

Application No. : VEP-640/2024  
Reference No. : EP 2/N6/F/151  
(For official use)

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. : [REDACTED]  
(if applicable)  
B3. Correspondence Address : [REDACTED]  
B4. Name of Contact Person : [REDACTED] B5. Position of Contact Person : [REDACTED]  
B6. Telephone No. : [REDACTED] B7. Fax No. : [REDACTED]  
B8. E-mail Address : (if any) [REDACTED]

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-565/2018  
C3. The Current Environmental Permit was Issued in : month / year  
04 | 2019

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.<br><br>Condition(s) in the Current Environmental Permit :  | D2.<br><br>Proposed Variation(s) :                                | D3.<br><br>Reason for Variation(s) :                                       | D4.<br><br>Describe the environmental changes arising from the proposed variation(s) :  | D5.<br><br>Describe how the environment and the community might be affected by the proposed variation(s) :   | D6.<br><br>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.<br><br>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 : |
|--|---|--|---|--|--|--|
| Condition 2.10 (ii) - All percussive piling works and demolition using excavator-mounted breakers shall not be carried from November to March to avoid construction noise impact to the overwintering / migratory waterbirds | Please refer to Section 5.1.2 of the Environmental Review Report. | Please refer to Section 2.1.3 to 2.1.5 of the Environmental Review Report. | No direct impact on recognized Sites of Conservation Importance or Important Habitats since all construction works are still confined within the boundary of the existing Yuen Long Sewage Treatment Works. With the implementation of the recommended additional mitigation measures, no environmental changes would be arising from the proposed variation. Please refer to the attached Environmental Review Report. | The proposed variation would not create additional impact to the environment and the community. Please refer to the detailed assessment in Section 3.2 of the Environmental Review Report. | The environmental performance requirements set out in the EIA report previously approved would not be affected by the proposed variation. Please refer to the attached Environmental Review Report.            | The additional measures are detailed in Section 4 of the Environmental Review Report. With the implementation of the additional measures, the requirements in the Technical Memorandum on EIA Process can be met.  |

**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.

[Redacted Signature]

Signature of Applicant

[Redacted Full Name]

Full Name in Block Letters

[Redacted Position]

Position



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

24 October 2024  
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.

Prepared for

**PAUL Y.-CREC JOINT VENTURE**

Prepared by

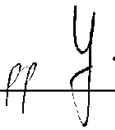
**Ramboll Hong Kong Limited**

**CONTRACT NO. DC/2019/10  
YUEN LONG EFFLUENT POLISHING PLANT –  
MAIN WORKS FOR STAGE 1  
CONSULTANCY SERVICE FOR SUPPORTING  
VARIATION OF CONDITION 2.10 OF EP-565/2019**


**ENVIRONMENTAL REVIEW REPORT**

Date **24 October 2024**

Prepared by **Theo Chan**  
**Environmental Consultant**

Signed  \_\_\_\_\_

Approved by **Y H Hui**  
**Principal Consultant**

Signed  \_\_\_\_\_

Project Reference **PYCYLEPPEI00**

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## 1. INTRODUCTION

### 1.1 Background

- 1.1.1 The existing Yuen Long Sewage Treatment Works (YLSTW; **Figure 1.1**) was commissioned in 1984 with a design capacity of 70,000 m<sup>3</sup>/day at average dry weather flow (ADWF) provides secondary level treatment to sewage catchment from Yuen Long area such as Wang Chau, Yuen Long Industrial Estate, the Yuen Long Town and Kam Tin.
- 1.1.2 There is a need for the upgrade of YLSTW into Yuen Long Effluent Polishing Plant (YLEPP) in order to cope with the forecast increase in sewage flow upon completion of sewerage under interfacing projects, extension of village sewerage in area as planned by Environmental Protection Department (EPD), as well as the proposed housing developments in the region.
- 1.1.3 The Project is a Designated Project (DP) under the Environmental Impact Assessment Ordinance (EIAO). An Environmental Impact Assessment (EIA) study was conducted and the EIA report (AEIAR-220/2019) was approved by EPD on 25 April 2019. The current Environmental Permit No. EP-565/2019 for the project was issued on 26 April 2019.

### 1.2 Need and Benefits of the Project

- 1.2.1 Currently, a significant portion of YLSTW catchment is still unsewered. The proposed trunk sewers and their upstream village sewerage projects in YLSTW's catchment are being or to be implemented. In the coming future, the sewerage system will be extended to Kam Tin, Fairview Park, Nam Sang Wai, Pat Heung, Shek Kong, Ngau Tam Mei and San Tin.
- 1.2.2 A water quality improvement programme is being implemented under Yuen Long Town Nullah (Town Centre Section) Stage 1 Improvement Works. This project will involve provision of a dry weather flow interceptor (DWFI) system to intercept the polluted dry weather runoff from Yuen Long Creek to YLEPP for treatment. In addition to the above mentioned projects, sewage flow from other existing and planned developments from Kam Tin South, Ngau Tam Mei and Wang Chau, including the proposed multi-storey buildings in the vicinity of Yuen Long Industrial Estate, in the catchment would also contribute to the flow build-up at YLEPP.
- 1.2.3 Having considered the abovementioned projects and population projections, the projected ADWF will reach approximately 180,000 m<sup>3</sup>/day in Year 2041. Given the current treatment capacity of YLSTW is only 70,000 m<sup>3</sup>/day, a capacity shortfall of YLSTW is anticipated in future. Thus, there is a need to upgrade the treatment capacity of YLSTW. The treatment level of YLSTW will also be upgraded for improvement of water quality of the discharge waterbody.
- 1.2.4 With the YLEPP in place, opportunities to treat the sewage from those unsewered areas will be created after completion of the Project, which provides centralised tertiary sewage treatment. Compared to de-centralised systems such as scattered septic tanks and local treatment plants, YLEPP will give higher treatment efficiency and cost effectiveness as well as improve the living environment of these areas. With the enhancement of odour management of the YLEPP (covering all odorous facilities and installation of deodorization units), odour nuisance to the surrounding area would be effectively controlled and minimized.
- 1.2.5 The Project will also provide opportunity to upgrade the existing YLSTW treatment level to a tertiary treatment level to meet the requirement of "No Net Increase in Pollution Load to Deep Bay". Given the high effluent standard of tertiary treatment,



the increased pollution loadings due to capacity increase will be offset by the upgraded treatment performance of YLEPP as well as the anticipated reduction of pollution loads from unsewered area within Deep Bay catchments through sewerage connection. It is anticipated that water quality improvement to the surrounding waterbodies will be resulted from implementation of the Project.

- 1.2.6 As a sustainability consideration, co-digestion of organic wastes with sewage sludge within YLEPP will be adopted to enhance energy recovery from the anaerobic digestion process. Additional facilities for organic wastes co-digestion, including reception facilities, digesters and ammonia stripping plants, will be located within the YLEPP's footprint.

## 2. OBJECTIVE

### 2.1 The Needs for Variation of Environmental Permit

2.1.1 The YLEPP will be constructed in two phases within the footprint of existing YLSTW. Phase 1 works will upgrade the existing YLSTW into YLEPP with a treatment capacity of 100,000 m<sup>3</sup>/day in ADWF. Phase 2 works will be implemented subject to further review of sewage flow projections and will further upgrade the treatment capacity up to 180,000 m<sup>3</sup>/day in ADWF.

2.1.2 Conditions 2.10 of the Environmental Permit (EP-565/2019) issued by the Director of Environmental Protection (DEP) is required to be followed by the Permit Holder during the construction phase of the Project to mitigate any ecological impact. Condition 2.10 is repeated below for reference:

*The Permit Holder shall implement the following mitigation measures to minimize ecological impact during construction of the Project:*

*(i) All construction works shall be confined within the boundary of the existing YLSTW (as shown in Figure 1);*

*(ii) All percussive piling works and demolition using excavator-mounted breakers shall not be carried out from November to March to avoid construction noise impact to the overwintering / migratory waterbirds; and*

*(iii) Noise barriers with absorptive materials of at least 4m high shall be erected along the northern, eastern and western sides of the Project boundary.*

2.1.3 The construction works was originally anticipated to commence in 2020 for completion by 2026 and 2030 for Phase 1 and Phase 2 respectively. Due to the impact of COVID-19, however, the Phase 1 works has been delayed and the main works commenced in April 2021.

2.1.4 Apart from the impact of COVID-19, a number of other unforeseen constraints such as unfavourable geotechnical conditions like fault lines, weak soils, etc., were encountered during the construction stage, resulting in a longer construction period than originally anticipated. In order to minimise the extension of construction period so as to reduce the associated environmental impacts as well as ensuring the environmental benefits of the YLEPP can be realised in time as per the EIA assessments, the project team has explored and evaluated several engineering measures.

2.1.5 The restriction of percussive piling between November to March, however, has been identified as a key constraint that limits the effectiveness of other engineering measures to remedy the construction program. As such, it is considered that allowing percussive piling for the Sludge Dewatering Building (SDB) in part of these months (hereafter referred as the proposed period) is essential for the YLEPP.

