wild shrubs fringe the edges, including scattered cultivated patches of banana (*Musa* sp.), tapioca (*Manihot esculenta*), and pandan (*Pandanus amaryllifolius*) [P-12].

In summary, the land use of the Study Area has undergone significant changes over the years, with eventual widespread land conversion throughout. While the surrounding land area has developed significantly, with vegetation removed to make way for schools, residences, and the KJE, the Study Area has been re-vegetated, following the closure of KTM Railway operations in recent years.



1943	1945	1958	1966	1974	1993	2002	2011
Rubber plantation were cultivated within the study area with mangrove swamp forest dominating on the right next to the eastern side. Stream was also present within the Study Area (Figure 4-2A)	A single track of KTM railway was built across from north to south of the Study Area	Tree cultivation was reduced for inhabitants to reside in the area with few housing estates/buildings were built within the Study Area	Rubber plantations were cleared and a large portion of the Study Area were marked out as sundry cultivation (Figure 4-2B)	Several roads were built around the settlement area, and the number of buildings has increased.	A canal was built on the western side, cutting across the North-south line of the study area. Settlement within the site has significantly decreased, with sundry cultivation taken over an area of previous inhabitants (Figure 4-2C)	Sundry cultivation and housing were removed (as shown in Figure 4-2C), and the study area was left to revegetate (Figure 4-2D).	KTM railway track was removed and transported back to Malaysia. Railway track was then converted as part of the Rail Corridor

Figure 4-2 Maps showing the chronological land use of the Study Area. (A) Rubber plantation were cultivated within the study area around 1943; (B) Rubber plantations were cleared and taken over by sundry cultivation. Settlements were present within the Study Area, indicated by the black-dotted oval and arrow; (C) Construction of the canal was completed at the western side of Study Area, cutting across from north to south of the boundary. Settlements has also decreased, indicated by the black-dotted oval and arrow; (D) Sundry cultivation and housings, indicated by the black-dotted oval and arrow, were removed[M-2]

4.3 Current Land Use

Presently, there are three key features within the Study Area – the woodland area, Pang Sua Canal and the existing Rail Corridor alignment.

Majority of the Study Area is comprised of managed vegetation, which consist of clusters of trees and turfed area with spontaneous vegetation (Figure 4-3A and Figure 4-3B). Following the closure of Keretapi Tanah Melayu (KTM) Railway in 2011, the Study Area has been re-vegetated and is currently covered in vegetation which varies from low grass in the eastern portion to denser vegetation and scattered trees going towards the west.

The Pang Sua Canal and PUB's existing drainage reserve are located in the west and south of the Study Area. The canal flows from south to north of the Study Area (Figure 4-3B and Figure 4-3C). The Rail Corridor also passes through the Study Area, close to the east boundary of the site (Figure 4-3D). It is currently a linear stretch of managed turf (Figure 4-3D). There are also built-up areas within the site, which includes a heavy vehicle car park and a now-defunct bus terminal (Figure 4-3D), which are located at the south-eastern portion of the Study Area.

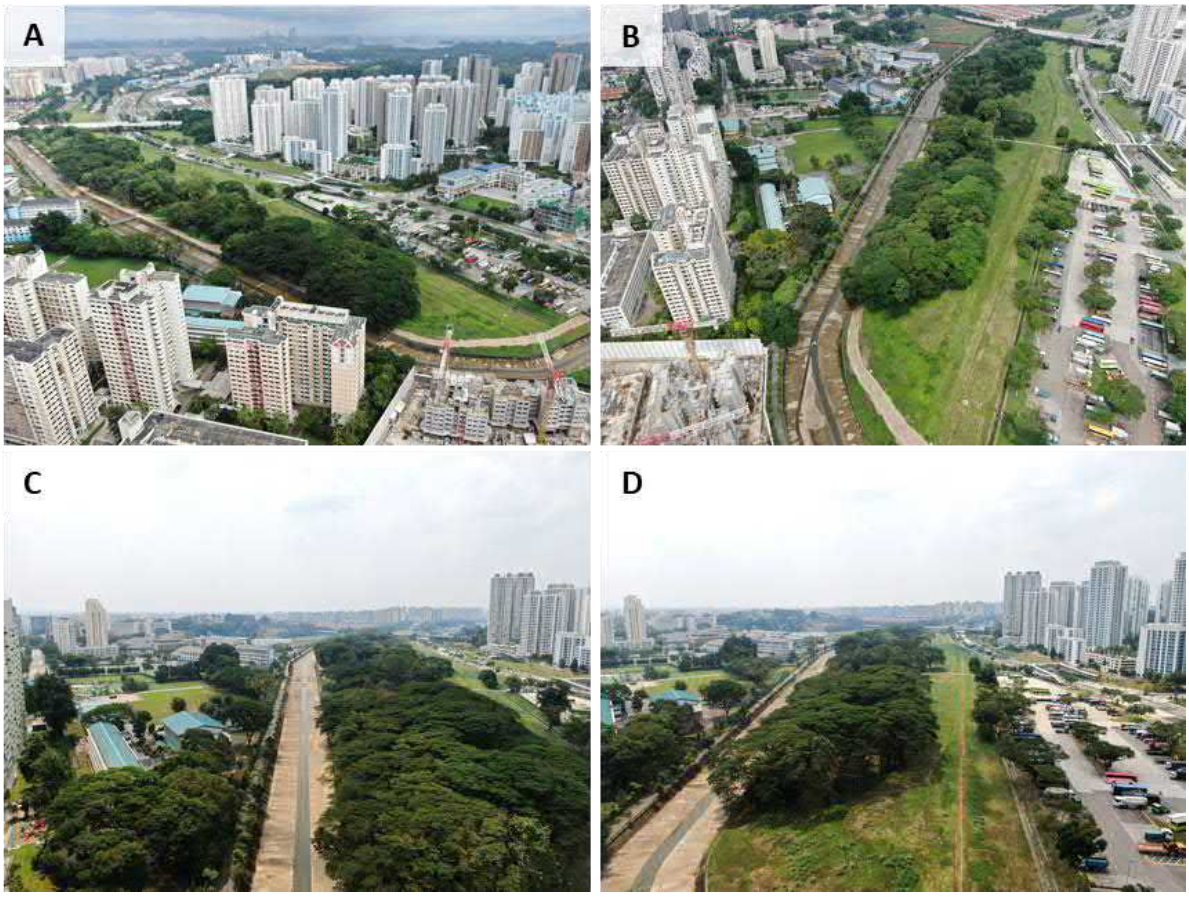


Figure 4-3 Photos of existing site conditions in the Study Area: (A) Aerial View of the whole site, (B) Aerial View of the Pang Sua Canal located in the west and south of the site, (C) Aerial view of Pang Sua Canal and trees along western section of the site, (D) Aerial view of Rail Corridor alignment, heavy vehicle carpark and now-defunct bus terminal

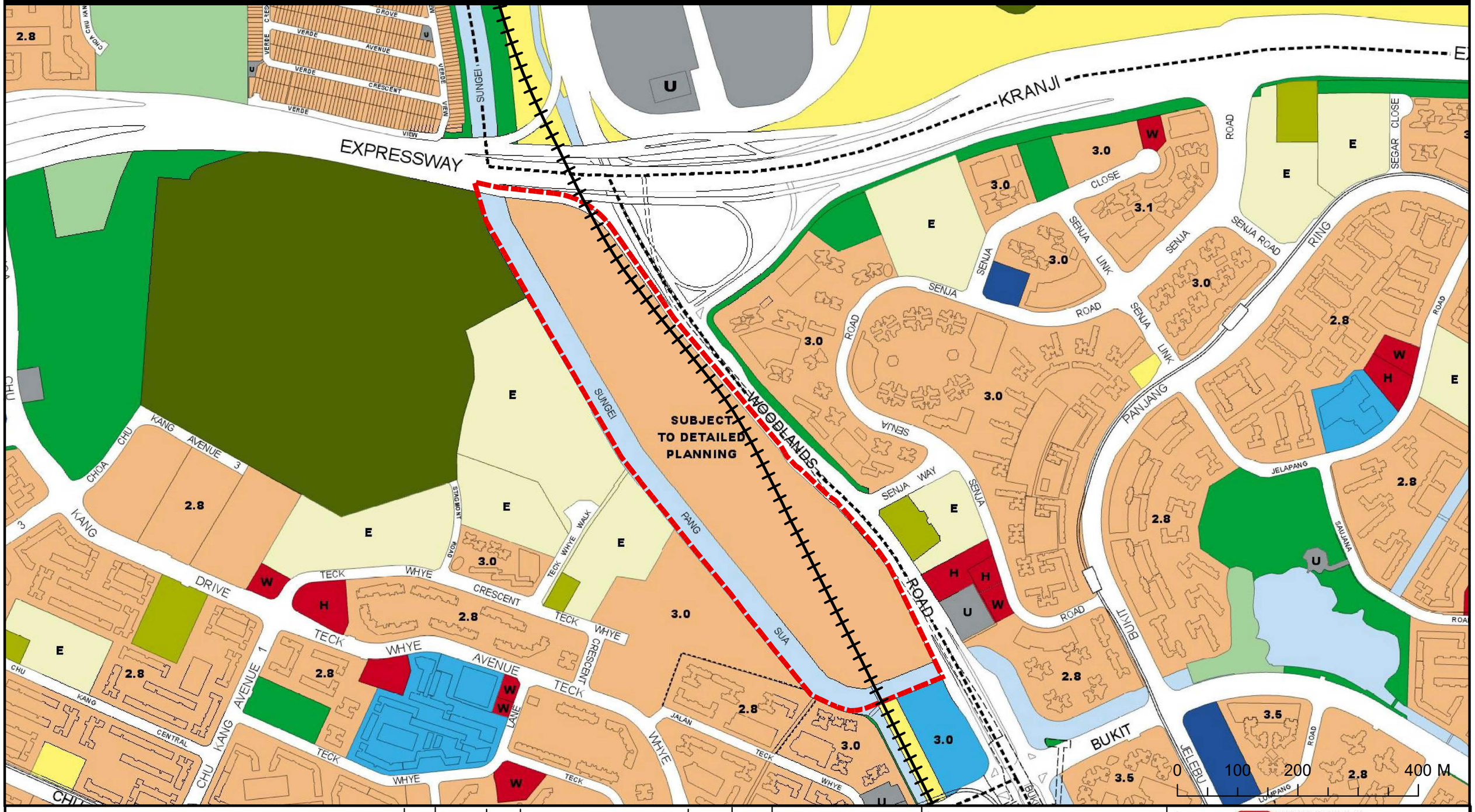
4.4 Future Land Use

As shown in the gazetted Master Plan 2019 (Figure 4-4), the Study Area has been categorised as "Residential (Subject to Detailed Planning)" and "Waterbody". Majority of the site is zoned for "Residential (Subject to Detailed Planning)" development, while the "Waterbody" development (i.e. the Pang Sua Canal) runs along the western and southern edges of the Study Area.

4.5 Geology

As shown on the Geological Map of Singapore [M-4] (refer to Figure 4-5), the Study Area is underlain by the Jalan Besar Formation (Kjbf), a part of the Kallang Group.

Jalan Besar Formation (Kjbf) is part of the Kallang Group strata which is the youngest of the existing geological formations of Singapore and is usually located at river valleys, river mouths, river plains, coastal areas and near offshore [O-2]. This Jalan Besar formation comprises relatively uniform-sized fluvial deposits, ranging from silty clay to coarse sand, with occasional occurrences of gravel and organic matter [P-45]. The member is usually unconsolidated but lightly consolidated beds might be found.



Legend

- Study Area
- Rail Corridor

E Educational Institution	Transport Facilities	Residential
W Place of Worship	U Utility	Commercial & Residential
H Health & Medical Care	Waterbody	Commercial
Civic & Community Institution	Park	Sports & Recreation
Open Space	Reserve Site	Special Use

N

Rev.	Date	By	Description	Chk'd	App'd
05	MAR 2022	CQA	Final Report	NHT	JAG
04	MAR 2022	CQA	Final Report	NHT	JAG
03	FEB 2022	CQA	Final Report	NHT	JAG

Qualified Person Endorsement : NA

HDB Endorsement : NA

Consultant : AECOM

Client: HOUSING & DEVELOPMENT BOARD

Project Title :

CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

PROPOSED LAND USE OF STUDY AREA AND ITS SURROUNDING

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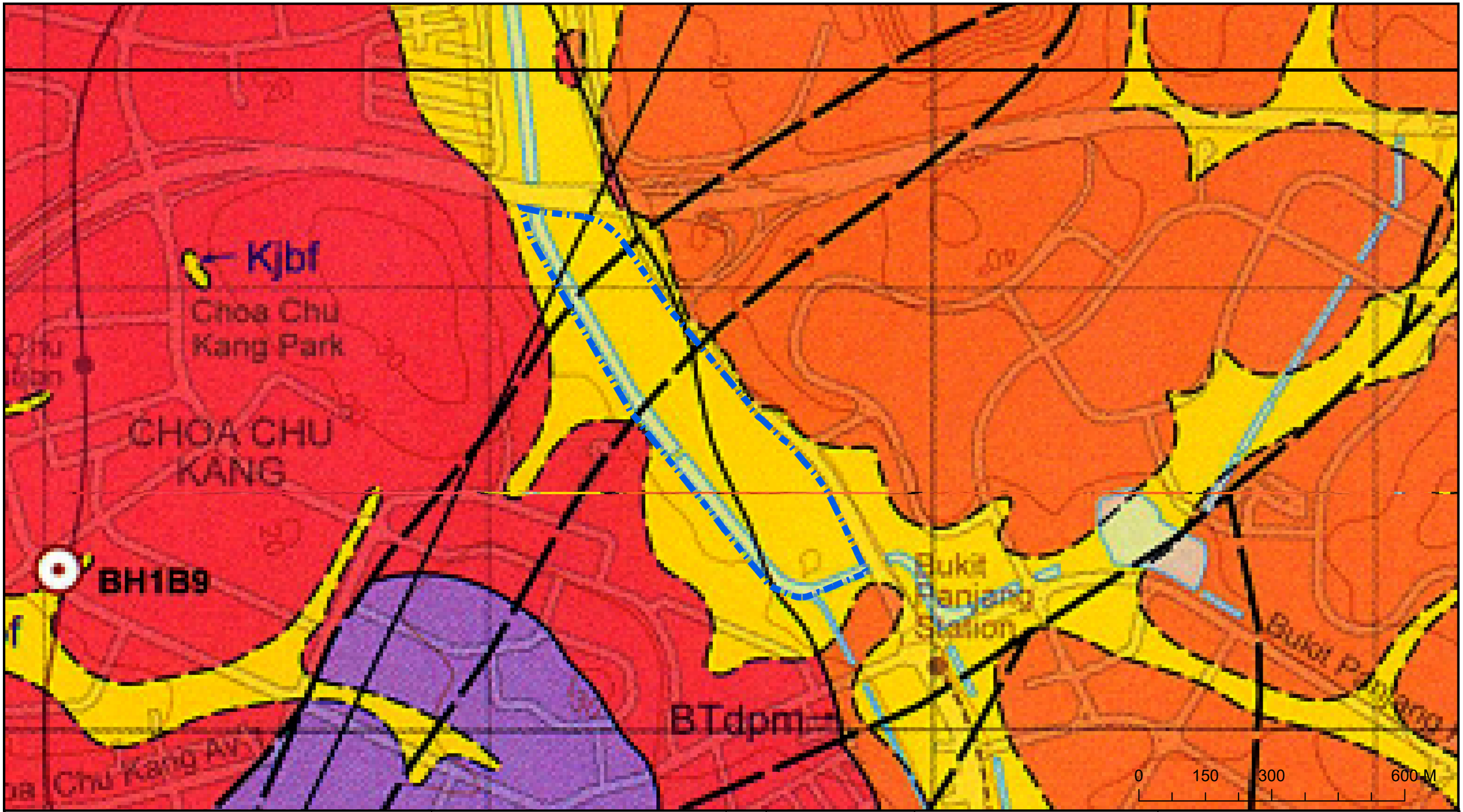
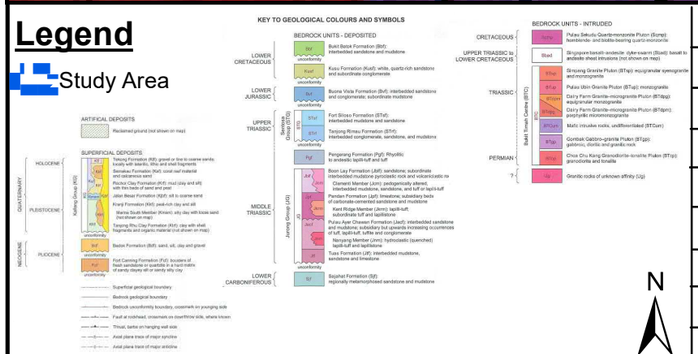
	Drawn CQA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - URA Master Plan 2019



Legend

Study Area



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Rev.	Date	By	Description	Chk'd	App'd
03	Feb 2022	CQA	Final Report	NHT	JAG

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URA Endorsement : NA

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Client: HOUSING & DEVELOPMENT BOARD

Project Title :

CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Geological map of the Study Area

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CQA	NHT	JAG	**4 - 5**	03	1 of 1
	Drawn CQA	Date FEB 2022	CAD File Name : NA		A3

Note: Source of basemap - Geological Map of Singapore 2021

5 Environmental Legislation, Policies, Plans, Standards and Criteria

A review of applicable environmental legislation, plans, standards and criteria to this baseline study was carried out and listed in the following sections. Where local Singapore legislation was not located, reference has been made to international guidelines and best practices as appropriate. All the following sections analysing the environmental baseline conditions are compared with the legislative references.

Table 5-1 Applicable legislation, policies, plans, standards and criteria

Environmental Parameter	Applicable Legislation, policies, plans, standards and criteria	Key Points
General	Biodiversity Impact Assessment (BIA) Guidelines, 2020 [R-2]	This document is published by NParks to provide a framework guiding biodiversity baseline study in Singapore. It recommends methods for conducting baseline survey. Section 2 of this BIA Guidelines detailed the baseline study methods recommended for vegetation mapping, habitat mapping, hydrology (including waterbody mapping, water conditions, water quantity and water quality)
Biodiversity	National Biodiversity Strategy and Action Plan (NBSAP), 2019 [R-1]	This document provides a framework to guide biodiversity conservation efforts in Singapore. It intends to establish both policy frameworks and specific measures to ensure better planning and co-ordination in the sustainable use, management and conservation of biodiversity. A holistic approach has been adopted where the input of various public sector agencies and nature groups have been taken into consideration in the preparation of the document.
	The Singapore Red Data Book (SRDB) [P-9]	Lists the endangered plants and animals in Singapore Published by Singapore's Nature Society Provides the scientific name, common name, status, description, habitat, distribution, threats, scientific interest and potential value, as well as conservation measures for each plant and animal listed.
	The International Union for Conservation of Nature and Natural Resources (IUCN)	Provides taxonomic, conservation status and distribution information on plants, fungi and animals that have been globally evaluated.

Environmental Parameter	Applicable Legislation, policies, plans, standards and criteria	Key Points
	Red List of Threated Species [P-15]	
Hydrology and Water Quality	Singapore Allowable Limits for Trade Effluent Discharge to Watercourse or Controlled Watercourse (NEA) [R-11]	Provides allowable limits for trade effluent discharge to watercourse or controlled watercourse in Singapore
	Standard Statistical Classification of Surface Freshwater Quality for the Maintenance of Aquatic Life, New York and Geneva UNECE (1994) [R-4]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies.
	Australian & New Zealand Guidelines for Freshwater and Marine Water Quality (2000) [R-7]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies.
	Canadian Water Quality Guidelines for the Protection of Aquatic Life (2007) [R-8]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies.
	Water Quality Standards Handbook USEPA (2017) [R-6]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies.
	Mitigating Impact from Aquaculture in the Philippines (PHILMINAQ) [R-9]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies
	National Water Quality Standards for Malaysia (DOE) [R-10]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies
	Water Quality Requirements WHO (n.d.) [R-5]	Provides standards for water quality assessment relating to aquatic life for surface waterbodies.

6 Study Approach

This limited EBS included the following stages:

- **Understanding the Baseline Environment** in terms of ecology and hydrology; and
- **Reporting** findings of the baseline study

Figure 6-1 below provides the detailed approach applied for this study.

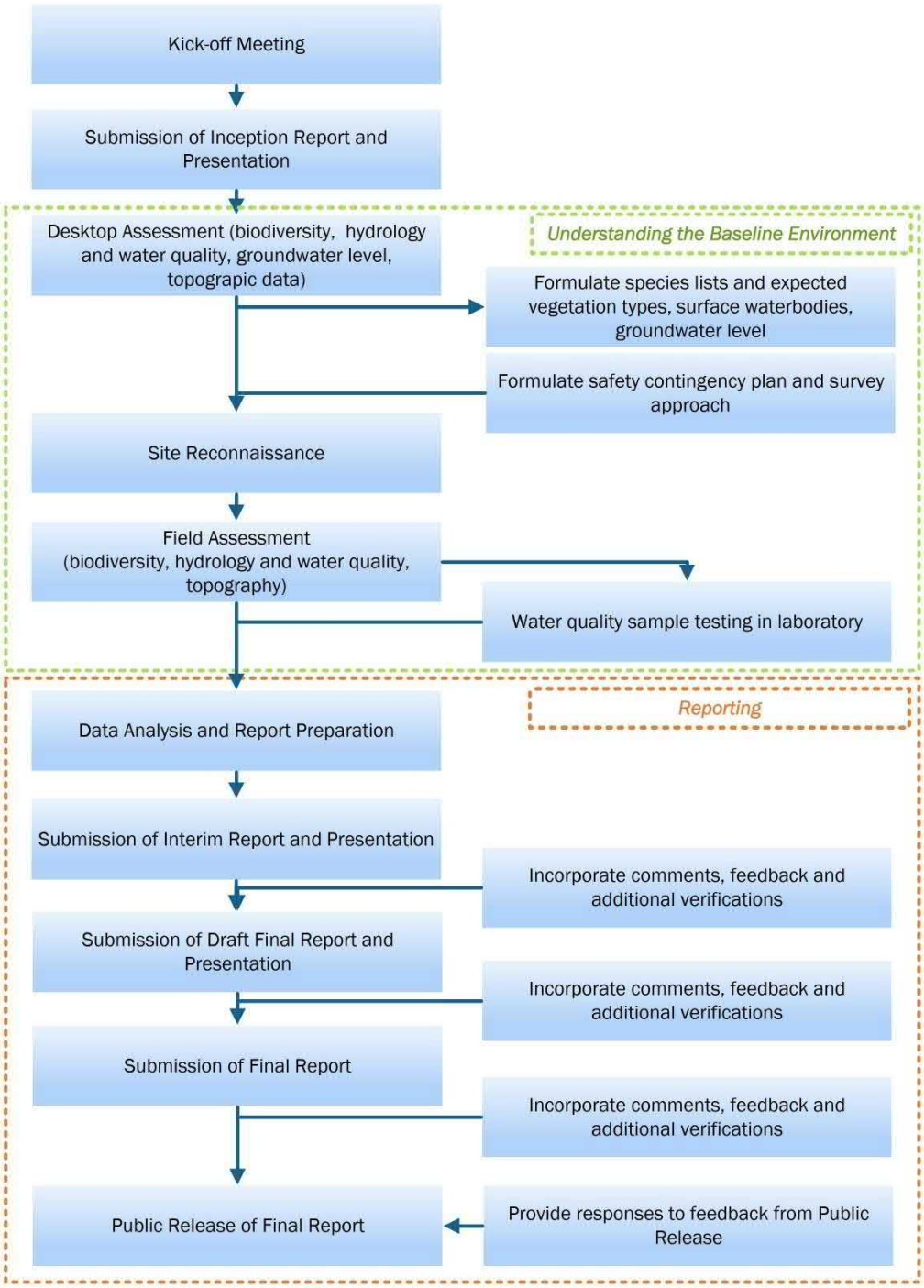

Figure 6-1 Detailed approach for the EBS

7 Biodiversity Baseline Environment

The Biodiversity Field Assessment aims to establish baseline biodiversity information of the proposed Study Area. Baseline information will be first gathered through reviews of past and present biodiversity records, published literature, and in consultation with taxonomic experts. Actual field surveys will then be carried out to verify and supplement the data. Through desktop and field assessments, important habitats, species of flora and fauna of conservation significance will be identified.

7.1 Personnel

The personnel and taxonomic experts involved in the biodiversity surveys for this Project are as follows:

Flora

1. Siti Zaleha Abdullah (Flora specialist);
2. Ting Ying Ying (Flora specialist);
3. Sherry Hung Ming Xuan (Flora specialist);
4. Boo Chih Min (Flora Lead);
5. Sim Eng Koon (Arborist); and
6. Derek Yap Chung Hoe (Arborist).

Fauna

1. Joys Tan (Lead Fauna Biologist; Mammal Specialist);
2. Choo Ruisheng (Fauna Biologist);
3. Alfred Chia (Bird Specialist);
4. Dr. Alex Figueroa (Herpetofauna Specialist);
5. Chloe Tan (Butterfly and Mammal Specialist);
6. John Lee Xinquan (Aculeate Hymenopteran Specialist);
7. Lim Kim Seng (Bird Specialist);
8. Robin Ngiam (Odonate Specialist); and
9. Tang Hung Bun (Odonate Specialist).

7.2 Methodology

7.2.1 Desktop Assessment

7.2.1.1 Land Use History

Historical and present-day land use of the Study Area were reviewed. Information on land use history were primarily gathered from old maps in the online collection of the National Archives of Singapore (NAS) as well as historical maps on the OneMap and the National University of Singapore (NUS) Libraries portals. A list of faunal species that are likely to occur at the site (termed thereafter as “species of probable occurrence”) was generated using information on past faunal records and existing habitat types and past fauna records up to 2 km from the Study Area.

7.2.1.2 Key References

Past and present floristic as well as faunistic species composition were examined using relevant key references that include books, specifically Pang Sua Woodland: Sanctuary Unveiled along the Rail Corridor by Nature Society (Singapore) (NSS) and Cicada Tree Eco-Place [P-10] and The Green Rail Corridor: A Biodiversity and Ecological Overview published by Nature Society (Singapore) (NSS) [P-11], scientific publications, unpublished literature, and online databases. Sources of databases include The Biodiversity of Singapore by the Lee Kong Chian Natural History Museum [W-7], Flora and Fauna Web by the National Parks Board [W-2], and iNaturalist [W-5]. Other key references include the Singapore Red Data Book [P-9], Singapore Biodiversity Records, encyclopaedia on Singapore's biodiversity [P-28], and the database of flora and fauna records compiled by our biodiversity specialists.

7.2.1.3 Taxonomy and Nomenclature

Key local and/or regional references for the various taxonomic groups are listed in Table 7-1 below.

Table 7-1 Key references for the nomenclature and taxonomy for each taxonomic group

Taxon	Key References
Plants	Chong et al., (2009) [P-7]; World Checklist of Selected Plant Families [W-17]; Plants of the World Online [W-18]
Aculeate hymenopteran	Ascher et al. (in prep) [P-1]
Odonates	Soh and Ngiam, (2019) [P-34]
Butterflies	Khew, (2015) [P-17]
Freshwater decapod crustaceans	Ng, (1997) [P-27]; Cai et al., (2007) [P-4]
Freshwater fish	Kottelat, (2013) [P-20]; Suzuki et al., (2015) [P-35]; Ho et al., (2016) [P-12]
Herpetofauna	Baker and Lim, (2012) [P-2]
Birds	Gill and Donsker, (2020) [W-4]
Mammals	Baker and Lim, (2012) [P-2]

7.2.1.4 Species of Conservation Significance

The assessment of whether certain species are of conservation significance is important for highlighting the need and priorities for conservation.

Floral species of conservation significance—i.e., listed in Chong et al. 2009 [P-7] as nationally Vulnerable, Endangered, Critically Endangered, or Presumed Extinct (which indicates a rediscovery)—were assessed to determine whether they are of conservation significance. While the national conservation status of threatened species is true of wild populations that originate in an area without direct or indirect human intervention, some populations may be relics that persist from past cultivation or escapees from present-day cultivation that does not belong to native genetic stock. The assessment of whether a species is of conservation significance was based on, but not limited to, information on the following: (1) land use history, (2) presence of large parent tree(s), (3) commercial availability, (4) data from previous environmental baseline studies, (5) reforestation efforts, (6) natural range, and (7) importance for associated fauna. If the origin of a threatened species population is disputable or difficult to determine, findings from field surveys of fauna were corroborated, and/or the more conservative approach was adopted by considering them of conservation significance. In carrying out such assessments, we are then able to prioritise conservation needs and focus resources in conserving them.

Faunal species of conservation significance include both threatened species as well as non-threatened species that are regarded as notable records. Threatened species are species listed as globally or nationally Vulnerable, Endangered, Critically Endangered. Notable non-threatened species are species that do not fall within the above categories, but are deemed to be of conservation interest within the Study Area based on recent local trends

observed by specialists including the following: (1) increased rarity of the species locally, (2) reduced habitat suitability for the species locally or (3) presence of breeding sites that are uncommon or rare locally. The national conservation statuses reference the Singapore Red Data Book (SRDB; [P-9] and other more updated local checklists, where available, such as Soh et al. 2019 [P-34] for odonates, Jain et al. 2018 [P-16] for butterflies and NParks (2021) [W-21] for amphibians, reptiles, mammals and bats. The global conservation status references the Red List of Threatened Species by the International Union for Conservation of Nature (IUCN, 2021 [P-15]).

7.2.2 Field Assessment

7.2.2.1 Site Reconnaissance

Site reconnaissance survey was conducted to obtain an initial understanding of the existing habitats and biodiversity. Field observations were used for planning and execution of the actual surveys. The objectives of the reconnaissance survey were as follows:

- Determine site accessibility and terrain;
- Conduct a preliminary assessment to determine the dominant vegetation types;
- Identify locations of existing natural permanent waterbodies, such as streams, ponds, and swampy areas (if any); and
- Mark out survey sampling routes and potential locations for camera traps.

7.2.2.2 Flora Field Assessment

The field assessment for flora consists of (1) habitat and vegetation mapping, (2) general walking floristic surveys, and (3) tree mapping conducted from 23 February 2021 to 29 April 2021. The methodologies listed below that were approved by various stakeholders, took into consideration of the framework for biodiversity baseline study in Singapore listed in the Biodiversity Impact Assessment (BIA) Guidelines, 2020, published by NParks [R-2].

7.2.2.2.1 Habitat Mapping

A preliminary map to highlight possible habitats that could be found within the Study Area was first prepared based on visual interpretations of satellite images from Google Earth Pro 7.3.3.7786 [O-1]. Preliminary classification of the habitat types, for example, waste woodlands, abandoned-land forest and managed vegetation were mapped out using visual features, such as textures and colours, observed in the satellite images. Adjustments were then made to the preliminary maps according to actual observations during ground truthing. Ground truthing was then conducted throughout the survey area with the aid of a GPS receiver (Garmin GPSMap® 64s). Photographs of the different habitats were also taken. The boundaries of each habitat type were tracked on the GPS receiver and mapped out on Google Earth 7.3.3.7786 [O-1]. The classification of habitat types references to NParks [R-2].

7.2.2.2.2 General Walking Surveys

All plants observed in the Study Area during floristic surveys were identified to species whenever possible. A checklist of all the plant species recorded from the present floristic surveys was compiled. The nomenclature and national conservation status follow that of Chong et al. (2009) [P-7], and/or other published papers with information on the updated assessment of the species nomenclature and/or conservation status. The latter is usually for one or a few individual species. Other information on the plant species was also cross-checked with online databases, namely, the National Parks Board Flora and Fauna Web and Singapore Biodiversity Online.

For plants that could not be immediately identified with certainty in the field, photographs and/or voucher specimens were taken. They were then identified using identification keys, taxonomic descriptions, online plant photo databases, with the help of taxonomic experts, and/or by matching the pressed and dried collected specimens with existing specimens in the Singapore Botanic Gardens' Herbarium (SING).

For very tall unidentifiable trees with leaves that are too high in the canopy to photograph, dried leaves matching these trees were collected from the floor, where vegetation was found, and used to aid in species identification.

7.2.2.2.3 Species of Conservation Significance

The geographic coordinates of plants of conservation significance were marked using a Global Positioning System (GPS) receiver (Garmin GPSMap® 64s), which records locations with accuracy of ± 4 m, during floristic surveys. Where there are clusters of plants of conservation significance—i.e., more than one individual occurring within 5 m

or less of another individual—the geographic location of the approximate centre of the area was marked using the GPS receiver.

7.2.2.2.4 Large Plant Specimens

Similarly, the GPS receiver was used to record locations of all trees of ≥ 3 m girth, as well as bamboo clusters, palm clusters, and strangling *Ficus* species of ≥ 3 m spread. Individuals were identified to species level. Their girth (for trees) and/or estimated spread (for bamboo clusters, palm clusters, and strangling Ficus species), as well as estimated height, were recorded and these specimens were tagged with unique serial numbers.

7.2.2.2.5 Other Plant Specimens of Value

Locations of other plants that are of value but do not meet the minimum size requirement, as detailed in the above sub-section, were recorded using the GPS receiver. Examples of such include bamboo clusters of < 3 m spread that may be important refugia for rare bamboo bats, amongst others, and keystone species. According to Lok et al., (2013), keystone species is defined as “important plants that other animal in the community depend heavily on” [P-24]. Geographic locations of all keystone species were recorded using the GPS receiver (Garmin GPSMap® 64s or/and Differential GPS receiver.

7.2.2.2.6 Tree Mapping

Mapped specimens were tagged with a unique serial number on site; this includes all trees, single-stemmed palms, and strangling *Ficus* species of ≥ 0.3 m girth. Single-stemmed palms are defined in this study as having one obvious and erect stem. Geographic locations, girth/spread and heights were also recorded. Differential Global Positioning System (DGPS) receivers (CHC® Navigation HCE320 GNSS data controller with the CHC® Navigation i90 Pro GNSS receiver and Leica DISTO™ D510 rangefinder; Hi-Target Qmini A5 High Precision Handheld data controller with the Hi-Target V-90 GNSS receiver and Leica DISTO™ D510 rangefinder) (Figure 7-1 and Figure 7-2)—which records locations with accuracy of ± 1 m and less—were used to record geographic locations of the specimens using the SVY21 plane coordinate system. This local datum gives a more accurate representation of the areas of coverage in Singapore compared to a global datum and is used by the Singapore Land Authority (SLA) (SLA, 2015 [W-1]). Where there are clusters of specimens of the same species occurring within 1–2 m of each other, only one specimen was tagged, and its location marked using the DGPS.

Figure 7-1 (A) CHC® Navigation HCE320 GNSS data controller (Source: Geo-Matching.Com); (B) how it is used in the field

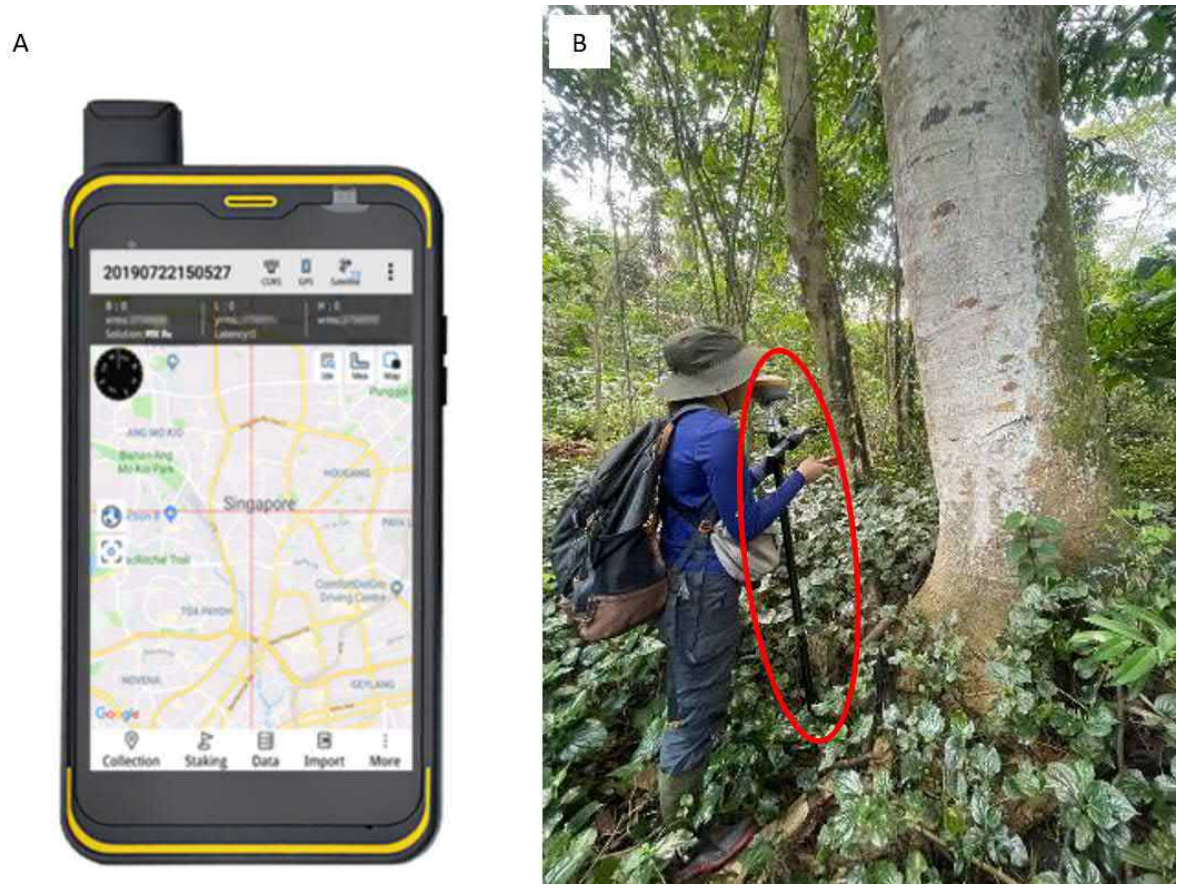

Figure 7-2 (A) Hi-Target Qmini A5 High Precision Handheld data controller (Source: Geo-Matching.Com; (B) how it is being used in the field

7.2.2.3 Faunal Field Assessment

Field surveys were carried out for terrestrial and aquatic fauna communities from these taxon groups: (1) aculeate hymenopterans, (2) butterflies, (3) odonates (damselflies and dragonflies), (4) herpetofauna (amphibians and reptiles), (5) birds, (6) mammals (including bats). The selection of targeted faunal groups references the Biodiversity Impact Assessment (BIA) Guidelines (2020) by NParks.

Table 7-2 summarises all the surveys that were carried out for fauna. Each survey was performed by at least two (maximum three) surveyors. All fauna encountered were identified to the lowest taxonomic level possible, and the location of each individual was recorded using a handheld GPS (Garmin GPSMAP 64s). (Garmin GPSMAP 64s). The number of individuals observed was also documented. All observations of notable species from the aforementioned taxa were also be recorded if seen outside the stated survey times. The locations of sampling units and camera traps are provided in Figure 7-3 and Figure 7-4.

Table 7-2 Summary of faunal field surveys

Survey Type	Taxon	Timing (h)	Duration	Sampling Unit	Technique
Diurnal transect surveys	Aculeate hymenopterans	0900–1500	20–30 minutes per transect	200-m continuous transects along a sampling route	Visual only; up to 25 m left, right, and front of surveyor
	Butterflies	0900–1500	20–30 minutes per transect	200-m continuous transects along a sampling route	Visual only; up to 25 m left, right, and front of surveyor
	Odonates (damselflies and dragonflies)	0900–1500	20–30 minutes per transect	200-m continuous transects along a sampling route	Visual only; up to 25 m left, right, and front of surveyor
Diurnal and nocturnal transect surveys	Herpetofauna (amphibians and reptiles)	0700–1000; 2000–2300	20–30 minutes per transect	200-m continuous transects along a sampling route	Visual and auditory; up to 50 m left, right, and front of surveyor
	Birds	0700–1000; 2000–2300	20–30 minutes per transect	200-m continuous transects along a sampling route	Visual and auditory; up to 50 m left, right, and front of surveyor
	Mammals (non-volant)	0700–1000; 2000–2300	20–30 minutes per transect	200-m continuous transects along a sampling route	Visual and auditory; up to 50 m left, right, and front of surveyor
Aquatic point counts	Odonates (damselflies and dragonflies)	0900–1500	5 minutes per point	Sampling points at fresh-waterbodies (intervals vary with waterbodies)	Visual only; up to 25 m from sampling point or the extent of waterbodies, whichever is smaller
	Herpetofauna (amphibians and reptiles)	2000–2300	5 minutes per point	Sampling points at fresh-waterbodies (intervals vary with waterbodies)	Visual only; up to 25 m from sampling point or the extent of waterbodies, whichever is smaller
Camera trapping	Mammals (non-volant)	24 hours a day	60 days	One trap per 6.25 ha. Additional traps were deployed	Infrared motion sensing

Survey Type	Taxon	Timing (h)	Duration	Sampling Unit	Technique
				at strategic locations.	
Bioacoustics surveys	Mammals (bats)	2000–2300	20–30 minutes per transect	200-m continuous transects along a sampling route	Auditory only
Roost emergence surveys	Mammals (bamboo bats only)	1830–2100	-	Bamboo clusters (if any)	Visual and auditory
Push and scoop netting	Aquatic fauna (fish)	Daytime	-	Sampling points at fresh-waterbodies (intervals vary with waterbodies)	-
Minnow trapping	Freshwater aquatic fauna (fish and decapod crustaceans)	Overnight	One day one night	Traps were deployed at strategic locations along waterbodies	Baited

Legend

- CCK N1 Study Area
- Rail Corridor
- Canal/Drain (Perennial)
- Drain (Ephemeral)
- Aquatic sampling points
- Terrestrial sampling route

N

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Figure Title :

Location of terrestrial sampling route and aquatic sampling points

Designed	Checked	Approved	Figure No. :	Rev.	Sheet
ZA	NHT	JAG	7-3	05	1 of 1
	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

Legend

- CCK N1 Study Area
- Rail Corridor
- Canal/Drain (Perennial)
- Drain (Ephemeral)
- Camera trap

N

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Figure Title :

Location of camera traps

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ZA	NHT	JAG	7-4	05	1 of 1
	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

7.2.2.3.1 Odonates (Dragonflies and Damselflies)

Diurnal transect surveys were carried out for adult damselflies and dragonflies along 200m continuous transects on a sampling route, as well as 5-minutes point counts at aquatic sampling points between 0900h and 1500h. Owing to difficulties in sampling and identification, aquatic larvae and exuviae were not surveyed. Adult odonates were identified visually (with binoculars where necessary), photographed, or caught using insect nets, if required. Captured individuals were released immediately after identification.

7.2.2.3.2 Aculeate Hymenopterans (Bees and Stinging Wasps, excluding Ants)

Adult bees and stinging wasps, nests, and food plants were visually surveyed along 200m continuous transects on a sampling route. Surveys were conducted between 0900h and 1500h. Bees and wasps were identified by sight or were photographed whenever possible. Otherwise, they were captured using handheld insect nets. Individuals were released immediately after identification. When identification in the field was not possible, live specimens were collected and examined *post-hoc* under microscope. The specimens were identified to the lowest taxonomic level possible using relevant references, identification keys, or in consultation with taxonomic experts.

7.2.2.3.3 Butterflies

Diurnal transect surveys were carried out for adult butterflies along 200m continuous transects on a sampling route between 0900h and 1500h. Butterfly caterpillars, pupae, eggs, and host plants were also recorded when observed. Adult butterflies were identified visually (with binoculars where necessary), photographed, or caught using insect nets if required. Captured individuals were released immediately after identification.

7.2.2.3.4 Herpetofauna (Amphibians and Reptiles)

Diurnal (0700h–1000h) and nocturnal (2000h–2300h) surveys were carried out for amphibians and reptiles along 200m continuous transects on a sampling route, as well as 5-minutes nocturnal point counts at aquatic sampling points. As herpetofauna occupy a wide range of habitat types, both the diurnal and nocturnal surveys also involved active searches for individuals on the ground, below rocks, logs, leaf litter, and debris, in the water, and/or on vegetation. Torches and/or headlamps were used to elicit eyeshine during nocturnal surveys. Vocalising fauna was also located or identified by call recognition, whenever possible. For species that are capable of quick retreats and escapes, the individuals were captured by hand, or using hooks, tongs, or dip nets for identification. Captured individuals were released immediately after identification.

7.2.2.3.5 Birds

Diurnal (0700h–1000h) and nocturnal (2000h–2300h) surveys were carried out for birds along 200m continuous transects on a sampling route with 20-30 minutes spent per transect. Individuals observed or heard within 50 m on the left, right, and front of surveyor along a transect were recorded. Birds were identified visually (with binoculars where necessary) and photographed. Torches and/or headlamps were used to elicit eyeshine during nocturnal surveys. Vocalising birds were also located or identified by call recognition, whenever possible. Notable behaviours (nesting, breeding, feeding, rosting) were recorded. As the main faunistic field surveys were carried out outside of the bird migratory season, additional migratory bird surveys were also conducted twice within the bird migratory season in October and November 2021, as agreed by HDB and NParks on 10 June 2021. These findings were discussed in the Choa Chu Kang N1 EBS Final Report in Section 7.3.2.9.

7.2.2.3.6 Mammals (Non-Volant)

Diurnal (0700h–1000h) and nocturnal (2000h–2300h) surveys were carried out for non-volant mammals along 200-m continuous transects on a sampling route. Both the diurnal and nocturnal surveys also involved searches in burrows and tree holes. Tracks, scats and holts were also recorded. Mammals were identified visually (with binoculars where necessary) and photographed. Torches and/or headlamps were used to elicit eyeshine during nocturnal surveys. Vocalising mammals, such as the squirrels, were also located or identified by call recognition, whenever possible.

Camera traps were equally distributed across the Study Area (Figure 7-4). One camera trap was deployed within each grid, which amounted to four camera traps. Each camera trap was set up at approximately 20–30 cm above ground (Figure 7-5). They operated for 24 hours a day and were programmed to record 10-second footage per motion trigger with a 10-second quiet period following each trigger. Each camera trap was deployed for 60 days. The camera trap model used is Browning Dark Ops HD Pro X BTC-6HDPX.

Figure 7-5 Example of a camera trap setup

7.2.2.3.7 Freshwater aquatic fauna (Fish and decapod crustaceans)

Surveys involved diurnal (0900h–1500h) and nocturnal (2000h–2300h) five-minute visual point counts at aquatic sampling points.

7.2.3 Data Analyses

7.2.3.1 Species Distribution Maps

Locations of species of conservation significance were presented on maps to show their distribution within the Study Area. All maps were prepared and generated using the mapping software QGIS 3.4.12.

7.2.3.2 Camera Trapping

Camera trap location, species identity, and the number of individuals were recorded for each video with a positive capture of fauna. An independent detection constitutes video of one or a group of individuals of the same faunal species occurring within 60 minutes at each camera trap. The number of independent detections was used to calculate detection rate of each mammal species.

7.2.3.3 Bat Sound File Analysis

All bat sound files were processed using Kaleidoscope v.4.5.4 (Wildlife Acoustics, Inc.) to separate extraneous noise from files with bat echolocation calls. The signal parameters for recognising a potential bat echolocation call were configured as follows: frequency range of 20–200 kilohertz (kHz), duration of 2–500 milliseconds (ms), maximum inter-syllable gap of 500 ms, and a minimum of 2 pulses. These files were visually processed to identify bat species based on call structures, peak frequency, minimum frequency, and call duration [P-32]. They were identified with reference to those in Pottie et al. (2005) [P-32], which provides echolocation signatures for bats in Singapore, and other relevant references [P-8, P-13].

7.2.3.4 Taxon Sampling Curves

Taxon sampling curves were plotted for selected taxa with sufficient occurrences as large sample sizes are required for the estimation of sample coverage to be robust [P-5]. The observed sample of incidence data was used to estimate sample coverage and species richness. Species richness was plotted against sample coverage, as opposed to survey effort, to estimate sample completeness/ survey adequacy, i.e., how extensively we have sampled the species in the community. Sample coverage refers to “the proportion of the total number of species in a community that belongs to the species represented in the sample” [P-5]. The curve was extrapolated to provide an estimation of species richness and sample coverage if sample size was doubled. The associated standard error and 95% confidence interval were also computed. Standard error represents the range of uncertainty of the estimate, while 95% confidence interval is the interval in which there is a 0.95 probability of containing the estimated true species richness. As some species will always remain undetected, total species richness had to be estimated

via extrapolation. This was done using the Chao estimator. All statistical analyses were carried out in the statistical programming environment R version 3.4.3 using the "iNEXT" package 2.0.20 [P-13].

7.3 Biodiversity Baseline Results

The baseline findings presented below are based on data that were collected from the floristic and faunistic surveys conducted between 1 March 2021 to 29 April 2021.

7.3.1 Floristic Baseline Results

7.3.1.1 Habitat Description

There are four habitat types identified in the Study Area, of which, the largest habitat is managed vegetation (Figure 7-6, Table 7-3). This habitat type consists of clusters of trees (9.62 ha; 45.2%) planted for landscaping purposes. These trees occupy the majority of the Study Area. The turf area, where the Rail Corridor is located, occupies 5.36 ha (25.2%) of the Study Area. The existing canal that is situated on the western side of the Study Area beside the woodland takes up 4.15 ha (19.4%) of the total land area (Section 7.3.1.1.3). The remaining areas are covered by non-vegetated habitats, which include infrastructure (2.17 ha; 10.2%), which can be found in the south-east of the Study Area.

Table 7-3 Absolute (ha) and relative (%) sizes of each habitat and vegetation type in the Study Area.

Habitat type	Absolute size (ha)	Relative size (%)
Managed vegetation	14.98	70.4
Planted trees	9.62	45.2
Turf	5.36	25.2
Canal	4.15	19.4
Others (Infrastructure)	2.17	10.2
Total	**21.3**	**100**

0 50 100 150 m

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)

N

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Figure Title :

Habitats present within Choa Chu Kang N1 Study Area

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Note: Source of basemap - Google Earth Map

7.3.1.1.1 Managed Vegetation

Managed vegetation in this Study Area consists of two different areas: clusters of trees planted for landscaping purposes and turf vegetation (Figure 7-7). The clusters of trees are situated on the western portion of the Study Area and mainly comprise planted exotic tree species. Different portions within the area were dominated by different trees, such as raintree (*Samanea saman)*, Senegal mahogany (*Khaya senegalensis*), trumpet tree (*Tabebuia rosea*), and breadfruit (*Artocarpus altilis*). Even though the site was largely covered with exotic species, few individuals of native species, such as sea almond (*Terminalia catappa)*, wild cinnamon (*Cinnamomum iners)* and rambutan (*Nephelium lappaceum*) were found distributed across the region. Maintenance of these trees, such as pruning was observed during the survey, suggesting that the vegetation undergoes frequent maintenance.

The turf area is situated on the east portion of the Study Area, with the Rail Corridor cutting through this area (Figure 7-6). A mixture of exotic species and cryptogenic weeds were recorded in the turf area, cowgrass (*Axonopus compressus*) and lalang (*Imperata cylindrica*) were found throughout the turf area. Other common herbaceous groundcovers, such as creeping tick trefoil (*Desmodium trifolium*), sensitive plant (*Mimosa pudica*), and blue pussyleaf (*Nelsonia canescens*) were spotted as well.

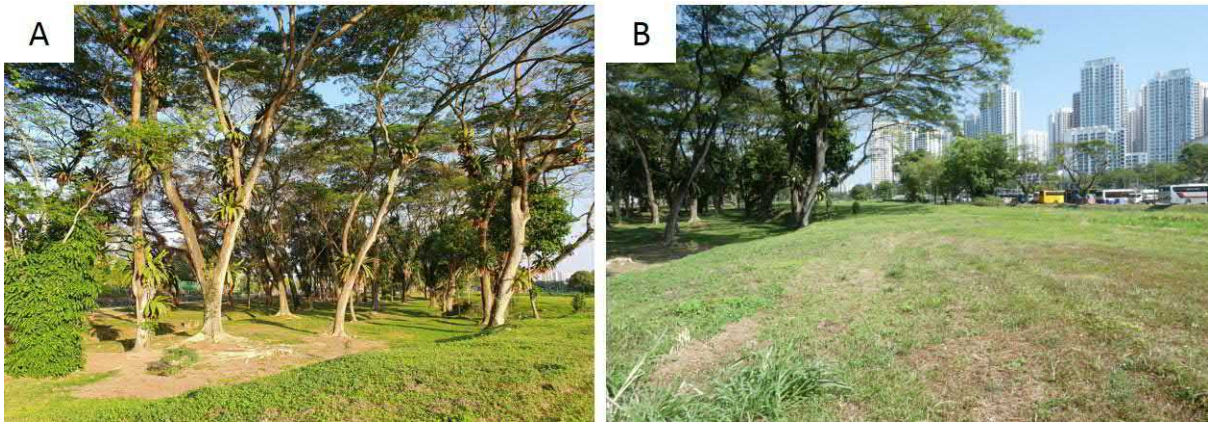

Figure 7-7 (A) Managed trees and (B) managed turf located side by side within the Study Area

7.3.1.1.2 Others (Infrastructures)

Infrastructure within the Study Area includes a heavy vehicle carpark and a defunct bus terminal. Both areas are located beside each other at the south-east portion of the Study Area. Numerous exotic trees such as raintree (*Samenea saman*) were seen planted within and along the boundary of the heavy vehicle carpark. Clusters of an exotic shrub species, camwood (*Baphia nitida*), alongside Madagascar almond (*Terminalia mantaly*) were planted along the perimeter of the bus terminal (Figure 7-8).

Figure 7-8 Infrastructure in CCK N1 Study Area. (A–B) *Samanea saman* (red arrow) planted within and along the boundary of the heavy vehicle carpark, respectively; (C) Overview of the defunct bus terminal; (D) *Baphia nitida* hedge (yellow arrow) along the boundary of the defunct bus terminal.

7.3.1.1.3 Watercourses

A large canal and three (3) concrete drains (Figure 7-9) were present within the Study Area as discussed in Section 8. One of the concrete drain (Figure 7-9B), which cuts across the centre of the Study Area, was unshaded and partially vegetated, and was found to be mostly dry during the survey period, although shallow water puddles were occasionally observed after rain. The other two concrete drains are located near the east of the Study Area.

Figure 7-9 Watercourses present within the Study Area – (A) large canal (D1) and (B) concrete drain (D3).

7.3.1.2 Overall

A total of 115 species and one species group (i.e., plants that could not be identified to species with certainty) belonging to 46 families were identified in the Study Area (Table 7-4; Appendix D). The species group consists of *Bambusa* cf. *heterostachya*.

Of the 115 species recorded, majority are exotic (77 species; 67.0%), only 27 species are native (23.5%) and 11 (9.5%) are cryptogenic (i.e., species that has unknown or uncertain origins). The plant species belonging to each status category are summarised in Table 7-4.

Of the 27 native species recorded, six (5.2%) species are considered as threatened species (i.e., species with statuses of Vulnerable, Endangered, and Critically Endangered). However, some threatened species are cultivated locally and/or are relics from past cultivation and hence may not be of conservation significance. For the overall findings, a distinction is not made as to whether these threatened species are from native wild populations or are cultivated locally and/or were relics from past cultivation. Species belonging to the latter category may therefore not be of conservation significance even though they have been accorded with threatened conservation status. This is discussed in greater detail in Section 7.2.1.4 and Section 7.3.1.3.

