

FORM 5
ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE
(CHAPTER 499)
SECTION 13(1)

Application for Variation of an Environmental Permit

PART A PREVIOUS APPLICATIONS

- No previous application for variation of an environmental permit.
- The environmental permit was previously amended.

Application No. :

PART B DETAILS OF APPLICANT

B1. Name : (person or company)

Drainage Services Department

[Note : In accordance with section 13(1) of the Ordinance, the person holding an environmental permit or a person who assumes responsibility for the designated project may apply for variation of the environmental permit.]

B2. Business Registration No. :
(if applicable)

B3. Correspondence Address :

B4. Name of Contact Person :

B5. Position of Contact Person :

B6. Telephone No. :

B7. Fax No. :

B8. E-mail Address : (if any)

PART C DETAILS OF CURRENT ENVIRONMENTAL PERMIT

C1. Name of the Current Environmental Permit Holder :

Drainage Services Department

C2. Application No. of the Current Environmental Permit : AEP-270/2007

C3. The Current Environmental Permit was Issued in : month / year

04 | 2007

Important Notes : Please submit the application together with
(a) 3 copies of this completed form; and
(b) appropriate fee as stipulated in the Environmental Impact Assessment (Fees) Regulation
to the Environmental Protection Department at the following address :
The EIA Ordinance Register Office,
27th floor, Southorn Centre, 130 Hennessy Road,
Wan Chai, Hong Kong.

Tick (✓) the appropriate box



PART D PROPOSED VARIATIONS TO THE CONDITIONS IN CURRENT ENVIRONMENTAL PERMIT

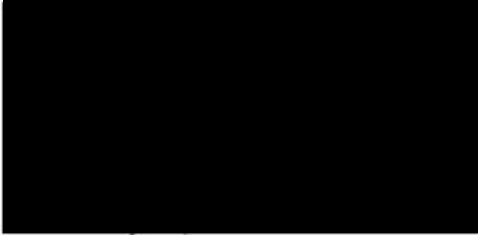
D1. Condition(s) in the Current Environmental Permit:	D2. Proposed Variation(s):	D3. Reason for Variation(s):	D4. Describe the environmental changes arising from the proposed variation(s):	D5. Describe how the environment and the community might be affected by the proposed variation(s):	D6. Describe how and to what extent the environmental performance requirements set out in the EIA report previously approved or project profile previously submitted for this project may be affected:	D7. Describe any additional measures proposed to eliminate, reduce or control any adverse environmental impact arising from the proposed variation(s) and to meet the requirements in the Technical Memorandum on Environmental Impact Assessment Process:
<p><u>Part B, Scale and Scope of Designated Project:</u> A drainage channel of width less than 100m. The scope of the Project mainly includes operation of:</p> <ul style="list-style-type: none"> (i) a main drainage channel from Castle Peak Road – Chau Tau Section to Shenzhen River near Ha Wan Tsuen. The channel is lined with grasscrete; (ii) an ancillary road system; (iii) an inflatable dam and associated pumping facilities; and (iv) wetland and landscaping works. 	<p>Add the following scope to the current EP:</p> <ul style="list-style-type: none"> (i) Construction and operation of about 1m to 1.5m high floodwall along western bank of STEMC; and (ii) Construction and operation of about 1m to 1.5m high floodwall and embankment on eastern bank of STEMC (iii) Construction and operation of about 0.7m to 1.5m high floodwall near Castle Peak Road and Kwu Tung Road <p>For locations of the proposed drainage improvement works, please refer to Figure 1.1 provided in the Environmental Review Report for supporting the Application of Variation of Environmental Permit No. EP-270/2007.</p> <p>During construction phase, the construction of the enhanced embankment and floodwall shall not be carried out during birds' peak overwintering season (November to March).</p>	<p>According to "Review of Drainage Master Plans in Yuen Long and North Districts – Feasibility Study" (the Review Study), the STEMC was identified of having flood protection level lower than its design intent for rural main catchment drainage channel to prevent overbank flow from the channel to nearby areas.</p> <p>To account for the severity and extent of possible flooding and the works implementation time, the Review Study proposed drainage improvement works at STEMC.</p> <p>Timing the construction works to avoid birds' peak wintering season (November to March) have been proposed to avoid disturbance impact to the wintering birds during the construction of the proposed drainage improvement works.</p>	<p>Air Quality – During the construction phase, dust will be generated from the construction works, but it is not expected to generate excessive dust levels during the construction phase. No operation phase air quality impact is anticipated.</p> <p>Noise – The construction noise levels at all representative NSRs are predicted to comply with the relevant noise standards for daytime construction activities at all representative NSRs. So it is not expected to generate excessive noise impacts during the construction phase, while no operation phase noise impact is expected.</p> <p>Water Quality – Potential sources of construction-related water quality impacts include construction site runoff; accidental spillage of chemicals; sewage from construction workforce; and general construction activities. No adverse impact will be anticipated in the construction phase, while there is no impact identified during the operation phase.</p>	<p>Air Quality – Although dust will be generated during the construction phase, the construction phase air quality impact would be alleviated to an acceptable level with proper implementation of the recommended dust control measures as stipulated in the Air Pollution Control (Construction Dust) Regulation.</p> <p>Noise – The construction noise levels at all representative NSRs are predicted to comply with the relevant noise standards for daytime construction activities at all representative NSRs. With the implementation of noise control measures including selecting quieter plant, use of enclosure/ acoustic shed and insulation fabric, adverse construction noise impact is not anticipated.</p> <p>Water Quality – Stormwater drains or nearby water courses may be affected by the construction activities, but with the adoption of the proposed good site practices and mitigation measures, no adverse impact will be</p>	<p>With proper mitigation measures in place, the predicted environmental impact will not exceed/ violate the environmental performance requirements set in the approved EIA Report.</p>	<p>Additional ecological mitigation measures including timing the construction works to avoid birds' peak wintering season (November to March) have been proposed.</p> <p>For other mitigation measures, please refer to Section 6.2.6 in the Environmental Review Report for supporting the Application of Variation of Environmental Permit No. EP-270/2007.</p>

D1. Condition(s) in the Current Environmental Permit:	D2. Proposed Variation(s):	D3. Reason for Variation(s):	D4. Describe the environmental changes arising from the proposed variation(s):	D5. Describe how the environment and the community might be affected by the proposed variation(s):	D6. Describe how and to what extent the environmental performance requirements set out in the EIA report previously approved or project profile previously submitted for this project may be affected:	D7. Describe any additional measures proposed to eliminate, reduce or control any adverse environmental impact arising from the proposed variation(s) and to meet the requirements in the Technical Memorandum on Environmental Impact Assessment Process:
			<p>Ecology – The potential ecological impact during construction is relatively minor, as the function of the constructed wetland will be maintained.</p> <p>Fisheries – No direct impact on the pond fish culture resources is anticipated during the construction or operation of the Project. So no unacceptable fisheries impact is anticipated.</p> <p>Landscape and Visual – The proposed works on existing STEMC is minor in scale which cause no change on the drainage channel character, thus the landscape and visual impact due to the proposed works is negligible.</p> <p>Waste Management – Wastes which are likely to be generated from the construction works include Construction and Demolition materials; vegetation removed from site clearance; chemical wastes; and general refuse. But no potential environmental impact is expected during the construction phase, while operation impact is expected to be minimal.</p>	<p>resulted during the construction phase.</p> <p>Ecology – As the STEMC is located in WCA, an ecologically sensitive habitat, ecological impact to the constructed wetland and WCA is a concern. Although the works for the embankment will take place inside the constructed wetland, the ecological impact is relatively minor as the scale of the work is small, footprint is limited and the embankment is gently sloped on both side facilitating wildlife use. The ecological impact can be mitigated with adoption of suitable mitigation measures including timing the construction works to avoid birds' peak wintering season (November to March).</p> <p>Fisheries – With water quality control measures in place, the Project is unlikely to have any indirect impact on pond fish culture resources and activities.</p> <p>Landscape and Visual Impact – the proposed works would cause no change on the drainage channel character, thus the landscape</p>		

D1. Condition(s) in the Current Environmental Permit:	D2. Proposed Variation(s):	D3. Reason for Variation(s):	D4. Describe the environmental changes arising from the proposed variation(s):	D5. Describe how the environment and the community might be affected by the proposed variation(s):	D6. Describe how and to what extent the environmental performance requirements set out in the EIA report previously approved or project profile previously submitted for this project may be affected:	D7. Describe any additional measures proposed to eliminate, reduce or control any adverse environmental impact arising from the proposed variation(s) and to meet the requirements in the Technical Memorandum on Environmental Impact Assessment Process:
			<p>Land contamination – No land contamination issues are expected for the construction and operation of the improvement works.</p>	<p>and visual impact due to the proposed works is negligible.</p> <p>Waste Management – Although wastes will be generated during the construction phase, waste management methods and practices and other environmental control measures have been recommended to ensure that potential impacts would be avoided or controlled to acceptable levels. So, no potential environmental impact is expected.</p> <p>Land contamination – The STEMC has no major change since 2006, therefore no land contamination issues are expected.</p> <p>Owing to the relatively small scale of works and far distance from sensitive receivers, the potential environmental impact to the adjacent sensitive receivers are generally minor. Therefore, the environment and the community would unlikely to be adversely affected by the proposed works with the adoption of the recommended mitigation measures.</p>		

PART E DECLARATION BY APPLICANT

E1. I hereby certify that the particulars given above are correct and true to the best of my knowledge and belief. I understand the environmental permit may be suspended, varied or cancelled if any information given above is false, misleading, wrong or incomplete.



Signature of Applicant



Full Name in Block Letters



Position



on behalf of _____ Drainage Services Department
Company Name and Chop (as appropriate)

_____ 27-2-2019
Date

NOTES :

1. A person who constructs or operates a designated project in Part I of Schedule 2 of the Ordinance or decommissions a designated project listed in Part II of Schedule 2 of the Ordinance without an environmental permit or contrary to the permit conditions commits an offence under the Ordinance and is liable to a maximum fine of \$5,000,000 and to a maximum imprisonment for 2 years.
2. A person for whom a designated project is constructed, operated or decommissioned and who permits the carrying out of the designated project in contravention of the Ordinance commits an offence and is liable to a maximum fine of \$5,000,000 and to a maximum imprisonment for 2 years.

**Agreement No. CE 78/2014
(DS) Drainage Improvement
Works at North District –
Package B – Investigation**

Environmental Review Report for Proposed
Improvement Works at San Tin Eastern Main
Channel

January 2019

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Agreement No. CE 78/2014 (DS) Drainage Improvement Works at North District – Package B – Investigation

Environmental Review Report for Proposed
Improvement Works at San Tin Eastern Main
Channel

January 2019

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1 Introduction

1.1 Background

Background of San Tin Eastern Main Channel

To alleviate the flooding risk in the San Tin recurrent flooding basin, Drainage Services Department (DSD) established a Main Drainage Channels and Poldered Village Protection Scheme for San Tin North West New Territories in the Territorial Land Drainage and Flood Control Strategy Study, Phase 2 (TLDFCSS-2 Study) in 1993. Construction of San Tin Eastern Main Channel (STEMC) was proposed under PWP Item No. 73CD with a design intent of meeting 50 years flood level for rural main catchment drainage channel.

The works for the STEMC is considered a Designated Project (DP) under Schedule 2, Part1, 11(b) in accordance with Environmental Impact Assessment (EIA) Ordinance. A statutory EIA study titled “AEIAR-019/1999 – Main Drainage Channels and Poldered Village Protection Schemes for San Tin, NWNT” was conducted and an Environmental Permit (EP)(EP-124/2002) for construction of the DP was granted. While an EP (EP-270/2007) for operation of the DP was granted in 2007, the EP (EP-124/2002) for construction was surrendered on 11 July 2012 upon completion of the construction works.

Further Drainage Improvement to STEMC

Further to the TLDFCSS-2 Study, review for further flood control works was continued in DSD’s Drainage Master Plan Study for Northern New Territories (NNTDMP) in 1999 which also include the San Tin area. Since then, there were changes in San Tin basin and adjacent areas due to the new development and town planning. In addition, some new flooding complaints reported at the upstream areas of the drainage basins indicated further improvement to the drainage system are required.

In 2008, DSD commissioned a “Review of Drainage Master Plans in Yuen Long and North Districts – Feasibility Study” (the Review Study) to incorporate the new development scenarios and review the effectiveness of the previously recommended works.

The Review Study completed in end 2011 and identified some areas in or at the periphery of North District, including STEMC, that could not meet the required flood protection level according to the latest land use changes and future developments taking into account various factors, including sedimentation at the downstream main channels, mangrove growth at river estuaries, updated extreme sea level statistics at Tsim Bei Tsui and projected Climate Change impacts in the hydraulic analysis.

In the Review Study, the STEMC was identified of having only about 10 years flood protection level which is lower than its design intent of meeting 50 years design flood level plus a 500mm freeboard or 200 years design flood level without freeboard, where the more stringent level would be adopted, for rural main catchment drainage channel to prevent overbank flow from the channel to nearby areas.

To account for the severity and extent of possible flooding and the works implementation time, the Review Study proposed drainage improvement works at STEMC. In August 2015, DSD commissioned Mott MacDonald Hong Kong Limited (MMHK) to undertake the investigation of Package B of the works under “Agreement No. CE 78/2014 (DS) - Drainage Improvement Works at North District - Package B – Investigation” (the Project B Investigation), which included the

improvement works in STEMC. The improvement works are tentatively scheduled to complete by 2027.

1.2 Objective of this Report

In view of the proposed drainage improvement works, to deal with key project changes after the approval of the EIA report, this Environmental Review (ER) Report is to seek agreement from the Environmental Protection Department (EPD) on those project changes that would affect the findings and recommendations of the approved EIA report, and demonstrate to the satisfaction of the EPD that the same environmental performances required in the approved EIA report and the associated Ecological Habitat Management Plan (EHMP) can be met by equivalent or additional measures.

This ER Report will be used as supporting document for application of Variation of Environmental Permit (VEP)(EP-270/2007) for the change.

The objectives of this ER Report are therefore to:

- Review the findings and recommendations presented in the approved EIA Report “AEIAR-019/1999 – Main Drainage Channels and Poldered Village Protection Schemes for San Tin, NWNT” and the associated EHMP;
- Review and evaluate the potential environmental impacts from the construction and operation of the improvement works;
- Proposed mitigation measures, if necessary; and
- Review the Environmental Monitoring and Audit (EM&A) requirement.

1.3 Structure of this Report

This ER Report contains the following sections in addition to this Section 1.

Section 2 presents Description of the Designated Project Change

Section 3 presents the Air Quality Impact Assessment

Section 4 presents the Noise Impact Assessment

Section 5 presents the Water Quality Impact Assessment

Section 6 presents the Ecological Impact Assessment

Section 7 presents the Fisheries Impact Assessment

Section 8 presents the Landscape and Visual Impact Assessment

Section 9 presents the Waste Management

Section 10 presents the Land Contamination Assessment

Section 11 presents the EM&A Requirement

Section 12 presents the Conclusion of this ER study

2 Description of Designated Project Change

2.1 Background

The STEMC, key component of the DP, is approximately 2.2km long and 45m wide with two river embankments at about 4.9mPD and channel bed ranging from 0.6mPD to 1.5mPD. The trapezoidal channel is about 30m wide (river bed) and hold about 4.5m depth of water. The design basically followed DSD's Stormwater Drainage Manual.

The DP also consists of one inflatable dam, one air blower house and one pumping station, for preventing backflow of sediment rich waters from Shenzhen River during high tide, as well as conveying water to Shenzhen River during low flow condition.

Taking into account hydraulic performance and operation requirement of the channel, the following ecological and aesthetical features were incorporated in the STEMC:

- The inner lining of the channel are grasscreted with perennial vegetation, except the dry season flow interception;
- The external slope of the channel is general fill slope with planting of suitable vegetation; and
- A maintenance access road on top of the western channel embankment of approximately 3.5m wide.

In both the surrendered EP (EP-124/2002) and the prevailing EP (EP-270/2007), the stated scale and scope of DP includes the following:

- A main drainage channel from Castle Peak Road – Chau Tau Section to Shenzhen River near Ha Wan Tsuen. The channel is lined with grasscrete;
- An ancillary road system;
- An inflatable dam and associated pumping facilities; and
- Wetland and landscaping works.

2.2 Description of the improvement works

Under the Review Study, the existing railing along both sides of the channel banks was recommended to be replaced by about 1m to 1.3m high floodwall so that the flood protection level of the river can be restored to the 50 years flood protection level with 500mm freeboard, and the maximum water level under 1 in 200 years storm event should also be retained within the main channel.

Further to the Review Study, the Package B Investigation recommends an alternative option of hybrid solution by providing floodwall along western bank; and embankment along eastern bank as far as practicable, instead of floodwall, aiming to reduce the ecological, landscape and visual impact to the surroundings.

The proposed improvement works along the eastern bank involves construction of embankment with top level of +6.0mPD, and is divided into three portions:

- Portion A: Construction of floodwall of height about 1.3m high (length: ~275m)
- Portion B: Construction of embankment of height about 1m – 1.5m high (length: ~1,365m)

- Portion C: Construction of floodwall of height about 1m high (Length: ~400m)

To minimize the impact to the existing Tun Yu Road next to the western bank of the main channel, the proposed improvement works at the western bank involves the replacement of the existing railing by a floodwall with top level of 6.0mPD. The improvement works is divided into two portions:

- Portion D: Construction of floodwall of height about 1m – 1.2m high (length: ~1,860m)
- Portion E: Construction of floodwall of height about 1.2m – 1.5m high (length: ~220m)

The proposed improvement works near Castle Peak Road and Kwu Tung Road includes:

- Portion F: Construction of floodwall of height about 0.7m – 1.5m high (length: ~510m)

The locations of the abovementioned Portions A to F can refer to **Figure 1.1**.

The major construction activities for the construction of the proposed floodwall and embankment include excavation, floodwall construction and slope filling. These activities were taken into account in the respective impact assessment. The proposed works boundary for these construction activities are shown in **Figures 3.1, 4.1, 5.1 and 7.1**, which has already taken into account the major works, temporary works, stockpiling area and PME area.

2.3 Change of the Designated Project

The proposed improvement works, i.e. the works for embankment and floodwall along the channel bank, was not specifically taken into account in the previous EIA study, though railing and embankment along the channel are currently in place as part of the STEMC component. The improvement works, although is minor, would trigger a change to the DP. To address the change of the DP, a variation of the prevailing EP is required to include construction and operation of the proposed improvement works.

2.4 Environmental Benefits

The proposed improvement works would bring environmental benefits as summarised below:

- Enhancing ecological connectivity within the constructed wetland by removal of some minor sections of concrete structure of the water channel and re-instatement of a natural material based water channel, where feasible, which would be beneficial to the wetland ecosystem.
- Facilitating wildlife use by exploring the opportunity to enhance the floodwall design with more ecological features such as climbing plant and refugia box attached on the floodwall.

2.5 Programme

The construction of the improvement works will be tentatively scheduled to commence in 2025 and complete by 2027.

2.6 Proposed Variation to the Environmental Permit

In regard to the conditions of the prevailing EP, a variation is needed to include the following:

- Construction and operation of about 1m to 1.5m high floodwall along western bank of STEMC
- Construction and operation of about 1m to 1.5m high floodwall and embankment on eastern bank of STEMC
- Construction and operation of about 0.7m to 1.5m high floodwall near Castle Peak Road and Kwu Tung Road

2.7 Potential Concurrent Project

Under the Project B Investigation, drainage improvement works is also proposed at Ha Wan Tsuen, which is within 500m from the STEMC. The drainage improvement works for Ha Wan Tsuen is a DP and the programme will be tentatively scheduled in 2022-2024, thus the it is not considered as a concurrent project.

The potential concurrent project may include Development of Lok Ma Chau Loop (LMCL). The construction contract of Development of LMCL: Land Decontamination and Advance Engineering Works under Contract No. YL/2017/03 and the detailed design and site investigation of Development of LMCL: Main Works Package 1 will be completed by early 2023 before the construction of the proposed works at STEMC. However, the construction programme of the infrastructure works for LMCP is not yet available.

3 Air Quality

3.1 Review of Previous EIA Findings

The previous EIA study identified that the major air pollutant sources associated with the construction of the STEMC were dredging, excavating, and truck movements on unpaved haul road. Fugitive Dust Model (FDM) was used to predict the dust impacts arising from the materials handling and truck movements on unpaved road to the representative Air Sensitive Receivers (ASRs) within the 500m Study Area. According to the model results, the predicted dust levels at the ASRs were within the dust criteria, even under the worst case scenario. With mitigation measures including good construction practice according to the Air Pollution (Construction Dust) Regulation in place, it was anticipated that there would be no substantial air quality impact. Release of odours was also anticipated during lifting of dredged and excavated mud or organic materials from ponds and agricultural fields. However, odour impact was not anticipated since the ASRs are more than 80m away from the site. During operation phase, no air pollutant sources were expected except maintenance dredging with scale much smaller than dredging during construction. Mitigation measure and EM&A requirements were recommended to minimise the nuisance from the construction and operation of STEMC.

Since the proposed improvement works was not covered in the previous EIA, a review of the potential air quality impacts from the improvement works is provided below.

3.2 Review of Potential Impacts from Proposed Improvement Works

3.2.1 Introduction

An impact assessment for air quality has been conducted to study the air quality impact associated with the improvement works as per the relevant criteria and standards specified in the following legislation and guidelines:

- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499.S16), EIAO-TM, Annexes 4 and 12
- Air Pollution Control Ordinance (APCO) (Cap. 311)
- Air Pollution Control (Construction Dust) Regulation

3.2.2 Legislation, Standards, Guidelines and Criteria

3.2.2.1 Technical Memorandum on Environmental Impact Assessment Process

The criteria and guidelines for evaluating air quality impacts are set out in Section 1 of Annex 4 and Annex 12 respectively of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) issued under the EIAO. The Section 1 of Annex 4 stipulates the criteria for evaluating air quality impacts. This includes meeting the Air Quality Objectives (AQOs) and other standards established under the APCO, as well as meeting the hourly Total Suspended Particulate (TSP) concentration of $500\mu\text{g}/\text{m}^3$ and the 5-second average odour concentration of 5 odour units (OU). Annex 12 provides the guidelines for conducting air quality assessments under the EIA process, including determination of ASRs, assessment methodology as well as impact prediction and assessment.

3.2.2.2 Air Pollution Control Ordinance

The principal legislation for the management of air quality is the APCO. It specifies AQOs, which stipulate the statutory limits of air pollutants and the maximum allowable numbers of exceedance over specific periods. With passage of the Air Pollution Control (Amendment) Ordinance 2013 by the Legislative Council on 10 July 2013, the new AQOs as listed in **Table 3.1** are due to take effect on 1 January 2014.

Table 3.1: New Air Quality Objectives to be Effective on 1 January 2014

Pollutant	Averaging Time	AQO concentration ($\mu\text{g}/\text{m}^3$)	Allowable exceedances
Sulphur Dioxide (SO_2)	10 minutes	500	3
	24 hours	125	3
Respirable Suspended Particulates (PM_{10})	24 hours	100	9
	Annual	50	N/A
Fine Suspended Particles ($\text{PM}_{2.5}$)	24 hours	75	9
	Annual	35	N/A
Nitrogen Dioxide (NO_2)	1 hour	200	18
	Annual	40	N/A
Carbon Monoxide (CO)	1 hour	30,000	0
	8 hours	10,000	0
Ozone (O_3)	8 hours	160	9
Lead	Annual	0.5	0

3.2.2.3 Air Pollution Control (Construction Dust) Regulation

Air Pollution Control (Construction Dust) Regulation stipulates the construction dust control requirements for both notifiable (e.g. site formation) and regulatory works (e.g. road opening) to be carried out by the contractor. The requirements for various notifiable and regulatory works are given in Parts 1 and 2 of the Regulation respectively. Part 3 of the Regulation stipulates the general control requirements (e.g. site boundary and entrance) for construction dust. The control requirements for individual activities (e.g. stockpiling of dusty material) are given in Part 4 of the Regulation.

3.2.3 Baseline Conditions

The nearest Environmental Protection Department (EPD) air quality monitoring station to the Project Site is located in Yuen Long. The 5-year averaged annual background concentration of pollutants reported from 2012 to 2016 at this station is presented in **Table 3.2**. These annual average values were taken as reference background levels in the following assessment.

It is noted that the annual concentration of nitrogen dioxide (NO_2) has exceeded the relevant AQO.

Table 3.2: 5-year Annual Average Concentration at Yuen Long Air Quality Monitoring Station (2012-2016)

Pollutant	5-year Annual Average Concentration ($\mu\text{g}/\text{m}^3$)	New Annual AQO ($\mu\text{g}/\text{m}^3$)
Sulphur Dioxide (SO_2)	10	-
Nitrogen Dioxide (NO_2)	49	40
Nitrogen Oxides (NO_x)	83	-
Carbon Monoxide (CO)	700	-

Pollutant	5-year Annual Average Concentration ($\mu\text{g}/\text{m}^3$)	New Annual AQO ($\mu\text{g}/\text{m}^3$)
Ozone (O_3)	38	-
Respirable Suspended Particulates (PM_{10})	46	50
Fine Suspended Particles ($\text{PM}_{2.5}$)	31	35

Source: Environmental Protection Department (2012, 2013, 2014, 2015, 2016). Air Quality in Hong Kong 2012/2013/2014/2015/2016.

Notes: Bold and Italic numbers mean non-compliance of AQO.

3.2.4 Study Area and Sensitive Receivers

The Study Area for the air quality impact assessment has been defined by a distance of 500m from the Works Boundary of the improvement works. It is noted that the ASRs identified in the previous EIA are not valid given that various development has taken place and the environmental setting has changed in the past 16 years. Representative ASRs within 500m from the Works Boundary have been identified according to the criteria set out in the EIAO-TM and through site inspections. They are summarised in **Table 3.3** and their locations are shown in **Figure 3.1**.

Table 3.3: Representative Air Sensitive Receivers

ASR	Description	Type of Use	Approximate Distance between ASRs and Nearest Works Boundary (m)
ASR1	Residential House on San Sham Road	Residential	174
ASR2	Ha Wan Tsuen	Residential	260
ASR3	Residential House on Ha Wan Tsuen Road	Residential	399
ASR4	Residential House on Lok Ma Chau Road	Residential	343
ASR5	Tung Chan Wai	Residential	284
ASR6	Lok Ma Chau Control Point	Office	161

3.2.5 Identification and Evaluation of Impacts

3.2.5.1 Construction Phase

Construction activities including minor-scaled excavation, floodwall construction and slope filling will be carried out during the construction phase. If without control measures, fugitive dust emissions would be expected from these construction activities.

During the construction phase, construction will start with site clearance which is classified as a regulatory work under the *Air Pollution Control (Construction Dust) Regulation*. Implementation of the standard dust suppression measures required under the schedule shall control dust emissions to an acceptable level. Dust emissions from excavation shall be controlled by water spraying immediately before, during and after the operation so as to maintain the surface wet.

Owing to the small scale of improvement works as compared to the construction of the whole STEMC in the previous EIA, it is expected that the construction phase air quality impact is insignificant with the implementation of proper good site practices during the construction of the proposed works. Moreover, no odour source is expected during the construction phase.

3.2.5.2 Operation Phase

The improvement works mainly include the provision of floodwalls and/ or embankment along the STEMC, no air pollutant emission source or odour source is anticipated during the operation phase. Therefore, no operation phase air quality impact is anticipated.

3.2.6 Mitigation Measures

3.2.6.1 Construction Phase

Dust mitigation measures should be adopted as required under the *Air Pollution Control (Construction Dust) Regulation*. A control programme would be instigated to monitor the construction process in order to enforce dust controls and modify methods of works to reduce dust emissions down to acceptable levels. The following dust control measures as stipulated in the *Air Pollution Control (Construction Dust) Regulation* should be implemented throughout the construction period:

Excavated Materials

Any stockpile of dusty material shall be either: (a) covered entirely by impervious sheeting; (b) placed in a sheltered area; or (c) sprayed with water or dust suppression chemicals so as to maintain the entire surface wet.

Exposed Earth

The amount of exposed soil should be kept at minimum by re-vegetation of completed earthworks to prevent wind erosion of soil and subsequent dust nuisance.

Loading, Unloading or Transfer of Dusty Materials

All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet.

Debris Handling

Any debris should be covered entirely by impervious sheeting or stored in a sheltered debris collection area.

Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped.

Transportation of Dusty Materials

Vehicles used for transporting dusty materials/ spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards.

Site Boundary and Entrance

Vehicle washing including a high pressure water jet shall be provided at every discernible or designated vehicle exit point. Every vehicle should be washed to remove any dusty materials from its body and wheels immediately before leaving the Project site.

Good Site Management

Good site management is important to reduce potential air quality impact to an acceptable level. As a general guidance, the contractor shall maintain high standard of housekeeping to prevent emissions of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimize the release of visible dust. Any piles of materials accumulated on or around the work areas shall be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas shall be carried out in a manner without generating fugitive dust emissions. The material shall be handled properly to prevent fugitive dust emissions before cleaning.

3.2.6.2 Operation Phase

No mitigation measures are considered necessary for the operation phase as no emission sources are expected.

3.2.7 Environmental Monitoring and Audit

As the construction of the improvement works is not expected to generate excessive dust levels, no air quality monitoring is considered necessary. Nevertheless, it is recommended that the site works are audited and mitigation measures are checked for their implementation during routine site inspections.

3.3 Conclusion

During the construction phase, dust will be generated from the construction works. With proper implementation of the recommended mitigation measures, the construction phase air quality impact would be alleviated to an acceptable level.

No operation phase air quality impact is anticipated and hence no mitigation measures would be required.

4 Noise

4.1 Review of Previous EIA Findings

In the previous EIA Study (AEIAR-019/1999), noise impact assessment was conducted to evaluate the noise impacts during the construction and operation phases. The assessment results revealed that adverse construction noise impacts were unlikely to happen at any of the identified Noise Sensitive Receivers (NSRs) under the unmitigated scenario. Therefore, it was considered that mitigation measures would not be required for the construction of STEMC to meet the daytime construction noise criteria in regard to ProPECC and EIAO-TM. Nevertheless, good site practices and nuisance avoidance measures were recommended to considerably reduce noise emissions from the construction works. Cumulative impacts with Lok Ma Chau Boundary Crossing project were not anticipated, whereas cumulative impacts with East Rail Spur Line project could not be assessed due to lack of information. During the operation phase, fixed plant noise from the pumping station was identified as the major operation phase noise source. Noise levels were predicted at the closest NSR to the pumping stations. Exceedances of up to 5dB(A) were expected at the NSR. Hence, mitigation measures were recommended including good engineering designs to help limit the noise emissions from the pumping stations.

Since the proposed improvement works was not included in the previous EIA, a review of the potential noise impacts from the improvement works is provided below.

4.2 Review of Potential Impacts from Proposed Improvement Works

4.2.1 Introduction

A noise impact assessment has been conducted to study the potential noise impact associated with the improvement works, following the below Legislation, Standards, Guidelines and Criteria relevant to construction noise impacts:

- Noise Control Ordinance (NCO);
- Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM);
- Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM);
- Technical Memorandum on Noise from Percussive Piling (PP-TM);
- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM); and
- ProPECC PN 2/93 Environmental Protection Department Practice Note for Professional Persons: Noise from Construction Activities – Non-statutory Controls

4.2.2 Legislation, Standards, Guidelines and Criteria

4.2.2.1 Noise Control Ordinance

Noise impacts arising from general construction activities (excluding percussive piling) conducted during the restricted hours (i.e. 1900 to 0700 hours on any day and anytime on Sunday or general holiday) and percussive piling during anytime are governed by the NCO.