2.1.6 As of today, all piles originally specified in the contract have been completed and pile loading tests are being carried out and will be completed in early November 2024 tentatively. Additional piles will be required subject to the results of the pile loading tests and design review based on the as-built length of the piles driven. Therefore, the VEP application is essential. Based on the latest construction programme (**Annex C**), the SDB works would be completed in May 2026. After the completion of civil and building works for SDB, there are still E&M works to be installed / tested by other contractors before the YLEPP can operate at its design capacity in the third quarter of 2027. It should be noted that during the construction period, the YLSTW remained operational at a reduced capacity, such a reduced capacity operation can only sustain up to 2026 as per the EIA report. Therefore, there would be an imminent risk of

overcapacity if means to expedient the works is not implemented. For the options considered, allowing the carrying out of percussive piling works during the proposed period is essential for timely commissioning of the YLEPP.

- 2.1.7 This Environmental Review Report provides a review on any additional potential environmental impacts (noise, air, water, waste, ecological, visual and cultural, etc.) that may arise from the proposed permission of percussive piling between November to March and where necessary, recommend additional environmental mitigation measures to minimise these impacts. It must be emphasized that this is a unique application under a very special circumstance that approval of this VEP application shall not be referred by other projects for allowing percussive piling in these months in the area.

### 3. REVIEW OF ASSESSMENT IN THE APPROVED EIA REPORT

#### 3.1 Construction Methods

- 3.1.1 The EIA report has highlighted that several construction methods for foundation works, including the conventional percussive piles, bored piles by reverse circulation drill, box rafts and shallow foundation, have been explored for this Project. The foundation options are highly subject to the ground conditions. While box rafts, bored piling by reverse circulation drill and shallow foundation typically cause less disturbances (including noise, vibration and dust etc.), the application of these methods for this Project is comparatively limited, given the site and engineering constraints, including deep bed rocks (over 150 m below ground) of the Project site, additional ground treatment (e.g. grouting) required for foundation works and large excavation volume, that could cause other environmental issues such as water pollution and adverse waste management implication. Due to ground conditions and programme constraints, percussive piling works would likely be unavoidable.
- 3.1.2 This is re-affirmed in the detailed design stage, in particular for the Sludge Dewatering Building (SDB) which is the subject of the VEP application. The geological profile of the SDB is illustrated in **Figures 2.1 to 2.3**. With due consideration of geological constraints and the engineering needs, percussive pile is the only practical method to construct the foundation for SDB. The percussive piling method to be adopted in the proposed period is the same as the one adopted in wet season.
- 3.1.3 It is anticipated that no more than two piling rigs will be used in the proposed period. This is less than the number used in the wet season. Hence, there are no change in construction method under the proposed VEP application. Percussive piling with the quieter hydraulic hammering and other mitigation measures will be implemented to ensure the noise level is reduced to the lowest possible. This is further discussed in the subsequent sections.

#### 3.2 Ecological Impacts (Terrestrial and Aquatic)

- 3.2.1 The EIA report has assessed potential environmental impacts associated with the construction and operation of the Project including the air quality, noise, water quality, waste management, land contamination, ecology, fisheries, landscape and visual and hazard to life. The EIA report has also recommended corresponding mitigation measures to address the identified impacts so that no residual impacts would be expected during construction or operation phase. As discussed above, in the present application, only variation in permissible percussive piling period is proposed and there are no change to the construction method, footprint of the Project nor additional construction works. Therefore, the assessment in the EIA report remains valid and no re-assessment is required, except the ecological impact which is further discussed below.
- 3.2.2 The EIA report has assessed the ecological impacts associated with the construction of the Project. Potential direct impacts on recognised sites of conservation importance around the Project Site (including the Ramsar Site, Priority Site, Wetland Conservation Area (WCA), Wetland Buffer Area (WBA; outside the Project Site), Sites of special scientific interest (SSSI) and Conservation Area (CA)) and natural habitats have been avoided through confinement of construction works within the boundary of the existing YLSTW. Since the Project would be constructed within the footprint of existing YLSTW, no direct impact on ecological resources would be anticipated.
- 3.2.3 The wetland habitats around the Project Site are known to support large number of overwintering waterbirds, with the confluence of Shan Pui River and Kam Tin River as well as active ponds at the northwest part of the assessment area in Fung Lok Wai being the key wetland habitats that supported the greatest abundance and diversity

- of waterbirds. Notwithstanding these, no breeding or nursery behaviour of any species were identified within the assessment area.
- 3.2.4 Major indirect impacts due to construction noise disturbances from demolition using breakers mounted on excavators and percussive piling works on key wetland habitats within assessment area and in close proximity to the Project site as well as migratory / overwintering waterbirds have been avoided through scheduling of the percussive piling works and demolition using breakers mounted on excavators outside dry season (i.e. November to March, which is the peak overwintering period of waterbirds).
- 3.2.5 According to the approved EIA report, with the implementation of the recommended mitigation measures (e.g. avoidance of percussive piling and demolition using breakers mounted on excavators and use of alternative quieter construction method during peak overwintering period within dry season; careful phasing of construction activities; provision of noise barriers around Project site, provision of moveable noise barrier/acoustic mat for piling plants and breaker; use of enclosure for construction plant, use of quality powered mechanical equipment (QPME); restriction of construction hours of construction activities with powered mechanical equipment (PME); etc.), no residual ecological impact would be expected during construction phase.
- 3.2.6 The proposed variation in permissible percussive piling period while represents a change to one of the mitigation measures recommended in the EIA Report (which was subsequently incorporated as EP Condition 2.10), the assessment in the EIA Report was based on typical construction works process, lacking a detailed consideration at the early stage regarding the specific circumstances under which the SDB will be constructed. To reflect the latest construction works process in relation to the SDB and the associated ecological impacts, an updated ecological impact assessment for the proposed variation has been conducted and presented in **Annex A**.
- 3.2.7 With the implementation of additional recommended mitigation measures, no material change to environmental impact would be expected due to the proposed variation in permissible percussive piling period.

## 4. SUMMARY OF MITIGATION MEASURES TO BE IMPLEMENTED FOR THE PROPOSED VARIATION

### 4.1 Objective

- 4.1.1 According to the EIAO-TM Annex 16, ecological impacts on important habitats and the associated wildlife caused by the proposed Project should be mitigated, in order of priority, avoidance, minimization, and compensation approaches to the maximum practical extent.
- 4.1.2 The approved EIA report recommended a list of noise reduction measures which could mitigate the potential impacts to ecology, according to the monitoring data during construction phase. The latest Noise Mitigation Measures Plan has been prepared and deposited in accordance with the EP Condition 2.12 and it includes a summary of the potential ecological impacts arising from the project construction activities. The Plan has been made accessible via the EIAO Internet Website. Besides the existing mitigation measures, additional mitigation measures specified below are proposed to further minimize the potential ecological impacts from the piling works during the proposed period. The Noise Mitigation Measures Plan will be further updated to include these additional mitigation measures.

### 4.2 Avoidance

#### Avoidance of Direct Impact on Recognized Sites of Conservation Importance, Important Habitats and Breeding/Roosting Ground

- 4.2.1 There is no expansion of the Project Site, and all construction works are still confined within the boundary of the existing YLSTW. Direct encroachment on other identified recognized sites of conservation importance (i.e., the Ramsar Site, Priority Site, WCA, WBA (outside the Project site), SSSI and CA), important habitat and roosting grounds (i.e., Shan Pui River Egret and ardeid night roost at Shan Pui River) would be avoided.

#### Avoidance of Indirect Impact on Ardeid Night Roost

- 4.2.2 Percussive piling in the proposed period will be conducted at daytime only, and it will not be conducted between 4:30 pm and 8:30 am of the following day. Furthermore, the proposed works area (i.e., SDB) is more than 100m from the ardeid night roost. Indirect impact on the ardeid night roost next to Shan Pui River during the proposed period is not expected.

### 4.3 Minimization

#### Minimization of Construction Disturbance by Adopting Percussive Piling during High Tide Period

- 4.3.1 Extensive area of mudflat along Shan Pui River in particular the confluence of Shan Pui River and Kam Tin River (with very high abundance and diversity of avifauna during dry season) is exposed during low tide period. The exposed mudflat provides abundant food sources for both large waterbirds and waders of species of conservation importance. The tidal level below 1.5m (above the Chart Datum) was taken as the tidal level at which avifauna surveys overlooking the mudflats and mangroves in Shan Pui River were undertaken during the EIA baseline survey stage. Thus, very high abundance and diversity of avifauna at mudflat MW1, high diversity of avifauna at mudflats MW2 and MW3 (please refer to Figure 3.2 of **Annex A** for location of these mudflats), were recorded in dry season of the EIA baseline stage. Due to the attractiveness to waterbirds of the mudflat during low tide period, percussive piling works is scheduled to be conducted when the tidal level is high (i.e., above 1.5m

when the mudflats would be mostly submerged) which is considered a precautionary approach to further minimize the potential impact to waterbirds in dry season.