Table 7-4 Number and percentage (%) of species belonging to each status category in the Study Area

Origin	Status	Number of Species	Percentage (%)
Native		**27**	**23.5**
	Common	21	18.3
	Vulnerable	2	1.7
	Endangered	1	0.9
	Critically Endangered	3	2.6
Exotic		**77**	**67.0**
	Cultivated Only		22.6
	Casual		13.9
	Naturalised		29.6
	Not assessed		0.9
Cryptogenic		**11**	**9.6**
Total		**115**	**100.0**

7.3.1.3 Species of Conservation Significance

A total of six plant species that were considered as threatened species, according to Chong et al, 2009 [P-7], were found scattered across the Study Area (Figure 7-10). The number of specimens and/or clusters of specimens of these threatened species are summarised in Table 7-5. The assessment of whether the listed threatened plant species are considered as conservation significance was based on criteria detailed in Section 7.2.1.4. According to the historical land use of the Study Area (See Section 7.2.1.1), five species—*Baccaurea motleyana*, *Epipremnum pinnatum*, rambutan (*Nephelium lappaceum*), *Sandoricum koetjape,* and *Mangifera odorata*—are most likely relics that had persisted from the past cultivation rather than local provenance and are not considered as species of conservation significance.

Therefore, only one species is considered to be of conservation significance. This species is a nationally Vulnerable climber, *Bridelia stipularis* (Appendix F). A small cluster was found growing on a weeping fig (*Ficus benjamina*) tree in the Study Area (Figure 7-11). This species can also usually be found in other habitats, such as in primary and secondary forests, freshwater swamp forests, mangrove forests and riverine areas.

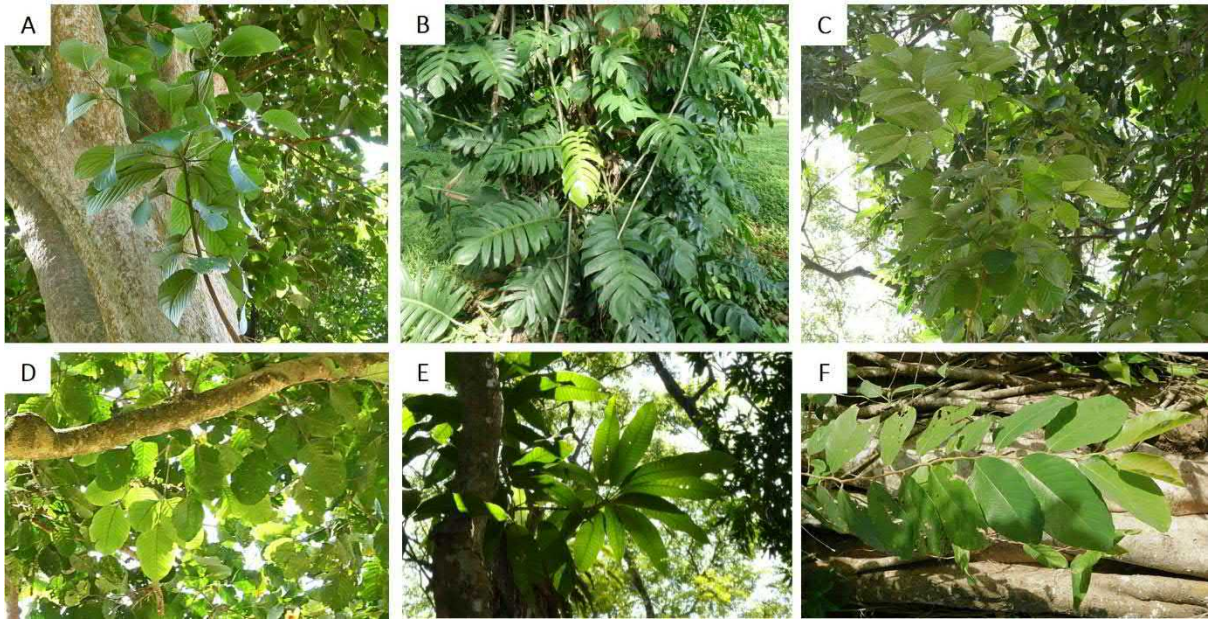

Figure 7-10 Threatened plant species found in CCK N1 Study Area. (A) *Baccaurea motleyana*; (B) *Epipremnum pinnatum*; (C) *Nephelium lappaceum*; (D) *Sandoricum koetjape*; (E) *Mangifera odorata*; (F) Species of conservation significance, *Bridelia stipularis*

Table 7-5 Number of plant species of conservation significance

Species Conservation Status*	Vulnerable	Endangered	Critically Endangered	Total
Non-Cultivated Threatened Species	1	0	0	1
Cultivated Threatened Species	1	1	3	5
Total	2	1	3	6

0 50 100 150 m

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)

CS Species

- Bridelia stipularis (VUL)

N

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Figure Title :

Location of species of conservation significance in Choa Chu Kang N1 Study Area

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7.3.1.4 Large Specimens

Ninety-one large plant specimens of ≥ 3 m were recorded in the Study Area (Table 7-6; Appendix F), of which 87 individuals are large trees with girth sizes that range from 3.0–5.4 m girth, belonging to five species and 4 families.). Majority of these specimens are exotic tree species. The remaining four specimens are stranglers with a spread that ranges from 3.2–8 m (Figure 7-13). The largest tree specimen recorded was angsana (*Pterocarpus indicus*) of 5.2 m girth. As for stranglers, a specimen of Malayan banyan (*Ficus microcarpa*) was recorded with spread of 8 m.

Plant species such as raintree (*Samanea saman*), create a biome of microhabitats within the Study Area. It can support numerous climber species such as *Epipremnum pinnatum* (Figure 7-12B) and *Syngonium podophyllum;* Figure 7-12A), and pteridophytes such as bird's nest fern (*Asplenium nidus*; Figure 7-12C) and oak leaf fern (*Drynaria quercifolia*), as well as orchid species such as pigeon orchid (*Dendrobium crumenatum*). This variety of microhabitats that can be found on *S. saman* provides a place of refuge for different species of fauna and functions as a habitat for nesting.

Table 7-6 Number of large specimens recorded in the Study Area

Habit	Origin	Species	No. Of Specimens
Tree	Exotic	*Artocarpus altilis*	1
		Khaya senegalensis	37
		Pterocarpus indicus	3
		Samanea saman	39
		Tabebuia rosea	7
Strangler	Cryptogenic	*Ficus benjamina*	2
	Native	*Ficus microcarpa*	2
Total			**91**

Figure 7-12 Large specimens with epiphytes found growing on raintree (*Samanea saman)* in the Study Area. (A) *Syngonium podophyllum*; (B) *Epipremnum pinnatum*; (C) Bird's nest fern (*Asplenium nidus*)

0 50 100 150 m

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)

Large Plant Specimens

- Strangler
- Tree

N

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Figure Title :

Distribution of large plant specimens in the Study Area

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	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

7.3.1.5 Other Specimens of Value

A small cluster of *Bambusa* cf. *heterostachya* of spread 2.5 m was found on the eastern side in the Study Area (Figure 7-14). Although no bamboo bats were detected during the roost emergence surveys, this bamboo cluster could still be a potential roost site for the nationally Critically Endangered bamboo bats (*Tylonyecteris sp.*) and provide a diet and habitat for other fauna groups (Section 7.3.2.11).

Based on the criteria listed in Section 7.2.2.2.5, two *Ficus* species in the Study Area were considered as keystone species. A total of two individuals of Malayan banyan (*Ficus microcarpa*) and weeping fig (*Ficus benjamina*) respectively were recorded during the tree mapping survey (Section 7.2.2.2.6). Both stranglers are monoecious (i.e., species that bear both male and female reproductive organs within the same individuals). This characteristic allows fruits to be produced throughout the year, thus providing an important food source for frugivores in the community, especially when no other fruits are available during the time of the year [P-18; P-19]. These keystone species could also possibly encourage the recruitment and population growth of native frugivores in the Study Area [P-24]. The distribution of other plant specimens of value is reflected in Figure 7-15 (Appendix J).

Figure 7-14 Bamboo cluster (*Bambusa cf. heterostachya*) recorded in the Study Area.

0 50 100 150 m

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)

Other Plant Specimens of Value

- Keystone species
- Bamboo

N

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05	MAR 2022	ZA	Final Report	NHT	JAG

Qualified Person Endorsement : NA

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CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Distribution of other plant specimens of value in the Study Area

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ZA	NHT	JAG	7-15	05	1 of 1
	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

7.3.1.6 Tree Mapping Findings

In total, 397 tree specimens of ⩾ 0.3 m girth belonging to 26 species and 15 families were tagged and recorded (Table 7-7; Figure 7-16, Appendix H). Majority are exotic species, of which, raintree (*Samanea saman)* and Senegal mahogany (*Khaya senegalensis*) collectively made up more than 50% of the tree specimens mapped in the Study Area, with a girth range of 0.9–4.8 m and 0.9–4 m respectively.

Table 7-7 Number and percentage (%) of tree species mapped in the Study Area.

Species	Number of Species	Percentage %
Artocarpus altilis	8	2.0
Artocarpus heterophyllus	9	2.3
Artocarpus integer	1	0.3
Averrhoa carambola	4	1.0
Baccaurea motleyana	1	0.3
Canarium odontophyllum	1	0.3
Chukrasia tabularis	1	0.3
Cinamomum iners	1	0.3
Dimocarpus longan subsp. malesianus	6	1.5
Durio zibethinus	9	2.3
Ficus benjamina	2	0.5
Ficus microcarpa	2	0.5
Hura crepitans	1	0.3
Khaya senegalensis	124	31.2
Mangifera indica	17	4.3
Mangifera odorata	2	0.5
Nephelium lappaceum	4	1.0
Peltophorum pterocarpum	1	0.3
Pterocarpus indicus	7	1.8
Samanea saman	140	35.3
Sandoricum koetjape	2	0.5
Schefflera actinophylla	1	0.3
Syzygium malaccense	1	0.3
Tabebuia rosea	33	8.3
Terminalia catappa	3	0.8
Terminalia mantaly	16	4.0
Grand Total	**397**	**100.0**

0 50 100 150 m

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)

Tree Mapping

- Native
- Exotic
- Cryptogenic

N

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Figure Title :

Distribution of trees according to their origin recorded in Choa Chu Kang N1 Study Area

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ZA	NHT	JAG	7-16	05	1 of 1
	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

7.3.2 Faunistic Baseline Results

7.3.2.1 Overall

The field assessment recorded 89 species, with more than half of the assemblage dominated by birds (36 species) and butterflies (18 species) (Table 7-8; Appendix I). Only one bird species of the conservation significance was recorded and elaborated in Section 7.3.2.9. Records of uncommon to moderately rare fauna were also recorded and elaborated in the sections below. Nine migratory bird species were also recorded, which comprised mainly common migrants, although two uncommon or rare migrants were also recorded. This is discussed in Section 7.3.2.9. Their presence shows the value of the Study Area in supporting uncommon species and migratory birds, some of which may have dispersed through the adjacent Rail Corridor.

Within the Study Area, areas with spontaneous vegetation along the Rail Corridor and clusters of trees in the southern part appear to provide denser canopy cover and hence, a more conducive microclimate allowing for fauna. The entire Study Area serves as a stepping stone for wildlife to travel to the surrounding green spaces and contribute to the ecological connectivity along the Rail Corridor in the area. The significance of the Study Area as a stepping stone for species moving along the Rail Corridor to surrounding green spaces is discussed in Section 7.4.

The watercourses within the Study Area are characterised by concretised canals, which are poor in aquatic life although fauna such as the ardeids (herons and egrets), monitor lizard (*Varanus salvator*), and smooth-coated otter (*Lutrogale perspicillata*) can use the canals as a corridor to move between habitats in the surrounding. This is also discussed in the sections below.

The full list of recorded faunal species, faunal survey data and camera trap data is available in Appendix I, Appendix J, and Appendix K, respectively.

Table 7-8 Summary of recorded faunal species and species of conservation significance

Faunal Group	No. of Recorded Faunal Species	
	All Species	Species of Conservation Significance
Odonates	**6**	**0**
Dragonflies	5	0
Damselflies	1	0
Aculeate hymenopterans	**5**	**0**
Bees	2	0
Stinging wasps	3	0
Butterflies	**18**	**0**
Freshwater fish	4	0
Herpetofauna	**14**	**0**
Amphibians	5	0
Reptiles	9	0
Birds	**36**	**1**
Mammals	**6**	**0**
Non-volant mammals	4	0
Bats	2	0
Total	**89**	**1**

The faunal surveys by Guttensohn & Leong (2021) [P-10] recorded 64 species, which comprised four odonates, seven butterflies, four amphibians, four reptiles, 41 birds and four non-volant mammals. No data on aculeate hymenopterans and bats were available. Seven species of migratory birds were recorded by Guttensohn & Leong (2021) [P-10], of which, three species, the Asian brown flycatcher (*Muscicapa dauurica*), crested honey-buzzard (*Pernis ptilorhynchus*), and little egret (*Egretta garzetta*), were recorded in this study.

Guttensohn & Leong (2021) [P-10] recorded five species of conservation significance, including three birds and two mammals. These are the changeable hawk-eagle (*Nisaetus cirrhatus*), red junglefowl (*Gallus gallus*) and

spotted wood owl (*Strix seloputo*), long-tailed macaque (*Macaca fascicularis*) and smooth-coated otter (*Lutrogale perspicillata*). These species were not recorded in this study.

7.3.2.2 Taxon Sampling Curve

Along the terrestrial sampling route, the sample coverage for the faunal groups was above 80% with the exception of aculeate hymenopterans and butterflies at 66.7% and 60.4% respectively (Table 7-9; Figure 7-17). At the aquatic sampling points, the sample coverage for amphibian and fish were at 81.0% and 77.8% respectively (Table 7-9; Figure 7-18). Species with too few data points were removed from the analysis.

Table 7-9. Result summary of taxon sampling analysis

Faunal group	Sample coverage (%)	Observed richness	Estimated richness (± s.e)
Terrestrial sampling route			
Odonates	60.4	9	29.4 ± 7.6
Aculeate hymenopterans	66.7	2	2.5 ± 1.1
Butterflies	87.3	20	24.1 ± 4.1
Reptiles	97.3	6	6.1 ± 0.5
Birds	85.3	21	23.4 ± 19.0
Aquatic sampling points			
Amphibian	81.0	3	3.8 ± 1.7
Fish	77.8	2	5.4 ± 3.5

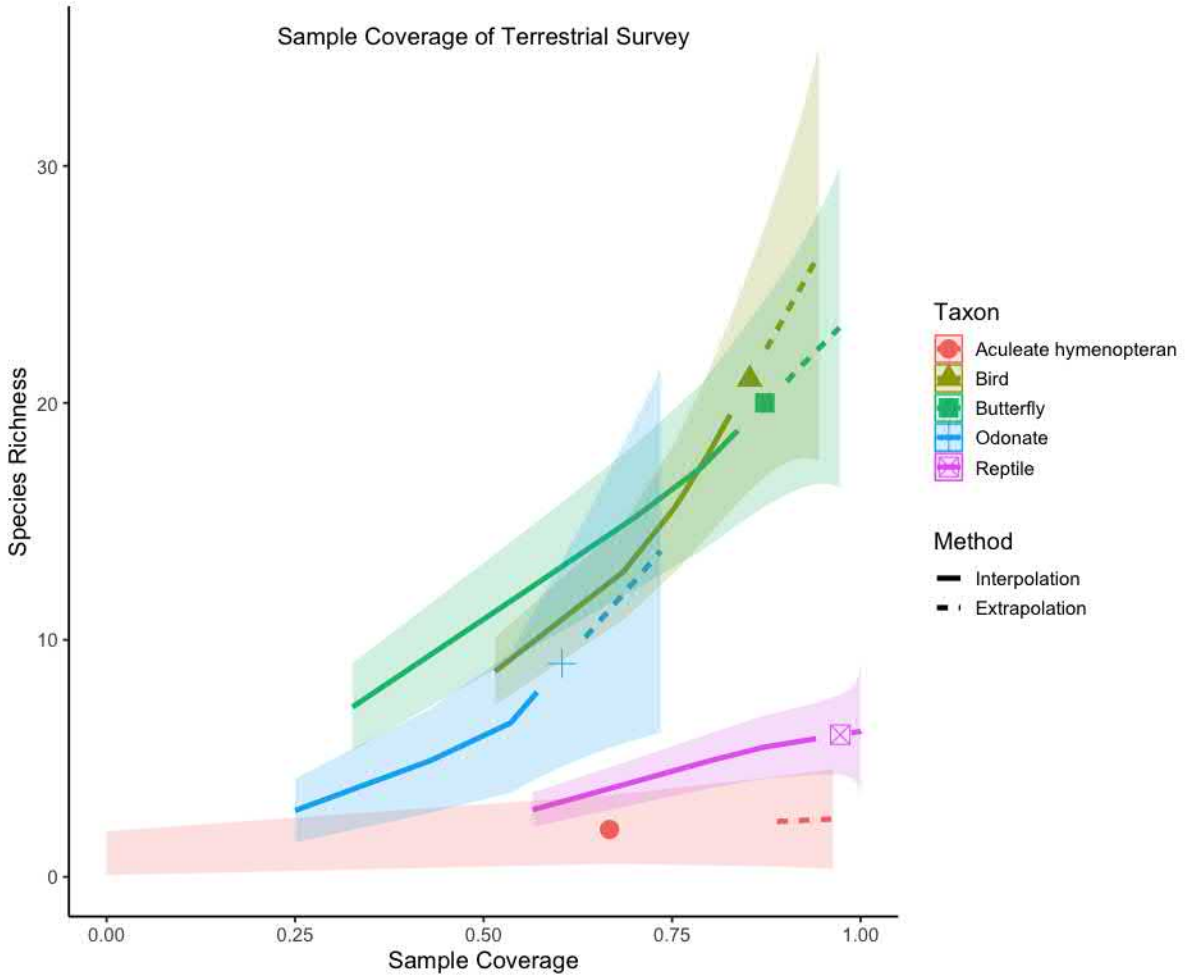

Figure 7-17 Taxon sampling curve for terrestrial sampling route

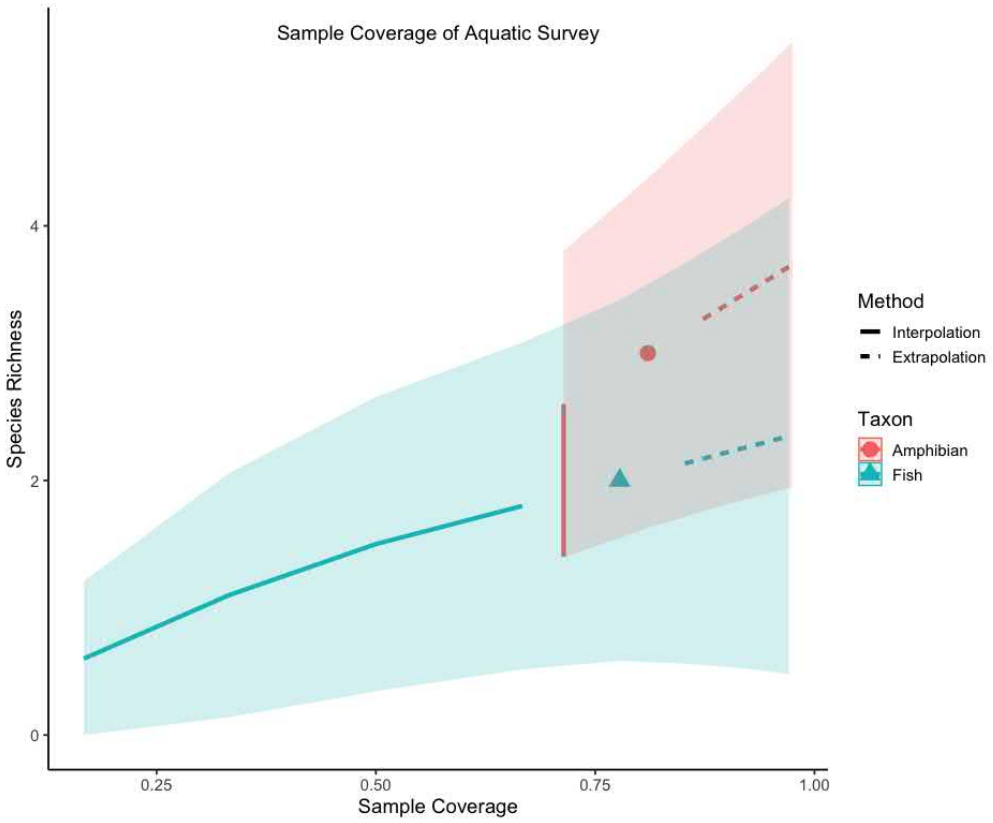

Figure 7-18 Taxon sampling curves for aquatic sampling points

7.3.2.3 Odonates

The field assessment recorded six species of odonates, none of which are of conservation significance. Five of these species are widespread and common, and frequently found in parks and gardens, as well as disturbed open habitats like canals. The remaining species were the dingy duskhawker (*Gynacantha subinterrupta*; Figure 7-19), which was an unexpected finding due to its preference for forested areas. One individual was observed within a small cluster of trees (Figure 7-20). It is a widespread but uncommon dragonfly that tends to hide within forest undergrowth during the day, emerging at dawn and dusk to forage for food [W-7]. Locations of past sightings include Bukit Timah Nature Reserve, Dairy Farm Nature Park, Upper Peirce Reservoir, and around Mandai [W-7]. Its presence may have been facilitated by the connectivity of the Study Area to the surrounding green patches or adjacent forested areas along the Rail Corridor.

Figure 7-19 Dingy Duskhawker (*Gynacantha subinterrupta*) recorded at the Study Area

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)
- Terrestrial sampling route
- Aquatic sampling point
- Gynacantha subinterrupta

N

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CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Location of uncommon odonate species

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Note: Source of basemap - Google Earth Map

7.3.2.4 Aculeate Hymenopterans

Five species were recorded during the field assessment. Three of the recorded species were identified to species level: Andrew's blue-banded digger bee (*Amegilla andrewsi*), lesser banded hornet (*Vespa affinis*) and Eastern honeybee (*Apis cerana*). These two species are native and commonly found in urban parks and gardens. The other two recorded species were only identified to genus level – *Bembicinus* sp. and *Scolia* sp., which are uncommon.

7.3.2.5 Butterflies

The field assessment recorded 18 butterfly species. Most are common or moderately common, typically found in parks, gardens, and urban areas such as the great eggfly (*Hypolimnas bolina bolina*), chestnut bob (*Iambrix salsala salsala*) and autumn leaf (*Doleschallia bisaltide bisaltide*) (Figure 7-21B–D). However, two moderately rare species, the common evening brown (*Melanitis leda leda*) and common redeye (*Matapa aria*; Figure 7-21A), were recorded. The sightings were distributed across the Study Area. The common evening brown (*Melanitis leda leda*) is usually seen at grasslands, thickets, or among dense vegetation [W-9]. Although its host plant, the guinea grass (*Megathyrsus maximus*) was not present in the Study Area, the butterfly was observed twice in the southern part of the Study Area (Figure 7-22). Thus, its arrival may have been aided by the connectivity of the Study Area from adjacent grasslands. On the other hand, host plants of the common redeye (*Matapa aria*) are bamboos (*Bambusa* species), hence it is typically sighted in a variety of habitats where bamboo clusters are present, from urban parks, wastelands, to nature reserves [W-10]. It was observed at two locations in the Study Area (See Figure 7-22), and may be due to the presence of one bamboo cluster in the central part of the Study Area.

Figure 7-21 Butterflies recorded at the Study Area. (A) Common Redeye (*Matapa aria*); (B) Great Eggfly (*Hypolimnas bolina bolina*); (C) Chestnut Bob (*Iambrix salsala salsala*); (D) Autumn Leaf (*Doleschallia bisaltide bisaltide*)

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)
- Terrestrial sampling route
- Matapa aria
- Melanitis leda leda

N

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Figure Title :

Location of moderately rare butterfly species

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Note: Source of basemap - Google Earth Map

7.3.2.6 Freshwater Fish

Four freshwater fish species were recorded during the field assessment. All were non-native species. This includes the guppy (*Poecilia reticulata*), bumblebee tilapia (*Heterotilapia buttikoferi*) and Malayan tiger barb (*Puntigrus partipentazona*). The last species is a goby (*Rhinogobius sp.*) that was not identified to species level.

7.3.2.7 Amphibians

The field assessment recorded five species, comprising three native and two non-native species. The species are the greenhouse frog (*Eleutherodactylus planirostris*), banded bull frog (*Kaloula pulchra*), painted chorus frog (*Microhyla butleri*), and Asian toad (*Duttaphrynus melanostictus*). All four are widespread and common urban species, typically found in both terrestrial and aquatic habitats. They were observed within the woodland as well as the canal (D1).

Guttensohn & Leong (2021) also documented the presence of the globally Near Threatened Malayan giant frog (*Limnonectes blythii*) within our Study Area [P-10]. It is typically observed in a forested environment [W-13].

7.3.2.8 Reptiles

Nine species, comprising five lizards, three snakes and one turtle, were recorded during field assessment. None of the recorded species are of conservation significance. They are widespread and common, and are typically found in urban or parkland habitats in Singapore. Species recorded include the changeable lizard (*Calotes versicolor*), painted bronzeback (*Dendrelaphis pictus;* Figure 7-23) and brahminy blind snake (*Indotyphlops braminus*).

While the reticulated python (*Malayopython reticulatus*) and Malayan water monitor (*Varanus salvator*) were not recorded, they may use the canal to travel to or from the Study Area. Guttensohn & Leong (2021) also recorded the clouded monitor (*Varanus nebulosus*) from the Study Area. It is a common native species that is restricted in distribution [P-10]. It is known to inhabit mature forests and adjacent parkland [P-10].

Figure 7-23 Painted Bronzeback (*Dendrelaphis pictus*) Recorded at the Study Area

7.3.2.9 Birds

Thirty-six species were recorded during field assessment, including 27 residents (five were introduced) and nine winter visitor species. Most of the recorded species are common. Only one species of conservation significance,

the nationally Endangered blue-crowned hanging-parrot (*Loriculus galgulus*) was recorded, located in the southern part of the Study Area (Figure 7-25). Since its assessment in 2012, the population has increased in range and numbers [P-22], thus encounters of it in the field are increasingly common.

Nine migratory bird species were recorded – crested honey buzzard (*Pernis ptilorhynchus*), little egret (*Egretta garzetta*), arctic warbler (*Phylloscopus borealis*), Indian cuckoo (*Cuculus micropterus*), brown shrike (*Lanius cristatus*), tiger shrike (*Lanius tigrinus*), yellow-rumped flycatcher (*Ficedula zanthopygia*), Asian brown flycatcher (*Muscicapa dauurica*) and yellow-crowed warbler (*Phylloscopus inornatus*). Five of these species were not recorded in Guttensohn & Leong (2021) [P-10]. The yellow-browed warbler is a rare migrant and was recorded in the central part of the Study Area in this study (Figure 7-25). It is usually found in forest habitats and sometimes seen in parklands [P-22]. The yellow-rumped flycatcher is an uncommon migrant that can be found in various habitats such as forests and parklands. These species may have travelled from the surrounding green spaces to the Study Area, suggesting the value of the Study Area in providing habitats for migratory species. The little egret (Figure 7-24) was seen in the canal in the western edge, suggesting that the canal may function as a corridor for egrets and terrestrial bird species that utilise open spaces.

A checklist of bird species compiled in 2020 that was reflected in Guttensohn and Leong (2021) has also recorded forest-associated species such as the dark-necked tailorbird (*Orthotomus atrogularis*) and rufous-tailed tailorbird (*Orthotomus sericeus*), as well as three species of conservation significance: the nationally Endangered red junglefowl (*Gallus gallus*), changeable hawk-eagle (*Nisaetus cirrhatus*) and the Nationally Critically Endangered spotted wood owl (*Strix seloputo*). These species were not recorded during the study, but expected to occur based on past records by NSS [P-10].

Notably, the globally Critically Endangered and nationally Endangered straw-headed bulbul (*Pycnonotus zeylanicus*) may also utilise the Study Area as an ecological corridor to travel between surrounding forested areas. It has been recorded in green spaces and forest patches adjacent to the Study Area, including Bukit Mandai Forest, Bukit Batok Nature Park, and Toh Tuck Forest [P-36; P-39]. Highly coveted for its melodious songs, the songbird trade has resulted in its extirpation throughout much of its range [P-36]. Fortunately, the population in Singapore is estimated to make up one-third of the global population [P-26]. This species requires wooded corridors to move between habitats [P-31; P-40]. The Study Area has the potential in serving as a stepping stone for both species of conservation significance and forest species to move to other surrounding green spaces.

Figure 7-24 Little Egret (*Egretta garzetta*) recorded in canal (D1) at the Study Area

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)
- Terrestrial sampling route
- Aquatic sampling point
- Loriculus galgulus
- Phylloscopus inornatus

N

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Figure Title :

Location of bird species of conservation significance and rare bird species

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	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

7.3.2.10 Mammals (Non-Volant)

The field assessment recorded four non-volant mammal species, namely the plantain squirrel (*Callosciurus notatus*), oriental house rat (*Rattus tanezumi*), common palm civet (*Paradoxurus musangus*), and feral dog (*Canis lupus familiaris*). The camera traps yielded 121 independent detections over 227 trap-nights (Table 7-10). Independent detections were not calculated for rodents, squirrels, and shrews that were unidentifiable to species level.

The plantain squirrel and common palm civet are considered widespread and common. It is a very common species that can be found in urban and parkland habitats. One individual of plantain squirrel was observed carrying nesting material, such as twigs, suggesting that the Study Area is possibly utilised by this species for nesting and breeding.

Nine independent detections were obtained for the common palm civet on three camera traps (CT01, CT03 and CT04; Table 7-11) within the Study Area.

While not recorded during field assessment, three species of conservation significance had been recorded in surrounding green spaces and may occur in the Study Area as reported in Guttensohn & Leong (2021) [P-10]. This includes the long-tailed macaque (*Macaca fascicularis*), smooth-coated otter (*Lutrogale perspicillata*), and Sunda pangolin (*Manis javanica*). The nationally widespread and common long-tailed macaque (*Macaca fascicularis*) is often observed in parkland and forest habitats, and was recently uplisted as a globally Vulnerable species due to human persecution across the rest of Southeast Asia [W-14].

The globally Vulnerable and nationally Endangered smooth-coated otter (*Lutrogale perspicillata*) has been observed using the nearby Pang Sua pond [W-5], as well as the northern part of Pang Sua canal (near Choa Chu Kang Crescent) in groups of up to six [P-10]. According to OtterWatch, a group that shares significant news of otters in Singapore, the otters sighted may have been the Pang Sua family that was first sighted in the Pang Sua estate back in 2017 [W-15]. The family has been observed to venture between Kranji Reservoir and the Pang Sua pond via Pang Sua canal [W-15], demonstrating the value of the Study Area, specifically Pang Sua Canal, in providing connectivity between disparate aquatic habitats.

Similarly, recent sightings of the globally and nationally Critically Endangered Sunda pangolin (*Manis javanica*) have been made in adjacent areas, such as in the canal south of the Study Area [P-10]. It is usually observed in nature reserves and degraded forest fragments of Singapore [P-25]. In a journal paper titled “The Sunda pangolin in Singapore- a multi-stakeholder approach to research and conservation” by Nash et al., (2020), an unpublished data by ACRES shows that this species has also been seen in public areas as some individuals, especially sub-adult males, disperse in search of a home range [P-25]. Notably, Singapore is a global stronghold for this species and is crucial in contributing to the global conservation of pangolins due to the lack of local poaching pressures, unlike in other countries where it ranges [P-25; P-21]. However, the viability of the local population is still threatened by habitat loss, degradation and fragmentation, and road-related mortality [P-21]. Increasing sustainability and connectivity between habitats is considered a key measure for the conservation of this species [P-21]. Therefore, the Study Area may provide connectivity for this species to safely travel between fragmented habitats. Other mitigating measures, such as wildlife culverts and overpass, can be implemented to help reduce road-related mortality, and contribute to the overall conservation of this species.

Table 7-10 Summary of trap-nights and number of independent detections of mammal species at each camera trap

Station	No. of trap-nights	No. of species	Detection rate of mammal species
CT01	72	3	0.82
CT02	47	1	0.04
CT03	36	3	1.03
CT04	72	3	0.31

Table 7-11 Location of and number of independent detections of mammal species across all camera traps

Scientific name	Common name	Station	No. of independent detections
Callosciurus notatus	Plantain squirrel	All stations (CT01–CT04)	83
Canis lupus familiaris	Feral dog	CT01, CT03 and CT04	28
Paradoxurus musangus	Common palm civet	CT01, CT03 and CT04	9
Rattus tanezumi	Oriental house rat	CT03	1
***Rattus* sp.**	Rat	CT03	N.A*
N/A	Unidentified squirrel or treeshrew	CT01, CT03 and CT04	N.A*

*Independent detection cannot be calculated since it was not identified to species level

7.3.2.11 Mammals (Bats)

Two bat species were recorded acoustically during field assessment: the whiskered myotis (*Myotis muricola*) and the Asiatic lesser yellow house bat (*Scotophilus kuhlii*) (Figure 7-26). Both species are widespread and common, and not of conservation significance.

Based on the presence of a bamboo cluster in the central part of the Study Area, two species of bamboo bats, the – the nationally Critically Endangered lesser bamboo bat (*Tylonycteris malayana*) which is restricted and rare, and the greater bamboo bat (*Tylonycteris malayana*) which is widespread but common, were considered of probable occurrence. Both species are known to roost in bamboo internodes and are especially susceptible to injury or mortality if their roosts are removed or damaged during development, hence they are regarded as species of conservation significance. While no bamboo bats (*Tylonycteris* species) were recorded from the bamboo during roost emergence surveys, they remain as a potential habitat for these species.

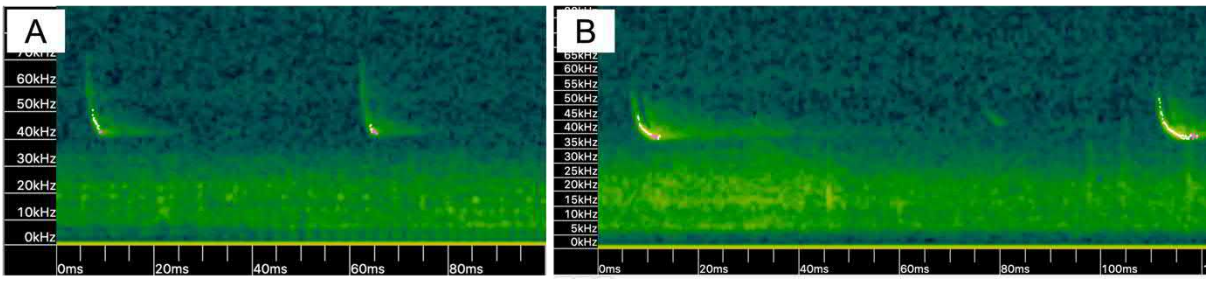
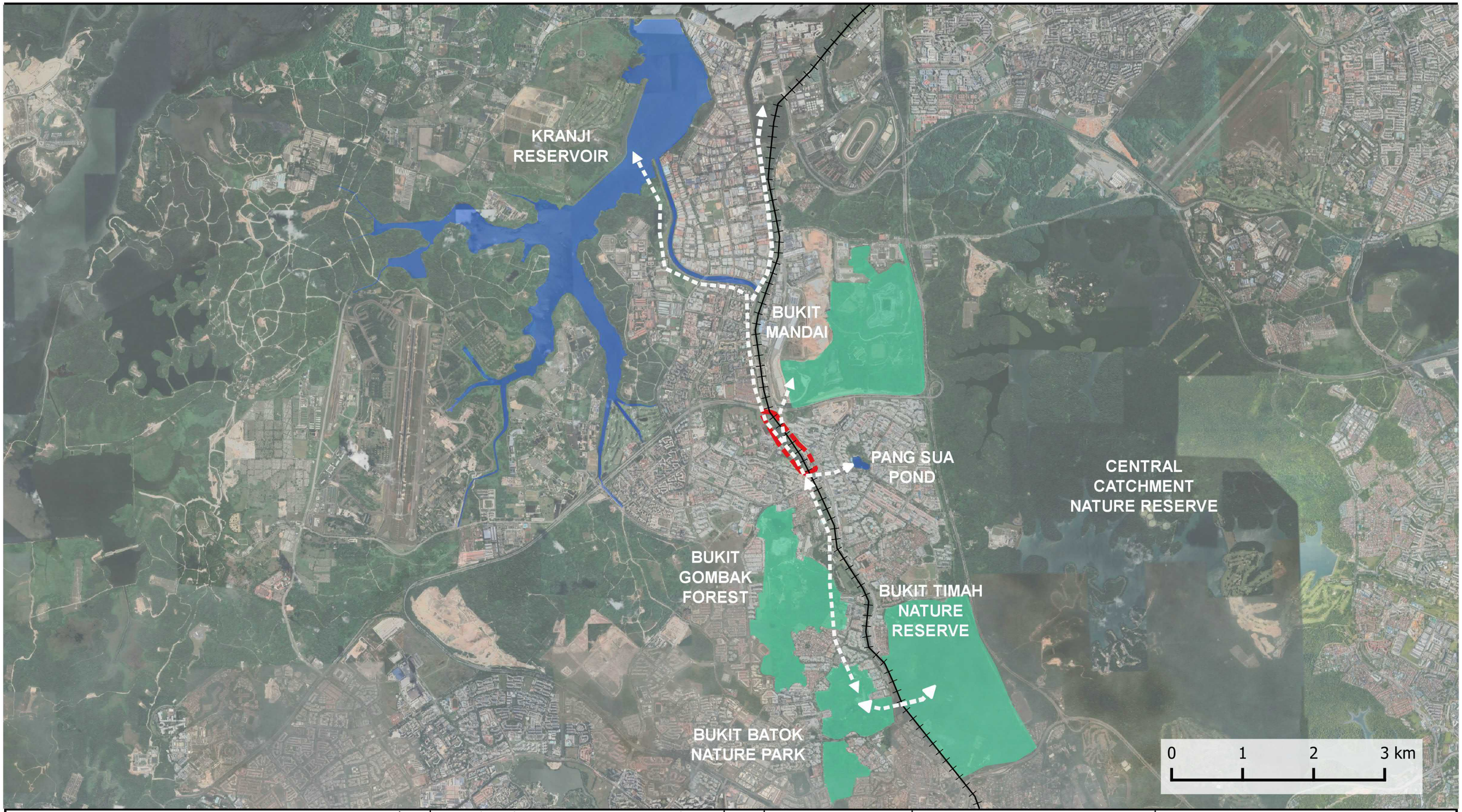


Figure 7-26 Spectrogram of (A) Asiatic yellow house bat (*Saccolaimus saccolaimus*) and (B) Whiskered myotis (*Myotis muricola*)

7.4 Ecological Significance and Connectivity

The 21.7 ha Study Area, Choa Chu Kang N1, is also known as the Sungei Pang Sua Woodland [P-10; P-11]. It is “an important part of the Green Rail Corridor between Hill View in the south and Stagmont Ring in the north, as it is the only wooded area in-between” [P-11]. The Study Area is also considered as “a conducive stepping stone” [P-10] (i.e., habitat patches in a landscape that facilitates movement of species between other forested patches [P-33]) and “a conduit for wildlife dispersal or movement” [P-10] that could facilitate the dispersal of fauna to the surrounding green spaces, such as Bukit Mandai forest to the northeast and Bukit Gombak forest to the south (Figure 7-27), and to other larger fragmented habitats, including Bukit Timah Nature Reserve (BTNR) in the southeast, and Mandai Mangrove and Mudflats in the north [P-10], hence, enhancing the ecological connectivity across the landscape.



Legend

- CCK N1 Study Area
- Rail Corridor
- Green space
- Waterbody

N

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Figure Title :

Site context and potential connectivity between Study Area green patches in proximity

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Note: Source of basemap - Google Earth Map

Large tree specimens recorded within Study Area contribute to a myriad of ecological roles, such as regulating microclimates of the vegetated area and the surrounding environment [P-3], as well as providing shade and microhabitats for faunal communities using the Study Area. Species of conservation significance, such as the nationally Endangered red jungle fowl (*Gallus gallus*) and the nationally Critically Endangered spotted wood owl (*Strix seloputo*) have been observed by Guttensohn & Leong (2021) in the Study Area [P-10]. Forest-associated species such as the dingy duskhawker (*Gynacantha subinterrupta*) and dark-necked tailorbird (*Orthotomus atrogularis*) [P-10], as well as migratory species such as the rare yellow-browed warbler (*Phylloscopus inornatus*) were also observed in this study.

Species residing in adjacent areas, particularly volant species can use the Study Area as a stepping stone to disperse to surrounding green spaces. An example is the globally Critically Endangered straw-headed bulbul (*Pycnonotus zeylanicus*) that was recorded at the adjacent Bukit Mandai Forest, BBNP, and Toh Tuck Forest [P-36; P-39], Species adapted to using canals can also use the canal to move through the Study Area. Some examples are the globally Vulnerable and nationally Endangered smooth-coated otter (*Lutrogale perspicillata*), as well as the globally Critically Endangered Sunda pangolin (*Manis javanica*) that have been observed to move within the canal in the vicinity of the Study Area based on desktop assessment (Section 7.3.2.10). The presence of species of conservation significance, forest-associated species, and migrants demonstrates the value of the Study Area as a stepping stone in enhancing ecological connectivity across the landscape.

7.5 General Recommendations

Guttensohn & Leong (2021) [P-10] highlighted the recommendations for the Study Area and to improve the ecological connectivity between the Study Area and other green spaces in the vicinity:

1. Greening of the Pang Sua Canal, which involves the possibility of de-canalisation of the canal that would create opportunities to incorporate planting of vegetation, such as small trees, flowering shrubs, and undergrowth that are able to withstand occasional flood conditions. This would also lead to the creation of habitats along the Canal,
2. Eco-links (e.g., culvert undercrossing, overpass wildlife crossings, etc.) at two locations: i) across/under KJE to Bukit Mandai Forest and ii) across Choa Chu Kang Road in the south, which leads to the southern part of Rail Corridor, and
3. Intensive tree planting with shrubby undergrowth in the northern part of the areas with planted trees.

Taking into consideration of some of the recommendations listed above as well as the Environmental Baseline Findings from Section 7.3, AECOM has recommended to establish an ecological corridor on the east of the Pang Sua Canal adjacent to the proposed residential development, so that wildlife can continue to use the area as a stepping stone to move between the surrounding green spaces as well as to incorporate habitat creation within the ecological corridor. The proposed corridor will potentially help to facilitate the movement of faunal species, such as small mammals and volant species, even after the proposed development is established. The corridor should be of a reasonable width to ensure the survival of small to medium-sized mammals and for them to utilize the corridor, especially within an urban landscape where limited habitats are available [P-44; W-20], in this case, a larger corridor is recommended [W-20].

Further studies could also be carried out to explore the possibility of localised widening of the ecological corridor to conserve clusters of mature trees, such as the cluster of rain trees located south of the Study Area, which have denser tree canopies that could provide a more conducive microclimate allowing for profusion of ferns and other epiphytic plants and for fauna species. Floral species of conservation significance – *Bridelia stipularis* – would be retained. Keystone species including a specimen of *Ficus microcarpa* and *Ficus benjamina* respectively, with spread of 3 – 8 m and *Bambusa* cf. *heterostchya* of 2.5m spread – will also be studied for retention.

The greening of the canal will need to be studied together with the design of this ecological corridor to explore the possibility of an optimal and integrated design, taking into consideration the ecological aspects of the corridor, the proposed residential development and infrastructure requirements.

It is expected that the proposed development will result in the loss of some of the existing mature trees within the Study Area. As such, enhancement planting strategies (i.e., planting of keystone species, tiered planting of different layers of vegetation to emulate a forest-like structure that has large trees with close canopy etc.) could be incorporated. However, the planting of new vegetation will require some time for it to mature and to reconstitute a forest-like structure.

Other general recommended features of the proposed ecological corridor are listed below:

Enhancement Planting

a. Planting of fruit trees (i.e., keystone species, such as *Ficus* sp.) and native species can be carried out within the corridor to provide food for any fauna species that could be using the corridor and to enhance its function as an ecological corridor.

b. Generally, vegetation planted should incorporate tiered planting of different layers of vegetation with different maturity from shrub to trees (i.e., undergrowth layer, understorey layer, canopy layer and emergent layer) and incorporate native species to increase the overall native biodiversity of the site.

c. Plants that attract pollinators and/or butterflies that are suitable to be planted on site should also be incorporated to provide food sources for the butterfly species that were recorded during the faunistic survey (Section 7.3.2.5), and to potentially attract other butterfly species that might utilise the area after is enhanced.

d. The alignment of the ecological corridor should also consider and integrate the existing large trees on site as the trees will be able to provide shade and canopy coverage within the corridor.

e. Softening of canal edge, where feasible

Light Features and Other Considerations

a. Use wildlife-friendly light properties or features to minimise light spills, i.e., the light that falls outside the area intended to be lit).

b. Optimising the placement of lights by providing lighting only on the area intended, and keeping lights close to the ground.

c. To set suitable configuration of location, height and orientation of the lights. Street lights can be faced towards the ‘urban’ areas instead of the proposed corridor, wherever possible. By lowering the height of light pole, it would reduce the volume of illuminated space in the canopies of trees, which would cause less disturbances to wildlife that dwells in tree canopies at night such as birds, and arboreal animals (Figure 7-28) [P-43]. This can be enhanced further by incorporating 'shielded' design of lighting fixtures, which helps to control the amount of light trespass of a certain area (Figure 7-29).

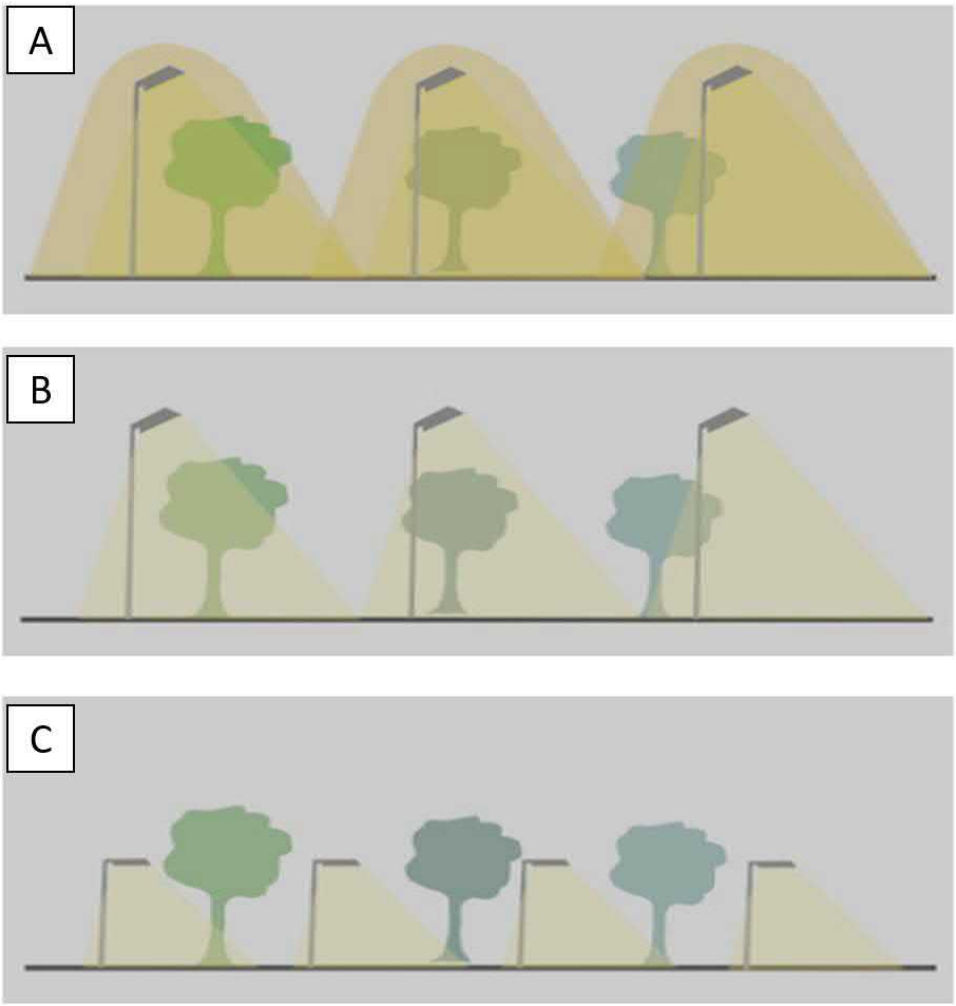

Figure 7-28 Combined effect of shielded lighting fixtures and short poles on reducing light trespass: A) lights with unshielded light fixtures; B) light fixtures with shield; C) light fixtures on short poles which cut-off light trespass and keep adjacent areas dark [P-43].

d. Leverage on terrain/ slopes and other landscaping as barriers to mitigate potential wildlife-human encounters.

e. More considered placement of noise generating activity areas such as playgrounds, to ensure a conducive environment.

f. Explore other mitigating measures, such as wildlife culverts across roads and an overpass across the Pang Sua Canal to facilitate safe movements by fauna species.

Figure 7-29 Example of acceptable lighting fixtures that helps to minimise light trespass and unacceptable lighting fixtures [W-19]

7.6 Summary of Key Findings

The 21.7 ha Study Area, Choa Chu Kang N1, is also known as the Sungei Pang Sua Woodland [P-10; P-11]. It is "an important part of the Green Rail Corridor between Hill View in the south and Stagmont Ring in the north, as it is the only wooded area in-between" [P-11]. The Study Area is also considered as "a conducive stepping stone" [P-10] (i.e., habitat patches in a landscape that facilitates movement of species between other forested patches [P-33]) and "a conduit for wildlife dispersal or movement" [P-10] that could facilitate the dispersal of fauna to the surrounding green spaces, such as Bukit Mandai forest to the northeast and Bukit Gombak forest to the south (Figure 7-27), and to other larger fragmented habitats, including Bukit Timah Nature Reserve (BTNR) in the southeast, and Mandai Mangrove and Mudflats in the north [P-10], hence, enhancing the ecological connectivity across the landscape.

The floristic field assessment shows that the Study Area mainly constitutes managed vegetation, comprising clusters of trees planted for landscape purposes (9.62 ha; 45.2%) which occupies about half of the Study Area, and turf area (5.36 ha; 25.2%). Existing canal and infrastructure, such as the heavy vehicle carpark and defunct bus terminal take up 6.32 ha (29.6%) of the Study Area. The floristic assessment identified a total of 115 species from 45 families. Of the 115 species recorded, majority are exotic (77 species; 67.0%), only 27 species are native (23.5%), and 11 (9.5%) were cryptogenic (i.e., species that has unknown or uncertain origins). Out of six native threatened species, only one species, *Bridelia stipularis* (Figure 7-30), was considered as species of conservation significance. Ninety-one large plant specimens were recorded in the Study Area, largely dominated by Senegal mahogany (*Khaya senegalensis*) and raintree (*Samanea saman*). Other specimens of value consist of two keystone species with two specimens respectively: Malayan banyan (*Ficus microcarpa*) and weeping fig (*F. benjamina),* with a spread that ranges from 3-8 m. In addition, a bamboo cluster, *Bambusa* cf. *heterostachya* with a spread of 2.5 m, were also identified to be possible roosting habitat for bamboo bats. In total, 397 trees of $\geqslant$ 0.3 m girth were tagged and recorded within the Study Area.

The faunistic field assessment recorded 89 species, dominated by birds (36 species) and butterflies (18 species). Most of the species recorded are widespread and common, typical of such parkland habitats. Most of the species recorded are widespread and common, typical of such parkland habitats. Only one species of conservation significance, the nationally Endangered blue-crowned hanging-parrot (*Loriculus galgulus*; refer to Figure 7-30) which is now considered locally widespread and common, was observed within the Study Area (see Section 7.3.2.9). While not of conservation significance, several other uncommon fauna were also recorded. This includes the uncommon dingy duskhawker (*Gynacantha subinterrupta*) that is usually found in forested areas, and two moderately rare butterflies: evening brown (*Melanitis leda leda*) and common redeye (*Matapa aria*). The evening brown (*Melanitis leda leda*) are usually sighted in grasslands, thickets, or among dense vegetation, while the common redeye (*Matapa aria*), are usually sighted in various habitat types where bamboo clusters are present, from urban parks, wastelands, to nature reserves [W-10]. Nine migratory bird species were also recorded, including uncommon migrants, such as the rare yellow-browed warbler (*Phylloscopus inornatus*) and uncommon migrant, yellow-rumped flycatcher (*Ficedula zanthopygia*). These records show the value of the Study Area in supporting uncommon species and migratory birds.

Other species of conservation significance that may utilise the Study Area as a stepping stone to move between habitats include the globally Critically Endangered and nationally Endangered straw-headed bulbul (*Pycnonotus zeylanicus*), the globally Vulnerable and nationally Endangered smooth-coated otter (*Lutrogale perspicillata*), as well as the globally and nationally Critically Endangered Sunda pangolin (*Manis javanica*) [P-10; P-11]. These species have been recorded in surrounding green spaces and/or waterbodies, and deemed possible to utilise the Study Area. The presence of species of conservation significance, forest-associated species, and migrants demonstrates the value of the Study Area as a stepping stone to surrounding green spaces, such as the Bukit Mandai forest to the northeast and Bukit Gombak forest to the south, in enhancing ecological connectivity across the landscape (Section 7.4). The waterbodies within the Study Area are poor in aquatic life and are more likely to be used by fauna as a corridor to move between habitats.

With that said, an ecological corridor is recommended to be implemented on the east of the existing Pang Sua Canal adjacent to the proposed residential development, so that wildlife can continue to use the area as a stepping stone to move between the surrounding green spaces. The proposed corridor will potentially help to facilitate the movement of faunal species, such as small mammals and volant species, even after the proposed development is established. The corridor should be of a reasonable width to ensure the survival of small to medium-sized mammals and for them to utilize the corridor, especially within an urban landscape where limited habitats are available [P-44; W-20], in this case, a larger corridor is recommended [W-20].

Further studies could also be carried out to explore the possibility of localised widening of the ecological corridor to conserve clusters of mature trees, such as the cluster of rain trees located south of the Study Area, which have denser tree canopies that could provide a more conducive microclimate allowing for profusion of ferns and other epiphytic plants and for fauna species. Floral species of conservation significance – *Bridelia stipularis* – would be retained. Keystone species including a specimen of *Ficus microcarpa* and *Ficus benjamina* respectively, with spread of 3 – 8 m and *Bambusa* cf. *heterostchya* of 2.5m spread – will also be studied for retention.

The greening of the canal will need to be studied together with the design of this ecological corridor to explore the possibility of an optimal and integrated design, taking into consideration the ecological aspects of the corridor, the proposed residential development and infrastructure requirements.

It is expected that the proposed development will result in the loss of some of the existing mature trees within the Study Area. As such, enhancement planting strategies (i.e., planting of keystone species, tiered planting of different layers of vegetation to emulate a forest-like structure that has large trees with close canopy etc.) could be incorporated.

Other general recommended features of the proposed ecological corridor, such as the strategic placement of light features within the proximity of the ecological corridor, can also be incorporated. Mitigating measures, such as wildlife culverts across roads and overpass across the Pang Sua Canal to facilitate safe movements by fauna species can also be studied.

0 50 100 150 m

Legend

- CCK N1 Study Area
- Rail Corridor
- Managed vegetation (Planted trees)
- Managed vegetation (Turf)
- Others (Infrastructure)
- Canal/Drain (Perennial)
- Drain (Ephemeral)

All CS and Rare Fauna Species

- Bridelia stipularis
- Gynacantha subinterrupta
- Melanitis leda leda
- Matapa aria
- Loriculus galgulus
- Phylloscopus inornatus

N

Rev.	Date	By	Description	Chk'd	App'd
05	MAR 2022	ZA	Final Report	NHT	JAG

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HDB Endorsement : NA

Consultant : AECOM

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CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Locations of all flora and fauna species of conservation significance

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ZA	NHT	JAG	7-30	05	1 of 1
	Drawn ZA	Date MAR 2022	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

8 Hydrology and Water Quality Baseline Environment

This section includes the assessment of hydrology and water quality of watercourses within the Study Area (Figure 8-5). Results from the site surveys are presented to establish the baseline conditions. As outlined in the Inception Report, the section below details the completed hydrological mapping of the Study Area and the results from water quality sampling of two (2) dry and one (1) wet weather events.