For carrying out of any general construction activities involving the use of any Powered Mechanical Equipment (PME) within restricted hours, a Construction Noise Permit (CNP) is

required from the Noise Control Authority under the NCO. The noise criteria and the assessment procedures for issuing a CNP are specified in GW-TM under the NCO.

The works area of this Project will fall outside the Designated Areas. Therefore, the DA-TM is not applicable to the Project.

According to the proposed construction methodology, percussive piling is not required for the Project. Therefore, the PP-TM is not applicable to the Project.

According to the construction programme, the proposed construction works would be carried out during non-restricted hours (i.e. 0700 to 1900 hours on any day not being a Sunday or general holiday). In the case of any construction activities during restricted hours, it is the contractor's responsibility to ensure compliance with the NCO as well as the relevant TMs. The contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should any be issued.

4.2.2.2 Technical Memorandum on Environmental Impact Assessment Process

Noise impacts arising from general construction activities other than percussive piling during the daytime period (i.e. 0700 to 1900 hours of any day not being a Sunday or general holiday) shall be assessed against to the noise standards under EIAO-TM as tabulated in **Table 4.1** below:

Table 4.1: Noise Standards for Daytime Construction Activities

Noise Sensitive Use	0700 to 1900 hours on any day not being a Sunday or general holiday Leq (30 min), dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostels	75
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 65 (During examinations)

Source: EIAO TM, Annex 5, Table 1B

Note: -The above standards apply to uses, which rely on opened windows for ventilation.
 -The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external facades.

4.2.3 Study Area and Sensitive Receivers

The Study Area for noise impact assessment is defined as within 300m from the Works Boundary of the proposed improvement works. It is noted that the NSRs identified in the previous EIA are not valid given that various development has taken place and the environmental setting has changed in the past 16 years. Therefore, representative NSRs within 300m from the Works Boundary have been identified in accordance with Annex 13 of the EIAO-TM. The existing, planned and committed noise sensitive developments and relevant uses on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board were also reviewed in the vicinity of the Project.

Site visits were conducted on 25 January and 22 February 2018 for identifying the existing NSRs within the Study Area. For the purpose of noise impact assessment, the first layer of NSRs located

close to boundary of the Project have been selected as assessment points/ identified representative NSRs within the Study Area.

The representative NSRs for assessment are presented in **Table 4.2** and their locations are shown in **Figure 4.1**. The photos of the existing representative NSRs are shown in **Appendix A**.

Table 4.2: Representative Noise Sensitive Receivers

NSR	Description	Existing/ Planned	Type of Use	No. of Floor	Noise Criteri a dB(A)	Distance between NSRs and nearest notional source position (m)	Distance between NSRs and nearest work boundary (m)
NSR1	Residential House near Lok Ma Chau Road	Existing	Residential	2/F	75	184	176
NSR2	Ha Wan Tsuen	Existing	Residential	1/F	75	271	265
NSR3	Tung Chan Wai (Residential House No. 63A)	Existing	Residential	3/F	75	281	279
NSR4	Wing Ping Tsuen (Residential House No. 285B)	Existing	Residential	3/F	75	173	167
NSR5	Residential House near Kwu Tung Road	Existing	Residential	1/F	75	87	69
NSR6	Residential House on Ki Lun Tsuen Road	Existing	Residential	1/F	75	195	186

4.2.4 Description of the Existing Environment

Site visits were undertaken on 25 January and 22 February 2018 to identify the background noise sources within the Study Area. The background noise environment at the sections to the north of the Castle Peak Road is dominated by the operation of the Lok Ma Chau Control Point, while the background noise environment at sections to the south of the Castle Peak Road is dominated by road traffic noise from Castle Peak Road, San Tin Highway and Kwu Tung Road.

4.2.5 Identification and Evaluation of Impacts

4.2.5.1 Construction Phase

The major construction activities of the improvement works involve excavation, floodwall construction and slope filling. The potential source of noise impact during the construction phase of the improvement works is from the use of PME for various construction activities. The PME likely to be used include excavators, vibrators and generators etc. As confirmed by the Project Engineer, construction activities for the Project would only be carried out during non-restricted hours (i.e. 0700 to 1900 hours on any day not being a Sunday or general holiday).

The type and quantity of PME likely to be used for this Project and their Sound Power Levels (SWLs) are shown in **Table 4.3** and **Table 4.4**. The type, quantity and the utilization of the PMEs have been reviewed and confirmed by the project engineer to be appropriate and practicable for carrying out the proposed construction works.

Table 4.3: Plant Inventory for Construction of Embankment

Noise Source	Ref. No	No.	SWL/unit	SWL/sub-total
Excavator (wheeled/tracked)	CNP081	2	112	115
Generator (standard)	CNP101	1	108	108
Dump truck, 5.5 tonne < gross vehicle weight ≤ 38 tonne	OCUPME-038	2	105	108
Compactor, vibratory	CNP050	2	105	108
Lorry, 5.5 tonne < gross vehicle weight ≤ 38 tonne	OCUPME-033	1	105	105
Breaker, mini-robot mounted	OCUPME-003	1	115	115
Total SWL, dB(A)				119

Table 4.4: Plant Inventory for Construction of Floodwall

Noise Source	Ref. No	No.	SWL/unit	SWL/sub-total
Concrete lorry mixer	CNP044	1	109	109
Poker, vibratory, hand-held (electric)	OCUPME-019	1	102	102
Generator (standard)	CNP101	1	108	108
Lorry, 5.5 tonne < gross vehicle weight ≤ 38 tonne	OCUPME-033	1	105	105
Water pump (electric)	CNP281	1	88	88
Bar bender and cutter (electric)	CNP021	1	90	90
Breaker, mini-robot mounted	OCUPME-003	1	115	115
Total SWL, dB(A)				117

According to the construction programme, the proposed improvement works will be conducted from north to the south. There would be some overlapping of works for construction of embankment and floodwall near NSR 1 and NSR2, which has been taken into consideration in the noise calculation below. Worst case scenario with the consideration of overlapping of construction works and full utilisation rate of PME are assumed in the prediction for conservative approach. Notional source positions of PME have been assumed based on the assessment approach stated in GW-TM. The predicted noise levels at worst-case scenario are presented in **Table 4.5** below.

Table 4.5: Unmitigated Construction Noise Levels at Representative NSRs

NSR	Description	Distance between NSRs and nearest notional source position (m)	Total SWL, dB(A)/ Embankment and Floodwall	Predicted Noise Level*, dB(A)/ Embankment and Floodwall
1	Residential House near Lok Ma Chau Road	184	121	71
2	Residential House in Ha Wan Tsuen	271	121	67
3	Tung Chan Wai (Residential House No. 63A)	281	117**	63**

NSR	Description	Distance between NSRs and nearest notional source position (m)	Total SWL, dB(A)/ Embankment and Floodwall	Predicted Noise Level*, dB(A)/ Embankment and Floodwall
4	Wing Ping Tsuen (Residential House No. 285B)	173	117**	67**
5	Residential House near Kwu Tung Road	87	117**	73**
6	Residential House on Ki Lun Tsuen Road	195	117**	66**

Remarks: * Facade correction of +3dB(A) has been included in the noise calculation of predicted noise level.

** According to **Figure 1.1**, only construction of floodwall will take place near NSR3,4,5,6. So, the total SWL of 121dB(A), counting the overlap of construction works of embankment and floodwall, is not applicable for the case of NSR3,4,5,6. Thus, a SWL of 117dB(A) for construction of floodwall only has been adopted in the noise calculation.

Potential construction noise impact has been assessed and the predicted noise levels at the representative NSRs are shown in **Table 4.5**. Under unmitigated scenario, the predicted construction noise impact would comply with the relevant noise standards for daytime construction activities at all representative NSRs. Therefore, adverse construction noise impact is not anticipated.

4.2.5.2 Operation Phase

For the proposed improvement work mentioned in **Section 2.5**, no noise emission source is anticipated during the operation phase.

4.2.6 Mitigation Measures

4.2.6.1 Construction Phase

While no adverse construction noise impact is anticipated, the following noise control measures are recommended to further reduce potential noise impact from construction activities:

- Good Site Practice;
- Selection of quieter plant;
- Use of enclosure / acoustic shed;
- Use of Insulating Fabric; and
- Schedule of the use of PME

Good Site Practice

Good site practice and noise management can significantly reduce the impact of site activities on nearby NSRs. The measures should be followed as far as practicable during construction:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly;
- Machines and plants that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- Mobile plant, if any, should be sited as far from NSRs as possible;
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated to direct noise away from NSRs;
- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities;

- Silencers or mufflers on construction equipment should be utilized and should be properly maintained during construction works; and
- Routine maintenance of plant and equipment should be carried out.

Selection of Quiet Plant

Quiet plant is defined as Quality Powered Mechanical Equipment (QPME) where actual SWL is less than the value specified in GW-TM for the same piece of equipment. This is one of the most effective measures and is increasingly practicable because of the availability of quiet equipment.

The contractor may be able to obtain particular models of plant that are quieter than the standards given in the GW-M. The SWLs for specific quiet plant can be taken from EPD's QPME Inventory.

Use of Noise Enclosure/ Acoustic Shed

The use of noise enclosure or acoustic shed is to cover stationary PME such as excavators, vibrators and generators. With the adoption of the noise enclosure or acoustic shed, the PME could be completely screened and the noise emission at source can be effectively reduced.

Use of Noise Insulating Fabric

Noise insulating fabric should be adopted for certain PME where applicable. With the adoption of the fabric, noise emission from the opening or gaps of the joints of the PME can be effectively reduced.

Schedule of the Use of PME

The construction activities should be scheduled, where practicable, to prevent the use of multiple PME simultaneously.

4.2.6.2 Operation Phase

No mitigation measure is considered necessary for the operation phase since no noise emission source is expected for the proposed improvement work mentioned in **Section 2.5**.

4.2.7 Environmental Monitoring and Audit

As the construction of improvement works is not expected to generate excessive noise impacts, noise monitoring is considered not necessary. However, environmental audit is recommended to ensure that the noise levels do not exceed the criteria during the construction phase.

4.3 Conclusion

Noise will be generated from the construction works. It is anticipated that the construction noise levels at all representative NSRs are predicted to comply with the relevant noise standards for daytime construction activities at all representative NSRs. Therefore, adverse construction noise impact is not anticipated. No operation phase noise impact is expected and hence no mitigation measures would be required.

5 Water Quality

5.1 Review of Previous EIA Findings

According to the previous EIA, the identified key water quality impacts of the construction of STEMC would be from the excavation along the proposed alignment of the STEMC during the construction phase. If the activity is not properly controlled, it is likely to result in release of suspended solids (SS) and pollutants from the disturbed existing stream sediments and reduction of DO within the local water bodies, thereby affecting the potential Water Sensitive Receivers (WSRs) downstream. Various mitigation measures and working method controls were proposed to minimise the potential water quality impacts to acceptable levels. During the operation phase, the potential impact from maintenance dredging was expected to be limited and would be controlled by proper mitigation measures.

The previous EIA did not cover the proposed improvement works, of which the potential water quality impacts are evaluated below.

5.2 Review of Potential Impacts from Proposed Improvement Works

5.2.1 Introduction

A water quality impact assessment has been conducted to evaluate the water quality impact associated with the improvement works. Sensitive receivers have also been identified for the prediction and evaluation of the impacts during construction and operation phases.

5.2.2 Legislation, Standards, Guidelines and Criteria

Legislation, Standards, Guidelines and Criteria relevant to the consideration of water quality impact assessment include the following:

5.2.2.1 Environmental Impact Assessment Ordinance (EIAO), Cap.499, S16

Under Section 16 of the EIAO, Environmental Protection Department (EPD) issued the "Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)" which specifies the assessment methods and criteria for environmental impact assessment. This environmental review follows the EIAO-TM to assess the potential water quality impacts that may arise during the construction and operational phases of the improvement works. Sections in the EIAO-TM relevant to the water quality impact assessment are: Annex 6 - Criteria for Evaluating Water Pollution; and Annex 14 - Guidelines for Assessment of Water Pollution.

5.2.2.2 Water Quality Objectives (WQOs)

The Water Pollution Control Ordinance (WPCO) (Cap.358) provides the major statutory framework for the protection and control of water quality in Hong Kong. According to the Ordinance and its subsidiary legislation, the whole Hong Kong waters are divided into ten Water Control Zones (WCZs). Water Quality Objectives (WQOs) were established to protect the beneficial uses of water quality in WCZs. Specific WQOs are applied to each WCZ. The effluent from the improvement works will be conveyed to Shenzhen River and ultimately drain into the Deep Bay WCZ.

5.2.2.3 No Net Increase in Pollution Load Requirement in Deep Bay

Effluent treatment is required prior to discharge into the water courses in the Deep Bay area, in order to meet the criteria of “no net gain” in pollution load as specified in the Town Planning Board Guidelines No. 12C. The underlying principle is to protect the important habitats and wildlife of the Deep Bay region. Although this guideline is not applicable and directly relevant to the proposed drainage improvement works, sewage produced from construction workforce requires treatment prior to disposal.

5.2.2.4 Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters

Discharges of effluents are subject to control under the WPCO. The Technical Memorandum on Standards for Effluent Discharge into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS) gives guidance on the permissible effluent discharges based on the type of receiving waters (foul sewers, storm water drains, inland and coastal waters). The limits control the physical, chemical and microbial quality of effluents. Effluent from constructing of the improvement works will be conveyed to Shenzhen River and ultimately drain into the Deep Bay Water Control Zone (WCZ). Any effluent from the improvement works must comply with the standards for effluents discharged into the coastal waters of the Deep Bay WCZ, as given in the TM-DSS.

5.2.2.5 Practice Note for Professional Persons (ProPECC Note PN1/94) on Construction Site Drainage

The Practice Note for Professional Persons (ProPECC Note PN1/94) on Construction Site Drainage provides guidelines for the handling and disposal of construction discharges. This ProPECC Note is generally applicable for control of site runoff and wastewater generated during the construction phase of the improvement works.

5.2.3 Study Area and Sensitive Receivers

The Study Area for water quality impact assessment is defined as areas within 500m from the Works Boundary and other areas such as water courses and the associated water systems in the vicinity that might be impacted by the improvement works.

The nearest water sensitive receivers include San Tin wetland, channel south of Lok Ma Chau Road, fish pond adjacent to meander, ditch at Ha Wan Tsuen, pond at Ha Wan Tsuen, meander and Shenzhen River.

5.2.4 Baseline Conditions

Baseline water quality surveys were undertaken to collect baseline water quality data of the STEMC. The surveys were conducted at two stations, including one upstream station (namely ST-U/M) and one downstream stations (namely ST-D/M) of the subject channel, as shown in **Figure 5.1**. The wet season surveys were conducted during October 2017, while dry season surveys were conducted in November 2017, at a frequency of three times per week, for two consecutive weeks. The interval between two consecutive samplings was no less than 36 hours. Since the water depth of the channel was less than 3m, only the mid-depth station have been monitored. The summaries of wet and dry season baseline water quality data of the STEMC are presented in **Table 5.1** and **Table 5.2** respectively.

Table 5.1: Wet Season Baseline Water Quality Data

Parameters	ST-U/M	ST-D/M
Dissolved Oxygen (DO), mg/L	5.2	6.1
Dissolved Oxygen (DO), %	65	75
Temperature, °C	26.9	26.8
pH	8.4	8.1
Turbidity, NTU	7.1	8.8
Conductivity, µS/cm	519	569
Water Depth, m	0.82	0.85
Biochemical Oxygen Demand (BOD5), mg/L	7	9
Suspended solid (SS), mg/L	9	13
Ammonia-nitrogen, mg/L	16.6	13.4
Total nitrogen, mg/L	18.6	15.1
<i>E coli.</i> , cfu /100mL	44,167	71,417

Table 5.2: Dry Season Baseline Water Quality Data

Parameters	ST-U/M	ST-D/M
Dissolved Oxygen (DO), mg/L	2.6	2.1
Dissolved Oxygen (DO), %	30.3	24.2
Temperature, °C	22.5	22.6
pH	7.6	7.7
Turbidity, NTU	22.8	56.7
Conductivity, µS/cm	584	570
Water Depth, m	0.12	0.45
Biochemical Oxygen Demand (BOD5), mg/L	33	40
Suspended solid (SS), mg/L	36	533
Ammonia-nitrogen, mg/L	25.9	15.1
Total nitrogen, mg/L	30.3	20.8
<i>E coli.</i> , cfu /100mL	454,967	325,917

5.2.5 Identification and Evaluation of Impacts

5.2.5.1 Construction Phase

The scale of construction of the improvement works is considered as minor, which only include excavation, floodwall construction and slope filling. Potential sources of construction-related water quality impacts include:

- Construction site runoff
- Accidental spillage of chemicals
- Sewage from construction workforce
- General construction activities

Construction Site Runoff and Drainage

Activities within a construction site can generate surface runoff which may contain high levels of suspended solids and contaminants. Such surface runoff can pollute watercourses and lead to deteriorations in water quality if left uncontrolled.

The key sources of pollution to surface water runoff from the construction site include:

- Runoff from exposed earth surfaces within the construction site, particularly during inclement weather
- Erosion of uncovered stockpiles
- Release of bentonite slurries, concrete washing and wastewater from other grouting activities
- Dewatering associated with excavation
- Wastewater from dust suppression spraying and vehicle washing

Uncontrolled discharges from a construction site have the potential to adversely impact nearby stormwater drains, but can be managed through good site practices and provision of appropriate site drainage management facilities. The good site practices outlined in ProPECC Note PN1/94 will be implemented to control site runoff and drainage during construction phase. Precautionary measures relating to rainstorms as stated in Appendix A2 of ProPECC Note PN1/94 will be also implemented to avoid water pollution due to site runoff during inclement weather.

Accidental spillage of chemicals

Chemicals stored on-site during construction phase such as petroleum, oil and grease, lubricants and solvents may be accidentally spilt or leaked at the construction site. If left unattended, such spilt / leaked chemicals may enter the site drainage system and adversely impact stormwater drains outside the site. To avoid and minimise such potential impacts, appropriate site storage and bunding of chemicals should be implemented as part of good site practice, and measures should be taken to clean up any spilt / leaked chemicals immediately.

Sewage from Construction Workforce

Domestic sewage will be generated by the construction workforce during construction phase. Release of untreated sewage into the surrounding environment can adversely impact the aquatic environment by causing pollution / eutrophication of nearby water courses, odour nuisance and subsequent deterioration in aquatic biodiversity.

General Construction Activities

Inadequate or improper storage of construction materials and waste has the potential to impact water quality through release of construction debris (such as packaging and construction materials) and general refuse (waste food containers, paper, bottles and cans) into the construction site drainage system. Implementation of good site management practices and provision of adequate waste receptacles will be adopted to mitigate the potential impacts of general construction activities on water quality.

5.2.5.2 Operational Phase

No water quality impact is expected during the operation phase.

5.2.6 Mitigation Measures

5.2.6.1 Construction Phase

Construction Site Runoff

Construction site runoff and wastewater shall not be directly discharged off site. Good site practices outlined in ProPECC Note PN1/94 should also be adopted to minimise runoff from construction works areas. The following measures are recommended, but are not exhaustive, and other relevant measures listed in ProPECC Note PN1/94 should be implemented as necessary to minimise the impacts of construction on downstream water quality:

- Temporary site drainage facilities shall be designed and implemented by the contractor prior to commencement of construction to convey surface runoff to storm drains. The design of the silt/ sand removal traps and sediment basins shall follow the design in ProPECC Note PN1/94;
- Perimeter cut-off drains shall be installed in advance of any excavation and site formation works to convey site runoff from the works areas to the silt removal facilities;
- Erection of lateral support and/ or physical barrier shall be provided, whenever possible, at site perimeter to prevent site runoff from entering the STEMC with ultimate discharge to Deep Bay, without unduly impeding the flow during heavy rain;
- Runoff into the excavation areas during rainstorm events shall be minimised as far as practicable. Any wastewater pumped out of the excavation areas shall be treated to remove suspended solids prior to discharge;
- Maintenance and inspection of the drainage system and sediment removal facilities should be carried out regularly to remove any sediment and blockages, especially when rainstorms are forecast;
- Final surface levels should be compacted and final surface protections installed to prevent erosion by rainstorms;
- Open stockpiles of material should be covered on site with waterproof layers such as tarpaulin;
- The wheels of all vehicles and plant should be cleaned before leaving the works areas. The washwater should be treated to remove any suspended sediment;
- Surface water from concrete batching areas and the rest of the site should be separated as far as possible. Wastewater from any concrete batching plant (if required) shall be treated to the required standards including pH adjustment and settlement of suspended sediments before discharging to stormwater drains; and
- Manholes should be adequately covered and temporarily sealed at all times.

Precautionary measures relating to inclement weather outlined in Appendix A2 of ProPECC Note PN1/94 should also be adopted to prevent water pollution due to site runoff. The following measures are recommended, but are not exhaustive, and other relevant measures listed in Appendix A2 of ProPECC Note PN1/94 should be implemented as necessary to minimise the impacts of construction on downstream water quality:

- Silt removal facilities, channels and manholes should be maintained and deposited silt and grit should be removed regularly;
- Temporarily exposed slope surfaces should be covered;
- Temporary access road should be protected by crushed stone or gravel;
- Intercepting channels should be provided to prevent storm runoff from washing across exposed soil surfaces; and
- Trenches should be dug and backfilled in short sections. Measures should be taken to minimize the ingress of rainwater into trenches.

Accidental Spillage of Chemicals

The Waste Disposal Ordinance (Cap. 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation should be observed and complied with for control of chemical wastes. The contractor should register as a chemical waste producer if chemicals are to be generated from site. Off-site disposal of chemical waste should only be carried out in accordance with the requirements of the WDO.

In addition, the following measures shall be observed:

- The labelling and storage of chemicals should be in accordance with the “Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes” and maintained at all times by the contractor;
- Oils and fuels should only be stored in designated areas which have appropriate pollution prevention control facilities such as oil and grease traps and petrol interceptors;
- The maintenance of vehicles should only be undertaken in areas of the site served by these pollution prevention measures; and
- All fuel tanks and storage areas should be locked and located on sealed areas of the site, within bunded areas with a capacity equal to 110% of the storage capacity of the largest container. The bund should be drained of surface water after each rainfall event.

Sewage from Construction Workforce

Portable toilets shall be provided throughout construction phase and shall be regularly maintained, collected and disposed of by a licensed waste collector.

General Construction Activities

Mitigation measures to be adopted for general construction activities including the following:

- Excavation works during rainy season shall be minimised to reduce downstream impacts to the Deep Bay area.
- Construction waste, debris and refuse generated on-site should be stored in designated areas and properly contained.
- Waste materials should be regularly removed off-site.
- Stockpiles of construction materials such as cement and excavated material should be covered when not in use.

With the adoption of these good site practices, no adverse water quality impacts are anticipated.

5.2.6.2 Operation Phase

No mitigation measure is considered necessary since no operational water quality impact is expected. However, as a general preventive measure to reduce water quality impact to the Deep Bay area, the proposed 300mm U-channels could be connected to silt traps in the catch pits.

5.2.7 Environmental Monitoring and Audit

Water quality monitoring during the construction phase is considered not necessary. However, a series of checklist items involving the water quality control measures should be included in the regular site audits during the construction phase to ensure the mitigation measures proposed are being adopted.

5.3 Conclusion

With the implementation of the proposed mitigation measures for water quality control, no adverse impact will be resulted in the construction phase, while there is no impact identified during the operation phase.

6 Ecology

6.1 Review of Previous EIA Findings

In the previous EIA study, ecological baseline has been developed. It identified that the DP is in an ecologically sensitive area and majority of the ecological habitat affected under the DP is commercial fish pond.

The DP is located partially in Wetland Conservation Area (WCA) with the remaining area entirely in Wetland Buffer Area (WBA). The intentions of the conservation area are to conserve the ecological value of wetlands and fishponds to form an integral part of the wetland ecosystem in the Deep Bay area and function as an important habitat for waterbirds.

In the EIA report, the ecological significance of the DP area was recognized supporting significant bird population including six ardeid species and at least 11 bird species of conservation concern including uncommon species Tufted Duck *Aythya fuligula*, Pheasant-tailed Jacana *Hydrophasianus chirurgus* and Black-faced Spoonbill *Platalea minor*, and a locally restricted dragonfly species *Orthetrum luzonicum*.

The main ecological impact of the DP was recognized as habitat loss for wetland fauna - the permanent loss of active and inactive fish ponds in San Tin area with high bird species richness. The reduction of wetland habitats in San Tin was evaluated as moderate to high ecological impact to bird species, ardeids and wetland dependent fauna including amphibians and fishes. Impact of habitat fragmentation due to the STEMC was also evaluated.

To mitigate the ecological impact due to the DP, compensation wetland was proposed. A 3.43ha constructed wetland was proposed to the east of the channel to compensate for loss of wetlands and provide a self-sustaining wetland for wetland dependent wildlife. An Ecological Habitat Management Plan (EHMP) was formulated to lay down the requirement of the constructed wetland. A post-construction monitoring survey was undertaken to record and evaluate re-colonization of these habitats by birds and wetland dependent fauna.

The EHMP set out the habitats that need to be included in the constructed wetland which include pond/open water, permanent marsh, seasonal marsh and terrestrial margins. To monitor the successfulness of the constructed wetland, few wetland-dependent species were set as targeted species for subsequent monitoring.

6.2 Review of Potential Impact arising from Proposed Improvement Works

Further to the completion of the STEMC, improvement works were proposed as detailed **Chapters 1 and 2**. The associated ecological impact is evaluated below.

6.2.1 Relevant Legislation, Standards & Guidelines

A number of international conventions, local legislation and guidelines provide the framework for the protection of species and habitats of ecological importance. Those related to this Project are:

- *Forests and Countryside Ordinance* (Cap. 96), which protects the rare plant species from selling, offering for sale, or possession illegally;
- *Forestry Regulations* (Cap. 96 sub. leg.) are subsidiary legislation of the *Forests and Countryside Ordinance* (Cap. 96). Under these regulations, no person shall without lawful

excuse sell, offer for sale, or have in his possession or under his custody or control any portion of any of the plants scheduled under the Forestry Regulations;

- *Wild Animals Protection Ordinance* (Cap. 170), which protects wild animals listed under the second schedule from being hunted, possession, sale or export, disturbance of their nest or egg without permission by authorised officer;
- *Protection of Endangered Species of Animals and Plants Ordinance* (Cap. 586), which regulates the import, introduction from the sea, export, re-export, and possession of specimens of a scheduled species, including live, dead, parts or derivatives. The Ordinance applies to all activities involving endangered species which include the parties of traders, tourists and individuals;
- *Environmental Impact Assessment Ordinance (EIAO)* (Cap. 499), which specifies designated projects under Schedule 2 of the Ordinance, unless exempted, must follow the statutory environmental impact assessment (EIA) process and require environmental permits for their construction and operation;
- *EIAO Guidance Notes No. 6/2010, 7/2010 and 10/2010*. These guidance notes provide the observations on Ecological Assessment from the EIAO perspective, providing the general guidelines for conducting an ecological baseline survey for ecological assessment, introducing some methodologies in conducting terrestrial and freshwater ecological baseline surveys, and methodologies for marine ecological baseline surveys respectively;
- *Annexes 8 and 16 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)*: Annex 8 recommends the criteria for evaluating ecological impacts. Annex 16 sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts;
- *The IUCN Red List of Threatened Species* is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The goal of the IUCN Red List is to provide information and analyses on the status, trends and threats to species in order to inform and catalyse action for biodiversity conservation;
- *The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)* is an international agreement between Governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival;
- *The Convention on the Conservation of Migratory Species of Wild Animals* (the Bonn Convention) is an intergovernmental treaty concluded under the aegis of the United Nations Environment Programme concerned with the conservation of wildlife and habitats on a global scale. Its aim is to conserve terrestrial, marine and avian migratory species throughout their range;
- *United Nations Convention on Biological Diversity (CBD)* (1992) is an international legally binding treaty. Its aim is to develop national strategies for the conservation and sustainable use of biological diversity; and
- *Wild Animal Protection Law of the Peoples' Republic of China (PRC)* is formulated for the purpose of protecting and saving the species of wildlife which are rare or near extinction, protecting, developing and rationally utilising wildlife resources and maintaining ecological balances.

6.2.2 Baseline Condition of the Project Area

The construction of the STEMC and the constructed wetland was completed in 2006. Since then, the condition remains largely unchanged. The STEMC comprises drainage channel, artificial habitat (mainly maintenance access). The ecological characteristic of the channel and the constructed wetland were obtained through literature review of recent EIA studies, ecological monitoring and latest ecological survey findings. Information reviewed includes but not limited to the following:

- Main Drainage Channels and Poldered Village Protection Scheme for San Tin, NWNT EIA Study(ERM 1999).
- Agreement No. CE 49/2000. Design of Ecological Mitigation Measures and Landscape Works and Assessment of Land Contamination for Eastern Main Drainage Channel for San Tin. Ecological Habitat Management Plan (Final). (Maunsell Consultants Asia Ltd. 2001)
- Planning and Engineering Study on Development of Lok Ma Chau Loop – Investigation. EIA Study. (ARUP 2013).
- San Tin Eastern Main Drainage Channel Constructed Wetland Monthly Monitoring Report. June 2014 – May 2017). (AFCD 2014-2017).

6.2.2.1 Literature Review

The ecological resources within the STEMC and the constructed wetland was recorded in various ecological studies and surveys, which were reviewed to investigate the ecological attributes of the habitats.

The previous EIA study recognized a low impact on fragmentation based on limited movement of the wetland dependent fauna, with the existence of San Sham Road along most of the eastern edge of the STEMC. Poor water quality recorded within the Channel also restricted the quantity and diversity of wildlife records, especially herpetofauna (ERM 1999). Mammals recorded along the STEMC only included the common and widespread Roof Rat *Rattus rattus*, while Javan Mongoose *Herpestes javanicus* was recorded in the San Tin Area.

According to the EHMP (Maunsell 2001), the constructed wetland intended to compensate loss of man-made freshwater habitats by creating freshwater and possibly brackish water habitats, including ponds and marshes. Terrestrial habitats recorded in the wetland include grass, scrub and woodland with planted trees and shrubs. The vegetation provided roosting, perching and nesting opportunities for the target birds and wetland dependent fauna, amphibian and odonate species.

For development of Lok Ma Chau Loop to the northeast of the STEMC, an EIA study was conducted which also established an ecological baseline condition for STEMC as part of its study area. Ecological baseline surveys in the Lok Ma Cha Loop EIA (Arup 2013) recognized that the STEMC offered opportunities for avifauna, particularly wading birds. Fifty bird species was recorded utilising the channel, majority (27 species) of them are wetland-dependent, including Wood Sandpiper *Tringa glareola*, Greater Painted Snipe *Rostratula benghalensis*, Pied Avocet *Recurvirostra avosetta*, Common Teal *Anas crecca* and Eurasian Wigeon *Anas penelope*, while 24 of them are of conservation concern. The list of bird species recorded in the habitats within the STEMC between 2010 and 2012 during the EIA study is represented in **Table 1** in **Appendix B**.

Fauna species of conservation concern including birds, odonates and herpetofauna were recorded in the wetland monitoring surveys. With reference to the record between 2014 and 2017, 23 bird species of conservation concern, including five ardeid species and wetland dependent species Little Grebe *Tachybaptus ruficollis* and Black-winged Stilt *Himantopus himantopus*, were

recorded utilizing the constructed wetland. A list of bird species recorded in the constructed wetland habitat is summarized in **Tables 2 and 3** in **Appendix B**. A summary of the herpetofauna, odonate and fish species recorded during the monitoring period is provided in **Tables 4 to 8** in **Appendix B**.