#### Minimization of Construction Noise Disturbance Impacts with Additional Noise Mitigation Measures

- 4.3.2 While percussive piling works during the proposed period is considered unavoidable as explained in previous sections, with due consideration to minimise the noise impact, it is proposed that no more than two piling rigs be allowed to work concurrently.
- 4.3.3 The SDB is at the middle south of the YLSTW. It is isolated from the nearby natural habitats by the existing structures / newly constructed facilities of YLSTW/YLEPP and the Yuen Long Industrial Estate (YLIE) (see **Figure 1.3**). These structures / facilities will provide some screening /shielding to the works at the SDB. To further minimize noise disturbance due to percussive piling works during the proposed period, additional mitigation measures have been devised and will be implemented to mitigate the extra noise impact on the surrounding habitats and species in conjunction with the implemented noise mitigation measures (e.g., noise barriers along the northern and eastern boundary of the Project Site) in effect. Prior to the scheduled piling during the proposed period, additional 4-metre-tall high noise barriers will be erected around SDB to further reduce the noise disturbance generated by percussive piling works, while a full height U-shaped noise barrier will be erected around each piling rig to minimize the noise disturbance generated by the operation of piling rigs. Furthermore, subject to the site condition, additional 2m high noise barrier shall be provided at rooftop of existing buildings to the northern and eastern sides of the SDB to provide further screening.
- 4.3.4 Previous studies and observations suggested that waterbirds could assimilate more readily to ongoing and regular noise than sudden/explosive irregular noise event at a similar noise level. For instance, irregular and high level of construction noise could cause higher disturbance to waterbirds, while regular piling noise of similar noise level would only cause lower level of disturbance that could become habituated readily by the waterbirds without any accompanied visual disturbance. Hence, the piling works will be strictly monitored to avoid irregular piling patterns, and the piling works will be commenced with soft-start on each piling day and after idling of piling, and then progressively increase the strength (at the beginning of piling works, the piling at the second rig will only start 5 minutes after the first rig has started), to allow the wildlife, particularly waterbirds, to habituate to the piling works.
- 4.3.5 Various at-source mitigation measures are available and could be adopted for reducing piling noise, for example, custom-made capsule, insulation wrap and noise enclosure, etc. There will be full height U-shaped noise barrier to shield the entire piling rigs to further reduce generation of noise affecting the waterbirds. In addition, the number of piling rigs were not limited/specified in the approved EIA Report and the conditions of the EP. It is proposed that the number of piling rigs will be limited to no more than two at any time during dry season. Together with general good site practices as recommended in the EIA Report (such as the use of QPME, well maintenance of plants, shutdown of unused plants, etc.) during the piling period, potential disturbance to the wildlife during the dry season could be minimized.
- 4.3.6 In percussive piling works, the noise and vibration are generated mainly due to the impact action of the hammer driving the piles. Hydraulic hammering is an improved driven piling and will produce less noise than traditional piling method. If the U-shaped noise barrier and/or noise shield are applied, the noise level could be further reduced significantly. Noise absorption material will be added to the U-shaped noise barrier and/or noise shield to improve noise shielding effectiveness. To further minimise the

potential impacts of the piling works, the engineer will also monitor the driving height of the hammer. In general, the higher the driving height, the greater the noise and vibration will be. However, in localities with soft ground, the driving height can be reduced with the same efficiency. For the YLEPP site, the engineer has estimated that this is generally achievable for the first 10m of the topsoil. It is anticipated the driving height can be reduced by 50% at this soil stratum.

4.3.7 The timing of the proposed percussive piling works in the proposed period will also be controlled such that:

- the percussive piling works will not be conducted between 4:30 pm and 8:30 am of the following day; and
- the piling works will only be conducted during high tide when the predicted tidal level is higher than 1.5 mCD (as predicted by Hong Kong Observatory for the nearest tidal station at Tsim Bei Tsui)\*.

\*The relevant tidal information for November 2024 to March 2025 is presented in **Annex B**. Moreover, predicted tides for the subsequent months of the proposed period will be presented in the monthly EM&A report a month in advance.

4.3.8 For the indirect disturbance impacts of other general construction activities during the proposed period, due to the low noise level and/or the distance from the Project Site to the ecological sensitive receivers, potential impacts to the waterbirds are considered insignificant.

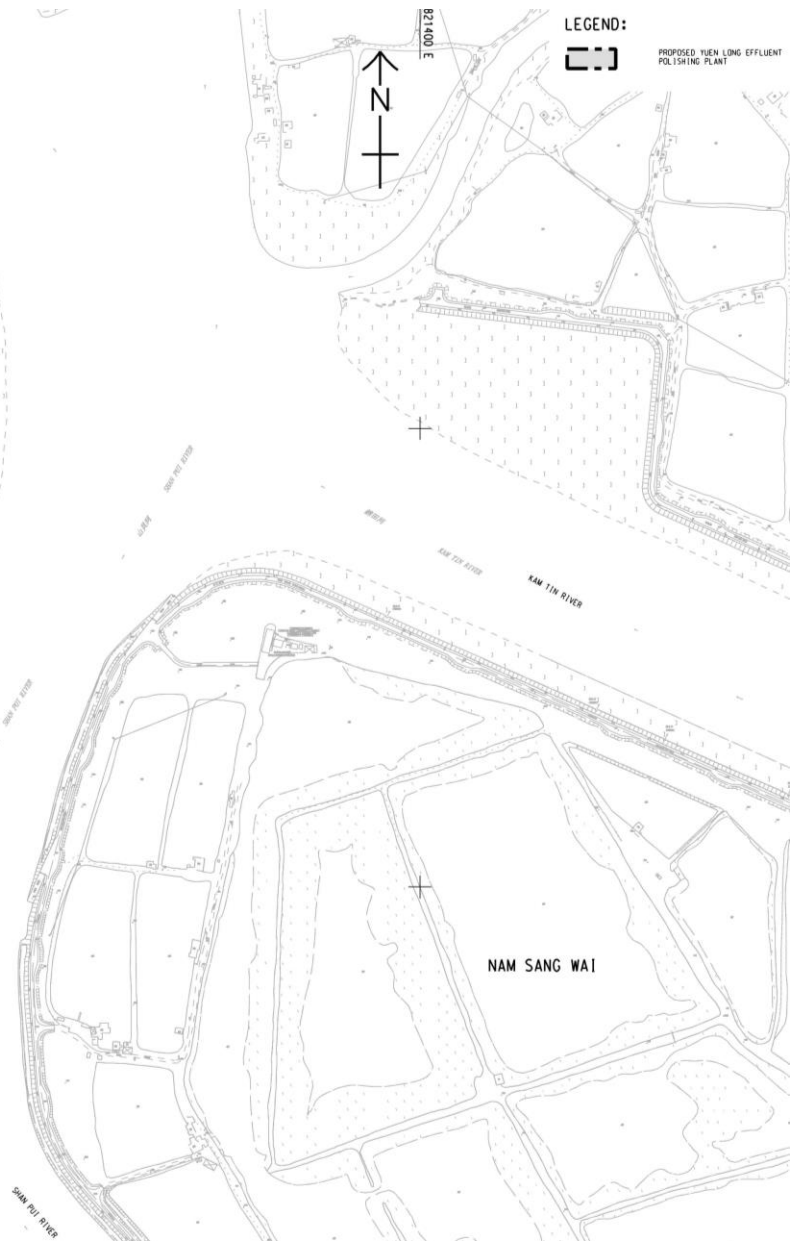
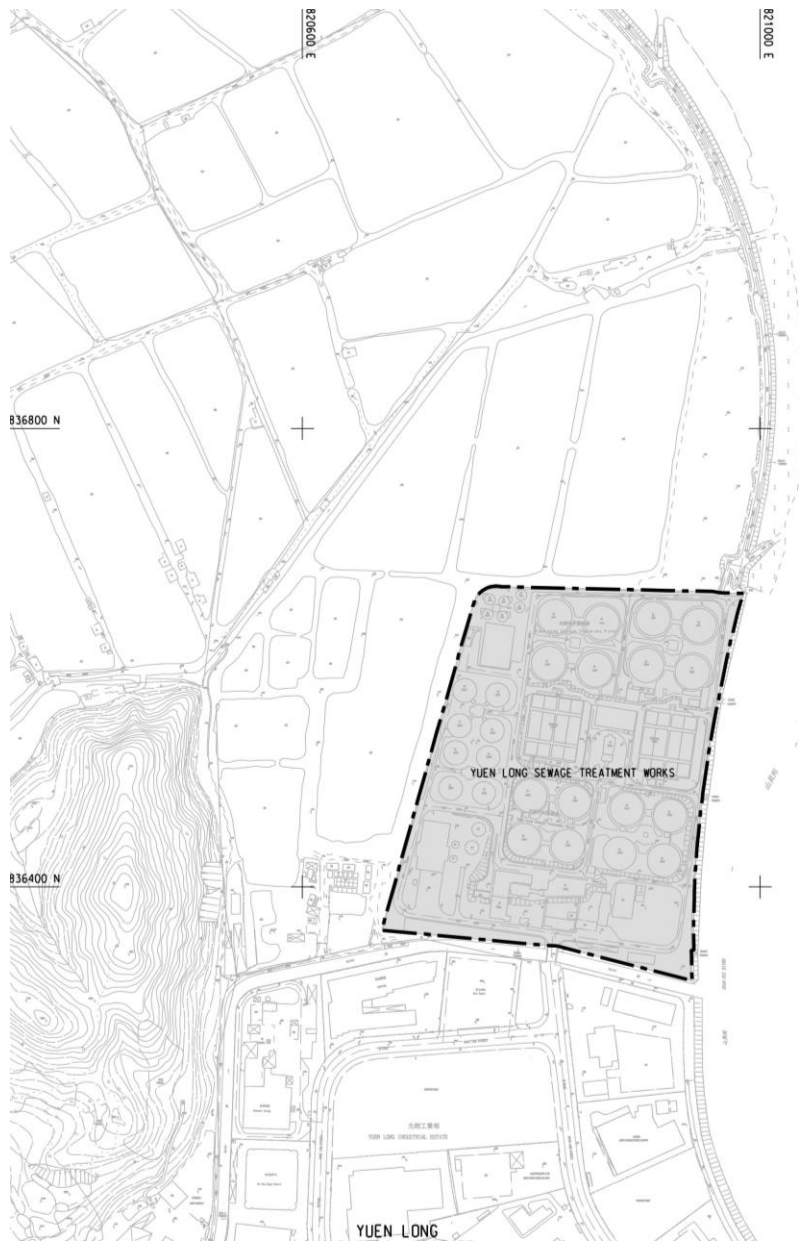