This progress reports presents findings from the field surveys undertaken on the following dates:

- 5 February 2021 (site reconnaissance);
- 8 March 2021 (dry weather sampling);
- 13 April 2021 (wet weather sampling); and
- 21 April 2021 (dry weather sampling).

8.1 Study Objectives

This section includes the identification of surface watercourses in the Study Area and assessment of baseline surface water quality and watercourse characteristics using a combination of visuals, in-situ and ex-situ samplings, and testing to determine the water quality status in the Study Area. Observations from site surveys (in-situ) and laboratory testing (ex-situ) were presented to establish the baseline conditions.

The scope of work for the hydrological and surface water baseline study consisted of:

- To understand the topographic and hydrographic characteristics of the Study Area based on topographic survey and reviewing data provided by the Client;
- To conduct site reconnaissance survey for a better understanding of the Study Area's topography, hydrology, land cover and existing watercourses with their properties (i.e. locations, water flow conditions and bank characteristics);
- To identify and map the location, alignment of all watercourses within the Study Area;
- To identify sampling locations for in-situ and ex-situ water quality analysis of existing watercourses located within the Study Area;
- To determine the baseline hydrological conditions; and
- To determine the stormwater sources feeding major watercourses if any and suggest the stormwater flow rate.

8.2 Personnel

The assessment and site surveys were conducted by the following AECOM personnel:

- Dr. Thanh Nguyen (Technical Reviewer of Hydrology and Surface Water Quality);
- Dr. Liang Liang (Hydrology and Surface Water Quality Technical Lead);
- Ms. Jacquelynn Chia (Hydrology and Surface Water Quality Specialist); and
- Mr. Grujica Sarenac (Hydrology and Surface Water Quality Specialist).

8.3 Methodology

8.3.1 Desktop Assessment

Desktop research consists of a review of secondary data (including existing topographic data, vegetation cover, existing land use and development activities, satellite images, groundwater level, etc.), which aids in determining the location of existing watercourses within the Study Area. The information retrieved during the desktop research comprised of publicly available data from government and technical agencies, existing available data (e.g. online satellite images), as well as published books, scientific journals, relevant articles, and other online sources. Topographic survey data was also used for hydrological data analysis from the completed topographic survey.

8.3.2 Hydrological Survey

The hydrological survey was conducted by casual exploration methods to identify and outline existing major watercourses within the Study Area.

The watercourse conditions, such as stream bank characteristics (e.g. natural bank or artificial bank), were identified based on visual observations. Using the available topographic survey data, ArcGIS software was used to develop elevation and slope maps for the site to support the hydrological survey. The topographic data provided by client on 24 February 2021 as well as surveyed in this Project have also been referenced in hydrological analysis. Topographic data typically assist in catchment delineation to understand the catchment characteristics, through which the catchment map was also generated.

A Global Positioning System (GPS) device was used to track the hydrological survey route and to locate sampling points. The GPS data was then synchronised with the photos taken on-site to identify the exact location of identified watercourses.

8.3.3 Water Quality Survey

The water quality sampling locations were subsequently identified based on preliminary hydrological findings during site reconnaissance. Generally, two (2) dry weathers (normal conditions) and one (1) wet weather (after a storm event) samples were collected from each water quality station. Dry-weather conditions are defined as after a continuous 48-hour period of no-rain, while wet-weather conditions are defined as a rainfall event having more than 10mm of rainfall, with samples to be collected within three (3) hours after the rain stops.

For this study, in-situ water quality parameters were measured using a calibrated multi-parameter digital sensor (YSI ProDSS) with USEPA approved testing methods for water quality parameters and included:

- Temperature;
- pH;
- Salinity/Conductivity;
- Total Dissolved Solids (TDS);
- Turbidity; and
- Dissolved oxygen (DO).

The ex-situ parameters to be analysed are listed below:

- Total Nitrogen (TN);
- Total Phosphorus (TP);
- Ammonium Nitrogen (NH_4-N);
- Nitrates (NO_3-N);
- Orthophosphate (PO_4-P).
- Total Suspended Solids (TSS);
- Total Organic Carbon (TOC);
- Enterococcus; and
- Lead (Pb).

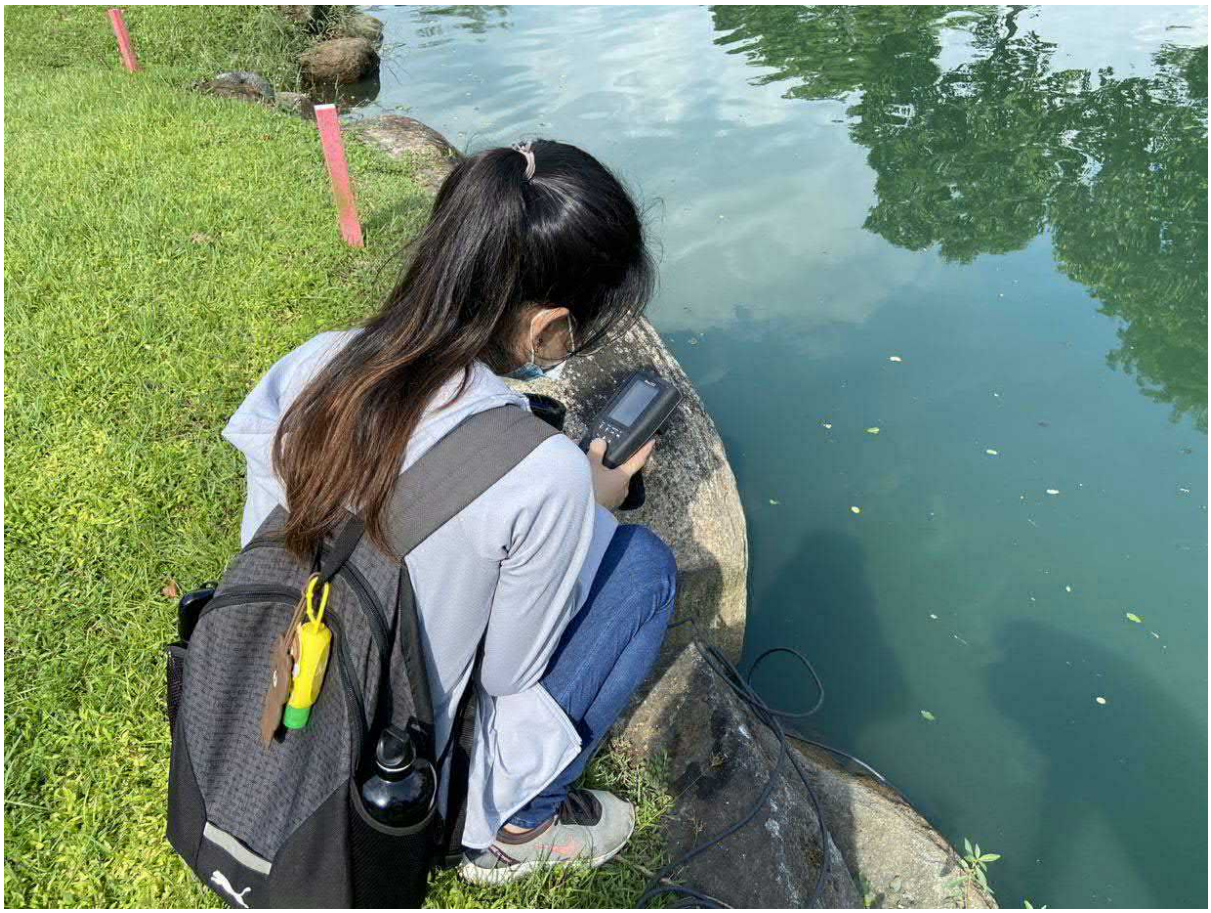


Figure 8-1 An example of in-situ water quality measurement (AECOM ©)

8.4 Baseline Monitoring Results

The following sections describes the hydrological and water quality conditions in the Study Area based on the baseline surveys.

8.4.1 Hydrological Conditions in the Study Area

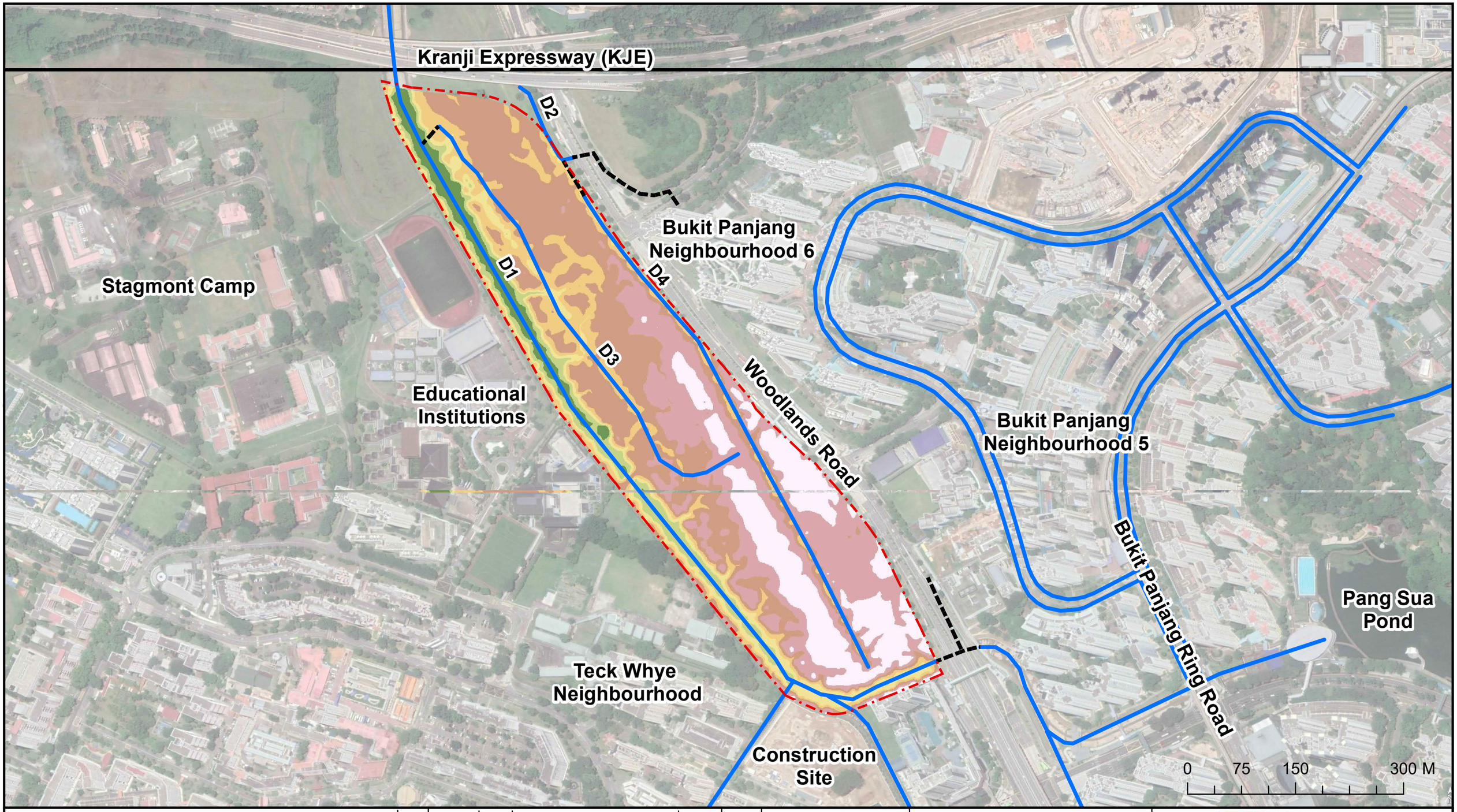
During site reconnaissance, Pang Sua Canal (D1), three (3) concrete drains (D2, D3 and D4) were observed as shown in Figure 8-2. The surveyed topographic data was used to generate elevation and slope maps, and subsequently overlaid with surface watercourses using ArcGIS software as shown in Figure 8-2 and Figure 8-3. From Figure 8-2, the elevation of the Study Area ranges from 0.55 mRL to 27.33 mRL with decreasing elevations from southeast toward northwest of the Study Area. The slope of Study Area is generally flat and mild, with steep slopes only along banks of watercourses as shown in Figure 8-3.

Based on generated elevation and slope maps, catchment delineation was conducted to further understand catchment characteristics of the Study Area. A catchment map was then developed as shown in Figure 8-4. The Study Area is divided into four (4) sub-catchment areas (i.e. western, central, southeastern, and northeastern catchment areas). Pang Sua Canal (D1) receives surface runoff from the western catchment area within the Study Area. Besides, Pang Sua Canal (D1) also receives inflow from upstream drainage networks which collect surface runoff from surrounding residential area (i.e. Teck Whye Neighbourhood and Bukit Panjang Neighbourhood) in the west and south, as well as an existing construction site in the south. The concrete drain D2 collects surface runoff from the concrete drain D4 and vegetated area in northeastern catchment area. D2 also receives inflow from an underground culvert in the east, which collects urban runoff from surrounding residential area. The concrete drain (D3) and the concrete drain (D4) collect surface runoff from the central and southeastern catchments, respectively. Generally, water in all the watercourses flows from southeast to northwest.

Table 8-1 provided details regarding the observed bank features and water flow conditions of the main watercourses during dry and wet weather conditions. The Pang Sua Canal D1 has perennial flow with water flow ranging from

0.2 m/s to 1.56 m/s observed during dry and wet weather conditions throughout the canal. The concrete drain D2 has perennial flow with low water flow of approximately 0.08 m/s to 0.6 m/s observed during dry and wet weather. The drains D3 and D4 were dry during dry weather samplings and has low flow rate of approximately 0.29 m/s and 0.43 m/s, respectively, during wet weather. All the drains and canal within the Study Area did not have obvious smell based on site observation.

In terms of groundwater level, site-specific groundwater table depth was not known at the time of reporting writing, as groundwater level baseline survey was not the scope of this Study. Based on AECOM's review of environmental studies carried out in the vicinity of the Study Area, groundwater depth within the Study Area was expected to be at about 2 m below ground surface (bgs) [P-41].



Legend

CCK N1 Study Area

Watercourses

Drain/ Canal

Culvert

Elevation (mRL)

<5

5-6

6-7

7-8

8-9

9-10

>10

N

Rev.	Date	By	Description	Chk'd	App'd
-	SEP 2021	LAL	Final Report	NHT	JAG
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Consultant : AECOM

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Figure Title :

Elevation with Watercourses of the Study Area

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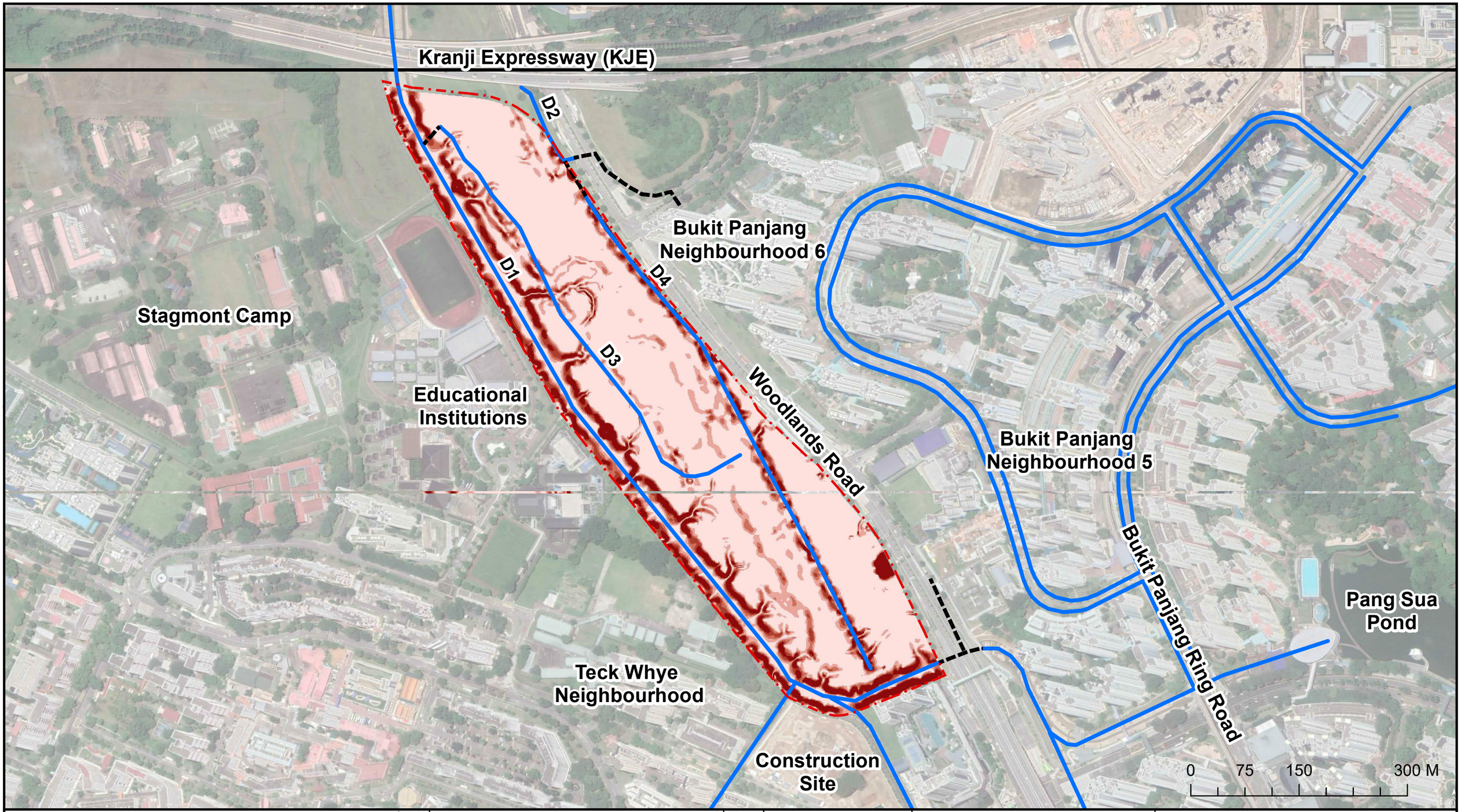
LAL	NHT	JAG
	Drawn: LAL	Date: SEP 2021

Figure No. : 8 - 2 | Rev. : - | Sheet : 1 of 1

CAD File Name : NA | A3

Note: Source of basemap - Google Earth Map



Legend

- CCK N1 Study Area
- **Watercourses**
  - Drain/ Canal
  - Culvert
- **Slope (%)**
  - <10
  - 10-15
  - 15-20
  - 20-25
  - >25

N

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Figure Title :

Slope Map of the Study Area

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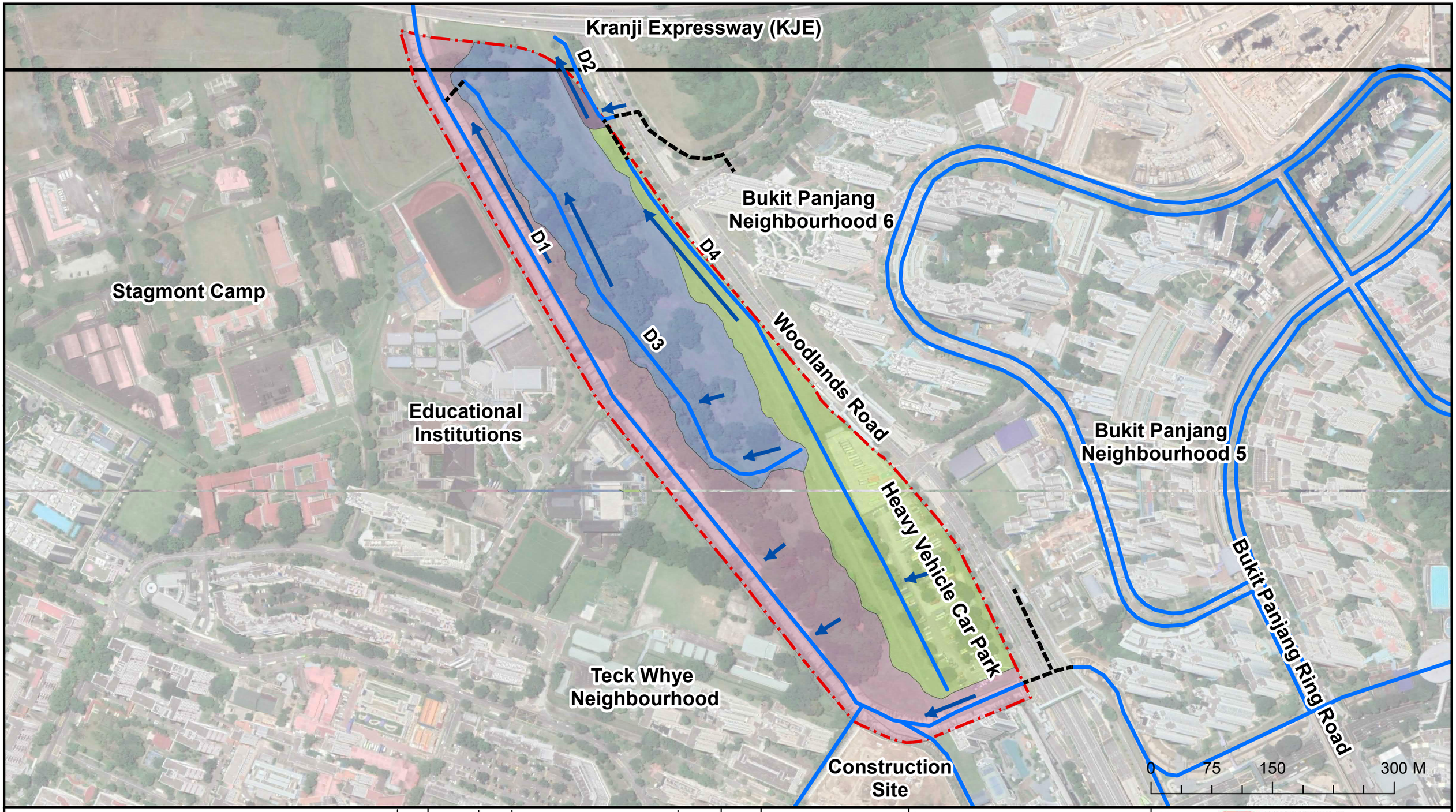

Legend

- CCK N1 Study Area
- Water Flow Direction

Watercourses

- Drain/ Canal
- Culvert

Catchment

- 1
- 2
- 3
- 4

N

Rev.	Date	By	Description	Chk'd	App'd
-	SEP 2021	LAL	Final Report	NHT	JAG
01	JUL 2021	LAL	Draft Final Report Rev 01	NHT	JAG
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Qualified Person Endorsement : NA

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Consultant : AECOM

Client: HOUSING & DEVELOPMENT BOARD

Project Title :

CONTRACT L/025/21 SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Catchment Map of the Study Area

Designed	Checked	Approved
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	Drawn: LAL	Date: SEP 2021

Figure No. : 8 - 4 | Rev. : - | Sheet : 1 of 1

CAD File Name : NA | A3

Note: Source of basemap - Google Earth Map

Table 8-1 Description of water quality sampling points within the Study Area

Watercourses	Bank Characteristics	Water Flow Conditions	Photos
Pang Sua Canal D1	Wide concrete canal Estimated canal length within the Study Area is 860m.	• Originates from confluence of upstream drainage networks collecting surface runoff from surrounding residential area (refer to Figure 8-4) before reaching the Study Area, and it drains into the Kranji Reservoir eventually. • Perennial flow **During dry weather condition:** • Upstream: slow water flow observed of approximately 0.2 - 0.4 m/s • Approximately 16 – 18.5 cm depth and an approximate width of 500 cm, at time of survey • Midstream: slow water flow observed of approximately 0.2 - 0.6 m/s • Approximately 16 - 23 cm depth and width of 500 cm at time of survey • Downstream: slow dry weather flow of approximately 0.25 - 0.6 m/s • Approximately 18 - 20 cm depth and an approximate width of 500 cm, at time of survey • Water was clear and no smell **During wet weather condition (at surveyed time):** • Upstream: slow water flow observed of approximately 0.79 m/s • Midstream: Water flow observed of approximately 1.56 m/s	**WQ3 (upstream)** During Dry Weather  During Wet Weather  **WQ2 (midstream)** During Dry Weather  During Wet Weather  **WQ1 (downstream)**

<table>
<tr><th>Watercourses</th><th>Bank Characteristics</th><th>Water Flow Conditions</th><th colspan="2">Photos</th></tr>
<tr><td></td><td></td><td>• Approximately 25 m width and cover the entire depth of the canal at time of survey
• <u>Downstream</u>: Water flow of approximately 1 m/s
• Approximately 10.5 m width at time of survey
• Water was clear and no smell</td><td>During Dry Weather
  </td><td>During Wet Weather
  </td></tr>
<tr><td>D2</td><td>Concrete drain with artificial banks</td><td>• Originates from vegetated area inside the Study Area and surrounding residential area in the east outside of the Study Area, flowing next to Woodlands Road, along the northeast boundary of the Study Area.
• Perennial flow

During dry weather condition:
• Slow water flow observed of approximately 0.08 - 0.4 m/s
• Approximately 5 - 7 cm water depth and width of 100 cm at time of survey.
• Water was clear and has no smell

During wet weather condition:
• Slow water flow observed of approximately 0.6 m/s
• Approximately 14 cm water depth and width of 120 cm at time of survey
• Water was clear and has no smell</td><td colspan="2">WQ4</td></tr>
<tr><td></td><td></td><td></td><td>During Dry Weather
  </td><td>During Wet Weather
  </td></tr>
<tr><td>D3</td><td></td><td></td><td colspan="2">WQ5</td></tr>
</table>

<table>
<tr><th>Watercourses</th><th>Bank Characteristics</th><th>Water Flow Conditions</th><th colspan="2">Photos</th></tr>
<tr><td></td><td>Concrete drain within Study Area.</td><td>• Originates from vegetated area within the Study Area
• Ephemeral flow

During dry weather condition:
• No flow observed

During wet weather condition:
• Slow water flow observed of approximately 0.29 m/s
• Approximately 1 cm water depth and width of 20 cm at time of survey</td><td>During Dry Weather
  </td><td>During Wet Weather
  </td></tr>
<tr><td>D4</td><td>Concrete drain with artificial banks</td><td>• Originates from the heavy vehicle car park within Study Area, flowing towards the north along the eastern part of the Study Area and discharging water to D2.
• Ephemeral flow

During dry weather condition:
• Almost no flow

During wet weather condition:
• Slow water flow observed of approximately 0.43 m/s
• Approximately 15 cm water depth and width of 1.5 m at time of survey
• Water was clear and has no smell</td><td colspan="2">WQ6
During Dry Weather
  </td><td>During Wet Weather
  </td></tr>
</table>

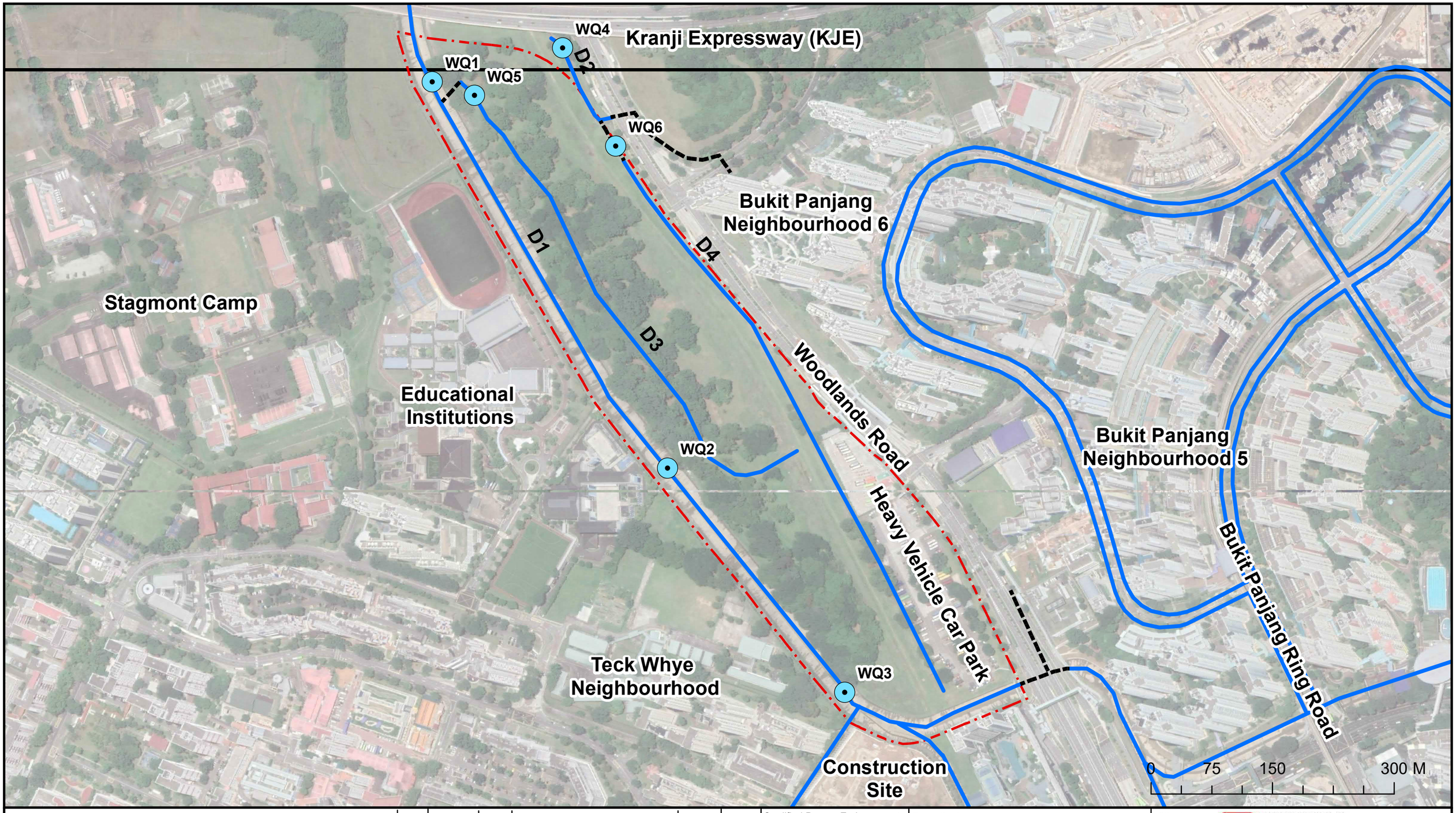
8.4.2 Water Quality Conditions in the Study Area

This section discusses about the selection of water quality sampling location based on hydrological findings as well as water quality baseline results.

8.4.2.1 Water Quality Sampling Locations

The water quality sampling locations were selected strategically within the identified watercourses within the Study Area based on preliminary hydrological findings during site reconnaissance. The baseline conditions of the surface water quality at the Study Area were then established at these selected water quality sampling stations by comparing the water quality results with national/international water quality standards/criteria relevant to ecological uses.

In the end, six (6) water quality stations were decided along the canal or drains as detailed in Figure 8-5 and Table 8-2. Station WQ1 was selected to capture the water quality of downstream of Pang Sua Canal (D1) before it flows out from Study Area. Station WQ2 was selected to capture the water quality of middle section of D1. Station WQ3 was selected to determine the upstream water quality of Pang Sua Canal (D1). Station WQ4 was selected to study the water quality in the concrete drain (D2) next to Woodlands Road. WQ5 was selected to capture the water quality in the concrete drain (D3) within Study Area. Station WQ6 was selected to determine the water quality in the concrete drain (D4) in the eastern part of Study Area.



Legend

- CCK N1 Study Area
- Water Quality Sampling Points

Watercourses

- Drain/ Canal
- Culvert

N

Rev.	Date	By	Description	Chk'd	App'd
-	SEP 2021	LAL	Final Report	NHT	JAG
01	JUL 2021	LAL	Draft Final Report Rev 01	NHT	JAG
-	JUN 2021	LAL	Draft Final Report	NHT	JAG

Qualified Person Endorsement : NA

HDB Endorsement : NA

Consultant : AECOM

Client: HOUSING & DEVELOPMENT BOARD

Project Title :

CONTRACT L/025/21
SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Figure Title :

Water quality sampling locations within/surrounding the Study Area

Designed	Checked	Approved	Figure No. :	Rev.	Sheet
LAL	NHT	JAG	8 - 5	-	1 of 1
	Drawn LAL	Date SEP 2021	CAD File Name : NA		A3

Note: Source of basemap - Google Earth Map

Table 8-2 Rationale for the selection of proposed water quality sampling locations

S/N	Monitoring Location	Rationale
WQ1	Pang Sua canal (D1)	To capture the water quality of at downstream of Pang Sua Canal before the runoff leaving the Study Area
WQ2	Pang Sua canal (D1)	To capture the water quality of water in the middle of Pang Sua Canal where it flows crossing the site
WQ3	Pang Sua canal (D1)	To capture the water quality of water flowing into Pang Sua Canal from surrounding urbanized area outside of the Study Area
WQ4	Concrete drain (D2)	To capture the water quality in D2 which is part of the study area
WQ5	Concrete drain (D3)	To capture the water quality in D3 in which stormwater in the centre area of the Project Site will be collected to this drain before discharging to Pang Sua canal. During the site reconnaissance (dry weather conditions) D3 was found to be dry. Hence the water quality samples from this location were only be taken during wet weather conditions.
WQ6	Concrete drain (D4)	To capture the water quality in D4 in which stormwater in the eastern part of the Project Site will be collected to. During the site reconnaissance (dry weather conditions) D4 was found to be dry. Hence the water quality samples from this location were only be taken during wet weather conditions.

8.4.2.2 Water Quality Baseline Assessment Criteria

The baseline water quality of the watercourses located within the Study Area was analysed against the NEA Trade Effluent Discharge limits for controlled watercourses [R-11]. This comparison could be used to determine whether the existing baseline water quality of the watercourses within the Study Area complies with NEA limits or already exceeds these limits. However, the NEA Trade Effluent Discharge limits does not provide criteria for the preservation and growth of aquatic life locally. To assess whether the water quality along the identified watercourses is suitable for aquatic life, certain parameters were compared to the water quality criteria for aquatic life from other countries including United Nations Economic Commission for Europe [R-4], World Health Organization [R-5], United States Environmental Protection Agency [R-6], Australian & New Zealand [R-7], Canada [R-8], Philippines [R-9], and Malaysia [R-10], which provides guidelines for the protection of aquatic life. The relevant limits and guidelines for water quality parameters were summarised in Table 8-3; however, where no guidelines exist, the monitored results would be considered as the baseline.

Table 8-3 Water quality guidelines and criteria

Parameter	NEA Trade Effluent Discharge Limits[1]	International Water Quality Criteria for Aquatic Life[2]
pH	6 -9	6.5 - 9
Temperature (°C)	45	-
Salinity (ppt)/ Conductivity (µS/cm)	-	-
Dissolved Oxygen, DO (mg/L)	-	> 4.0
Turbidity (NTU)	-	50
Total Dissolved Solids, TDS (mg/L)	1,000	1,000
Total Suspended Solids, TSS (mg/L)	30	50
Total Organic Carbon, TOC (mg/L)	-	-
Total Phosphorous, TP (mg/L)	-	Eutrophic limit: 0.075 mg/L
Orthophosphate, PO_4-P (mg/L)	0.65 (equivalent to 2 as PO_4)	<0.033 (equivalent to <0.1 as PO_4)
Total Nitrogen, TN (mg/L)	-	Eutrophic limit: 1.5mg/L
Ammonium Nitrogen, NH_4-N (mg/L)	-	0.5
Nitrate, NO_3-N (mg/L)	4.52 (equivalent to 20 as NO_3)	10 (equivalent to 44 as NO_3)
Enterococcus[3]	-	-
Lead, Pb (µg/L)	100	Acute LOEL[4]: 82

Parameter	NEA Trade Effluent Discharge Limits[1]	International Water Quality Criteria for Aquatic Life[2]
		Chronic LOEL[4]: 3.2

Note:

1. **NEA Trade Effluent Discharge Limits for discharge into a controlled watercourse.**
2. **The sources of international water quality criteria for aquatic life include United Nations Economic Commission for Europe [R-4], World Health Organization [R-5], United States Environmental Protection Agency [R-6], Australian & New Zealand [R-7], Canada [R-8], Philippines [R-9], and Malaysia [R-10]**
3. **Singapore's Water Quality Guidelines for Recreational Beaches and Fresh Water Bodies requires that the Enterococcus count should be less than or equal to 200 counts per 100 millilitres of water at 95% of the time**
4. **LOEL – Lowest Observed Effect Level**

8.4.2.3 Water Quality Baseline Results

All water quality stations have been sampled for both in-situ and ex-situ analysis. The in-situ and ex-situ water quality sampling were conducted on 8 March and 21 April 2021 for two (2) dry weather events and 13 April 2021 for one (1) wet weather event in the Study Area as shown in Table 8-4.

The water quality stations (i.e. WQ1 to WQ4) at Pang Sua Canal (D1) and the concrete drain (D2) were sampled during both dry and wet weather conditions due to their perennial conditions. Meanwhile, the ephemeral drains D3 and D4 were sampled during storm event only. Hence, only wet weather samples were collected at WQ5 and WQ6.

Table 8-4 Water quality monitoring schedule

Sampling Event / Sampling Location	Dry Weather		Wet weather
	08 March 2021	21 April 2021	13 April 2021
WQ1	√	√	√
WQ2	√	√	√
WQ3	√	√	√
WQ4	√	√	√
WQ5	-	-	√
WQ6	-	-	√

Note:
√ indicates that the station has been sampled
- indicates that sampling not required

Table 8-5 Water quality results

Parameter		WQ1 (D1)	WQ2 (D1)	WQ3 (D1)	WQ4 (D2)	WQ5 (D3)	WQ6 (D4)	Average	NEA Allowable Limits [1]	Water Quality Criteria for Aquatic Life from other countries[2]
Temperature (˚C)	Dry Average	31.4	31.3	30.9	29.3	-	-	30.7	45	-
	Wet Average	29.1	29.7	30.0	29.5	28.3	30.7	29.6		
pH	Dry Average	8.54	8.72	8.63	**9.54**	-	-	8.86	6 – 9	6.5 - 9
	Wet Average	8.05	8.25	**9.07**	8.60	6.98	8.46	8.24		
DO (mg/L)	Dry Average	9.23	9.18	8.98	7.97	-	-	8.84	-	> 4.0
	Wet Average	8.27	7.76	7.93	7.80	4.59	7.40	7.29		
Salinity (PSU)	Dry Average	0.17	0.17	0.16	0.31	-	-	0.20	-	-
	Wet Average	0.05	0.04	0.06	0.07	0.23	0.05	0.08		
Total Dissolved Solids (mg/L)	Dry Average	231.3	224.8	224.3	415.0	-	-	273.9	1000	1000
	Wet Average	66.0	52.0	89.8	105.0	307.0	66.0	114.3		
Conductivity (µS/cm)	Dry Average	403.9	391.4	387.6	694.6	-	-	469.4	-	-
	Wet Average	109.7	87.5	151.4	175.3	503.0	111.9	189.8		
Turbidity (NTU)	Dry Average	27.8	33.0	33.4	23.4	-	-	29.4	-	50
	Wet Average	43.4	**73.9**	47.4	47.5	9.3	17.1	39.8		
Total Suspended Solids, TSS (mg/L)	Dry Average	25.1	**30.1**	**36.0**	24.8	-	-	29.0	30	50
	Wet Average	**40.0**	**70.0**	**45.7**	**37.0**	<10	<10	**32.1**		
Total Nitrogen, TN (mg/L)	Dry Average	1.15	1.05	1.18	1.20	-	-	1.15	-	Eutrophic limit: 1.5mg/L
	Wet Average	**1.50**	**2.17**	**3.50**	**2.20**	0.67	**2.29**	**2.06**		
Nitrate as NO_3-N (mg/L)	Dry Average	0.55	0.57	0.57	0.54	-	-	0.56	4.52 (equivalent to 20 as NO_3)	10 (equivalent to 44 as NO_3)
	Wet Average	1.27	2.14	2.04	1.96	0.35	1.92	1.61		
Ammonium Nitrogen as NH_4-N (mg/L)	Dry Average	0.099	0.105	0.103	0.210	-	-	0.129	-	0.5
	Wet Average	0.098	0.150	0.300	0.099	0.053	0.170	0.145		
Total Phosphorous, TP (mg/L)	Dry Average	**0.222**	**0.250**	**0.317**	**0.078**	-	-	**0.217**	-	Eutrophic limit: 0.075 mg/L
	Wet Average	0.037	0.047	0.045	0.043	0.071	0.025	0.045		
Orthophosphate as PO_4-P (mg/L)	Dry Average	**0.144**	**0.179**	**0.200**	**0.060**	-	-	**0.146**	0.65 (equivalent to 2 as PO_4)	<0.033 (equivalent to <0.1 as PO_4)
	Wet Average	0.020	0.014	0.028	**0.034**	**0.057**	0.018	0.029		
Total Organic Carbon, TOC (mg/L)	Dry Average	2.52	2.27	2.38	3.25	-	-	2.61	-	-
	Wet Average	2.85	4.15	6.63	6.46	4.23	7.15	5.25		
Enterococcus (cfu/100ml)	Dry Average	2,125	2,015	1,990	225	-	-	1,589	-	-
	Wet Average	7,000	14,000	16,000	14,000	6,800	8,100	10,983		
Lead, Pb (µg/L)	Dry Average	0.27	0.28	0.32	<0.5	-	-	0.22	100	Acute LOEL[4]: 82 Chronic LOEL[4]: 3.2
	Wet Average	<0.5	<0.5	<0.5	0.69	<0.5	<0.5	0.12		

Note:

1. **NEA Trade Effluent Discharge Limits are for controlled watercourses.**
2. **The sources of water quality criteria for aquatic life include United Nations Economic Commission for Europe [R-5], World Health Organization [R-6], United States Environmental Protection Agency [R-7], Australian & New Zealand [R-8], Canada [R-9], Philippines [R-10], and Malaysia [R-11].**
3. **Red values mean data exceeding the NEA limits; Blue values mean data exceeding aquatic life criteria; Purple values mean data exceeding both NEA limits and aquatic life criteria.**
4. **<0.5 means lower than 0.5 µg/L of level of detection limit.**
5. **LOEL – Lowest Observed Effect Level**

As described in Section 8.4.1, watercourses in the study area had either perennial or ephemeral flow. It is unlikely that ephemeral watercourses will have any aquatic life. Hence, water quality of all stations was compared with NEA guidelines, while that of stations located along perennial watercourses (i.e. WQ1, WQ2, WQ3 and WQ4) was compared against criteria for aquatic life. In should be noted that according to biodiversity findings in Section 7, only Pang Sua Canal (D1) supported poor aquatic life at the time of survey.

As shown in Figure 8-6, water temperature across all water quality stations during dry and wet condition do not vary significantly ranged from 28.3 ˚C – 31.4 ˚C, which is below the NEA trade effluent limit of 45˚C.

The pH of the waterbodies within the Study Area during dry and wet weathers (i.e. average at 8.86 and 8.24, respectively) were close to the upper limit for both NEA trade effluent (i.e. 6 – 9) and water quality criteria for aquatic life (i.e. 6.5 – 9). Sometimes (either dry or wet days), the pH at two perennial watercourses (i.e. Pang Sua Canal – D1 and drain D2) had slightly elevated pH above 9 (i.e. both NEA guideline and criteria for aquatic life), possibly due to the wash-off of the concrete surface from surrounding urbanized area (especially the construction site nearby), where chemicals washed away from concrete could lead to the increased pH. The residential area might have also contributed to the elevated pH value by discharging wash waters containing high alkali compounds such as detergent chemicals during normal dry days. During wet weather, the pH of WQ5 (i.e. pH 6.98) was slightly acidic might be due to the presence of humic acid from decomposing organic debris from the surrounding vegetation since the drain only receives runoff from vegetated area.

The measures dissolved oxygen (DO) for all sampling sites ranged from 7.97 to 9.23 mg/L (average at 8.84 mg/L) during dry weather, while from 4.59 to 8.27 (average at 7.29 mg/L) during wet weather. All water quality stations met water quality criteria for aquatic life (i.e. > 4.0 mg/L).

The conductivity of water and Total Dissolve Solid (TDS) are strongly dependent on the number of ions available to participate in the conduction process. These parameters positively correlated to salinity which measures the amount of salts dissolved in water. The average salinity, TDS and conductivity of the water found within the study were low during dry weathers (i.e. 0.20 PSU, 273.9 mg/L and 469.4 µS/cm, respectively) and wet weather (i.e. 0.08 PSU, 114.3 mg/L and 189.8 µS/cm, respectively) which confirmed prevalence of freshwater, given that the seawater generally has salinity of around 35 PSU [P-30], conductivity of around 3.31×10^6 µS/m [P-37] and TDS of around 35,000 mg/L [P-42].

The turbidity of water at the sampling locations ranged from 23.4 to 33.4 Nephelometric Turbidity Units (NTU) (average at 29.4 NTU) during dry weather, while from 9.3 to 73.9 NTU (average at 39.8 NTU) during wet weather. Turbidity increased along Pang Sua Canal (D1) and drain D2 during storm events compared to dry days, especially with turbidity level at WQ2 along Pang Sua Canal (i.e. 73.9 NTU) exceeding criteria for aquatic life (i.e. 50 NTU). This might be due to flushing from surrounding urban surface (including the construction site nearby) which carried high concentration of TSS during storm event.

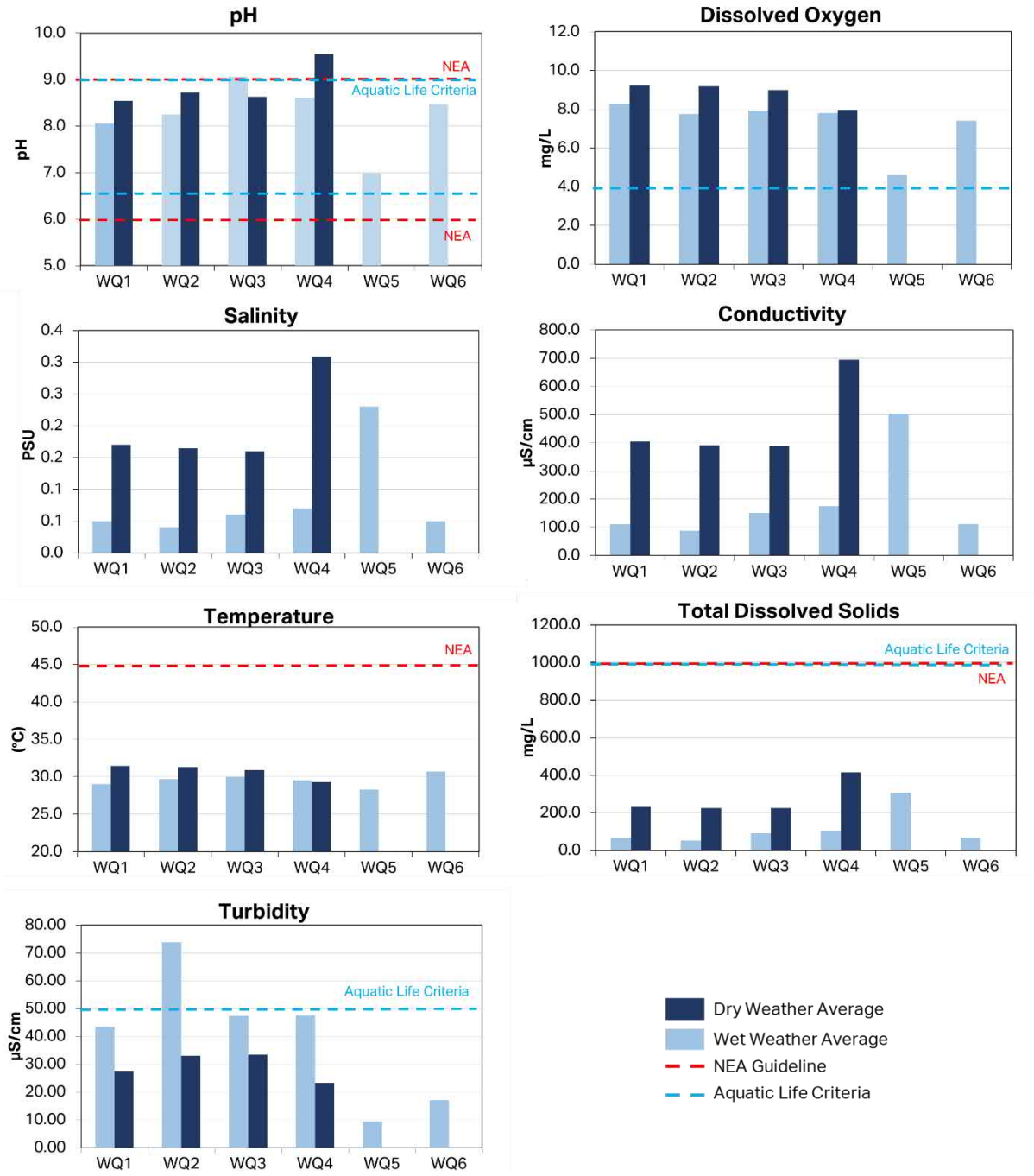


Figure 8-6 Average monitoring results of in-situ parameters for dry and wet weather conditions

As shown in Figure 8-7 and Table 8-5, Total Suspended Solids (TSS) had an average concentration of 29.0 mg/L (ranging from 24.8 – 30.1 mg/L) during dry weather and 32.1 mg/L (ranging from less than 10 to 70 mg/L) during wet weather. Similar with turbidity, TSS increased along Pang Sua Canal (D1) and drain D2 during storm events compared to dry days. The TSS concentration for Pang Sua Canal D1 ranged from 25.1 to 70.0 mg/L during both dry and wet weather, either exceeding NEA trade effluent limit (i.e. 30 mg/L) or aquatic life criteria (i.e. 50 mg/L), while D2 only exceeding NEA trade effluent limit (i.e. 30 mg/L) with TSS of 37.0 mg/L during wet day. This might be due to the runoff from the surrounding residential areas or construction site nearby, where the paved surface of surrounding urbanized area has less tendency to trap any TSS from surface runoff before it reaches to the waterbodies. The TSS concentration for WQ5 (i.e. D3) and WQ6 (i.e. D4) were below the 10 mg/L of detection limit during wet weather, which might be due to the surrounding vegetated surface trapping sediment before stormwater discharging into canal/drains.

Total Nitrogen (TN) had an average concentration of 1.15 mg/L and 2.06 mg/L during dry and wet weather, respectively. Comparing with the water quality criteria for aquatic life, the detected TN at Pang Sua Canal (D1), drains D2 and D4 during wet weather were above the eutrophic limit of TN in waterbodies (i.e. 1.5 mg/L), suggesting nitrogen was potential cause of eutrophication in the watercourses. The TN levels might due to the stormwater run-off from residential and construction areas outside of the Study Area (e.g. fertilizer from vegetation, food waste, etc.) as well as the vegetated area within the Study Area (e.g. decomposed organic nitrogen). NO_3-N had an average concentration of 0.56 mg/L and 1.61 mg/L during respective dry and wet weathers, with values of all stations below the NEA guidelines limit (i.e. 4.52 mg/L) and aquatic life criteria (i.e. 10 mg/L). NH_4-N had an average concentration of 0.129 mg/L and 0.145 mg/L during respective dry and wet weathers, with values of all stations below the aquatic life criteria (i.e. 0.5 mg/L).

Total phosphorus (TP) vary significantly between dry and wet weathers, TP ranged from 0.078 mg/L to 0.317 mg/L (average at 0.217 mg/L) during dry weathers and ranged from 0.025 mg/L to 0.071 mg/L (average at 0.045 mg/L) during wet weather. Compared with water quality criteria for aquatic life, Pang Sua Canal (D1) and drain D2 exceeded the eutrophication limit (i.e. 0.075 mg/L) during dry weathers, indicating eutrophication potential. During storm event, TP concentration within all watercourses fell below the eutrophication limit. The concentration of PO_4-P (Orthophosphate) at Pang Sua Canal (D1) and drain D2 (ranging from 0.060 mg/L to 0.200 mg/L) during dry weathers as well as drains D2 and D3 (i.e. 0.034 mg/L and 0.057 mg/L, respectively) during wet weather slightly exceeded the aquatic life criteria (i.e. 0.033 mg/L), but within the NEA trade effluent limits (i.e. 0.65 mg/L). Phosphorus data showed eutrophication potential in Pang Sua Canal (D1) and drain D2, which was consistent with the site observation of greenish waterbodies with algae (refer to photos in Table 8-1). The source of phosphorus might come from urbanized area (e.g. fertilizer from tree plantation, food wastes, etc.) outside of the Study Area and from the decomposed vegetation within the Study Area.

Total organic carbon (TOC) had an average concentration of 2.61 mg/L during dry weathers and 5.25 mg/L during wet weather. Although there are no available TOC guidelines for aquatic life, but comparable to criteria for drinking source water from Canada (i.e. 4 mg/L, [R-12]), indicating relatively low TOC in the tested watercourses within the Study Area.

Enterococcus counts ranged from 225 cfu/100ml to 2,125 cfu/100ml with an average value of 1,589 cfu/100ml during dry weathers and ranged from 6,800 cfu/100ml to 16,000 cfu/100ml with an average value of 10,983 cfu/100ml. There are no available enterococcus guidelines for freshwater aquatic life, but comparing with the NEA Recreational Water Quality Guidelines [W-6] on enterococcus (200 cfu/100ml), the enterococcus concentrations were slightly high in our Study Area. This indicated possible human or animal faecal pollution in the watercourses within the Study Area. However, it should be noted that the criteria is for marine water and none of the watercourses is expected to hold any recreational activities involving direct human contact. During wet weather, the Pang Sua Canal (D1) and drain D2 had elevated enterococcus counts (i.e. 14,000 cfu/100mL, 16,000 cfu/100mL and 14,000 cfu/100mL, respectively) compared to that in dry weather, indicating that the enterococcus might come from storm carrying faecal contaminants from surrounding residential or vegetated area.

Lead (Pb) had an average value of 0.22 µg/L during dry weathers and 0.12 µg/L during wet weather, which were all below the NEA limits (100 µg/L) and aquatic life criteria (Acute LOEL: 82 µg/L, Chronic LOEL: 3.2 µg/L). This indicates low Pb pollution within this Study Area.

Both in-situ and ex-situ water quality parameters showed relatively high pH, TSS and nutrient (i.e. nitrogen and phosphorus) concentrations in the watercourses, indicating poor water quality for survival of aquatic life. This aligns with biodiversity findings in Section 7, which shows only Pang Sua Canal (D1) supported poor aquatic life at the time of survey.