6.2.2.2 Ecological Survey

For this ER, an ecological field survey was conducted to supplement ecological baseline information. The survey last for one year from August 2016 to July 2017 covering flora and fauna species. The result is summarized below with the data provided in **Appendix B**.

River channel, constructed wetland and developed area were the major habitat types identified along the STEMC where the proposed works will take place. River channel, being trained and channelized, is dominated by grass species established along the concrete embankment and river bed. At the upper stream, the modified channel bed and riparian zone were covered by herbaceous plants such as *Persicaria lapathifolia*, *Panicum maximum* and *Imperata cylindrica* var. *major*. At the lower stream, progressively more mud was settled, and vegetation only covered the riparian area on the concrete embankment dominated by grass *Imperata cylindrica* var. *major*, *Melinis repens* and *Panicum maximum*. Constructed wetland, created to mitigate the wetland loss for the improvement works at the STEMC, comprise ponds and marshes made up of intermix of planted and naturally established aquatic macrophytes including *Eleocharis spiralis*, *Phragmites australis*, *Cyperus malaccensis* and *Paspalum scrobiculatum* var. *orbiculare* and exotic *Brachiaria mutica*, with the terrestrial margins dominated by *Panicum maximum*. Developed area within the Project Area mainly comprise trees planted for screening purpose, including *Acacia confusa*, *Celtis sinensis*, *Ficus hispida*, *Lagerstroemia speciosa*, and self-sown shrubs *Lantana camara* and *Morus alba*.

One plant species of conservation concern, *Eulophia graminea*, was recorded in the STEMC. Four individuals of orchids *Eulophia graminea* were recorded at the river channel embankment. This species is protected under Cap. 96A and Cap. 586, and occurs naturally in marginal habitats such as on verges, grassy slopes and waste ground (Barretto *et al.* 2011; AFCD 2017a). Floristic survey results for the major habitats identified in the STEMC are provided in **Table 9** in **Appendix B**.

The channel section of the STEMC supported migratory bird species in autumn and winter with regular records of waders including Black-winged Stilt *Himantopus himantopus*, Pied Avocet *Recurvirostra avosetta*, Wood Sandpiper *Tringa glareola* and ducks Eurasian Teal *Anas crecca*. The lower section of the STEMC, in particular the section between the Sai Kwo Road vehicle bridge and the inflatable dam near Lok Ma Chau MTR Station, serves as a foraging ground for these wetland birds. Five ardeid species were recorded utilizing the river channel habitat during the dry season, with most records dominated by Grey Heron *Ardea cinerea*. Constructed wetland provided habitat for at least three ardeid species in the wet season.

One locally uncommon mammal species, Small Asian Mongoose *Herpestes javanicus*, was recorded during the field survey. A single record was made at the river channel embankment of the of the STEMC.

Two reptile species were recorded utilizing the STEMC. Both are common and widespread within the territory.

Six odonate species were recorded utilizing river channel habitat and eleven species were recorded at the constructed wetland habitat. All odonate species recorded in the surveys are regarded as common and widespread in Hong Kong, with no species of conservation concern recorded.

Results from the updated baseline survey recognized an overall low butterfly abundance and diversity in habitats within the STEMC. With all species regarded as abundant and common locally, no species of conservation concern was recorded. Four species of freshwater fish were recorded in the river channel and one in constructed wetland, all of them originated from introduced species/population.

Bird species recorded in the dry and wet season during the field survey period are provided in **Table 10** and **Table 11** in **Appendix B** respectively, while summary for mammal, reptile, butterfly, dragonfly and freshwater fish species recorded in the survey period are provided in **Tables 12** to **16** in **Appendix B**.

6.2.3 Summary of species of conservation concern

With the information gathered from literature, monitoring and field survey, a total of 48 species of conservation concern were identified in the STEMC and the constructed wetland. The record locations together with their status are presented in **Table 6.1**.

Table 6.1: Evaluation of Species of Conservation Concern

Species	Location ¹	Principal Status ²	Conservation Status ³	Protection Status ⁴	Distribution ⁵	Commonness in HK ⁵	Reference ⁶
Avifauna							
Eurasian Wigeon <i>Anas penelope</i>	RC	W	RC	-	Deep Bay wetland area	Abundant	1, 3
Northern Pintail <i>Anas acuta</i>	RC	W	RC	-	Deep Bay wetland area	Abundant	1
Eurasian Teal <i>Anas crecca</i>	RC	W	RC	-	Primarily in Deep Bay wetland area	Abundant	1
Little Grebe <i>Tachybaptus ruficollis</i>	CW	R, W	LC	-	Primarily in Deep Bay area	Common	2,3
Black-faced Spoonbill <i>Platalea minor</i>	RC	W	PGC; RLCV(EN); IUCN(EN)	CSMPS(II)	Deep Bay wetland area	Common	1
Yellow Bittern <i>Ixobrychus sinensis</i>	CW	M, Su, W	(LC)	-	Deep Bay area, Chek Keng, Tai Long Wan	Uncommon	2,3
Cinnamon Bittern <i>Ixobrychus cinnamomeus</i>	RC, CW	M, Su, W	LC	-	Deep Bay area, Long Valley, Tai Yuen (Sheung Shui), Pui O	Uncommon	2,3
Black-crowned Night Heron <i>Nycticorax nycticorax</i>	RC, CW	P	(LC)	-	Mainly in Deep Bay wetlands, Starling Inlet and Tolo Harbour	Common	1,2,3
Chinese Pond Heron <i>Ardeola bacchus</i>	RC, CW	P	PRC (RC)	-	Widely distributed in Hong Kong	Common	1,2,3
Grey Heron <i>Ardea cinerea</i>	RC, CW	W	PRC	-	Deep Bay Area, Starling Inlet, Kowloon	Common	1,2,3

Species	Location ¹	Principal Status ²	Conservation Status ³	Protection Status ⁴	Distribution ⁵	Commonness in HK ⁵	Reference ⁶
					Park, Cape D' Aguilar		
Great Egret <i>Ardea alba</i>	RC, CW	P	PRC (RC)	-	Widely distributed in Hong Kong	Common	1,2,3
Intermediate Egret <i>Ardea intermedia</i>	RC	R, W	RC	-	Deep Bay Area, Starling Inlet, Kowloon Park, Cape D' Aguilar	Uncommon	3
Little Egret <i>Egretta garzetta</i>	RC, CW	P	PRC (RC)	-	Widely distributed in coastal area throughout Hong Kong	Common	1,2,3
Eastern Cattle Egret <i>Bubulcus coromandus</i>	RC, CW	R, M, W	LC	-	Widely distributed in Hong Kong	Common	3
Great Cormorant <i>Phalacrocorax carbo</i>	RC	W	PRC	-	Widely distributed in coastal area throughout Hong Kong	Common	2
Black Kite <i>Milvus migrans</i>	CW	W, R	(RC)	CITES (II); Cap.586	Widely distributed in Hong Kong	Common	2,3
Eastern Buzzard <i>Buteo japonicus</i>	RC	W	-	CITES(II); Cap. 586	Widely distributed in Hong Kong	Common	1,2,3
Greater Spotted Eagle <i>Clanga clanga</i>	CW	W	GC CRDB(R) RLCV(EN) IUCN(VU)	CITES(II); Cap. 586	Scarce winter visitor in Deep Bay	Scarce	2
Greater Painted-snipe <i>Rostratula benghalensis</i>	RC	R, M	LC	-	Ha Tsuen, Lok Ma Chau, Kam Tin, Long Valley, Hong Kong Wetland Park	Common	3
Black-winged Stilt <i>Himantopus himantopus</i>	RC	W	RC	-	Deep Bay area, Long Valley, Kam Tin	Common	1,2,3
Pied Avocet <i>Recurvirostra avosetta</i>	RC	W	RC	-	Deep Bay area	Abundant	1,3
Grey-headed Lapwing <i>Vanellus cinereus</i>	RC	W	LC	-	Grassy or wetland areas, particularly at Kam Tin	Common	1,3
Spotted Redshank <i>Tringa erythropus</i>	RC	W/M	RC	-	Deep Bay Area	Abundant	1,3
Marsh Sandpiper	RC, CW	M,W	RC	-	Deep Bay Area	Abundant	1,3

Species	Location ¹	Principal Status ²	Conservation Status ³	Protection Status ⁴	Distribution ⁵	Commonness in HK ⁵	Reference ⁶
<i>Tringa stagnatilis</i>	RC	M,W	RC	-	Deep Bay Area	Abundant	1,3
Common Greenshank <i>Tringa nebularia</i>	RC	M,W	LC	-	Widely distributed in wetland area throughout Hong Kong	Common	1,2,3
Wood Sandpiper <i>Tringa glareola</i>	RC	M,W	LC	-	Freshwater wetland areas throughout Hong Kong	Common	1,3
Temminck's Stint <i>Calidris temminckii</i>	RC	M, Sp, W	LC	-	Deep Bay area	Uncommon	3
Long-toed Stint <i>Calidris subminuta</i>	CW	R	CRDB(V)	-	Widely distributed in Hong Kong	Common	1,2,3
Greater Coucal <i>Centropus sinensis</i>	RC, CW	R	(LC)	-	Widely distributed in coastal area throughout Hong Kong	Common	2,3
White-throated Kingfisher <i>Halcyon smyrnensis</i>	CW	R	(LC)	-	Lakes and ponds throughout Hong Kong	Uncommon	2
Pied Kingfisher <i>Ceryle rudis</i>	CW	M	LC	-	Widely distributed in coastal area throughout Hong Kong	Abundant	2
Black-naped Oriole <i>Oriolus chinensis</i>	CW	W	LC	-	Tai Po Kau, Lam Tsuen, Shek Kong, Wu Kau Tang, Shing Mun, Kowloon Hills, Pok Fu Lam, Ngong Ping	Rare	2
Brown-headed Thrush <i>Turdus chrysolaus</i>	RC, CW	M, W	LC	-	Widely distributed in dry agricultural areas throughout Hong Kong.	Common	3
Red-throated Pipit <i>Anthus cervinus</i>	CW	R	RLCV(NT), LC	CITES(II); Cap. 586	Widely distributed in hillside shrubland throughout Hong Kong	Common	3
Chinese Hwamei <i>Garrulax canorus</i>	CW	W	GC	-	Widely distributed in Hong Kong	Abundant	2,3
Red-billed Starling <i>Spodiopsar</i>							

Species	Location ¹	Principal Status ²	Conservation Status ³	Protection Status ⁴	Distribution ⁵	Commonness in HK ⁵	Reference ⁶
sericeus							
White-cheeked Starling <i>Spodiopsar cineraceus</i>	CW	W	PRC	-	Deep Bay area, Kam Tin, Long Valley	Common	2
White-shouldered Starling <i>Sturnia sinensis</i>	RC, CW	M,W,Su	(LC)	-	Kam Tin, Deep Bay area, Po Toi Island, Long Valley, Victoria Park, Ho Chung, Ma Tso Lung, Mui Wo, Lam Tsuen Valley	Common	2,3
Collared Crow <i>Corvus torquatus</i>	CW	R	LC IUCN(NT)	-	Inner Deep Bay area, Nam Chung, Kei Ling Ha, Tai Mei Tuk, Pok Fu Lam, Chek lap Kok, Shuen Wan, Lam Tsuen	Uncommon	2
Chinese Grosbeak <i>Eophona migratoria</i>	CW	W	LC	-	Kam Tin, Nam Chung, Shek Kong, Deep Bay area, Ho Chung, Lam Tsuen, Hok Tau, Island House, Kowloon Park	Uncommon	2
Dragonfly							
Scarlet Basker <i>Urothemis signata signata</i>	CW	-	LC	-	Abandoned fish ponds throughout Hong Kong	Common	2
Ruby Darter <i>Rhodothemis rufa</i>	CW	-	LC	-	Ponds and marshes throughout Hong Kong	Common	2
Blue Sprite <i>Pseudagrion microcephalum</i>	CW	-	LC	-	Kai Kuk Shue Ha, Kau Sai Chau, Lai Chi Wo, Mai Po, Mui Wo, River Jhelum and Tung Ping Chau	Common	2
Herpetofauna							
Spotted Narrow-mouthed Frog <i>Kalophrynus interlineatus</i>	CW	-	RLCV(NT)	-	Widely distributed from low to moderate	Widely distributed	2

Species	Location ¹	Principal Status ²	Conservation Status ³	Protection Status ⁴	Distribution ⁵	Commonness in HK ⁵	Reference ⁶
					altitudes in northern and central New Territories		
Taiwan Kukri Snake <i>Oligodon formosanus</i>	CW	-	RLCV(NT)	-	Widely distributed throughout Hong Kong	Widely distributed	2
Chinese Cobra <i>Naja atra</i>	CW	-	PRC RLCV(VU) CRDB(V)	Cap. 586	-	Common	2
Mammals							
Small Asian Mongoose <i>Herpestes javanicus</i>	RC	-	RLCV(VU)	CITES(III); Cap. 170; Cap. 586	Fairly widely distributed in countryside areas in the New Territories	Uncommon	1
Flora							
<i>Eulophia graminea</i>	RC	-	-	Cap. 96A; Cap. 586	Ho Chung, Sha Tin, Lam Tsuen, Pillar Point	Infrequent widespread	1

Note:

1. Location refers to RC = River Channel within the STEMC (as mentioned to be constructed watercourse in previous EIA studies); Constructed wetland = CW (referred to be mitigation wetland in previous EIA studies and updated baseline monitoring report).
2. Principal status refers to Carey *et al.* (2001): R = Resident; W = Winter Visitor; Su = Summer Visitor; M = Migrant; A = Autumn; Sp = Spring; P = Present all year, exact composition unknown.
3. Conservation status refers to Zhao (1998), Zheng & Wang (1998), Fellowes *et al.* (2002), Jiang *et al.* (2016), IUCN (2017) and Corlett *et al.* (2000).
Zhao (1998) and Zheng & Wang (1998): CRDB(V) = Vulnerable; (R) = Rare.
Fellowes *et al.* (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence;
Jiang *et al.* (2016): RLCV(NT) = Near Threatened; (EN) = Endangered;
IUCN (2017): IUCN(NT) = Near Threatened; (VU) = Vulnerable;
Conservation status of plants refers to Corlett *et al.* (2000).
4. Protection status refers to CITES (2017), CSIS (2017), Cap. 96A, Cap. 170 and Cap. 586.
CITES (2017): II = Listed in CITES Appendix II; III = Listed in CITES Appendix III;
CSIS (2017): CSMPS(II) = Class II Protected Species in China;
All wild birds in Hong Kong are protected under Cap. 170;
Cap. 96A = Forestry Regulations. Forest and Countryside Ordinance;
Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.
5. Distribution and commonness refer to AFCD (2010); AFCD (2017a & 2017b), Barretto *et al.* (2011) and HKBWS (2017). If the commonness of the species changed after the data reported, the latest commonness prevails.
6. Reference refers to 1 = baseline survey results conducted by this study; 2 = results of monthly monitoring surveys (AFCD 2014-2017); 3 = baseline survey results as compiled in Development of Lok Ma Chau Loop – investigation EIA report (Arup 2013).

Majority of the species of conservation concern are wetland birds which highlight the importance of the STEMC and constructed wetland to this fauna group. While the following section addresses the ecological impact to all fauna species, the focus of it is on the bird fauna as it appears as the key fauna group using the STEMC and constructed wetland.

6.2.4 Habitat Evaluation

With the baseline ecological resources identified above, habitats identified within the STEMC and the constructed wetland were evaluated in accordance with the guidelines stipulated in Table (2) in Annex 8 of the EIAO-TM. Overall ecological values for each habitat type were ranked with a ranking system starting with highest ecological value range from:

- High
- Moderate-high
- Moderate
- Moderate-low
- Low
- Very Low

Evaluation of the habitats in the STEMC and the constructed wetland are presented in **Table 6.2** to **Table 6.4** below. Representative photos of the habitats are provided in **Table 17** in **Appendix B**.

Table 6.2: Evaluation of River Channel in STEMC

Criterion	River Channel
Naturalness	Low; highly modified man-made habitat with regular maintenance, limited natural features
Size	The channel is approx. 2.2km long (excluding the section southeast to Castle Peak Road)
Diversity	Low plant species diversity and structural complexity. Moderate fauna diversity, particularly for bird species
Rarity	Common habitat in Hong Kong; at least 27 bird species and a mammal species of conservation concern; an orchid species of conservation concern
Re-creatability	Relatively easy to re-create
Fragmentation	Not fragmented; linked with Shenzhen River at downstream
Ecological linkage	Lower section of the STEMC located immediately downstream of the inflatable dam; ecologically connected with other wetland fauna community in WCA
Potential value	River channel is confined by concrete structure. Improvement measures can be implemented in the river channel but its potential is limited
Nursery/ Breeding Ground	Not a significant nursery or breeding area
Age	Since its establishment in 2006
Abundance/richness of wildlife	The channel supported a moderate diversity of birds in wintering season
Ecological value	Moderate

Table 6.3: Evaluation of Constructed wetland

Criterion	Constructed wetland
Naturalness	Man-made habitat recreated for ecological enhancement
Size	Overall size of the habitat is approximately 3.43ha
Diversity	Moderate fauna species diversity
Rarity	Increasingly common habitat in Hong Kong; 31 fauna species of conservation concern recorded in this habitat, including an amphibian species and two reptile species;
Re-creatability	Relatively easy to recreate via suitable hydrological and vegetation management
Fragmentation	Not fragmented but the habitat is confined
Ecological linkage	Functionally linked with other wetland habitats in WCA
Potential value	Potential is limited as the habitat is enclosed by artificial structure
Nursery/ Breeding Ground	Yes; potentially breeding site for wetland fauna, especially herpetofauna and invertebrates
Age	Since its establishment in 2006
Abundance/richness of wildlife	Moderate-low abundance/ richness of wetland dependent fauna

Criterion	Constructed wetland
Ecological value	Moderate

Table 6.4: Evaluation of Developed Area

Criterion	Developed Area
Naturalness	Man-made habitat with interspersing vegetation, including fruit trees, ornamental shrubs and trees
Size	River bank/maintenance access along the approx. 2.2km channel section (excluding the section southeast to Castle Peak Road)
Diversity	Low fauna and flora diversity
Rarity	No species of conservation concern recorded
Re-creatability	Readily re-creatable
Fragmentation	The habitat is not fragmented, mostly interconnected with roads and bridges, the Lok Ma Chau Spur Line Station and the access roads near the Closed Border Area are surrounded by fish ponds
Ecological linkage	Not functionally linked with habitats with high ecological importance.
Potential value	Low
Nursery/ Breeding Ground	None
Age	Since its establishment in 2006
Abundance/richness of wildlife	Low abundance / richness of fauna
Ecological value	Low

6.2.5 Evaluation of Potential Impact

This section identifies and evaluates the potential ecological impacts on habitats and species, caused by the proposed improvement works during construction and operation phases. The potential impacts described below have been assessed and evaluated in accordance with the criteria stipulated in the EIAO-TM.

With reference to the minor improvement works proposed in **Section 2.2**, the following minor impact is identified and evaluated.

- Direct impact on habitat for wildlife
- Disturbance to wildlife in construction phase
- Barrier to wildlife movement in operation phase

Direct impact on habitat for wildlife and flora

The area potentially affected by the proposed works include constructed wetland area, artificial structure in drainage channel. The approximately 2080m floodwall on the western side of the STEMC would affect solely artificial structure, while on the eastern side the works involve approximately 675m floodwall and 1365m embankment structure. The whole embankment section falls into the constructed wetland, with two small floodwall sections on the northern and southern end of the constructed wetland. There is another floodwall section of about 510m at developed area southeast to Castle Peak Road.

The footprint for the floodwall in the western side is estimated at 0.41ha. In the eastern side, the floodwall and embankment in the wetland area is 0.03ha and 0.85ha respectively, while there is another 0.1ha floodwall outside the wetland area. Within the constructed wetland, the extent of floodwall section is minimized as far as possible to avoid potential impact.

Construction activities would cause temporary loss of habitat for wildlife use but the habitat will be reinstated after completion of works. For the works for installation of floodwall at western bank, the effect of temporary loss of habitat is minor because of the concrete base of the works area, which are heavily disturbed by road traffic. Loss of the concrete river bank during construction period will have insignificant impact on loss of habitat. The protected orchid is found on the grassy slope in the inner side of the channel which would not be affected by the proposed works.

The enhancement of embankment on the eastern side of the channel will be taken place within the constructed wetland. Currently there is a small embankment along the central section of the wetland. The improvement works of embankment will largely follow existing embankment footprint without need of substantial encroachment onto the wet area on eastern side.

The impact to the wet area in the constructed wetland habitat is relatively minor as the scale of works involved is not substantial and the habitat affected is mainly the existing embankment area which is not particularly ecologically sensitive.

Thus the loss of nature habitat (embankment/terrestrial margin) will happen only temporarily during the construction phase, which will not happen in birds' peak wintering season, as specified in **Section 6.2.6**. After completion of the works, the enhanced embankment will be vegetated which serve both ecological and landscape functions, thus it could be used by wildlife and no significant loss of habitat will be resulted in the operation phase. Although the works will inevitably involve tree removal, in the detailed design stage, the embankment footprint will be adjusted locally to minimize the number of affected tree. After all, the 3.43ha constructed wetland recommended in the EIA report will not be compromised after completion of the proposed works. The impact to the habitat for wildlife is evaluated in **Table 6.5**.

Table 6.5: Evaluation of Direct Impact on Habitat for Wildlife

Criteria	Direct impact on habitat
Habitat Quality	Man-made habitat, concrete area at the western side of STEMC, mainly wetland embankment area in the eastern side of STEMC
Species	Species associated with concrete area and embankment area in the constructed wetland
Size/Abundance	Abundance of wildlife affected is low for the concrete area, and moderate for the constructed wetland area
Duration	Only in construction phase
Reversibility	Reversible
Magnitude	Minor owing to the relatively minor scale of works
Overall Impact Severity	Minor as loss of embankment in the constructed wetland is temporary (not in bird's peak wintering season) and will be reinstated; loss of artificial habitat is not significant for wildlife

Indirect impact due to disturbance to wildlife in construction phase

Noise, dust and runoff associated with the construction activities would cause nuisance to the wildlife using the adjacent natural habitat as well as constructed wetland habitat. The works at the western side of STEMC is minor as it involves merely enhancement of existing railing, thus the works area will largely confine to the artificial area at existing channel side access road which would not affect the fish pond and the associated wildlife. Furthermore, the works will not be conducted in birds' peak wintering season, so the impact to the wintering bird is very limited.

The works at eastern side of the STEMC is in close proximity to the constructed wetland, the noise, dust and runoff associated with the works for embankment and the floodwall would cause disturbance to the wildlife associated with the wetland habitat, particularly bird species which are more sensitive to disturbance. Even though the environmental impact of noise, air and water will

be suitably controlled to acceptable level by adopting good site practice, the construction activity will inevitably affect the wildlife nearby in the constructed wetland. With reference to the ecological survey, the wetland bird abundance in the wetland is highly seasonal, which is due to the fact that the wetland birds are predominantly migratory species.

While works in proximity to the wetland is unavoidable, the ecological impact can be minimized by timing the construction activities in non-wintering season for avoiding disturbance to wetland birds. Details of the mitigation measures are given in the following **Section 6.2.6**.

Thus, if the works can be carried out only in non-wintering season, the potential impact to the wetland birds in other wetland habitats in WCA, including the river channel in STEMC, could be minimized. The indirect disturbance impact is evaluated in **Table 6.6**.

Table 6.6: Evaluation of Indirect Disturbance Impact

Criteria	Indirect disturbance impact
Habitat Quality	Man-made habitat, concrete area at the western side of STEMC, wetland habitat in the river channel and to the eastern side of STEMC
Species	Various fauna, especially wetland bird species associated with the river channel and the wetland
Size/Abundance	Abundance of wildlife affected is low for the concrete area, and moderate for the constructed wetland area and the river channel
Duration	Construction phase
Reversibility	Reversible after completion of construction
Magnitude	Moderate to minor subject to the timing of the works being conducted
Overall Impact Severity	Moderate if without mitigation measures; minor if avoidance measures adopted

Barrier effect to wildlife movement in operation phase

During the operation phase, there is a concern that the floodwall and embankment structure may block the wildlife moving across it. In the western side of STEMC, the potential wildlife usage of the floodwall area is relatively low owing to the artificial nature of the site. Movement of wildlife across the floodwall is relatively infrequent and usually involves common species adopting artificial habitat. In the eastern side of the STEMC, the embankment is located between the river channel and the constructed wetland, movement of wildlife across the embankment is expected to be more frequent.

Even the wildlife’s movement is rather infrequent in the western side, the new floodwall could block the movement of wildlife, e.g. Eurasian Otter. Thus, ecological features for enabling wildlife moving across is proposed to be incorporated in the floodwall design to prevent the barrier effect. Details of the measures are presented in following **Section 6.2.6**, which could minimize the impact.

In the eastern side of the STEMC, the embankment will be covered with soil and vegetated naturally. Furthermore, the edge of the embankment is gentle sloped which facilitate wildlife, especially reptile, amphibian and non-flying mammals species, climbing over it. After establishment of the vegetation, the setting would be similar to the current one, therefore it would not affect wildlife moving across it. The barrier effect is evaluated in **Table 6.7**.

Table 6.7: Evaluation of Barrier Effect

Criteria	Barrier effect
Habitat Quality	Man-made habitat, concrete area at the western side of STEMC, wetland habitat in the river channel and to the eastern side of STEMC

Criteria	Barrier effect
Species	Mainly mammal and herpetofauna species
Size/Abundance	Abundance of wildlife affected is low for the concrete area, and moderate for the constructed wetland area and the river channel
Duration	Operation Phase
Reversibility	Reversible
Magnitude	Generally minor for the floodwall section which is in an insensitive location; minor for embankment section
Overall Impact Severity	If without mitigation measures, the severity of barrier is minor as the eastern side is an embankment that the fauna species can climb over, whilst on the western side it is mainly a developed access road with limited wildlife walk across. Ecological features to be incorporated in the floodwall design will keep the impact minor.

Implication to the Ecological Habitat Management Plan

An EHMP has been submitted as EP requirement to set out the requirement for the constructed wetland such as habitat type, design, selection of planting species and target species. Four types of habitat were set out in the EHMP comprising pond/open water, permanent marsh, seasonal marsh, and terrestrial margins; and an array of target species was set including following:

- Snipes (Common Snipe, Pintail Snipe, Swinhoe’s Snipe and Greater Painted Snipe)
- Ardeids (Little Egret, Cattle Egret, Great Egret, Grey Heron, Black-crowned Night Heron and Chinese Pond Heron)
- Red-billed Starling
- Chironomids
- *Orthetrum luzonicum*
- Spotted Narrow-mouthed Frog

The constructed wetland was subsequently constructed according to the EHMP and a regular ecological monitoring was undertaken. The monitoring result indicates most of the target species have been achieved and the planned habitats have been largely in place.

A section of the proposed works, i.e. embankment works at the eastern side of STEMC, will partially take place in the constructed wetland for the existing embankment. According to the EHMP, the embankment is in the habitat type of “terrestrial margins”. After completion of the works, the enhanced embankment will still be part of the terrestrial margins, thus it would not result in any loss of habitat in the constructed wetland. As addressed in the above section, the work will not affect the pond in the constructed wetland and the re-provided terrestrial margins will still have ecological function, thus its impact to the ecological function of the constructed wetland will be very limited.

Furthermore, as the habitat composition of the constructed wetland will remain the same, it would not affect its attractiveness to the target species. Thus it would not induce significant change to the monitoring, management and maintenance of the constructed wetland.

6.2.6 Mitigation Measures for Potential Impact

Despite of the minor scale of works, potential ecological impact in both construction and operation phases were identified which need to be mitigated. As such, proposed mitigation measures are incorporated in the project design, as presented below, in order to mitigate the impact to acceptable level.

Avoidance

With a view of avoiding blockage to wildlife movement in the STEMC, soil-topped embankment instead of physical hard structure floodwall was considered in higher priority for the section in the constructed wetland area. The proposed embankment is thus in similar setting to the existing one. The sloped embankment will be topped with soil which will be suitable for establishment of vegetation and free movement of fauna species. Such design could avoid the barrier effect due to floodwall structure. Furthermore, the width of the embankment would be adjusted locally to avoid tree felling in the constructed wetland as far as possible.

In the construction phase, it is identified that disturbance impact is apparent if the construction activities are conducted in dry season coincident with birds' wintering season. Thus, it is suggested timing the construction works to avoid birds' peak wintering season (November to March) for avoiding disturbance impact to the wintering birds.

Furthermore, it is proposed that the works shall avoid affect the pond habitat inside the constructed wetland permanently and temporarily; thus, the impact to wetland habitat and the associated fauna can be avoided.

6.2.7 Enhancement/ Precautionary Measures

In the existing constructed wetland, a water channel runs along the wetland. Some sections of the water channel are concrete based, which is considered as non-natural material. Taking opportunity of this drainage improvement works, it will also explore enhancing the naturalness of the wetland. Where it is feasible, it will remove some minor section of the concrete structure and re-instate a natural material based water channel. A natural based water channel would enhance ecological connectivity which would be beneficial to the wetland ecosystem.

Other than the given mitigation measures, the embankment will be designed to maintain the integrity and water supply to the constructed wetland with following considerations:

- The water channel and water pipe, if necessary, will be realigned to suit the design of the embankment during the detailed design stage. The water channel between the storage pond to pond 2a would be maintained by adjusting the embankment design. An example of local adjustment of embankment design at the narrowest section of the constructed wetland and the indicative locations of ponds and storage ponds are shown in **Diagrams 2 and 3 in Appendix B** respectively.
- To maintain water supply to the constructed wetland, the u-channel in the constructed wetland will be designed to divert runoff into the constructed wetland in normal situation. Direct discharge to the main channel will only happen in high flow situation such as heavy rain.

For the floodwall structure, small ecological features functioning as animal corridor, such as holes and pathway, will be incorporated in the design. Indicative diagram on ecological features examples is provided in **Diagram 1 in Appendix B**. With reference to the ecological data gathered, the STEMC is used by small sized mammal, reptile and amphibian species. Holes or pathway embedded in the enhanced floodwall design could facilitate fauna moving across it.

Other than holes or pathway in the floodwall, it will further explore enhancing the floodwall with more ecological features such as climbing plant and refugia box attached on the floodwall to facilitate wildlife use.

Although a concerned flora species is identified near the Project Site, it is unlikely to be affected by the proposed works. Nevertheless, as a precautionary measure, it is recommended to carry out a pre-construction survey before commencement of construction work to confirm the flora

species would not be affected by the construction activities. In the event that the concerned species is found within the works area, suitable protective measures, e.g. fencing, shall be provided and monitored during the construction period.

6.2.8 EM&A Requirement

Ecological monitoring is considered not necessary during the construction phase. During the operation phase, the long-term ecological monitoring for the constructed wetland conducted by AFCD for providing data for demonstrating the effectiveness of the wetland shall be maintained.

6.3 Conclusion

The ecological impact associated with the proposed improvement works have been reviewed. The improvement works are located on existing STEMC, with mainly floodwall and embankment design along the river bank. Owing to the relatively small scale of works, the potential ecological impact during construction is relatively minor. The enhanced floodwall might have some minor impact on preventing wildlife moving across it but it will be mitigated with ecological features, e.g. wildlife corridor, embedded in the floodwall.