## 5. PROPOSED VARIATION OF ENVIRONMENTAL PERMIT

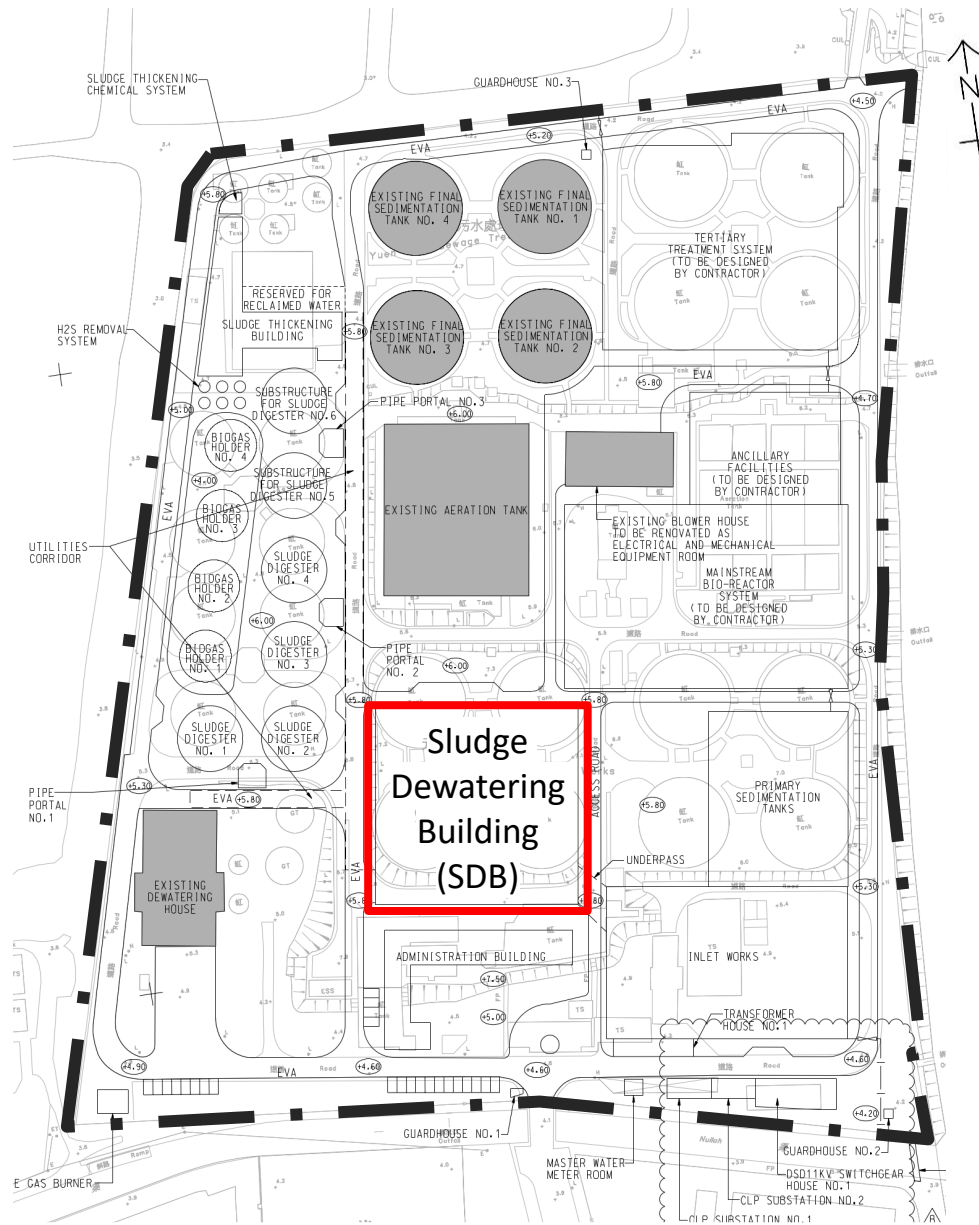
### 5.1 Objective

- 5.1.1 The above sections have justified that the proposed variation in permissible percussive piling period (i.e., allowing limited percussive piling from November to March), would be environmentally acceptable during construction stage with the implementation of recommended additional mitigation measures. Furthermore, it was also checked against the condition for material change stipulated in Section 6.2 of the EIAO-TM. The potential environmental impact associated with percussive piling has been assessed in the EIA report and this construction method has been allowed for this Project. The proposed variation, with the additional mitigation measure, will not affect the environmental performance of the project as assessed in the EIA report. Therefore, no material change is anticipated.
- 5.1.2 Having considered the specific circumstances under which the SDB is constructed and the assessment above, it is proposed to revise Condition 2.10 of the EP-565/2019 to allow percussive piling works for foundation construction of the SDB to be conducted during the proposed period. In addition to noise mitigation measures mentioned in the EIA, for percussive piling works within the SDB to be conducted during the proposed period, the pile and piling rig shall be enclosed with movable full height U-shaped noise barrier with absorptive materials of at least 12m, the active construction area of SDB shall also be enclosed with noise barriers with absorptive materials of at least 4m high. Furthermore, no more than two piling rigs for percussive piling shall be used within the entire Project Site at any time during this period. Moreover, the piling works will not be conducted between 4:30 pm and 8:30 am of the following day; and the piling works will only be conducted during high tide when the predicted tidal level is higher than 1.5 mCD, and the predicted tides for the subsequent months of the proposed period will be presented in the monthly EM&A report a month in advance.
- 5.1.3 It is also proposed that a new figure shall be added in the varied environmental permit to show the location of SDB, stating that percussive piling would only be allowed within the area of SDB in the proposed period.