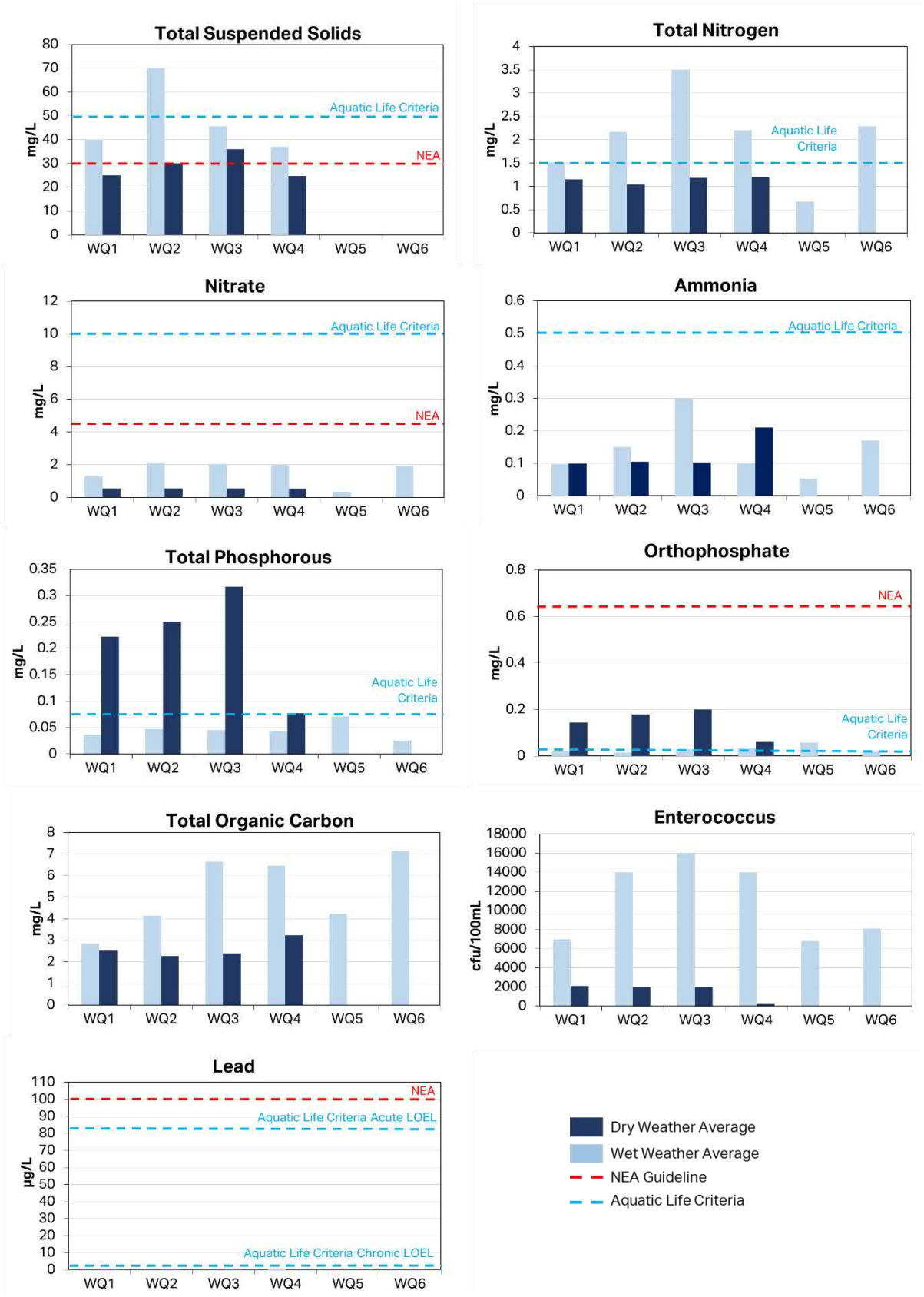


Figure 8-7 Average monitoring results of ex-situ parameters for dry and wet weather conditions

8.5 Summary of Key Findings

While the hydrological baseline study aimed to identify watercourses present in the Study Area including their location, water flow conditions and bank characteristics, the water quality surveys determined the quality of water in these surface watercourses.

Based on surveyed topographic data (including previous topographic data provided by Client and current site observation), water catchment analysis indicated that the Study Area mainly contributes water to the identified watercourses including one (1) perennial Pang Sua Canal (D1), three (3) concrete drains (D2, D3 and D4).

- Pang Sua Canal D1 is located along the western part of the Study Area, with perennial flow from the southeast to the northwest. It receives surface runoff from the western catchment area within the Study Area, as well as surrounding residential and construction areas;
- Concrete drain D2 is located at the northeast study boundary, with perennial flow from southeast to northwest. It collects surface runoff from the concrete drain D4 and vegetated area within the Study area, as well as surrounding residential area through culvert structure;
- Concrete drain D3 with ephemeral flow is located within the Study Area; and
- Concrete drain D4 with ephemeral flow is located at the eastern part of the Study Area.

Regarding the groundwater level in the Study Area, based on AECOM's desktop review and experience working in the area, groundwater depth within the Study Area was expected to be at about 2 m bgs.

Six (6) water quality sampling locations have been identified based on hydrological findings, including three (3) at the upstream, mid-stream and downstream of Pang Sua Canal (D1), and one (1) at each drain (i.e. D2, D3 and D4).

Water samples were tested for parameters including temperature, pH, salinity, total dissolved solids (TDS), conductivity, turbidity, dissolved oxygen (DO), total suspended solids (TSS), total organic carbon (TOC), total nitrogen (TN), nitrates (NO_3-N), ammonium nitrogen (NH_4-N), total phosphorus (TP), orthophosphates (PO_4-P), enterococcus and lead.

Results were compared with both NEA discharge guidelines in Singapore and international criteria for aquatic life. According to NEA discharge guidelines, the temperature, TDS, NO_3-N, PO_4-P and Pb at all sampling locations met the discharge limits. Temperature did not vary much across all the sampling stations for wet and dry weathers. pH of perennial watercourses (i.e. Pang Sua Canal D1 and concrete drain D2) slightly exceeded the NEA limit and aquatic life criteria sometimes, possibly due to the wash-off of the concrete surface of surrounding urbanized area (especially the construction site nearby), where chemicals washed away from concrete could lead to the increased pH. Given that the Study Area is inland area and far from the sea, the salinity, conductivity and TDS of the water confirmed the prevalence of freshwater. Low Pb indicated low contamination from modern anthropogenic activities. However, relatively high TSS and turbidity in Pang Sua Canal D1 and concrete drain D2 could due to flushing from surrounding urban surface (including the construction site nearby) which carried high concentration of TSS during storm event. NO_3-N and NH_4-N was generally low below NEA and aquatic criteria. However, TN concentrations during wet weather and Phosphorus concentrations (i.e. TP and PO_4-P) during dry weather were relatively high in Pang Sua Canal D1 and concrete drain D2, indicating a higher eutrophication potential which was consistent with greenish water with algae observed during site survey. Elevated enterococcus counts were observed along the Pang Sua Canal D1 and concrete drain D2 due to storm carrying faecal contaminants from surrounding residential or vegetated area. TOC showed minor organic contents in all water samples during dry and wet weather conditions.

From the results of the hydrological and water quality assessment, it could be inferred that the Pang Sua Canal D1 and concrete drain D2 which were generally perennial (fed from stormwater). Both Pang Sua Canal D1 and concrete drain D2 have relatively high pH, TSS and nutrient (i.e. nitrogen and phosphorus) concentrations, indicating poor water quality for survival of aquatic life. This aligns with biodiversity findings in Section 7, which shows only Pang Sua Canal (D1) supported poor aquatic life at the time of survey.

9 Conclusion

All the environmental baseline studies (including biodiversity, hydrology and surface water quality, as well as groundwater level) of this Project have been completed. This section provides the summary of key findings from the EBS.

The floristic field assessment show that the Study Area mainly constitutes managed vegetation, comprising clusters of tree species planted for landscaping purposes (9.62 ha; 45.2%) which occupies about half of the Study Area, and turf area (5.36 ha; 25.2%). Existing canal and infrastructure, such as the heavy vehicle carpark and defunct bus terminal take up 6.32 ha (29.6%) of the Study Area. The floristic assessment identified a total of 115 species from 45 families. Of the 115 species recorded, majority are exotic (77 species; 67.0%), only 27 species are native (23.5%), and 11 (9.5%) are cryptogenic (i.e., species that has unknown or uncertain origins). Only one nationally Vulnerable climber species, *Bridelia stipularis*, is considered as species of conservation significance in the Study Area. Ninety-one large plant specimens were recorded in the Study Area, largely dominated by Senegal mahogany (*Khaya senegalensis*) and raintree (*Samanea saman*). Other specimens of value consist of two keystone species with two specimens respectively: Malayan banyan (*Ficus microcarpa*) and weeping fig (*F. benjamina*), with a spread that ranges from 3-8 m. In addition, a bamboo cluster, *Bambusa* cf. *heterostachya* with a spread of 2.5 m, were also identified to be possible roosting habitat for bamboo bats. In total, 397 trees of $\geqslant$ 0.3 m girth were tagged and recorded during the floristic survey.

The faunistic field assessment recorded 89 species, dominated by birds (36 species) and butterflies (18 species). Most of the species recorded are widespread and common, typical of such parkland habitats. Only one species of conservation significance, the nationally Endangered blue-crowned hanging-parrot (*Loriculus galgulus*), which is now considered locally widespread and common, was observed within the Study Area (see Section 7.3.2.9). While not of conservation significance, several other uncommon fauna were also recorded. This includes the uncommon dingy duskhawker (*Gynacantha subinterrupta*) that is usually found in forested areas, and two moderately rare butterflies: evening brown (*Melanitis leda leda*) and common redeye (*Matapa aria*). The evening brown (*Melanitis leda leda*) are usually sighted in grasslands, thickets, or among dense vegetation, while the common redeye (*Matapa aria*), are usually sighted in various habitat types where bamboo clusters are present, from urban parks, wastelands, to nature reserves [W-10]. Nine migratory bird species were also recorded, including uncommon migrants, such as the rare yellow-browed warbler (*Phylloscopus inornatus*) and uncommon migrant, the yellow-rumped flycatcher (*Ficedula zanthopygia*). These records show the value of the Study Area in supporting uncommon species and migratory birds.

Other species of conservation significance that may utilise the Study Area as a stepping stone to move between habitats include the globally Critically Endangered and nationally Endangered straw-headed bulbul (*Pycnonotus zeylanicus*), the globally Vulnerable and nationally Endangered smooth-coated otter (*Lutrogale perspicillata*), and the globally and nationally Critically Endangered Sunda pangolin (*Manis javanica*) [P-10]. These species have been recorded in surrounding green spaces and may disperse to the Study Area. The watercourse within the Study Area is poor in aquatic life and are more likely to be used by fauna to move between habitats.

Choa Chu Kang N1 is also known as the Sungei Pang Sua Woodland [P-10; P-11 It is “an important part of the Green Rail Corridor between Hill View in the south and Stagmont Ring in the north, as it is the only wooded area in-between” [P-11]. The Study Area is also considered as “a conducive stepping stone” [P-10] (i.e., habitat patches in a landscape that facilitates movement of species between other forested patches [P-33]) and “a conduit for wildlife dispersal or movement” [P-10] that could facilitate the dispersal of fauna to the surrounding green spaces, such as Bukit Mandai forest to the northeast and Bukit Gombak forest to the south (Figure 7-27), and to other larger fragmented habitats, including Bukit Timah Nature Reserve (BTNR) in the southeast, and Mandai Mangrove and Mudflats in the north [P-10], hence, enhancing the ecological connectivity across the landscape.

With that said, an ecological corridor is recommended to be implemented on the east of the Pang Sua canal adjacent to the proposed residential development, so that wildlife can continue to use the area as a stepping stone to move between the surrounding green spaces. The proposed corridor will potentially help to facilitate the movement of faunal species, such as small mammals and volant species, even after the proposed development is established. The corridor should be of a reasonable width to ensure the survival of small to medium-sized mammals and for them to utilize the corridor, especially within an urban landscape where limited habitats are available [P-44; W-20], in this case, a larger corridor is recommended [W-20].

Further studies could also be carried out to explore the possibility of localised widening of the ecological corridor to conserve clusters of mature trees, such as the cluster of rain trees located south of the Study Area, which have denser tree canopies that could provide a more conducive microclimate allowing for profusion of ferns and other epiphytic plants and for fauna species. Floral species of conservation significance – *Bridelia stipularis* – would be retained. Keystone species including a specimen of *Ficus microcarpa* and *Ficus benjamina* respectively, with spread of 3 – 8 m and *Bambusa* cf. *heterostchya* of 2.5m spread – will also be studied for retention.

The greening of the canal will need to be studied together with the design of this ecological corridor to explore the possibility of an optimal and integrated design, taking into consideration the ecological aspects of the corridor, the proposed residential development and infrastructure requirements.

It is expected that the proposed development will result in the loss of some of the existing mature trees within the Study Area. As such, enhancement planting strategies (i.e., planting of keystone species, tiered planting of different layers of vegetation to emulate a forest-like structure that has large trees with close canopy etc.) could be incorporated.

Other general recommended features of the proposed ecological corridor, such as the strategic placement of light features within the proximity of the ecological corridor, could also be incorporated. Mitigating measures, such as wildlife culverts across roads and overpass across the Pang Sua Canal to facilitate safe movements by fauna species can also be studied.

The hydrological baseline study aimed to identify watercourses present in the Study Area including their location, water flow conditions and bank characteristics, and the water quality surveys determined the quality of water in these watercourses.

Based on surveyed topographic data (including previous topographic data provided by Client and current site observation), water catchment analysis indicated that the Study Area mainly contributes water to the identified watercourses including one (1) perennial Pang Sua Canal (D1), three (3) concrete drains (D2, D3 and D4).

- Pang Sua Canal D1 is located along the western part of the Study Area, with perennial flow from the southeast to the northwest. It receives surface runoff from the western catchment area within the Study Area, as well as surrounding residential and construction areas;
- Concrete drain D2 is located at the northeast study boundary, with perennial flow from southeast to northwest. It collects surface runoff from the concrete drain D4 and vegetated area within the Study area, as well as surrounding residential area through culvert structure;
- Concrete drain D3 with ephemeral flow is located within the Study Area; and
- Concrete drain D4 with ephemeral flow is located at the eastern part of the Study Area.

Six (6) water quality sampling locations have been identified based on preliminary hydrological findings during site reconnaissance, including three (3) at the upstream, mid-stream and downstream of Pang Sua Canal (D1), and one (1) at each drain (i.e. D2, D3 and D4).

Water samples were tested for parameters including temperature, pH, salinity, total dissolved solids (TDS), conductivity, turbidity, dissolved oxygen (DO), total suspended solids (TSS), total organic carbon (TOC), total nitrogen (TN), nitrates (NO_3-N), ammonium nitrogen (NH_4-N), total phosphorus (TP), orthophosphates (PO_4-P), enterococcus and lead.

Results were compared with both NEA discharge guidelines in Singapore and international criteria for aquatic life. According to NEA discharge guidelines, the temperature, TDS, NO_3-N, PO_4-P and Pb at all sampling locations met the discharge limits. Temperature did not vary much across all the sampling stations for wet and dry weathers. pH of perennial watercourses (i.e. Pang Sua Canal D1 and concrete drain D2) slightly exceeded the NEA limit and aquatic life criteria sometimes, possibly due to the wash-off of the concrete surface of surrounding urbanized area (especially the construction site nearby), where chemicals washed away from concrete could lead to the increased pH. Given that the Study Area is inland area and far from the sea, the salinity, conductivity and TDS of the water confirmed the prevalence of freshwater. Low Pb indicated low contamination from modern anthropogenic activities. However, relatively high TSS and turbidity in Pang Sua Canal D1 and concrete drain D2 could be due to flushing from surrounding urban surface (including the construction site nearby) which carried high concentration of TSS during storm event. NO_3-N and NH_4-N was generally low below NEA and aquatic criteria. However, TN concentrations during wet weather and Phosphorus concentrations (i.e. TP and PO_4-P) during dry weather were relatively high in Pang Sua Canal D1 and concrete drain D2, indicating eutrophication potential and consistent with

greenish water with algae observed during site survey. Elevated enterococcus counts were observed along the Pang Sua Canal D1 and concrete drain D2 due to storm carrying faecal contaminants from surrounding residential or vegetated area. TOC showed minor organic contents in all water samples during dry and wet weather conditions.

Regarding the groundwater level in the Study Area, based on AECOM's desktop review and experience working in the area, groundwater depth within the Study Area was expected to be at about 2 m bgs.

In summary, from environmental baseline surveys conducted, the Study Area can be described as urbanized land, with managed vegetation and one floral species of conservation significance observed on site, lined with northwards flowing manmade canal/ drains. In terms of fauna, several faunal records were considered notable, including the uncommon odonate species, dingy duskhawker (*Gynacantha subinterrupta*) and moderately rare butterfly species such as evening brown (*Melanitis leda leda*) and common redeye (*Matapa aria*). From the results of the hydrological and water quality assessment, only one (1) canal (i.e. Pang Sual Canal) and one (1) concrete drain were perennial with relatively high pH, TSS and nutrient (i.e. nitrogen and phosphorus) concentrations. This indicates poor water quality for survival of aquatic life, aligning with biodiversity findings which shows only Pang Sua Canal (D1) supported poor aquatic life at the time of survey.

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Appendix A
AECOM Health and Safety Plan

Delivering a better world

APPENDIX A:

HEALTH AND SAFETY PLAN

SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Prepared by:

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Project Number: ***60651709***

HEALTH AND SAFETY PLAN
APPROVAL PAGE

This project Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the chemical, physical and biological hazards known or suspected to be present on the projects site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered during the completion of the projects, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve this HASP. This HASP has been written for the exclusive use of AECOM, its employees, and subcontractors. The plan is written for specified site conditions, dates and personnel, and must be amended if these conditions change.

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LIST OF ATTACHMENTS

1.0 Introduction

This Health and Safety Plan (HASP) was developed by AECOM's Environment Business Line (AECOM) for implementing the site survey for Specialist Consultancy Services For Environmental Baseline Studies (EBS) at Southern Tengah and Choa Chu Kang N1. This establishes the health and safety procedures required to minimize potential risk to personnel for the duration of the activity. This is a project and site-specific HASP and should be used concurrently with the AECOM Field SH&E Manual and standard operating procedures (SOPs) and a completed site specific Emergency Response Information Form (Attachment B).

1.1 Policy

AECOM, as a leading global provider of environmental, health and safety services, is committed in protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by the implementation of all our operations. We are also committed to protecting and preserving the natural environment in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless waste and loss. It shall be the policy of this project that all operations be conducted safely as stated in *AECOM SH&E Policy Statement*.

1.2 Scope and Application

The provisions of this HASP apply to all AECOM project staff who may potentially be exposed to safety and/or health hazards related to activities described in Section 3.0 of this document. Unanticipated site-specific conditions or situations may occur during the implementation of this project. Also, AECOM and/or the contractors may elect to perform certain tasks in a manner that is different from what was originally intended due to a change in field conditions. As such, this HASP must be considered a *working document* that is subject to change to meet the needs of this project.

1.3 Regulatory Compliance

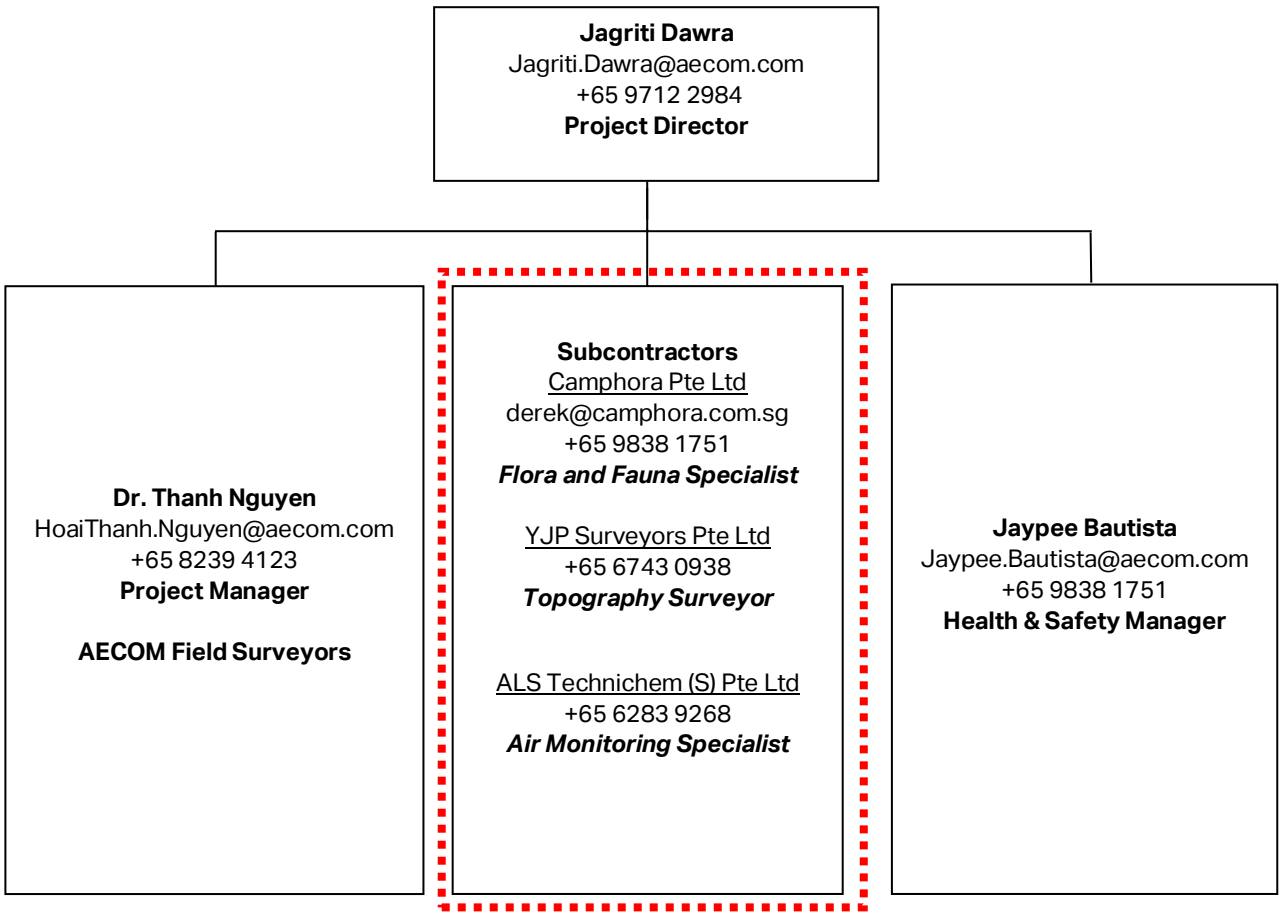
All activities covered by this HASP must be conducted in complete compliance with this HASP and with all applicable environmental, health and safety regulations of Singapore. Additionally, all work will be conducted in accordance with AECOM SH&E Policies and Procedures found in the *AECOM Field SH&E Manual* and Singapore Occupational Safety and Health Administration (OSHA) framework. Personnel covered by this HASP who cannot or will not comply with any of these requirements will be excluded from site activities.

1.4 Management of Change

The procedures in this HASP have been developed based on current knowledge regarding the specific biological and physical hazards, which are known or anticipated for the proposed onsite baseline survey. Site specific requirements and hazards for this project will be taken into consideration and will be included in any update of this HASP. Should additional information become available regarding unique site hazards or operational change, it may be necessary to modify this HASP. All proposed modifications to this HASP must be reviewed and approved by the AECOM Project Manager (PM) and HSSE Focal before such modifications are implemented. The Receipt and Acceptance Sign-off sheet must be submitted to the AECOM PM. The HASP Receipt and Acceptance Sign-off Sheet are included in this HASP as Attachment A.

1.5 Health and Safety Organization

The implementation of health and safety at the site location will be the shared responsibility of the Project Manager (PM), the Project Field Surveyors (FS), the HSSE Focal (HSSEF), and other site-based personnel and contractors implementing the proposed scope of work. The responsibilities of the PM, FS and HSSEF are shown in detail in the *AECOM SH&E Field Manual*. For the implementation of this project, the following Health and Safety Organizational Chart will apply:



1.5.1 Project Manager

The Project Manager (PM) has overall management authority and responsibility for the project, including safety. The PM will provide the FS with work plans, safety personnel, and budgetary resources, which are appropriate to meet the safety needs of the project operations. Helping the PM with the management of the project is the Deputy Project Manager (DPM).

1.5.2 AECOM Field Surveyors

The AECOM Field Surveyor (FS) has the overall responsibility and authority to complete the work according to the provided scope of work. The FS must verify that all tasks are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment.

1.5.3 Subcontractors

Subcontractors (in red box) involved in this project should review and understand the contents of this HASP prior to the start of on-site work. However, as part of the contract with the subcontractors, they are expected to follow their internal health and safety protocols. The subcontractor shall be fully responsible and shall indemnify AECOM for any losses, liabilities and claims as stipulated in Clause 9 and Clause 13 of the signed Subconsultant Engagement. Moreover, the subcontractors are expected to maintain proper and adequate insurances to cover health and safety related emergencies.

1.5.4 Other Field Personnel

All other field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner.

1.6 Stop Work Authority

AECOM Stop Work Procedures (S3AS-106-PR) grants all AECOM employees, including employees of any of its subcontractors the right and responsibility to exercise a 'Stop Work Authority' any time that an employee identifies a discrepancy, deficiency, or potentially dangerous condition or act that is likely to cause an unsafe or unhealthy situation. Any time a 'Stop Work Authority' is issued at the site, work must immediately cease and

all involved employees should review that task and the appropriate JSRA to ensure that any hazards are recognized by all concerned workers. The **Behaviour Based Safety** (BBS) process enables each worker to

2.1 Project Background

AECOM Singapore Pte Ltd was appointed by the Housing and Development Board (HDB) of Singapore, through the Letter of Acceptance dated 29 January 2021, to carry out Specialist Consultancy Services For Environmental Baseline Studies (EBS) at Southern Tengah and Choa Chu Kang N1. The indicative proposed boundary of the study area is shown below in **Figure 1**. The proposed study area of Southern Tengah and Choa Chu Kang N1 are estimated to be 60 ha and 21.7 ha respectively.

As the existing terrain is partially vegetated and undulating, the proposed study area would entail civil engineering works such as site clearance (demolition of all buildings/structures, removal of existing trees and vegetation), earthworks cutting/filling within site to achieve desirable platform levels required for the proposed residential development from the drainage and sewerage perspectives; construction of roads, drainage works, sewerage works etc; and building works such as foundation, superstructure construction, utilities/services laying, etc.

Figure 1 Project Location

2.2 Scope of Work

To assess the nature and existing baseline of study area, HDB would like to conduct an Environmental Impact Study (EIS) for Southern Tengah and EBS for Choa Chu Kang (CCK) N1. The scope of the field work for the project is composed of the following items:

2.2.1 Biodiversity

For Southern Tengah site, the study will include baseline study which comprise of fauna, flora, habitats and areas of conservation interest. The EIS will assess the impacts on flora and fauna communities, habitats and/or ecological processes due to risk of pollution to aquatic habitats, noise and air pollution from construction phase of the project. Area of high conservation value and buffer zones will be identified. Appropriate mitigation measures (if warranted) and recommendations for monitoring programme will be proposed.

For Choa Chu Kang N1 site, the study will only include baseline study which comprise of fauna, flora, habitats and areas of conservation interest.

2.2.2 Hydrology and Water Quality

For Southern Tengah site, the study will map out any permanent streams and/or waterbodies in the study area and investigate the flow conditions (indicative flow velocity, depth and width during dry and wet weathers) of those waterbodies. The dimensions, patterns and profiles of stream channels and other waterbodies will be identified and documented. Catchment delineation will be conducted to identify the water sources and how the water flows within the site. Impacts related to the stream alignment, potential runoff and water pollution will be identified for construction phase. Impacts related to possible construction discharges will be identified. Contaminant concentrations will be compared to relevant water quality criteria. The water quality data to criteria relevant to ecological uses will be compared. The impacts on water quality in the study area will be assessed qualitatively and analytically that results from construction phase of the project.

For Choa Chu Kang site, the study will map out any permanent streams and/or waterbodies in the study area and investigate the flow conditions (indicative flow velocity, depth and width during dry and wet weathers) of those waterbodies. The dimensions, patterns and profiles of stream channels and other waterbodies will be identified and documented. Catchment delineation will be conducted to identify the water sources and how the water flows within the site.

2.2.3 Soil and Groundwater

For Southern Tengah Site, groundwater conditions (i.e. groundwater level) will be assessed through secondary data provided by the Client and/or agencies. No groundwater monitoring wells are assumed to be installed for the EIS. The soil and groundwater impact assessment will be conducted to identify and evaluate the potential impact of construction to the existing soil and groundwater quality (and groundwater system) within the site. Mitigation measures will be proposed to mitigate the identified negative impact(s), if any.

For Choa Chu Kang N1 site, baseline groundwater conditions (i.e. groundwater level) will be assessed through secondary data provided by the Client and/or agencies. No groundwater monitoring wells are assumed to be installed for the EIS.

2.2.4 Air Quality

For Southern Tengah site, the EIS will include a dust baseline survey whose results will be used to evaluate ambient dust (PM_{10} and $PM_{2.5}$) and air quality. The study will assess the impacts from dust generated during the construction phase on the nearest sensitive receptors.

2.2.5 Airborne Noise

For Southern Tengah site, the baseline noise monitoring will be carried out to establish the baseline noise levels. This study will assess the potential impact qualitatively from noise generated during construction phase on the neighbouring sensitive receptors.

2.2.6 Topography Survey

Topographic survey will be conducted to gather data about the elevation of points within the study area and present them as contour lines on a plot. The purpose of a topographic survey is to collect survey data about the natural and man-made features of the land, as well as its elevations. A survey map of terrain and levels within the study area will be provided. The survey area for Southern Tengah Site and CCK N1 Site are approximately 60 ha and 21.7 ha.

3.0 Hazard Assessment

3.1 Physical Hazards

AECOM recognizes that performing certain tasks related to executing the scope of work for the site would expose workers to a variety of physical hazards. As such, AECOM employees have been trained and mentored to carry out assessment activities following AECOM standard operating procedures (SOPs) making SH&E a priority in their operations.

3.1.1 Slip, Trip and Fall Hazards

On any work area, it is expected that the ground may be uneven. The ground surface may be unreliable due to settling. The site should be initially assessed for potential slip, trip and fall hazards. Identify excavations, open pits, holes, and trenches then place appropriate markers at locations with these hazards. Establish and follow an unobstructed walking path identified when working due to the irregular terrain.

3.1.2 Pinch Points

The use of hand tools, mechanical equipment, heavy machinery and more can create pinch points within the working area. Pinch points can be recognized when moving objects are present in the work space in close proximity to employees, and it is reasonable to assume that a part of the employee's body can be caught between the moving objects. Pinch points will be considered when performing a JSRA for the task being performed and recommendations will be made to reduce the potential for body parts to become caught in moving parts, including but not limited to:

- Guarding machinery and equipment to prevent body parts from being caught in the moving objects;
- When tools are used as an extension of the body consideration will be given to how the tool may become a hazard if it is caught within moving parts; and
- The use of PPE, e.g. gloves, boots, etc., to protect exposed body parts.

3.1.3 Manual Lifting

Most materials associated with construction-related activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use at least two people to lift, or roll/lift with your arms as close to the body as possible. Under no circumstances should any one person lift more than 12 kgs unassisted. Using the proper techniques to lift and move heavy pieces of equipment is important to reduce the potential for back injury. Use mechanical devices to move objects that are too heavy to be moved manually. If mechanical devices are not available, ask another person to assist you. Bend at the knees and not the waist when lifting loads. Let your legs do the lifting and do not twist your body while lifting. Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards.

3.1.4 Cuts and Lacerations

Field personnel should always look for sharp surfaces such as glass when handling sampling bottles, soil samples or debris. Always wear cut/puncture resistant gloves when hand-clearing cannot be avoided. Never attempt to remove objects caught in an auger stem with the hand and make sure the equipment is turned off.

Machine guards on generators and other mechanical equipment with rotating components are designed to protect hands and arms from being cut, amputated or crushed. Machine areas that are typically guarded include points of operation and moving points or pinch points (any point other than a point of operation at which it is possible for a part of the body to be caught).

3.1.5 Traffic Hazards

Motor vehicle traffic may impact the field team during the implementation of the proposed investigation. The FS must identify the parking location for personnel vehicles and heavy equipment, designated pedestrian walkways, position of designated traffic watcher, traffic control for offsite activities, and coordination with other third party contractors. The FS must verify installation of a barricade around the work area and proper placement of traffic cones, flags and warning signs to warn motorists and pedestrians especially for drilling locations near the access road. All employees onsite should wear an ANSI-approved Class II safety vest.

3.2 Weather Hazards

3.2.1 Heat Stress

Heat stress related problems include **heat rash, fainting, heat cramps, heat exhaustion and heat stroke.** Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks. The surveyors should establish work-rest cycles (short and frequent are more beneficial than long and seldom) and rest in a shaded, cool area.

Most workers exposed to hot environments drink less fluid than needed because of an insufficient thirst. DO NOT DEPEND ON THIRST TO SIGNAL WHEN AND HOW MUCH TO DRINK. **During field work, drink at least 4 - 6 litres (120 - 200 ounces) of fluids for an 8-hour workday.** Sufficient potable water and approved beverages should be made available each day for the field team. The field surveyors should also identify the most effective technique for heat stress monitoring.

3.2.2 Sun Exposure

Field personnel are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 30, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should consider wearing safety glasses that offer protection from UVA/UVB rays.

3.2.3 Darkness

AECOM discourages field activities to be done at low light conditions, particularly at night. When working in dark areas, ensure that additional artificial lighting must be present to illuminate the work area to ensure that paths and potential site hazards are clearly visible. The field personnel should also recognize the effect of fatigue on workers not accustomed to working at night or extended periods. If night works is required, approval from the PM/DPM, HDB, PUB and SLA must be obtained prior to start of any night works. Moreover, a minimum of two personnel should be completing the work. Lone worker at night time is NOT allowed.

3.2.4 Inclement Weather and Other Natural Disasters

Severe weather can occur with little warning. Employees will be vigilant for the potential of storms, lightning, high winds, and flash flood events. The field personnel will be attentive to daily weather forecasts for the project area each morning. Predicted weather conditions of potential field impact should be considered when performing the work. No field surveys will be conducted during inclement weather, thunder or lightning in the vicinity of the study area.

Be alert to the signs of changing weather, such as darkening skies, a sudden wind shift or drop in temperature. If you are expected to be onsite, plan your evacuation and safety measures in advance. During thunderstorms, when you first see lightning or hear thunder, activate your emergency plan and go inside to the closest building or vehicle. In the event that the national weather service predicts that one of the areas where AECOM is working is in the direct path of a typhoon or cyclone, the PM will immediately contact the field personnel to determine what, if any, precautions are necessary, including the need for evacuation.

This same protocol will be followed in the event that other natural disasters (e.g., floods, landslides, earthquakes, etc.) could impact field personnel. DO NOT IGNORE INSTRUCTIONS TO GET TO SAFETY.

3.3 Biological Hazards

As the site is located in a secondary forest, biological hazards are expected to be present. The AECOM project team shall ensure that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this HASP are integrated into the project planning process and conveyed to AECOM employees conducting the field work. This information shall be communicated in the site kick-off meetings. Possible biological hazards that may be encountered at the site include mosquitoes, wild boars, spiders, bees, and snakes. Where detected, assessment of trees will only be carried out at a distance.

The hazard assessments must also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with plants that may cause irritation, cuts and punctures. Hazards associated with the use of tools and equipment to remove vegetation.

3.3.1 Spiders

Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads, and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes. Most spider bites produce wounds with localized inflammation and swelling. All spiders are poisonous, but fear of all spiders is unwarranted because most are either too small or possess poison that is too weak to harm humans. Only a few have bites that are dangerous to humans. However, the bite of these few species can cause serious medical problems and possible death under certain circumstances.

3.3.2 Mosquitoes

When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections. CDC data indicates that mosquito-borne illnesses, including the strains of dengue, Zika, malaria and encephalitis, are a health risk to employees working in outdoor environments. Mosquitoes breed in stagnant water and typically only travel a quarter mile from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. Project managers and client should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water. Application of mosquito-repellent lotion is advised especially when working outdoors. Employees also need to consider whether they are sensitive to the use of insect repellents. Priority should be given to elimination of breeding areas.

3.3.3 Bees and Hornets

Bees, hornets and wasps may be found in derelict buildings, sheltered areas, and even on open ground. Avoid reaching into areas where visibility is limited. If stung by a wasp or bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting or any swelling or numbness beyond the site of the bite or sting.

Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. AECOM recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.

3.3.4 Snakes

Most snake bites happen when the snake is trodden on, either in the dark or in undergrowth. If you find a snake while at work, contact local authorities which will arrange for a suitably qualified snake handler to catch and relocate the snake. DO NOT attempt to catch the snake yourself as this may result in serious injury. Simply track the snake's movements and await the arrival of the snake handler. Attention to the following recommendations might reduce the number of accidents.

- Know your local snakes, the sort of places where they like to live and hide, at what times of year, day/night or in what kinds of weather they are most likely to be active.
- Be especially vigilant about snake bites after rains, during flooding, at harvest time and at night.
- Wear proper shoes or boots and long trousers, especially when walking in the dark or in undergrowth.
- Avoid working in areas where snakes are suspected present or there is a history of their presence. Wear snake chaps if it is necessary to work in or near these areas.
- Avoid snakes as far as possible. Never handle, threaten or attack a snake and never intentionally trap or corner a snake in an enclosed space.
- Avoid or take great care handling dead snakes, or snakes that appear to be dead.
- Avoid having rubble, rubbish, termite mounds or domestic animals close to human dwellings, as all of these attract snakes.
- If you suspect that snake is present in close proximity to your work location, back off and request for help.

- Avoid work alone in remote sites – the buddy can serve as additional eyes for hazard identification and aide in times of emergency
- Prepare an emergency vehicle on standby for working in remote sites especially difficult in transportation (e.g. rent a car)

The hazard assessments must also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with plants that may cause irritation, cuts and punctures. Hazards associated with the use of tools and equipment to remove vegetation.

3.3.5 Wild Boars

There is potential dangerous of wild boar attack in the forested area of Southern Tengah site. Based on local worker near the site, they have noticed wild boar few times in the forest of Southern Tengah. There is a few recommendations when encountered wild boar:

- Be calm and move slowly away from the wild boar.
- Do not approach or attempt to attack the wild boar.
- Keep a safe distance and do not corner or provoke the wild boar.
- If see adults with young piglets, leave them alone to avoid increase the alertness of the adult and they may attempt to defend their youngs.
- Wear proper shoes or boots and long trousers, especially when walking in the dark or in undergrowth.
- Avoid working in areas where wild boars are suspected present or there is a history of their presence.
- Avoid or take great care handling dead wild boar, or wild boar that appear to be dead.
- If you suspect that wild boar is present in close proximity to your work location, back off and request for help.

3.4 Covid

AECOM adopts a screening process to prevent spread of Covid-19 to employees, sub-consultants, subcontractors, and visitors at AECOM project offices and field locations, as detailed in Attachment C. This process will be strictly followed by field staff and visitors within the scope of AECOM-managed activities.

4.0 Personal Protective Equipment

4.1 Basic PPE

PPE will be worn during field work activities to meet the facility's basic PPE requirements and to prevent on-site personnel from being injured by the safety hazards posed by the site and/or the activities being performed. The following tables describe the basic PPE requirements for general site activities and for certain specific tasks/areas.

Basic PPE Item	Requirements for Donning Item
Long sleeved work jacket or shirt; 100% cotton	Required at all times. No torn or sleeveless shirts allowed
Long pants; denim or cotton	Required at all times. No short pants allowed.
Closed shoes/knee-high rubber boots/gaiters	Required at all times.
Hard Hat (ANSI Z89.1, Type 1, Class E)	Required when working in areas or activities with overhead hazards (i.e. operation of rig)
Traffic vests (ANSI 107, Class II)	Required when working in areas with moving vehicles.
Work Gloves	Type required dependent on work performed. Brightly colored gloves are recommended.

4.2 Other Safety Equipment

The following additional safety items should be available at the site:

- Portable, hand-held eyewash bottles
- Fully-stocked First Aid Kit
- Hard barricades or traffic cones to designate work area;
- Multipurpose Dry Chemical (Type A-B-C) Fire (when hot works are implemented). The fire extinguisher should be accessible and placed close to the area were the Hot Work activities are occurring.
- Trekking pole/stick
- Face shield/mask

5.0 Personal & Travel Related Safety & Security

5.1 General Information

This project involves travel to an area of Singapore that may or may not pose security threats to the AECOM field team members that will perform the project work. All field personnel will use the buddy system when working within any controlled work area. Under no circumstances will any employee be present alone in a controlled area. To ensure the personal safety of AECOM staff, the following general precautions need to be considered and implemented:

- Obtain travel, health and security advisories applicable prior to mobilization. This includes notice to proceed from NParks, HDB, URA, SLA, ISD, MINDEF and SPF.
- Schedule onsite works during daylight hours or until nearby establishments are still open.
- Keep a mobile phone with you onsite. Maintain regular contact with someone in the office.
- To avoid being a target, dress conservatively. Do not wear expensive looking jewellery.
- Always try to travel light. You can move more quickly and with ease and will be more likely to have a free hand.
- If you wear glasses, pack an extra pair and pack medicines you need in your carry-on luggage.
- Notify a representative of the site/facility and your supervisor immediately if you become concerned at any time about your personal safety and security while conducting this work.

5.2 Communications

Throughout field surveys, a minimum of two personnel will work together at all times and carry hand phones to keep in contact with non-field personnel. Local telephone facilities or services may be limited at the site. Field teams must have a portable mobile phone to contact other AECOM Project Managers, and if necessary, local emergency responders.

6.0 SITE CONTROL

6.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

6.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any AECOM site.

6.3 Personal Hygiene

The following personal hygiene requirements will be observed:

- Water Supply: A water supply meeting the following requirements will be utilized:
  - ❖ Potable Water - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
  - ❖ Non-Potable Water - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:

Non-Potable Water
Not Intended for Drinking Water Consumption

- Toilet Facilities: The FS shall identify the nearest toilet facilities onsite.

7.0 HEALTH AND SAFETY REQUIREMENTS

7.1 Training Requirements

7.1.1 Site Safety Officer Accreditation

All AECOM personnel performing activities covered by this HASP must have completed the appropriate prescribed internal training requirements.

7.2 SH&E Briefings and Meetings

7.2.1 Field Kick-off Meetings

Prior to the commencement of on-site activities, a field kick-off meeting will be conducted by the FS to review the specific requirements of this HASP. Attendance of the pre-entry meeting is mandatory for all personnel covered by this HASP and must be documented on the HASP Acceptance Form provided in Attachment A. All documentation should be maintained in the project file. The pre-entry briefing must be completed for each new employee before they begin work at the site.

7.3 Medical Surveillance Program

AECOM has a medical surveillance program in place specifically designed to provide pre-placement baseline medical examinations to determine the medical suitability of, and to establish a "medical baseline" for, newly hired employees. The program provides annual examinations to detect medical conditions or changes, which may affect medical suitability for unrestricted work; and also provides interim and post exposure examinations, as necessary, based on types of projects and materials handled.

7.4 Substance Abuse

AECOM understands that the unlawful or improper presence or use of controlled substances or alcohol in the workplace presents a danger to everyone. Employees who refuse to meet the requirements of the AECOM Substance Abuse Policy shall be removed from the project and may be subjected to disciplinary action, up to and including termination.

8.0 Emergency Response

AECOM response actions will be limited to evacuation and medical/first aid as described within this section. As such, this section of the HASP has been written to comply with 29CFR 1910.38 (a). AECOM employees and their subcontractors should be prepared to evacuate the work site in the event of an emergency. When work involves working at a remote location where medical facilities may not exist, it is imperative that the field team understand how to contact transportation companies to assist with transport to the closest medical facility. This information must be determined in advance of mobilizing to a remote location with no medical facilities, reviewed with the field team and verified with the identified transport companies on the day of field mobilization to ensure services are available. AECOM will bring a portable phone to the site to ensure that communications with local emergency responders is maintained, when necessary.

8.1 Emergency Information and References

Prior to working, the field personnel will review with the PM the scope of work and any site-specific information that may be available, including emergency information specific to the site location, emergency contact information and the designated emergency evacuation area. Emergency references of MEDICAL (ambulance), FIRE and POLICE services that can be summoned to the facility during an emergency should be determined as part of the Site Specific Data Form and should be discussed during the daily safety meetings. The field personnel and/or PM must ensure completion of the **Emergency Response Information** form (Attachment B) prior to mobilization.

8.2 Accident Reporting and Investigation

8.2.1 AECOM Reporting Requirements

All work-related H&S incidents, including injuries and illnesses, first aid cases, accidents, property damage incidents, and near-miss incidents must be reported to the PM as soon as possible. The PM should then notify the HSSE Focal to discuss the incident and to determine whether the incident must be reported to LTA (see below) and whether an accident investigation should be conducted and documented. If any person is injured, his/her supervisor, the PM and HSSE Focal must be notified immediately.

If an investigation will be required, it should be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An AECOM Accident Investigation Form in the *AECOM Field SH&E Manual* must be completed as soon as possible and submitted to the PM.

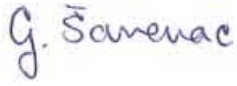
Attachment A

HASP Receipt and Acceptance Form

Health and Safety Plan Receipt and Acceptance Form

for Biodiversity and Hydrology Baseline Studies and Environmental Impact Study for Keppel Club, PSA Club, Bukit Chermin, Berlayer Creek and Former BP Oil Refinery Site

I have received a copy of the Health and Safety Plan (HASP) prepared for the above referenced project. I have read and understood its contents and I agree that I will abide by its requirements.

Name	Signature	Company	Date
Jagriti Dawra		AECOM Singapore Pte Ltd	17-Feb-2021
Jaypee Perez Bautista		AECOM Singapore Pte Ltd	17-Feb-2021
Dr Hoai Thanh Nguyen		AECOM Singapore Pte Ltd	19-Feb-2021
Dr. Liang Liang		AECOM Singapore Pte Ltd	19-Feb-2021
Jacquelynn Chia		AECOM Singapore Pte Ltd	17-Feb-2021
Grujica Sarenac		AECOM Singapore Pte Ltd	19-Feb-2021
Hanzel Lalitan		AECOM Singapore Pte Ltd	19-Feb-2021
Phyo Naing Zay		AECOM Singapore Pte Ltd	19-Feb-2021
Rou Jie Tan		AECOM Singapore Pte Ltd	18-Feb-2021
Yee Chian Choo		AECOM Singapore Pte Ltd	17-Feb-2021

Reva Gupta		AECOM Singapore Pte Ltd	18-Feb-2021
Jafon Ng		AECOM Singapore Pte Ltd	19-Feb-2021

Attachment B

Emergency Response Information

Local Police:

For Southern Tengah site: Jurong West Neighbourhood Police Centre, 700 Corporation Rd, Singapore 649818

Tel: +65 1800 268 9999

For Choa Chu Kang N1 site: Choa Chu Kang Neighbourhood Police Post , 116 Teck Whye Ln, #01-740, Singapore 680116

Tel: +65 1800 762 9999

Local Fire: Bukit Batok Fire Station, 80 Bukit Batok Rd, Singapore 658072

Tel: +65 6314 6931

Closest Hospital/Clinic to Site:

Hospitals and Clinics Near *Southern Tengah site*

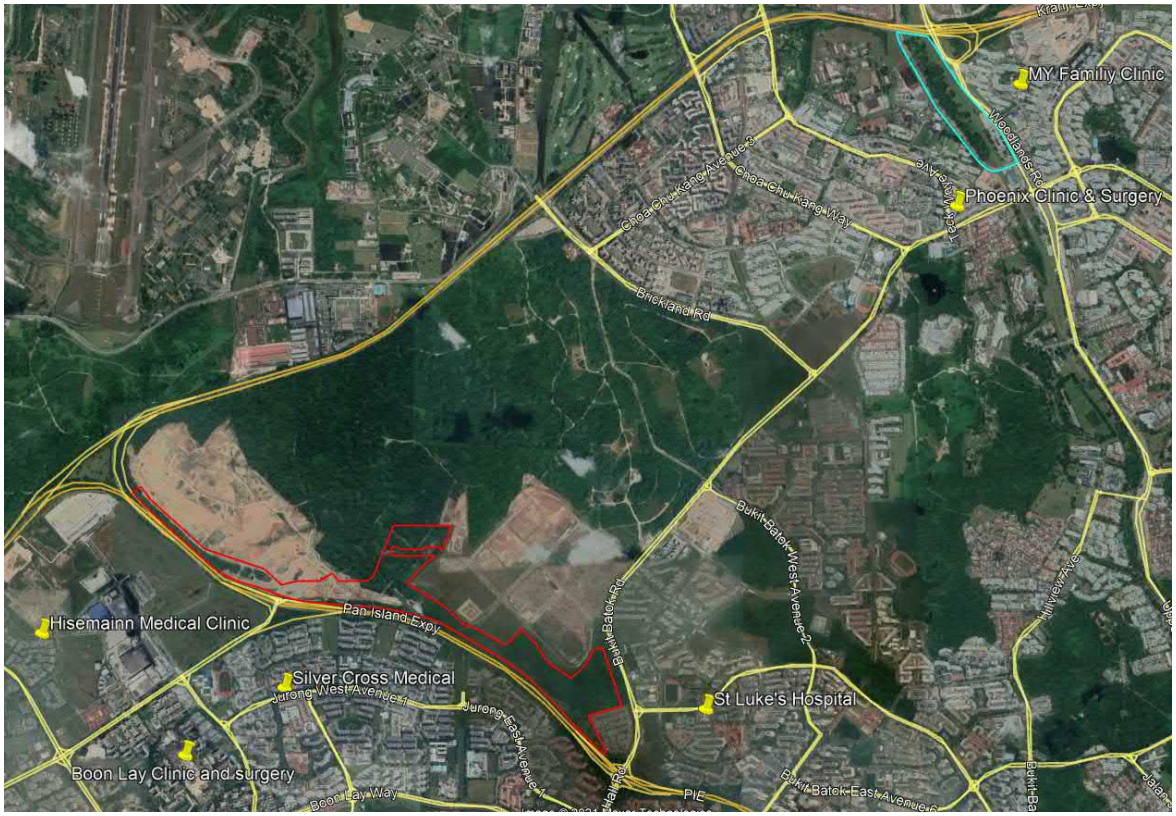
Name of Hospital and Clinic	Distance from Project Site (km)	Address	Contact Number/Hotline	Opening Hours	Coordinates
St Luke's Hospital	~1.76 km	2 Bukit Batok Street 11, Singapore 659674	+65 6563 2281	Mon – Sun: 24 hours	1°20'56.95"N, 103°44'31.10"E
Silver Cross Medical (Jurong West)	~1.8 km	502 Jurong West Ave 1, #01-803, Singapore 640502	+65 6899 2141	Fri – Wed: 8am-10pm; Thurs – 8am-5pm	1°21'1.34"N, 103°43'3.76"E
Boon Lay Clinic and surgery	~1.7 km	221 Boon Lay Pl, #01-240, Singapore 640221	+65 6265 5247	Mon – Thurs: 9am-12.30pm, 2-5pm,7-9pm Fri: 9am-12.30pm, 2-5pm; Sat – Sun: 9am-12.30pm	1°20'47.38"N, 103°42'43.15"E
Hisemainn Medical Clinic	~2.4km	Blk 276 Jurong West Street 25 #01-06, 640276	+65 6795 8990	Mon - Fri:8.30am-3.30pm, 6.30-9.30pm; Sat-Sun: 8.30am-12.30pm	1°21'12.63"N, 103°42'13.47"E

Hospitals and Clinics Near *Choa Chu Kang N1 site*

Name of Hospital and Clinic	Distance from Project Site (km)	Address	Contact Number/Hotline	Opening Hours	Coordinates
St Luke's Hospital	~6.7km	2 Bukit Batok Street 11,	+65 6563 2281	Mon – Sun: 24 hours	1°20'56.95"N, 103°44'31.10"E

		Singapore 659674			
MY FAMILY CLINIC (SENJA)	~1.3km	Senja Rd, #01-04 Senja Grande, Blk 628, Singapore 670628	+65 6314 0638	Mon & Wed: 8am-2pm,6-10pm; Tues, Thurs,Fri: 8am-2pm; Sat-Sun: 8am-12pm	1°23'6.30"N, 103°45'36.33"E
Phoenix Clinic & Surgery	~0.5km (walking distance)	150 Jln Teck Whye, 01-43, Singapore 680150	+65 6767 5345	Mon-Fri: 8.30am-2.30pm,7-9.30pm; Sat: 9-11.30pm; Sun: 7-9.30pm	1°22'41.06"N, 103°45'23.20"E

Location of Nearest Hospital/Clinic:



Attachment C

COVID-19 Screening Process and Toolbox Meeting Record Form

Singapore

Appendix C - COVID-19 Screening Process

To help prevent the spread of Covid-19 to employees, sub-consultants, subcontractors, and visitors at AECOM project offices and field locations, it is recommended that all employees, sub-consultants, subcontractors and visitors undergo a screening process as part of the toolbox meeting prior to start of the project.

The AECOM field staff presiding over the toolbox meeting shall:

1. Check if each employee, sub-consultant, subcontractor and visitor at the project site is wearing a surgical or N95 mask. Note that face shields cannot replace masks but can be worn together with a mask;
2. Measure the temperature of each employee, sub-consultant, subcontractor and visitor at the project site using a thermal scanner. The measurement shall be done twice – one in the morning before the toolbox meeting and one in the afternoon prior to start of work; and
3. Ask each employee, sub-consultant, subcontractor and visitor at the project site to answer the questions listed in the Covid-19 Screening Questionnaire below.

Use the Toolbox Meeting Record (**S3[APAC]-006-FM2, Singapore Office version**) to record the temperature and assess whether each employee, sub-consultant, subcontractor and visitor at the project site is fit for duty.

Covid-19 Screening Questionnaire:

1. Do you have any of the following symptoms: fever, cough, muscle aches, fatigue, difficulty breathing, sore throat or vomiting? **Yes or No.**

If the person answers Yes, ask him not to proceed with work. Contact the person's manager to inform that the person is showing at least one of the signs mentioned above and therefore will not be allowed to work. Recommend the person to seek medical assistance if necessary.

2. Have you been diagnosed with COVID-19? **Yes or No.**

If the person answers Yes, ask whether he has been cleared by the Government of Singapore. Ask for certification of negative result, if applicable.

3. a) Have you been in close contact with a confirmed or probable case of COVID-19? **Yes or No.**

   b) If Yes to 3a) have you followed the required isolation period as required by the Singapore Government? **Yes or No.**

If the person answers No to 3b), contact the person's manager to inform that the person will not be allowed to work at the site. If Yes, ask for certification or clearance, if applicable.

4. a) Have you travelled outside Singapore within the past 14 days? **Yes or No.**

   b) If Yes to 2a) did you follow the quarantine instructions by the Singapore Government? **Yes or No or Not applicable**

The person shall be considered fit-for-duty if:

1. The body temperature is below 37 °C; and

2. The person clears the screening questionnaire.

APAC - Singapore

Toolbox Meeting Record – Covid-19

S3[APAC]-006-FM2

Project Name:			
Meeting Location:			
Meeting Date:		**Time:**	

Presenter(s) / Supervisor Leading Toolbox Talk:			
Name:		**Signature:**	
Name:		**Signature:**	

Upcoming Activity Review (activities due to commence on-site in the following week and expected dates of completion & ideas or suggestions for SHEQ improvement)	**Date**
1.	
2.	
3.	
4.	
5.	

Alert / Fact Sheet / Lessons Learnt / Topic Reviewed
1.
2.
3.
4.

Comments / Issues raised by attendees and review of outstanding issues	Action By	Due Date
1.		
2.		
3.		
4.		
5.		

ATTENDEES

The information listed above has been adequately explained to me and I understand how and where to get additional support on the topics covered if I require it.