Although the works for the embankment will take place inside the constructed wetland, the ecological impact is relatively minor as the scale of the work is small, footprint is limited and the embankment is gently sloped on both side facilitating wildlife use. With the mitigation measures proposed including timing the construction work to avoid bird's peak wintering season (i.e. November to March), the potential ecological impact is expected to be minor.

6.4 Reference

AFCD (2010). Hong Kong Biodiversity. Agriculture, Fisheries and Conservation Department Newsletter. Issue No. 19. September 2010.

AFCD (2014-2017). San Tin Eastern Main Drainage Channel Constructed Wetland Monthly Monitoring Report. June 2014 – May 2017.

AFCD (2017a). Hong Kong Plant Database. <http://www.herbarium.gov.hk/Search_Form.aspx> Retrieved in August 2017.

AFCD (2017b). Hong Kong Biodiversity Database. <<https://www.afcd.gov.hk/English/conservation/hkbiodiversity/database/search.asp?lang=en>> Retrieved in August 2017.

Arup (2013) Planning and Engineering Study on Development of Lok Ma Chau Loop – Investigation. EIA Study.

Barretto, G. D. A., Cribb, P. J., & Gale, S. (2011). The wild orchids of Hong Kong. Natural History Publications (Borneo) Sdn. Bhd. and Kadoorie Farm and Botanic Garden.

Carey, G. (2001). The Avifauna of Hong Kong. Hong Kong Bird Watching Society.

China Species Information System (CSIS) (2017). China State Major Protection Status. <<http://cnbiodiv.net/>>. Retrieved in August 2017.

CITES (2017). Checklist of CITES species. <<http://checklist.cites.org/#/en>>. Retrieved in August 2017.

Corlett, R. T., Xing, F., Ng, S. C., Chau, L. K. C., & Wong, L. M. Y. (2000). Hong Kong vascular plants: distribution and status. *Memoirs of the Hong Kong Natural History Society* 23: 157.

ERM (1999). Main Drainage Channels and Poldered Village Protection Scheme for San Tin, NWNT EIA Study.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. and Yu, Y.T. (2002). Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

Hong Kong Bird Watching Society (2017). Hong Kong Bird Report 2015.

IUCN (2017). IUCN Red List of Threatened Species. Version 2017.1. <www.iucnredlist.org>. Retrieved in August 2017.

Jiang, Z. G., Jiang, J. P., Wang, Y. Z., Zhang, E., Zhang, Y. Y., Li, L. L., Xie, F., Cai, B., Cao, L., Zheng G.M., Dong, L., Zhang Z.W., Ding, P., Luo Z.H., Ding, C.Q., Luo Z.H., Ding, C.Q., Ma, Z.J., Tang, S.H., Cao, W.X., Li, C.W., Hu, H.J., Ma, Y., Wu, Y., Wang, Y.X., Zhou, K.Y., Liu, S.Y., Chen, Y.Y., Li, J.T., Feng, Z.J., Wang, Y., Wang, B., Li, C., Song, X.L., Cai, L., Zang, C.X., Zeng, Y., Meng, Z.B., Fang, H.X. and Ping, W.G. (2016). Red list of China's vertebrates. *Biodiversity Science* 24: 500-551.

Maunsell Consultants Asia Limited (2001). Agreement No. CE 49/2000. Design of Ecological Mitigation Measures and Landscape Works and Assessment of Land Contamination for Eastern Main Drainage Channel for San Tin. Ecological Habitat Management Plan (Final).

Zhao, E. (1998). China Red Data Book of Endangered Animals: Amphibia and Reptilia. National Environmental Protection Agency Endangered Species Scientific Commission, People's Republic of China. Beijing: Science Press.

Zheng, G.M. and Wang, Q.S. (1998). China Red Data Book of Endangered Animals: Aves. National Environmental Protection Agency Endangered Species Scientific Commission, People's Republic of China. Beijing: Science Press.

7 Fisheries Impact

This section presents an assessment of the potential fisheries impact associated with the improvement works.

7.1 Relevant Legislation, Standards and Guidelines

The following legislation and guidelines are applicable to the fisheries impact assessment in Hong Kong:

- Environmental Impact Assessment Ordinance (Cap. 499) – Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), Annexes 9 and 17;
- Fisheries Protection Ordinance (Cap. 171).

7.2 Description of the Existing Environment

In Hong Kong, fisheries are comprised of capture fisheries, mariculture and pond fish culture. As only fish ponds but no mariculture are found within the 500m Study Area, this section only covers and assesses the potential impacts which the construction and operation of the Project may bring to the pond fish culture.

Most of the pond fish culture resources and activities in Hong Kong are located in the northwest New Territories, with freshwater and brackish fish ponds. Pond fish species are reared for commercial purpose. According to the latest available information from Agriculture, Fisheries and Conservation Department (AFCD) on aquaculture in Hong Kong in 2017, the local inland ponds covered an area of around 1,132 ha and produced 2,543 tonnes of freshwater fish. About 96% of the farms are engaged in polyculture (bighead carp, grass carp, common carp and silver carp in combination with tilapia or grey mullet). The remaining 4% practise monoculture of carnivorous species such as giant groupers, seabreams and spotted scat in brackish fish ponds near to the coastline.

Based on the available information, there are active, inactive and abandoned fish ponds within the Study Area. The active fish ponds mainly locate to the west of Portion D of the proposed works, whilst the fish ponds to the east of Portion A and B are mostly inactive. The areas of the active, inactive and abandoned fish ponds are 45.3ha, 14.9ha and 2.9ha respectively. The locations of the fish ponds are presented in **Figure 7.1**.

7.3 Identification and Evaluation of Impacts

7.3.1 Construction Phase

No direct impact (such as permanent resumption or temporary occupation of pond) will result from the Project during the construction phase as the ponds are located outside the Project Area boundary.

Access to fish ponds is unlikely to be blocked during the construction phase. Hence, there is no significant impact to the fish ponds regarding blockage of access.

Since some of the ponds are located in close proximity to the Project Area, indirect impacts including construction site runoff and sewage from construction workforce may occur on the ponds. However, with proper implementation of good site practices and appropriate mitigation

measures to minimise impact on water quality (see **Section 5**), no significant indirect impacts arising from the Project on the ponds are anticipated.

7.3.2 Operation Phase

No impact on the ponds is expected during the operation phase.

7.4 Mitigation Measures

The proposed construction and operation of the Project are not predicted to have any direct impact on pond fish culture in the Study Area. With water quality control measures in place (see **Section 5**), the Project is unlikely to have any indirect impact on pond fish culture resources and activities in the Study Area. Therefore, no fisheries-specific mitigation measure is required.

7.5 Environmental Monitoring and Audit

The proposed construction and operation of the Project are not predicted to have any direct impact on pond fish culture in the Study Area. With water quality control measures in place (see **Section 5**), the Project is unlikely to have any significant indirect impact on pond fish culture resources and activities in the Study Area. Therefore, no monitoring for fisheries is considered necessary. Nevertheless, regular site audits for checking the proper implementation of the water quality control measures are recommended.

7.6 Conclusion

Active, inactive and abandoned fish ponds were identified within the 500m Study Area of the Project Area. No direct impact on the pond fish culture resources is anticipated during the construction or operation of the Project. Indirect impacts arising from construction activities would be properly mitigated through standard water quality control measures and thus no significant indirect impact is anticipated. Overall, no unacceptable fisheries impact is anticipated and no fisheries-specific mitigation is required.

7.7 Reference

AFCD. (2018). Marine fish culture, pond fish culture and oyster culture. Retrieved April 30, 2018, from http://www.afcd.gov.hk/english/fisheries/fish_aqu/fish_aqu_mpo/fish_aqu_mpo.html.

8 Landscape and Visual Impact

8.1 Review of Previous EIA Findings

It was evaluated in the previous EIA study that the landscape elements that may be impacted are landscape character, vegetation and fish ponds. The visual impact receivers are residents in the residential buildings, people on public road and footpaths, and people who view the development from their place of work.

Regarding landscape baseline conditions, four landscape character zones were identified comprising the followings:

- Fish pond landscape which has a rural peaceful character;
- Container storage yards, vehicle repair businesses and other commercial ventures;
- Highways and cross border roads; and
- Village areas of San Tin

The landscape impact due to the works for STEMC was evaluated as greater for fish pond but minimal to other zones.

The impact to vegetation due to loss of trees/ tree groups were evaluated as moderate due to the visual prominence of these trees in the landscape, while the impact of loss of grass/ herb layer was considered to be slight in landscape terms.

The impact to the landscape rectangular pond pattern comprising individual fish ponds were replaced by linear water body within the channel and therefore the impact in landscape terms was evaluated as slight.

The visual impact was evaluated as severe to moderate for a few visual sensitive receivers at the residential buildings along fish ponds, while the degree of impact of visual intrusion for other visual sensitive receivers were evaluated as slight to negligible.

8.2 Review of Potential Impacts from Proposed Improvement Works

8.2.1 Existing Landscape Baseline Conditions

Since the completion of the STEMC, there is virtually no change of the landscape character in the periphery of the STEMC. The previously identified landscape character in the periphery is still valid in addition to the new drainage channel landscape character of the STEMC.

8.2.2 Potential Impacts During the Construction Phase

The nature of the improvement works is described in **Section 2.2**, the expected construction activities involve excavation, floodwall construction and slope filling. And the works will mainly be carried out at the existing drainage channel bank without encroachment onto adjacent fish pond landscape area.

During construction phase, there is neither change in landscape character nor reduction in rural area; the potential temporary visual and landscape impact cause by the construction activities are considered as minimal. As the scale of the works is relatively small, the potential impact to the landscape character of channel and the visual impact are considered minor.

8.2.3 Potential Impacts During the Operation Phase

The potential impact to the landscape characters associated with the operation of the STEMC is evaluated as minor as the improvement works are relatively small in scale and will occur on existing channel. And there will be no change to the fish ponds.

Impact to landscape vegetation will also be minor as the trees on the constructed wetland will be retained as far as possible, while the slope of the embankment will be naturally vegetated after establishment.

8.2.4 EM&A Requirement

No landscape and visual specific monitoring is necessary but the general principle of retaining tree on-site as far as possible is beneficial to landscape and visual value.

8.3 Conclusion

The construction of the STEMC has induced a substantial change to the fish pond landscape. But after completion of the STEMC, there was little change of the landscape to the STEMC and periphery. The proposed works on existing STEMC is minor in scale which cause no change on the drainage channel character, thus the landscape and visual impact due to the proposed works is negligible.

9 Waste Management

9.1 Review of Previous EIA Findings

According to the previous EIA study, the waste management assessment identified various types of solid wastes generated from the construction and operation phases and the wastes required suitable handling and disposal to avoid pollution to the environment. The assessment revealed that the key issue would be arisen from dredging and disposal of river sediment during the construction phase. Construction of the STEMC would produce excavated materials, which could be classified as seriously contaminated sediment in accordance with EPD's guidelines. The contaminated sediment has been handled and disposed of in accordance with the recommendations in the previous EIA study during the construction phase of the STEMC. With proper implementation of the recommended measures and disposal of sediments at approved disposal sites, the associated environmental impacts from the construction of STEMC met the guidelines of the EIAO-TM.

Since the proposed improvement works was not included in the assessment scope of the previous EIA, a review of the waste management for the improvement works is presented below.

9.2 Review of Potential Impacts from Proposed Improvement Works

9.2.1 Introduction

Waste management assessment has been undertaken to assess the potential waste management issues associated with the improvement works, in terms of the amount and type of wastes to be generated during construction and operation phases.

9.2.2 Legislation, Standards, Guidelines and Criteria

The following legislation and guidelines specifies the relevant criteria and standards for the waste management assessment:

- Waste Disposal Ordinance (Cap. 354).
- Environmental Impact Assessment Ordinance (Cap. 499)
- Waste Reduction Framework Plan (WRFP)
- Works Bureau Technical Circular No. 2/93 - Public Dumps
- Works Bureau Technical Circular No. 25/99 - Incorporation of Information on Construction and Demolition Material Management in Public Works Sub-committee Papers
- Environment, Transport and Works Bureau Technical Circular (Works) No. 19/2005 – Environmental Management on Construction Sites
- The Works Bureau Technical Circular No. 12/2002 - Specifications Facilitating the Use of Recycled Aggregates
- Development Bureau, Technical Circular (Works) No. 6/2010 - Trip-ticket System for Disposal of Construction and Demolition Materials
- Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock
- ETWB TC(W) No. 34/2002 Management of Dredged/Excavated Sediment

9.2.3 Identification and Evaluation of Waste Management Implications

9.2.3.1 Construction Phase

Wastes which are likely to be generated during the construction phase of the improvement works include the following:

- Construction and Demolition (C&D) materials
- Vegetation removed from site clearance
- Chemical wastes
- General refuse

Each type of the above waste arising is described below, together with an evaluation of the potential environmental impacts associated with the waste generation, handling, storage, transport and disposal.

River sediment is unlikely to be excavated during the construction waste since the proposed works will be constructed along the river bank, but not in the river bed.

Construction and Demolition Materials

The following **Table 9.1** presents the estimated volumes of materials to be excavated and the volume required for filling activities to construct the improvement works.

Table 9.1: Estimated Quantities of Excavated Materials to be Generated from the Improvement Works

Waste type	Volume to be Excavated (m ³)	Volume Required for Filling Activities (m ³)	Balance (m ³)
Inert Construction and Demolition (C&D) Materials	9,270	12,835	-3,565 (imported fill required)
Non-inert Construction and Demolition (C&D) Materials	490	0	490 (disposed of at designated landfill)

About of 9,270m³ inert C&D materials will be generated during construction. The contractor is required to reuse this material on site as far as possible. Apart from reusing the excavated inert C&D materials for filling activities, an additional volume of about 3,565m³ of imported fill material is required.

About 490m³ non-inert C&D materials (top soil including vegetation removed from site clearance) will arise. This material will be disposed of at a designated landfill. The Project Proponent should obtain an agreement in advance with the Director of Environmental Protection (DEP) to ensure that the landfill facilities are able and capable of accepting the anticipated amount of non-inert C&D materials mentioned above.

In order to minimise the impact resulting from collection and transportation of C&D materials for off-site disposal, the excavated material arising from site formation and foundation works should be reused on-site as backfilling material and for landscaping works as far as practicable. Other mitigation requirements are listed below:

- A Waste Management Plan (WMP) should be prepared in accordance with ETWB TC(W) No.19/2005
- A recording system for the amount of wastes generated, recycled and disposed of (including the disposal sites) should be adopted for easy tracking

In order to monitor the disposal of excavated and non-inert C&D materials at public filling facilities and landfills and to control fly-tipping, a trip-ticket system should be adopted (refer to DEVB TC(W) No. 6/2010).

Vegetation Removed from Site Clearance

It is anticipated that the excavated topsoil including vegetation within the wetland could not be reused on site. They will be disposed of at a designated landfill. The number of trees affected is limited as they will be retained on site as far as possible, while the affected trees will be reinstated or transplanted.

Chemical Waste

Chemical wastes arising during the construction phase might pose environmental, health and safety hazards if they are not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations. The potential hazards include:

- Toxic effects to workers;
- Impacts on water quality from spills; and
- Fire hazards.

The maintenance and servicing of construction plant and equipment may generate chemical wastes such as cleaning fluids, solvents, lubrication oil and fuel. Maintenance of vehicles may also involve the use of a variety of chemicals, oil and lubricants including heavy duty cleaners, organic solvents, degreasers, brake fluids, battery acid and soldering fluids. It is difficult to quantify the amount of chemical waste that would arise from the construction activities since it would be dependent on the contractor's on-site maintenance requirements and the amount of plant used. However, it is anticipated that the quantity of chemical waste, such as lubricating oil and solvent produced from plant maintenance, would be small and estimated to be less than 50 liters per month. The amount of chemical waste to be generated will be quantified in the Waste Management Plan to be prepared by the contractor.

Materials classified as chemical waste will require special handling and storage arrangements before removal for appropriate treatment at the licensed Chemical Waste Treatment Facility. Wherever possible opportunities should be explored to reuse and recycle materials. Provided that the handling, storage and disposal of chemical wastes are carried out in accordance with these requirements, adverse environmental impacts are not expected.

General Refuse

The construction workforce would generate refuse comprising food scraps, waste paper, empty containers, etc. The number of work force (clerical and workers) to be employed for the Project is estimated to be less than 50. The daily general refuse arising from the construction workforce can be estimated based on a generation rate of 0.65kg per worker per day. The total refuse generated per day would be estimated to be less than 100 kg per month. Release of general refuse into the surface channel should not be permitted as introduction of these wastes is likely to have detrimental effects on water quality in the area. Such refuse should be properly managed so that intentional or accidental release to the surrounding environment does not occur. Disposal of refuse at sites other than approved waste transfer or disposal facilities should be prohibited. Effective collection of site wastes would be required to prevent waste materials from being blown around by wind, flushed or leached into the water environment, or creating an odour nuisance or pest and vermin problem. Waste storage areas should be well maintained and cleaned regularly. With the implementation of good waste management practices at the site, adverse environmental

impacts are not expected to arise from the storage, handling and transportation of wastes from construction workforce.

9.2.3.2 Operation Phase

During the operation phase of the improvement works, minimal maintenance would be required for the wetland. The environmental issues associated with such maintenance works are considered minimal and could be controlled through standard working procedures and environmental controls. No adverse waste impact is anticipated and no mitigation measure is considered necessary for the operation phase.

9.2.4 Mitigation Measures

9.2.4.1 Construction Phase

Good Site Practices

Adverse impacts related to waste management such as dust, odour, noise and wastewater discharge will not be expected to arise, provided that good site practices will be strictly followed. Recommendations for good site practices during the construction activities include:

- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site
- Training of site personnel in proper waste management and chemical handling procedures
- Provision of sufficient waste disposal points and regular collection of waste
- Appropriate measures to minimise windblown litter and dust/odour during transportation of waste by either covering trucks or by transporting wastes in enclosed containers
- Stockpiles of C&D materials should be kept covered by impervious sheets to avoid wind-blown dust.
- All dusty materials including C&D materials should be sprayed with water immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling at the stockpile areas
- Well planned delivery programme for off-site disposal such that adverse environmental impact from transporting the inert or non-inert C&D materials is not anticipated

Waste Reduction Measures

Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Sort non-inert C&D materials to recover any recyclable portions
- Segregation and storage of different types of waste in different containers or skips or stockpiles to enhance reuse or recycling of materials and their proper disposal
- Encourage collection of recyclable waste such as waste paper and aluminium cans by providing separate labelled bins to enable such waste to be segregated from other general refuse generated by the work force
- Proper site practices to minimise the potential for damage or contamination of inert C&D materials
- Plan the use of construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste

In addition to the above measures, specific mitigation measures are recommended below for the identified waste arising to minimise environmental impacts during handling, transportation and disposal of these wastes.

Inert and Non-inert C&D materials

In order to minimise impacts resulting from collection and transportation of inert C&D materials for off-site disposal, the inert C&D materials should be reused on-site as fill material as far as practicable. In addition, inert C&D materials generated from excavation works could be reused as fill materials in local projects that require public fill for reclamation.

The surplus inert C&D materials will be disposed of at the Government's public fill reception facilities (PFRFs) for beneficial use by other projects in Hong Kong.

The C&D materials generated from general site clearance should be sorted on site to segregate any inert materials for reuse or disposal of at PFRFs whereas the non-inert materials will be disposed of at the designated landfill site.

In order to monitor the disposal of inert and non-inert C&D materials at respectively PFRFs and the designated landfill site, and to control fly-tipping, it is recommended that the contractor should follow the DEVB Technical Circular (Works) No. 6/2010 for Trip Ticket System for Disposal of Construction & Demolition Materials issued by Development Bureau. In addition, it is also recommended that the contractor should prepare and implement a Waste Management Plan detailing their various waste arising and waste management practices in accordance with the relevant requirements of the ETWB Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site.

Chemical Waste

If chemical wastes are produced at the construction site, the contractor will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the "Code of Practice on the Packaging Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidising, irritant, toxic, harmful, corrosive, etc. The contractor should use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

Potential environmental impacts arising from the handling activities (including storage, collection, transportation and disposal of chemical waste) are expected to be minimal with the implementation of appropriate mitigation measures as recommended.

General Refuse

General refuse should be stored in enclosed bins or compaction units separated from inert C&D materials. A reputable waste collector should be employed by the contractor to remove general refuse from the site, separately from inert C&D materials. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'windblown' light material.

9.2.4.2 Operation Phase

No mitigation measure is considered necessary.

9.2.5 Environmental Monitoring and Audit

Throughout the construction phase of the improvement works, regular site inspections should be carried out to determine if wastes are being properly managed. Different aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal would be included in the programme.

9.3 Conclusion

The potential environmental impacts of waste arising from the improvement works have been reviewed. Construction phase waste management methods and practices and other environmental control measures have been recommended to ensure that potential impacts would be avoided or controlled to acceptable levels. With the implementation of the proposed mitigation measures, no potential environmental impact is expected. Operation impact is expected to be minimal.

10 Land Contamination

10.1 Review of Previous EIA Findings

According to the previous EIA study, contaminated land arising from lands which had been used for vehicle maintenance, trailer storage and scrap metal works, and the contaminated land located in areas to be excavated during the construction of STEMC were identified as the land contamination sources. Though the STEMC would encroach into area with identified land contamination sources, mitigation measures, including handling and disposal of any excavated soil from the contaminated area have been recommended. With proper implementation of the recommended mitigation measures, land contamination impacts were not expected to be a key issue,

Nonetheless a Contamination Assessment Report (CAR) has been conducted to document the sampling programme and remedial requirement and subsequently a Remediation Action Plan (RAP) has been developed (Maunsell Consultants Asia Ltd., 2002). Prior to the commencement of construction works, contamination investigation works had been carried out. Decontamination treatment works was documented and reported on monthly basis. According to the Monthly EM&A Report (March 2005) for STEMC, all marine dumping of Type 1 and 2 contaminated excavated sediment has been completed. With reference to the Monthly Progress Report no.12 for the Contract No. DC/2001/09 Construction of the San Tin Eastern Main Drainage Channel, cement solidification of all designated Type 3 contaminated sediment has been completed in November 2004. (Golder Associates (HK) Ltd., 2004) Therefore, there should be no further land contamination concern.

10.2 Review of Potential Impacts from Proposed Improvement Works

It is noted that the previous EIA study expected no significant concerns relating to the contaminated land during the construction phase of STEMC. Although the proposed improvement works would encroach into land contamination sources identified in the previous EIA study, the remediation works completed in 2005 has already included the remediation of the soil in the works area under the proposed improvement works. After completion of the STEMC construction works, there was no change on the land use. In addition, the proposed improvement works including mainly the construction of floodwall on the western bank of STEMC, and embankments and floodwalls in the existing wetland on the eastern bank of STEMC, are expected to have no potential sources for land contamination. While the operation phase of the proposed works would not pose any land contamination issues as well. It is therefore considered that there would be no environmental impacts related to land contamination for the construction and operation phases of proposed works. Hence, mitigation measures and EM&A relating to land contamination are considered not required for the proposed works.

10.3 Conclusion

No land contamination issues are expected for the construction and operation of the improvement works. No mitigation measures and EM&A programme is therefore considered necessary.

10.4 Reference

Maunsell Consultants Asia Ltd. (2002). Design of Ecological Mitigation Measures and Landscaping Works and Assessment of Land Contamination for Eastern Main Drainage Channel

for San Tin – Contamination Assessment Report (CAR) / Remediation Action Plan (RAP).
Agreement No. CE 49/2000.

Golder Associates (HK) Ltd. (2004). Monthly Progress Report No. 12 - November 2014. Contract
No. DC/2001/09.

11 EM&A Requirement

11.1 Introduction

This section presents a summary of EM&A requirements prescribed in this ER Report. From the foregoing review, although no adverse impact is identified, a series of control measures and mitigation measures and a construction phase EM&A programme are proposed. It is recommended that the environmental mitigation measures shall be checked and their appropriateness shall be confirmed during routine site audits/ inspections.

11.2 Air Quality

As the improvement works is not expected to generate excessive dust levels, no air quality monitoring is considered necessary. Nevertheless, it is recommended that the site works are audited and mitigation measures are checked for their implementation during routine site inspections.

11.3 Noise Impact

As the improvement works is not expected to generate excessive noise impacts, noise monitoring is considered not necessary. Nonetheless, environmental audit is recommended to ensure that the noise levels do not exceed the criteria during the construction phase.

11.4 Water Quality

Water quality monitoring for the construction phase is considered not necessary. However, a series of checklist items involving the water quality control measures should be included in the regular site audits during the construction phase to ensure the mitigation measures proposed are being adopted.

11.5 Ecology

Ecological monitoring is considered not necessary during the construction phase. During the operation phase, the long-term ecological monitoring for the constructed wetland conducted by AFCD for providing data for demonstrating the effectiveness of the wetland shall be maintained.

11.6 Fisheries Impact

The proposed construction and operation of the Project are not predicted to have any direct impact on pond fish culture in the Study Area. With water quality control measures in place, the Project is unlikely to have any significant indirect impact on pond fish culture resources and activities in the Study Area. Therefore, no monitoring for fisheries is considered necessary. Nevertheless, regular site audits for checking the proper implementation of the water quality control measures are recommended.

11.7 Landscape and Visual Impact

No landscape and visual specific monitoring is necessary but the general principle of retaining tree on-site as far as possible is beneficial to landscape and visual value.

11.8 Waste Management

Throughout the construction phase of the improvement works, regular site inspections should be carried out to determine if wastes are being properly managed. Different aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal of would be included in the programme.

11.9 Land Contamination

Since no land contamination issues are expected for the construction and operation of the improvement works, no land contamination specific EM&A programme is considered necessary for this aspect.

12 Conclusion

The environmental impact associated with the proposed drainage improvement works at STEMC has been reviewed with an aim to support the VEP application. Various environmental aspects have been reviewed. Owing to the relatively small scale of works and far distance from sensitive receivers, the potential impact of air, noise and water quality to the adjacent sensitive receivers are generally minor. No impact is anticipated to the fisheries activities. Waste management implications and landscape and visual impact are also considered minor owing to the small scale of works. The STEMC has no major change since 2006, therefore no land contamination issue is expected.







As the STEMC is located in WCA, an ecologically sensitive habitat, ecological impact to the constructed wetland and WCA is a concern. To address the ecological concern, various approaches of mitigation including avoidance measures have been proposed. With various suitably designed mitigation measures in both the construction and operation phase including timing the construction work to avoid birds' peak wintering season (i.e. November to March), the potential impact can be mitigated to acceptable level with no residual impact.

Overall, the environmental impact associated with the proposed drainage improvement works is relatively minor with the given scale of works, while the ecological impact can be mitigated with adoption of suitable mitigation measures. To ensure the environmental compliance of the proposed works, an environmental monitoring and audit programme is proposed.

Appendices

- A. Photos of Noise Sensitive Receivers
- B. Ecological Information

A. Photos of Noise Sensitive Receivers

	
<p>NSR 1 Residential House near Lok Ma Chau Road</p>	<p>NSR 2 Ha Wan Tsuen</p>
	
<p>NSR 3 Tung Chan Wai (Residential House No. 63A)</p>	<p>NSR 4 Wing Ping Tsuen (Residential House No. 285B)</p>
	
<p>NSR 5 Residential House near Kwu Tung Road</p>	<p>NSR 6 Residential House on Ki Lun Tsuen Road</p>

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Diagram 2	Embankment Design with and without Adjustment at the Narrowest Section of the Constructed Wetland
Diagram 3	Indicative Locations of Ponds and Storage Pond

Appendix B

Table 1: Bird Species recorded at River Channel and Constructed Wetland Habitat at San Tin Eastern Main Channel under the Lok Ma Chau Loop EIA Study

Common Name	Scientific Name	Chinese Name	Conservation Status ¹	Protection Status ²	River Channel ³	Constructed Wetland ⁴
Crested Myna	<i>Acridotheres cristatellus</i>	八哥			✓	✓
Common Myna	<i>Acridotheres tristis</i>	家八哥			✓	✓
Oriental Reed Warbler	<i>Acrocephalus orientalis</i>	東方大葦鶯			✓	
Common Sandpiper	<i>Actitis hypoleucos</i>	磯鶯			✓	✓
Common Kingfisher	<i>Alcedo atthis</i>	普通翠鳥			✓	✓
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	白胸苦惡鳥			✓	✓
Eurasian Teal	<i>Anas crecca</i>	綠翅鴨	RC		✓	
Eurasian Wigeon	<i>Anas penelope</i>	赤頸鴨	RC		✓	
Red-throated Pipit	<i>Anthus cervinus</i>	紅喉鶇	LC		✓	✓
Olive-backed Pipit	<i>Anthus hodgsoni</i>	樹鶇			✓	✓
Richard's Pipit	<i>Anthus richardi</i>	田鶇			✓	✓
Little Swift	<i>Apus nipalensis</i>	小白腰雨燕				✓
Great Egret	<i>Ardea alba</i>	大白鷺	PRC(RC)		✓	✓
Grey Heron	<i>Ardea cinerea</i>	蒼鷺	PRC		✓	✓
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鷺	PRC(RC)		✓	✓
Eastern Cattle Egret	<i>Bubulcus coromandus</i>	牛背鷺	LC		✓	✓
Eastern Buzzard	<i>Buteo japonicus</i>	普通鵟		CITES (II); Cap.586	✓	
Long-toed Stint	<i>Calidris subminuta</i>	長趾濱鶯	LC		✓	
Temminck's Stint	<i>Calidris temminckii</i>	青腳濱鶯	LC		✓	
Greater Coucal	<i>Centropus sinensis</i>	褐翅鴉鶇	CRDB (V)			✓
Little Ringed Plover	<i>Charadrius dubius</i>	金眶鸻	(LC)		✓	
Oriental Magpie Robin	<i>Copsychus saularis</i>	鶇鶇				✓
Large-billed Crow	<i>Corvus macrorhynchos</i>	大嘴烏鴉				✓
Azure-winged Magpie	<i>Cyanopica cyanus</i>	灰喜鵲			✓	
Black Drongo	<i>Dicrurus macrocercus</i>	黑卷尾			✓	✓
Little Egret	<i>Egretta garzetta</i>	小白鷺	PRC(RC)		✓	✓
Intermediate Egret	<i>Egretta intermedia</i>	中白鷺	RC		✓	
Common Koel	<i>Eudynamys scolopaceus</i>	噪鵲				✓
Red-throated Flycatcher	<i>Ficedula albicilla</i>	紅喉姬鶇			✓	
Common Snipe	<i>Gallinago gallinago</i>	扇尾沙雉			✓	✓
Pintail/Swinhoe's Snipe*	<i>Gallinago stenura/megala</i>	針尾沙雉/大沙雉			✓	
Hwamei	<i>Garrulax canorus</i>	畫眉	RLCV (NT)	CITES(II)		✓
Masked Laughingthrush	<i>Garrulax perspicillatus</i>	黑臉噪鵲				✓
Black-collared Starling	<i>Gracupica nigricollis</i>	黑領椋鳥			✓	✓
White-throated Kingfisher	<i>Halcyon smyrnensis</i>	白胸翡翠	(LC)		✓	✓
Black-winged Stilt	<i>Himantopus himantopus</i>	黑翅長腳鶯	RC		✓	
Barn Swallow	<i>Hirundo rustica</i>	家燕			✓	✓
Cinnamon Bittern	<i>Ixobrychus cinnamomeus</i>	栗葦鶯	LC		✓	✓
Yellow Bittern	<i>Ixobrychus sinensis</i>	黃葦鶯	(LC)			✓
Eurasian Wryneck	<i>Jynx torquilla</i>	螻鶯			✓	
Long-tailed Shrike	<i>Lanius schach</i>	棕背伯勞			✓	✓
Lanceolated Warbler	<i>Locustella lanceolata</i>	矛紋蝗鶯	RLCV (NT)		✓	
Scaly-breasted Munia	<i>Lonchura punctulata</i>	斑文鳥				✓
Black Kite	<i>Milvus migrans</i>	黑鷹	(RC)	CITES (II); Cap.586		✓
White Wagtail	<i>Motacilla alba</i>	白鶺鴒			✓	✓
Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>	黃鶺鴒			✓	
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	夜鷺	(LC)			✓
Great Tit	<i>Parus major</i>	大山雀				✓
Eurasian Tree Sparrow	<i>Passer montanus</i>	樹麻雀				✓
Daurian Redstart	<i>Phoenicurus aureus</i>	北紅尾鴉				✓
Dusky Warbler	<i>Phylloscopus fuscatus</i>	褐柳鶯			✓	✓
Yellow-browed Warbler	<i>Phylloscopus inornatus</i>	黃眉柳鶯			✓	✓
Common Magpie	<i>Pica pica</i>	喜鵲				✓
Yellow-bellied Prinia	<i>Prinia flaviventris</i>	黃腹鶯				✓

Common Name	Scientific Name	Chinese Name	Conservation Status ¹	Protection Status ²	River Channel ³	Constructed Wetland ⁴
Plain Prinia	<i>Prinia inornata</i>	純色鶯鶯			✓	✓
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	白喉紅臀鶯				✓
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	紅耳鶯				✓
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鶯				✓
Pied Avocet	<i>Recurvirostra avosetta</i>	反嘴鹮	RC		✓	
Greater Painted-snipe	<i>Rostratula benghalensis</i>	彩鹮	LC		✓	
Common Stonechat	<i>Saxicola stejnegeri</i>	黑喉石(即鳥)			✓	✓
Spotted Dove	<i>Spilopelia chinensis</i>	珠頸斑鳩				✓
Red-billed Starling	<i>Spodiopsar sericeus</i>	絲光椋鳥	GC			✓
White-shouldered Starling	<i>Sturnia sinensis</i>	灰背椋鳥	(LC)		✓	✓
Little Grebe	<i>Tachybaptus ruficollis</i>	小鸕鶿	LC			✓
Spotted Redshank	<i>Tringa erythropus</i>	鶺鴒	RC		✓	
Wood Sandpiper	<i>Tringa glareola</i>	林鶺鴒	LC		✓	
Common Greenshank	<i>Tringa nebularia</i>	青腳鶺鴒	RC		✓	
Green Sandpiper	<i>Tringa ochropus</i>	白腰草鶺鴒			✓	✓
Marsh Sandpiper	<i>Tringa stagnatilis</i>	澤鶺鴒	RC		✓	✓
Grey-backed Thrush	<i>Turdus hortulorum</i>	灰背鶇				✓
Common Blackbird	<i>Turdus merula</i>	烏鶇				✓
Grey-headed Lapwing	<i>Vanellus cinereus</i>	灰頭麥雞	LC		✓	
Japanese White-eye	<i>Zosterops japonicus</i>	暗綠繡眼鳥			✓	✓

Notes:

- Conservation status refers to Zheng & Wang (1998), Fellowes et al. (2002), Jiang et al. (2016)
Conservation status by China Red Data Book of Endangered Animals: Aves (CRDB) (Zheng & Wang 1998); E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate.
Conservation status by Fellowes et al. (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
Conservation status by Red List of China's Vertebrates (RLCV) (Jiang et al. 2016): NT = Near Threatened; EN = Endangered; VU = Vulnerable; CR = Critically Endangered
- Protection status refers to CITES (2017), Cap. 170 and Cap. 586.
Protection status by CITES (2017): II = Listed in CITES Appendix II. All wild birds in Hong Kong are protected under Cap. 170.
Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.
- Adopted from Development of Lok Ma Chau Loop - Investigation EIA Report. Data collected by AEC from May 2009 to August 2012.
- Adopted from Development of Lok Ma Chau Loop - Investigation EIA Report. Data collected by AFCD from October 2010 to September 2011.
* Pintail Snipe and Swinhoe's Snipe cannot be separated in field; conservation status of Swinhoe's Snipe *Gallinago megala* is of Local Concern by Fellowes et al. (2002).