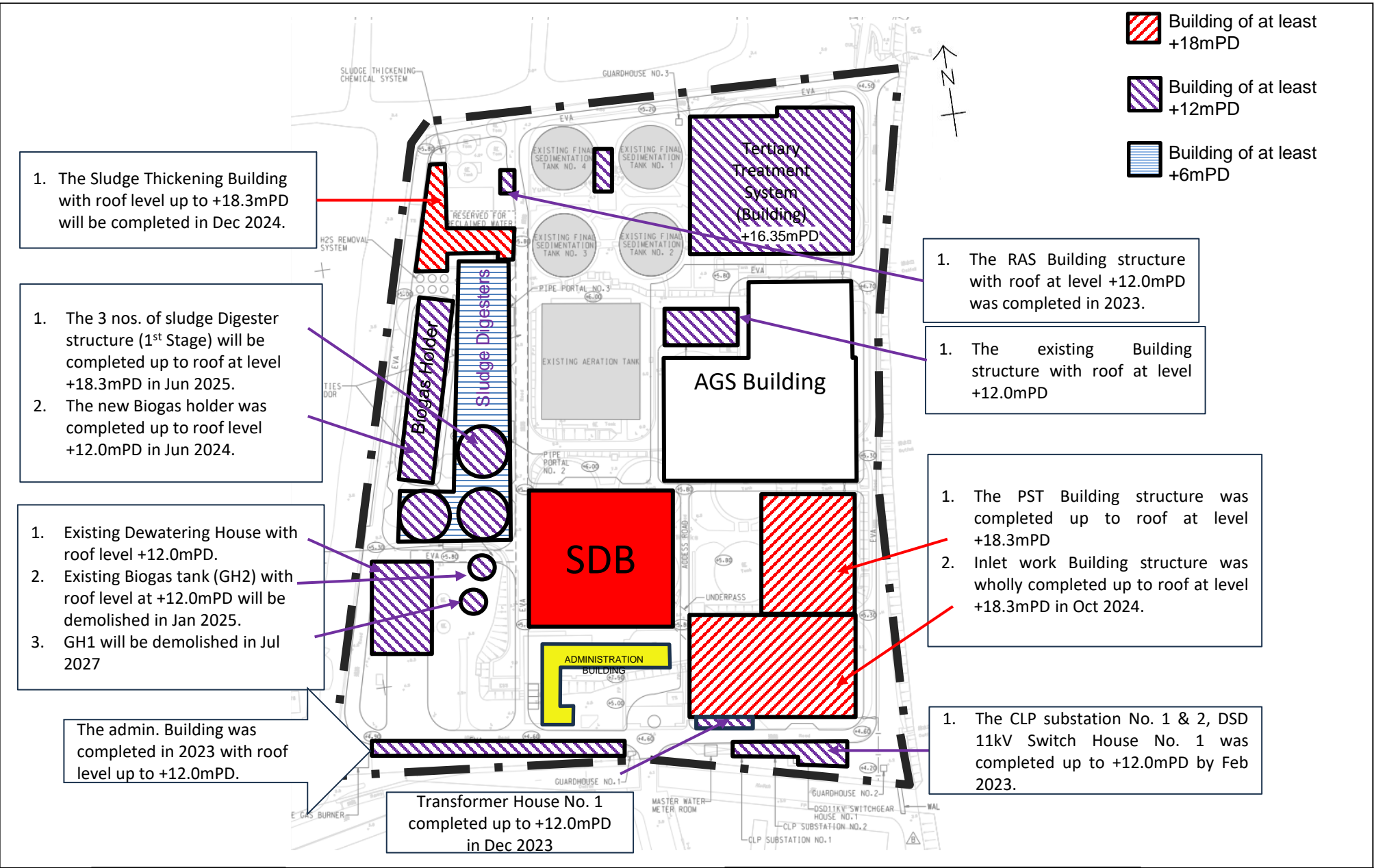
## FIGURES



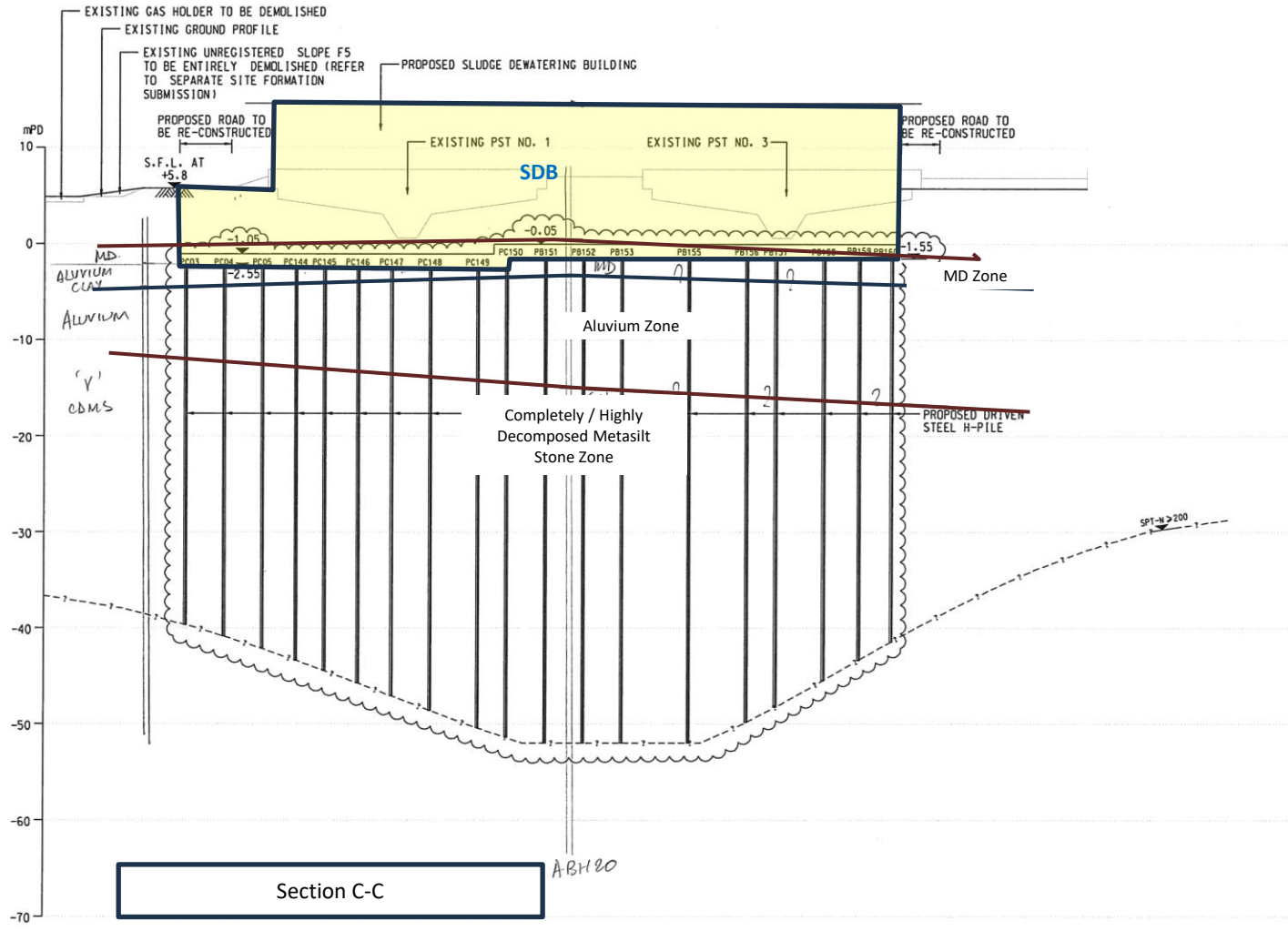
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 PROPOSED YUEN LONG EFFLUENT POLISHING PLANT

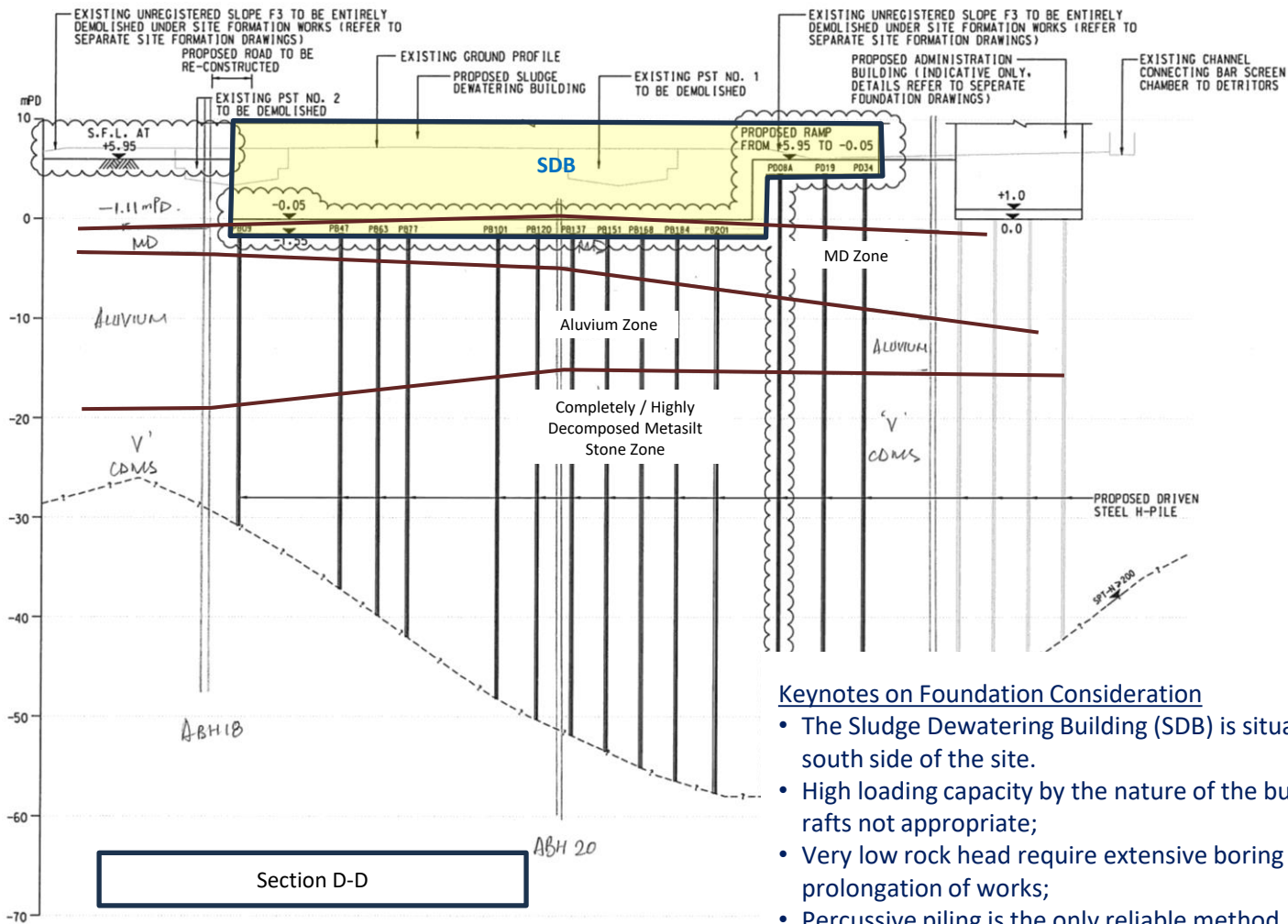


Location of SDB









**Keynotes on Foundation Consideration**

- The Sludge Dewatering Building (SDB) is situated at the middle south side of the site.
- High loading capacity by the nature of the building rendering box rafts not appropriate;
- Very low rock head require extensive boring if using bored-piling, prolongation of works;
- Percussive piling is the only reliable method