Name	Company	Fit for Duty Check			
		Morning		Afternoon	
		Temperature	Fit-for-duty?	Temperature	Fit-for-duty?
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					

ATTENDEES **The information listed above has been adequately explained to me and I understand how and where to get additional support on the topics covered if I require it.**					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					

Appendix B
AECOM Job Safety Risk Assessment

Delivering a better world

APPENDIX B:

JOB SAFETY RISK ASSESSMENT

SPECIALIST CONSULTANCY SERVICES FOR ENVIRONMENTAL BASELINE STUDIES (EBS) AT SOUTHERN TENGAH AND CHOA CHU KANG N1

Prepared by:

AECOM Singapore Pte Ltd

300 Beach Road, #23-00 The Concourse,

Singapore 199555

Project Number: ***60651709***

AECOM

JOB SAFETY RISK ASSESSMENT

Project:	Specialist Consultancy Services for Environmental Baseline Studies (EBS) at Southern Tengah and Choa Chu Kang N1	**Location:**	Southern Tengah and Choa Chu Kang N1
Work Activity:	Onsite Survey, water quality sampling, biodiversity surveys, topographic survey, air/noise monitoring		
Personnel Protective Equipment (PPE):	Long-sleeved shirt, long trousers, raincoat/poncho (as applicable), mosquito head net, trekking pole, face shield/mask, knee-high rubber boots and insect repellent.		
Development Team:	**Name/Designation:** Jacquelynn Chia / Consultant **Date:** 5 February 2021	**Reviewed by:**	**Name/Designation:** Jaypee Bautista / Health & Safety Manager **Date:** 5 February 2021
JSRA Type:	☒ New ☐ Revised	**Next Review Date:**	5 February 2022

No	Job Steps	Potential Hazard(s)	Existing Risk Control	Initial Risk Evaluation			Additional Risk Control	Residual Risk Evaluation			Responsible Person	Completed by:
				L	S	R		L	S	R		
1.1	Site walkabout / locating of point counts/transects • Inspecting the area / vicinity walk within the site • Conduct flora and fauna surveys	Slips, trips and fall due to uneven surface, slippery ground, soft soil, obstructions (fence/railing) or wayward objects (FB, FC)	- Use alternative routes, if available, for areas blocked by fences/railings - Assess for slippery, uneven surface or obstructions; remove wayward objects; identify safe routes and pathways; follow designated paths as shown in maps (access maps)	3	2	6	- If climbing over a low fence or railing cannot be avoided, always maintain three-point contact - Use trekking poles or stick to assess the ground and to aid balance when walking around uneven/grassy ground - Remove obstructions - Maintain a slow and steady walking pace while working onsite - Ensure anti-slip threads on safety boots are clean and not worn out	1	3	3	AECOM Personnel	
1.2		Exposure to extreme heat	- Take periodic breaks and keep hydrated – drink water or ionic drinks - Stay under the shade whenever possible	3	2	6	- Apply sunscreen as necessary - Use umbrella as necessary	1	2	3	AECOM Personnel	
1.3		Biological hazard - Mosquito bites (and other insect bites – bees, hornets, ants)	- Read AECOM Safety for Life Safety Alert regarding mosquitoes and malaria - Be on an active lookout for beehives and hornet nests	3	2	6	- Use insect repellent (spray or patch) - Wear light coloured clothing with long sleeves and long pants	1	2	2	AECOM Personnel	

No	Job Steps	Potential Hazard(s)	Existing Risk Control	Initial Risk Evaluation			Additional Risk Control	Residual Risk Evaluation			Responsible Person	Completed by:
				L	S	R		L	S	R		
							- Be aware of peak mosquito hours – avoid works during dusk and dawn - Wear mosquito head nets - Use a poncho/raincoat, if necessary, to cover body parts					
1.4		Biological hazard - Snake bites (CB) / animal bites (wild animals like wild boars)	- Do not approach or provoke wild animals - Leave the area cautiously and slowly	2	3	6	- Avoid walking through dense vegetation / tall grass. Use known tracks or cleared routes (i.e., with no or little vegetation). - If there is a person who is familiar with the site, seek advice on safer or alternative routes. - Always carry a stick or trekking pole which you can use as protection - Use knee-high rubber boots or gaiters, especially when walking on grassy and waterlogged areas - Avoid walking alone in remote sites	1	3	3	AECOM Personnel	
1.5		Intermittent weather	- Stop work during heavy rain or thunderstorm	2	4	8	- Seek shelter; do not hide under trees in case of thunderstorms - Resume work only 30 minutes after a thunderstorm	1	3	3	AECOM Personnel	
2.1	Water Quality Sampling • Grab sampling of water sample using sample container • Use of water quality kit to measure water parameters	Contact with preservatives in sampling bottles (CW)	Wear appropriate PPE, such as nitrile gloves, long sleeve shirts and safety glasses	2	1	2	-				AECOM Personnel	
2.2		Ergonomic hazards – repetitive movements, overreaching, bending, twisting, slouching (O)	- Observe good ergonomic practices such as minimizing twisting, bending and slouching, avoiding overreaching and awkward positions - Sit on a stool, if possible	3	2	6	- Sit on a stool, if possible - Use a trolley to carry buckets to designated waste disposal/storage location or - Avoid overfilling the buckets	1	2	2	AECOM Personnel	

No	Job Steps	Potential Hazard(s)	Existing Risk Control	Initial Risk Evaluation			Additional Risk Control	Residual Risk Evaluation			Responsible Person	Completed by:
				L	S	R		L	S	R		
							(at most, half-filled) if a trolley is not available or usable					
2.3		Slip, trip, fall due soft grounds or slippery surface/uneven grounds while climbing the fence; Getting stuck/trapped in subsiding/very soft ground (FS, FB) Slip, trip and fall into waterbody (FB)	- Observe good housekeeping practices – clean up spills - Maintain slow and steady walking pace while walking on site - Conduct surface water sampling with a buddy as a watchman	2	3	6	- Remove obstructions if observed - Use a trekking pole for additional support - Wear rubber boots / high boots with high traction - Ensure three-point contact while climbing the fence	1	3	3	AECOM Personnel	
3.1	Installation / placement of noise monitoring equipment • Attach microphone to the pole and drive the pole to the ground	Ergonomic – repetitive movement and awkward posture (slouching, twisting, overreaching, kneeling, lifting) when shifting / setting up the equipment	- Keep tools and equipment within arm's reach - Use proper lifting techniques - Use pallet jack/trolley or a two-man lift when lifting heavy equipment - Use proper equipment to extend hand reach instead of overreaching	3	2	6	- Do not sustain awkward positions (e.g. shoulders too high/low, prolonged extension of elbow) - Take frequent breaks to rest muscles and hydrate - Use a stool or knee pad, if possible, to avoid awkward legs	1	2	2	AECOM Personnel	
3.2	• Store battery-powered measurement equipment in the protective box • Secure cable and equipment box • Noise monitoring will run for 1 week before removal • Demobilization – retrieval of equipment from the site	Hand injury (cuts, lacerations, puncture, an abrasions) due to pinch points and sharp edges	- Identify and be aware of possible pinch points and sharp edges during installation of equipment	2	2	4	- Use cut and puncture resistant working gloves	1	1	1	AECOM Personnel	

No	Job Steps	Potential Hazard(s)	Existing Risk Control	Initial Risk Evaluation			Additional Risk Control	Residual Risk Evaluation			Responsible Person	Completed by:
				L	S	R		L	S	R		
4.1	Installation / placement of air monitoring equipment (subcon ALS) • Attach equipment and solar power panel to the ground	Ergonomic – repetitive movement and awkward posture (slouching, twisting, overreaching, kneeling, lifting) when shifting / setting up the equipment	- Keep tools and equipment within arm's reach - Use proper lifting techniques - Use pallet jack/trolley or a two-man lift when lifting heavy equipment - Use proper equipment to extend hand reach instead of overreaching	3	2	6	- Do not sustain awkward positions (e.g. shoulders too high/low, prolonged extension of elbow) - Take frequent breaks to rest muscles and hydrate - Use a stool or knee pad, if possible, to avoid awkward legs	1	2	2	ALS Personnel	
4.2	• Secure cable and equipment box • Barricade the equipment with proper signs indicating the work, contact person details etc • Air monitoring will run for 1 week before removal • Demobilization – retrieval of equipment from the site	Hand injury (cuts, lacerations, puncture, an abrasions) due to pinch points and sharp edges	- Identify and be aware of possible pinch points and sharp edges during installation of equipment	2	2	4	- Use cut and puncture resistant working gloves	1	1	1	ALS Personnel	
5.1	Biodiversity survey	Refer to the General Safety Plan provided in Appendix C and developed by Camphora Pte Ltd for this project									Camphora Personnel	
6.1	Topography Survey	TBD									TBD	

My signature below indicates that all requirements and conditions listed above have been verified, met, and reviewed will all affected personnel prior to start of work.	
Supervisor's Signature: Jagriti Dawra	Date/Time: 17-Feb-2021

I have read this JSRA, and I understand the hazards and safe work practices associated with the task.			
Signature: Dr Hoai Thanh Nguyen	Date/Time: 19-Feb-2021	Signature: Jacquelynn Chia	Date/Time: 17-Feb-2021

Signature:	Dr Liang Liang	Date/Time: 19-Feb-2021	Signature:	Grujica Sarenac	Date/Time: 19-Feb-2021
Signature	Phyo Naing Zay	Date/Time: 19-Feb-2021	Signature:	Hanzel Lalitan	Date/Time: 19-Feb-2021
Signature:	Rou Jie Tan	Date/Time: 18-Feb-2021	Signature:	Yee Chian Choo	Date/Time: 17-Feb-2021
Signature:	Reva Gupta	Date/Time: 18-Feb-2021	Signature:		Date/Time:
Signature:		Date/Time:	Signature:		Date/Time:

Risk Assessment Matrix:

Likelihood / Severity	*Rare (1)*	*Remote (2)*	*Occasional (3)*	*Frequent (4)*	*Almost Certain (5)*
Catastrophic (5)	5	10	15	20	25
Major (4)	4	8	12	16	20
Moderate (3)	3	6	9	12	15
Minor (2)	2	4	6	8	10
Negligible (1)	1	2	3	4	5

Code for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Fall to Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Fall – Same Level (FS)	Release To (R)	Struck By (SB)

Appendix C
Camphora Safety Plan

Delivering a better world

RISK ASSESSMENT FORM

Company:	Camphora Pte Ltd	**Conducted by:**	Derek Yap		Reference
Process:	Conducting Flora, Fauna and Arboriculture in Forested Site	**Names, designations:**	Lead Arborist		Cam-EIA
Location:	Choa Chu Kang N1	**Date:**	Jan-21		
First Assessment Date:	N/A	**Project Name:**	EBS CCK N1		
Last Review Date:	N/A				

1. Hazard Identification				2. Risk Evaluation				3. Risk Control	
1a.	**1b.**	**1c.**	**1d.**	**2a.**	**2b.**	**2c.**	**2d.**	**3a.**	**3b.**
No.	**Work Activity**	**Hazard**	**Possible Accident / Ill Health & Persons-at-Risk**	**Existing Risk Control (if any)**	**S**	**L**	**Risk Level**	**Additional Risk Control**	**Action Officer, Designation (Follow-up date)**
1	Mobilisation of project team	Unaware of site conditions and site-specific safety rules and regulations	Entering into prohibited areas, injury to persons	1) Ensure approval has been granted by clients/authority; carry approval letter if available; seek advice from clients regarding site access/conditions. 2) Check in to company group chat before work commences and check out after work is done.	2	1	2 (L)	Study topography plans prior to entry.	Designated team leader for the project
2	Working outdoors	Heat, humidity	Heat injuries, heat stroke	Bring plenty of water; take regular breaks; be aware of heat injuries and the symptoms	4	1	4 (M)	Wear light-coloured and breathable clothings and head gear (e.g hats) Look out for team mates	Designated team leader for the project
3	Working outdoors	Lightning, rain, gusty wind	Lightning strike	Stop all work activity. Get out of site as soon as possible or seek shelter when there is lightning. Do not stay under tall trees and avoid open spaces.	5	1	5 (M)	Monitor NEA weather forecast app for lightning risk, rain activity and strong wind. Continue work, only after waiting for at least 30 minutes after the last lightning strike	Designated team leader for the project

4	Working within natural/forested areas/grasslands	Falling branches, dangerous fauna, thorns, toxic plants, hidden obstacles, uneven grounds, potholes, slippery, muddy, rocky surfaces	Stings/bites/scratches, trips/slips/falls, head injury, feet injury, getting lost	1) Work in a group of at least two people; conduct visual assessment of surroundings for hornets/bees/snakes/dead branches/roots/protruding vegetation while walking; stamp feet and make loud noises when walking through thick vegetation 2) Wear long sleeves and pants; wear appropriate close-toed footwear; use clear paths where possible; ensure experienced field personnel are present at all times; bring first aid kit; avoid touching toxic plants 3) Check your bags prior to carrying it, if you leave it on the ground in case of fauna crawling into it 4) Wear gloves to handle bats to prevent bites 5)Familiarise with the emergency response plans	3	1	3 (L)	1) Exit forested site during inclement weather; use GPS to track location; bring spare batteries for GPS; remain contactable by mobile phone. Inform team leads upon entering/exiting site via phone 2) First aid kit to have anti-histamines for bee stings. 3) Use flagging tape to demarcate locations of hidden obstacles to warn other team mates	Designated team leader for the project

5	Night works	Low lighting conditions. Uneven terrain. Dangerous fauna, getting lost	Stings/bites/scratches, trips/slips/falls, bodily injury, getting lost	1) Work in a group of at least 3 people; conduct visual assessment of surroundings for hornets/bees/snakes/dead branches/roots/protruding vegetation while walking; stamp feet and make loud noises when walking through thick vegetation; 2) Wear long sleeves and pants; wear appropriate close-toed footwear; use clear paths where possible; ensure experienced field personnel are present at all time 3) Bring first aid kit; avoid areas where crocodiles have been sighted; ensure sufficient light while working. 4) Familiarise with the emergency response plans	2	1	2 (L)	Use GPS to track location; bring spare batteries for GPS; remain contactable by mobile phone; bring spare batteries for torches/headlamps	Designated team leader for the project
6	Working at the water edges	Falling into water	Injuries due to trips/slips/falls, drowning	1) Work in a group of at least 2 people; wear appropriate close-toed footwear with grip; avoid working near the edge of deep water.	4	1	4 (M)	-	Designated team leader for the project

7	Working in streams Crossing stream or canal	Soft substrate, slippery surface, debris, rocks, dangerous animals	Slips/falls, cuts, scratches, stings/bites Injury due to crossing deep or fast flowing stream, or canal	1) Work in a group of at least two person; look before stepping into stream, avoid slippery rocks; wear appropriate footwear such as booties and covered shoes 2) Bring first aid kit 3) Assess surroundings to find a crossing at narrow, slow moving part of stream. As a guide no deeper than knee depth. Can use a stick to determine the depth and softness of the substrate. Where possible, put plank across to facilitate crossing. If stream cannot be crossed safely, detour to find another safer route.	3	1	3 (L)	Feel the ground as we walk in waters	Designated team leader for the project
8	Working within water bodies	Soft substrate, large boulders, loose fishing lines, dangerous animals, sharp objects	Stings/bites/scratches , trips/slips/falls/cuts	1) Work in a group of at least 2 people; keep to no more than 2m from other personnel when in the water; wear appropriate footwear such as booties; wear long sleeves and pants; 2) Ensure experienced field personnel are present at all times; ensure personnel know how to navigate through muddy/soft ground areas and identify points to avoid and traverse; bring first aid kit.	3	1	3 (L)	Ensure that a third individual is present on-site (who is not in the water) and remains contactable by mobile phone; ensure access to hot water to treat stings/bites by echinoderms, fishes, worms, etc.	Designated team leader for the project
9	Working near steep slopes	Falling from slope	Injury from trips/slips/falls	1) Watch our steps and not stand too close to edge. Avoid walking down steep slopes, and find other ways to go down. 2) Wear proper footwear	2	1	2 (L)	Avoid works during inclement weather to avoid slips/falls.	Designated team leader for the project

10	Plant collection, clearing of path	Use of sharp tools such as parang, secateurs, hammer	Cuts and injuries by improper use of hammer, secateurs and parang	1) Be aware of cutting points and your surroundings; do not be distracted when making cuts. Ensure no one is nearby when using parang and stay away from the person using parang 2) Bring first aid kit	2	1	2 (L)	Wear gloves.	Designated team leader for the project
11	Carrying of heavy equipment from point to point	Improper lifting technique	Health issue such as back pain, strained muscles	Use the correct lifting and putting down technique, always bend the knees to lift the heavy equipment instead of bending the back. More people to help carry if too heavy.	3	1	3 (L)	Use trolley whenever possible. Take turns to carry. If need to carry for a distance, rest in between every once a while before proceeding to walk with the equipment	Designated team leader for the project
13	General field work during Post-circuit breaker period in forested areas	Physical contact with other personnel that can lead to the spread of the coronavirus	COVID-19 infection	1) Comply to the regulations set by authorities. Wear a mask. 2) Work in small teams of no more than 8 people; ensure proper record-keeping of personnel present for each work session; keep at least 1m safe distance from other personnel where possible.	5	1	5 (M)	Good personal hygiene. Support contact tracing by activating the TraceTogether app; check body temperature before starting work and see a doctor and do not go to work if temperature is 37.8^{o}C or above. Do not go to work if unwell, see a doctor	Designated team leader for the project

CAMPHORA PTE LTD RISK ASSESSMENT

Severity	(1)	(2)	(3)	(4)	(5)
Catastrophic (5)	5 (M)	10 (M)	15 (H)	20 (H)	25 (H)
Major (4)	4 (M)	8 (M)	12 (M)	16 (H)	20 (H)
Moderate (3)	3 (L)	6 (M)	9 (M)	12 (M	15 (H)
Minor (2)	2 (L)	4 (M)	6 (M)	8 (M)	10 (M)
Negligible (1)	1 (L)	2 (L)	3 (L)	4 (M)	5 (M)

H= High Risk, M = Medium risk, L = Low Risk

Likelihood		Description
Almost Certain	5	Continual or repeating experience.
Frequent	4	4 Common occurrences.
Occasional	3	Possible or known to occur.
Remote	2	Not likely to occur under normal circumstances.
Rare	1	Not expected to occur but still possible.

Severity		Description
Catastrophic	5	Fatality, fatal diseases or multiple major injuries.
Major	4	Serious injuries or life-threatening occupational disease (includes amputations, major fractures, multiple injuries, occupational cancer, acute poisoning).
Moderate	3	Injury requiring medical treatment or ill-health leading to disability (includes lacerations, burns, sprains, minor fractures, dermatitis, deafness, work-related upper limb disorders).
Minor	2	Injury or ill-health requiring first-aid only (includes minor cuts and bruises, irritation, ill-health with temporary discomfort).
Negligible	1	Not likely to cause injury or ill-health

Risk level	Risk Acceptability	Recommended actions
High Risk	Not acceptable	• High Risk level must be reduced to at least Medium Risk before work commences. • There should not be any interim risk control measures. Risk control measures should not be overly dependent on PPE or appliances. • If practicable, the hazard should be eliminated before work commences. • Management review is required before work commences.
Medium Risk	Tolerable	• A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as reasonably practicable (ALARP) within a defined time period. • Interim risk control measures, such as administrative controls or PPE, may be implemented while longer term measures are being established. • Management attention is required.
Low Risk	Acceptable	• No additional risk control measures may be needed. • Frequent review and monitoring of hazards are required to ensure that the risk level assigned is accurate and does not increase overtime.

Contact Information		Remarks	Equipment Checklist	
Emergency Contacts			Equipment	Numbers
Ambulance	995		GPS (Garmin 64s)	
Fire	995		Binoculars	
Police	999		Hammer and nails	
Hospital with anti-venom			Long Pruner, Parang	
Alexandra Hospital	6472 2000		Camera Traps	
National University Hospital	6779 5555		Differential GPS	
Tan Tock Seng Hospital	6256 6011			
S'pore General Hospital	6222 3322			

Client Contacts

	Personnel title	Name	IC no.	Contact no.
1	Project Manager (AECOM)	Hoai Thanh Nguyen	-	

Team Contacts

	Personnel title	Name	IC no.	Contact no.
1	Project manager (OIC)	Siti Zaleha	SXXXX919E	
2	Project coordinator (2IC)	Joys Tan	SXXXX850F	

3	Arborist	Derek Yap	SXXXX806C		
4	Senior Flora Specialist	Boo Chih Min	SXXXX320A		

Appendix D
Flora Species List

Delivering a better world

Species	Family	Common Name	Origin	Status
Ageratum conyzoides	Asteraceae	Billygoat-Weed, Chick Weed, Goatweed	Exotic	Naturalised
Alocasia macrorrhizos	Araceae	Giant Taro, Greater Alocasia, Birah Negeri	Exotic	Naturalised
Artemisia vulgaris	Asteraceae	Common Mugwort, Common Wormwood, Moxa	Exotic	Cultivated only
Artocarpus altilis	Moraceae	Breadfruit, Sukun, Suku	Exotic	Casual
Artocarpus heterophyllus	Moraceae	Jackfruit, Nangka, Jack	Exotic	Casual
Asplenium nidus	Aspleniaceae	Bird's Nest Fern, Rumah Langsuyar, Paku Pandan	Native	Common
Asystasia gangetica ssp. *micrantha*	Acanthaceae	Common Asystasia, Chinese Violet, Creeping Foxglove	Exotic	Naturalised
Averrhoa carambola	Oxalidaceae	Star Fruit, Belimbing Manis, Kembola	Exotic	Casual
Axonopus compressus	Poaceae	Tropical Carpet Grass, Wide-Leaved Carpet Grass, Cow Grass	Exotic	Naturalised
Baccaurea motleyana	Phyllanthaceae	Rambai, Common Rambai, Jelintik	Native	Critically Endangered
Bambusa cf. *heterostachya*	Poaceae	-	Exotic	Casual
Basella alba	Basellaceae	Indian Spinach, Ceylon Spinach	Exotic	Cultivated only
Bidens alba	Asteraceae	Shepherd's Needles, Butterfly Needles, Hairy Beggartick	Exotic	Cultivated only
Bidens pilosa	Asteraceae	Begger's Tick, Hairy Beggarticks, Spanish Needles	Exotic	Naturalised
Bridelia stipularis	Phyllanthaceae	Kenidai, Kernam	Native	Vulnerable
Canarium odontophyllum	Burseraceae	Dabai, Kambayau	Exotic	Cultivated only
Carica papaya	Caricaceae	Papaya, Betik, Pawpaw, Betek	Exotic	Casual
Centrosema molle	Fabaceae	-	Exotic	Naturalised
Chamaesyce hirta	Euphorbiaceae	Hairy Spurge, Ara Tanah, Asthma Weed	Exotic	Naturalised
Chamaesyce thymifolia	Euphorbiaceae	-	Cryptogenic	-
Chrysopogon aciculatus	Poaceae	Love Grass, Temuchut	Native	Common
Chukrasia tabularis	Meliaceae	Chittagong Wood, Chukrasia, Chickrassy	Exotic	Cultivated only
Cinnamomum iners	Lauraceae	Wild Cinnamon, Clove Cinnamon, Kayu Manis	Native	Common
Citrus x aurantiifolia	Rutaceae	Lime, Limau, Limau Asam	Exotic	Cultivated only
Cleome rutidosperma	Cleomaceae	Fringed Spiderflower, Ciliate Spider-Flower, Consumption Weed	Exotic	Naturalised
Clidemia hirta	Melastomataceae	Koster's Curse	Exotic	Naturalised
Clitoria ternatea	Fabaceae	Butterfly Pea, Blue Pea, Blue Vine	Exotic	Naturalised
Commelina diffusa	Commelinaceae	Spreading Dayflower, Climbing Dayflower, Scurvy Weed	Cryptogenic	-
Cordyline fruticosa	Asparagaceae	Red Dracaena, Cabbage Tree	Exotic	Casual
Crassocephalum crepidioides	Asteraceae	Thickhead Weed, Redflower Ragleaf, Fireweed	Exotic	Naturalised
Cyathula prostrata	Amaranthaceae	Hookweed, Pastureweed, Nyarang	Native	Common
Davallia denticulata	Davalliaceae	Rabbit's Foot Fern, Paku Tertutup	Native	Common
Dendrobium crumenatum	Orchidaceae	Pigeon Orchid, White Dove Orchid, Pigeon Flower	Native	Common
Desmodium heterophyllum	Fabaceae	Variable-Leaf Tick Trefoil, Spanish Clover, Greater Clover-Leaved Desmodium	Cryptogenic	-
Digitaria longiflora	Poaceae	False Couch Grass	Native	Common
Dimocarpus longan ssp. *malesianus*	Sapindaceae	Mata Kuching	Exotic	Casual
Dracaena surculosa	Ruscaceae	Gold Dust Dracaena, Spotted Dracaena, Japanese Bamboo	Exotic	Cultivated only
Drynaria quercifolia	Polypodiaceae	Oak Leaf Fern, Daun Kepala Tupai, Sakat Laipang	Native	Common
Durio zibethinus	Malvaceae	Durian, Durian Kampong	Exotic	Casual
Eleutheranthera ruderalis	Asteraceae	-	Exotic	Naturalised

Emilia sonchifolia	Asteraceae	Katumbi Jantan, Cupid's Shaving Brush, Emilia	Cryptogenic	-
Epipremnum aureum	Araceae	Ivy Arum, Golden Pothos, Money Plant	Exotic	Casual
Epipremnum pinnatum	Araceae	Dragon-Tail Plant, Taro Vine, Silver Vine	Native	Critically Endangered
Eragrostis unioloides	Poaceae	-	Native	Common
Ficus benjamina	Moraceae	Weeping Fig, Benjamin's Fig, Java Fig	Cryptogenic	-
Ficus elastica	Moraceae	Rubber Plant, Rubber Tree	Exotic	Casual
Ficus heteropleura	Moraceae	Sandy-Leafed Fig	Native	Common
Ficus microcarpa	Moraceae	Malayan Banyan, Jejawi, Curtain Fig	Native	Common
Ficus punctata	Moraceae	Climbing Fig, Tangisong Burong	Native	Common
Fimbristylis dichotoma	Cyperaceae	-	Cryptogenic	-
Gomphrena globosa	Amaranthaceae	Globe Amaranth, Bachelor's Button, Thousand Day Red	Exotic	Cultivated only
Gymnopetalum scabrum	Cucurbitaceae	-	Cryptogenic	-
Heterotis rotundifolia	Melastomataceae	Spanish Shawl, Pinklady, Trailing Dissotis	Exotic	Cultivated only
Hibiscus mutabilis	Malvaceae	Confederate Rose, Dixie Rosemallow, Cotton Rose	Exotic	Cultivated only
Hura crepitans	Euphorbiaceae	Sandbox Tree, Monkey's Dinner Bell, Huru	Exotic	Cultivated only
Impatiens balsamina	Balsaminaceae	Garden Balsam, Rose Balsam, Touch-Me-Not	Exotic	Cultivated only
Imperata cylindrica	Poaceae	Lalang, Cogon Grass, Alang-Alang	Cryptogenic	-
Indigofera hirsuta	Fabaceae	Hairy Indigo, Roughhairy Indigo	Exotic	Naturalised
Ipomoea batatas	Convolvulaceae	Sweet Potato, Keledek	Exotic	Casual
Ipomoea cairica	Convolvulaceae	Messina Creeper, Mile A Minute Vine, Railway Creeper	Exotic	Naturalised
Ischaemum muticum	Poaceae	Seashore Centipede Grass, Rumput Tembaga Jantan, Rumput Kemarau	Native	Common
Khaya senegalensis	Meliaceae	Senegal Mahogany, African Mahogany, Senegal Khaya	Exotic	Cultivated only
Kyllinga nemoralis	Cyperaceae	White Kyllinga, Whitehead Spikesedge, White Water Sedge	Cryptogenic	-
Kyllinga polyphylla	Cyperaceae	Navua Sedge	Exotic	Naturalised
Leuenbergeria bleo	Cactaceae	Wax Rose, Rose Cactus, Jarum Tujuh Bilah	Exotic	Cultivated only
Mangifera indica	Anacardiaceae	Mango, Mangas, Mangga	Exotic	Casual
Mangifera odorata	Anacardiaceae	Saipan Mango, Fragrant Mango, Kuini	Native	Vulnerable
Melothria pendula	Cucurbitaceae	Guadeloupe Cucumber	Exotic	Naturalised
Microsorum punctatum	Polypodiaceae	-	Native	Common
Mikania micrantha	Asteraceae	American Rope, Mile-A-Minute Weed, Bittervine	Exotic	Naturalised
Mimosa diplotricha	Fabaceae	-	Exotic	Naturalised
Mimosa pudica	Fabaceae	Sensitive Plant, Sleepy Plant, Action Plant	Exotic	Naturalised
Morus alba	Moraceae	White Mulberry	Exotic	Cultivated only
Musa acuminata	Musaceae	-	Exotic	Cultivated only
Nelsonia canescens	Acanthaceae	Blue Pussyleaf	Exotic	Naturalised
Nephelium lappaceum	Sapindaceae	Rambutan, Hairy Lychee	Native	Critically Endangered
Nephrolepis biserrata	Oleandraceae	Broad Sword Fern, Paku Larat, Giant Sword Fern	Native	Common
Oldenlandia corymbosa	Rubiaceae	Two-Flowered Oldenlandia, Flat-Top Mille Graines, Old World Diamond-Flower	Exotic	Naturalised
Oxalis barrelieri	Oxalidaceae	Lavender Sorrel	Exotic	Naturalised
Oxalis corniculata	Oxalidaceae	Yellow Wood Sorrel, Creeping Wood Sorrel	Exotic	Naturalised
Paederia foetida	Rubiaceae	Lesser Malayan Stinkwort, Akar Sekentut, Daun Kentut-Kentut	Native	Common

Paspalum conjugatum	Poaceae	Buffalo Grass, Hilo Grass	Exotic	Naturalised
Philodendron erubescens	Araceae	Blushing Philodendron, Red-Leaf Philodendron	Exotic	Cultivated only
Phyllanthus amarus	Phyllanthaceae	Child Pick-A-Back, Gale Of Wind, Carry Me Seed	Exotic	Naturalised
Phyllanthus urinaria	Phyllanthaceae	Shatterstone, Leafflower, Chamber Bitter	Exotic	Naturalised
Piper sarmentosum	Piperaceae	Wild Pepper, Wild Betel, Kadok	Native	Common
Plectranthus monostachyus	Lamiaceae	Monkey's Potato	Exotic	Naturalised
Portulaca grandiflora	Portulacaceae	Japanese Rose, Moss Rose, Portulaca	Exotic	Cultivated only
Portulaca oleracea	Portulacaceae	-	Exotic	Naturalised
Pterocarpus indicus	Fabaceae	Angsana, Sena, Burmese Rosewood	Exotic	Casual
Ptychosperma macarthurii	Arecaceae	Macarthur Palm, Hurricane Palm, Macarthur Feather Palm	Exotic	Naturalised
Pyrrosia longifolia	Polypodiaceae	Suloi	Native	Common
Pyrrosia piloselloides	Polypodiaceae	Dragon's Scale Fern, Sakat Ribu-Ribu, Sisek Naga	Native	Common
Ruellia prostrata	Acanthaceae	-	Exotic	Unknown
Samanea saman	Fabaceae	Rain Tree, Pukul Lima, Cow Tamarind	Exotic	Casual
Sandoricum koetjape	Meliaceae	Sentul, Santol, Sentol	Native	Endangered
Sansevieria cylindrica	Asparagaceae	Common Spear Plant, Spear Sansevieria	Exotic	Cultivated only
Schefflera actinophylla	Araliaceae	Umbrella Tree, Octopus Tree, Australian Ivy - Palm	Exotic	Casual
Selenicereus undatus	Cactaceae	Dragon Fruit, Pitaya, Common Night Blooming Cerus	Exotic	Cultivated only
Setaria barbata	Poaceae	-	Exotic	Naturalised
Solanum torvum	Solanaceae	Turkey Berry, Devil's Fig, Terung Pipit	Exotic	Naturalised
Spathodea campanulata	Bignoniaceae	African Tulip Tree, Flame Of The Forest, Fountain Tree	Exotic	Naturalised
Sphagneticola trilobata	Asteraceae	Yellow Creeping Daisy, Singapore Daisy, Creeping Ox-Eye	Exotic	Naturalised
Sporobolus indicus var. *major*	Poaceae	Giant Parramatta Grass	Native	Common
Striga asiatica	Orobanchaceae	Asiatic Witchweed	Cryptogenic	-
Struchium sparganophorum	Asteraceae	-	Exotic	Naturalised
Synedrella nodiflora	Asteraceae	Cinderella Weed, Pig's Grass	Exotic	Naturalised
Syngonium podophyllum	Araceae	Arrowhead Vine	Exotic	Naturalised
Syzygium aqueum	Myrtaceae	Water Apple, Jambu Air Mawar, Water Rose Apple	Exotic	Cultivated only
Syzygium lineatum	Myrtaceae	Common Kelat, Gelam Tikus, Ubah	Native	Common
Tabebuia rosea	Bignoniaceae	Trumpet Tree, Pink Poui, New World Trumpet	Exotic	Casual
Talinum triangulare	Portulacaceae	Surinum Purslane, Ceylon Spinach, Waterleaf	Exotic	Cultivated only
Tecoma stans	Bignoniaceae	Golden Bells, Yellow Bells, Yellow Bignonia	Exotic	Cultivated only
Terminalia mantaly	Combretaceae	Madagascar Almond, Umbrella Tree	Exotic	Cultivated only
Thunbergia fragrans	Acanthaceae	Angel Wings, Fragrant Thunbergia, Indra Pushpa	Exotic	Naturalised
Tridax procumbens	Asteraceae	Coat Buttons, Kanching Baju	Exotic	Naturalised
Typhonium roxburghii	Araceae	-	Cryptogenic	-
Xanthosoma sagittifolium	Araceae	-	Exotic	Cultivated only
Zoysia japonica	Poaceae	Japanese Lawn Grass, Korean Lawn Grass, Korean Grass	Exotic	Cultivated only

Appendix E
List and Location of Plant Species of Conservation Significance

Delivering a better world

Species	Family	Origin	Status	Habit	Northing	Easting
Bridelia stipularis	Phyllanthaceae	Native	Vulnerable	Climber	40600.414	19485.567

Appendix F
List and Location of Plant Species of Conservation Significance

Delivering a better world

Appendix F - List and Location of Large Specimens

Tag ID	Species	Family	Origin	Status	Girth/ spread (m)	Height (m)	Northing (DGPS)	Easting (DGPS)
CCK005	*Samanea saman*	Fabaceae	Exotic	Casual	3	10	40482.245	19696.691
CCK007	*Samanea saman*	Fabaceae	Exotic	Casual	3.95	11	40526.41	19674.04
CCK008	*Samanea saman*	Fabaceae	Exotic	Casual	3	10	40542.299	19668.227
CCK022	*Samanea saman*	Fabaceae	Exotic	Casual	4.8	11	40475.053	19776.17
CCK024	*Samanea saman*	Fabaceae	Exotic	Casual	3.35	9	40517.939	19754.234
CCK038	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	3.8	12	40597.053	19547.462
CCK039	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	5.2	16	40593.928	19540.023
CCK043	*Samanea saman*	Fabaceae	Exotic	Casual	4.4	15	40532.87	19590.572
CCK048	*Samanea saman*	Fabaceae	Exotic	Casual	3.85	15	40499.212	19615.06
CCK049	*Samanea saman*	Fabaceae	Exotic	Casual	3.4	15	40494.263	19619.033
CCK052	*Samanea saman*	Fabaceae	Exotic	Casual	3.4	15	40497.514	19603.039
CCK062	*Samanea saman*	Fabaceae	Exotic	Casual	3.1	15	40454.799	19624.963
CCK067	*Samanea saman*	Fabaceae	Exotic	Casual	3.5	15	40450.817	19643.646
CCK069	*Samanea saman*	Fabaceae	Exotic	Casual	3.05	15	40446.873	19635.619
CCK073	*Samanea saman*	Fabaceae	Exotic	Casual	3.3	15	40429.997	19639.847
CCK076	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	15	40442.494	19657.791
CCK078	*Samanea saman*	Fabaceae	Exotic	Casual	3.8	15	40434.75	19658.551
CCK080	*Samanea saman*	Fabaceae	Exotic	Casual	3.1	15	40427.957	19662.167
CCK082	*Samanea saman*	Fabaceae	Exotic	Casual	3.9	15	40410.623	19656.289
CCK091	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	12	40390.007	19642.873
CCK099	*Samanea saman*	Fabaceae	Exotic	Casual	3.1	14	40407.187	19630.092
CCK102	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	13	40428.737	19611.985
CCK107	*Samanea saman*	Fabaceae	Exotic	Casual	4.1	14	40449.836	19606.817
CCK116	*Samanea saman*	Fabaceae	Exotic	Casual	3.7	14	40478.059	19573.526
CCK117	*Samanea saman*	Fabaceae	Exotic	Casual	3	15	40487.632	19574.405
CCK120	*Artocarpus altilis*	Moraceae	Exotic	Casual	3.7	16	40498.368	19572.154
CCK129	*Samanea saman*	Fabaceae	Exotic	Casual	3.7	15	40531.414	19546.229
CCK134	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	15	40550.517	19536.64
CCK139	*Samanea saman*	Fabaceae	Exotic	Casual	3.7	18	40586.33005	19511.66388
CCK149	*Samanea saman*	Fabaceae	Exotic	Casual	3.7	17	40602.13999	19503.8854
CCK152	*Ficus benjamina*	Moraceae	Cryptogenic	-	3.9	15	40625.02997	19481.18352
CCK153	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	5.4	15	40638.29997	19463.82312

CCK158	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	14	40665.62002	19431.3281
CCK165	*Khaya senegalensis*	Meliaceae	Exotic	-	3.5	12	40681.54003	19425.43039
CCK166	*Khaya senegalensis*	Meliaceae	Exotic	-	3.7	15	40698.78999	19417.75212
CCK167	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	14	40702.98996	19421.09088
CCK168	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	14	40706.74995	19410.96386
CCK172	*Khaya senegalensis*	Meliaceae	Exotic	-	3.4	14	40741.13999	19401.17169
CCK173	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	14	40722.89004	19390.37623
CCK174	*Khaya senegalensis*	Meliaceae	Exotic	-	3.4	14	40725.99004	19382.80879
CCK175	*Khaya senegalensis*	Meliaceae	Exotic	-	3	13	40726.65	19377.91217
CCK176	*Khaya senegalensis*	Meliaceae	Exotic	-	3.05	13	40748.43995	19383.69983
CCK182	*Samanea saman*	Fabaceae	Exotic	Casual	3.4	14	40788.58005	19379.02707
CCK187	*Ficus benjamina*	Moraceae	Cryptogenic	-	3.2	16	40803.73004	19369.01171
CCK192	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	15	40798.41995	19346.97666
CCK194	*Samanea saman*	Fabaceae	Exotic	Casual	3.1	15	40826.62002	19346.8663
CCK213	*Samanea saman*	Fabaceae	Exotic	Casual	3.1	14	40895.28	19294.1184
CCK216	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	14	40921.93004	19273.41985
CCK218	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3.2	10	40941.50996	19254.61296
CCK219	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3	10	40953.88998	19256.9504
CCK222	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3	10	40976.22999	19234.24856
CCK223	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3.4	10	40981.08999	19227.23762
CCK228	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3	8	41027.75996	19197.08035
CCK231	*Khaya senegalensis*	Meliaceae	Exotic	-	3.6	13	41118.76005	19149.67507
CCK233	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	13	41119.41999	19152.2347
CCK234	*Khaya senegalensis*	Meliaceae	Exotic	-	3.1	12	41119.18997	19162.69568
CCK237	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3.6	10	41100.07001	19178.94296
CCK239	*Khaya senegalensis*	Meliaceae	Exotic	-	3.8	12	41143.20004	19188.18124
CCK242	*Khaya senegalensis*	Meliaceae	Exotic	-	3.4	12	41099.85001	19223.79168
CCK245	*Khaya senegalensis*	Meliaceae	Exotic	-	3	8	41098.40995	19261.62926
CCK248	*Samanea saman*	Fabaceae	Exotic	Casual	4.5	12	40618.82	19510.58
CCK258	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	14	40705.81	19460.24
CCK271	*Khaya senegalensis*	Meliaceae	Exotic	-	3.1	16	40743.27	19424.87
CCK272	*Khaya senegalensis*	Meliaceae	Exotic	-	3.2	17	40742.65	19444.16
CCK275	*Khaya senegalensis*	Meliaceae	Exotic	-	3.5	15	40786.17	19451.23

CCK282	*Khaya senegalensis*	Meliaceae	Exotic	-	3.6	18	40786.49	19405.16
CCK285	*Khaya senegalensis*	Meliaceae	Exotic	-	3.3	18	40816.79	19369.68
CCK286	*Khaya senegalensis*	Meliaceae	Exotic	-	3.4	20	40809.39	19371.38
CCK291	*Khaya senegalensis*	Meliaceae	Exotic	-	3	20	40842.89	19362.14
CCK300	*Khaya senegalensis*	Meliaceae	Exotic	-	3	22	40864.78	19349.82
CCK301	*Khaya senegalensis*	Meliaceae	Exotic	-	3.6	20	40877.34	19347.16
CCK305	*Khaya senegalensis*	Meliaceae	Exotic	-	3.4	19	40866.39	19382.9
CCK306	*Khaya senegalensis*	Meliaceae	Exotic	-	3.4	18	40878.55	19380.16
CCK310	*Khaya senegalensis*	Meliaceae	Exotic	-	3	17	40942.8	19353.58
CCK315	*Khaya senegalensis*	Meliaceae	Exotic	-	3.7	18	40940.03	19356.94
CCK319	*Samanea saman*	Fabaceae	Exotic	Casual	3	18	40914.37	19315.58
CCK321	*Samanea saman*	Fabaceae	Exotic	Casual	3	18	40911.46	19306.15
CCK322	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	18	40912.81	19298.59
CCK323	*Samanea saman*	Fabaceae	Exotic	Casual	3.4	18	40910.78	19294.51
CCK332	*Khaya senegalensis*	Meliaceae	Exotic	-	3	18	40957.88	19343.21
CCK335	*Khaya senegalensis*	Meliaceae	Exotic	-	3.1	18	40970.52	19323.8
CCK336	*Ficus microcarpa*	Moraceae	Native	Common	8	18	40965.1	19312.82
CCK338	*Samanea saman*	Fabaceae	Exotic	Casual	3.7	18	40945.86	19290.73
CCK342	*Samanea saman*	Fabaceae	Exotic	Casual	3.2	15	40931.34	19280.25
CCK347	*Khaya senegalensis*	Meliaceae	Exotic	-	4	17	40975.01	19306.23
CCK361	*Khaya senegalensis*	Meliaceae	Exotic	-	3	15	41021.69	19271.03
CCK365	*Ficus microcarpa*	Moraceae	Native	Common	3.2	15	41017.47	19224.87
CCK368	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	3.6	14	41044.98	19200.55
CCK376	*Khaya senegalensis*	Meliaceae	Exotic	-	3	20	41068.11	19244.66
CCK377	*Khaya senegalensis*	Meliaceae	Exotic	-	3	20	41075.66	19241.28
CCK380	*Khaya senegalensis*	Meliaceae	Exotic	-	3	15	41089.31	19238.68

Appendix G
List and Location of Other Specimens of Value

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Appendix G - List and Location of Other Specimens of Value

Tag ID	Species	Family	Origin	Status	Girth/Spread (m)	Height (m)	Northing	Easting
-	*Bambusa* cf. *heterostachya*	Poaceae	Exotic	-	2.5	6	40734.874	19474.999
CCK119	*Nephelium lappaceum*	Sapindaceae	Native	Critically endangered	1.1	10	40497.897	19577.732
CCK152	*Ficus benjamina*	Moraceae	Cryptogenic	-	3.9	15	40625.02997	19481.18352
CCK187	*Ficus benjamina*	Moraceae	Cryptogenic	-	3.2	16	40803.73004	19369.01171
CCK336	*Ficus microcarpa*	Moraceae	Native	Common	8	18	40965.1	19312.82
CCK365	*Ficus microcarpa*	Moraceae	Native	Common	3.2	15	41017.47	19224.87

Appendix H
List and Location of All Tree Specimen

Delivering a better world

Tag ID	Species	Family	Origin	Status	Habit	Girth/ spread (m)	Height (m)	Northing (DGPS)	Easting (DGPS)
CCK001	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.95	10	40377.215	19755.589
CCK002	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	2.1	10	40395.487	19741.627
CCK003	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.85	9	40406.392	19735.065
CCK004	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.25	10	40435.357	19720.886
CCK005	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3	10	40482.245	19696.691
CCK006	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.55	10	40504.015	19685.205
CCK007	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.95	11	40526.41	19674.04
CCK008	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3	10	40542.299	19668.227
CCK009	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.85	10	40554.671	19661.946
CCK010	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.4	8	40562	19697.082
CCK011	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.6	8	40507.67	19717.43
CCK012	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	9	40496.251	19722.792
CCK013	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2	7	40485.958	19728.228
CCK014	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.65	7	40475.356	19734.422
CCK015	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.9	10	40425.464	19775.279
CCK016	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	0.95	6	40412.105	19771.723
CCK017	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.4	9	40410.671	19811.385
CCK018	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1	9	40426.097	19804.368
CCK019	*Peltophorum pterocarpum*	Fabaceae	Native	Critically endangered	Tree	2.2	9	40437.741	19800.589
CCK020	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.4	9	40440.099	19797.711
CCK021	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.85	8	40455.422	19792.327
CCK022	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	4.8	11	40475.053	19776.17
CCK023	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	2.4	9	40505.559	19761.674
CCK024	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.35	9	40517.939	19754.234
CCK025	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.3	9	40568.307	19736.139
CCK026	*Averrhoa carambola*	Oxalidaceae	Exotic	Casual	Tree	0.7	5	40672.706	19583.761
CCK027	*Averrhoa carambola*	Oxalidaceae	Exotic	Casual	Tree	1.1	6	40675.476	19581.416
CCK028	*Averrhoa carambola*	Oxalidaceae	Exotic	Casual	Tree	1	6	40677.475	19582.11
CCK029	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	0.7	6	40681.771	19580.271
CCK030	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.6	13	40681.809	19579.16
CCK031	*Mangifera odorata*	Anacardiaceae	Native	Vulnerable	Tree	1.6	12	40693.897	19576.896
CCK032	*Averrhoa carambola*	Oxalidaceae	Exotic	Casual	Tree	1.4	5	40703.182	19569.267
CCK033	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	0.95	10	40610.301	19517.194
CCK034	*Dimocarpus longan* subsp. *malesianus*	Sapindaceae	Exotic	Casual	Tree	1.65	14	40608.04	19519.044
CCK035	*Dimocarpus longan* subsp. *malesianus*	Sapindaceae	Exotic	Casual	Tree	1.1	13	40605.939	19517.802
CCK036	*Dimocarpus longan* subsp. *malesianus*	Sapindaceae	Exotic	Casual	Tree	1.8	14	40603.396	19520.982
CCK037	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.8	10	40615.362	19556.388
CCK038	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	3.8	12	40597.053	19547.462

CCK039	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	5.2	16	40593.928	19540.023
CCK040	*Terminalia catappa*	Combretaceae	Native	Common	Tree	2.4	16	40577.075	19564.046
CCK041	*Terminalia catappa*	Combretaceae	Native	Common	Tree	1.1	12	40575.939	19564.803
CCK042	*Terminalia catappa*	Combretaceae	Native	Common	Tree	1.8	12	40574.547	19569.08
CCK043	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	4.4	15	40532.87	19590.572
CCK044	*Syzygium malaccense*	Myrtaceae	Exotic	Casual	Tree	1.8	11	40523.577	19577.275
CCK045	*Nephelium lappaceum*	Sapindaceae	Native	Critically endangered	Tree	1.2	12	40515.4	19580.117
CCK046	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.8	15	40510.523	19595.636
CCK047	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	15	40518.121	19602.902
CCK048	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.85	15	40499.212	19615.06
CCK049	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.4	15	40494.263	19619.033
CCK050	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.25	12	40492.393	19612.835
CCK051	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.2	13	40492.917	19606.577
CCK052	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.4	15	40497.514	19603.039
CCK053	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	15	40491.628	19594.995
CCK054	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	15	40486.229	19600.753
CCK055	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	15	40474.404	19608.627
CCK056	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	11	40479.343	19613.846
CCK057	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.1	15	40474.623	19615.663
CCK058	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.4	14	40480.199	19631.799
CCK059	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.1	13	40471.472	19628.692
CCK060	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	15	40465.808	19623.795
CCK061	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.55	15	40460.388	19616.204
CCK062	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.1	15	40454.799	19624.963
CCK063	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.9	15	40465.768	19632.409
CCK064	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.75	15	40462.596	19635.02
CCK065	*Dimocarpus longan* subsp. *malesianus*	Sapindaceae	Exotic	Casual	Tree	0.45	6	40462.844	19640.723
CCK066	*Dimocarpus longan* subsp. *malesianus*	Sapindaceae	Exotic	Casual	Tree	0.55	6	40453.179	19637.753
CCK067	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.5	15	40450.817	19643.646
CCK068	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	0.75	8	40449.797	19644.207
CCK069	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.05	15	40446.873	19635.619
CCK070	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.2	14	40441.124	19636.058
CCK071	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.45	13	40441.031	19627.325
CCK072	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.5	15	40434.244	19633.194
CCK073	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.3	15	40429.997	19639.847
CCK074	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	0.9	9	40428.728	19648.053
CCK075	*Sandoricum koetjape*	Meliaceae	Native	Endangered	Tree	0.55	9	40443.373	19650.88
CCK076	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	15	40442.494	19657.791
CCK077	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	1.05	12	40441.841	19658.592

CCK078	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.8	15	40434.75	19658.551
CCK079	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	0.6	10	40429.261	19665.871
CCK080	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.1	15	40427.957	19662.167
CCK081	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2	12	40419.464	19657.449
CCK082	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.9	15	40410.623	19656.289
CCK083	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.1	13	40403.465	19657.428
CCK084	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	8	40402.08	19661.474
CCK085	*Artocarpus integer*	Moraceae	Exotic	Casual	Tree	0.5	8	40395.758	19653.853
CCK086	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.85	16	40389.899	19651.131
CCK087	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	0.7	5	40377.554	19648.665
CCK088	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	0.5	3	40376.803	19647.137
CCK089	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.1	13	40383.087	19644.816
CCK091	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	12	40390.007	19642.873
CCK091	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.35	13	40392.848	19645.013
CCK092	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.15	14	40394.124	19648.894
CCK093	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.65	15	40399.057	19644.513
CCK094	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.55	14	40396.165	19640.848
CCK095	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.55	14	40393.597	19639.319
CCK096	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.7	14	40402.368	19641.811
CCK097	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.55	15	40405.96	19636.083
CCK098	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	15	40407.974	19639.723
CCK099	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.1	14	40407.187	19630.092
CCK100	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.35	12	40405.262	19630.657
CCK101	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.45	14	40429.94	19619.958
CCK102	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	13	40428.737	19611.985
CCK103	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	0.6	9	40440.681	19614.78
CCK104	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	0.9	10	40443.4	19612.224
CCK105	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.3	12	40439.48	19607.192
CCK106	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.75	12	40444.695	19599.07
CCK107	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	4.1	14	40449.836	19606.817
CCk108	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.95	12	40452.548	19593.376
CCK109	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	0.6	9	40470.61	19594.587
CCK110	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	1.6	16	40474.127	19596.364
CCK111	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.1	12	40478.122	19593.726
CCK112	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	0.5	9	40477.486	19591.273
CCK113	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	1.3	16	40481.057	19591.985
CCK114	*Mangifera odorata*	Anacardiaceae	Native	Vulnerable	Tree	1.8	13	40482.447	19586.809
CCK115	*Nephelium lappaceum*	Sapindaceae	Native	Critically endangered	Tree	1	11	40478.912	19583.499
CCK116	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.7	14	40478.059	19573.526

CCK117	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3	15	40487.632	19574.405
CCK118	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.25	13	40497.537	19574.87
CCK119	*Nephelium lappaceum*	Sapindaceae	Native	Critically endangered	Tree	1.1	10	40497.897	19577.732
CCK120	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	3.7	16	40498.368	19572.154
CCK121	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	1.4	12	40501.043	19572.96
CCK122	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	1.5	16	40497.442	19567.965
CCK123	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.25	12	40493.891	19555.999
CCK124	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	0.35	8	40493.848	19557.778
CCK125	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	2.3	15	40500.295	19563.079
CCK126	*Baccaurea motleyana*	Phyllanthaceae	Native	Critically endangered	Tree	1.4	13	40509.783	19568.106
CCK127	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	2.8	17	40516.986	19561.588
CCK128	*Sandoricum koetjape*	Meliaceae	Native	Endangered	Tree	2.05	13	40517.472	19552.284
CCK129	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.7	15	40531.414	19546.229
CCK130	*Nephelium lappaceum*	Sapindaceae	Native	Critically endangered	Tree	1.55	10	40539.503	19537.253
CCK131	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.2	14	40540.478	19538.063
CCK132	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.7	14	40542.022	19533.294
CCK133	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	1.1	6	40543.006	19535.051
CCK134	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	15	40550.517	19536.64
CCK135	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	1.1	8	40558.518	19544.181
CCK136	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	0.95	8	40556.768	19508.364
CCK137	*Canarium odontophyllum*	Burseraceae	Exotic	-	Tree	0.85	10	40558.485	19503.667
CCK138	*Chukrasia tabularis*	Meliaceae	Exotic	Cultivated Only	Tree	1	6	40561.224	19501.351
CCK139	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.7	18	40586.33005	19511.66388
CCK140	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	2.7	17	40586.64002	19510.90713
CCK141	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	1.65	17	40587.91004	19515.71479
CCK142	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	1.8	16	40582.31	19511.08505
CCK143	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	2.9	16	40592.72997	19513.13307
CCK144	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	17	40589.75996	19508.78164
CCK145	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.9	15	40593.29999	19502.77224
CCK146	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	1.1	8	40593.29998	19503.1061
CCK147	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	1.7	10	40603.90997	19510.34012
CCK148	*Artocarpus altilis*	Moraceae	Exotic	Casual	Tree	1.95	17	40604.91001	19510.56273
CCK149	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.7	17	40602.13999	19503.8854
CCK150	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.8	16	40599.16	19493.20172
CCK151	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	16	40599.82002	19493.31302
CCK152	*Ficus benjamina*	Moraceae	Cryptogenic	-	Strangler	3.9	15	40625.02997	19481.18352
CCK153	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	5.4	15	40638.29997	19463.82312
CCK154	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.95	15	40656.87998	19450.92552
CCK155	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.85	13	40669.47996	19466.04987

CCK156	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.5	12	40672.14001	19454.03093
CCK157	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	12	40672.03002	19446.24081
CCK158	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	14	40665.62002	19431.3281
CCK159	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	12	40671.35995	19438.89582
CCK160	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	12	40680.65	19439.56385
CCK161	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.9	12	40690.15994	19441.34476
CCK162	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.85	12	40695.69004	19433.88868
CCK163	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	12	40694.48003	19430.32745
CCK164	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	12	40689.94	19424.76294
CCK165	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.5	12	40681.54003	19425.43039
CCK166	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.7	15	40698.78999	19417.75212
CCK167	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	14	40702.98996	19421.09088
CCK168	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	14	40706.74995	19410.96386
CCK169	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	13	40719.69001	19413.96904
CCK170	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.9	13	40731.73995	19412.85655
CCK171	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	13	40741.03005	19405.28932
CCK172	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.4	14	40741.13999	19401.17169
CCK173	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	14	40722.89004	19390.37623
CCK174	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.4	14	40725.99004	19382.80879
CCK175	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	13	40726.65	19377.91217
CCK176	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.05	13	40748.43995	19383.69983
CCK177	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.5	11	40753.19005	19386.37088
CCK178	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.75	13	40760.16005	19396.27567
CCK179	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.5	12	40761.59997	19385.59214
CCK180	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2	9	40761.15	19376.68914
CCK181	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.9	12	40778.40001	19390.93448
CCK182	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.4	14	40788.58005	19379.02707
CCK183	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.7	14	40788.36001	19378.91578
CCK184	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.55	11	40775.53003	19357.22547
CCK185	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.2	13	40779.95005	19350.53724
CCK186	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.2	12	40780.39003	19350.42597
CCK187	*Ficus benjamina*	Moraceae	Cryptogenic	-	Strangler	3.2	16	40803.73004	19369.01171
CCK188	*Dimocarpus longan* subsp. *malesianus*	Sapindaceae	Exotic	Casual	Tree	2	12	40792.00001	19355.76814
CCK189	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.7	14	40814.22999	19359.77521
CCK190	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.35	15	40805.27004	19354.87828
CCK191	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.8	15	40798.52997	19347.08795
CCK192	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	15	40798.41995	19346.97666
CCK193	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.8	15	40807.03999	19342.0803
CCK194	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.1	15	40826.62002	19346.8663