Appendix B

Table 2: Bird Species Recorded at the Constructed Wetland from AFCD survey between June 2014 to March 2016

Common Name	Scientific Name	Conservation status ¹	Protection status ²	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Oriental Reed Warbler	<i>Aceocephalus orientalis</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Crested Myna	<i>Acridotheres cristatellus</i>		-	5	10	3	7	2	18	4	3	9	10	7	4	7	10	3	40	4	7	15	4	5	10
Common Myna	<i>Acridotheres tristis</i>		-	2	1	3	3	2	0	2	0	2	0	2	6	2	0	2	0	4	0	2	2	0	2
Common Sandpiper	<i>Actitis hypoleucos</i>		-	0	0	9	1	0	0	1	0	0	0	1	0	0	0	1	5	0	0	0	0	0	0
Common Kingfisher	<i>Alcedo atthis</i>		-	0	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	1	0	1	1	2	1
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>		-	0	2	4	3	3	0	0		0	0	1	1	4	1	2	6	2	1	0	0	1	2
Olive-backed Pipit	<i>Anthus hodgsoni</i>		-	0	0	0	0	1	6	19	6	5	9	3	0	0	0	0	0	0	4	5	0	7	8
Richard's Pipit	<i>Anthus richardi</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
House Swift	<i>Apus nipalensis</i>		-	0	0	0	0	0	0	0	0	30	20	0	0	0	0	0	0	0	0	0	0	0	0
House Swift	<i>Apus nipalensis</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	5
Great Egret	<i>Ardea alba</i>	PRC(RC)	-	0	0	0	0	0	1	2	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0
Grey Heron	<i>Ardea cinerea</i>	PRC	-	0	0	0	0	4	6	4	3	5	2	1	1	0	0	0	0	2	3	3	2	13	0
Chinese Pond Heron	<i>Ardeola bacchus</i>	PRC (RC)	-	1	1	8	4	5	3	3	2	1	4	0	0	1	6	2	6	8	2	1	1	1	3
Eastern Buzzard	<i>Buteo japonicus</i>		-	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	3	2	1	0	1
Red-rumped Swallow	<i>Cecropis daurica</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Greater Coucal	<i>Centropus sinensis</i>	CRDB(V)	-	1	2	0	1	1	1	1	0	0	1	1	0	0	1	1	1	20	0	0	0	0	3
Pied Kingfisher	<i>Ceryle rudis</i>	(LC)	-	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Common Emerald Dove	<i>Chalcophaps indica</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Greater Spotted Eagle	<i>Clanga clanga</i>	GC:IUCN(VU); RLCV(EN);CRD B(R)	CITES(II); Cap. 586	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Domestic Pigeon	<i>Columba livia</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oriental Magpie Robin	<i>Copsychus saularis</i>		-	0	5	2	0	2	3	1	1	2	4	4	1	0	2	2	1	3	3	3	2	3	3
Large-billed Crow	<i>Corvus macrorhynchos</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Collared Crow	<i>Corvus torquatus</i>	LC:IUCN(NT)	-	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0
Azure-winged Magpie	<i>Cyanopica cyanus</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Forest Wagtail	<i>Dendronanthus indicus</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Hair-crested Drongo	<i>Dicrurus hottentottus</i>		-	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Black Drongo	<i>Dicrurus macrocercus</i>		-	0	0	0	0	2	2	1	1	0	1	0	0	0	0	0	1	11	0	0	0	0	0
Little Egret	<i>Egretta garzetta</i>	PRC (RC)	-	3	1	1	6	1	0	0	3	0	0	0	2	0	0	0	0	1	1	5	0	0	0
Little Bunting	<i>Emberiza pusilla</i>		-	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Chinese Grosbeak	<i>Eophona migratoria</i>	LC	-	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Asian Koel	<i>Eudynamis scolopaceus</i>		-	1	0	0	0	0	0	0	0	1	3	0	1	0	0	2	0	3	0	0	0	0	1
Asian Koel	<i>Eudynamis scolopaceus</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-throated Flycatcher	<i>Ficedula albicilla</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Red-breasted Flycatcher	<i>Ficedula parva</i>		-	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Snipe	<i>Gallinago gallinago</i>		-	0	0	0	0	2	0	0	1	2	0	2	0	0	0	0	0	0	0	1	0	1	4
Pintail Snipe	<i>Gallinago stenura</i>		-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Masked Laughingthrush	<i>Garrulax perspicillatus</i>		-	0	1	0	0	1	1	2	10	4	6	2	6	3	12	0	0	4	8	6	3	5	14
Black-collared Starling	<i>Gracupica nigricollis</i>		-	2	4	1	1	1	3	3	4	8	4	14	7	5	1	6	42	3	0	8	1	6	7

Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Japanese White-eye	<i>Zosterops japonicus</i>	-	-	0	0	0	0	12	4	20	27	34	52	5	0	2	0	12	0	3	6	30	11 5	11	0

Notes:

1. Conservation status refers to Zheng & Wang (1998), Fellowes *et al.* (2002), Jiang *et al.* (2016), IUCN (2017)

Zheng & Wang (1998): E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate.

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

Jiang *et al.* (2016): NT = Near Threatened; EN = Endangered; VU = Vulnerable; CR = Critically Endangered

IUCN (2017): NT = Near Threatened; VU = Vulnerable; EN = Endangered.

2. Protection status refers to CITES (II), Cap. 170 and Cap. 586.

CITES (II): List under Convention on International Trade in Endangered Species of Wild Fauna and Flora Appendix II.

Cap. 170: Wild Animals Protection Ordinance

Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

Common Name	Scientific Name	Conservation status ¹	Protection status ²	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
Red Turtle Dove	<i>Streptopelia tranquebarica</i>	-	-	0	0	5	0	0	0	0	0	0	0	1	4	0	0
Little Grebe	<i>Tachybaptus ruficollis</i>	LC	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood Sandpiper	<i>Tringa olareola</i>	LC	-	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Emerald Dove	<i>Chalcophaps indica</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Richard's Pipit	<i>Anthus richardi</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
House Swift	<i>Apus nipalensis</i>	-	-	0	0	0	0	0	0	0	0	0	0	1	7	2	1
Great Cormorant	<i>Phalacrocorax carbo</i>	PRC	-	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Black-collared Starling	<i>Gracupica nigricollis</i>	-	-	6	0	7	3	0	1	5	1	2	2	4	4	3	2
Red-billed Starling	<i>Spodopas sericeus</i>	GC	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White-shouldered Starling	<i>Sturnia sinensis</i>	LC	-	0	0	1	3	0	0	0	0	0	0	0	1	0	0
Greater Spotted Eagle	<i>Clanga clanga</i>	GC:IUCN(VU); RLCV(EN):CRDB(R)	CITES (II); Cap.586	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Asian Brown Flycatcher	<i>Muscivora latirostris</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oriental Reed Warbler	<i>Acecephalus orientalis</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large-billed Crow	<i>Corvus macrorhynchos</i>	-	-	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Red-rumped Swallow	<i>Cecropis daurica</i>	-	-	41	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Tit	<i>Parus major</i>	-	-	0	0	3	0	0	0	0	0	0	1	3	1	0	0
Red-billed Blue Magpie	<i>Urocissa erythrorhyncha</i>	-	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Domestic Pigeon	<i>Columba livia</i>	-	-	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Grey-streaked Flycatcher	<i>Muscivora griseisticta</i>	-	-	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Pintail Snipe	<i>Gallinago stenura</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Asian Koel	<i>Eudynamys scolopacea</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	10	1
Forest Wagtail	<i>Dendronanthus indicus</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-throated Flycatcher	<i>Ficedula albicilla</i>	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

- Conservation status refers to Zheng & Wang (1998), Fellowes *et al.* (2002), Jiang *et al.* (2016), IUCN (2017)
Conservation status by China Red Data Book of Endangered Animals: Aves (CRDB) (Zheng & Wang 1998); E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate.
Conservation status by Fellowes *et al.* (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT = Near Threatened; EN = Endangered; VU = Vulnerable; CR = Critically Endangered
Conservation status by IUCN Red List of Threatened Species Version 2017.1: NT = Near Threatened; VU = Vulnerable; EN = Endangered.
- Protection status refers to CITES (2017), Cap. 170 and Cap. 586.
Protection status by CITES (2017): CITES (II) = Listed in CITES Appendix II. All wild birds in Hong Kong are protected under Cap. 170.
Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

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Table 4: Herpetofauna Recorded at the Constructed Wetland by AFCD survey from June 2014 to March 2016

Common Name	Scientific Name	Commonness ¹	Conservation status ²	Protection status ³	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Butler's Pigmy Frog	<i>Microhyla butleri</i>	Widely distributed	-	-	1	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Günther's Frog	<i>Rana guentheri</i>	Very Common	-	-	10	9	19	0	0	0	0	0	0	0	9	8	3	2	0	0	0	0	0	0	0	0
Paddy Frog	<i>Fejervarya limnocharis</i>	Very Common	-	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Tree Frog	<i>Polypedates megacephalus</i>	Common	-	-	1	4	2	0	0	0	0	0	0	0	0	2	3	2	0	0	0	0	0	0	0	0
Ornate Pigmy Frog	<i>Microhyla ornata</i>	Abundant	-	-	3	0	3	0	0	0	0	0	0	0	0	10	0	10	0	0	0	0	0	0	0	0
Reeves' Smooth Skink	<i>Scincella reevesii</i>	Common	-	-	1	0	6	0	0	0	0	0	0	0	1	1	3	0	8	0	0	0	0	0	0	0
Bowring's Gecko	<i>Hemidactylus bowringii</i>	Very Common	-	-	0	8	2	0	0	0	0	0	0	0	3	6	2	0	1	0	0	0	0	0	0	0
Asian Common Toad	<i>Bufo melanostictus</i>	Abundant	-	-	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-eared slider	<i>Trachemys scripta</i>	Introduced	-	-	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asiatic Painted Frog	<i>Kaloula pulchra</i>	Common	-	-	0	0	1	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
Spotted Narrow-mouthed Frog	<i>Kalophrynus interlineatus</i>	Widely distributed	RLCV(NT)	-	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Taiwan Kukri Snake	<i>Oligodon formosanus</i>	Widely distributed	RLCV(NT)	-	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Chinese Cobra	<i>Naja atra</i>	Common	PRC; RLCV(VU; CRDB(V)	Cap. 586	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Checkered Keelback	<i>Xenochrophis piscator</i>	Widely distributed in New Territories	-	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Note:

- Commonness refers to Hong Kong Biodiversity Database (AFCD 2017)
- Conservation status refers to Zhao (1998); Fellowes *et al.* (2002) and Jiang *et al.* (2016).
Conservation status refers to Fellowes *et al.* (2002): LC = Local Concern.
Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT = Near Threatened; VU = Vulnerable.
Conservation status by China Red Data Book of Endangered Animals: Amphibia and Reptilia (Zhao 1998): V = Vulnerable.
- Protection status refers to Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

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Table 5: Herpetofauna Recorded at the Constructed Wetland by AFCD survey from April 2016 to May 2017

Common Name	Scientific Name	Commonness ¹	Conservation status ²	Protection status ³	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
Butler's Pigmy Frog	<i>Microhyla butleri</i>	Widely distributed	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Günther's Frog	<i>Rana quentheri</i>	Very Common	-	-	3	12	1	1	4	0	0	0	0	0	0	0	4	0
Paddy Frog	<i>Fejervarya limnocharis</i>	Very Common	-	-	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Brown Tree Frog	<i>Polypedates megacephalus</i>	Common	-	-	1	4	0	7	1	0	0	0	0	0	0	0	4	0
Ornate Pigmy Frog	<i>Microhyla ornata</i>	Abundant	-	-	1	0	0	0	16	0	0	0	0	0	0	0	0	0
Reeves' Smooth	<i>Scincella reevesii</i>	Common	-	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Bowring's Gecko	<i>Hemidactylus bowringii</i>	Very Common	-	-	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Asian Common Toad	<i>Bufo melanostictus</i>	Abundant	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red-eared slider	<i>Trachemys scripta</i>	Introduced	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asiatic Painted Frog	<i>Kaloula pulchra</i>	Common	-	-	3	0	1	1	2	0	0	0	0	0	0	0	3	0
Spotted Narrow-mouthed Frog	<i>Kalophrynus interlineatus</i>	Widely distributed	RLCV(NT)	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taiwan Kukri Snake	<i>Oligodon formosanus</i>	Widely distributed	RLCV(NT)	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chinese Cobra	<i>Naja atra</i>	Common	PRC; RLCV(VU); CRDB(V)	Cap. 586	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Checkered Keelback	<i>Xenochrophis piscator</i>	Widely distributed in New Territories	-	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Note:

1. Commonness refers to Hong Kong Biodiversity Database (AFCD 2017)
2. Conservation status refers to Zhao (1998); Fellowes *et al.* (2002) and Jiang *et al.* (2016).
Conservation status refers to Fellowes *et al.* (2002): LC = Local Concern.
Conservation status by Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT = Near Threatened; VU = Vulnerable.
Conservation status by China Red Data Book of Endangered Animals: Amphibia and Reptilia (Zhao 1998): V = Vulnerable.
3. Protection status refers to Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

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Table 6: Odonate Species Recorded at the Constructed Wetland by AFCD survey from June 2014 to March 2016

Common Name	Scientific Name	Commonness ¹	Conservation status ²	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
Asian Pintail	<i>Acisoma panorpoides</i>	Common	-	7	1	1	2	0	0	0	0	0	0	0	3	2	0	0	1	0	0	0	0	0	0
Wandering Midget	<i>Agriocnemis pygmaea</i>	Common	-	4	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Blue Dasher	<i>Brachydiplax chalybea</i>	Common	-	4	28	0	0	2	0	0	0	0	0	1	91	23	15	13	1	1	0	0	0	0	0
Orange-tailed Sprite	<i>Ceragrion auranticum</i>	Abundant	-	45	2	0	6	4	0	0	0	0	0	10	4	4	0	3	0	1	0	0	0	0	0
Crimson Darter	<i>Crocothemis servilla</i>	Abundant	-	1	4	2	0	4	0	0	0	0	0	0	0	5	0	0	1	0	0	0	0	0	0
Common Fiangetail	<i>Ictinogomphus pertinax</i>	Abundant	-	2	2	2	1	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0	0
Common Bluetail	<i>Ischnura senegalensis</i>	Abundant	-	64	14	2	2	0	0	0	0	0	0	2	43	1	2	0	2	0	0	0	0	0	0
Pied Percher	<i>Neurothemis tullia</i>	Common	-	9	5	0	1	2	0	0	0	0	0	2	0	0	1	4	0	0	0	0	0	0	0
Green Skimmer	<i>Orthetrum sabina</i>	Common	-	6	14	22	10	9	0	0	0	0	0	3	4	23	3	5	5	0	0	0	0	0	0
Wandering Glider	<i>Pantala flavescens</i>	Abundant	-	4	15	92	40	74	0	0	0	0	0	0	22	2	30	9	44	17	0	0	0	0	0
Pied Skimmer	<i>Pseudothemis zonata</i>	Common	-	1	1	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0
Variigated Flutterer	<i>Rhyothemis variegata</i>	Common	-	33	11	0	32	7	0	0	0	0	0	12	94	11	6	12	15	0	0	0	0	0	0
Scarlet Basker	<i>Urothemis signata</i>	Common	LC	4	2	1	4	3	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0
Asian Amberwing	<i>Brachythemis contaminata</i>	Abundant	-	0	3	0	1	3	0	0	0	0	0	11	4	3	9	8	10	4	0	0	0	0	0
Evening Skimmer	<i>Tholymis tilarga</i>	Common	-	0	5	0	0	0	0	0	0	0	0	0	1	0	22	7	0	0	0	0	0	0	0
Saddlebag Glider	<i>Tramea virginia</i>	Common	-	0	3	2	2	1	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0
Dingy Dusk-darter	<i>Zyxomma petiolatum</i>	Common	-	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pale-spotted Emperor	<i>Anax guttatus</i>	Abundant	-	0	0	0	1	2	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0
Yellow Featherlegs	<i>Coperia marginipes</i>	Abundant	-	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ruby Darter	<i>Rhodothemis rufa</i>	Common	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Golden Fiangetail	<i>Sinictinogomphus clavatus</i>	Common	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Common Red Skimmer	<i>Orthetrum pruinosum</i>	Abundant	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Blue Sprite	<i>Pseudagrion microcephalum</i>	Uncommon	LC	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Forest Chaser	<i>Lyriothemis elegantissima</i>	Common	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Blue Percher	<i>Diplacodes trivialis</i>	Abundant	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Crimson Dropwing	<i>Trithemis aurora</i>	Abundant	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Orange-tailed Midget	<i>Agriocnemis femina</i>	Abundant	-	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Note:

1. Commonness in Hong Kong refers to AFCD (2017).
2. Conservation status refers to Fellowes *et al.* (2002); LC = Local Concern.

Appendix B

Table 7: Odonate Species Recorded at the Constructed Wetland by AFCD survey from April 2016 to May 2017

Common Name	Scientific Name	Commonness ¹	Conservation status ²	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
Asian Pintail	<i>Acisoma panorpoides</i>	Common	-	0	0	2	0	0	0	0	0	0	0	0	0	0	8
Wandering Midget	<i>Agriocnemis pygmaea</i>	Common	-	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Blue Dasher	<i>Brachydiplax chalybea</i>	Common	-	0	6	42	2	4	0	0	0	0	0	0	0	0	6
Orange-tailed Sprite	<i>Ceriatagrion auranticum</i>	Abundant	-	4	11	3	0	1	1	3	0	5	0	0	0	18	24
Crimson Darter	<i>Crocothemis servilia</i>	Abundant	-	0	1	5	1	2	1	1	0	0	0	0	0	0	1
Common Flangetail	<i>Ictinogomphus pertinax</i>	Abundant	-	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Common Bluetail	<i>Ischnura senegalensis</i>	Abundant	-	6	3	19	2	3	0	1	0	3	0	0	0	10	14
Pied Percher	<i>Neurothemis tullia</i>	Common	-	1	0	0	2	0	0	1	0	0	0	0	0	0	0
Green Skimmer	<i>Orthetrum sabina</i>	Common	-	2	4	4	4	9	6	5	0	0	0	0	0	0	4
Wandering Glider	<i>Pantala flavescens</i>	Abundant	-	19	7	0	1	31	61	72	0	5	0	0	0	6	0
Pied Skimmer	<i>Pseudothemis zonata</i>	Common	-	0	3	17	0	0	0	0	0	0	0	0	0	0	7
Variegated Flutterer	<i>Rhyothemis variegata</i>	Common	-	4	65	17	7	13	4	8	0	0	0	0	0	0	62
Scarlet Basker	<i>Urothemis signata</i>	Common	LC	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Asian Amberwing	<i>Brachythemis contaminata</i>	Abundant	-	1	1	2	0	6	0	1	0	0	0	0	0	3	2
Evening Skimmer	<i>Tholymis tillarga</i>	Common	-	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Saddlebag Glider	<i>Tramea virginia</i>	Common	-	0	2	0	0	2	2	1	0	0	0	0	0	0	0
Dingy Dusk-darter	<i>Zyxomma petiolatum</i>	Common	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pale-spotted Emperor	<i>Anax guttatus</i>	Abundant	-	0	1	1	0	0	2	1	0	0	0	0	0	0	0
Yellow Featherlegs	<i>Copera marginipes</i>	Abundant	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ruby Darter	<i>Rhodothemis rufa</i>	Common	LC	0	0	0	0	0	0	0	0	5	0	0	0	5	0
Golden Flangetail	<i>Sinictinogomphus clavatus</i>	Common	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Common Red Skimmer	<i>Orthetrum pruinosum</i>	Abundant	-	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Blue Sprite	<i>Pseudagrion microcephalum</i>	Uncommon	LC	0	0	5	0	0	0	0	0	0	0	0	0	0	0
Forest Chaser	<i>Lyriothemis elegantissima</i>	Common	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Blue Percher	<i>Diplacodes trivialis</i>	Abundant	-	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crimson Drogwing	<i>Trithemis aurora</i>	Abundant	-	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Orange-tailed Midget	<i>Agriocnemis femina</i>	Abundant	-	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Note:

1. Commonness in Hong Kong refers to AFCD (2017).
2. Conservation status refers to Fellowes *et al.* (2002). LC = Local Concern.

Appendix B**Table 8: Fish species recorded in the Constructed Wetland by AFCD survey from June 2014 to May 2017**

Site P1			
Common Name	Scientific Name	Commonness¹	Conservation status²
Mosquito Fish	<i>Gambusia affinis</i>	Common	-
Nile Tilapia	<i>Oreochromis niloticus</i>	Common	-
Site P2			
Common Name	Scientific Name	Commonness¹	Conservation status²
Goldfish	<i>Carassius auratus</i>	Not common but cultivated	-
Mosquito Fish	<i>Gambusia affinis</i>	Common	-
Common carp	<i>Cyprinus carpio</i>	Not common but cultivated	IUCN (VU)

Note:

1. Commonness refers to Hong Kong Biodiversity Database (AFCD 2017).
2. Conservation status refers to IUCN (2017): VU = Vulnerable.
3. The conservation status for the Common Carp refer to the native population only but not the captive one.

Appendix B

Table 9: Plant Species Recorded at the Major Habitats in the STEMC and their Relative Abundances in Each Habitat Type

Scientific Name	Origin ¹	Growth Form	Status ¹	Habitats		
				River Channel	Constructed Wetland	Developed Area
<i>Abelmoschus moschatus</i>	Native	Herb	Restricted	*		
<i>Acacia auriculiformis</i>	Exotic	Tree	Widely cultivated	*		
<i>Acacia confusa</i>	Exotic	Tree	Widely cultivated			**
<i>Acacia mangium</i>	Exotic	Tree	Widely cultivated	*		
<i>Achyranthes aspera</i>	Native	Herb	Common	*		
<i>Ageratum conyzoides</i>	Exotic	Herb	Common		*	
<i>Alocasia macrorrhizos</i>	Native	Herb	Very common	*	*	
<i>Alternanthera paronychioides</i>	Exotic	Herb	Restricted		*	
<i>Alternanthera philoxeroides</i>	Exotic	Herb	Common	***	*	
<i>Alternanthera sessilis</i>	Native	Herb	Common	***	**	
<i>Alysicarpus vaginalis</i>	Native	Herb	Very common	*		
<i>Amaranthus viridis</i>	Native	Herb	Very common	*		
<i>Aster subulatus</i>	Exotic	Herb	Naturalized	*		
<i>Bacopa monnieri</i>	Native	Herb	Common		*	
<i>Bambusa sp.</i>	-	Bamboo	-		*	
<i>Bidens alba</i>	Exotic	Herb	Very common	***	**	
<i>Bombax ceiba</i>	Exotic	Tree	Cultivated	*		*
<i>Bothriochloa bladhii</i>	Native	Herb	Very common	**	*	
<i>Bothriochloa ischaemum</i>	Native	Herb	Common		*	
<i>Bracharia mutica</i>	Exotic	Herb	Very common		***	
<i>Bridelia tomentosa</i>	Native	Shrub/Tree	Very common		*	*
<i>Celtis sinensis</i>	Native	Tree	Common and widely planted	*	*	*
<i>Centella asiatica</i>	Native	Herb	Very common		*	
<i>Chloris barbata</i>	Native	Herb	Very common	**		
<i>Cinnamomum camphora</i>	Native	Tree	Common, also cultivated		*	
<i>Cleome burmannii</i>	Exotic	Herb	Restricted and naturalized	*		*
<i>Commelina diffusa</i>	Native	Herb	Common	**	**	
<i>Cuscuta chinensis</i>	Native	Herb	Common	*		
<i>Cynodon dactylon</i>	Native	Herb	Very common	***	**	
<i>Cyperus distans</i>	Native	Herb	Common	*		
<i>Cyperus exaltatus</i>	Native	Herb	Restricted	*	**	
<i>Cyperus haspan</i>	Native	Herb	Common		*	
<i>Cyperus involucratus</i>	Exotic	Herb	Cultivated or naturalized	*		*
<i>Cyperus iria</i>	Native	Herb	Common		**	
<i>Cyperus malaccensis</i>	Native	Herb	Common		***	
<i>Cyperus sp.</i>	-	Herb	-		*	
<i>Cyperus surinamensis</i>	Exotic	Herb	-	*		
<i>Delonix regia</i>	Exotic	Tree	Cultivated			*
<i>Desmodium heterophyllum</i>	Native	Herb	Common	*		
<i>Desmodium tortuosum</i>	Exotic	Herb	Common	*		
<i>Digitaria ciliaris</i>	Native	Herb	Very common	**	**	
<i>Duranta erecta</i>	Exotic	Climber/Shrub	Cultivated		*	
<i>Echinochloa crusgalli</i>	Native	Herb	Common	*	*	
<i>Eclipta prostrata</i>	Native	Herb	Common		*	
<i>Eleocharis spiralis</i>	Native	Herb	Regarded as Rare in Corlett <i>et al.</i> (2000), found in restricted locality in AFCD (2010)		**	
<i>Emilia sonchifolia</i>	Native	Herb	Very common		*	
<i>Eragrostis tenella</i>	Native	Herb	Very common		**	
<i>Euphorbia hirta</i>	Exotic	Herb	Very common	*	*	*
<i>Euphorbia hypericifolia</i>	Native	Herb	Common	*	*	
<i>Eulophia graminea</i>	Native	Herb	Infrequent Widespread in Barretto <i>et al.</i> (2011), Cap. 96A: Cap. 586	*		
<i>Ficus hispida</i>	Native	Shrub/Tree	Very common	*	*	**