## ANNEXES

**Annex A**

**Updated Ecological Impact Assessment Report**

Prepared for

**PAUL Y.-CREC JOINT VENTURE**

Prepared by

**Ramboll Hong Kong Limited**

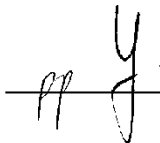
**CONTRACT NO. DC/2019/10  
YUEN LONG EFFLUENT POLISHING PLANT –  
MAIN WORKS FOR STAGE 1  
CONSULTANCY SERVICE FOR SUPPORTING  
VARIATION OF CONDITION 2.10 OF EP-565/2019**

**UPDATED ECOLOGICAL IMPACT ASSESSMENT REPORT**

Date **24 October 2024**

Prepared by **Ecosystems Limited**

Signed




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Approved by

**Y H Hui**  
**Principal Consultant**

Signed



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Project Reference

**PYCYLEPPEI00**

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## 1. INTRODUCTION

### 1.1 Background

- 1.1.1 The existing Yuen Long Sewage Treatment Works (YLSTW; **Figure 1.1**) was commissioned in 1984 with a design capacity of 70,000 m<sup>3</sup>/day at average dry weather flow (ADWF) provides secondary level treatment to sewage catchment from Yuen Long area such as Wang Chau, Yuen Long Industrial Estate, the Yuen Long Town and Kam Tin. An EIA study was conducted for proposed upgrading of YLSTW into Yuen Long Effluent Polishing Plant (YLEPP). The EIA report (AEIAR-220/2019) was approved by EPD on 25 April 2019. The current Environmental Permit No. EP-565/2019 for the project was issued on 26 April 2019.
- 1.1.2 Conditions 2.10 of the Environmental Permit (EP-565/2019) issued by the Director of Environmental Protection (DEP) is required to be followed by the Permit Holder during the construction phase of the Project to mitigate any arising ecological impact: Condition 2.10 (i): All construction works shall be confined within the boundary of the existing YLSTW; Condition 2.10 (ii): All percussive piling works and demolition using excavator-mounted breakers shall not be carried out from November to March to avoid construction noise impact to the overwintering / migratory waterbirds; and Condition 2.10 (iii): Noise barriers with absorptive materials of at least 4m high shall be erected along the northern, eastern and western sides of the Project boundary.
- 1.1.3 The restriction of percussive piling between November and March cause significant implication to construction works arrangement. It also affects the implementation time of YLEPP which aim to improve water quality of the Deep Bay. The assignment reviews the feasibility of variation of condition 2.10 of EP-565/2019 for the percussive piling works of Sludge Dewatering Building (SDB) within the extent of YLSTW (**Figure 1.2**), during part of the period between November 2024 and March 2025 (hereafter the proposed period).

### 1.2 Purpose of the Ecological Impact Assessment Review Report

- 1.2.1 A comprehensive ecological impact assessment (EcoIA) was conducted under the EIA Report for YLEPP, which was already approved in 2019. However, the EcoIA was based on the overall proposed works for the YLEPP. The present Updated EcoIA (UEcoIA) aims to assess the potential ecological impacts in particular on the ecological sensitive receivers (i.e. waterbirds) to arise from the proposed piling works for only one building (i.e. SDB) near the southern part of the existing YLSTW, and in combination of other non-restricted proposed works between November 2024 and March 2025.
- 1.2.2 The UEcoIA Report reviews and summarizes the ecology-relevant results of the EIA Report and Environmental Monitoring and Auditing (EM&A) Reports, updates EcoIA relevant to condition 2.10 of EP-565/2019 and proposes corresponding ecological mitigation measures based on the condition that percussive piling works would be carried out during the proposed period.

### 1.3 Project Site and Assessment Area

- 1.3.1 The Project Site is located within the existing Yuen Long Sewage Treatment Works (YLSTW), which falls within the Wetland Buffer Area (WBA) (**Figure 3.1**). Areas at the south of the Project Site are made up of developed area, mainly the Yuen Long Industrial Estate. The northern and western sides of the Project area are dominated by active and inactive fishponds of Fung Lok Wai (FLW), while Shan Pui River (SPR) runs along the eastern side of the Project Site (**Figure 3.1**). The assessment area for terrestrial ecology includes areas within a 500m distance from the boundary of the Project Site and other areas likely to be impacted by the Project (**Figure 3.1**).

1.3.2 The proposed variation of EP-565/2019 for the percussive piling works of Sludge Dewatering Building (SDB) which are located at the southern side of the Project Site. The proposed SDB is surrounded by existing developed area. The configuration and location of the SDB of YLSTW is illustrated in **Figure 1.2**.

#### **1.4 Literature Review**

1.4.1 The findings of studies relevant to YLSTW were reviewed. A literature review was conducted to collect ecological baseline information within and in the vicinity of the assessment area, in particular information on all habitat/species of conservation importance such as their occurrence, distribution and abundance. Literature and websites reviewed include the followings: Approved EIA Report (AEIAR-220/2019) for the Agreement No. CE3/2015(DS) Yuen Long Effluent Polishing Plant – Investigation, Design and Construction Works; Monthly EM&A Reports from April 2021 to June 2024 for the Contract No. SPW 07/2020 Environmental Team for Construction of Yuen Long Effluent Polishing Plant Stage 1; and other relevant literature.



## 2. REVIEW OF CONSTRUCTION OPINIONS

### 2.1 Construction Methods

- 2.1.1 The EIA report has highlighted that several construction methods for foundation works which are highly subject to the ground conditions, and the application of these methods for this Project is comparatively limited, given the site and engineering constraints, including deep bed rocks (over 150 m below ground; see **Figure 2.1 to 2.3**) of the Project site, percussive piling works is unavoidable.
- 2.1.2 This is re-affirmed in the detailed stage, in particular for the SDB which is the subject of the VEP application.

### 2.2 Construction Programme

- 2.2.1 The YLEPP will be constructed in two phases within the footprint of existing YLSTW. Phase 1 works will upgrade the existing YLSTW into YLEPP with a treatment capacity of 100,000 m<sup>3</sup>/day in ADWF. Phase 2 works will be implemented subject to further review of sewage flow projections and will further upgrade the treatment capacity up to 180,000 m<sup>3</sup>/day in ADWF.
- 2.2.2 The construction works was originally anticipated to commence in 2020 for completion by 2026 and 2030 for Phase 1 and Phase 2 respectively. Due to the impact of COVID-19, however, the works has been delayed and the main works commenced in April 2021.
- 2.2.3 As of today, all piles originally specified in the contract have been completed and pile loading tests are being carried out and will be completed in early November 2024 tentatively. Although the piles have been completed as specified in the contract, there is still a potential that additional piles will be required subject to the results of the pile loading tests and design review based on the as-built length of the piles driven. Therefore, the VEP application is still considered necessary. The latest construction programme is shown in **Appendix A**. Based on the latest programme, the SDB works would be completed in early May 2026. After the completion of civil and building works for SDB, there are still E&M works to be installed / tested by other contractors before the YLEPP can operate at its design capacity in the third quarter of 2027. It should be noted that during the construction period, the YLSTW remained operational at a reduced capacity, such a reduced capacity operation can only sustain up to 2026 as per the EIA report. Therefore, there would be an imminent risk of overcapacity if means to expedient the works is not implemented. For the options considered, the carrying of piling works during the proposed period is considered essential which can save about 5 months for timely commissioning of the YLEPP.

### 3. LITERATURE REVIEW

#### 3.1 General

3.1.1 The approved EIA for YLEPP was reviewed for the ecological resources within the area affected by that Project, including the identified habitats and species of conservation importance, potential impacts from the construction and operation of YLEPP, and potential mitigation measures to reduce the potential impacts of the construction and operation of YLEPP. The EM&A reports (from April 2021 to June 2024) under Contract No. SPW 07/2020 Environmental Team for Construction of Yuen Long Effluent Polishing Plant Stage 1 – were also reviewed.