CCK195	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.8	15	40813.68004	19331.28565
CCK196	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.7	14	40818.42997	19322.6054
CCK197	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.25	15	40841.21003	19334.29131
CCK198	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	2	14	40843.98001	19335.29299
CCK199	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.1	15	40844.75005	19332.17697
CCK200	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.95	14	40859.12998	19302.68632
CCK201	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.2	12	40841.64997	19322.04973
CCK202	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.5	13	40849.73004	19324.83218
CCK203	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.5	13	40848.18	19314.5937
CCK204	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	7	40850.28004	19307.91653
CCK205	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	14	40858.46004	19308.25066
CCK206	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	14	40866.63995	19317.82164
CCK207	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2	14	40867.63995	19315.70721
CCK208	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.9	14	40865.75999	19307.91704
CCK209	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.4	12	40863.55004	19301.12845
CCK210	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.5	12	40870.18002	19300.90609
CCK211	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.3	12	40880.36004	19309.58683
CCK212	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.4	14	40889.64003	19306.80496
CCK213	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.1	14	40895.28	19294.1184
CCK214	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.3	14	40894.50996	19294.11837
CCK215	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.2	12	40886.10998	19288.44245
CCK216	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	14	40921.93004	19273.41985
CCK217	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.6	10	40933.75999	19270.97193
CCK218	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3.2	10	40941.50996	19254.61296
CCK219	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3	10	40953.88998	19256.9504
CCK220	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.8	10	40955.44005	19246.05544
CCK221	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.2	10	40968.14998	19242.92869
CCK222	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3	10	40976.22999	19234.24856
CCK223	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3.4	10	40981.08999	19227.23762
CCK224	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.75	10	40987.27996	19224.56694
CCK225	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.9	9	40991.48994	19222.78648
CCK226	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.85	10	40999.44998	19217.33368
CCK227	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.4	10	41009.94999	19213.2164
CCK228	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3	8	41027.75996	19197.08035
CCK229	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.9	9	41079.39995	19170.48445
CCK230	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.8	9	41079.94999	19169.37159
CCK231	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.6	13	41118.76005	19149.67507
CCK232	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.7	13	41119.20005	19152.45726
CCK233	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	13	41119.41999	19152.2347

CCK234	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.1	12	41119.18997	19162.69568
CCK235	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.9	9	41114.45004	19160.02463
CCK236	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.3	9	41104.94002	19170.4853
CCK237	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3.6	10	41100.07001	19178.94296
CCK238	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.05	10	41122.41002	19182.83876
CCK239	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.8	12	41143.20004	19188.18124
CCK240	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.9	12	41118.09999	19213.55387
CCK241	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.45	10	41101.40003	19214.43248
CCK242	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.4	12	41099.85001	19223.79168
CCK243	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	11	41100.39997	19235.14299
CCK244	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.7	8	41109.57995	19253.72825
CCK245	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	8	41098.40995	19261.62926
CCK246	*Durio zibethinus*	Malvaceae	Exotic	Casual	Tree	1.4	14	40634.93	19511.6
CCK247	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	2.3	8	40649.55	19509.15
CCK248	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	4.5	12	40618.82	19510.58
CCK249	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	2.4	16	40683.72	19542.88
CCK250	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	1.6	14	40673.8	19507.21
CCK251	*Pterocarpus indicus*	Fabaceae	Exotic	Casual	Tree	2.6	12	40663.58	19506.64
CCK252	*Artocarpus heterophyllus*	Moraceae	Exotic	Casual	Tree	1.05	9	40642.75	19521.7
CCK253	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.6	9	40636.37	19498.65
CCK254	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.35	6	40664	19508.86
CCK255	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	2.2	9	40673.36	19476.63
CCK256	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.9	8	40672.91	19462.38
CCK257	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.8	14	40693.86	19468.58
CCK258	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	14	40705.81	19460.24
CCK259	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	10	40717.64	19480.08
CCK260	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.3	8	40715.95	19492.28
CCK261	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.3	8	40718.74	19466.98
CCK262	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	14	40735.73	19482.49
CCK263	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	12	40724.79	19448.61
CCK264	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.5	13	40723.79	19447.05
CCK265	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1	10	40719.03	19446.05
CCK266	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.1	13	40719.5	19454.59
CCK267	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2	11	40731.23	19450
CCK268	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.8	14	40738.97	19441.2
CCK269	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	13	40748.18	19442.01
CCK270	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.05	11	40729.38	19434.88
CCK271	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.1	16	40743.27	19424.87
CCK272	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.2	17	40742.65	19444.16

CCK273	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.85	13	40748.87	19413.74
CCK274	*Hura crepitans*	Euphorbiaceae	Exotic	Cultivated Only	Tree	1.4	6	40778.63	19453.38
CCK275	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.5	15	40786.17	19451.23
CCK276	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.95	10	40790.81	19455.13
CCK277	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.9	15	40790.31	19435.55
CCK278	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	10	40801.12	19452.87
CCK279	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2	9	40806.54	19451.27
CCK280	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.9	10	40790.66	19427.08
CCK281	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	18	40788.03	19419.96
CCK282	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.6	18	40786.49	19405.16
CCK283	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.8	18	40787.23	19397.36
CCK284	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	17	40805.13	19372.72
CCK285	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.3	18	40816.79	19369.68
CCK286	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.4	20	40809.39	19371.38
CCK287	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.7	8	40832.66	19368.52
CCK288	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.1	18	40827.29	19362.37
CCK289	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.8	15	40836.11	19361.98
CCK290	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.5	20	40843.91	19373.83
CCK291	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	20	40842.89	19362.14
CCK292	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.8	12	40845.45	19381.11
CCK293	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2	17	40837.42	19384.5
CCK294	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	18	40837.36	19386.68
CCK295	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.9	12	40842.11	19385.18
CCK296	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	18	40847.84	19381.22
CCK297	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2	17	40854.96	19355.41
CCK298	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	18	40862.19	19341.5
CCK299	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	18	40862.63	19338.46
CCK300	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	22	40864.78	19349.82
CCK301	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.6	20	40877.34	19347.16
CCK302	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.9	18	40875.99	19351.57
CCK303	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	20	40869.17	19359.65
CCK304	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	20	40884.72	19361.79
CCK305	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.4	19	40866.39	19382.9
CCK306	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.4	18	40878.55	19380.16
CCK307	*Cinamomum iners*	Lauraceae	Native	Common	Tree	0.8	7	40927.08	19369.99
CCK308	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.8	15	40939.73	19371.44
CCK309	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	16	40946.93	19369.4
CCK310	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	17	40942.8	19353.58
CCK311	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1	11	40950.44	19348.38

CCK312	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.8	18	40947.8	19342.41
CCK313	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.8	18	40943.2	19348.78
CCK314	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	17	40932.85	19347.39
CCK315	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.7	18	40940.03	19356.94
CCK316	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.6	17	40925.88	19331.08
CCK317	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.7	17	40922.55	19328.43
CCK318	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.7	18	40922.05	19314.24
CCK319	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3	18	40914.37	19315.58
CCK320	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.4	18	40914.43	19309.99
CCK321	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3	18	40911.46	19306.15
CCK322	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	18	40912.81	19298.59
CCK323	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.4	18	40910.78	19294.51
CCK324	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.5	18	40908.99	19295.47
CCK325	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.2	13	40919.71	19306.24
CCK326	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.8	14	40926.26	19309.29
CCK327	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.6	15	40931.54	19313.51
CCK328	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.6	15	40931.89	19323.81
CCK329	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.2	12	40937.04	19323.77
CCK330	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.7	14	40948.05	19331.45
CCK331	*Schefflera actinophylla*	Araliaceae	Exotic	Casual	Tree	0.5	5	40957.57	19346.58
CCK332	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	18	40957.88	19343.21
CCK333	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.6	10	40964.57	19334.31
CCK334	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	1.8	14	40959.41	19331.63
CCK335	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3.1	18	40970.52	19323.8
CCK336	*Ficus microcarpa*	Moraceae	Native	Common	Strangler	8	18	40965.1	19312.82
CCK337	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2	16	40961.46	19307.39
CCK338	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.7	18	40945.86	19290.73
CCK339	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.3	15	40931.96	19299.74
CCK340	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	2.8	15	40924.94	19291.78
CCK341	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.6	12	40926.17	19280.19
CCK342	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	3.2	15	40931.34	19280.25
CCK343	*Samanea saman*	Fabaceae	Exotic	Casual	Tree	1.6	12	40940.35	19287.73
CCK344	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	15	40953.07	19282.7
CCK345	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.6	16	40965.2	19288.07
CCK346	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	0.9	10	40964.48	19294.78
CCK347	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	4	17	40975.01	19306.23
CCK348	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.7	11	40987.95	19309.26
CCK349	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	18	40969.32	19280.36
CCK350	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.4	13	40972.2	19264.67

CCK351	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.6	13	40973.07	19258.12
CCK352	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.1	10	40973.31	19253.87
CCK353	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.4	10	40986.57	19243.09
CCK354	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.6	10	40990.56	19239.6
CCK355	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.3	10	40998.34	19241.34
CCK356	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	15	41004.69	19250.16
CCK357	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.2	15	41002.78	19255.29
CCK358	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2	15	40996.96	19262.82
CCK359	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.5	15	41001.35	19263.7
CCK360	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.1	15	41011.94	19266.7
CCK361	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	15	41021.69	19271.03
CCK362	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2	15	41012.74	19245
CCK363	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2	15	41008.39	19241.83
CCK364	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.6	10	41011.74	19237.32
CCK365	*Ficus microcarpa*	Moraceae	Native	Common	Strangler	3.2	15	41017.47	19224.87
CCK366	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.4	7	41034.36	19218.1
CCK367	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.5	14	41039.46	19207.83
CCK368	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	3.6	14	41044.98	19200.55
CCK369	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.1	16	41051.3	19209.03
CCK370	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.2	12	41056.69	19211.35
CCK371	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	1.6	12	41060.37	19216.3
CCK372	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.4	17	41059.58	19223.85
CCK373	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.7	18	41045.93	19261.58
CCK374	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.7	18	41055.04	19258.71
CCK375	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	2.3	18	41066.95	19257.24
CCK376	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	20	41068.11	19244.66
CCK377	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	20	41075.66	19241.28
CCK378	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.4	15	41069.83	19211.11
CCK379	*Tabebuia rosea*	Bignoniaceae	Exotic	Casual	Tree	2.4	15	41069.99	19200.76
CCK380	*Khaya senegalensis*	Meliaceae	Exotic	Cultivated Only	Tree	3	15	41089.31	19238.68
CCK381	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.4	8	40607.695	19697.041
CCK382	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.6	7	40606.023	19699.763
CCK383	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.6	9	40603.885	19702.097
CCK384	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.6	6	40602.73	19699.684
CCK385	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.6	6	40601.182	19697.459
CCK386	*Mangifera indica*	Anacardiaceae	Exotic	Casual	Tree	1.2	8	40600.41	19638.254
CCK387	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	1.2	11	40664.101	19601.971
CCK388	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	1.1	9	40668.056	19599.855
CCK389	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.7	9	40669.997	19602.117

CCK390	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.7	9	40671.94	19606.288
CCK396	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	1	9	40673.555	19609.814
CCK397	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.8	9	40676.838	19616.256
CCK398	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.75	9	40678.765	19619.732
CCK399	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.8	9	40680.442	19623.418
CCK400	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	0.9	11	40682.506	19628.416
CCK401	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	1	11	40679.863	19631.737
CCK402	*Terminalia mantaly*	Combretaceae	Exotic	Cultivated Only	Tree	1	9	40676.648	19635.302

Appendix I
List of Probable and Recorded Faunal Species

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Appendix I – List of Probable and Recorded Faunal Species

Faunal Group	No. of Probable Species		No. of Recorded Species		No. of Recorded Species not on Probable List		No. of Species Recorded in Guttensohn & Leong (2021)	
	All Species	CS Species	All Species	CS Species	All Species	CS Species	All Species	CS Species
Odonates	27	0	6	0	1	0	4	0
Dragonflies	24	0	5	0	1	0	4	0
Damselflies	3	0	1	0	0	0	0	0
Aculeate hymenopterans	79	0	5	0	0	0	N.A	N.A
Bees	38	0	2	0	0	0	N.A	N.A
Stinging wasps	41	0	3	0	0	0	N.A	N.A
Butterflies	86	1	18	0	0	0	7	0
Freshwater fish	7	0	4	0	0	0	N.A	N.A
Herpetofauna	40	4	14	0	0	0	8	0
Amphibians	12	0	5	0	0	0	4	0
Reptiles	28	4	9	0	0	0	4	0
Birds	126	17	36	1	0	0	41	3
Mammals	21	5	6	0	0	0	4	0
Non-volant mammals	13	3	4	0	0	0	4	0
Bats	8	2	2	0	0	0	N.A	N.A
Total	**386**	**27**	**89**	**1**	**1**	**0**	**64**	**3**

Appendix I – List of Probable and Recorded Faunal Species

No.	Type	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (Soh et al., 2019)	Species of Conservation Significance	Distribution/Rarity (Soh et al. 2019)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
1	Damselfly	Coenagrionidae	*Agriocnemis femina*	Variable wisp	Least Concern	Least Concern	No	Widespread and Common	Yes	Yes	No
2	Damselfly	Coenagrionidae	*Ceriagrion cerinorubellum*	Ornate coraltail	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
3	Damselfly	Coenagrionidae	*Pseudagrion microcephalum*	Blue sprite	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
4	Dragonfly	Aeshnidae	*Gynacantha subinterrupta*	Dingy duskhawker	Least Concern	Least Concern	No	Widespread but Uncommon	No	Yes	No
5	Dragonfly	Gomphidae	*Ictinogomphus decoratus*	Common flangetail	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
6	Dragonfly	Libellulidae	*Acisoma panorpoides*	Trumpet tail	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
7	Dragonfly	Libellulidae	*Brachydiplax chalybea*	Blue dasher	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
8	Dragonfly	Libellulidae	*Brachythemis contaminata*	Common Amberwing	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
9	Dragonfly	Libellulidae	*Camacinia gigantea*	Sultan	Least Concern	Least Concern	No	Widespread but Uncommon	Yes	No	No
10	Dragonfly	Libellulidae	*Crocothemis servilia*	Common scarlet	Least Concern	Least Concern	No	Widespread and Common	Yes	Yes	Yes
11	Dragonfly	Libellulidae	*Diplacodes trivialis*	Blue percher	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
12	Dragonfly	Libellulidae	*Neurothemis fluctuans*	Common parasol	Least Concern	Least Concern	No	Widespread and Common	Yes	Yes	Yes
13	Dragonfly	Libellulidae	Orchithemis pulcherrima	Variable sentinel	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
14	Dragonfly	Libellulidae	*Orthetrum chrysis*	Spine-tufted skimmer	Least Concern	Least Concern	No	Widespread and Common	Yes	Yes	No
15	Dragonfly	Libellulidae	*Orthetrum glaucum*	Common blue skimmer	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
16	Dragonfly	Libellulidae	*Orthetrum luzonicum*	Slender blue skimmer	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
17	Dragonfly	Libellulidae	*Orthetrum sabina*	Variegated green skimmer	Least Concern	Least Concern	No	Widespread and Common	Yes	No	Yes
18	Dragonfly	Libellulidae	*Orthetrum testaceum*	Scarlet skimmer	Least Concern	Least Concern	No	Widespread and Common	Yes	No	Yes
19	Dragonfly	Libellulidae	*Pantala flavescens*	Wandering glider	Least Concern	Least Concern	No	Widespread and Common	Yes	Yes	No
20	Dragonfly	Libellulidae	*Potamarcha congener*	Common chaser	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
21	Dragonfly	Libellulidae	*Pseudothemis jorina*	Banded skimmer	Least Concern	Least Concern	No	Widespread but Uncommon	Yes	No	No

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22	Dragonfly	Libellulidae	*Rhodothemis rufa*	Common redbolt	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
23	Dragonfly	Libellulidae	*Rhyothemis phyllis*	Yellow-barred flutterer	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
24	Dragonfly	Libellulidae	*Tholymis tillarga*	White-barred duskhawk	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
25	Dragonfly	Libellulidae	*Tramea transmarina*	Saddlebag glider	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
26	Dragonfly	Libellulidae	*Trithemis aurora*	Crimson dropwing	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
27	Dragonfly	Libellulidae	*Trithemis festiva*	Indigo dropwing	Least Concern	Least Concern	No	Widespread and Common	Yes	No	No
28	Dragonfly	Libellulidae	*Urothemis signata*	Scarlet basker	Not Assessed	Least Concern	No	Widespread and Common	Yes	No	No

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No.	Type	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (Ascher et al. (in prep); JXQ Lee, pers comm)	Species of Conservation Significance	Native Status (The Biodiversity of Singapore, 2020; JXQ Lee, pers comm)	Probable Species	Recorded Species
1	Bee	Apidae	*Amegilla andrewsi*	#N/A	Not Assessed	Least Concern	No	Native	Yes	Yes
2	Bee	Apidae	*Amegilla korotonensis*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
3	Bee	Apidae	*Apis andreniformis*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
4	Bee	Apidae	*Apis cerana*	Eastern honey bee	Not Assessed	Not Assessed	No	Native	Yes	Yes
5	Bee	Apidae	*Apis dorsata*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
6	Bee	Apidae	*Apis florea*	N.A	Not Assessed	Not Assessed	No	Non-native	Yes	No
7	Bee	Apidae	*Braunsapis clarihirta*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
8	Bee	Apidae	*Braunsapis cupulifera**	N.A	Not Assessed	Least Concern	No	Native	Yes	No
9	Bee	Apidae	*Braunsapis hewitti**	N.A	Not Assessed	Least Concern	No	Native	Yes	No
10	Bee	Apidae	*Braunsapis puangensis*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
11	Bee	Apidae	*Ceratina collusor*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
12	Bee	Apidae	*Ceratina dentipes*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
13	Bee	Apidae	*Ceratina lieftincki*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
14	Bee	Apidae	*Ceratina smaragdula*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
15	Bee	Apidae	*Ceratina unimaculata*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
16	Bee	Apidae	*Ceratini nigrolateralis*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
17	Bee	Apidae	*Tetragonula valdezi*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
18	Bee	Apidae	*Thyreus ceylonicus*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
19	Bee	Apidae	*Thyreus himalayensis*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
20	Bee	Apidae	*Xylocopa aestuans*	White-cheeked carpenter bee	Not Assessed	Not Assessed	No	Native	Yes	No
21	Bee	Apidae	*Xylocopa caerulea*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
22	Bee	Apidae	*Xylocopa flavonigrescens*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
23	Bee	Apidae	*Xylocopa latipes*	Broad-handed carpenter bee	Not Assessed	Not Assessed	No	Native	Yes	No
24	Bee	Colletidae	*Hylaeus penangensis*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
25	Bee	Halictidae	*Lasioglossum adonidiae*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
26	Bee	Halictidae	*Lasioglossum deliense*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
27	Bee	Halictidae	*Lasioglossum vagans*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
28	Bee	Halictidae	*Lipotriches ceratina*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
29	Bee	Halictidae	*Nomia strigata*	Pearly-banded bee	Not Assessed	Not Assessed	No	Native	Yes	No
30	Bee	Halictidae	*Pseudapis siamensis*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
31	Bee	Megachilidae	*Euaspis polynesia*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
32	Bee	Megachilidae	*Megachile conjuncta*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
33	Bee	Megachilidae	*Megachile disjuncta*	N.A	Not Assessed	Not Assessed	No	Non-native	Yes	No
34	Bee	Megachilidae	*Megachile umbripennis*	N.A	Not Assessed	Not Assessed	No	Non-native	Yes	No
35	Bee	Megachilidae	*Coelioxys confusus*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No

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36	Bee	Megachilidae	*Heriades sp.*	N.A	N.A	N.A	No	N.A	Yes	No
37	Bee	Megachilidae	*Megachile laticeps*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
38	Bee	Megachilidae	*Megachile subrixator*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
39	Wasp	Crabronidae	*Bembicinus sp.*	NA	Not Assessed	Not Assessed	No	Native	Yes	Yes
40	Wasp	Crabronidae	*Liris subtessellatus*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
41	Wasp	Crabronidae	*Trypoxylon sp.*	N.A	N.A	N.A	No	N.A	Yes	No
42	Wasp	Crabronidae	*Unidentified Larrinae*	N.A	N.A	N.A	No	N.A	Yes	No
43	Wasp	Pompilidae	*Auplopus sp. (grey)*	N.A	N.A	N.A	No	N.A	Yes	No
44	Wasp	Pompilidae	*Tachypompilus analis*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
45	Wasp	Scoliidae	*Campsomeriella collaris*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
46	Wasp	Scoliidae	*Phalerimeris phalerata*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
47	Wasp	Scoliidae	*Scolia sp.*	NA	Not Assessed	Not Assessed	No	Native	Yes	Yes
48	Wasp	Sphecidae	*Chalybion bengalense*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
49	Wasp	Sphecidae	*Isodontia diodon*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
50	Wasp	Sphecidae	*Sceliphron javanum*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
51	Wasp	Sphecidae	*Sphex diabolicus*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
52	Wasp	Sphecidae	*Sphex sericeus*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
53	Wasp	Sphecidae	*Sphex subtruncatus*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
54	Wasp	Vespidae	*Allorhynchium argentatum*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
55	Wasp	Vespidae	*Antepipona sp. nr. bipustulata*	N.A	N.A	N.A	No	N.A	Yes	No
56	Wasp	Vespidae	*Delta campaniforme*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
57	Wasp	Vespidae	*Delta pyriforme*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
58	Wasp	Vespidae	*Elimus sp.*	N.A	N.A	N.A	No	Native	Yes	No
59	Wasp	Vespidae	*Eumenes sp.*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
60	Wasp	Vespidae	*Liostenogaster nitidipennis*	N.A	Not Assessed	Near Threatened	No	Native	Yes	No
61	Wasp	Vespidae	*Liostenogaster varipicta*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
62	Wasp	Vespidae	*Parapolybia varia*	Lesser paper wasp	Not Assessed	Near Threatened	No	Native	Yes	No
63	Wasp	Vespidae	*Parischnogaster mellyi*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
64	Wasp	Vespidae	*Parischnogaster nigricans*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
65	Wasp	Vespidae	*Phimenes flavopictus*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
66	Wasp	Vespidae	*Polistes sagittarius*	Banded paper wasp	Not Assessed	Least Concern	No	Native	Yes	No
67	Wasp	Vespidae	*Polistes stigma*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
68	Wasp	Vespidae	*Polistes tenebris*	N.A	Not Assessed	Data Deficient	No	Native	Yes	No
69	Wasp	Vespidae	*Rhynchium haemorrhoidale*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
70	Wasp	Vespidae	*Ropalidia erythrospila*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No

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71	Wasp	Vespidae	*Ropalidia jacobsoni*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
72	Wasp	Vespidae	*Ropalidia stigma*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
73	Wasp	Vespidae	*Ropalidia sumatrae*	N.A	Not Assessed	Not Assessed	No	Native	Yes	No
74	Wasp	Vespidae	*Ropalidia timida*	N.A	Not Assessed	Not Assessed	No	N.A	Yes	No
75	Wasp	Vespidae	*Stenodyneriellus guttulatus*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
76	Wasp	Vespidae	*Subancistrocerus sichelii*	N.A	Not Assessed	Least Concern	No	Native	Yes	No
77	Wasp	Vespidae	*Vespa affinis*	Lesser banded hornet	Not Assessed	Not Assessed	No	Native	Yes	Yes
78	Wasp	Vespidae	*Vespa analis*	Yellow vented hornet	Not Assessed	Not Assessed	No	Native	Yes	No
79	Wasp	Vespidae	*Vespa tropica*	Greater banded hornet	Not Assessed	Not Assessed	No	Native	Yes	No

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1	Hesperiidae	*Ampittia dioscorides camertes*	Bush hopper	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
2	Hesperiidae	*Baoris farri farri*	Bamboo paintbrush swift	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
3	Hesperiidae	*Baoris oceia*	Paintbrush swift	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
4	Hesperiidae	*Caltoris cormasa*	Full stop swift	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
5	Hesperiidae	*Cephrenes trichopepla*	Yellow palm dart	Not Assessed	Not assessed	No	Common	Yes	No	No
6	Hesperiidae	*Iambrix salsala salsala*	Chestnut bob	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
7	Hesperiidae	*Matapa aria*	Common redeye	Not Assessed	Not Assessed	No	Moderately rare	Yes	Yes	No
8	Hesperiidae	Oriens gola pseudolus	Common dartlet	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
9	Hesperiidae	*Pelopidas agna agna*	Bengal swift	Not Assessed	Endangered	Yes	Moderately common	Yes	No	No
10	Hesperiidae	*Pelopidas assamensis*	Great swift	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
11	Hesperiidae	*Pelopidas conjunctus conjunctus*	Conjoined swift	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
12	Hesperiidae	*Pelopidas mathias mathias*	Small branded swift	Not Assessed	Not Assessed	No	Common	Yes	No	No
13	Hesperiidae	*Polytremis lubricans lubricans*	Contiguous swift	Not Assessed	Not Assessed	No	Common	Yes	No	No
14	Hesperiidae	*Potanthus omaha omaha*	Lesser dart	Not Assessed	Not Assessed	No	Common	Yes	No	No
15	Hesperiidae	*Potanthus trachala tytleri*	Detached dart	Not Assessed	Nationally Extinct (Rediscovered)	No	Moderately rare	Yes	No	No
16	Hesperiidae	*Taractrocera archias quinta*	Yellow grass dart	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
17	Hesperiidae	*Taractrocera ardonia lamia*	Spotted grass dart	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
18	Hesperiidae	*Telicota augias augias*	Pale palm dart	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
19	Hesperiidae	*Telicota besta bina*	Besta palm dart	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
20	Hesperiidae	*Telicota colon stinga*	Common palm dart	Not Assessed	Nationally Extinct (Rediscovered)	No	Moderately common	Yes	No	No
21	Hesperiidae	*Telicota linna*	Linna palm dart	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
22	Lycaenidae	*Allotinus unicolor unicolor*	Lesser darkwing	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
23	Lycaenidae	Anthene emolus goberus	Ciliate blue	Not Assessed	Not Assessed	No	Common	Yes	No	No
24	Lycaenidae	*Anthene lycaenina miya*	Pointed ciliate blue	Not Assessed	Not Assessed	No	Moderately rare	Yes	No	No
25	Lycaenidae	Arhopala centaurus nakula	Centaur oakblue	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
26	Lycaenidae	*Euchrysops cnejus cnejus*	Gram blue	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
27	Lycaenidae	*Ionolyce helicon merguiana*	Pointed line blue	Not Assessed	Not Assessed	No	Common	Yes	No	No
28	Lycaenidae	*Iraota rochana boswelliana*	Scarce silverstreak	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
29	Lycaenidae	*Jamides celeno aelianus*	Common caerulean	Not Assessed	Not Assessed	No	Common	Yes	No	No
30	Lycaenidae	*Lampides boeticus*	Pea blue	Not Assessed	Not Assessed	No	Common	Yes	No	No
31	Lycaenidae	*Logania marmorata damis*	Pale mottle	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
32	Lycaenidae	*Nacaduba berenice icena*	Rounded sixline blue	Not Assessed	Not Assessed	No	Common	Yes	No	No
33	Lycaenidae	*Nacaduba beroe neon*	Opaque sixline blue	Not Assessed	Not Assessed	No	Common	Yes	No	No
34	Lycaenidae	*Prosotas dubiosa lumpura*	Tailless line blue	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
35	Lycaenidae	*Rapala iarbus iarbus*	Common red flash	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
36	Lycaenidae	*Rapala pheretima sequeira*	Copper flash	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
37	Lycaenidae	*Spalgis epius epius*	Apefly	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
38	Lycaenidae	*Tajuria cippus maxentius*	Peacock royal	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No

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39	Lycaenidae	*Tajuria dominus dominus*	N.A	Not Assessed	Not Assessed	No	Very rare	Yes	No	No
40	Lycaenidae	*Zizeeria maha serica*	Pale grass blue	Not Assessed	Not Assessed	No	Common	Yes	No	No
41	Lycaenidae	*Zizina otis lampa*	Lesser grass blue	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
42	Lycaenidae	*Zizula hylax pygmaea*	Pygmy grass blue	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
43	Nymphalidae	*Acraea terpsicore*	Tawny coster	Not Assessed	Not assessed	No	Common	Yes	Yes	Yes
44	Nymphalidae	*Danaus chrysippus chrysippus*	Plain tiger	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
45	Nymphalidae	*Doleschallia bisaltide bisaltide*	Autumn leaf	Not Assessed	Not assessed	No	Common	Yes	Yes	No
46	Nymphalidae	*Elymnias hypermnestra agina*	Common palmfly	Not Assessed	Not Assessed	No	Common	Yes	No	No
47	Nymphalidae	*Euploea mulciber mulciber*	Striped blue crow	Not Assessed	Not Assessed	No	Common	Yes	No	No
48	Nymphalidae	*Euthalia aconthea gurda*	Baron	Not Assessed	Not Assessed	No	Common	Yes	No	No
49	Nymphalidae	*Hypolimnas anomala anomala*	Malayan eggfly	Not Assessed	Not Assessed	No	Common	Yes	No	No
50	Nymphalidae	*Hypolimnas bolina bolina*	Great eggfly	Not Assessed	Not Assessed	No	Moderately common	Yes	Yes	Yes
51	Nymphalidae	*Hypolimnas bolina jacintha*	Jacintha eggfly	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
52	Nymphalidae	*Ideopsis vulgaris macrina*	Blue glassy tiger	Not Assessed	Not Assessed	No	Common	Yes	No	No
53	Nymphalidae	*Junonia almana javana*	Peacock pansy	Least Concern	Not Assessed	No	Common	Yes	Yes	Yes
54	Nymphalidae	*Junonia atlites atlites*	Grey pansy	Not Assessed	Not Assessed	No	Moderately common	Yes	Yes	Yes
55	Nymphalidae	*Junonia hedonia ida*	Chocolate pansy	Not Assessed	Not Assessed	No	Common	Yes	Yes	Yes
56	Nymphalidae	*Junonia orithya wallacei*	Blue pansy	Not Assessed	Not Assessed	No	Common	Yes	Yes	Yes
57	Nymphalidae	*Melanitis leda leda*	Common evening brown	Not Assessed	Not Assessed	No	Moderately rare	Yes	Yes	No
58	Nymphalidae	*Mycalesis mineus macromalayana*	Dark brand bush brown	Not Assessed	Not Assessed	No	Common	Yes	No	Yes
59	Nymphalidae	*Mycalesis perseoides perseoides*	Burmese bush brown	Not Assessed	Data Deficient	No	Common	Yes	No	No
60	Nymphalidae	*Mycalesis perseus cepheus*	Dingy bush brown	Not Assessed	Not Assessed	No	Moderately common	Yes	No	Yes
61	Nymphalidae	*Mycalesis visala phamis*	Long brand bush brown	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
62	Nymphalidae	*Neptis hylas papaja*	Common sailor	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
63	Nymphalidae	*Orsotriaena medus cinerea*	Dark grass brown	Not Assessed	Not Assessed	No	Common	Yes	No	No
64	Nymphalidae	*Parantica agleoides agleoides*	Dark glassy tiger	Not Assessed	Not Assessed	No	Common	Yes	No	No
65	Nymphalidae	*Phaedyma columella singa*	Short banded sailor	Not Assessed	Not Assessed	No	Common	Yes	No	No
66	Nymphalidae	*Phalanta phalantha phalantha*	Leopard	Not Assessed	Not Assessed	No	Common	Yes	No	No
67	Nymphalidae	*Polyura hebe plautus*	Plain nawab	Not Assessed	Not Assessed	No	Common	Yes	No	No
68	Nymphalidae	*Ypthima baldus newboldi*	Common five-ring	Not Assessed	Not Assessed	No	Common	Yes	No	No
69	Nymphalidae	*Ypthima huebneri*	Common four-ring	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No
70	Nymphalidae	*Ypthima pandocus corticaria*	Common three-ring	Not Assessed	Not Assessed	No	Common	Yes	No	No
71	Nymphalidae	*Cethosia cyane*	Leopard lacewing	Not Assessed	Not Assessed	No	Common	Yes	No	No
72	Nymphalidae	*Ypthima horsfieldii humei*	Malayan five-ring	Not Assessed	Not Assessed	No	Common	Yes	No	No
73	Papilionidae	*Chilasa clytia clytia*	Common mime	Not Assessed	Not Assessed	No	Common	Yes	No	No
74	Papilionidae	*Graphium agamemnon agamemnon*	Tailed jay	Not Assessed	Not Assessed	No	Common	Yes	No	No
75	Papilionidae	*Graphium sarpedon luctatius*	Common bluebottle	Not Assessed	Not Assessed	No	Common	Yes	No	No
76	Papilionidae	*Papilio demoleus malayanus*	Lime butterfly	Not Assessed	Not Assessed	No	Common	Yes	No	Yes
77	Papilionidae	*Papilio polytes romulus*	Common mormon	Not Assessed	Not Assessed	No	Common	Yes	No	No
78	Pieridae	*Appias libythea olferna*	Striped albatross	Not Assessed	Not Assessed	No	Common	Yes	Yes	Yes

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (Davison et al., 2008; Jain et al, 2018)	Species of Conservation Significance	Distribution/ Abundance /Rarity (Khew, 2015)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
79	Pieridae	*Catopsilia pomona pomona*	Lemon emigrant	Not Assessed	Not Assessed	No	Common	Yes	No	No
80	Pieridae	*Catopsilia pyranthe pyranthe*	Mottled emigrant	Not Assessed	Not Assessed	No	Common	Yes	No	No
81	Pieridae	*Catopsilia scylla cornelia*	Orange emigrant	Not Assessed	Not Assessed	No	Common	Yes	No	No
82	Pieridae	*Delias hyparete metarete*	Painted jezebel	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
83	Pieridae	*Eurema blanda snelleni*	Three spot grass yellow	Not Assessed	Not Assessed	No	Common	Yes	Yes	No
84	Pieridae	*Eurema hecabe contubernalis*	Common grass yellow	Not Assessed	Not Assessed	No	Common	Yes	No	Yes
85	Pieridae	*Leptosia nina malayana*	Psyche	Not Assessed	Not Assessed	No	Common	Yes	No	No
86	Pieridae	*Eurema andersonii andersonii*	Anderson's grass yellow	Not Assessed	Not Assessed	No	Moderately common	Yes	No	No

Appendix I – List of Probable and Recorded Faunal Species

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (Davison et al., 2008)	Species of Conservation Significance	Native Status (Baker & Lim, 2012)	Probable Species	Recorded Species
1	Clariidae	*Clarias cf. batrachus*	Common walking catfish	Not Assessed	Not Assessed	Yes	Native	Yes	No
2	Clariidae	*Clarias gariepinus*	Sharp-toothed walking catfish	Least Concern	Not Assessed	No	Non-native	Yes	No
3	Synbranchidae	*Monopterus javanensis*	Sunda swamp-eel	Least Concern	Not Assessed	No	Native	Yes	No
4	Poeciliidae	*Poecilia reticulata*	Guppy	Not Assessed	Not Assessed	No	Non-native	Yes	Yes
5	Cichlidae	*Heterotilapia buttikoferi*	Bumblebee tilapia	Least Concern	Not Assessed	No	Non-native	Yes	Yes
6	Cyprinidae	*Puntigrus partipentazona*	Malayan tiger barb	Least Concern	Not Assessed	No	Non-native	Yes	Yes
7	Gobiidae	*Rhinogobius sp.*	Goby	N.A	N.A	N.A	Non-native	Yes	Yes

Appendix I – List of Probable and Recorded Faunal Species

No.	Type	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Signficance	Distribution/ Abundance/ Rarity (Baker & Lim, 2012)	Native Status (Baker & Lim, 2012)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
1	Frog	Dicroglossidae	*Fejervarya cancrivora*	Crab-eating frog	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	Yes	No
2	Frog	Dicroglossidae	*Fejervarya limnocharis*	Field frog	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
3	Frog	Dicroglossidae	*Limnonectes blythii*	Malayan giant frog	Near Threatened	Least Concern	No	Widespread and Common	Native	Yes	No	Yes
4	Frog	Eleutherodactylidae	*Eleutherodactylus planirostris*	Greenhouse frog	Least Concern	Not Assessed	No	Widespread and Common	Non-native	Yes	Yes	Yes
5	Frog	Microhylidae	*Kaloula pulchra*	Banded bull frog	Least Concern	Not Assessed	No	Widespread and Common	Non-native	Yes	Yes	Yes
6	Frog	Microhylidae	*Microhyla butleri*	Painted chorus frog	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	Yes	No
7	Frog	Microhylidae	*Microhyla heymonsi*	Dark-sided chorus frog	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
8	Frog	Microhylidae	*Microhyla mukhlesuri*	East Asian ornate chorus frog	Least Concern	Not Assessed	No	Restricted and Rare	Non-native	Yes	No	No
9	Frog	Ranidae	*Hylarana erythraea*	Green paddy frog	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
10	Frog	Ranidae	*Lithobates catesbeianus*	American bullfrog	Least Concern	Not Assessed	No	Widespread and Common	Non-native	Yes	No	No
11	Frog	Rhacophoridae	*Polypedates leucomystax*	Four-lined tree frog	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
12	Toad	Bufonidae	*Duttaphrynus melanostictus*	Asian toad	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	Yes	Yes

No.	Type	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Signficance	Distribution/Abundance/Rarity (Baker & Lim, 2012)	Native Status (Baker & Lim, 2012)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
1	Lizard	Agamidae	*Calotes versicolor*	Changeable lizard	Not Assessed	Not Assessed	No	Widespread and Common	Non-native	Yes	Yes	No
2	Lizard	Agamidae	*Draco sumatranus*	Sumatran flying dragon	Not Assessed	Least Concern	No	Widespread and Common	Native	Yes	No	No
3	Lizard	Gekkonidae	*Gehyra mutilata*	Four-clawed gecko	Not Assessed	Not Assessed	No	Widespread and Common	Native	Yes	No	No
4	Lizard	Gekkonidae	*Gekko monarchus*	Spotted house gecko	Not Assessed	Not Assessed	No	Widespread and Common	Native	Yes	Yes	Yes
5	Lizard	Gekkonidae	*Hemidactylus brookii*	Brooke's house gecko	Not Assessed	Not Assessed	No	Restricted and Rare	Non-native	Yes	Yes	No
6	Lizard	Gekkonidae	*Hemidactylus frenatus*	Spiny-tailed house gecko	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	Yes	No
7	Lizard	Gekkonidae	*Hemidactylus platyurus*	Flat-tailed gecko	Not Assessed	Least Concern	No	Widespread and Common	Native	Yes	No	No
8	Lizard	Gekkonidae	*Lepidodactylus lugubris*	Mourning gecko	Not Assessed	Not Assessed	No	Widespread but Rare	Native	Yes	No	No
9	Lizard	Scincidae	*Eutropis multifasciata*	Many-lined sun skink	Not Assessed	Least Concern	No	Widespread and Common	Native	Yes	No	No
10	Lizard	Scincidae	*Lygosoma bowringii*	Garden supple skink	Not Assessed	Least Concern	No	Widespread and Common	Native	Yes	Yes	Yes
11	Lizard	Varanidae	*Varanus nebulosus*	Clouded monitor	Not Assessed	Least Concern	No	Restricted but Common	Native	Yes	No	Yes
12	Lizard	Varanidae	*Varanus salvator*	Malayan water monitor	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
13	Snake	Colubridae	*Ahaetulla prasina*	Oriental whip snake	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	Yes	Yes
14	Snake	Colubridae	*Chrysopelea paradisi*	Paradise gliding snake	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
15	Snake	Colubridae	*Coelognathus flavolineatus*	Common Malayan racer	Least Concern	Least Concern	Yes	Widespread but Rare	Native	Yes	No	No
16	Snake	Colubridae	*Dendrelaphis caudolineatus*	Striped bronzeback	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
17	Snake	Colubridae	*Dendrelaphis pictus*	Painted bronzeback	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	Yes	No
18	Snake	Colubridae	*Lycodon capucinus*	House wolf snake	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
19	Snake	Colubridae	*Oligodon octolineatus*	Striped kukri snake	Least Concern	Least Concern	No	Widespread and Common	Native	Yes	No	No
20	Snake	Colubridae	*Sibynophis melanocephalus*	Black-headed collared snake	Least Concern	Vulnerable	Yes	Widespread but Uncommon	Native	Yes	No	No

No.	Type	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Signficance	Distribution/Abundance/Rarity (Baker & Lim, 2012)	Native Status (Baker & Lim, 2012)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
21	Snake	Colubridae	*Xenochrophis vittatus*	Striped keelback	Least Concern	Not Assessed	No	Widespread and Common	Non-native	Yes	No	No
22	Snake	Elapidae	*Naja sumatrana*	Equatorial spitting cobra	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No	No
23	Snake	Homalopsidae	*Homalopsis buccata*	Puff-faced water snake	Least Concern	Vulnerable	Yes	Widespread but Uncommon	Native	Yes	No	No
24	Snake	Pythonidae	*Malayopython reticulatus*	Reticulated python	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No	No
25	Snake	Typhlopidae	*Argyrophis muelleri*	White-bellied blind snake	Least Concern	Critically Endangered	Yes	Widespread but Rare	Native	Yes	No	No
26	Snake	Typhlopidae	*Indotyphlops braminus*	Brahminy blind snake	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	Yes	No
27	Snake	Xenopeltidae	*Xenopeltis unicolor*	Iridescent earth snake	Least Concern	Least Concern	No	Widespread but Uncommon	Native	Yes	No	No
28	Turtle	Emydidae	*Trachemys scripta*	Red-eared slider	Least Concern	Not Assessed	No	Widespread and Common	Non-native	Yes	Yes	No

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Significance	Distribution/ Abundance/ Rarity (NSS, 2020; Singapore Birds Project, 2020)	Primary Native Status (NSS, 2020; Singapre Birds Project, 2020)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
1	Acanthizidae	*Gerygone sulphurea*	Golden-bellied gerygone	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	No
2	Accipitridae	*Accipiter gularis*	Japanese sparrowhawk	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
3	Accipitridae	*Accipiter soloensis*	Chinese sparrowhawk	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
4	Accipitridae	*Accipiter trivirgatus*	Crested goshawk	Least Concern	Critically Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
5	Accipitridae	*Aviceda jerdoni*	Jerdon's baza	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
6	Accipitridae	*Aviceda leuphotes*	Black baza	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
7	Accipitridae	*Elanus caeruleus*	Black-winged kite	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
8	Accipitridae	*Haliaeetus ichthyaetus*	Grey-headed fish eagle	Near Threatened	Critically Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
9	Accipitridae	*Haliaeetus leucogaster*	White-bellied sea eagle	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
10	Accipitridae	*Haliastur indus*	Brahminy kite	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
11	Accipitridae	*Nisaetus cirrhatus*	Changeable hawk-eagle	Least Concern	Endangered	Yes	Uncommon	Resident breeder	Yes	No	Yes
12	Accipitridae	*Pernis ptilorhynchus*	Crested honey-buzzard	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	Yes	Yes
13	Aegithinidae	*Aegithina tiphia*	Common iora	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
14	Alcedinidae	*Alcedo atthis*	Common kingfisher	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	Yes
15	Alcedinidae	*Halcyon smyrnensis*	White-throated kingfisher	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
16	Alcedinidae	*Pelargopsis capensis*	Stork-billed kingfisher	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
17	Alcedinidae	*Todiramphus chloris*	Collared kingfisher	Least Concern	Not Assessed	No	Abundant	Resident breeder	Yes	Yes	Yes
18	Apodidae	*Aerodramus fuciphagus*	Edible-nest swiftlet	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
19	Apodidae	*Aerodramus maximus*	Black-nest swiftlet	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
20	Apodidae	*Aerodramus sp.*	Swiflet	N.A	N.A	N.A	N.A	Resident breeder	N.A	Yes	Yes
21	Ardeidae	*Ardea alba*	Great egret	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
22	Ardeidae	*Ardea cinerea*	Grey heron	Least Concern	Vulnerable	Yes	Uncommon	Resident breeder	Yes	No	No
23	Ardeidae	*Ardea intermedia*	Intermediate egret	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	Yes
24	Ardeidae	*Ardea purpurea*	Purple heron	Least Concern	Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
25	Ardeidae	*Ardeola bacchus*	Chinese pond heron	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
26	Ardeidae	*Bubulcus coromandus*	Eastern cattle egret	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
27	Ardeidae	*Butorides striata*	Striated heron	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
28	Ardeidae	*Egretta garzetta*	Little egret	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	Yes	Yes
29	Ardeidae	*Ixobrychus sinensis*	Yellow bittern	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Significance	Distribution/ Abundance/ Rarity (NSS, 2020; Singapore Birds Project, 2020)	Primary Native Status (NSS, 2020; Singapre Birds Project, 2020)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
30	Ardeidae	*Nycticorax nycticorax*	Black-crowned night heron	Least Concern	Critically Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
31	Bucerotidae	*Anthracoceros albirostris*	Oriental pied hornbill	Least Concern	Critically Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
32	Cacatuidae	*Cacatua goffiniana*	Tanimbar corella	Near Threatened	Not Assessed	No	Common	Introduced resident breeder	Yes	No	No
33	Campephagidae	*Lalage nigra*	Pied triller	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
34	Campephagidae	*Pericrocotus divaricatus*	Ashy minivet	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
35	Caprimulgidae	*Caprimulgus affinis*	Savanna nightjar	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
36	Caprimulgidae	*Caprimulgus macrurus*	Large-tailed nightjar	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
37	Ciconiidae	*Anastomus oscitans*	Asian openbill	Least Concern	Not Assessed	No	Rare	Non-breeding visitor	Yes	No	No
38	Cisticolidae	*Cisticola juncidis*	Zitting cisticola	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
39	Cisticolidae	*Orthotomus atrogularis*	Dark-necked tailorbird	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
40	Cisticolidae	*Orthotomus sericeus*	Rufous-tailed tailorbird	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	Yes
41	Cisticolidae	*Orthotomus sutorius*	Common tailorbird	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
42	Cisticolidae	*Prinia flaviventris*	Yellow-bellied prinia	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
43	Columbidae	*Columba livia*	Rock dove	Least Concern	Not Assessed	No	Abundant	Introduced resident breeder	Yes	Yes	No
44	Columbidae	*Ducula bicolor*	Pied imperial pigeon	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
45	Columbidae	*Geopelia striata*	Zebra dove	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
46	Columbidae	*Spilopelia chinensis*	Spotted dove	Least Concern	Not Assessed	No	Abundant	Resident breeder	Yes	Yes	Yes
47	Columbidae	*Streptopelia tranquebarica*	Red turtle dove	Least Concern	Not Assessed	No	Uncommon	Introduced resident breeder	Yes	No	No
48	Columbidae	*Treron vernans*	Pink-necked green pigeon	Least Concern	Not Assessed	No	Abundant	Resident breeder	Yes	Yes	Yes
49	Coraciidae	*Eurystomus orientalis*	Oriental dollarbird	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
50	Corvidae	*Corvus macrorhynchos*	Large-billed crow	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
51	Corvidae	*Corvus splendens*	House crow	Least Concern	Not Assessed	No	Common	Introduced resident breeder	Yes	Yes	Yes
52	Cuculidae	*Cacomantis merulinus*	Plaintive cuckoo	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
53	Cuculidae	*Cacomantis sepulcralis*	Rusty-breasted cuckoo	Least Concern	Vulnerable	Yes	Uncommon	Resident breeder	Yes	No	No
54	Cuculidae	*Cacomantis sonneratii*	Banded bay cuckoo	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
55	Cuculidae	*Centropus bengalensis*	Lesser coucal	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
56	Cuculidae	*Chrysococcyx minutillus*	Little bronze-cuckoo	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
57	Cuculidae	*Chrysococcyx xanthorhynchus*	Violet cuckoo	Least Concern	Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
58	Cuculidae	*Cuculus micropterus*	Indian cuckoo	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	Yes	No

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59	Cuculidae	*Eudynamys scolopaceus*	Asian koel	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
60	Dicaeidae	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	No
61	Dicruridae	*Dicrurus annectans*	Crow-billed drongo	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	Yes
62	Estrildidae	*Lonchura leucogastroides*	Javan munia	Least Concern	Not Assessed	No	Uncommon	Introduced resident breeder	Yes	No	No
63	Estrildidae	*Lonchura malacca*	Tricolored munia	Least Concern	Not Assessed	No	N.A	Introduced	Yes	No	No
64	Estrildidae	*Lonchura punctulata*	Scaly-breasted munia	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
65	Falconidae	*Falco peregrinus*	Peregrine falcon	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
66	Hemiprocnidae	*Hemiprocne longipennis*	Grey-rumped treeswift	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
67	Hirundinidae	*Cecropis daurica*	Red-rumped swallow	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
68	Hirundinidae	*Hirundo rustica*	Barn swallow	Least Concern	Not Assessed	No	Abundant	Winter visitor	Yes	No	Yes
69	Hirundinidae	*Hirundo tahitica*	Pacific swallow	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
70	Laniidae	*Lanius cristatus*	Brown shrike	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	Yes	No
71	Laniidae	*Lanius schach*	Long-tailed shrike	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
72	Laniidae	*Lanius tigrinus*	Tiger shrike	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	Yes	No
73	Leiothrichidae	*Garrulax leucolophus*	White-crested laughingthrush	Least Concern	Not Assessed	No	Common	Introduced resident breeder	Yes	No	No
74	Megalaimidae	*Psilopogon haemacephalus*	Coppersmith barbet	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
75	Megalaimidae	*Psilopogon lineatus*	Lineated barbet	Least Concern	Not Assessed	No	Uncommon	Introduced resident breeder	Yes	No	No
76	Meropidae	*Merops philippinus*	Blue-tailed bee-eater	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
77	Meropidae	*Merops viridis*	Blue-throated bee-eater	Least Concern	Not Assessed	No	Common	Migrant breeder	Yes	No	No
78	Monarchidae	*Terpsiphone incei*	Amur paradise flycatcher	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
79	Motacillidae	*Anthus rufulus*	Paddyfield pipit	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
80	Motacillidae	*Motacilla cinerea*	Grey wagtail	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
81	Motacillidae	*Motacilla tschutschensis*	Eastern yellow wagtail	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
82	Muscicapidae	*Copsychus saularis*	Oriental magpie-robin	Least Concern	Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
83	Muscicapidae	*Ficedula mugimaki*	Mugimaki flycatcher	Least Concern	Not Assessed	No	Uncommon	Passage migrant	Yes	No	No

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Significance	Distribution/ Abundance/ Rarity (NSS, 2020; Singapore Birds Project, 2020)	Primary Native Status (NSS, 2020; Singapre Birds Project, 2020)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
84	Muscicapidae	*Ficedula zanthopygia*	Yellow-rumped flycatcher	Least Concern	Not Assessed	No	Uncommon	Passage migrant	Yes	Yes	No
85	Muscicapidae	*Muscicapa dauurica*	Asian brown flycatcher	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	Yes	Yes
86	Muscicapidae	*Muscicapa sibirica*	Dark-sided flycatcher	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
87	Nectariniidae	*Aethopyga siparaja*	Crimson sunbird	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
88	Nectariniidae	*Anthreptes malacensis*	Brown-throated sunbird	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
89	Nectariniidae	*Cinnyris jugularis*	Olive-backed sunbird	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
90	Oriolidae	*Oriolus chinensis*	Black-naped oriole	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
91	Pandionidae	*Pandion haliaetus*	Western osprey	Least Concern	Not Assessed	No	Common	Non-breeding visitor	Yes	No	No
92	Passeridae	*Passer montanus*	Eurasian tree sparrow	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
93	Phasianidae	*Gallus gallus*	Red junglefowl	Least Concern	Endangered	Yes	Uncommon	Resident breeder	Yes	No	Yes
94	Phasianidae	*Gallus gallus (domestic)*	Domestic chicken	Not Assessed	Not Assessed	No	N.A	Introduced	Yes	No	No
95	Phylloscopidae	*Phylloscopus borealis*	Arctic warbler	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	Yes	No
96	Phylloscopidae	*Phylloscopus coronatus*	Eastern crowned warbler	Least Concern	Not Assessed	No	Uncommon	Winter visitor	Yes	No	No
97	Phylloscopidae	*Phylloscopus inornatus*	Yellow-browed warbler	Least Concern	Not Assessed	No	Rare	Winter visitor	Yes	Yes	No
98	Picidae	*Chrysophlegma miniaceum*	Banded woodpecker	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	No
99	Picidae	*Dinopium javanense*	Common flameback	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
100	Picidae	*Micropternus brachyurus*	Rufous woodpecker	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
101	Picidae	*Picus vittatus*	Laced woodpecker	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
102	Picidae	*Yungipicus moluccensis*	Sunda pygmy woodpecker	Least Concern	Not Assessed	No	Abundant	Resident breeder	Yes	Yes	No
103	Ploceidae	*Ploceus philippinus*	Baya weaver	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
104	Psittaculidae	*Loriculus galgulus*	Blue-crowned hanging-parrot	Least Concern	Endangered	Yes	Uncommon	Resident breeder	Yes	Yes	No
105	Psittaculidae	*Psittacula alexandri*	Red-breasted parakeet	Near Threatened	Not Assessed	No	Common	Introduced resident breeder	Yes	Yes	No
106	Psittaculidae	*Psittacula krameri*	Rose-ringed parakeet	Least Concern	Not Assessed	No	Uncommon	Introduced resident breeder	Yes	No	No
107	Psittaculidae	*Psittacula longicauda*	Long-tailed parakeet	Vulnerable	Not Assessed	Yes	Common	Resident breeder	Yes	No	No

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Significance	Distribution/ Abundance/ Rarity (NSS, 2020; Singapore Birds Project, 2020)	Primary Native Status (NSS, 2020; Singapre Birds Project, 2020)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
108	Psittaculidae	*Trichoglossus haematodus*	Coconut lorikeet	Least Concern	Not Assessed	No	Uncommon	Introduced resident breeder	Yes	Yes	No
109	Pycnonotidae	*Pycnonotus goiavier*	Yellow-vented bulbul	Least Concern	Not Assessed	No	Abundant	Resident breeder	Yes	Yes	Yes
110	Pycnonotidae	*Pycnonotus jocosus*	Red-whiskered bulbul	Least Concern	Not Assessed	No	Uncommon	Introduced resident breeder	Yes	No	No
111	Pycnonotidae	*Pycnonotus plumosus*	Olive-winged bulbul	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
112	Pycnonotidae	*Pycnonotus zeylanicus*	Straw-headed bulbul	Critically Endangered	Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
113	Rallidae	*Amaurornis phoenicurus*	White-breasted waterhen	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
114	Rallidae	*Rallina fasciata*	Red-legged crake	Least Concern	Vulnerable	Yes	Uncommon	Resident breeder	Yes	No	No
115	Rhipiduridae	*Rhipidura javanica*	Malaysian pied fantail	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
116	Scolopacidae	*Actitis hypoleucos*	Common sandpiper	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
117	Strigidae	*Ketupa ketupu*	Buffy fish owl	Least Concern	Critically Endangered	Yes	Uncommon	Resident breeder	Yes	No	No
118	Strigidae	*Otus lempiji*	Sunda scops owl	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
119	Strigidae	*Strix seloputo*	Spotted wood owl	Least Concern	Critically Endangered	Yes	Uncommon	Resident breeder	Yes	No	Yes
120	Strigidae	*Tyto javanica*	Eastern barn owl	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	No
121	Sturnidae	*Acridotheres javanicus*	Javan myna	Least Concern	Not Assessed	No	Abundant	Introduced resident breeder	Yes	Yes	Yes
122	Sturnidae	*Acridotheres tristis*	Common myna	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	No
123	Sturnidae	*Agropsar sturninus*	Daurian starling	Least Concern	Not Assessed	No	Common	Winter visitor	Yes	No	No
124	Sturnidae	*Aplonis panayensis*	Asian glossy starling	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	Yes
125	Sturnidae	*Gracula religiosa*	Common hill myna	Least Concern	Not Assessed	No	Uncommon	Resident breeder	Yes	No	Yes
126	Timaliidae	*Mixornis gularis*	Pin-striped tit babbler	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	No	Yes
127	Zosteropidae	*Zosterops simplex*	Swinhoe's white-eye	Least Concern	Not Assessed	No	Common	Resident breeder	Yes	Yes	No