Scientific Name	Origin ¹	Growth Form	Status ¹	Habitats		
				River Channel	Constructed Wetland	Developepd Area
<i>Ficus microcarpa</i>	Native	Tree	Common and widely cultivated		*	
<i>Ficus subpisocarpa</i>	Native	Tree	Common		*	
<i>Fimbristylis aestivalis</i>	Native	Herb	Restricted		*	
<i>Flueggea virosa</i>	Native	Shrub	Common	*		
<i>Grangea maderaspatana</i>	Native	Herb	Common		*	
<i>Hibiscus tiliaceus</i>	Native	Tree	Very common	**	*	
<i>Imperata cylindrica</i> var. <i>major</i>	Native	Herb	Very common	***	*	
<i>Ipomoea aquatica</i>	Exotic	Herb	Very common	**	**	
<i>Ipomoea cairica</i>	Exotic	Herb	Very common	**		**
<i>Ipomoea triloba</i>	Exotic	Herb	Common	*	*	*
<i>Kyllinga brevifolia</i>	Native	Herb	Common		*	
<i>Kyllinga polyphylla</i>	Exotic	Herb	Common	**	*	
<i>Lagerstroemia speciosa</i>	Exotic	Tree	Cultivated			*
<i>Lantana camara</i>	Exotic	Shrub	Very common	*	*	*
<i>Leersia hexandra</i>	Native	Herb	Common		**	
<i>Leptochloa chinensis</i>	Native	Herb	Very common		*	
<i>Leucaena leucocephala</i>	Exotic	Shrub/Tree	Cultivated or naturalized	**	*	***
<i>Ligustrum sinense</i>	Exotic	Shrub/Tree	Common, also widely cultivated		*	
<i>Lindernia antipoda</i>	Native	Herb	Common		*	
<i>Ludwigia adscendens</i>	Native	Herb	Common		*	
<i>Ludwigia erecta</i>	Exotic	Herb	-	*		
<i>Ludwigia octovalvis</i>	Native	Herb	Common		*	
<i>Ludwigia perennis</i>	Native	Herb	Restricted	*		
<i>Ludwigia x taiwanensis</i>	Native	Herb	-		*	
<i>Lygodium japonicum</i>	Native	Climber/Herb	Very common	*	*	
<i>Macaranga tanarius</i> var. <i>tomentosa</i>	Native	Tree	Common	*	*	**
<i>Macroptilium atropurpureum</i>	Exotic	Herb	Common	*		
<i>Macroptilium lathyroides</i>	Exotic	Herb	Common	*		
<i>Malvastrum coromandelianum</i>	Native	Herb/Shrub	Common	*	*	
<i>Melia azedarach</i>	Exotic	Tree	Cultivated or naturalized	*	**	**
<i>Melinis repens</i>	Exotic	Herb	Very common	**		
<i>Mikania micrantha</i>	Exotic	Climber/Herb	Very common		**	*
<i>Mimosa pudica</i>	Exotic	Herb	Very common	*	*	
<i>Morus alba</i>	Native	Shrub/Tree	Common and cultivated	*	*	*
<i>Musa x paradisiaca</i>	Exotic	Herb	Cultivated		*	*
<i>Nelumbo nucifera</i>	Exotic	Herb	Cultivated		*	
<i>Oenanthe javanica</i>	Native	Herb	Restricted		*	
<i>Oxalis corniculata</i>	Native	Herb	Very common	**	*	
<i>Oxalis debilis</i> subsp. <i>corymbosa</i>	Exotic	Herb	Common		*	
<i>Paederia scandens</i>	Native	Herb	Very common	*	*	
<i>Panicum dichotomiflorum</i>	Native	Herb	Common	**	**	
<i>Panicum maximum</i>	Exotic	Herb	Very common	****	****	**
<i>Paspalum notatum</i>	Exotic	Herb	Common	**		
<i>Panicum repens</i>	Native	Herb	Very common	**	**	
<i>Paspalum conjugatum</i>	Native	Herb	Common		**	
<i>Paspalum notatum</i>	Exotic	Herb	Common	*	*	
<i>Paspalum scrobiculatum</i> var. <i>orbiculare</i>	Native	Herb	Very common		***	
<i>Pennisetum alopecuroides</i>	Native	Herb	Common	**		
<i>Pennisetum purpureum</i>	Exotic	Herb	Very common	**		
<i>Persicaria barbata</i>	Native	Herb	Common		**	
<i>Persicaria glabra</i>	Native	Herb	Restricted		**	
<i>Persicaria lapathifolia</i>	Native	Herb	Common	*	*	
<i>Phragmites australis</i>	Native	Herb	Very common	*	**	
<i>Phyllanthus emblica</i>	Native	Shrub/Tree	Very common		*	
<i>Phyllanthus urinaria</i>	Native	Herb	Common		*	
<i>Pogonatherum crinitum</i>	Native	Herb	Common		*	

Scientific Name	Origin ¹	Growth Form	Status ¹	Habitats		
				River Channel	Constructed Wetland	Developed Area
<i>Polygonum plebeium</i>	Native	Herb	Restricted		*	
<i>Pouzolzia zeylanica</i>	Native	Herb	Common			*
<i>Pycreus polystachyos</i>	Native	Herb	Very common		**	
<i>Rumex triquetrum</i>	Native	Herb	Common	*	*	
<i>Salix babylonica</i>	Exotic	Tree	Cultivated		*	
<i>Sapium discolor</i>	Native	Tree	Very common		*	
<i>Sapium sebiferum</i>	Native	Tree	Common		*	
<i>Saururus chinensis</i>	Native	Herb	Restricted		*	
<i>Schoenoplectus subulatus</i>	Native	Herb	Restricted		**	
<i>Senna alata</i>	Exotic	Shrub	Cultivated	*		
<i>Sesbania cannabina</i>	Exotic	Herb	Common	*		
<i>Sida acuta</i>	Native	Herb	Common			*
<i>Sida rhombifolia</i>	Native	Shrub	Common	*		*
<i>Solanum americanum</i>	Exotic	Herb	Very common	*	*	
<i>Solanum torvum</i>	Exotic	Shrub	Common	*		*
<i>Solena amplexicaulis</i>	Native	Climber	Very common		*	
<i>Sonchus oleraceus</i>	Exotic	Herb	Very common	*		
<i>Spathodea campanulata</i>	Exotic	Tree	Cultivated			*
<i>Spilanthes paniculata</i>	Native	Herb	Common		**	
<i>Sporobolus fertilis</i>	Native	Herb	Very common	*		*
<i>Sterculia lanceolata</i>	Native	Tree	Very common		*	
<i>Tridax procumbens</i>	Exotic	Herb	Very common	*		*
<i>Vernonia cinerea</i>	Native	Herb	Very common		*	
<i>Vitex negundo</i> var. <i>cannabifolia</i>	Native	Shrub/Tree	Restricted	*		
<i>Wedelia trilobata</i>	Exotic	Herb	Common, also widely cultivated	***	*	
<i>Youngia japonica</i>	Native	Herb	Very common		*	
Total no. of species recorded				70	94	25

Note

1. Origin and status refers The Hong Kong vascular plants: distribution and status (Corlett et al. 2000); Hong Kong Biodiversity Newsletter Issue No. 19 (AFCD 2010); The Wild Orchids of Hong Kong (Barretto et al. 2011); Hong Kong Plant Database (AFCD 2017).

Appendix B

Table 10: Bird species recorded during the dry season in the San Tin Eastern Main Channel (November 2016 – March 2017)

Common Name	Scientific Name	Principal Status ²	Conservation Status ³	Protection Status ⁴	Habitats					
					River Channel		Constructed Wetland		Developed Area	
					Max	Monthly Mean	Max	Monthly Mean	Max	Monthly Mean
Eurasian Wigeon	<i>Anas penelope</i>	W	RC	-	7	1.4	0	0	0	0
Northern Pintail	<i>Anas acuta</i>	W	RC	-	1	0.2	0	0	0	0
Garganey	<i>Anas querquedula</i>	M,W	-	-	2	0.4	0	0	0	0
Eurasian Teal	<i>Anas crecca</i>	W	RC	-	29	22	0	0	0	0
Black-faced Spoonbill	<i>Platalea minor</i>	W	PGC; RLCV(EN); IUCN(EN)	CSMPS(II)	3	0.6	0	0	0	0
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	P	(LC)	-	1	0.2	0	0	0	0
Chinese Pond Heron	<i>Ardeola bacchus</i>	P	PRC (RC)	-	1	0.8	0	0	0	0
Grey Heron	<i>Ardea cinerea</i>	W	PRC	-	16	11.4	0	0	0	0
Great Egret	<i>Ardea alba</i>	P	PRC (RC)	-	1	0.6	0	0	0	0
Little Egret	<i>Egretta garzetta</i>	P	PRC (RC)	-	3	1.6	0	0	0	0
Eastern Buzzard	<i>Buteo japonicus</i>	W	-	-	1	0.2	0	0	0	0
White-breasted Waterhen	<i>Amauromis phoenicurus</i>	R	-	-	2	0.8	0	0	0	0
Black-winged Stilt	<i>Himantopus himantopus</i>	W	RC	-	40	21.8	0	0	0	0
Pied Avocet	<i>Recurvirostra avosetta</i>	W	RC	-	18	13.8	0	0	0	0
Grey-headed Lapwing	<i>Vanellus cinereus</i>	W	LC	-	3	1.8	0	0	0	0
Little Ringed Plover	<i>Charadrius dubius</i>	W,R	(LC)	-	3	0.6	0	0	0	0
Common Snipe	<i>Gallinago gallinago</i>	W	-	-	7	4.2	0	0	0	0
Spotted Redshank	<i>Tringa erythropus</i>	W/M	RC	-	6	2.2	0	0	0	0
Marsh Sandpiper	<i>Tringa stagnatilis</i>	M,W	RC	-	16	10.8	0	0	0	0
Common Greenshank	<i>Tringa nebularia</i>	M,W	RC	-	11	11.2	0	0	0	0
Green Sandpiper	<i>Tringa ochropus</i>	W	-	-	3	3	0	0	0	0
Wood Sandpiper	<i>Tringa glareola</i>	M,W	LC	-	61	31.2	0	0	0	0
Common Sandpiper	<i>Actitis hypoleucos</i>	M,W	-	-	5	1.8	0	0	0	0
Temminck's Stint	<i>Calidris temminckii</i>	M,W	LC	-	1	0.2	0	0	0	0
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	-	-	-	0	0	2	0.4	0	0
Spotted Dove	<i>Spilopelia chinensis</i>	R	-	-	4	2.4	30	8	3	0.6
Common Kingfisher	<i>Alcedo atthis</i>	AM,P	-	-	1	0.2	0	0	0	0
Eurasian Hoopoe	<i>Upupa epops</i>	W, SuM	-	-	0	0	1	0.4	0	0
Brown Shrike	<i>Lanius cristatus</i>	SpM	-	-	0	0	1	0.2	0	0
Long-tailed Shrike	<i>Lanius schach</i>	R	-	-	1	0.2	1	0.2	0	0
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	R	-	-	0	0	3	0.6	0	0
Chinese Bulbul	<i>Pycnonotus sinensis</i>	R	-	-	0	0	4	0.8	2	0.4
Barn Swallow	<i>Hirundo rustica</i>	SpM,SuM	-	-	16	3.6	0	0	0	0
Red-rumped Swallow	<i>Cecropis daurica</i>	M	-	-	4	0.8	0	0	0	0
Dusky Warbler	<i>Phylloscopus fuscatus</i>	W	-	-	1	0.6	8	2.2	1	0.2
Yellow-browed Warbler	<i>Phylloscopus inornatus</i>	W	-	-	0	0	8	2	0	0
Yellow-bellied Prinia	<i>Prinia flaviventris</i>	R	-	-	3	1	0	0	0	0
Masked Laughingthrush	<i>Garrulax perspicillatus</i>	R	-	-	0	0	6	2.4	1	0.2
Japanese White-eye	<i>Zosterops japonicus</i>	R,?W	-	-	0	0	4	0.8	0	0
Crested Myna	<i>Acridotheres cristatellus</i>	R	-	-	2	0.4	2	0.8	0	0
Black-collared Starling	<i>Gracupica nigricollis</i>	R	-	-	5	1.2	4	0.8	1	0.2
Chinese Blackbird	<i>Turdus mandarinus</i>	W,M	-	-	0	0	1	0.2	0	0
Oriental Magpie Robin	<i>Copsychus saularis</i>	R	-	-	1	0.4	2	0.6	1	0.2
Red-throated Flycatcher	<i>Ficedula albicilla</i>	AM,W	-	-	0	0.4	1	0.4	0	0
Stejneger's Stonechat	<i>Saxicola stejnegeri</i>	W,M	-	-	1	0.2	0	0	0	0
Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	-	-	7	1.4	0	0	0	0
Eastern Yellow Wagtail	<i>Motacilla tschutschensis</i>	M,W	-	-	2	0.6	0	0	0	0
Grey Wagtail	<i>Motacilla cinerea</i>	W	-	-	2	1.8	0	0	0	0

White Wagtail	<i>Motacilla alba</i>	W,R	-	-	6	7.6	1	0.4	0	0
Olive-backed Pipit	<i>Anthus hodgsoni</i>	W	-	-	8	3.4	2	0.4	0	0
Red-throated Pipit	<i>Anthus cervinus</i>	M,W	LC	-	2	0.4	0	0	0	0
Black-faced Bunting	<i>Emberiza spodocephala</i>	M,W	-	-	0	0	2	0.4	0	0
Total no. of species recorded						41		19		6

Notes:

- Dry season refers to November to March
- Principal status refers to Carey *et al.* (2001): R = Resident; W = Winter Visitor; Su = Summer Visitor; M = Migrant; A = Autumn; Sp = Spring; P = Present all year, exact composition unknown.
- Conservation status refers to Fellowes *et al.* (2002), Jiang *et al.* (2016), IUCN (2017).
Conservation status by Fellowes *et al.* (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
Conservation status by Jiang *et al.* (2016): RLCV(EN)= Endangered
Conservation status by IUCN (2017): EN = Endangered.
- Protection status refers to CSIS (2017), Cap. 170
Protection status by China State Major Protection Status (CSMPS) (CSIS 2017): II = Class II Protected Species in China.
All wild birds in Hong Kong are protected under Cap. 170.

Appendix B

Table 11: Bird species recorded during wet season in the San Tin Eastern Main Channel (August 2016 – October 2016; April – July 2017)

Common Name	Scientific Name	Principal Status ²	Conservation Status ³	Protection Status ⁴	Habitats					
					River Channel		Constructed Wetland		Developed Area	
					Max	Monthly Mean	Max	Monthly Mean	Max	Monthly Mean
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	P	(LC)	-	0	0	1	0.1	0	0
Chinese Pond Heron	<i>Ardeola bacchus</i>	P	PRC (RC)	-	2	1.1	1	0.1	0	0
Grey Heron	<i>Ardea cinerea</i>	W	PRC	-	6	1.4	0	0	0	0
Great Egret	<i>Ardea alba</i>	P	PRC (RC)	-	3	0.9	5	0.7	0	0
Little Egret	<i>Egretta garzetta</i>	P	PRC (RC)	-	8	3.7	0	0	0	0
Great Cormorant	<i>Phalacrocorax carbo</i>	W	PRC	-	1	0.1	0	0	0	0
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	R	-	-	2	0.4	1	0.1	0	0
Black-winged Stilt	<i>Himantopus himantopus</i>	W	RC	-	10	6.4	0	0	0	0
Common Snipe	<i>Gallinago gallinago</i>	W	-	-	7	1.1	0	0	0	0
Common Redshank	<i>Tringa totanus</i>	W	RC	-	10	1.4	0	0	0	0
Common Greenshank	<i>Tringa nebularia</i>	M,W	RC	-	1	0.1	0	0	0	0
Green Sandpiper	<i>Tringa ochropus</i>	W	-	-	4	1.9	1	0.1	0	0
Wood Sandpiper	<i>Tringa glareola</i>	M,W	LC	-	45	9.1	2	0.3	0	0
Common Sandpiper	<i>Actitis hypoleucos</i>	M,W	-	-	3	0.9	0	0	0	0
Domestic Pigeon	<i>Columba livia</i>	R	-	-	0	0	1	0.1	0	0
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	-	-	-	1	0.1	2	0.6	0	0
Spotted Dove	<i>Spilopelia chinensis</i>	R	-	-	2	0.3	5	1.9	4	1.1
Greater Coucal	<i>Centropus sinensis</i>	R	CRDB (Vu)	-	0	0	1	0.1	0	0
Common Kingfisher	<i>Alcedo atthis</i>	AM,P	-	-	1	0.1	1	0.1	0	0
Long-tailed Shrike	<i>Lanius schach</i>	R	-	-	2	0.3	1	0.1	0	0
Black Drongo	<i>Dicrurus macrocercus</i>	M,Su	-	-	0	0.0	2	0.3	0	0
Large-billed Crow	<i>Corvus macrorhynchos</i>	R	-	-	1	0.1	0	0	0	0
Cinereous Tit	<i>Parus cinereus</i>	R	-	-	0	0	2	0.3	0	0
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	R	-	-	0	0	2	0.3	0	0
Sooty-headed Bulbul	<i>Pycnonotus aurigaster</i>	R	-	-	2	0.3	0	0	0	0
Barn Swallow	<i>Hirundo rustica</i>	SpM,Su	-	-	3	0.4	5	0.7	0	0
Yellow-bellied Prinia	<i>Prinia flaviventris</i>	R	-	-	3	0.4	2	0.3	0	0
Plain Prinia	<i>Prinia inornata</i>	R	-	-	2	0.7	0	0	0	0
Common Tailorbird	<i>Orthotomus sutorius</i>	R	-	-	0	0	2	0.4	0	0
Japanese White-eye	<i>Zosterops japonicus</i>	R,?W	-	-	4	0.6	2	0.3	0	0
Crested Myna	<i>Acridotheres cristatellus</i>	R	-	-	5	1.4	10	1.4	0	0
Common Myna	<i>Acridotheres tristis</i>	R	-	-	0	0	2	0.6	0	0
Black-collared Starling	<i>Gracupica nigricollis</i>	R	-	-	1	0.1	10	1.9	0	0
Oriental Magpie Robin	<i>Copsychus saularis</i>	R	-	-	1	0.3	5	1.4	1	0.3
Scaly-breasted Munia	<i>Lonchura punctulata</i>	R	-	-	10	2.4	5	0.7	0	0
Grey Wagtail	<i>Motacilla cinerea</i>	W	-	-	1	0.1	0	0	0	0
White Wagtail	<i>Motacilla alba</i>	W,R	-	-	6	2.7	2	0.6	0	0
Total no. of species recorded					29		25		2	

Notes:

1. Wet season refers to April to October.
2. Principal status refers to Carey *et al.* (2001): R = Resident; W = Winter Visitor; Su = Summer Visitor; M = Migrant; A = Autumn; Sp = Spring; P = Present all year, exact composition unknown.
3. Conservation status refers to Fellowes *et al.* (2002), China Red Data Book of Endangered Animals: Aves (Zheng & Wang 1998).
Conservation status by Fellowes *et al.* (2002): LC = Local Concern; PRC = Potential Regional Concern; RC = Regional Concern; PGC = Potential Global Concern; GC = Global Concern.
Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
Conservation status by Zheng & Wang (1998): E = Endangered, V = Vulnerable, R = Rare, I = Indeterminate.
Conservation status by IUCN (2017): NT = Near Threatened; VU = Vulnerable; EN = Endangered.
4. All wild birds in Hong Kong are protected under Cap. 170.

Appendix B

Table 12: Mammal species recorded in the San Tin Eastern Main Channel during August 2016 to July 2017

Common Name	Scientific Name	Commonness ¹	Conservation Status ²	Protection Status ^{3,4,5}
Small Asian Mongoose	<i>Herpestes javanicus</i>	Uncommon	RLCV(VU)	CITES(III); Cap.170; Cap.586
Total no. of species recorded				1

Notes:

1. Commonness refers to the Hong Kong Biodiversity Database (AFCD 2017).
2. Conservation status refers to Jiang *et al.* 2016: VU = Vulnerable.
3. Protection status refers to CITES (2017): III = Listed in CITES Appendix III.
4. Cap. 170 = Wild Animals Protection Ordinance.
5. Cap. 586 = Protection of Endangered Species of Animals and Plants Ordinance.

Appendix B

Table 13: Reptile species recorded in the San Tin Eastern Main Channel during August 2016 to July 2017

Common Name	Scientific Name	Distribution in Hong Kong ¹	Conservation Status	Protection Status	Habitats ²	
					River Channel	Developed Area
Red-eared Slider	<i>Trachemys scripta</i>	Widely distributed and common; in reservoirs or ponds in urban parks	-	-	6	0
Bowring's Gecko	<i>Hemidactylus bowringii</i>	Distributed throughout Hong Kong	-	-	0	10
Total no. of species recorded					1	1

Note:

1. Distribution in Hong Kong refers to Hong Kong Biodiversity Database (AFCD 2017).
2. Refers to the total count of the species recorded throughout field surveys.

Appendix B

Table 14: Butterfly species recorded in the San Tin Eastern Main Channel during August 2016 to July 2017

Common Name	Scientific Name	Commonness ¹	Conservation Status	Protection Status	Habitats ²		
					River Channel	Developed Area	Constructed Wetland
Dark Cerulean	<i>Jamides bochus</i>	Common	-	-	0	0	1
Pale Grass Blue	<i>Pseudoizeeria maha</i>	Very Common	-	-	1	0	2
Common Nawab	<i>Polyura athamas</i>	Uncommon	-	-	0	0	1
Common Tiger	<i>Danaus genutia</i>	Common	-	-	0	0	1
Angled Castor	<i>Ariadne ariadne</i>	Common	-	-	0	0	1
Rustic	<i>Cupha erymanthis</i>	Very Common	-	-	0	0	1
Great Egg-fly	<i>Hypolimnas bolina</i>	Common	-	-	0	0	2
Common Sailer	<i>Neptis hylas</i>	Very Common	-	-	1	0	0
Common Bluebottle	<i>Graphium sarpedon</i>	Very Common	-	-	1	0	0
Common Mormon	<i>Papilio polytes</i>	Very Common	-	-	0	0	1
Lemon Emigrant	<i>Catopsilia pomona</i>	Common	-	-	2	3	3
Common Grass Yellow	<i>Eurema hecabe</i>	Very Common	-	-	2	0	3
Red-base Jezebel	<i>Delias pasithoe</i>	Very Common	-	-	0	2	0
Indian Cabbage White	<i>Pieris canidia</i>	Very Common	-	-	2	2	4
Total no. of species recorded					6	3	11

Note:

1. Commonness refers to Hong Kong Biodiversity Database (AFCD 2017).
2. Refers to the total count of the species recorded throughout field surveys.

Appendix B

Table 15: Odonate species recorded in the San Tin Eastern Main Channel during August 2016 to July 2017

Common Name	Scientific Name	Commonness ¹	Conservation Status	Protection Status	Habitats ²	
					River Channel	Constructed Wetland
Midget	<i>Agriocnemis</i> sp.	-	-	-	0	2
Orange-tailed Sprite	<i>Ceragrion auranticum</i>	Abundant	-	-	0	1
Common Bluetail	<i>Ischnura senegalensis</i>	Abundant	-	-	0	8
Common Flangetail	<i>Ictinogomphus pertinax</i>	Common	-	-	1	0
Asian Pintail	<i>Acisoma panorpoides</i>	Common	-	-	0	2
Blue Dasher	<i>Brachydiplax chalybea</i>	Common	-	-	0	3
Pied Percher	<i>Neurothemis tullia</i>	Common	-	-	0	1
Common Red Skimmer	<i>Orthetrum pruinosum</i>	Abundant	-	-	1	1
Green Skimmer	<i>Orthetrum sabina</i>	Abundant	-	-	2	3
Wandering Glider	<i>Pantala flavescens</i>	Abundant	-	-	50	20
Pied Skimmer	<i>Pseudothemis zonata</i>	Common	-	-	0	1
Variegated Flutterer	<i>Rhyothemis variegata</i>	Common	-	-	20	5
Evening Skimmer	<i>Tholymis tillarga</i>	Common	-	-	1	0
Total no. of species recorded					6	11

Note:

1. Commonness refers to Hong Kong Biodiversity Database (AFCD 2017).
2. Refers to the total count of the species recorded throughout field surveys.

Appendix B

Table 16: Fish species recorded in the San Tin Eastern Main Channel during August 2016 to July 2017




Common Name	Scientific Name	Commonness ¹	Conservation Status ²	Habitats	
				River Channel	Constructed Wetland
Common Carp	<i>Cyprinus carpio</i>	-	IUCN(VU) ³	2	0
North African Catfish	<i>Clarias gariepinus</i>	-	-	3	0
Nile Tilapia	<i>Oreochromis niloticus</i>	Common, introduced	-	100	0
Spotted Snakehead	<i>Channa maculata</i>	-	-	20	0
Snakehead Murrel	<i>Channa striata</i>	Uncommon, introduced	-	0	1
Total no. of species recorded				4	1

Notes:

1. Commonness refers to Hong Kong Biodiversity Database (AFCD 2017).
2. Conservation status refers to IUCN (2017): VU = Vulnerable.
3. The conservation status for the Common Carp refer to the native population only but not the captive one.

Appendix B

Table 17 Representative Habitat Photos

	River Channel
	Constructed Wetland
	Developed Area

Appendix - B

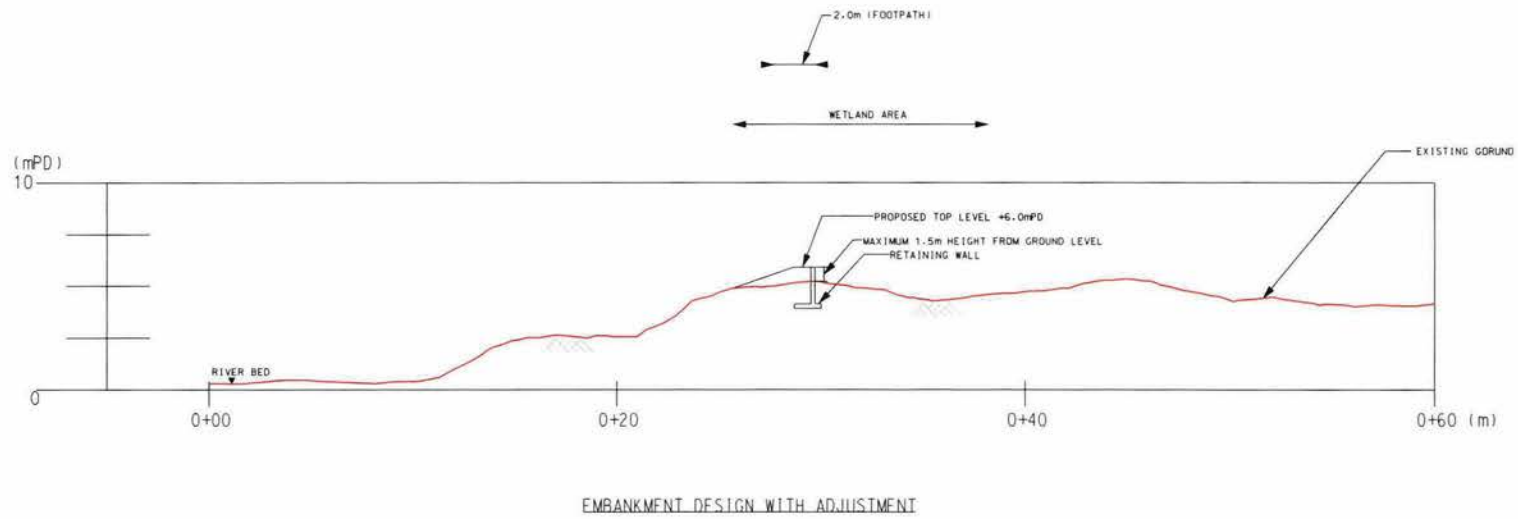
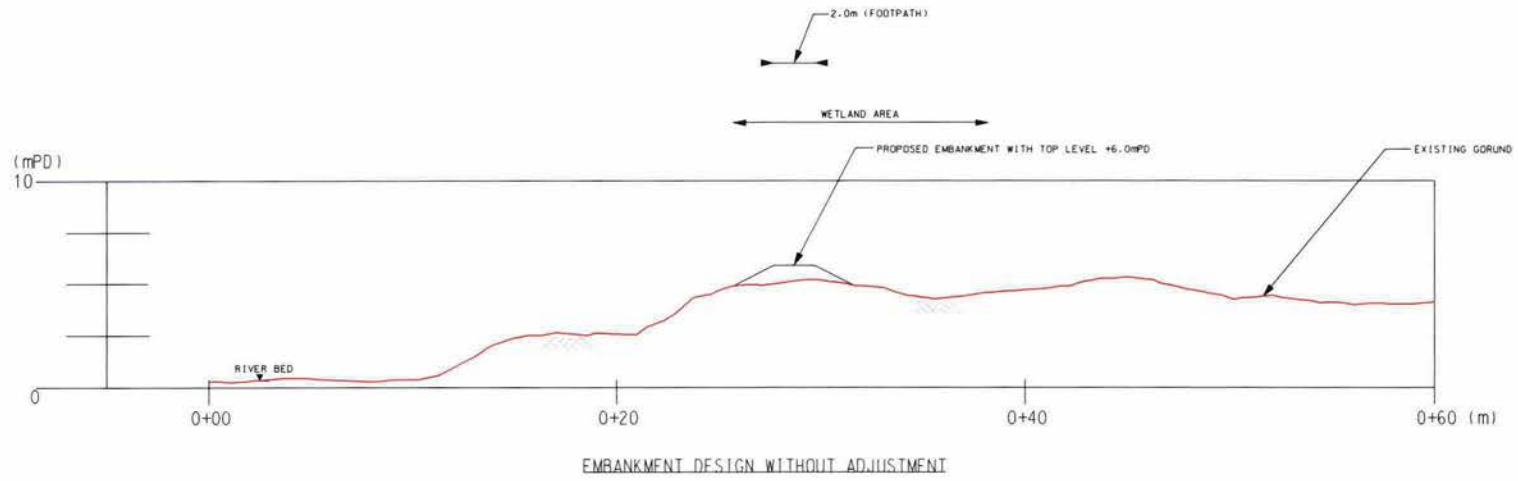
Diagram 1 - Indicative Diagram on Ecological Features

<p>LEGEND ANIMAL TRACK</p> <p>SIMILAR LADDER AT THE OTHER SIDE.</p> <p>BLOW UP</p> <p>FLOOD WALL</p> <p>LADDER TO FACILITATE SMALL ANIMAL CLIMB OVER.</p> <p>This diagram shows a 3D perspective of a flood wall with a ladder-like structure on top. Green arrows indicate animal tracks crossing the ladder. A circular 'BLOW UP' inset shows a close-up of the ladder rungs with a small animal on top. A label points to a 'SIMILAR LADDER AT THE OTHER SIDE'.</p>	<p>Sketch Diagram of animal ladder (Indicative Diagram: Not to Scale)</p>
<p>BLOW UP</p> <p>DIA. 300MM</p> <p>FLOOD WALL</p> <p>HOLE IN FLOOD WALL TO FACILITATE SMALL ANIMAL PASSAGE.</p> <p>This diagram shows a 3D perspective of a flood wall with a circular hole. A circular 'BLOW UP' inset shows a close-up of the hole with a small animal passing through. A label indicates the hole's diameter is 'DIA. 300MM'.</p>	<p>Sketch Diagram of animal corridor</p>

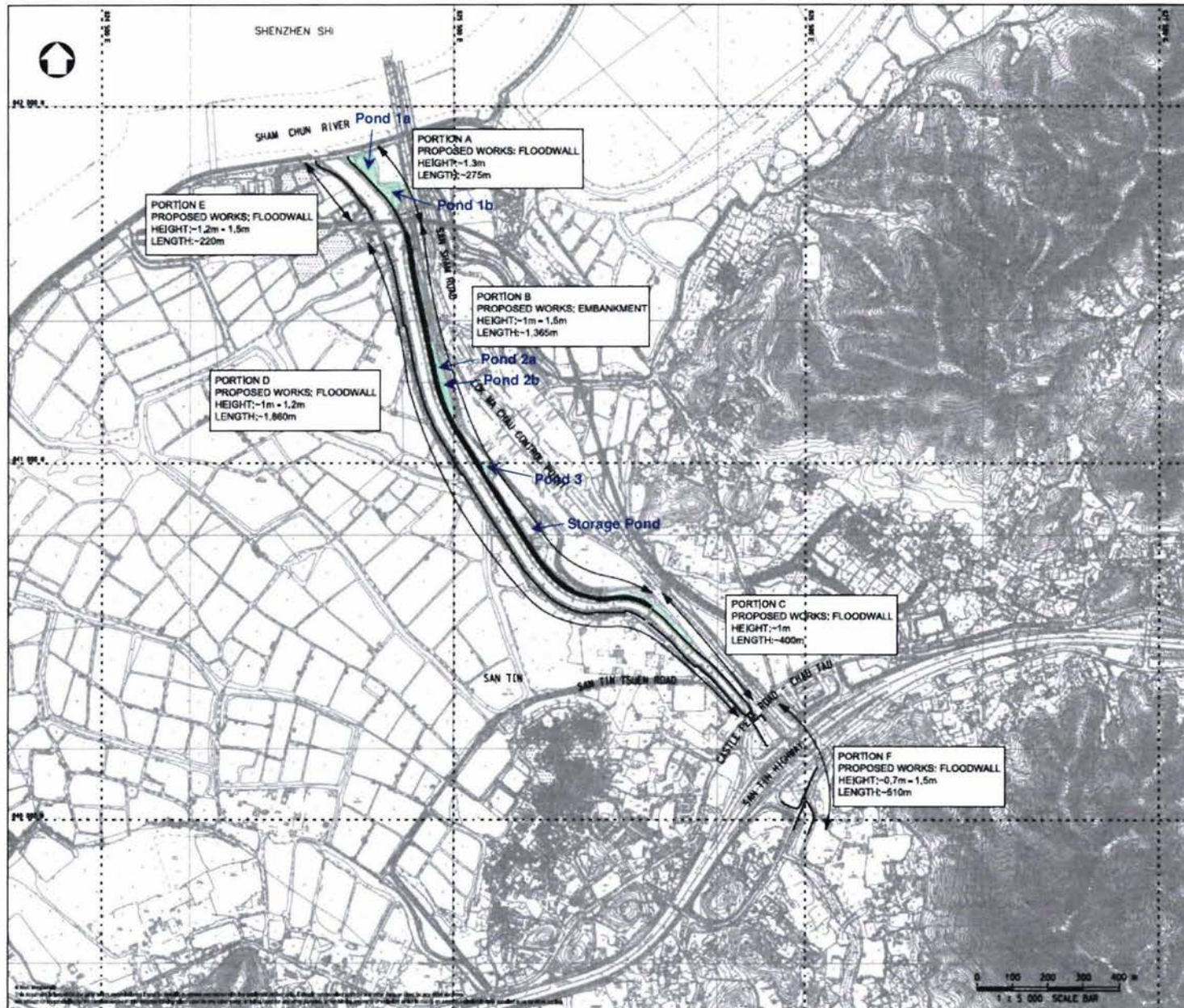
Note:

The diagrams are not to scale and for design intent only.