#### 3.2 Recognized Sites of Conservation Importance

3.2.1 The recognized sites of conservation importance identified within and in the vicinity of the assessment area are shown in **Figure 3.1**.

3.2.2 The recognized sites of conservation importance within the assessment area include Mai Po Marsh Site of Special Scientific Interest (SSSI), Mai Po Inner Deep Bay Ramsar Site, Deep Bay Wetland outside Ramsar Site Priority Site for Enhanced Conservation, Wetland Conservation Area (WCA), Wetland Buffer Area (WBA) and "Conservation Area". The following sections describe the location, designation principle and function of the identified recognized sites of conservation importance within the assessment area and their locations are illustrated in **Figure 3.1**.

##### Mai Po Marshes Site of Special Scientific Interest

3.2.3 The southern edge of Mai Po Marshes SSSI, which is zoned under Mai Po & Fairview Park Outline Zoning Plan (OZP) No. S/YL-MP/6, falls within the north-eastern tip of the assessment area (**Figure 3.1**). This SSSI is to conserve the ecological value and function of the existing fishponds and mangroves. The Mai Po Marshes SSSI contains areas of tidal shrimp ponds (gei wais) and fishponds, as well as the largest mangrove area in Hong Kong, providing rich food sources for migratory waterbirds and nesting habitats for a number of bird species.

##### Deep Bay Wetland Outside Ramsar Site Priority Site for Enhanced Conservation

3.2.4 The then Environment, Transport and Works Bureau (ETWB) and the Agriculture, Fisheries and Conservation Department (AFCD) identified twelve Priority Sites for enhanced conservation under the New Nature Conservation Policy promulgated in 2004, intending to enhance the ecological value of leased land under the ownership of the lease by means of Management Agreements and Public Private Partnership. One of them is in the vicinity of the assessment area, namely Deep Bay Wetland Outside Ramsar Site.

3.2.5 Part of Deep Bay Wetland Outside Ramsar Site Priority Site for Enhanced Conservation falls within the northern half of the assessment area (**Figure 3.1**). The major habitat type of the site is fishpond, which is man-made and intensively modified by human. The site maintains certain characteristics of natural wetland that attract lots of waterbirds and other wildlife, making it a semi-natural habitat for the wildlife there. 166 bird species, including the Black-faced Spoonbill, were recorded therein (AFCD 2004). It was ranked 9<sup>th</sup> among the 12 Priority Sites for Enhanced Conservation.

### Mai Po Inner Deep Bay Ramsar Site

- 3.2.6 The northern edge of the assessment area, where fishponds and modified watercourses can be found, falls within the Mai Po and Inner Deep Bay Ramsar Site (the Ramsar Site) (**Figure 3.1**). The Ramsar Site covers about 1,500ha of intertidal mudflats, mangroves, *gei wais*, fishponds and reedbed, supporting incredibly high diversity of waterbirds and other aquatic and intertidal fauna. Freshwater and sediment influx for Inner Deep Bay receives come from Hong Kong and Shenzhen. The Ramsar Site was designated as a “Wetland of International Importance” under the Ramsar Convention in 1995.

### Wetland Conservation Area

- 3.2.7 The northwestern part of the assessment area, comprising fishponds in FLW and Nam Sang Wai (NSW), along with the confluence of Kam Tin River (KTR) and SPR, fall within the WCA (**Figure 3.1**). The WCA was designated by the Town Planning Board (TPB) to conserve the ecological value and functions of the fishponds in the Deep Bay wetland ecosystem (TPB Guideline No. 12C). The WCA comprises existing active and abandoned fishponds within the Deep Bay wetland system links with the Mai Po Inner Deep Bay Ramsar Site.
- 3.2.8 Except for permitted essential conservation or infrastructural works, no development involving pond-filling or other works detrimental to the ecological function of the wetland are allowed within the WCA. All essential works conducted within the WCA should comply with the “No-Net-Loss in Wetland” principle. An EcoIA would be mandatory for any development requiring planning permission from the TPB under the Town Planning Ordinance (Cap. 131). Compensation for the loss in wetland area or function arising from development would be imposed as part of the planning approval conditions.

### Wetland Buffer Area

- 3.2.9 The Project Site and the southern part of the assessment area, comprising mainly the hillside area north to Ng Uk Tsuen, Yuen Long Industrial Estate (YLIE) and the upstream section of SPR, falls within the WBA (**Figure 3.1**). The WBA is approximately 500m in width and lies along the landward boundary of the WCA. The intention of WBA is to protect the ecological integrity of wetland habitats within the WCA (TPB Guideline No. 12C). Development within the WBA causing negative impacts on the ecological value of the WCA should be avoided unless appropriate mitigation measures are implemented. However, residential or recreational developments may be approved with appropriate conditions where undesirable open storage area is removed and wetlands are restored. Such development should satisfy the “No-Net-Loss in Wetland” principle.

### Conservation Area (CA)

- 3.2.10 Part of the fishponds in FLW within the assessment area as well as a small portion of mangroves and modified watercourses at Tai Sang Wai (TSW) in the north-eastern tip of the assessment Area is zoned “CA” in the Lau Fau Shan and Tsim Bei Tsui OZP No. S/YL-LFS/8 and NSW OZP No. S/YL-NSW/8 respectively (**Figure 3.1**). The planning intention of the zone is to conserve the ecological value of wetland and fishponds which form an integral part of the wetland ecosystem in the Deep Bay Area. Any change in use within this zone should adhere to the “no-net-loss in wetland” principle.

The primary intention is to discourage new development unless it is required to support the conservation of the ecological integrity of the wetland ecosystem, unless the development is an essential infrastructure project with overriding public interest.

- 3.2.11 The existing fishpond culture within this zone should be maintained and its continuous operation is encouraged. Conservation management activities which will enhance the overall Deep Bay wetland ecosystem are also promoted. Alternative beneficial uses to fishponds such as nature reserve or wetland habitat are permitted as of right within the zone. For those developments which may be permitted on application to the Board, such application should be supported by an EcoIA and a management plan to demonstrate that the development would not result in any net loss in wetland function and negative disturbance impact. Such development should also be compatible with the conservation objectives of the wetland in the Deep Bay Area and should be appropriate as well as be able to enhance the visual and landscape quality of the area. Wetland compensation is required for any development involving pond filling and mitigation measures against any disturbance would be necessary. Certain uses/facilities that are of small scale or necessary to serve the local needs may also be considered on application to the Board.

### **3.3 Important Habitats**

- 3.3.1 The important habitats within the assessment area and identified in the approved EIA report as well as the EM&A reports include confluence of SPR and KTR, active ponds north to Nullah N2 in FLW, wetland habitats adjacent to the Project Site, ardeid night roost next to SPR and SPR Egrettry. The following sections describe the location, designation principle and function of the identified important habitats within the assessment area and their locations are illustrated in **Figure 3.1**.

#### *Confluence of Shan Pui River and Kam Tin River*

- 3.3.2 During low-tide period, the exposed mudflats in the confluence of SPR and KTR (MW1 in **Figure 3.2**) supported the greatest diversity and abundance of overwintering waterbirds during the EIA stage, as the exposed mudflat provides abundant food sources for both large waterbirds and waders of species of conservation importance. Compared to other wetland habitats within the assessment area, the abundance and diversity of avifauna species of conservation importance at the confluence were "Very High" during dry seasons, and "Low to Moderate" during wet seasons (rankings of abundance and diversity of avifauna in different locations are shown in **Figure 3.2**). The confluence of SPR and KTR covers an area of over 10ha and the islands of mudflats at the confluence is separated over 100 m from the closest Project boundary, with centre of the mudflat in the middle of the confluence locating at least over 200 m from the Project Site (**Figure 3.2**).
- 3.3.3 Most of the results from the ecological bird monitoring under the EM&A programme recorded no exceedance in Action / Limit Level during the construction phase (April 2021 up to June 2024), except between the period of April to June 2021, July to September 2021, April to June 2022, October to December 2022, and January to March 2003, but these exceedances were not project-related. On the other hand, piling works for SDB were commenced in April 2024, overwintering and migratory birds were still be found in Deep Bay area in this period. According to the monitoring results of April 2024, the abundance of avifauna species including species of conservation importance, and Shannon Diversity Index Value of avifauna including species of conservation importance, were all higher than the baseline results.

#### *Active ponds north to Nullah N2 in Fung Lok Wai*

- 3.3.4 For the active ponds north to Nullah N2 in FLW within the assessment area (P2 in **Figure 3.2**), while these ponds are located at the edge of FLW and are estimated to constitute less than 10% of the FLW pond area, they are structurally and functionally linked with the fishponds outside the assessment area and supported a variety of waterbirds species of conservation importance including large waterbirds (ardeids and Great Cormorant), ducks and waders. In the approved EIA report, these ponds were also utilized more by birds during the dry season that they supported “Medium to High” abundance and diversity of avifauna species of conservation importance during dry seasons, and “Low to Medium” abundance & “Medium” diversity during wet seasons (rankings of abundance and diversity of avifauna in different locations are shown in **Figure 3.2**). The active ponds north to Nullah N2 in FLW are located at least around 150 m to over 270 m from the closest Project boundary (**Figure 3.2**).