Appendix I – List of Probable and Recorded Faunal Species

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (NParks, 2021)	Species of Conservation Significance	Distribution/Abundance/Rarity (Baker & Lim, 2012)	Native Status (Baker & Lim, 2012)	Probable Species	Recorded Species	Recorded in Guttensohn & Leong (2021)
1	Canidae	*Canis lupus familiaris*	Feral dog	Not Assessed	Not Assessed	No	N.A	Non-native	Yes	Yes	No
2	Cercopithecidae	*Macaca fascicularis*	Long-tailed macaque	Vulnerable	Not Assessed	Yes	Widespread and Common	Native	Yes	No	Yes
3	Felidae	*Felis catus*	Feral cat	Not Assessed	Not Assessed	No	N.A	Non-native	Yes	No	No
4	Manidae	Manis javanica	Sunda pangolin	Critically Endangered	Critically Endangered	Yes	Widespread but Rare	Native	Yes	No	No
5	Muridae	*Mus castaneus*	House mouse	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No	No
6	Muridae	*Rattus norvegicus*	Brown rat	Least Concern	Not Assessed	No	Widespread and Common	Non-native	Yes	No	No
7	Muridae	*Rattus tanezumi*	Oriental house rat	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	Yes	No
8	Muridae	*Rattus tiomanicus*	Malaysian wood rat	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No	No
9	Mustelidae	*Lutrogale perspicillata*	Smooth-coated otter	Vulnerable	Endangered	Yes	Widespread but Rare	Native	Yes	No	Yes
10	Sciuridae	*Callosciurus notatus*	Plantain squirrel	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	Yes	Yes
11	Soricidae	*Suncus murinus*	House shrew	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No	No
12	Suidae	Sus scrofa	Wild pig	Least Concern	Not Assessed	No	Widespread but Uncommon	Native	Yes	No	Yes
13	Viverridae	*Paradoxurus musangus*	Common palm civet	Least Concern	Not Assessed	No	Widespread but Uncommon	Native	Yes	Yes	No

Appendix I – List of Probable and Recorded Faunal Species

No.	Family	Scientific Name	Common Name	Global Status (IUCN/CITES)	National Status (Davison et al., 2008)	Species of Conservation Significance	Distribution/Abundance/Rarity (Baker & Lim, 2012)	Native Status (Baker & Lim, 2012)	Probable Species	Recorded Species
1	Emballonuridae	*Saccolaimus saccolaimus*	Pouch-bearing bat	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No
2	Pteropodidae	*Cynopterus brachyotis*	Lesser dog-faced fruit bat	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	No
3	Vespertilionidae	*Myotis muricola*	Whiskered myotis	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	Yes
4	Vespertilionidae	*Pipistrellus javanicus*	Javan pipistrelle	Least Concern	Not Assessed	No	Widespread but Uncommon	Native	Yes	No
5	Vespertilionidae	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	Least Concern	Not Assessed	No	Widespread and Common	Native	Yes	Yes
6	Vespertilionidae	*Tylonycteris fulvida*	Lesser bamboo bat	Least Concern	Vulnerable	Yes	Restricted and Rare	Native	Yes	No
7	Vespertilionidae	*Tylonycteris malayana*	Greater bamboo bat	Least Concern	Vulnerable	Yes	Widespread and Common	Native	Yes	No
8	Pteropodidae	*Eonycteris spelaea*	Cave nectar bat	Least Concern	Not Assessed	No	Widespread but Uncommon	Native	Yes	No

Appendix J
Faunal Survey Data

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Appendix J - Faunal Survey Data

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
24-Feb-21	1	1.38167	103.75827	N.A	732	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
24-Feb-21	1	1.38167	103.75827	N.A	732	Mammal	*Callosciurus notatus*	Plantain squirrel	2	Seen	-	Targeted	-
24-Feb-21	1	1.38167	103.75827	N.A	732	Reptile	*Lygosoma bowringii*	Garden supple skink	1	Seen	-	Targeted	-
24-Feb-21	1	1.38167	103.75827	N.A	732	Bird	*Eudynamys scolopaceus*	Asian koel	1	Heard	-	Targeted	-
24-Feb-21	1	1.38167	103.75827	N.A	732	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Targeted	-
24-Feb-21	1	1.38167	103.75827	N.A	732	Bird	*Todiramphus chloris*	Collared kingfisher	1	Seen	-	Targeted	-
24-Feb-21	1	1.38188	103.75796	N.A	735	Bird	*Oriolus chinensis*	Black-naped oriole	1	Heard	-	Targeted	-
24-Feb-21	1	1.38188	103.75796	N.A	735	Bird	*Cinnyris jugularis*	Olive-backed sunbird	2	Heard	-	Targeted	-
24-Feb-21	1	1.38188	103.75796	N.A	735	Bird	*Aplonis panayensis*	Asian glossy starling	1	Heard	-	Targeted	-
24-Feb-21	1	1.38229	103.75784	N.A	737	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
24-Feb-21	1	1.38229	103.75784	N.A	737	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
24-Feb-21	1	1.38229	103.75784	N.A	737	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Heard	-	Targeted	-
24-Feb-21	1	1.38229	103.75784	N.A	737	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Heard	-	Targeted	-
24-Feb-21	1	1.38229	103.75784	N.A	737	Bird	*Loriculus galgulus*	Blue-crowned hanging-parrot	1	Heard	-	Targeted	-
24-Feb-21	1	1.38229	103.75784	N.A	737	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
24-Feb-21	1	1.38238	103.75767	N.A	741	Bird	*Treron vernans*	Pink-necked green pigeon	5	Seen	-	Targeted	-
24-Feb-21	1	1.38238	103.75767	N.A	741	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	Carrying twigs
24-Feb-21	1	1.38238	103.75767	N.A	741	Bird	*Oriolus chinensis*	Black-naped oriole	1	Seen	-	Targeted	-
24-Feb-21	1	1.38278	103.75742	N.A	745	Bird	*Treron vernans*	Pink-necked green pigeon	2	Seen	-	Targeted	-
24-Feb-21	1	1.38278	103.75742	N.A	745	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
24-Feb-21	1	1.38311	103.75724	N.A	747	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Incidental	-
24-Feb-21	1	1.38311	103.75724	N.A	747	Bird	*Aplonis panayensis*	Asian glossy starling	1	Heard	-	Incidental	-
24-Feb-21	1	1.38336	103.75710	N.A	749	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Incidental	-
24-Feb-21	1	1.38358	103.75691	N.A	751	Bird	*Aplonis panayensis*	Asian glossy starling	2	Seen	-	Incidental	-
24-Feb-21	1	1.38358	103.75691	N.A	751	Mammal	*Callosciurus notatus*	Plantain squirrel	4	Seen	-	Incidental	-
24-Feb-21	1	1.38358	103.75691	N.A	751	Bird	*Corvus splendens*	House crow	1	Seen	-	Incidental	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
24-Feb-21	1	1.38358	103.75691	N.A	751	Bird	*Treron vernans*	Pink-necked green pigeon	8	Seen	-	Incidental	-
24-Feb-21	1	1.38358	103.75691	N.A	751	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Incidental	-
24-Feb-21	1	1.38358	103.75691	N.A	751	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Incidental	-
24-Feb-21	1	1.38411	103.75653	N.A	755	Bird	*Aplonis panayensis*	Asian glossy starling	1	Seen	-	Incidental	-
24-Feb-21	1	1.38411	103.75653	N.A	755	Bird	*Eudynamys scolopaceus*	Asian koel	1	Heard	-	Incidental	-
24-Feb-21	1	1.38429	103.75633	N.A	757	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
24-Feb-21	1	1.38429	103.75633	N.A	757	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Targeted	-
24-Feb-21	1	1.38470	103.75608	N.A	759	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Targeted	-
24-Feb-21	1	1.38470	103.75608	N.A	759	Bird	*Eudynamys scolopaceus*	Asian koel	1	Seen	-	Targeted	-
24-Feb-21	1	1.38470	103.75608	N.A	759	Bird	*Treron vernans*	Pink-necked green pigeon	1	Seen	-	Targeted	-
24-Feb-21	1	1.38470	103.75608	N.A	759	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
24-Feb-21	1	1.38512	103.75588	N.A	802	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
24-Feb-21	1	1.38512	103.75588	N.A	802	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
24-Feb-21	1	1.38512	103.75588	N.A	802	Bird	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	1	Heard	-	Targeted	-
24-Feb-21	1	1.38512	103.75588	N.A	802	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
24-Feb-21	1	1.38512	103.75588	N.A	802	Bird	*Chrysophlegma miniaceum*	Banded woodpecker	1	Heard	-	Targeted	-
24-Feb-21	1	1.38579	103.75534	N.A	807	Bird	*Trichoglossus haematodus*	Coconut lorikeet	2	Seen	-	Targeted	-
24-Feb-21	1	1.38596	103.75521	N.A	808	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Targeted	-
24-Feb-21	1	1.38596	103.75521	N.A	808	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
24-Feb-21	1	1.38596	103.75521	N.A	808	Bird	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	1	Heard	-	Targeted	-
24-Feb-21	1	1.38596	103.75521	N.A	808	Bird	*Unidentified Apodidae*	N.A	10	Seen	-	Targeted	-
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Acridotheres javanicus*	Javan myna	2	Seen	-	Incidental	-
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Treron vernans*	Pink-necked green pigeon	2	Seen	-	Incidental	-
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Zosterops simplex*	Swinhoe's white-eye	1	Seen	-	Incidental	-
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Heard	-	Incidental	-
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Chrysophlegma miniaceum*	Banded woodpecker	1	Heard	-	Incidental	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Incidental	-
24-Feb-21	1	1.38648	103.75481	N.A	812	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	3	Seen	-	Incidental	-
24-Feb-21	1	1.38711	103.75422	N.A	816	Bird	*Egretta garzetta*	Little egret	1	Seen	2311	Incidental	In canal
24-Feb-21	1	1.38711	103.75422	N.A	816	Bird	*Treron vernans*	Pink-necked green pigeon	2	Seen	-	Incidental	-
24-Feb-21	1	1.38822	103.75359	N.A	820	Bird	*Zosterops simplex*	Swinhoe's white-eye	2	Seen	-	Incidental	-
24-Feb-21	1	1.38149	103.75832	N.A	1410	Butterfly	*Mycalesis sp.*	N.A	4	Seen	6874	Targeted	-
24-Feb-21	1	1.38149	103.75832	N.A	1410	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38149	103.75832	N.A	1410	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
24-Feb-21	1	1.38149	103.75832	N.A	1410	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6875	Targeted	-
24-Feb-21	1	1.38151	103.75830	N.A	1411	Butterfly	*Zizula hylax pygmaea*	Pygmy grass blue	1	Seen	-	Targeted	-
24-Feb-21	1	1.38162	103.75827	N.A	1413	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38162	103.75827	N.A	1413	Butterfly	*Mycalesis sp.*	N.A	2	Seen	6877, 6878	Targeted	-
24-Feb-21	1	1.38175	103.75822	N.A	1414	Butterfly	*Eurema sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38175	103.75822	N.A	1414	Butterfly	*Hypolimnas bolina bolina*	Great eggfly	1	Seen	-	Targeted	-
24-Feb-21	1	1.38175	103.75822	N.A	1414	Butterfly	*Hypolimnas bolina bolina*	Great eggfly	1	Seen	6880	Targeted	-
24-Feb-21	1	1.38175	103.75823	N.A	1415	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38179	103.75820	N.A	1416	Butterfly	*Junonia atlites atlites*	Grey pansy	4	Seen	-	Targeted	-
24-Feb-21	1	1.38179	103.75820	N.A	1416	Butterfly	*Doleschallia sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38186	103.75814	N.A	1417	Butterfly	*Doleschallia bisaltide bisaltide*	Autumn leaf	1	Seen	6881	Targeted	-
24-Feb-21	1	1.38186	103.75814	N.A	1417	Butterfly	*Zizina otis lampa*	Lesser grass blue	1	Seen	-	Targeted	-
24-Feb-21	1	1.38189	103.75814	N.A	1418	Butterfly	*Junonia hedonia ida*	Chocolate pansy	3	Seen	-	Targeted	-
24-Feb-21	1	1.38191	103.75812	N.A	1419	Butterfly	*Zizina otis lampa*	Lesser grass blue	1	Seen	-	Targeted	-
24-Feb-21	1	1.38202	103.75802	N.A	1420	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
24-Feb-21	1	1.38218	103.75794	N.A	1422	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38218	103.75794	N.A	1422	Butterfly	*Junonia hedonia ida*	Chocolate pansy	2	Seen	-	Targeted	-
24-Feb-21	1	1.38223	103.75789	N.A	1423	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
24-Feb-21	1	1.38223	103.75789	N.A	1423	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38229	103.75787	N.A	1424	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38235	103.75783	N.A	1425	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6884	Targeted	-
24-Feb-21	1	1.38235	103.75783	N.A	1425	Butterfly	*Melanitis leda leda*	Common evening brown	1	Seen	-	Targeted	-
24-Feb-21	1	1.38235	103.75783	N.A	1425	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38248	103.75775	N.A	1426	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
24-Feb-21	1	1.38248	103.75775	N.A	1426	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6885	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
24-Feb-21	1	1.38248	103.75775	N.A	1426	Butterfly	*Mycalesis sp.*	N.A	2	Seen	-	Targeted	-
24-Feb-21	1	1.38247	103.75772	N.A	1427	Butterfly	*Unidentified Hesperiidae*	N.A	1	Seen	6888	Targeted	-
24-Feb-21	1	1.38251	103.75781	N.A	1428	Butterfly	*Iambrix salsala salsala*	Chestnut bob	2	Seen	-	Targeted	-
24-Feb-21	1	1.38251	103.75781	N.A	1428	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38251	103.75781	N.A	1428	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6890	Targeted	-
24-Feb-21	1	1.38257	103.75768	N.A	1429	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6891	Targeted	-
24-Feb-21	1	1.38257	103.75768	N.A	1429	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
24-Feb-21	1	1.38259	103.75767	N.A	1430	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6892	Targeted	-
24-Feb-21	1	1.38264	103.75761	N.A	1431	Butterfly	*Mycalesis sp.*	N.A	2	Seen	-	Targeted	-
24-Feb-21	1	1.38264	103.75761	N.A	1431	Butterfly	*Unidentified Hesperiidae*	N.A	1	Seen	6893, 6894	Targeted	-
24-Feb-21	1	1.38282	103.75749	N.A	1433	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38304	103.75732	N.A	1434	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38308	103.75726	N.A	1435	Butterfly	*Melanitis leda leda*	Common evening brown	1	Seen	-	Incidental	-
24-Feb-21	1	1.38308	103.75726	N.A	1435	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38318	103.75726	N.A	1436	Butterfly	*Iambrix salsala salsala*	Chestnut bob	2	Seen	-	Incidental	-
24-Feb-21	1	1.38318	103.75726	N.A	1436	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38334	103.75712	N.A	1438	Butterfly	*Unidentified Hesperiidae*	N.A	1	Seen	6896	Incidental	-
24-Feb-21	1	1.38334	103.75712	N.A	1438	Butterfly	*Matapa aria*	Common redeye	1	Seen	6898	Incidental	-
24-Feb-21	1	1.38334	103.75712	N.A	1438	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38339	103.75709	N.A	1439	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Incidental	-
24-Feb-21	1	1.38342	103.75706	N.A	1440	Butterfly	*Mycalesis sp.*	N.A	4	Seen	6902, 6901, 6899, 6900	Incidental	-
24-Feb-21	1	1.38344	103.75706	N.A	1442	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Incidental	-
24-Feb-21	1	1.38344	103.75706	N.A	1443	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6903	Incidental	-
24-Feb-21	1	1.38352	103.75702	N.A	1443	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6904	Incidental	-
24-Feb-21	1	1.38352	103.75702	N.A	1444	Butterfly	*Eurema sp.*	N.A	1	Seen	-	Incidental	-
24-Feb-21	1	1.38352	103.75702	N.A	1444	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38352	103.75702	N.A	1444	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38356	103.75701	N.A	1445	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6906	Incidental	-
24-Feb-21	1	1.38356	103.75701	N.A	1445	Reptile	*Lygosoma bowringii*	Garden supple skink	1	Seen	-	Incidental	-
24-Feb-21	1	1.38365	103.75693	N.A	1446	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38365	103.75693	N.A	1446	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Incidental	-
24-Feb-21	1	1.38365	103.75693	N.A	1447	Butterfly	*Eurema sp.*	N.A	1	Seen	-	Incidental	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
24-Feb-21	1	1.38396	103.75670	N.A	1450	Bird	*Phylloscopus inornatus*	Yellow-browed warbler	1	Heard	6907	Incidental	-
24-Feb-21	1	1.38396	103.75670	N.A	1450	Butterfly	*Junonia atlites atlites*	Grey pansy	3	Seen	-	Incidental	-
24-Feb-21	1	1.38396	103.75670	N.A	1450	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38396	103.75670	N.A	1451	Butterfly	*Junonia orithya wallacei*	Blue pansy	2	Seen	-	Incidental	-
24-Feb-21	1	1.38404	103.75658	N.A	1451	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6908	Incidental	-
24-Feb-21	1	1.38427	103.75653	N.A	1453	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6909	Targeted	-
24-Feb-21	1	1.38437	103.75643	N.A	1454	Butterfly	*Mycalesis sp.*	N.A	4	Seen	6911, 6910	Targeted	-
24-Feb-21	1	1.38442	103.75642	N.A	1455	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
24-Feb-21	1	1.38442	103.75642	N.A	1455	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38449	103.75636	N.A	1456	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38454	103.75631	N.A	1457	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6912, 6913	Targeted	-
24-Feb-21	1	1.38457	103.75629	N.A	1457	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
24-Feb-21	1	1.38473	103.75618	N.A	1459	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38475	103.75617	N.A	1459	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
24-Feb-21	1	1.38486	103.75605	N.A	1459	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38486	103.75605	N.A	1459	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6915	Targeted	-
24-Feb-21	1	1.38486	103.75605	N.A	1459	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
24-Feb-21	1	1.38486	103.75605	N.A	1459	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38486	103.75605	N.A	1501	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6916	Targeted	-
24-Feb-21	1	1.38505	103.75595	N.A	1502	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38512	103.75586	N.A	1502	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
24-Feb-21	1	1.38515	103.75586	N.A	1503	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38515	103.75586	N.A	1503	Butterfly	*Iambrix salsala salsala*	Chestnut bob	2	Seen	-	Targeted	-
24-Feb-21	1	1.38515	103.75586	N.A	1504	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38532	103.75574	N.A	1505	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
24-Feb-21	1	1.38537	103.75567	N.A	1506	Butterfly	*Iambrix salsala salsala*	Chestnut bob	2	Seen	-	Targeted	-
24-Feb-21	1	1.38537	103.75567	N.A	1506	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38542	103.75564	N.A	1507	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38542	103.75564	N.A	1507	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38549	103.75557	N.A	1507	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
24-Feb-21	1	1.38557	103.75547	N.A	1509	Butterfly	*Mycalesis sp.*	N.A	4	Seen	6919	Targeted	-
24-Feb-21	1	1.38557	103.75547	N.A	1509	Butterfly	*Eurema sp.*	N.A	1	Seen	-	Targeted	-
24-Feb-21	1	1.38557	103.75547	N.A	1509	Butterfly	*Junonia hedonia ida*	Chocolate pansy	2	Seen	-	Targeted	-
24-Feb-21	1	1.38570	103.75539	N.A	1510	Butterfly	*Mycalesis sp.*	N.A	4	Seen	-	Targeted	-
24-Feb-21	1	1.38570	103.75539	N.A	1510	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
24-Feb-21	1	1.38570	103.75539	N.A	1512	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
24-Feb-21	1	1.38582	103.75533	N.A	1513	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
24-Feb-21	1	1.38582	103.75533	N.A	1514	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
24-Feb-21	1	1.38582	103.75533	N.A	1515	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
24-Feb-21	1	1.38596	103.75524	N.A	1515	Butterfly	*Iambrix salsala salsala*	Chestnut bob	2	Seen	-	Targeted	-
24-Feb-21	1	1.38602	103.75518	N.A	1515	Butterfly	*Mycalesis sp.*	N.A	6	Seen	-	Targeted	-
24-Feb-21	1	1.38628	103.75474	N.A	1517	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38628	103.75474	N.A	1517	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Incidental	-
24-Feb-21	1	1.38651	103.75462	N.A	1519	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Incidental	-
24-Feb-21	1	1.38709	103.75424	N.A	1523	Butterfly	*Eurema blanda snelleni*	Three spot grass yellow	1	Seen	-	Incidental	-
24-Feb-21	1	1.38762	103.75394	N.A	1525	Butterfly	*Junonia almana javana*	Peacock pansy	1	Seen	-	Incidental	-
24-Feb-21	1	1.38780	103.75386	N.A	1526	Butterfly	*Mycalesis sp.*	N.A	1	Seen	6920	Incidental	-
25-Feb-21	1	1.38573	103.75540	N.A	945	Odonate	*Neurothemis fluctuans*	Common parasol	1	Seen	-	Targeted	-
25-Feb-21	1	1.38659	103.75522	N.A	1000	Odonate	*Neurothemis fluctuans*	Common parasol	1	Seen	-	Targeted	-
25-Feb-21	1	1.38659	103.75522	N.A	1000	Butterfly	*Hypolimnas bolina jacintha*	Jacintha eggfly	2	Seen	-	Incidental	-
25-Feb-21	1	1.38659	103.75522	N.A	1000	Aculeate hymenopteran	*Amegilla andrewsi*	Andrew's blue-banded digger bee	1	Seen	-	Targeted	-
25-Feb-21	1	1.38659	103.75522	N.A	1000	Butterfly	*Matapa aria*	Common redeye	1	Seen	2344	Incidental	-
25-Feb-21	1	1.38659	103.75522	N.A	1000	Butterfly	*Mycalesis sp.*	N.A	1	Seen	-	Incidental	-
25-Feb-21	1	1.38728	103.75429	N.A	1009	Odonate	*Orthetrum chrysis*	Spine-tufted skimmer	3	Seen	-	Incidental	-
25-Feb-21	1	1.38728	103.75429	N.A	1009	Odonate	*Agriocnemis femina*	Variable wisp	1	Seen	-	Incidental	-
25-Feb-21	1	1.38728	103.75429	N.A	1009	Aculeate hymenopteran	*Vespa affinis*	Lesser banded hornet	1	Seen	-	Incidental	-
25-Feb-21	1	1.38739	103.75423	N.A	1020	Odonate	*Neurothemis fluctuans*	Common parasol	1	Seen	-	Incidental	-
25-Feb-21	1	1.38860	103.75379	N.A	1023	Odonate	*Pantala flavescens*	Wandering glider	2	Seen	-	Incidental	-
25-Feb-21	1	1.38828	103.75479	N.A	1031	Odonate	*Pantala flavescens*	Wandering glider	1	Seen	-	Targeted	-
25-Feb-21	1	1.38726	103.75536	N.A	1037	Odonate	*Crocothemis servilia*	Common scarlet	2	Seen	-	Targeted	-
25-Feb-21	1	1.38726	103.75536	N.A	1037	Aculeate hymenopteran	*Bembicinus sp.*	N.A	20	Seen	-	Targeted	Carrying an egg into hole
25-Feb-21	1	1.38631	103.75612	N.A	1047	Odonate	*Crocothemis servilia*	Common scarlet	1	Seen	-	Targeted	-
25-Feb-21	1	1.38631	103.75612	N.A	1047	Odonate	*Pantala flavescens*	Wandering glider	1	Seen	-	Incidental	-
25-Feb-21	1	1.38493	103.75713	N.A	1053	Bird	*Anthus rufulus*	Paddyfield pipit	1	Seen	2355	Incidental	-
25-Feb-21	1	1.38405	103.75757	N.A	1056	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Feb-21	1	1.38377	103.75770	N.A	1056	Butterfly	*Junonia atlites atlites*	Grey pansy	3	Seen	-	Targeted	1 mating pair

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
25-Feb-21	1	1.38316	103.75804	N.A	1058	Odonate	*Pantala flavescens*	Wandering glider	2	Seen	-	Targeted	-
25-Feb-21	1	1.38316	103.75804	N.A	1058	Odonate	*Pantala flavescens*	Wandering glider	1	Seen	-	Targeted	-
4-Mar-21	1	1.38183	103.75906	N.A	0.82922	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195405.wav
4-Mar-21	1	1.38183	103.75906	N.A	0.8294	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195420.wav
4-Mar-21	1	1.38183	103.75906	N.A	0.82962	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195439.wav
4-Mar-21	1	1.38183	103.75908	N.A	0.8297	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195446.wav
4-Mar-21	1	1.38183	103.75908	N.A	0.82981	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195456.wav
4-Mar-21	1	1.38140	103.75940	N.A	0.83065	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195608.wav
4-Mar-21	1	1.38140	103.75940	N.A	0.83072	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195614.wav
4-Mar-21	1	1.38140	103.75940	N.A	0.83082	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195623.wav
4-Mar-21	1	1.38136	103.75831	N.A	0.83237	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195837.wav
4-Mar-21	1	1.38147	103.75823	N.A	0.83247	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195845.wav
4-Mar-21	1	1.38152	103.75817	N.A	0.83274	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195909.wav
4-Mar-21	1	1.38162	103.75816	N.A	0.83281	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195915.wav
4-Mar-21	1	1.38162	103.75816	N.A	0.83313	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195942.wav
4-Mar-21	1	1.38166	103.75820	N.A	0.83328	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_195955.wav
4-Mar-21	1	1.38169	103.75822	N.A	0.8336	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200023.wav
4-Mar-21	1	1.38169	103.75822	N.A	0.8336	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_200023.wav
4-Mar-21	1	1.38172	103.75825	N.A	0.83387	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200046.wav
4-Mar-21	1	1.38172	103.75825	N.A	0.83394	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200052.wav

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
4-Mar-21	1	1.38192	103.75814	N.A	0.83544	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200302.wav
4-Mar-21	1	1.38192	103.75814	N.A	0.83556	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200312.wav
4-Mar-21	1	1.38203	103.75808	N.A	0.83596	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200347.wav
4-Mar-21	1	1.38206	103.75807	N.A	0.83625	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200412.wav
4-Mar-21	1	1.38206	103.75807	N.A	0.83639	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200424.wav
4-Mar-21	1	1.38206	103.75807	N.A	0.83652	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200435.wav
4-Mar-21	1	1.38206	103.75807	N.A	0.8366	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200442.wav
4-Mar-21	1	1.38209	103.75782	N.A	0.83777	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200623.wav
4-Mar-21	1	1.38209	103.75782	N.A	0.83786	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200631.wav
4-Mar-21	1	1.38212	103.75785	N.A	0.83817	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200658.wav
4-Mar-21	1	1.38214	103.75785	N.A	0.83829	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200708.wav
4-Mar-21	1	1.38214	103.75785	N.A	0.8384	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200718.wav
4-Mar-21	1	1.38222	103.75785	N.A	0.83873	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200746.wav
4-Mar-21	1	1.38227	103.75785	N.A	0.83906	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200815.wav
4-Mar-21	1	1.38229	103.75783	N.A	0.83931	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200836.wav
4-Mar-21	1	1.38229	103.75783	N.A	0.83931	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_200836.wav
4-Mar-21	1	1.38229	103.75783	N.A	0.83944	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200848.wav
4-Mar-21	1	1.38236	103.75781	N.A	0.83997	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_200933.wav
4-Mar-21	1	1.38241	103.75780	N.A	0.84071	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201037.wav

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
4-Mar-21	1	1.38241	103.75780	N.A	0.84078	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201043.wav
4-Mar-21	1	1.38248	103.75778	N.A	0.84106	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201108.wav
4-Mar-21	1	1.38251	103.75776	N.A	0.84118	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201118.wav
4-Mar-21	1	1.38251	103.75776	N.A	0.84126	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201125.wav
4-Mar-21	1	1.38251	103.75777	N.A	0.84141	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201138.wav
4-Mar-21	1	1.38253	103.75778	N.A	0.84231	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201256.wav
4-Mar-21	1	1.38254	103.75776	N.A	0.84288	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201345.wav
4-Mar-21	1	1.38252	103.75771	N.A	0.84321	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201413.wav
4-Mar-21	1	1.38253	103.75771	N.A	0.84339	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201429.wav
4-Mar-21	1	1.38253	103.75771	N.A	0.84339	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_201429.wav
4-Mar-21	1	1.38255	103.75776	N.A	0.84366	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_201452.wav
4-Mar-21	1	1.38260	103.75767	N.A	0.84413	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201533.wav
4-Mar-21	1	1.38259	103.75763	N.A	0.84434	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_201551.wav
4-Mar-21	1	1.38259	103.75763	N.A	0.8444	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_201556.wav
4-Mar-21	1	1.38259	103.75763	N.A	0.8444	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_201556.wav
4-Mar-21	1	1.38264	103.75764	N.A	0.84457	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210304_201611.wav
4-Mar-21	1	1.38314	103.75761	N.A	0.84752	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_202026.wav
4-Mar-21	1	1.38475	103.75644	N.A	0.85837	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203603.wav
4-Mar-21	1	1.38475	103.75644	N.A	0.85853	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203617.wav

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
4-Mar-21	1	1.38479	103.75641	N.A	0.85873	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203634.wav
4-Mar-21	1	1.38501	103.75616	N.A	0.86014	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203836.wav
4-Mar-21	1	1.38510	103.75614	N.A	0.86031	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203851.wav
4-Mar-21	1	1.38510	103.75614	N.A	0.86042	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203900.wav
4-Mar-21	1	1.38520	103.75608	N.A	0.86059	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_203915.wav
4-Mar-21	1	1.38630	103.75529	N.A	0.86788	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210304_204945.wav
4-Mar-21	1	1.38116	103.75859	N.A	1958	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
4-Mar-21	1	1.38161	103.75817	N.A	1959	Reptile	*Gekko monarchus*	Spotted house gecko	2	Seen	-	Targeted	-
4-Mar-21	1	1.38169	103.75815	N.A	2000	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
4-Mar-21	1	1.38169	103.75815	N.A	2000	Reptile	*Gekko monarchus*	Spotted house gecko	2	Seen	-	Targeted	-
4-Mar-21	1	1.38175	103.75818	N.A	2001	Amphibian	*Microhyla butleri*	Painted chorus frog	1	Heard	-	Targeted	-
4-Mar-21	1	1.38183	103.75811	N.A	2002	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
4-Mar-21	1	1.38206	103.75794	N.A	2004	Reptile	*Gekko monarchus*	Spotted house gecko	1	Seen	-	Targeted	-
4-Mar-21	1	1.38213	103.75786	N.A	2005	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
4-Mar-21	1	1.38209	103.75782	N.A	2006	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
4-Mar-21	1	1.38253	103.75763	N.A	2011	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	5	Seen	-	Targeted	-
4-Mar-21	1	1.38255	103.75769	N.A	2014	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	3	Seen	-	Targeted	-
4-Mar-21	1	1.38267	103.75755	N.A	2017	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Seen	-	Targeted	-
4-Mar-21	1	1.38271	103.75758	N.A	2018	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
4-Mar-21	1	1.38319	103.75756	N.A	2021	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	2	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
4-Mar-21	1	1.38322	103.75759	N.A	2022	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	2	Seen	-	Targeted	-
4-Mar-21	1	1.38330	103.75766	N.A	2024	Reptile	*Dendrelaphis pictus*	Painted bronzeback	1	Seen	JT2426	Targeted	-
4-Mar-21	1	1.38330	103.75766	N.A	2024	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
4-Mar-21	1	1.38342	103.75760	N.A	2026	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38375	103.75748	N.A	2029	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
4-Mar-21	1	1.38458	103.75724	N.A	2032	Reptile	*Calotes versicolor*	Changeable lizard	4	Seen	-	Targeted	-
4-Mar-21	1	1.38474	103.75711	N.A	2033	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38479	103.75635	N.A	2037	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Seen	-	Targeted	-
4-Mar-21	1	1.38552	103.75574	N.A	2042	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38574	103.75570	N.A	2044	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38587	103.75560	N.A	2046	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38608	103.75539	N.A	2047	Amphibian	*Kaloula pulchra*	Banded bull frog	1	Seen	-	Targeted	-
4-Mar-21	1	1.38613	103.75537	N.A	2048	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38627	103.75523	N.A	2050	Reptile	*Gekko monarchus*	Spotted house gecko	1	Seen	-	Targeted	-
4-Mar-21	1	1.38671	103.75521	N.A	2054	Reptile	*Ahaetulla prasina*	Oriental whip snake	1	Seen	JT2429	Targeted	-
4-Mar-21	1	1.38678	103.75521	N.A	2056	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38709	103.75533	N.A	2058	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38722	103.75538	N.A	2100	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
4-Mar-21	1	1.38732	103.75535	N.A	2101	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
4-Mar-21	1	1.38746	103.75527	N.A	2101	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
4-Mar-21	1	1.38746	103.75527	N.A	2101	Reptile	*Dendrelaphis pictus*	Painted bronzeback	1	Seen	-	Targeted	-
4-Mar-21	1	1.38746	103.75527	N.A	2101	Bird	*Caprimulgus macrurus*	Large-tailed nightjar	1	Seen	-	Targeted	-
4-Mar-21	1	1.38759	103.75519	N.A	2103	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38759	103.75519	N.A	2103	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
4-Mar-21	1	1.38779	103.75505	N.A	2104	Reptile	*Calotes versicolor*	Changeable lizard	3	Seen	-	Targeted	-
4-Mar-21	1	1.38810	103.75488	N.A	2105	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
4-Mar-21	1	1.38829	103.75480	N.A	2106	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
4-Mar-21	1	1.38708	103.75423	N.A	2114	Amphibian	*Fejervarya sp.*	N.A	1	Seen	-	Incidental	-
11-Mar-21	1	1.38233	103.75755	N.A	2157	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Seen	-	Incidental	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
11-Mar-21	1	1.35081	103.73595	A1_04	2151-2156	Amphibian	*Duttaphrynus melanostictus*	Asian toad	9	Seen	-	Targeted	-
11-Mar-21	1	1.35081	103.73595	A1_04	2151-2156	Amphibian	*Fejervarya sp.*	N.A	2	Seen	-	Targeted	-
11-Mar-21	1	1.35081	103.73595	A1_04	2151-2156	Reptile	*Lygosoma bowringii*	Garden supple skink	1	Seen	-	Targeted	-
11-Mar-21	1	1.35000	103.73495	A1_02	2212-2217	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
11-Mar-21	1	1.35000	103.73495	A1_02	2212-2217	Amphibian	*Fejervarya sp.*	N.A	1	Seen	-	Targeted	-
11-Mar-21	1	1.34982	103.73416	A1_01	2216-2221	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
11-Mar-21	1	1.34982	103.73416	A1_01	2216-2221	Reptile	*Indotyphlops braminus*	Brahminy blind snake	1	Seen	-	Targeted	-
15-Mar-21	1	1.38342	103.75791	N.A	915	Butterfly	*Delias hyparete metarete*	Painted jezebel	2	Seen	-	Targeted	-
15-Mar-21	1	1.38342	103.75791	N.A	915	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
15-Mar-21	1	1.38342	103.75791	N.A	915	Butterfly	*Zizina otis lampa*	Lesser grass blue	1	Seen	-	Targeted	-
15-Mar-21	1	1.38378	103.75774	N.A	917	Butterfly	*Junonia orithya wallacei*	Blue pansy	4	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Butterfly	*Zizina otis lampa*	Lesser grass blue	2	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Bird	*Acridotheres javanicus*	Javan myna	4	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Bird	*Aerodramus sp.*	N.A	10	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Bird	*Aplonis panayensis*	Asian glossy starling	1	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Butterfly	*Zizina otis lampa*	Lesser grass blue	1	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Butterfly	*Prosotas dubiosa lumpura*	Tailless line blue	1	Seen	-	Targeted	-
15-Mar-21	1	1.38392	103.75766	N.A	918	Butterfly	*Delias hyparete metarete*	Painted jezebel	1	Seen	-	Targeted	-
15-Mar-21	1	1.38440	103.75743	N.A	921	Butterfly	*Danaus chrysippus chrysippus*	Plain tiger	1	Seen	-	Targeted	-
15-Mar-21	1	1.38440	103.75743	N.A	921	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
15-Mar-21	1	1.38471	103.75727	N.A	923	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
15-Mar-21	1	1.38471	103.75727	N.A	923	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
15-Mar-21	1	1.38653	103.75528	N.A	929	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
15-Mar-21	1	1.38653	103.75528	N.A	929	Butterfly	*Prosotas dubiosa lumpura*	Tailless line blue	1	Seen	-	Targeted	-
15-Mar-21	1	1.38653	103.75528	N.A	929	Butterfly	*Hypolimnas bolina jacintha*	Jacintha eggfly	1	Seen	-	Targeted	-
15-Mar-21	1	1.38653	103.75528	N.A	929	Odonate	*Gynacantha subinterrupta*	Dingy duskhawker	1	Seen	7426	Incidental	-
15-Mar-21	1	1.38653	103.75528	N.A	929	Bird	*Acridotheres javanicus*	Javan myna	1	Seen	-	Targeted	-

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15-Mar-21	1	1.38653	103.75528	N.A	929	Bird	*Oriolus chinensis*	Black-naped oriole	1	Seen	-	Targeted	-
15-Mar-21	1	1.38812	103.75490	N.A	936	Bird	*Todiramphus chloris*	Collared kingfisher	1	Seen	-	Targeted	-
15-Mar-21	1	1.38812	103.75490	N.A	936	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
15-Mar-21	1	1.38812	103.75490	N.A	936	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
23-Mar-21	2	1.38848	103.75470	N.A	735	Amphibian	*Kaloula pulchra*	Banded bull frog	1	Seen	-	Targeted	-
23-Mar-21	2	1.38848	103.75470	N.A	735	Bird	*Hirundo tahitica*	Pacific swallow	1	Seen	-	Targeted	-
23-Mar-21	2	1.38848	103.75470	N.A	735	Bird	*Acridotheres javanicus*	Javan myna	2	Seen	-	Targeted	-
23-Mar-21	2	1.38848	103.75470	N.A	735	Bird	*Unidentified Apodidae*	N.A	1	Seen	-	Targeted	-
23-Mar-21	2	1.38848	103.75470	N.A	735	Bird	*Aplonis panayensis*	Asian glossy starling	1	Seen	-	Targeted	-
23-Mar-21	2	1.38781	103.75501	N.A	736	Bird	*Oriolus chinensis*	Black-naped oriole	1	Heard	-	Targeted	-
23-Mar-21	2	1.38781	103.75501	N.A	736	Bird	*Treron vernans*	Pink-necked green pigeon	1	Seen	-	Targeted	-
23-Mar-21	2	1.38781	103.75501	N.A	736	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Incidental	-
23-Mar-21	2	1.38731	103.75532	N.A	740	Bird	*Aplonis panayensis*	Asian glossy starling	8	Seen	-	Targeted	-
23-Mar-21	2	1.38731	103.75532	N.A	740	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
23-Mar-21	2	1.38731	103.75532	N.A	740	Bird	*Treron vernans*	Pink-necked green pigeon	2	Seen	-	Targeted	-
23-Mar-21	2	1.38731	103.75532	N.A	740	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Heard	-	Targeted	-
23-Mar-21	2	1.38699	103.75542	N.A	742	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
23-Mar-21	2	1.38657	103.75515	N.A	744	Bird	*Aplonis panayensis*	Asian glossy starling	2	Heard	-	Targeted	-
23-Mar-21	2	1.38657	103.75515	N.A	744	Bird	*Oriolus chinensis*	Black-naped oriole	1	Heard	-	Targeted	-
23-Mar-21	2	1.38657	103.75515	N.A	744	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
23-Mar-21	2	1.38589	103.75544	N.A	747	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Heard	-	Targeted	-
23-Mar-21	2	1.38589	103.75544	N.A	747	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
23-Mar-21	2	1.38589	103.75544	N.A	747	Mammal	*Callosciurus notatus*	Plantain squirrel	2	Seen	-	Targeted	-
23-Mar-21	2	1.38589	103.75544	N.A	747	Bird	*Treron vernans*	Pink-necked green pigeon	1	Seen	-	Targeted	-
23-Mar-21	2	1.38589	103.75544	N.A	747	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Targeted	-
23-Mar-21	2	1.38589	103.75544	N.A	747	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Heard	-	Targeted	-
23-Mar-21	2	1.38561	103.75567	N.A	751	Bird	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	1	Heard	-	Targeted	-
23-Mar-21	2	1.38561	103.75567	N.A	751	Bird	*Spilopelia chinensis*	Spotted dove	1	Heard	-	Targeted	-
23-Mar-21	2	1.38561	103.75567	N.A	751	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Heard	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
23-Mar-21	2	1.38561	103.75567	N.A	751	Bird	*Aplonis panayensis*	Asian glossy starling	6	Seen	-	Targeted	-
23-Mar-21	2	1.38561	103.75567	N.A	751	Bird	*Todiramphus chloris*	Collared kingfisher	2	Seen	-	Targeted	-
23-Mar-21	2	1.38561	103.75567	N.A	751	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	2	Seen	-	Targeted	-
23-Mar-21	2	1.38484	103.75627	N.A	757	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
23-Mar-21	2	1.38484	103.75627	N.A	757	Bird	*Todiramphus chloris*	Collared kingfisher	1	Seen	-	Targeted	-
23-Mar-21	2	1.38484	103.75627	N.A	757	Bird	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	1	Heard	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Aerodramus sp.*	N.A	3	Seen	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Heard	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Columba livia*	Rock dove	1	Seen	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Oriolus chinensis*	Black-naped oriole	1	Heard	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
23-Mar-21	2	1.38479	103.75722	N.A	805	Bird	*Aplonis panayensis*	Asian glossy starling	6	Seen	-	Targeted	-
23-Mar-21	2	1.38411	103.75757	N.A	809	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Targeted	-
23-Mar-21	2	1.38411	103.75757	N.A	809	Bird	*Treron vernans*	Pink-necked green pigeon	1	Seen	-	Targeted	-
23-Mar-21	2	1.38411	103.75757	N.A	809	Bird	*Yungipicus moluccensis*	Sunda pygmy woodpecker	1	Heard	-	Targeted	-
23-Mar-21	2	1.38411	103.75757	N.A	809	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Seen	-	Targeted	-
23-Mar-21	2	1.38340	103.75790	N.A	813	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
23-Mar-21	2	1.38340	103.75790	N.A	813	Bird	*Aplonis panayensis*	Asian glossy starling	4	Seen	-	Targeted	-
23-Mar-21	2	1.38340	103.75790	N.A	813	Bird	*Acridotheres javanicus*	Javan myna	2	Seen	-	Targeted	-
23-Mar-21	2	1.38340	103.75790	N.A	813	Bird	*Oriolus chinensis*	Black-naped oriole	1	Seen	-	Targeted	-
23-Mar-21	2	1.38222	103.75802	N.A	820	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
23-Mar-21	2	1.38222	103.75802	N.A	820	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Heard	-	Targeted	-
23-Mar-21	2	1.38222	103.75802	N.A	820	Bird	*Orthotomus sutorius*	Common tailorbird	2	Heard	-	Targeted	-
23-Mar-21	2	1.38222	103.75802	N.A	820	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
23-Mar-21	2	1.38222	103.75802	N.A	820	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
23-Mar-21	2	1.38222	103.75802	N.A	820	Bird	*Gerygone sulphurea*	Golden-bellied gerygone	1	Heard	-	Targeted	-
23-Mar-21	2	1.38174	103.75797	N.A	823	Mammal	*Callosciurus notatus*	Plantain squirrel	1	Seen	-	Targeted	-
23-Mar-21	2	1.38174	103.75797	N.A	823	Bird	*Spilopelia chinensis*	Spotted dove	2	Seen	-	Targeted	-
23-Mar-21	2	1.38174	103.75797	N.A	823	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Targeted	-
23-Mar-21	2	1.38174	103.75797	N.A	823	Bird	*Orthotomus sutorius*	Common tailorbird	1	Seen	-	Targeted	-
23-Mar-21	2	1.38112	103.75923	N.A	828	Bird	*Lanius cristatus*	Brown shrike	1	Seen	-	Incidental	-
25-Mar-21	2	1.38816	103.75485	N.A	1113	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38804	103.75492	N.A	1114	Butterfly	*Phalanta phalantha phalantha*	Leopard	1	Seen	-	Targeted	-
25-Mar-21	2	1.38804	103.75492	N.A	1114	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38786	103.75502	N.A	1116	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
25-Mar-21	2	1.38639	103.75531	N.A	1124	Butterfly	*Iambrix salsala salsala*	Chestnut bob	3	Seen	-	Targeted	-
25-Mar-21	2	1.38636	103.75538	N.A	1125	Butterfly	*Melanitis leda leda*	Common evening brown	1	Seen	-	Targeted	-
25-Mar-21	2	1.38636	103.75538	N.A	1126	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
25-Mar-21	2	1.38636	103.75538	N.A	1126	Butterfly	*Delias hyparete metarete*	Painted jezebel	1	Seen	-	Targeted	-
25-Mar-21	2	1.38616	103.75545	N.A	1127	Butterfly	*Junonia hedonia ida*	Chocolate pansy	2	Seen	-	Targeted	-
25-Mar-21	2	1.38616	103.75545	N.A	1127	Butterfly	*Hypolimnas bolina bolina*	Great eggfly	1	Seen	CT7776	Targeted	-
25-Mar-21	2	1.38616	103.75545	N.A	1128	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38578	103.75582	N.A	1132	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38564	103.75589	N.A	1133	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38552	103.75592	N.A	1133	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38544	103.75599	N.A	1134	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
25-Mar-21	2	1.38544	103.75599	N.A	1134	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
25-Mar-21	2	1.38544	103.75599	N.A	1135	Butterfly	*Anthene emolus goberus*	Ciliate blue	1	Seen	CT7778	Targeted	-
25-Mar-21	2	1.38538	103.75602	N.A	1136	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
25-Mar-21	2	1.38538	103.75602	N.A	1136	Butterfly	*Delias hyparete metarete*	Painted jezebel	1	Seen	-	Targeted	-
25-Mar-21	2	1.38503	103.75618	N.A	1139	Butterfly	*Mycalesis mineus macromalayana*	Dark brand bush brown	1	Seen	CT7779	Targeted	-
25-Mar-21	2	1.38488	103.75639	N.A	1139	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
25-Mar-21	2	1.38488	103.75639	N.A	1140	Butterfly	*Zizula hylax pygmaea*	Pygmy grass blue	1	Seen	-	Targeted	-
25-Mar-21	2	1.38470	103.75649	N.A	1141	Butterfly	*Appias libythea olferna*	Striped albatross	2	Seen	-	Targeted	-
25-Mar-21	2	1.38470	103.75649	N.A	1141	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38470	103.75649	N.A	1141	Butterfly	*Acraea terpsicore*	Tawny coster	2	Seen	-	Targeted	-
25-Mar-21	2	1.38465	103.75664	N.A	1143	Butterfly	*Junonia hedonia ida*	Chocolate pansy	2	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
25-Mar-21	2	1.38465	103.75664	N.A	1143	Butterfly	*Matapa aria*	Common redeye	10	Seen	-	Targeted	Perched on bamboo
25-Mar-21	2	1.38466	103.75680	N.A	1145	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38466	103.75680	N.A	1145	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
25-Mar-21	2	1.38466	103.75680	N.A	1145	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38471	103.75701	N.A	1146	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38471	103.75701	N.A	1146	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38457	103.75727	N.A	1147	Butterfly	*Acraea terpsicore*	Tawny coster	1	Seen	-	Targeted	-
25-Mar-21	2	1.38451	103.75729	N.A	1148	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38451	103.75729	N.A	1148	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
25-Mar-21	2	1.38451	103.75729	N.A	1148	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
25-Mar-21	2	1.38427	103.75741	N.A	1150	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38413	103.75748	N.A	1151	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38413	103.75748	N.A	1151	Butterfly	*Appias libythea olferna*	Striped albatross	2	Seen	-	Targeted	-
25-Mar-21	2	1.38413	103.75748	N.A	1151	Butterfly	*Acraea terpsicore*	Tawny coster	2	Seen	-	Targeted	-
25-Mar-21	2	1.38396	103.75756	N.A	1152	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38396	103.75756	N.A	1152	Butterfly	*Zizina otis lampa*	Lesser grass blue	1	Seen	-	Targeted	-
25-Mar-21	2	1.38370	103.75778	N.A	1153	Butterfly	*Zizina otis lampa*	Lesser grass blue	5	Seen	-	Targeted	-
25-Mar-21	2	1.38329	103.75799	N.A	1156	Butterfly	*Junonia almana javana*	Peacock pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38319	103.75786	N.A	1156	Butterfly	*Junonia orithya wallacei*	Blue pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38319	103.75786	N.A	1156	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38319	103.75786	N.A	1156	Butterfly	*Eurema sp.*	N.A	1	Seen	-	Targeted	-
25-Mar-21	2	1.38313	103.75771	N.A	1157	Butterfly	*Junonia almana javana*	Peacock pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38313	103.75771	N.A	1157	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38298	103.75753	N.A	1159	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
25-Mar-21	2	1.38298	103.75753	N.A	1159	Butterfly	*Prosotas dubiosa lumpura*	Tailless line blue	2	Seen	-	Targeted	-
25-Mar-21	2	1.38275	103.75763	N.A	1203	Bird	*Cuculus micropterus*	Indian cuckoo	1	Seen	CT7789-CT7782	Incidental	-
25-Mar-21	2	1.38276	103.75741	N.A	1205	Butterfly	*Iambrix salsala salsala*	Chestnut bob	1	Seen	-	Targeted	-
25-Mar-21	2	1.38248	103.75757	N.A	1206	Butterfly	*Prosotas dubiosa lumpura*	Tailless line blue	1	Seen	-	Targeted	-
25-Mar-21	2	1.38248	103.75757	N.A	1207	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38248	103.75757	N.A	1207	Butterfly	*Mycalesis mineus macromalayana*	Dark brand bush brown	1	Seen	CT7791	Targeted	-
25-Mar-21	2	1.38204	103.75789	N.A	1209	Butterfly	*Mycalesis mineus macromalayana*	Dark brand bush brown	1	Seen	CT7792	Targeted	-
25-Mar-21	2	1.38204	103.75789	N.A	1209	Butterfly	*Junonia atlites atlites*	Grey pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38204	103.75789	N.A	1210	Butterfly	*Prosotas dubiosa lumpura*	Tailless line blue	10	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
25-Mar-21	2	1.38197	103.75797	N.A	1212	Butterfly	*Prosotas dubiosa lumpura*	Tailless line blue	10	Seen	-	Targeted	-
25-Mar-21	2	1.38197	103.75797	N.A	1212	Butterfly	*Junonia hedonia ida*	Chocolate pansy	1	Seen	-	Targeted	-
25-Mar-21	2	1.38185	103.75807	N.A	1213	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
25-Mar-21	2	1.38185	103.75807	N.A	1213	Butterfly	*Appias libythea olferna*	Striped albatross	1	Seen	-	Targeted	-
25-Mar-21	2	1.38175	103.75811	N.A	1213	Bird	*Gerygone sulphurea*	Golden-bellied gerygone	1	Heard	-	Targeted	-
25-Mar-21	2	1.38175	103.75811	N.A	1213	Butterfly	*Junonia atlites atlites*	Grey pansy	2	Seen	-	Targeted	-
25-Mar-21	2	1.38167	103.75817	N.A	1215	Butterfly	*Mycalesis mineus macromalayana*	Dark brand bush brown	1	Seen	CT7794	Targeted	-
31-Mar-21	2	1.38690	103.75438	N.A	0.85213	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_202704.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.85233	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_202721.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.8536	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_202911.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.85403	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_202948.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.85667	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203336.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.85789	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203522.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.8584	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203606.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.85848	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203613.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.85854	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203618.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.8588	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203640.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.8589	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_203649.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86356	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_204332.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86472	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_204512.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86656	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210331_204751.wav