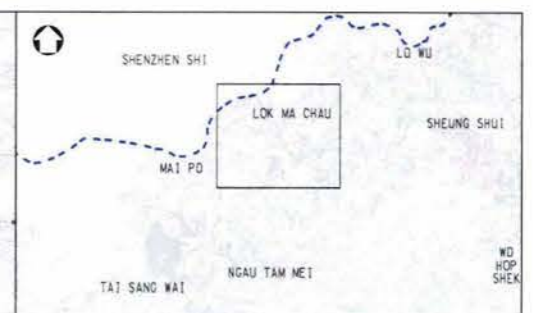
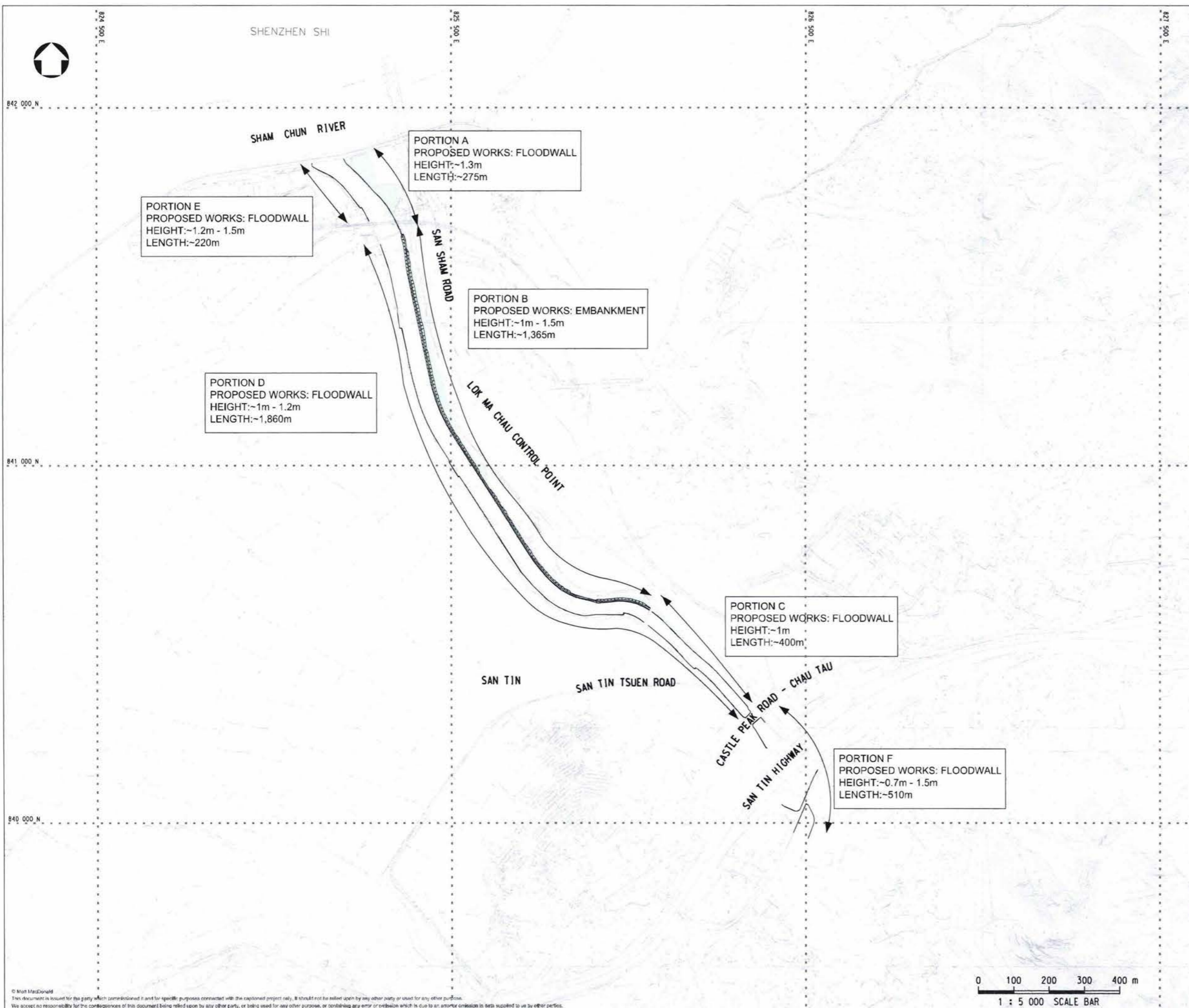
Appendix - B
 Diagram 2 - Embankment Design with and without Adjustment at the Narrowest Section of the Constructed Wetland



Appendix B
Diagram 3 – Indicative Locations of Ponds and Storage Pond



Figures



KEY PLAN (1:100000)

LEGEND:
 — EXISTING CONSTRUCTED WETLAND
 — PROPOSED WORKS

Rev	Date	Drawn	Description	Chk'd	App'd
P3	JUL 18	KT	THIRD ISSUE	FC	SHC
P2	FEB 18	KT	SECOND ISSUE	FC	SHC
P1	AUG 17	KT	FIRST ISSUE	FC	SHC

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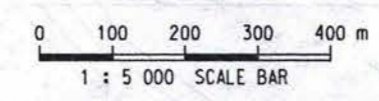
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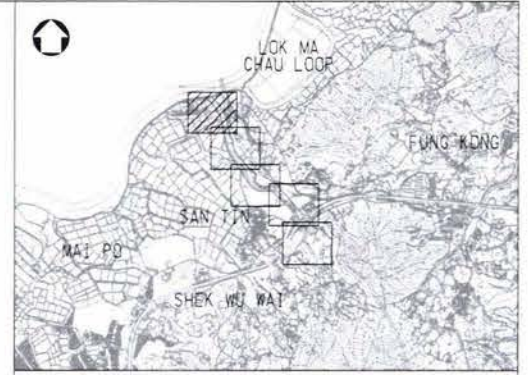
Project
 AGREEMENT NO. CE 78/2014(DS)
 DRAINAGE IMPROVEMENT WORKS
 AT NORTH DISTRICT - PACKAGE B -
 INVESTIGATION

Title
 LAYOUT PLAN OF THE
 PROPOSED WORKS
 AT SAN TIN
 EASTERN MAIN CHANNEL

Designed	FC	Eng check	GC
Drawn	MING	Coordination	MT
Dwg check	FC	Approved	SHC
Scale at A1	1:5000	Status	PRE
Rev			P3

Drawing Number: **FIGURE 1.1**





KEY PLAN
SCALE 1 : 50000

NOTES :

1. ALL GRIDS ARE HONG KONG METRIC GRID 1980.
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.) OF HONG KONG UNLESS SHOWN OTHERWISE.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.

LEGEND :

- PROPOSED FLOOD WALL
- PROPOSED FLOOD GATE
- EXISTING CONSTRUCTED WETLAND

Rev	Date	Drawn	Description	Ch'kd	App'd
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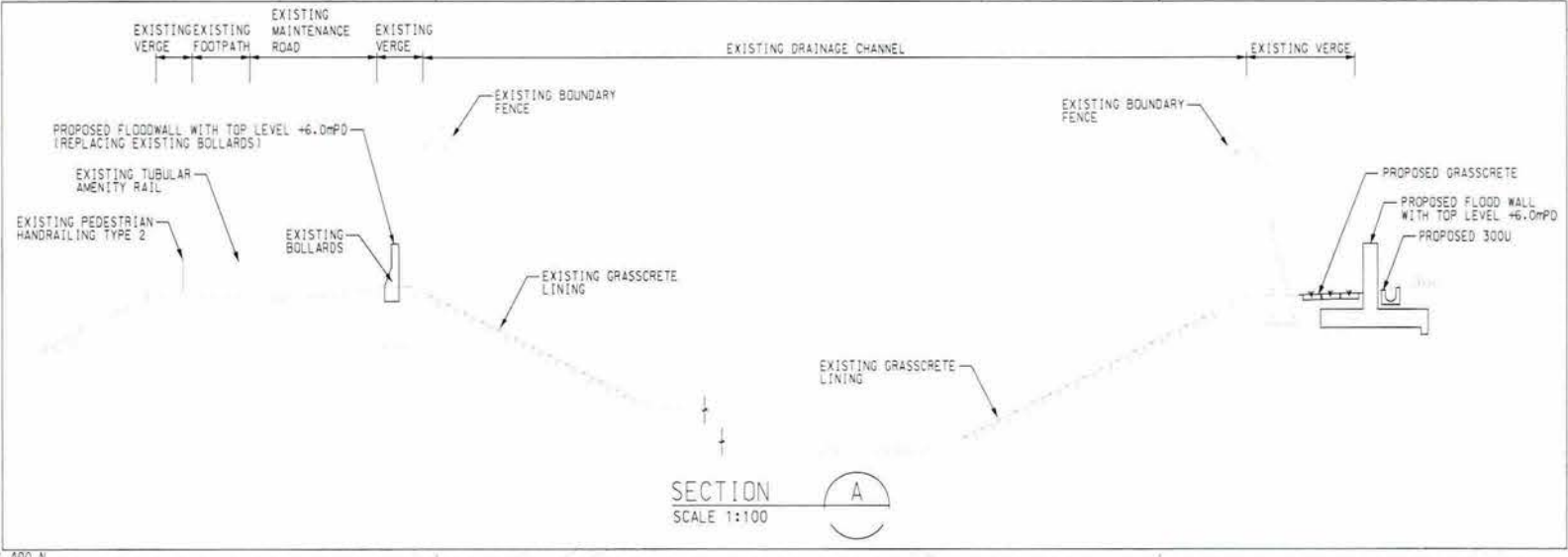
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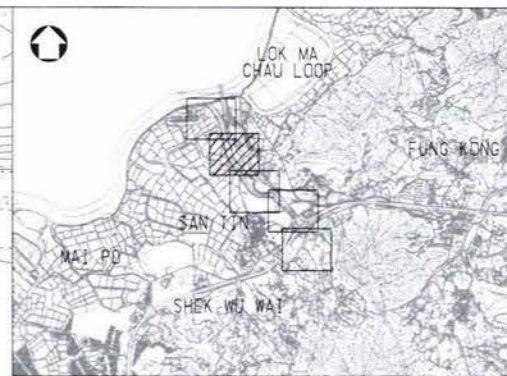
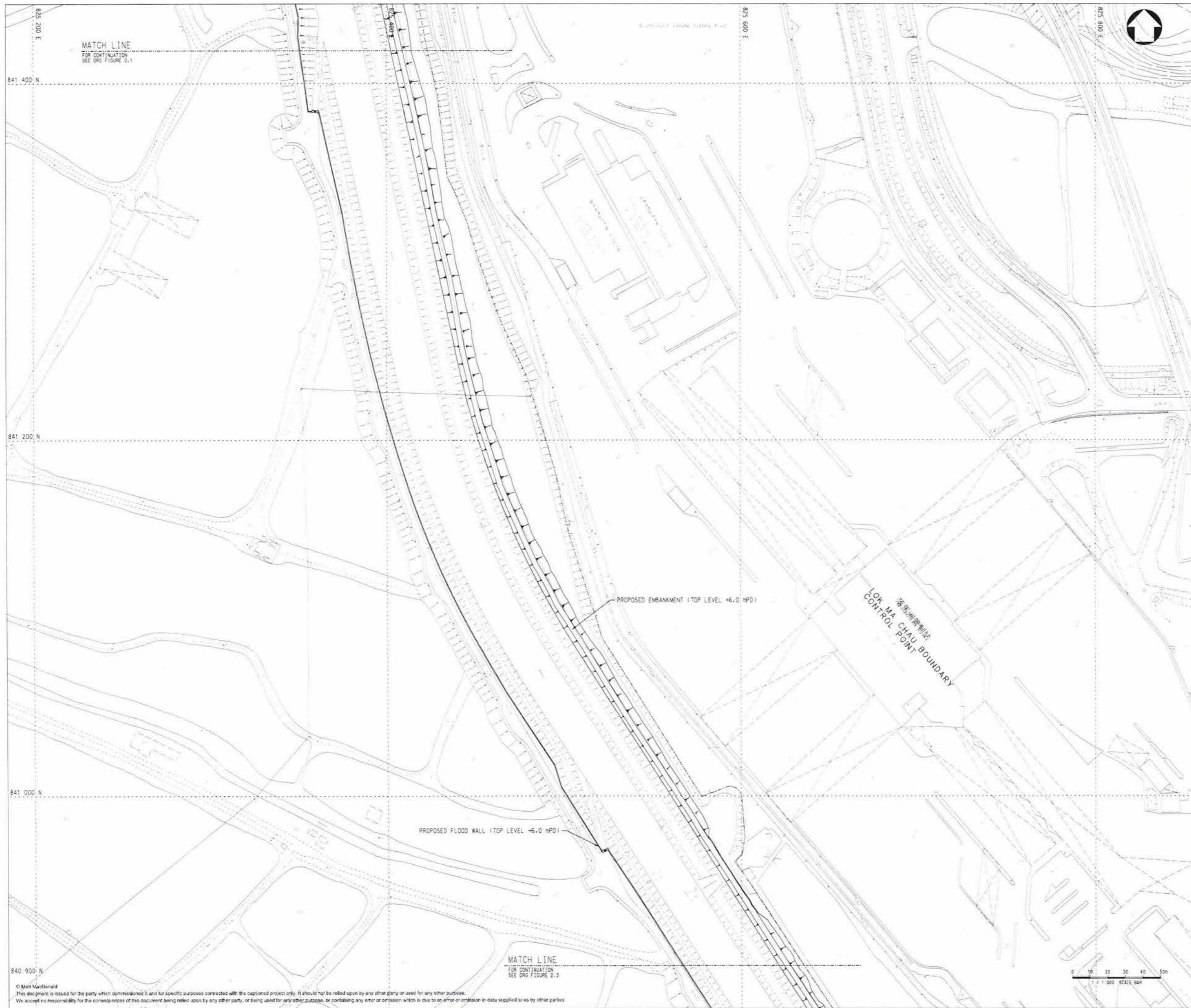
Project:
**AGREEMENT NO. CE 78/2014(DS)
DRAINAGE IMPROVEMENT WORKS
AT NORTH DISTRICT - PACKAGE B -
INVESTIGATION**

Title:
**PROPOSED DRAINAGE
IMPROVEMENT WORKS
AT SAN TIN EASTERN MAIN
CHANNEL (SHEET 1 OF 5)**

Designed	KL	Eng check	MT
Drawn	LKK	Coordination	MT
Dwg check	MT	Approved	SHC
Scale at A1	1:1000(A1)	Status	PRE
Drawing Number		Rev	C

FIGURE 2.1





KEY PLAN
SCALE 1 : 50000

- NOTES :
1. ALL GRIDS ARE HONG KONG METRIC GRID 1980.
 2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.) OF HONG KONG UNLESS SHOWN OTHERWISE.
 3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.

- LEGEND :
- PROPOSED FLOOD WALL
 - ⊗ PROPOSED FLOOD GATE
 - EXISTING CONSTRUCTED WETLAND

Rev	Date	Drawn	Description	Ch'kd	App'd
C	JUL 18	KT	THIRD ISSUE	MT	SHC
B	FEB 18	KT	SECOND ISSUE	MT	SHC
A	AUG 17	LKK	FIRST ISSUE	MT	SHC

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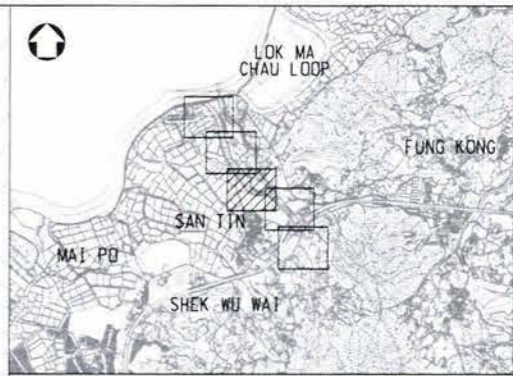
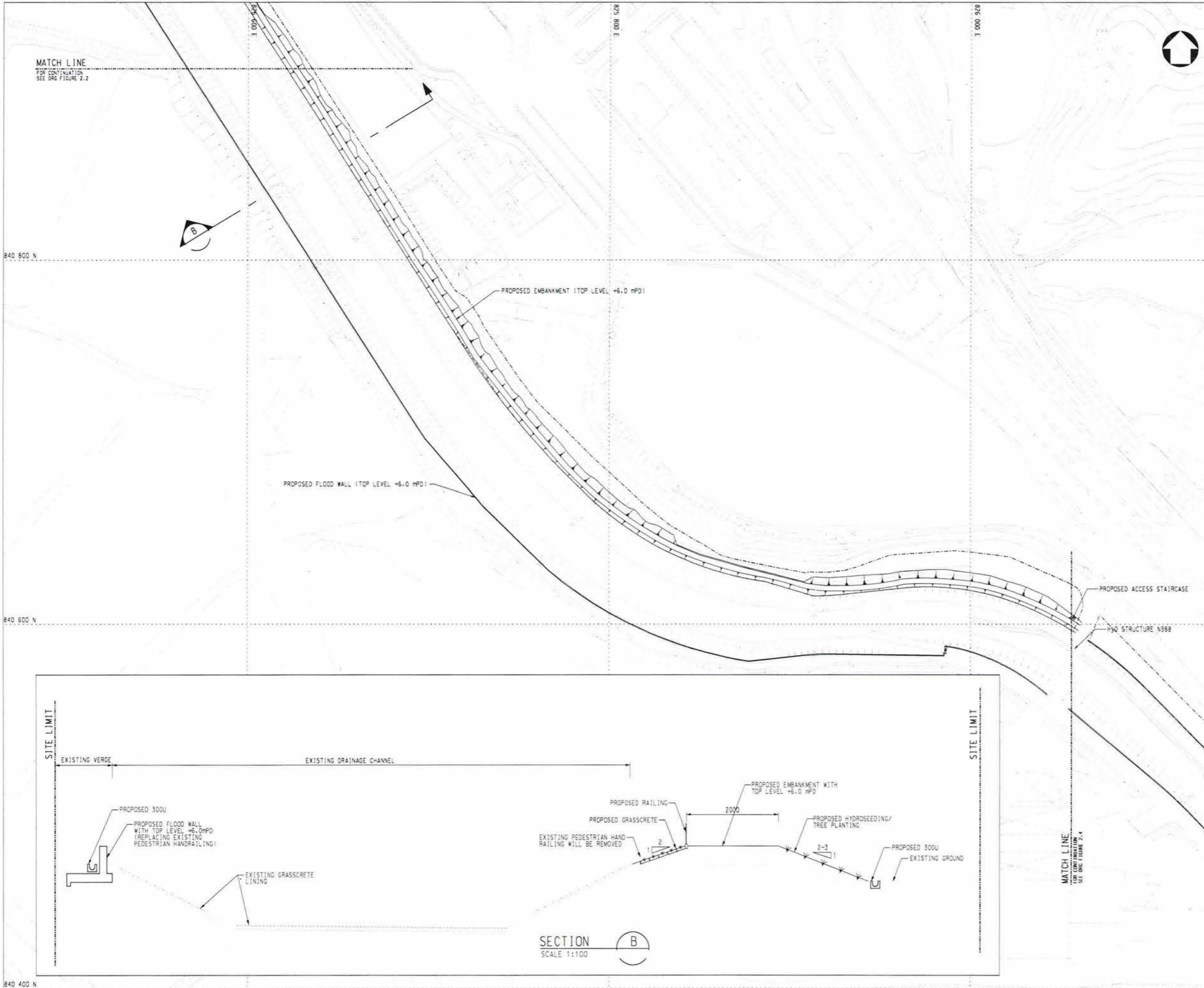
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DRAINAGE IMPROVEMENT WORKS
AT NORTH DISTRICT - PACKAGE B -
INVESTIGATION**

Title:

**PROPOSED DRAINAGE
IMPROVEMENT WORKS
AT SAN TIN EASTERN MAIN
CHANNEL (SHEET 2 OF 5)**

Designed	KL	Eng check	MT
Drawn	LKK	Coordination	MT
Dwg check	MT	Approved	SHC
Scale at A1	Status	Rev	
1:1000(A1)	PRE	C	

Drawing Number **FIGURE 2.2**



KEY PLAN
SCALE 1 : 50000

- NOTES :**
1. ALL GRIDS ARE HONG KONG METRIC GRID 1980.
 2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.) OF HONG KONG UNLESS SHOWN OTHERWISE.
 3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.

LEGEND :

	PROPOSED FLOOD WALL
	PROPOSED FLOOD GATE
	EXISTING CONSTRUCTED WETLAND

Rev	Date	Drawn	Description	Chk'd	App'd
C	JUL 16	KT	THIRD ISSUE	MT	SHC
B	FEB 16	KT	SECOND ISSUE	MT	SHC
A	AUG 17	LKK	FIRST ISSUE	MT	SHC

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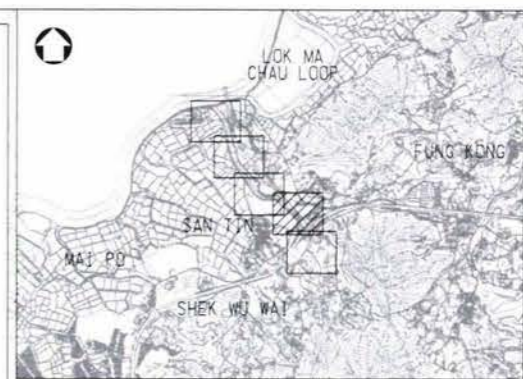
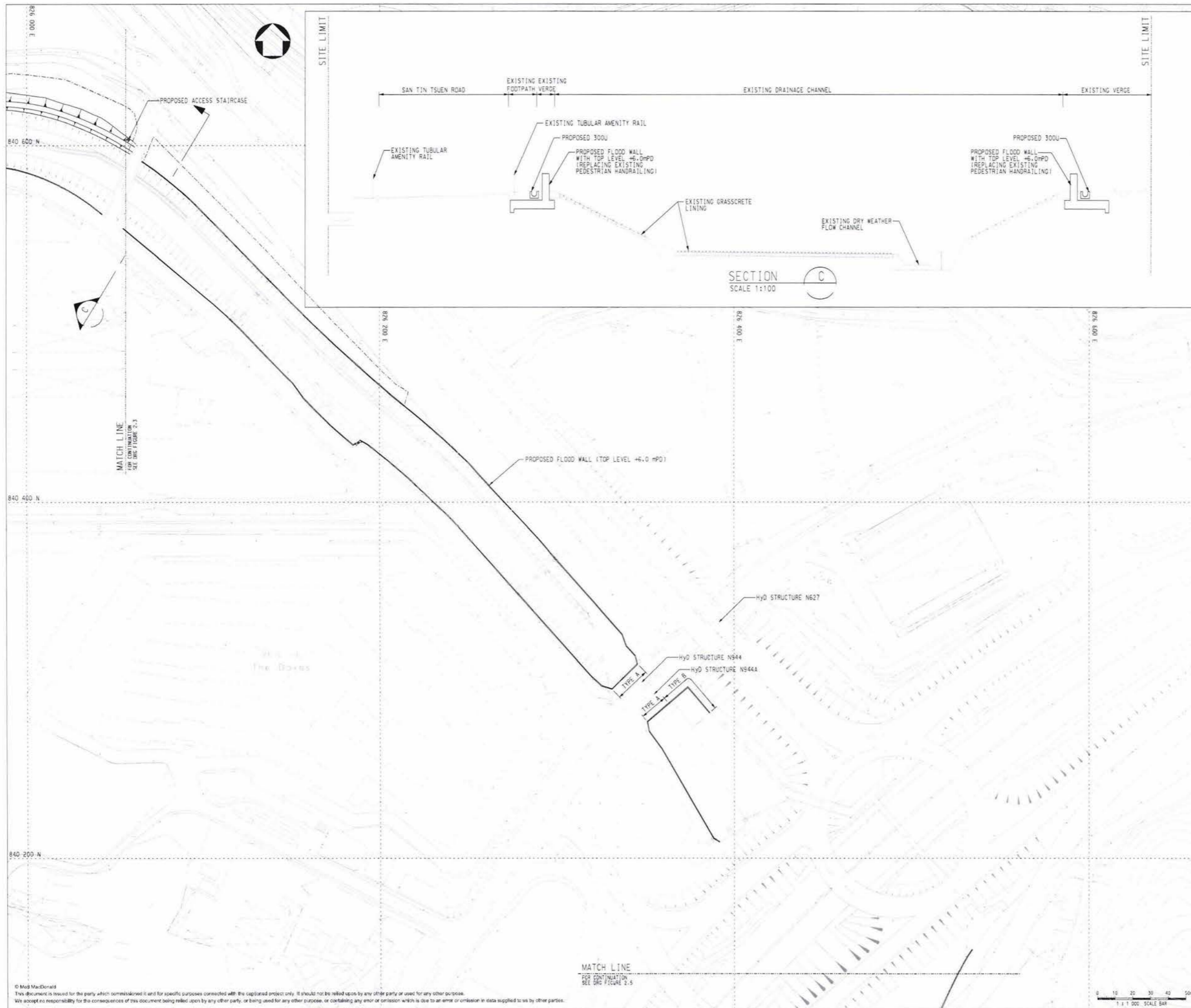
Title
**PROPOSED DRAINAGE
IMPROVEMENT WORKS
AT SAN TIN EASTERN MAIN
CHANNEL (SHEET 3 OF 5)**

Designed	KL	Eng check	MT
Drawn	LKK	Coordination	MT
Dwg check	MT	Approved	S-HC

Scale at A1
1:1000(A1) Status **PRE** Rev **C**

Drawing Number
FIGURE 2.3





KEY PLAN
SCALE 1 : 50000

- NOTES :
1. ALL GRIDS ARE HONG KONG METRIC GRID 1980.
 2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.) OF HONG KONG UNLESS SHOWN OTHERWISE.
 3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.
 5. FOR TYPE A AND TYPE B FLOOD WALL TYPICAL CROSS SECTION, PLEASE REFER TO DRG. NO. MH/351109/GA/STMEC/1005

- LEGEND :
- PROPOSED FLOOD WALL
 - PROPOSED FLOOD GATE
 - EXISTING CONSTRUCTED WETLAND

Rev	Date	Drawn	Description	Ch'kd	App'd
C	JUL 18	KT	THIRD ISSUE	MT	SHC
B	FEB 18	KT	SECOND ISSUE	MT	SHC
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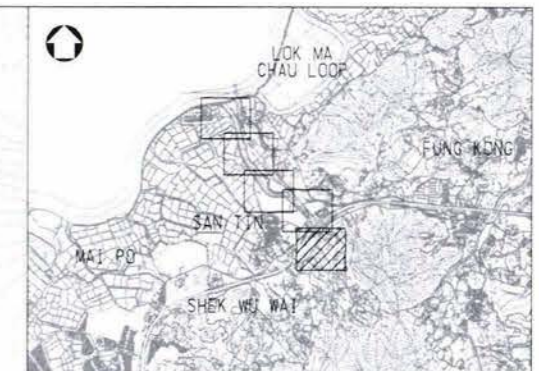
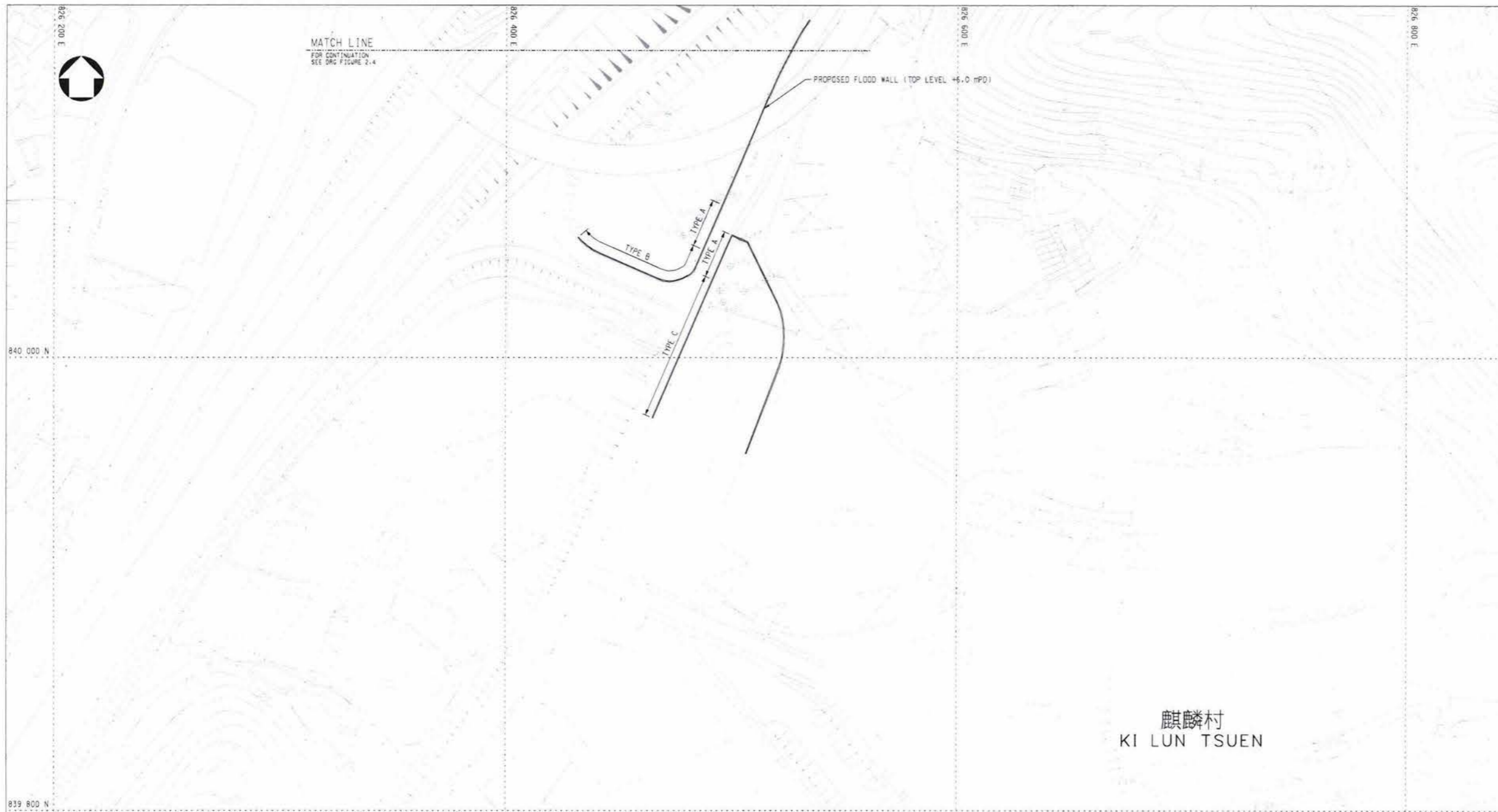
Client:

DS The Government of the Hong Kong
Special Administrative Region
Drainage Services Department

Project:
**AGREEMENT NO. CE 78/2014(DS)
DRAINAGE IMPROVEMENT WORKS
AT NORTH DISTRICT - PACKAGE B -
INVESTIGATION**

Title: **PROPOSED DRAINAGE
IMPROVEMENT WORKS
AT SAN TIN EASTERN MAIN
CHANNEL (SHEET 4 OF 5)**

Designed	KL	Eng check	MT
Drawn	LKK	Coordination	MT
Dwg check	MT	Approved	SHC
Scale at A1	Status	Rev	
1:1000(A1)	PRE	C	
Drawing Number	FIGURE 2.4		



KEY PLAN
SCALE 1 : 50000

- NOTES :
1. ALL GRIDS ARE HONG KONG METRIC GRID 1980.
 2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.) OF HONG KONG UNLESS SHOWN OTHERWISE.
 3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
 4. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSE.

- LEGEND :
- PROPOSED FLOOD WALL
 - ⊠ PROPOSED FLOOD GATE

Rev	Date	Drawn	Description	Ch'k'd	App'd
C	JUL 18	KT	THIRD ISSUE	MT	SHC
B	FEB 18	KT	SECOND ISSUE	MT	SHC
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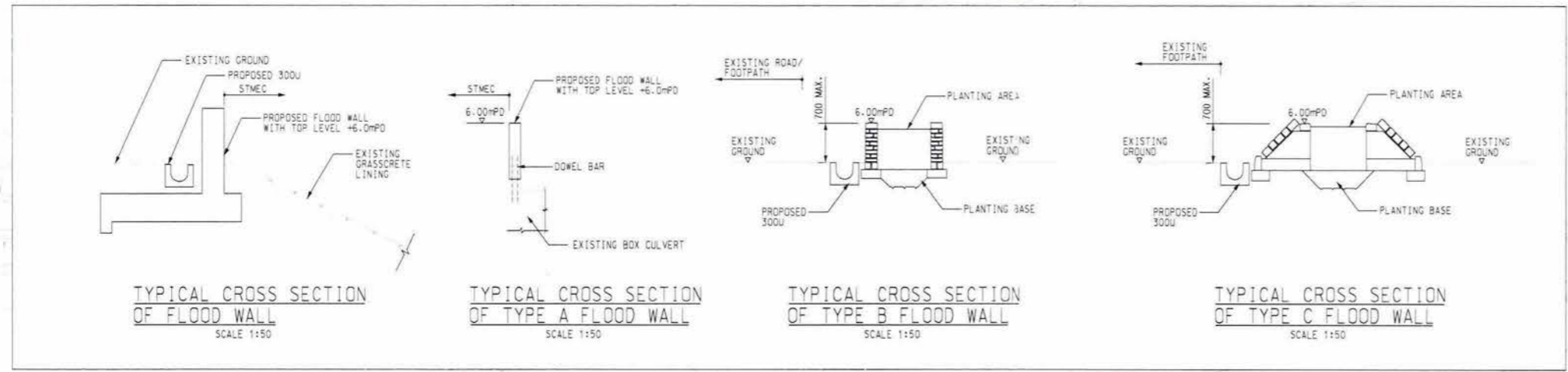
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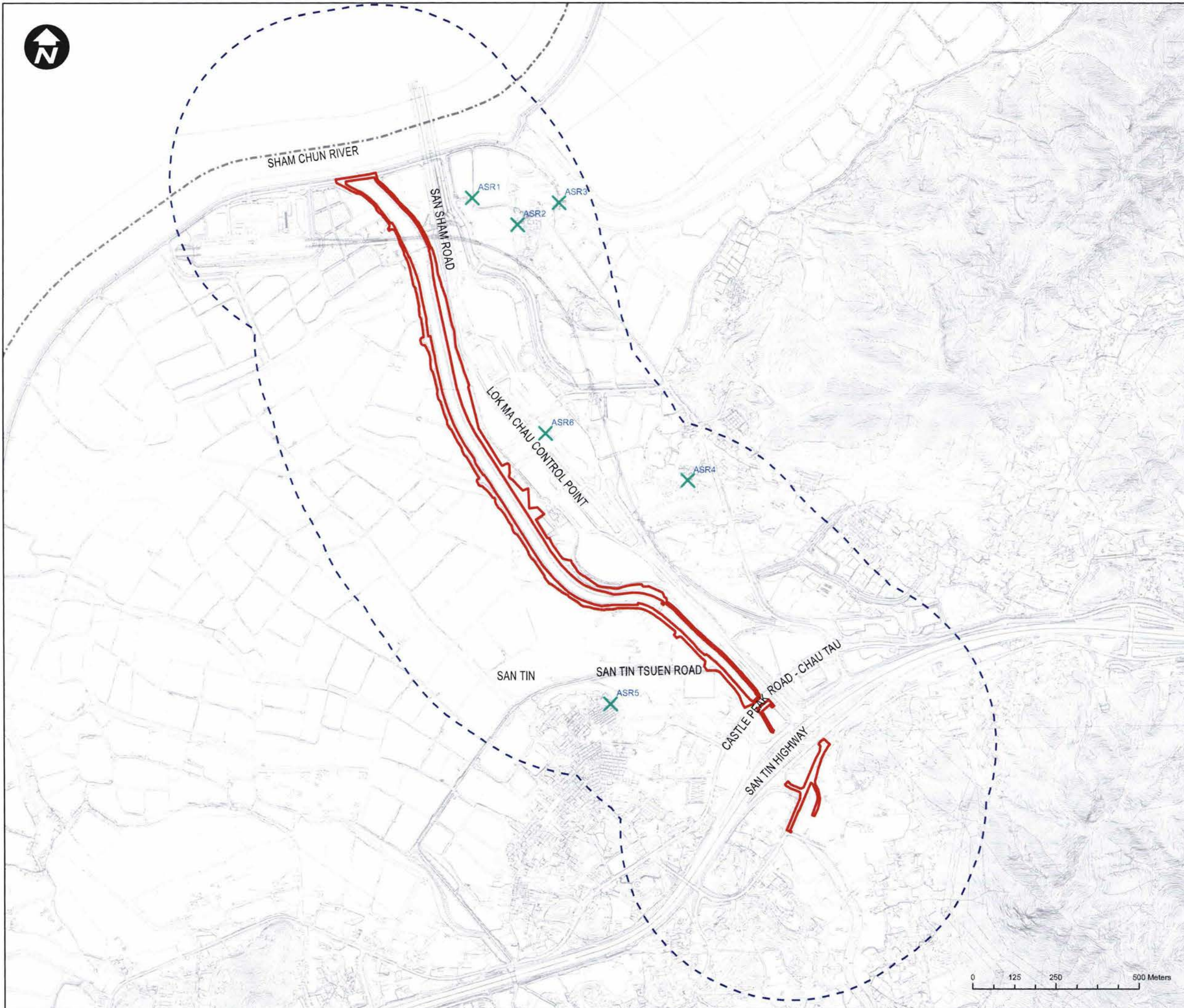
Project:
**AGREEMENT NO. CE 78/2014(DS)
DRAINAGE IMPROVEMENT WORKS
AT NORTH DISTRICT - PACKAGE B -
INVESTIGATION**

Title:
**PROPOSED DRAINAGE
IMPROVEMENT WORKS
AT SAN TIN EASTERN MAIN
DRAINAGE CHANNEL
(SHEET 5 OF 5)**

Designed	KL	Eng check	MT
Drawn	LKK	Coordination	MT
Dwg check	MT	Approved	SHC
Scale at A1 1:1000(A1)	Status PRE	Rev	C

Drawing Number: **FIGURE 2.5**





Notes

1. ALL LEVELS ARE METRES TO PRINCIPAL DATUM (PD) UNLESS NOTED OTHERWISE.
2. ALL CO-ORDINATES REFER TO HONG KONG 1980 METRIC GRID CO-ORDINATES SYSTEM.
3. PIPE AND BOX CULVERT SIZES ARE SHOWN IN MILLIMETERS

Key to symbols

LEGEND

- 500M STUDY AREA
- PROPOSED WORKS BOUNDARY
- AIR SENSITIVE RECEIVERS

Rev	Date	Drawn	Description	Ch'k'd	App'd

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AT NORTH DISTRICT - PACKAGE B-
INVESTIGATION

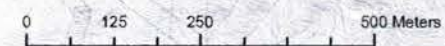
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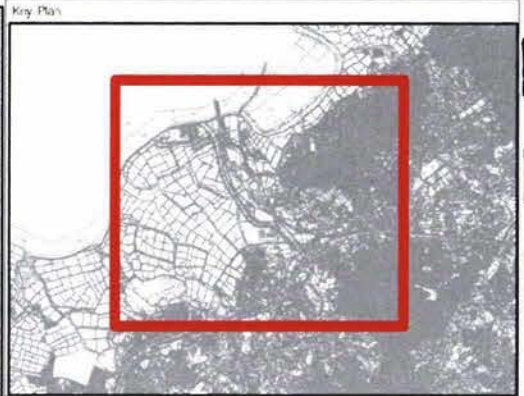
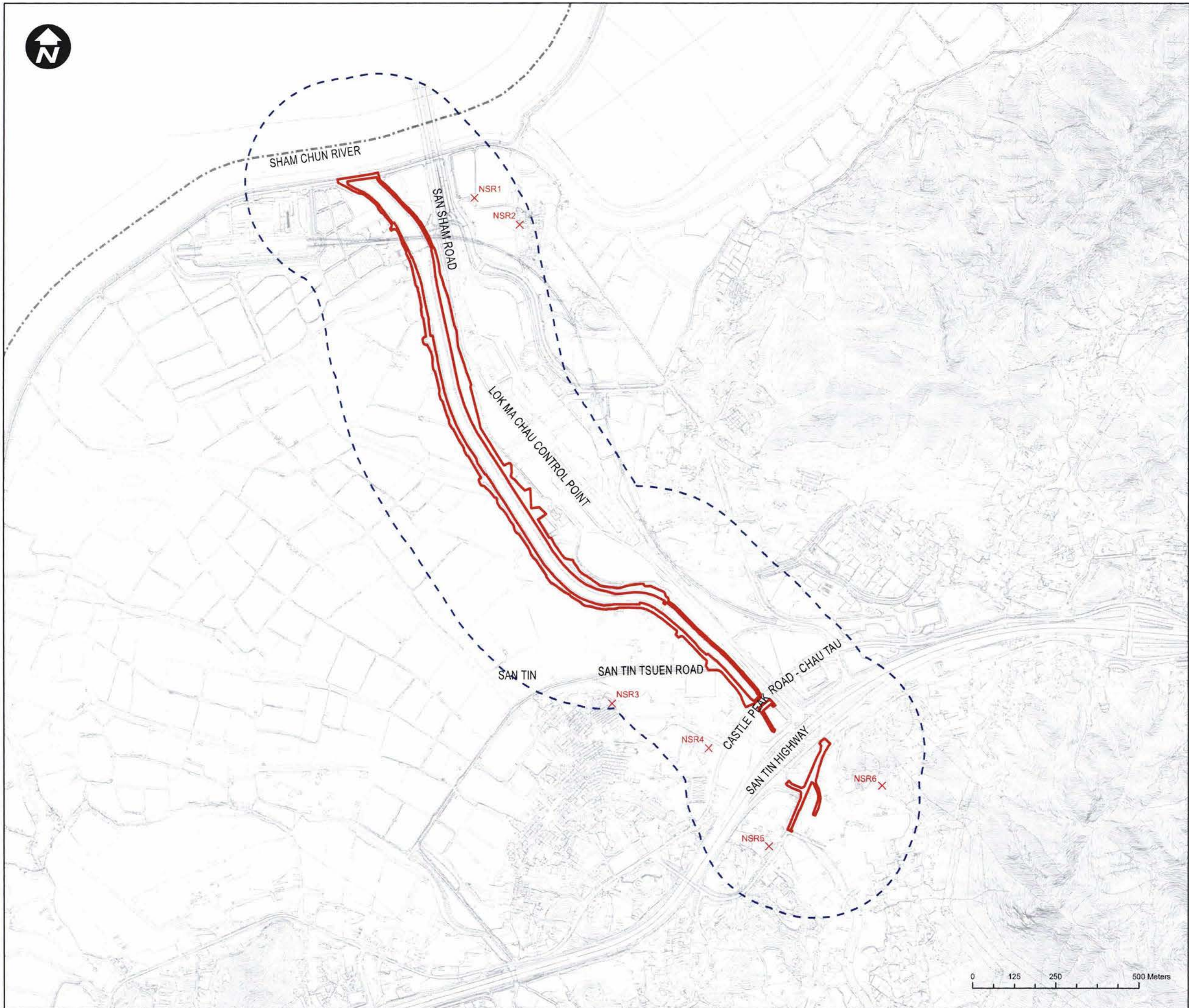
PROPOSED WORKS AT SAN TIN
EASTERN MAIN CHANNEL -
LOCATIONS OF AIR SENSITIVE
RECEIVERS

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

Drawing Number

FIGURE 3.1





Notes

1. ALL LEVELS ARE METRES TO PRINCIPAL DATUM (PD) UNLESS NOTED OTHERWISE.
2. ALL CO-ORDINATES REFER TO HONG KONG 1980 METRIC GRID CO-ORDINATES SYSTEM.
3. PIPE AND BOX CULVERT SIZES ARE SHOWN IN MILLIMETERS

Key to Symbols

LEGEND

- 300M STUDY AREA
- PROPOSED WORKS BOUNDARY
- NOISE SENSITIVE RECEIVERS

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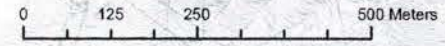
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DRAINAGE IMPROVEMENT WORKS
AT NORTH DISTRICT - PACKAGE B-
INVESTIGATION

Title

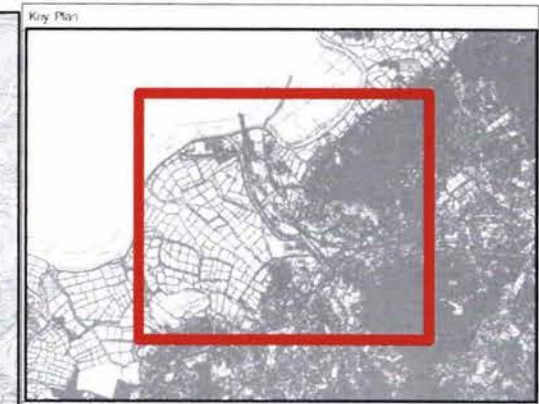
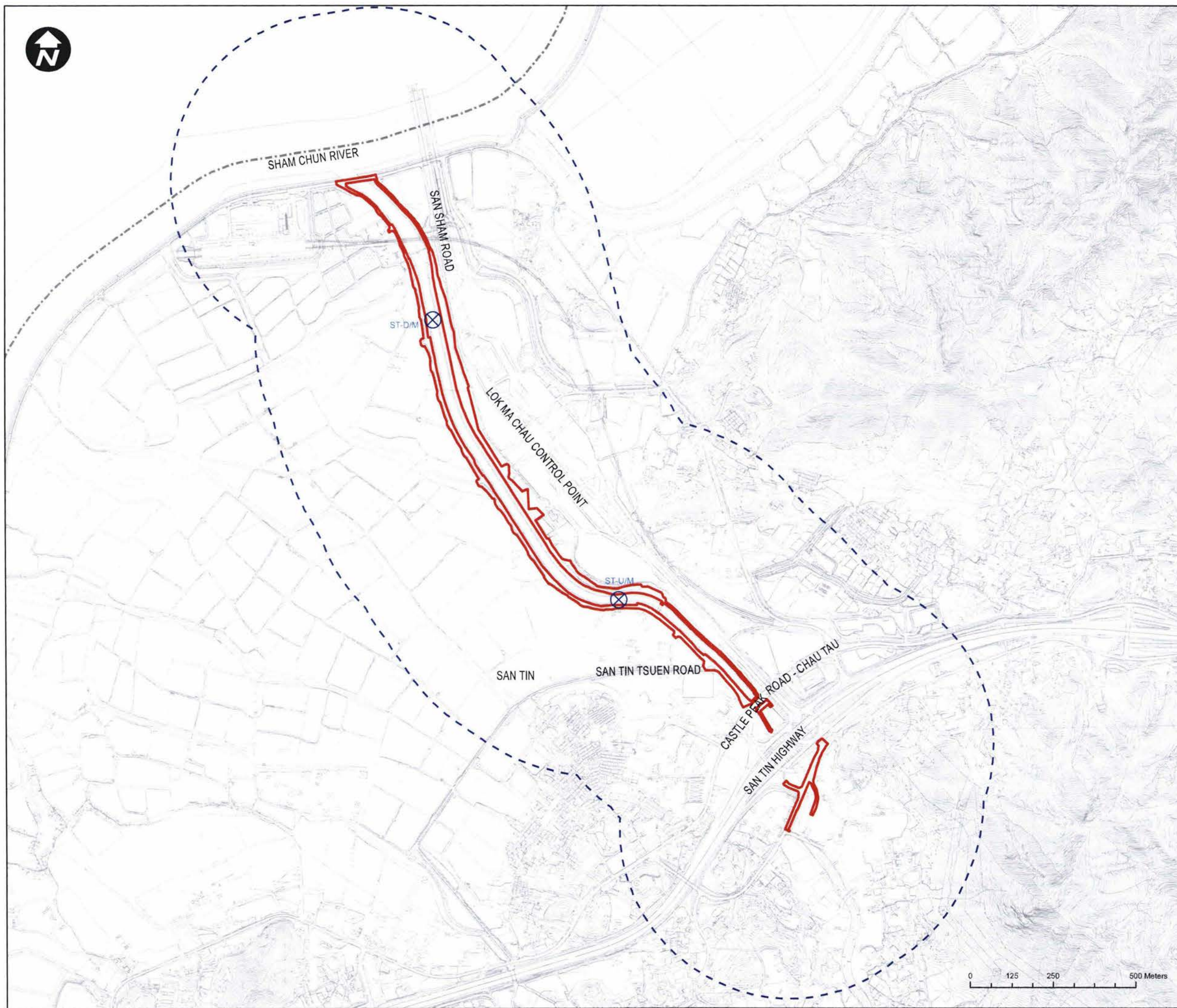
PROPOSED WORKS AT SAN TIN
EASTERN MAIN CHANNEL -
LOCATIONS OF NOISE SENSITIVE
RECEIVERS

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	



Drawing Number

FIGURE 4.1



Notes:

1. ALL LEVELS ARE METRES TO PRINCIPAL DATUM (PD) UNLESS NOTED OTHERWISE.
2. ALL CO-ORDINATES REFER TO HONG KONG (1980) METRIC GRID CO-ORDINATES SYSTEM.
3. PIPE AND BOX CULVERT SIZES ARE SHOWN IN MILLIMETERS.

Key to symbols:

LEGEND

- 500M STUDY AREA
- PROPOSED WORKS BOUNDARY
- WATER SAMPLING STATIONS

Rev	Date	Drawn	Description	Ch'kd	App'd

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INVESTIGATION

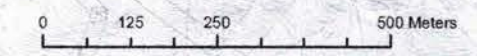
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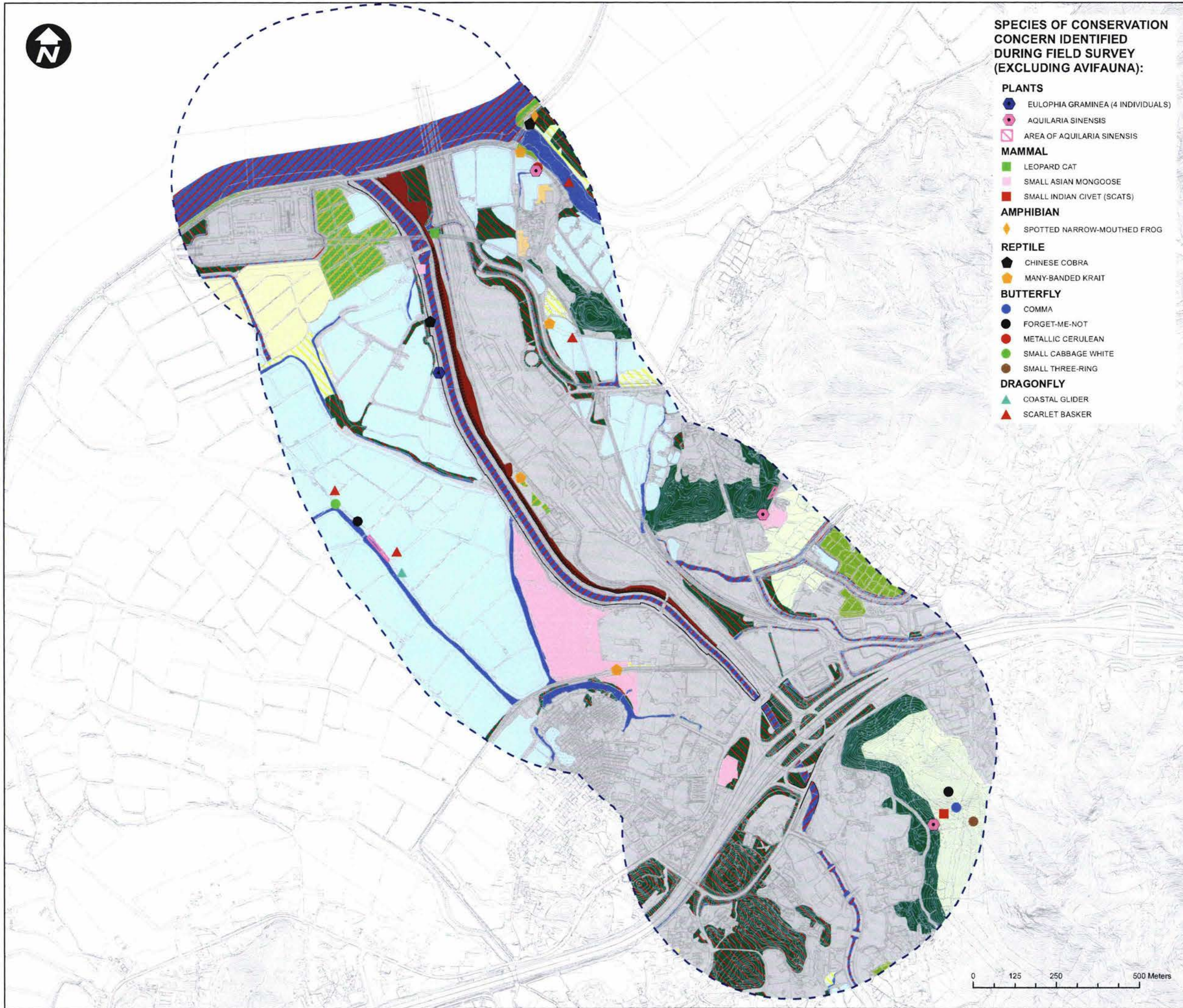
PROPOSED WORKS AT SAN TIN
EASTERN MAIN CHANNEL -
LOCATIONS OF WATER SAMPLING
STATIONS

Designed		Eng check	
Drawn		Coordination	
Diag check		Approved	
Scale at A3	Status	Rev	

Drawing Number

FIGURE 5.1





SPECIES OF CONSERVATION CONCERN IDENTIFIED DURING FIELD SURVEY (EXCLUDING AVIFAUNA):

- PLANTS**
- EULOPHIA GRAMINEA (4 INDIVIDUALS)
 - AQUILARIA SINENSIS
 - AREA OF AQUILARIA SINENSIS
- MAMMAL**
- LEOPARD CAT
 - SMALL ASIAN MONGOOSE
 - SMALL INDIAN CIVET (SCATS)
- AMPHIBIAN**
- ◆ SPOTTED NARROW-MOUTHED FROG
- REPTILE**
- ◆ CHINESE COBRA
 - ◆ MANY-BANDED KRAIT
- BUTTERFLY**
- COMMA
 - FORGET-ME-NOT
 - METALLIC CERULEAN
 - SMALL CABBAGE WHITE
 - SMALL THREE-RING
- DRAGONFLY**
- ▲ COASTAL GLIDER
 - ▲ SCARLET BASKER



Notes

1. ALL LEVELS ARE METRES TO PRINCIPAL DATUM (PD) UNLESS NOTED OTHERWISE.
2. ALL CO-ORDINATES REFER TO HONG KONG (1980) METRIC GRID CO-ORDINATES SYSTEM.
3. PIPE AND BOX CULVERT SIZES ARE SHOWN IN MILLIMETERS.

Key to Symbols

LEGEND

- PROPOSED WORKS FOOTPRINT
- MITIGATION WETLAND FOR STEM
- 500M STUDY AREA
- AGRICULTURAL LAND
- POND
- MITIGATION WETLAND FOR LMC SPUR LINE
- SEMI-NATURAL WATERCOURSE
- CHANNELISED WATERCOURSE
- GRASSLAND
- GRASSLAND/SHRUBLAND
- ORCHARD
- SECONDARY WOODLAND
- PLANTATION
- REEBED
- WASTE GROUND
- DEVELOPED AREA

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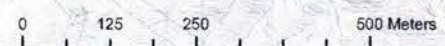
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DRAINAGE IMPROVEMENT WORKS
AT NORTH DISTRICT - PACKAGE B-
INVESTIGATION

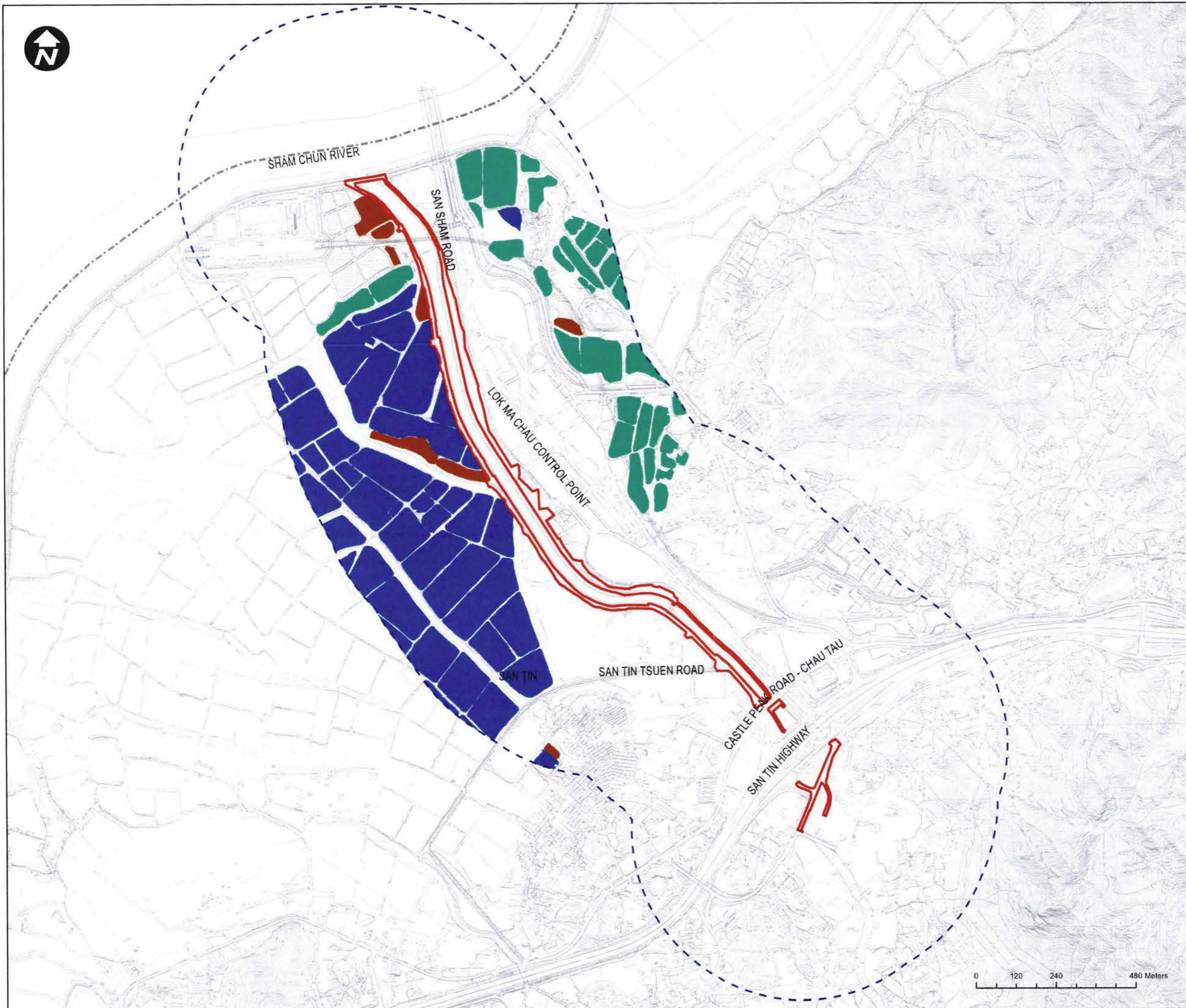
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PROPOSED WORKS AT SAN TIN
EASTERN MAIN CHANNEL -
HABITAT MAP

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Drawn	Coordination
Dwg check	Approved
Scale at A3	Status
	Rev



Drawing Number **FIGURE 6.1**



Notes

1. ALL LEVELS ARE METRES TO PRINCIPAL DATUM (PD) UNLESS NOTED OTHERWISE.
2. ALL CO-ORDINATES REFER TO HONG KONG (1980) METRIC GRID CO-ORDINATES SYSTEM.
3. PIPE AND BOX CULVERT SIZES ARE SHOWN IN MILLIMETERS.

Key to symbols

LEGEND

- 500M STUDY AREA
- PROPOSED WORKS BOUNDARY
- ABANDONED POND
- ACTIVE POND
- INACTIVE POND

Rev	Date	Drawn	Description	Ch'g'd	App'd

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Title

PROPOSED WORKS AT SAN TIN
EASTERN MAIN CHANNEL -
LOCATIONS OF FISH PONDS

Designed		Eng check	
Drawn		Coordination	
Dwg check		Approved	
Scale at A3	Status	Rev	

Drawing Number

FIGURE 7.1