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
31-Mar-21	2	1.38690	103.75438	N.A	0.86728	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_204853.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86745	Mammal (Bat)	*Myotis muricola*	Whiskered myotis	1	Acoustic	-	Targeted	20210331_204908.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86789	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_204946.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86797	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_204953.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86808	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_205002.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86822	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_205014.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86839	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_205029.wav
31-Mar-21	2	1.38690	103.75438	N.A	0.86868	Mammal (Bat)	*Scotophilus kuhlii*	Asiatic lesser yellow house bat	1	Acoustic	-	Targeted	20210331_205054.wav
31-Mar-21	2	1.38805	103.75496	N.A	1329	Odonate	*Pantala flavescens*	Wandering glider	3	Seen	-	Targeted	-
31-Mar-21	2	1.38747	103.75525	N.A	1333	Odonate	*Neurothemis fluctuans*	Common parasol	4	Seen	-	Targeted	-
31-Mar-21	2	1.38747	103.75525	N.A	1333	Odonate	*Brachydiplax chalybea*	Blue dasher	1	Seen	-	Targeted	-
31-Mar-21	2	1.38747	103.75525	N.A	1333	Odonate	*Trithemis aurora*	Crimson dropwing	1	Seen	-	Targeted	-
31-Mar-21	2	1.38747	103.75525	N.A	1335	Odonate	*Crocothemis servilia*	Common scarlet	1	Seen	-	Targeted	-
31-Mar-21	2	1.38747	103.75525	N.A	1335	Odonate	*Rhyothemis phyllis*	Yellow-barred flutterer	1	Seen	-	Targeted	-
31-Mar-21	2	1.38747	103.75525	N.A	1335	Odonate	*Tramea transmarina*	Saddlebag glider	2	Seen	-	Targeted	-
31-Mar-21	2	1.38726	103.75533	N.A	1339	Aculeate hymenopteran	*Bembicinus sp.*	N.A	2	Seen	-	Targeted	Small individual collected
31-Mar-21	2	1.38726	103.75533	N.A	1345	Aculeate hymenopteran	*Amegilla andrewsi*	Andrew's blue-banded digger bee	1	Seen	-	Targeted	-
31-Mar-21	2	1.38726	103.75533	N.A	1345	Aculeate hymenopteran	*Bembicinus sp.*	N.A	1	Seen	-	Targeted	-
31-Mar-21	2	1.38726	103.75533	N.A	1345	Odonate	*Pantala flavescens*	Wandering glider	1	Seen	-	Targeted	-
31-Mar-21	2	1.38630	103.75537	N.A	1350	Odonate	*Lathrecista asiatica*	Scarlet grenadier	4	Seen	-	Targeted	-
31-Mar-21	2	1.38496	103.75601	N.A	1359	Aculeate hymenopteran	*Scolia sp.*	NA	1	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
31-Mar-21	2	1.38491	103.75627	N.A	1402	Odonate	*Orthetrum chrysis*	Spine-tufted skimmer	1	Seen	-	Targeted	-
31-Mar-21	2	1.38461	103.75722	N.A	1409	Bird	*Lanius sp.*	N.A	1	Seen	-	Incidental	-
31-Mar-21	2	1.38365	103.75773	N.A	1414	Odonate	*Neurothemis fluctuans*	Common parasol	1	Seen	-	Targeted	-
31-Mar-21	2	1.38269	103.75753	N.A	1417	Aculeate hymenopteran	*Apis cerana*	Eastern honey bee	1	Seen	-	Targeted	-
31-Mar-21	2	1.38223	103.75785	N.A	1423	Bird	*Unidentified Cuculidae*	N.A	1	Seen	-	Incidental	-
31-Mar-21	2	1.38193	103.75809	N.A	1425	Odonate	*Lathrecista asiatica*	Scarlet grenadier	2	Seen	-	Targeted	-
31-Mar-21	2	1.38175	103.75820	N.A	1426	Odonate	*Lathrecista asiatica*	Scarlet grenadier	1	Seen	-	Targeted	-
31-Mar-21	2	1.38798	103.75459	N.A	2006	Amphibian	*Microhyla mukhlesuri*	East Asian ornate chorus frog	30	Heard	-	Targeted	-
31-Mar-21	2	1.38798	103.75459	N.A	2006	Amphibian	*Polypedates leucomystax*	Four-lined tree frog	1	Heard	-	Targeted	-
31-Mar-21	2	1.38840	103.75476	N.A	2007	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
31-Mar-21	2	1.38821	103.75486	N.A	2008	Amphibian	*Duttaphrynus melanostictus*	Asian toad	2	Seen	-	Targeted	-
31-Mar-21	2	1.38802	103.75496	N.A	2009	Amphibian	*Duttaphrynus melanostictus*	Asian toad	2	Seen	-	Targeted	-
31-Mar-21	2	1.38795	103.75498	N.A	2009	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38755	103.75521	N.A	2010	Amphibian	*Polypedates leucomystax*	Four-lined tree frog	1	Heard	-	Targeted	-
31-Mar-21	2	1.38755	103.75521	N.A	2010	Amphibian	*Microhyla mukhlesuri*	East Asian ornate chorus frog	1	Heard	-	Targeted	-
31-Mar-21	2	1.38746	103.75524	N.A	2011	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
31-Mar-21	2	1.38746	103.75524	N.A	2011	Amphibian	*Microhyla butleri*	Painted chorus frog	20	Seen	-	Targeted	-
31-Mar-21	2	1.38746	103.75524	N.A	2011	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
31-Mar-21	2	1.38735	103.75533	N.A	2013	Bird	*Caprimulgus sp.*	N.A	1	Seen	-	Targeted	-
31-Mar-21	2	1.38735	103.75533	N.A	2013	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38705	103.75545	N.A	2014	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
31-Mar-21	2	1.38613	103.75538	N.A	2021	Amphibian	*Kaloula pulchra*	Banded bull frog	2	Seen	-	Targeted	-
31-Mar-21	2	1.38573	103.75550	N.A	2024	Amphibian	*Microhyla mukhlesuri*	East Asian ornate chorus frog	5	Heard	-	Targeted	-
31-Mar-21	2	1.38573	103.75550	N.A	2024	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
31-Mar-21	2	1.38562	103.75555	N.A	2025	Amphibian	*Duttaphrynus melanostictus*	Asian toad	3	Seen	-	Targeted	-
31-Mar-21	2	1.38556	103.75559	N.A	2026	Mammal	*Rattus sp.*	N.A	1	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
31-Mar-21	2	1.38516	103.75604	N.A	2029	Amphibian	*Microhyla mukhlesuri*	East Asian ornate chorus frog	10	Heard	-	Targeted	-
31-Mar-21	2	1.38489	103.75623	N.A	2031	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
31-Mar-21	2	1.38489	103.75623	N.A	2031	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Seen	-	Targeted	-
31-Mar-21	2	1.38479	103.75636	N.A	2032	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38465	103.75667	N.A	2035	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38486	103.75697	N.A	2036	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38500	103.75711	N.A	2038	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38500	103.75711	N.A	2038	Amphibian	*Duttaphrynus melanostictus*	Asian toad	1	Seen	-	Targeted	-
31-Mar-21	2	1.38489	103.75718	N.A	2038	Reptile	*Calotes versicolor*	Changeable lizard	3	Seen	-	Targeted	-
31-Mar-21	2	1.38481	103.75722	N.A	2039	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38469	103.75727	N.A	2039	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
31-Mar-21	2	1.38458	103.75733	N.A	2039	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38438	103.75743	N.A	2040	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38419	103.75755	N.A	2041	Reptile	*Calotes versicolor*	Changeable lizard	3	Seen	-	Targeted	-
31-Mar-21	2	1.38419	103.75755	N.A	2041	Reptile	*Ahaetulla prasina*	Oriental whip snake	1	Seen	-	Targeted	-
31-Mar-21	2	1.38358	103.75783	N.A	2044	Bird	*Caprimulgus macrurus*	Large-tailed nightjar	1	Seen	-	Targeted	-
31-Mar-21	2	1.38358	103.75783	N.A	2044	Amphibian	*Microhyla mukhlesuri*	East Asian ornate chorus frog	3	Heard	-	Targeted	-
31-Mar-21	2	1.38328	103.75791	N.A	2045	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38291	103.75786	N.A	2046	Amphibian	*Microhyla mukhlesuri*	East Asian ornate chorus frog	2	Heard	-	Targeted	-
31-Mar-21	2	1.38272	103.75778	N.A	2047	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Heard	-	Targeted	-
31-Mar-21	2	1.38225	103.75804	N.A	2050	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-
31-Mar-21	2	1.38221	103.75806	N.A	2051	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Heard	-	Targeted	-
31-Mar-21	2	1.38200	103.75815	N.A	2051	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
31-Mar-21	2	1.38183	103.75821	N.A	2052	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
31-Mar-21	2	1.38177	103.75821	N.A	2052	Amphibian	*Eleutherodactylus planirostris*	Greenhouse frog	1	Seen	-	Targeted	-
31-Mar-21	2	1.38177	103.75821	N.A	2052	Reptile	*Hemidactylus frenatus*	Spiny-tailed house gecko	1	Seen	-	Targeted	-
31-Mar-21	2	1.38168	103.75819	N.A	2052	Reptile	*Calotes versicolor*	Changeable lizard	1	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
31-Mar-21	2	1.38131	103.75824	N.A	2053	Reptile	*Calotes versicolor*	Changeable lizard	2	Seen	-	Targeted	-
22-Apr-21	2	1.38099	103.75930	N.A	2215	Fish	*Heterotilapia buttikoferi*	Bumblebee tilapia	1	Seen	-	Incidental	-
22-Apr-21	2	1.38099	103.75930	N.A	2217	Amphibian	*Duttaphrynus melanostictus*	Asian toad	3	Seen	-	Targeted	-
22-Apr-21	2	1.38366	103.75610	A1_03	2138-2142	Fish	*Poecilia reticulata*	Guppy	100	Seen	-	Targeted	-
22-Apr-21	2	1.38366	103.75610	A1_03	2138-2142	Amphibian	*Duttaphrynus melanostictus*	Asian toad	3	Seen	-	Targeted	-
22-Apr-21	2	1.38173	103.75773	A1_04	2147-2152	Reptile	*Trachemys scripta*	Red-eared slider	1	Seen	-	Targeted	-
22-Apr-21	2	1.38117	103.75974	A1_05	2159-2204	Amphibian	*Duttaphrynus melanostictus*	Asian toad	2	Seen	-	Targeted	-
22-Apr-21	2	1.38117	103.75974	A1_05	2159-2204	Reptile	*Hemidactylus brookii*	Brooke's house gecko	3	Seen	-	Incidental	-
22-Apr-21	2	1.38117	103.75974	A1_05	2159-2204	Amphibian	*Fejervarya cancrivora*	Crab-eating frog	1	Heard	-	Targeted	-
22-Apr-21	2	1.38605	103.75467	A1_02	2221-2226	Amphibian	*Duttaphrynus melanostictus*	Asian toad	11	Seen	-	Targeted	-
22-Apr-21	2	1.38853	103.75336	A1_01	2235-2240	Fish	*Unidentified cichlidae*	Cichlid	1	Seen	-	Targeted	-
22-Apr-21	2	1.38853	103.75336	A1_01	2235-2240	Fish	*Poecilia reticulata*	Guppy	100	Seen	-	Targeted	-
22-Apr-21	2	1.38853	103.75336	A1_01	2235-2240	Amphibian	*Duttaphrynus melanostictus*	Asian toad	6	Seen	-	Targeted	-
22-Apr-21	2	1.38853	103.75336	A1_01	2235-2240	Amphibian	*Kaloula pulchra*	Banded bull frog	1	Seen	-	Targeted	-
22-Apr-21	2	1.38853	103.75336	A1_01	2235-2240	Fish	*Puntigrus partipentazona*	Malayan tiger barb	2	Seen	-	Targeted	-
22-Apr-21	2	1.38853	103.75336	A1_01	2235-2240	Fish	*Rhinogobius sp.*	Goby	2	Seen	-	Targeted	-
29-Apr-21	2	1.38118	103.75974	A1_05	1143	#N/A	*Orthetrum sabina*	#N/A	1	Seen	-	Incidental	-
29-Apr-21	2	1.38118	103.75974	A1_05	1137-1142	#N/A	*Pantala flavescens*	#N/A	1	Seen	-	Targeted	-
29-Apr-21	2	1.38367	103.75611	A1_03	1200-1205	#N/A	*Poecilia reticulata*	#N/A	11	Seen	-	Targeted	-
29-Apr-21	2	1.38853	103.75337	A1_01	1228-1232	#N/A	*Amphilophus citrinellus*	#N/A	1	Seen	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
29-Apr-21	2	1.38853	103.75337	A1_01	1228-1232	#N/A	*Poecilia reticulata*	#N/A	105	Seen	-	Targeted	-
29-Apr-21	2	1.38853	103.75337	A1_01	1228-1232	#N/A	*Orthetrum sabina*	#N/A	1	Seen	-	Targeted	-
19-Oct-21	3	1.38173	103.75819	N.A	708	Bird	*Halcyon smyrnensis*	White-throated kingfisher	1	Heard	-	Targeted	-
19-Oct-21	3	1.38173	103.75819	N.A	708	Bird	*Zosterops simplex*	Swinhoe's white-eye	1	Heard	-	Targeted	-
19-Oct-21	3	1.38173	103.75819	N.A	708	Bird	*Oriolus chinensis*	Black-naped oriole	2	Heard	-	Targeted	-
19-Oct-21	3	1.38173	103.75819	N.A	708	Bird	*Cinnyris jugularis*	Olive-backed sunbird	2	Heard	-	Targeted	-
19-Oct-21	3	1.38201	103.75794	N.A	715	Bird	*Muscicapa dauurica*	Asian brown flycatcher	3	Heard	-	Targeted	-
19-Oct-21	3	1.38222	103.75783	N.A	717	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
19-Oct-21	3	1.38222	103.75783	N.A	717	Bird	*Lanius cristatus*	Brown shrike	1	Heard	-	Targeted	-
19-Oct-21	3	1.38222	103.75783	N.A	717	Bird	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	1	Heard	-	Targeted	-
19-Oct-21	3	1.38222	103.75783	N.A	717	Bird	*Halcyon smyrnensis*	White-throated kingfisher	1	Heard	-	Targeted	-
19-Oct-21	3	1.38262	103.75757	N.A	725	Bird	*Eudynamys scolopaceus*	Asian koel	1	Heard	-	Targeted	-
19-Oct-21	3	1.38262	103.75757	N.A	725	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
19-Oct-21	3	1.38262	103.75757	N.A	725	Bird	*Treron vernans*	Pink-necked green pigeon	1	Seen	-	Targeted	-
19-Oct-21	3	1.38262	103.75757	N.A	725	Bird	*Oriolus chinensis*	Black-naped oriole	1	Heard	-	Targeted	-
19-Oct-21	3	1.38262	103.75757	N.A	725	Bird	*Aplonis panayensis*	Asian glossy starling	2	Heard	-	Targeted	-
19-Oct-21	3	1.38262	103.75757	N.A	725	Bird	*Ficedula zanthopygia*	Yellow-rumped flycatcher	1	Heard	-	Targeted	-
19-Oct-21	3	1.38337	103.75709	N.A	734	Bird	*Phylloscopus borealis*	Arctic warbler	1	Seen	DSCN 801	Targeted	-
19-Oct-21	3	1.38337	103.75709	N.A	734	Bird	*Lanius cristatus*	Brown shrike	1	Heard	-	Targeted	-
19-Oct-21	3	1.38359	103.75695	N.A	736	Bird	*Muscicapa dauurica*	Asian brown flycatcher	2	Heard	-	Targeted	-
19-Oct-21	3	1.38359	103.75695	N.A	736	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
19-Oct-21	3	1.38359	103.75695	N.A	736	Bird	*Geopelia striata*	Zebra dove	1	Heard	-	Targeted	-
19-Oct-21	3	1.38359	103.75695	N.A	736	Bird	*Aegithina tiphia*	Common iora	3	Heard	-	Targeted	-
19-Oct-21	3	1.38390	103.75670	N.A	738	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
19-Oct-21	3	1.38428	103.75638	N.A	740	Bird	*Aplonis panayensis*	Asian glossy starling	3	Heard	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
19-Oct-21	3	1.38428	103.75638	N.A	740	Bird	*Eudynamys scolopaceus*	Asian koel	2	Heard	-	Targeted	-
19-Oct-21	3	1.38428	103.75638	N.A	740	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
19-Oct-21	3	1.38428	103.75638	N.A	740	Bird	*Oriolus chinensis*	Black-naped oriole	1	Heard	-	Targeted	-
19-Oct-21	3	1.38553	103.75552	N.A	748	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
19-Oct-21	3	1.38553	103.75552	N.A	748	Bird	*Aegithina tiphia*	Common iora	3	Seen	-	Targeted	-
19-Oct-21	3	1.38553	103.75552	N.A	748	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Seen	-	Targeted	-
19-Oct-21	3	1.38553	103.75552	N.A	748	Bird	*Ficedula zanthopygia*	Yellow-rumped flycatcher	1	Seen	-	Targeted	Male
19-Oct-21	3	1.38599	103.75519	N.A	759	Bird	*Muscicapa dauurica*	Asian brown flycatcher	2	Seen	-	Targeted	-
19-Oct-21	3	1.38599	103.75519	N.A	759	Bird	*Orthotomus sutorius*	Common tailorbird	2	Seen	-	Targeted	-
19-Oct-21	3	1.38599	103.75519	N.A	759	Bird	*Zosterops simplex*	Swinhoe's white-eye	3	Seen	-	Targeted	-
19-Oct-21	3	1.38640	103.75485	N.A	803	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
19-Oct-21	3	1.38640	103.75485	N.A	803	Bird	*Aplonis panayensis*	Asian glossy starling	32	Seen	-	Targeted	-
19-Oct-21	3	1.38640	103.75485	N.A	803	Bird	*Muscicapa dauurica*	Asian brown flycatcher	1	Seen	-	Targeted	-
19-Oct-21	3	1.38833	103.75484	N.A	818	Bird	*Psittacula alexandri*	Red-breasted parakeet	1	Heard	-	Incidental	-
2-Nov-21	4	1.38758	103.75453	N.A	716	Bird	*Egretta garzetta*	Little egret	1	Seen	-	Targeted	-
2-Nov-21	4	1.38758	103.75453	N.A	716	Bird	*Aplonis panayensis*	Asian glossy starling	17	Seen	-	Targeted	-
2-Nov-21	4	1.38758	103.75453	N.A	716	Bird	*Lanius tigrinus*	Tiger shrike	1	Heard	-	Targeted	-
2-Nov-21	4	1.38758	103.75453	N.A	716	Bird	*Aerodramus sp.*	Swiftlet	1	Seen	-	Targeted	-
2-Nov-21	4	1.38712	103.75484	N.A	719	Bird	*Aplonis panayensis*	Asian glossy starling	21	Seen	-	Targeted	-
2-Nov-21	4	1.38712	103.75484	N.A	719	Bird	*Aegithina tiphia*	Common iora	1	Heard	-	Targeted	-
2-Nov-21	4	1.38672	103.75508	N.A	722	Bird	*Pernis ptilorhynchus*	Crested honey-buzzard	1	Seen	-	Targeted	Flying over
2-Nov-21	4	1.38672	103.75508	N.A	722	Bird	*Oriolus chinensis*	Black-naped oriole	2	Seen	-	Targeted	-
2-Nov-21	4	1.38672	103.75508	N.A	722	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Targeted	-
2-Nov-21	4	1.38672	103.75508	N.A	722	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
2-Nov-21	4	1.38672	103.75508	N.A	722	Bird	*Pernis ptilorhynchus*	Crested honey-buzzard	1	Seen	-	Targeted	-
2-Nov-21	4	1.38672	103.75508	N.A	722	Bird	*Corvus splendens*	House crow	2	Seen	-	Targeted	-
2-Nov-21	4	1.38599	103.75550	N.A	729	Bird	*Muscicapa dauurica*	Asian brown flycatcher	1	Heard	-	Targeted	-

Date	Cycle	Latitude	Longitude	Point (terrestrial/ aquatic)	Time	Taxon	Species	Common name	Qty	Observation type	Photo no.	Survey method	Remarks
2-Nov-21	4	1.38599	103.75550	N.A	729	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
2-Nov-21	4	1.38599	103.75550	N.A	729	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
2-Nov-21	4	1.38599	103.75550	N.A	729	Bird	*Treron vernans*	Pink-necked green pigeon	1	Seen	-	Targeted	-
2-Nov-21	4	1.38566	103.75567	N.A	733	Bird	*Pycnonotus goiavier*	Yellow-vented bulbul	1	Heard	-	Targeted	-
2-Nov-21	4	1.38526	103.75599	N.A	737	Bird	*Halcyon smyrnensis*	White-throated kingfisher	1	Heard	-	Targeted	-
2-Nov-21	4	1.38526	103.75599	N.A	737	Bird	*Eudynamys scolopaceus*	Asian koel	1	Heard	-	Targeted	-
2-Nov-21	4	1.38458	103.75659	N.A	740	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
2-Nov-21	4	1.38458	103.75659	N.A	740	Bird	*Chrysophlegma miniaceum*	Banded woodpecker	2	Heard	-	Targeted	-
2-Nov-21	4	1.38458	103.75659	N.A	740	Bird	*Eudynamys scolopaceus*	Asian koel	1	Heard	-	Targeted	-
2-Nov-21	4	1.38458	103.75659	N.A	740	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	-
2-Nov-21	4	1.38347	103.75720	N.A	745	Bird	*Dicaeum cruentatum*	Scarlet-backed flowerpecker	1	Heard	-	Targeted	-
2-Nov-21	4	1.38347	103.75720	N.A	745	Bird	*Phylloscopus borealis*	Arctic warbler	1	Heard	-	Targeted	-
2-Nov-21	4	1.38347	103.75720	N.A	745	Bird	*Lanius cristatus*	Brown shrike	1	Heard	-	Targeted	-
2-Nov-21	4	1.38347	103.75720	N.A	745	Bird	*Orthotomus sutorius*	Common tailorbird	1	Heard	-	Targeted	-
2-Nov-21	4	1.38268	103.75771	N.A	752	Bird	*Cinnyris jugularis*	Olive-backed sunbird	1	Heard	-	Targeted	Male
2-Nov-21	4	1.38268	103.75771	N.A	752	Bird	*Todiramphus chloris*	Collared kingfisher	1	Heard	-	Targeted	-
2-Nov-21	4	1.38238	103.75798	N.A	754	Bird	*Lanius cristatus*	Brown shrike	1	Heard	-	Targeted	-
2-Nov-21	4	1.38185	103.75815	N.A	758	Bird	*Muscicapa dauurica*	Asian brown flycatcher	1	Heard	-	Targeted	-
2-Nov-21	4	1.38106	103.75907	N.A	802	Bird	*Columba livia*	Rock dove	22	Seen	-	Targeted	-

Appendix J - Faunal Survey Data

Date	Survey	AM/PM	Time in	Time out	Weather
24-Feb-21	Butterfly	AM	14:00	15:30	Cloudy
4-Mar-21	Bird, herp, mammal	PM	19:54	21:14	Fair
12-Mar-21	Odonate, fish (aquatic)	AM	9:00	10:30	Cloudy (rain in between)
15-Mar-21	Bird, herp, mammal	AM	9:00	9:37	Sunny
24-Feb-21	Bird, herp, mammal	AM	7:30	9:00	Fair
25-Feb-21	Hymenopteran, odonate, butterfly	AM	9:15	11:15	Fair
23-Mar-21	Bird, herp, mammal	AM	7:15	8:30	Fair
25-Mar-21	Butterfly	AM	11:12	12:15	Cloudy
31-Mar-21	Bird, herp, mammal	PM	20:00	20:53	Fair
31-Mar-21	Odonate, Hymenopteran	AM	13:20	14:26	Fair
31-Mar-21	Roost emergence	PM	18:45	21:00	Fair
22-Apr-21	Fish, herp, mammal	PM	21:38	22:45	Fair
29-Apr-21	Fish, odonate	AM	9:00	12:30	Fair
19-Oct-21	Migratory birds	AM	7:05	8:30	Fair
2-Nov-21	Migratory birds	AM	7:00	8:30	Fair

Appendix K
Camera Trap Data

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Appendix K - Camera Trap Data

Station	Latitude	Longitude	Deployment date	End date	No. of trap nights
CT_01	1.38739	103.7544	22-Feb-21	27-Apr-21	64
CT_02	1.38679	103.7551	22-Feb-21	27-Apr-21	36
CT_03	1.3839	103.7568	22-Feb-21	27-Apr-21	39
CT_04	1.38245	103.7578	22-Feb-21	27-Apr-21	64

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT01	8/3/2021	23/2/2021 8:33	23/2/2021	8:33:54	IMG_0019.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT01	8/3/2021	23/2/2021 8:34	23/2/2021	8:34:20	IMG_0020.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT01	8/3/2021	23/2/2021 15:48	23/2/2021	15:48:02	IMG_0022.AVI	Mammal	Canis lupus familiaris	2	-
CT01	8/3/2021	24/2/2021 9:26	24/2/2021	9:26:58	IMG_0023.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT01	8/3/2021	24/2/2021 9:34	24/2/2021	9:34:24	IMG_0024.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	25/2/2021 0:11	24/2/2021	0:11:44	IMG_0025.AVI	Mammal	Canis lupus familiaris	1	-
CT01	8/3/2021	25/2/2021 7:44	24/2/2021	7:44:34	IMG_0026.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	25/2/2021 15:40	25/2/2021	15:40:52	IMG_0029.AVI	Bird	Acridotheres javanicus	2	-
CT01	8/3/2021	28/2/2021 10:42	28/2/2021	10:42:52	IMG_0046.AVI	Bird	Acridotheres javanicus	7	-
CT01	8/3/2021	28/2/2021 14:15	28/2/2021	14:15:42	IMG_0048.AVI	Bird	Acridotheres javanicus	5	-
CT01	8/3/2021	1/3/2021 2:37	28/2/2021	2:37:10	IMG_0049.AVI	Mammal	Canis lupus familiaris	3	-
CT01	8/3/2021	2/3/2021 9:53	2/3/2021	9:53:40	IMG_0050.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	2/3/2021 10:10	2/3/2021	10:10:56	IMG_0051.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	3/3/2021 9:21	3/3/2021	9:21:04	IMG_0054.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	3/3/2021 9:25	3/3/2021	9:25:14	IMG_0055.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	3/3/2021 18:24	3/3/2021	18:24:22	IMG_0056.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	4/3/2021 6:55	3/3/2021	6:55:26	IMG_0057.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	4/3/2021 14:21	4/3/2021	14:21:52	IMG_0058.AVI	Mammal	Callosciurus notatus	1	-
CT01	8/3/2021	4/3/2021 19:20	4/3/2021	19:20:32	IMG_0059.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT01	8/3/2021	5/3/2021 7:00	4/3/2021	7:00:52	IMG_0060.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT01	8/3/2021	5/3/2021 8:52	5/3/2021	8:52:22	IMG_0062.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT02	8/3/2021	27/2/2021 11:13	27/2/2021	11:13:06	IMG_0043.AVI	N.A	Unidentified sp.	1	Possibly dog
CT02	8/3/2021	2/3/2021 10:06	2/3/2021	10:06:24	IMG_0080.AVI	Bird	Acridotheres javanicus	3	-
CT02	8/3/2021	2/3/2021 10:06	2/3/2021	10:06:52	IMG_0081.AVI	Bird	Acridotheres javanicus	3	-
CT02	8/3/2021	2/3/2021 10:09	2/3/2021	10:09:18	IMG_0082.AVI	Bird	Acridotheres javanicus	3	-
CT02	8/3/2021	2/3/2021 10:18	2/3/2021	10:18:20	IMG_0088.AVI	Bird	Acridotheres javanicus	5	-
CT02	8/3/2021	2/3/2021 17:34	2/3/2021	17:34:48	IMG_0118.AVI	Bird	Acridotheres javanicus	3	-
CT02	8/3/2021	3/3/2021 13:00	3/3/2021	13:00:22	IMG_0183.AVI	Bird	Acridotheres javanicus	2	-
CT02	8/3/2021	3/3/2021 14:13	3/3/2021	14:13:24	IMG_0187.AVI	Bird	Acridotheres javanicus	2	-
CT02	8/3/2021	3/3/2021 18:39	3/3/2021	18:39:40	IMG_0192.AVI	Bird	Acridotheres javanicus	5	-

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT03	8/3/2021	22/2/2021 18:30	22/2/2021	18:30:14	IMG_0014.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	27/2/2021 18:14	27/2/2021	18:14:40	IMG_0020.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	27/2/2021 18:51	27/2/2021	18:51:06	IMG_0021.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT03	8/3/2021	28/2/2021 12:33	28/2/2021	12:33:36	IMG_0023.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	28/2/2021 18:08	28/2/2021	18:08:38	IMG_0024.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	1/3/2021 8:28	1/3/2021	8:28:30	IMG_0025.AVI	N.A	Unidentified sp.	1	-
CT03	8/3/2021	3/3/2021 1:17	2/3/2021	1:17:56	IMG_0031.AVI	Mammal	Paradoxurus musangus	1	-
CT03	8/3/2021	3/3/2021 7:22	2/3/2021	7:22:18	IMG_0032.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT03	8/3/2021	3/3/2021 9:19	3/3/2021	9:19:12	IMG_0033.AVI	N.A	Unidentified sp.	1	-
CT03	8/3/2021	4/3/2021 18:39	4/3/2021	18:39:34	IMG_0036.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	5/3/2021 7:05	4/3/2021	7:05:18	IMG_0037.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	5/3/2021 17:30	5/3/2021	17:30:44	IMG_0041.AVI	Bird	Acridotheres javanicus	4	-
CT03	8/3/2021	5/3/2021 19:19	5/3/2021	19:19:38	IMG_0042.AVI	N.A	Unidentified sp.	1	-
CT03	8/3/2021	6/3/2021 6:55	5/3/2021	6:55:48	IMG_0043.AVI	Mammal	Callosciurus notatus	1	-
CT03	8/3/2021	7/3/2021 10:56	7/3/2021	10:56:18	IMG_0049.AVI	Bird	Acridotheres javanicus	13	-
CT03	8/3/2021	7/3/2021 10:56	7/3/2021	10:56:48	IMG_0050.AVI	Bird	Acridotheres javanicus	23	-
CT03	8/3/2021	8/3/2021 5:27	7/3/2021	5:27:46	IMG_0054.AVI	Mammal	Rattus sp.	1	-
CT04	8/3/2021	22/2/2021 11:58	22/2/2021	11:58:22	IMG_0003.AVI	Mammal	Canis lupus familiaris	1	-
CT04	8/3/2021	22/2/2021 21:01	22/2/2021	21:01:26	IMG_0004.AVI	Mammal	Paradoxurus musangus	1	-
CT04	8/3/2021	24/2/2021 18:16	24/2/2021	18:16:54	IMG_0007.AVI	Mammal	Canis lupus familiaris	1	-
CT04	8/3/2021	24/2/2021 18:17	24/2/2021	18:17:20	IMG_0008.AVI	Mammal	Canis lupus familiaris	1	-
CT04	8/3/2021	25/2/2021 0:23	24/2/2021	0:23:40	IMG_0009.AVI	Mammal	Canis lupus familiaris	1	-
CT04	8/3/2021	26/2/2021 14:56	26/2/2021	14:56:30	IMG_0010.AVI	Mammal	Canis lupus familiaris	1	-
CT04	8/3/2021	28/2/2021 17:14	28/2/2021	17:14:34	IMG_0012.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT04	8/3/2021	1/3/2021 3:01	28/2/2021	3:01:58	IMG_0013.AVI	Mammal	Canis lupus familiaris	2	-
CT04	8/3/2021	3/3/2021 14:04	3/3/2021	14:04:58	IMG_0014.AVI	Mammal	Canis lupus familiaris	3	-
CT04	8/3/2021	4/3/2021 9:06	4/3/2021	9:06:42	IMG_0015.AVI	Mammal	Canis lupus familiaris	1	-
CT04	8/3/2021	4/3/2021 23:28	4/3/2021	23:28:30	IMG_0016.AVI	Mammal	Canis lupus familiaris	3	-
CT04	8/3/2021	5/3/2021 8:35	5/3/2021	8:35:42	IMG_0017.AVI	N.A	Unidentified sp.	1	-

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT04	8/3/2021	7/3/2021 12:09	7/3/2021	12:09:44	IMG_0040.AVI	N.A	Unidentified sp.	1	1 unid sp. shifting the camera + 1 unid sp. (squirrel?) in the foreground
CT01	9/4/2021	9/3/2021 8:58	9/3/2021	8:58:08	IMG_0006.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	9/3/2021 10:33	9/3/2021	10:33:28	IMG_0007.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT01	9/4/2021	10/3/2021 9:54	10/3/2021	9:54:56	IMG_0008.AVI	Bird	Acridotheres javanicus	1	-
CT01	9/4/2021	10/3/2021 9:58	10/3/2021	9:58:32	IMG_0010.AVI	Bird	Acridotheres javanicus	4	-
CT01	9/4/2021	10/3/2021 10:04	10/3/2021	10:04:10	IMG_0011.AVI	Bird	Acridotheres javanicus	6	-
CT01	9/4/2021	10/3/2021 10:05	10/3/2021	10:05:12	IMG_0012.AVI	Bird	Acridotheres javanicus	1	-
CT01	9/4/2021	10/3/2021 10:07	10/3/2021	10:07:10	IMG_0013.AVI	Bird	Acridotheres javanicus	1	-
CT01	9/4/2021	11/3/2021 11:40	11/3/2021	11:40:34	IMG_0017.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	14/3/2021 10:39	14/3/2021	10:39:06	IMG_0019.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	14/3/2021 11:38	14/3/2021	11:38:00	IMG_0020.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	18/3/2021 7:43	17/3/2021	7:43:20	IMG_0022.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	20/3/2021 9:51	20/3/2021	9:51:40	IMG_0024.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	22/3/2021 7:10	21/3/2021	7:10:34	IMG_0025.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	23/3/2021 7:04	22/3/2021	7:04:34	IMG_0026.AVI	Mammal	Callosciurus notatus	2	-
CT01	9/4/2021	24/3/2021 7:00	23/3/2021	7:00:54	IMG_0030.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	25/3/2021 6:59	24/3/2021	6:59:54	IMG_0031.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	26/3/2021 6:50	25/3/2021	6:50:42	IMG_0032.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	27/3/2021 5:48	26/3/2021	5:48:30	IMG_0033.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	27/3/2021 11:39	27/3/2021	11:39:10	IMG_0034.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	28/3/2021 6:30	27/3/2021	6:30:50	IMG_0035.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	29/3/2021 6:51	28/3/2021	6:51:18	IMG_0039.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	30/3/2021 6:59	29/3/2021	6:59:24	IMG_0041.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	30/3/2021 11:58	30/3/2021	11:58:12	IMG_0043.AVI	Mammal	Canis lupus familiaris	2	-
CT01	9/4/2021	30/3/2021 21:39	30/3/2021	21:39:52	IMG_0044.AVI	Mammal	Paradoxurus musangus	1	-
CT01	9/4/2021	31/3/2021 6:26	30/3/2021	6:26:50	IMG_0045.AVI	Mammal	Paradoxurus musangus	1	-
CT01	9/4/2021	31/3/2021 20:20	31/3/2021	20:20:26	IMG_0046.AVI	Mammal	Paradoxurus musangus	1	-
CT01	9/4/2021	2/4/2021 6:37	1/4/2021	6:37:56	IMG_0047.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	2/4/2021 7:03	1/4/2021	7:03:14	IMG_0048.AVI	Mammal	Callosciurus notatus	1	-

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT01	9/4/2021	4/4/2021 2:46	3/4/2021	2:46:50	IMG_0049.AVI	Mammal	Canis lupus familiaris	1	-
CT01	9/4/2021	4/4/2021 16:30	4/4/2021	16:30:22	IMG_0050.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	5/4/2021 6:43	4/4/2021	6:43:24	IMG_0051.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	5/4/2021 10:51	5/4/2021	10:51:10	IMG_0052.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	5/4/2021 10:51	5/4/2021	10:51:46	IMG_0053.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	6/4/2021 9:03	6/4/2021	9:03:06	IMG_0055.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	7/4/2021 6:46	6/4/2021	6:46:50	IMG_0056.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	7/4/2021 10:39	7/4/2021	10:39:10	IMG_0057.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	8/4/2021 6:49	7/4/2021	6:49:24	IMG_0058.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	8/4/2021 9:38	8/4/2021	9:38:56	IMG_0059.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	9/4/2021 7:00	8/4/2021	7:00:48	IMG_0060.AVI	Mammal	Callosciurus notatus	1	-
CT01	9/4/2021	9/4/2021 7:02	8/4/2021	7:02:42	IMG_0061.AVI	Mammal	Callosciurus notatus	1	-
CT02	9/4/2021	9/3/2021 16:40	9/3/2021	16:40:38	IMG_0008.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:41	9/3/2021	16:41:08	IMG_0009.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:46	9/3/2021	16:46:00	IMG_0010.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:47	9/3/2021	16:47:06	IMG_0011.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:47	9/3/2021	16:47:28	IMG_0012.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:48	9/3/2021	16:48:34	IMG_0013.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:48	9/3/2021	16:48:56	IMG_0014.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:50	9/3/2021	16:50:12	IMG_0015.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:51	9/3/2021	16:51:22	IMG_0016.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:53	9/3/2021	16:53:42	IMG_0018.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	9/3/2021 16:54	9/3/2021	16:54:54	IMG_0019.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:19	10/3/2021	10:19:30	IMG_0023.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:21	10/3/2021	10:21:12	IMG_0026.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:21	10/3/2021	10:21:34	IMG_0027.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:22	10/3/2021	10:22:34	IMG_0028.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:22	10/3/2021	10:22:54	IMG_0029.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:25	10/3/2021	10:25:44	IMG_0030.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:26	10/3/2021	10:26:06	IMG_0031.AVI	Bird	Acridotheres javanicus	1	Following workers

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT02	9/4/2021	10/3/2021 10:27	10/3/2021	10:27:26	IMG_0032.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:27	10/3/2021	10:27:46	IMG_0033.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:33	10/3/2021	10:33:48	IMG_0034.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 10:34	10/3/2021	10:34:12	IMG_0035.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 11:38	10/3/2021	11:38:04	IMG_0038.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 14:22	10/3/2021	14:22:30	IMG_0040.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 15:41	10/3/2021	15:41:38	IMG_0042.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 15:45	10/3/2021	15:45:20	IMG_0043.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 15:46	10/3/2021	15:46:24	IMG_0044.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 15:52	10/3/2021	15:52:30	IMG_0048.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 15:52	10/3/2021	15:52:58	IMG_0049.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 15:57	10/3/2021	15:57:30	IMG_0050.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:01	10/3/2021	16:01:18	IMG_0051.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:01	10/3/2021	16:01:46	IMG_0052.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:10	10/3/2021	16:10:02	IMG_0053.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:10	10/3/2021	16:10:40	IMG_0054.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:13	10/3/2021	16:13:10	IMG_0055.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:16	10/3/2021	16:16:32	IMG_0056.AVI	Reptile	Calotes versicolor	1	-
CT02	9/4/2021	10/3/2021 16:29	10/3/2021	16:29:44	IMG_0057.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:43	10/3/2021	16:43:30	IMG_0058.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:43	10/3/2021	16:43:52	IMG_0059.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 16:47	10/3/2021	16:47:24	IMG_0060.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 17:55	10/3/2021	17:55:14	IMG_0061.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 18:03	10/3/2021	18:03:08	IMG_0062.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 18:03	10/3/2021	18:03:32	IMG_0063.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	10/3/2021 18:03	10/3/2021	18:03:56	IMG_0064.AVI	Bird	Acridotheres javanicus	1	Following workers
CT02	9/4/2021	12/3/2021 13:33	12/3/2021	13:33:36	IMG_0065.AVI	Mammal	Callosciurus notatus	1	-
CT02	9/4/2021	12/3/2021 13:34	12/3/2021	13:34:22	IMG_0067.AVI	Mammal	Callosciurus notatus	1	-
CT02	9/4/2021	16/3/2021 12:55	16/3/2021	12:55:12	IMG_0072.AVI	Mammal	Callosciurus notatus	1	-
CT02	9/4/2021	16/3/2021 15:48	16/3/2021	15:48:40	IMG_0073.AVI	Mammal	Callosciurus notatus	1	-

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT02	9/4/2021	16/3/2021 15:49	16/3/2021	15:49:02	IMG_0074.AVI	Mammal	Callosciurus notatus	1	-
CT02	9/4/2021	16/3/2021 15:49	16/3/2021	15:49:26	IMG_0075.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	9/3/2021 5:52	8/3/2021	5:52:02	IMG_0008.AVI	Mammal	Rattus tanezumi	1	-
CT03	9/4/2021	9/3/2021 12:58	9/3/2021	12:58:06	IMG_0011.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	9/3/2021 13:54	9/3/2021	13:54:24	IMG_0012.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	9/3/2021 18:46	9/3/2021	18:46:42	IMG_0023.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	10/3/2021 0:44	9/3/2021	0:44:38	IMG_0024.AVI	Mammal	Rattus tanezumi	1	-
CT03	9/4/2021	10/3/2021 6:31	9/3/2021	6:31:34	IMG_0025.AVI	Mammal	Rattus tanezumi	1	-
CT03	9/4/2021	10/3/2021 8:12	10/3/2021	8:12:46	IMG_0026.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	11/3/2021 2:32	10/3/2021	2:32:54	IMG_0075.AVI	Mammal	Canis lupus familiaris	1	-
CT03	9/4/2021	11/3/2021 12:25	11/3/2021	12:25:46	IMG_0078.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	11/3/2021 17:31	11/3/2021	17:31:28	IMG_0088.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	11/3/2021 20:05	11/3/2021	20:05:12	IMG_0089.AVI	Mammal	Paradoxurus musangus	3	-
CT03	9/4/2021	12/3/2021 0:32	11/3/2021	0:32:18	IMG_0090.AVI	Mammal	Rattus tanezumi	1	-
CT03	9/4/2021	12/3/2021 11:36	12/3/2021	11:36:54	IMG_0091.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	12/3/2021 17:48	12/3/2021	17:48:00	IMG_0092.AVI	Mammal	Callosciurus notatus	1	-
CT03	9/4/2021	13/3/2021 3:32	12/3/2021	3:32:38	IMG_0093.AVI	Mammal	Paradoxurus musangus	1	-
CT03	9/4/2021	13/3/2021 11:21	13/3/2021	11:21:06	IMG_0094.AVI	Reptile	Calotes versicolor	1	-
CT03	9/4/2021	13/3/2021 11:58	13/3/2021	11:58:16	IMG_0095.AVI	Mammal	Callosciurus notatus	1	-
CT04	9/4/2021	8/3/2021 17:14	8/3/2021	17:14:08	IMG_0012.AVI	Mammal	Unidentified squirrel or treeshrew	1	-
CT04	9/4/2021	9/3/2021 0:53	8/3/2021	0:53:34	IMG_0013.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	10/3/2021 8:57	10/3/2021	8:57:12	IMG_0014.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	10/3/2021 15:57	10/3/2021	15:57:24	IMG_0015.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	11/3/2021 6:57	10/3/2021	6:57:14	IMG_0016.AVI	Mammal	Canis lupus familiaris	2	-
CT04	9/4/2021	11/3/2021 6:57	10/3/2021	6:57:36	IMG_0017.AVI	Mammal	Canis lupus familiaris	2	-
CT04	9/4/2021	13/3/2021 9:15	13/3/2021	9:15:36	IMG_0018.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	18/3/2021 16:40	18/3/2021	16:40:14	IMG_0029.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	18/3/2021 16:54	18/3/2021	16:54:48	IMG_0030.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	21/3/2021 22:06	21/3/2021	22:06:04	IMG_0043.AVI	Mammal	Canis lupus familiaris	1	-
CT04	9/4/2021	23/3/2021 1:17	22/3/2021	1:17:38	IMG_0044.AVI	Mammal	Canis lupus familiaris	1	-

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT04	9/4/2021	23/3/2021 13:08	23/3/2021	13:08:04	IMG_0048.AVI	Bird	Todiramphus chloris	1	-
CT04	9/4/2021	30/3/2021 12:05	30/3/2021	12:05:08	IMG_0050.AVI	Mammal	Canis lupus familiaris	3	-
CT01	27/4/2021	9/4/2021 13:11	9/4/2021	13:11:06	IMG_0005.AVI	Mammal	Canis lupus familiaris	1	-
CT01	27/4/2021	10/4/2021 2:55	9/4/2021	2:55:18	IMG_0006.AVI	Mammal	Paradoxurus musangus	1	-
CT01	27/4/2021	10/4/2021 6:40	9/4/2021	6:40:14	IMG_0007.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	10/4/2021 6:48	9/4/2021	6:48:44	IMG_0008.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	10/4/2021 6:49	9/4/2021	6:49:36	IMG_0009.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	10/4/2021 11:36	10/4/2021	11:36:12	IMG_0010.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	11/4/2021 7:15	10/4/2021	7:15:08	IMG_0011.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	12/4/2021 6:51	11/4/2021	6:51:36	IMG_0012.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	12/4/2021 10:57	12/4/2021	10:57:34	IMG_0013.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	12/4/2021 11:02	12/4/2021	11:02:30	IMG_0014.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	13/4/2021 7:04	12/4/2021	7:04:58	IMG_0015.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	14/4/2021 9:12	14/4/2021	9:12:12	IMG_0018.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	16/4/2021 7:33	15/4/2021	7:33:02	IMG_0020.AVI	N.A	Unidentified sp.	1	-
CT01	27/4/2021	16/4/2021 7:35	15/4/2021	7:35:56	IMG_0021.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	16/4/2021 11:26	16/4/2021	11:26:20	IMG_0022.AVI	Mammal	Canis lupus familiaris	2	-
CT01	27/4/2021	17/4/2021 7:30	16/4/2021	7:30:58	IMG_0023.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	19/4/2021 15:12	19/4/2021	15:12:30	IMG_0025.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	20/4/2021 7:27	19/4/2021	7:27:56	IMG_0026.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	22/4/2021 7:25	21/4/2021	7:25:16	IMG_0027.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	22/4/2021 17:11	22/4/2021	17:11:38	IMG_0028.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	24/4/2021 12:45	24/4/2021	12:45:30	IMG_0031.AVI	Mammal	Callosciurus notatus	1	-
CT01	27/4/2021	26/4/2021 8:36	26/4/2021	8:36:12	IMG_0032.AVI	Mammal	Callosciurus notatus	1	-
CT02	27/4/2021	9/4/2021 13:16	9/4/2021	13:16:28	IMG_0007.AVI	Mammal	Callosciurus notatus	1	-
CT02	27/4/2021	11/4/2021 15:49	11/4/2021	15:49:32	IMG_0008.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	9/4/2021 11:32	9/4/2021	11:32:52	IMG_0003.AVI	Bird	Acridotheres javanicus	7	-
CT03	27/4/2021	10/4/2021 6:58	9/4/2021	6:58:00	IMG_0006.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	10/4/2021 17:14	10/4/2021	17:14:42	IMG_0012.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	10/4/2021 18:15	10/4/2021	18:15:22	IMG_0013.AVI	Mammal	Callosciurus notatus	1	-

Appendix K - Camera Trap Data

Station	SamplingDate	FileModifyDate	Date	Time	FileName	Taxon	Scientific Name	Quantity	Remarks
CT03	27/4/2021	11/4/2021 12:30	11/4/2021	12:30:24	IMG_0015.AVI	N.A	Unidentified sp.	1	-
CT03	27/4/2021	11/4/2021 21:07	11/4/2021	21:07:06	IMG_0017.AVI	Mammal	Paradoxurus musangus	1	-
CT03	27/4/2021	12/4/2021 2:09	11/4/2021	2:09:22	IMG_0018.AVI	N.A	Unidentified sp.	1	-
CT03	27/4/2021	12/4/2021 7:53	11/4/2021	7:53:28	IMG_0019.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	13/4/2021 9:42	13/4/2021	9:42:08	IMG_0025.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	13/4/2021 10:00	13/4/2021	10:00:32	IMG_0026.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	14/4/2021 9:33	14/4/2021	9:33:44	IMG_0027.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	14/4/2021 11:47	14/4/2021	11:47:32	IMG_0028.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	16/4/2021 10:34	16/4/2021	10:34:02	IMG_0029.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	16/4/2021 16:34	16/4/2021	16:34:52	IMG_0030.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	16/4/2021 16:44	16/4/2021	16:44:54	IMG_0031.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	17/4/2021 7:32	16/4/2021	7:32:48	IMG_0032.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	19/4/2021 18:10	19/4/2021	18:10:40	IMG_0034.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	20/4/2021 17:48	20/4/2021	17:48:16	IMG_0036.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	21/4/2021 16:44	21/4/2021	16:44:08	IMG_0040.AVI	N.A	Unidentified sp.	1	-
CT03	27/4/2021	22/4/2021 7:07	21/4/2021	7:07:00	IMG_0041.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	23/4/2021 17:08	23/4/2021	17:08:46	IMG_0043.AVI	Mammal	Callosciurus notatus	1	-
CT03	27/4/2021	25/4/2021 16:58	25/4/2021	16:58:04	IMG_0044.AVI	Mammal	Callosciurus notatus	1	-
CT04	27/4/2021	11/4/2021 16:41	11/4/2021	16:41:58	IMG_0005.AVI	Mammal	Callosciurus notatus	1	-
CT04	27/4/2021	11/4/2021 16:42	11/4/2021	16:42:20	IMG_0006.AVI	Mammal	Callosciurus notatus	1	-
CT04	27/4/2021	16/4/2021 11:34	16/4/2021	11:34:48	IMG_0021.AVI	Mammal	Canis lupus familiaris	1	-

Appendix L
Baseline Surface Water Quality Laboratory Report

Delivering a better world

TEST REPORT

Our Reference No.	:	**R211237**	Date Received	:	08/03/2021
Project Code / Ref.	:	CCK	Date Commenced	:	08/03/2021
			Date Reported	:	17/03/2021
Customer Ref. No.	:	60651709			
Customer Name	:	AECOM Singapore Pte Ltd			
Customer Address	:	300 Beach Road #03-00 The Concourse Singapore 199555			
Attention To	:	Ms Liang Liang			
Sample Description	:	5 Water Samples			
RESULTS:		Refer to Page 2			

Tan Thuan Piang
Technical Manager

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Website: www.mls.sg

R211237

RESULTS

Test Parameter	Unit	Test Method	Sampling Date: 08/03/2021					LOR
			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	
			WQ1 (CCK)	WQ2 (CCK)	WQ3 (CCK)	WQ4 (CCK)	WQ1 (Tengah)	
Total Nitrogen as TN	mg/L	APHA 4500-P (J)	1.12	1.00	1.27	1.40	1.30	0.01
Total Phosphorus as TP	mg/L	APHA 4500-P (J)	0.37	0.40	0.58	0.086	0.069	0.01
Ammonia as NH_4-N	mg/L	APHA 4500-NH_3 (H)	0.048	0.080	0.035	0.26	0.011	0.01
Nitrate as NO_3-N	mg/L	APHA 4500-NO_3 (I)	0.48	0.49	0.51	0.53	0.66	0.005
Orthophosphates as PO_4-P	mg/L	APHA 4500-P (G)	0.23	0.28	0.36	0.064	0.051	0.005
Total Suspended Solids as TSS	mg/L	APHA 2540D	37.7	48.7	.55.67	35.1	71.3	1
Total Organic Carbon,TOC	mg/L	APHA 5310B	2.58	2.40	2.49	3.24	4.17	1
Enterococcus	cfu/100mL	APHA 9230C	3,500	3,300	3,500	200	1,400	1
Lead as Pb	µg/L	APHA 3125B	0.54	0.56	0.63	<0.5	0.80	0.5

Note:

1. APHA is a standard method for Determination of Water and Waste Water (APHA 23rd Edition, 2017)
2. "<" = Less than. The data reported is less than Detection Limit of the test.

TEST REPORT

Our Reference No.	:	**R211921**	Date Received	:	13/04/2021
Project Code / Ref.	:	CCK & Tengah	Date Commenced	:	13/04/2021
			Date Reported	:	27/04/2021
Customer Ref. No.	:	60651709			
Customer Name	:	AECOM Singapore Pte Ltd			
Customer Address	:	300 Beach Road #03-00 The Concourse Singapore 199555			
Attention To	:	Ms Liang Liang			
Sample Description	:	13 Water Samples			
RESULTS:		Refer to Page 2 to 3			

Tan Thuan Piang
Technical Manager

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R211921

RESULTS

Test Parameter	Unit	Test Method	Sampling Date: 13/04/2021			LOR
			Sample 1	Sample 2	Sample 3	
			CCK WQ1	CCK WQ2	CCK WQ3	
Total Nitrogen as TN	mg/L	APHA 4500-P (J)	1.50	2.17	3.50	0.01
Total Phosphorus as TP	mg/L	APHA 4500-P (J)	0.037	0.047	0.045	0.01
Ammonia as NH_4-N	mg/L	APHA 4500-NH_3 (H)	0.098	0.15	0.30	0.01
Nitrate as NO_3-N	mg/L	APHA 4500-NO_3 (I)	1.27	2.14	2.04	0.005
Orthophosphates as PO_4-P	mg/L	APHA 4500-P (G)	0.020	0.014	0.028	0.005
Total Suspended Solids as TSS	mg/L	APHA 2540D	40.0	70.0	45.7	1
Total Organic Carbon,TOC	mg/L	APHA 5310B	2.85	4.15	6.63	1
Enterococcus	cfu/100mL	APHA 9230C	7,000	14,000	16,000	1
Lead as Pb	µg/L	APHA 3125B	<0.5	<0.5	<0.5	0.5

Test Parameter	Unit	Test Method	Sampling Date: 13/04/2021			LOR
			Sample 4	Sample 5	Sample 6	
			CCK WQ4	CCK WQ5	CCK WQ6	
Total Nitrogen as TN	mg/L	APHA 4500-P (J)	2.20	0.67	2.29	0.01
Total Phosphorus as TP	mg/L	APHA 4500-P (J)	0.043	0.071	0.025	0.01
Ammonia as NH_4-N	mg/L	APHA 4500-NH_3 (H)	0.099	0.053	0.17	0.01
Nitrate as NO_3-N	mg/L	APHA 4500-NO_3 (I)	1.96	0.35	1.92	0.005
Orthophosphates as PO_4-P	mg/L	APHA 4500-P (G)	0.034	0.057	0.018	0.005
Total Suspended Solids as TSS	mg/L	APHA 2540D	37.0	<10	<10	1
Total Organic Carbon,TOC	mg/L	APHA 5310B	6.46	4.23	7.15	1
Enterococcus	cfu/100mL	APHA 9230C	14,000	6,800	8,100	1
Lead as Pb	µg/L	APHA 3125B	0.69	<0.5	<0.5	0.5

Note:

1. APHA is a standard method for Determination of Water and Waste Water (APHA 23rd Edition, 2017)
2. "<" = Less than, The data reported is less than Detection Limit of the test.

R211921

RESULTS

Test Parameter	Unit	Test Method	Sampling Date: 13/04/2021				LOR
			Sample 7	Sample 8	Sample 9	Sample 10	
			Tengah WQ1	Tengah WQ2	Tengah WQ3	Tengah WQ4	
Total Nitrogen as TN	mg/L	APHA 4500-P (J)	4.26	1.04	1.11	2.29	0.01
Total Phosphorus as TP	mg/L	APHA 4500-P (J)	0.059	0.095	0.10	0.084	0.01
Ammonia as NH_4-N	mg/L	APHA 4500-NH_3 (H)	0.79	1.03	0.54	1.59	0.01
Nitrate as NO_3-N	mg/L	APHA 4500-NO_3 (I)	1.25	0.15	0.61	0.52	0.005
Orthophosphates as PO_4-P	mg/L	APHA 4500-P (G)	0.046	0.063	0.062	0.057	0.005
Total Suspended Solids as TSS	mg/L	APHA 2540D	54.3	32.0	235	15.3	1
Total Organic Carbon,TOC	mg/L	APHA 5310B	6.45	10.5	6.97	4.76	1
Enterococcus	cfu/100mL	APHA 9230C	1,800	1,300	1,000	700	1
Lead as Pb	µg/L	APHA 3125B	1.42	<0.5	7.69	<0.5	0.5

Test Parameter	Unit	Test Method	Sampling Date: 13/04/2021				LOR
			Sample 11	Sample 12	Sample 13		
			Tengah WQ5	Tengah WQ6	Tengah WQ7		
Total Nitrogen as TN	mg/L	APHA 4500-P (J)	1.36	1.23	0.91		0.01
Total Phosphorus as TP	mg/L	APHA 4500-P (J)	0.11	0.072	0.056		0.01
Ammonia as NH_4-N	mg/L	APHA 4500-NH_3 (H)	0.84	0.59	0.13		0.01
Nitrate as NO_3-N	mg/L	APHA 4500-NO_3 (I)	0.42	0.010	0.75		0.005
Orthophosphates as PO_4-P	mg/L	APHA 4500-P (G)	0.075	0.033	0.035		0.005
Total Suspended Solids as TSS	mg/L	APHA 2540D	<10	12.7	<10		1
Total Organic Carbon,TOC	mg/L	APHA 5310B	6.91	3.92	2.02		1
Enterococcus	cfu/100mL	APHA 9230C	1,000	100	<1		1
Lead as Pb	µg/L	APHA 3125B	<0.5	<0.5	<0.5		0.5

Note:

1. APHA is a standard method for Determination of Water and Waste Water (APHA 23rd Edition, 2017)
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TEST REPORT

Our Reference No.	:	**R212086**	Date Received	: 21/04/2021
Project Code / Ref.	:	CCK	Date Commenced	: 21/04/2021
			Date Reported	: 30/04/2021
Customer Ref. No.	:	60651709		
Customer Name	:	AECOM Singapore Pte Ltd		
Customer Address	:	300 Beach Road #03-00 The Concourse Singapore 199555		
Attention To	:	Ms Liang Liang		
Sample Description	:	4 Water Samples		
RESULTS:		Refer to Page 2		

Tan Thuan Piang
Technical Manager

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R212086

RESULTS

Test Parameter	Unit	Test Method	Sampling Date: 21/04/2021				LOR
			Sample 1	Sample 2	Sample 3	Sample 4	
			WQ1	WQ2	WQ3	WQ4	
Total Nitrogen as TN	mg/L	APHA 4500-P (J)	1.18	1.09	1.09	0.99	0.01
Total Phosphorus as TP	mg/L	APHA 4500-P (J)	0.074	0.10	0.054	0.069	0.01
Ammonia as NH_4-N	mg/L	APHA 4500-NH_3 (H)	0.15	0.13	0.17	0.16	0.01
Nitrate as NO_3-N	mg/L	APHA 4500-NO_3 (I)	0.61	0.64	0.62	0.54	0.005
Orthophosphates as PO_4-P	mg/L	APHA 4500-P (G)	0.057	0.078	0.039	0.056	0.005
Total Suspended Solids as TSS	mg/L	APHA 2540D	12.5	11.4	16.4	14.5	1
Total Organic Carbon,TOC	mg/L	APHA 5310B	2.45	2.14	2.27	3.25	1
Enterococcus	cfu/100mL	APHA 9230C	750	730	480	250	1
Lead as Pb	µg/L	APHA 3125B	<0.5	<0.5	<0.5	<0.5	0.5

Note:

1. APHA is a standard method for Determination of Water and Waste Water (APHA 23rd Edition, 2017)
2. "<" = Less than. The data reported is less than Detection Limit of the test.

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