#### Wetland Habitats adjacent to Project Site

- 3.3.5 The wetland habitats in proximity to the Project Site include the mangrove strip and modified watercourse at SPR to the immediate east of Project site (MG & MW2 in **Figure 3.2**) as well as active ponds to the immediate north and west of the Project site in Fung Lok Wai (P1 in **Figure 3.2**). These sites have already been subject to some disturbances from the operation of the existing YLSTW and Yuen Long Industrial Estate (YLIE), the magnitude of construction disturbances is anticipated to be greater than the disturbances from the daily of operation of the YLSTW and YLIE and these sites could be more prone to the construction disturbances given the short separation distance from the Project Site. Nonetheless, these habitats supported comparatively less diversity and abundance of waterbirds than the key wetland habitats. On the other hand, the seasonal variation in bird records between the dry and wet season months could also be observed from MW2 and P1 that the sensitivity of these habitats would be higher during dry season with the presence of some migratory/overwintering waterbirds. While ardeid night roosts were recorded from the mangrove strip east to the Project Site (**Figure 3.2**), no breeding/nursery behaviour was recorded and the mangrove habitats within the assessment area were not a key habitat for the migratory/overwintering waterbirds that the abundance and diversity of avifauna species of conservation importance recorded during both dry and wet seasons were significantly lower than other wetland habitats (**Figure 3.2**).

#### Ardeid Night Roost next to Shan Pui River

- 3.3.6 During the EIA study, Little Egret, Great Egret and Chinese Pond Heron, which are all species of conservation importance, were recorded roosting at night in the mangrove northeast to the Project Site (**Figure 3.2**) during night-time surveys in June 2017. Great Egret was recorded with a maximum of 20 individuals, while Chinese Pond Heron and Little Egret were recorded with a maximum of 10 individuals separately. This ardeid night roost observed during the field surveys was searched but not found during night-time surveys in July 2017. Further site checks were conducted and ardeids were observed roosting in the mangrove northeast to the Project Site again in July 2018. Ardeids (over 60 individuals) were also observed roosting at the mangrove strip east of the Project Site (**Figure 3.2**) in December 2018 but the ardeid night roost northeast to the Project Site was not observed during the site visits. In a night roost, the birds land directly in the trees and perch quickly on a suitable branch where they will sleep over the night. No sign of breeding was noted from the night roosts. During the pre-construction ardeid night roost survey, a pre-roosting aggregate of 5 individuals of Chinese Pond Heron, was noted on the exposed mudflat (further to the east of the final roosting site), which did not exhibit any breeding sign, was observed at around 17:38.

3.3.7 Monthly monitoring of the area within 100m from the Project boundary was conducted during the construction phase to check the status and location of any active ardeid night roost. As one of the mitigation measures to safeguard the ardeid night roost near the Project Site is the restriction of using PME within 100m from the night roost before the ardeids return, night roosts were still be identified within 100m from the Project Site during the construction phase.

Shan Pui River Egretty (SPRE)

3.3.8 No egretty was found within the assessment area during EIA stage. SPRE was first reported in 2019 (Anon 2020), since when Little Egret and Chinese Pond Heron have been reported.

3.3.9 As a matter of the new egretty, monitoring activities of Egretty within 500m from the Project Site (i.e. Shan Pui River Egretty) has been incorporated in the EM&A programme and conducted once a month in the ardeid breeding season, i.e. from March to August, during the construction phase. Based on the findings of the monthly egretty monitoring up to July 2024, the maximum nest count of Chinese Pond Heron at SPRE was 64 during the breeding season of 2024, in previously identified nesting sites (NS) on the immediate northern side of the Project boundary (NS1); and approximately 270m north of the Project boundary (NS4) (Fugro. (2021b – 2023e), Aurecon. (2023 – 2024e). The approximate location of the egretty is shown in **Figure 3.3**. Since 2019, Chinese Pond Heron has been the dominant of SPRE and the number of nests ranges from 38 to 151 (Anon 2020, 2021a, 2021b and 2022). 38 nests of Chinese Pond Heron were recorded during the ardeid breeding season by the Hong Kong Bird Watching Society in 2022 (Anon 2022). The latest approximate location of SPRE as of July 2024 is illustrated in **Figure 3.3**.

Ecological Value of Habitat within Assessment Area

3.3.10 The overall ecological value of the habitats within the assessment area stated in the approved EIA report for YLEPP is summarised in **Table 3-1**.

**Table 3-1 Summary of Ecological Value of Different Habitats within the Assessment Area from the Approved EIA Report**

| Habitat                                   | Overall ecological value  |
|---|---|
| Developed area including the Project Site | Low   |
| Plantation                                | Low   |
| Orchard                                   | Low   |
| Shrubland                                 | Low to moderate   |
| Grassland                                 | Low   |
| Reedbed                                   | Moderate to high  |
| Mangrove                                  | Moderate  |
| Pond                                      | Moderate to high  |
| Modified watercourse                      | Shan Pui River and Kam Tin River: Moderate to high;<br>Nullahs N1 and N2: Low |

**3.4 Species of Conservation Importance**

3.4.1 The number of vascular plant, terrestrial mammal, bird, herpetofauna, butterfly, odonate, freshwater fauna species, including those of conservation importance, recorded within the Project Site and assessment area during the EIA study is tabulated in **Table 3-1**. Limited number of flora and fauna species was recorded within the Project Site during the EIA stage.

3.4.2 A total of 74 species of conservation importance were noted from the reviewed literature and are of relevance to the present study. The respective number of plant,

terrestrial mammal, bird, herpetofauna, butterfly and odonate species of conservation importance recorded within the assessment area is summarized in **Table 3-2**. None of the benthos species recorded is considered of conservation importance. The habitat map and non-avifauna species of conservation importance recorded within the Assessment Area during the EIA stage are illustrated in **Figure 3.4**.

- 3.4.3 The bird surveys conducted during the EIA stage show that peaks of bird species diversity and abundance occurred between November 2016 and March 2017, i.e. the dry season months.

**Table 3-2 Number of Species Recorded within the Project Site and Assessment Area during the EIA Study**

| Types of survey    | Number of species recorded within the Project Site <sup>1</sup>                           | Number of species recorded within the assessment area <sup>1</sup> |
|--------------------|---|--|
| Vascular plant     | 61 (0)  | 271 (2)  |
| Terrestrial mammal | 2 (2)   | 6 (6)  |
| Avifauna           | 19 (1)  | 110 (39)   |
| Herpetofauna       | 3 (0)   | 17 (5)   |
| Butterfly          | 7 (0)   | 70 (8)   |
| Odonate            | 3 (0)   | 25 (4)   |
| Benthos            | Benthos survey was not carried out within the Project Site, where waterbodies were absent | 7 (0)  |

Note:

- (1) Bird species solely considered with any level of concern on the ground that their assessment was on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence by Fellowes *et al.* (2002)
- (2) Number of species of conservation importance recorded within the Project Site and assessment area of the EIA study is enclosed in brackets.
- (3) Mai Po Bent-winged firefly survey was performed, and its abundance was also counted.

Reference:

- (1) AECOM. (2019). Approved Environmental Impact Assessment Report for Yuen Long Effluent Polishing Plant (AEIAR-220/2019).

## 4. UPDATED ECOLOGICAL IMPACT ASSESSMENT

### 4.1 General

- 4.1.1 Based on the current programme (see **Section 2**), there is an imminent risk over capacity of the YLSTW in 2026 if without rectification. The proposed allowance of percussive piling during the proposed period represents the only change in works, in order to ensure the YLEPP upgrade work be completed in late 2026 / early 2027 as per the EIA report. As such, this updated ecological assessment only focuses on potential ecological impacts arise from the piling works and other concurrent works within the Project Site during the proposed period. The other aspects of EcoIA presented in the EIA report are considered remain valid and re-assessment is considered not necessary.

### 4.2 Construction Phase

#### ***Direct Impact***

##### *Habitat Loss*

- 4.2.1 The proposed adoption of percussive piling within the Project Site during the proposed period will not create additional habitat loss. No additional ecological mitigation measures would be required.

##### *No Direct Impact on Recognized Sites of Conservation Importance or Important Habitats*

- 4.2.2 Percussive piling works to be conducted during the proposed period will be confined within the Project Site and will not encroach on any recognized site of conservation importance. Thus, no direct impact will be exerted on them. No additional ecological mitigation measure would be required.

#### ***Indirect Impact***

##### *Disturbance from Construction Activities*

- 4.2.3 While the works area would be restricted within the boundary of the existing YLSTW, the temporary increase in disturbances, including noise, dust emission, glare and other human activities etc. induced by construction activities at the Project Site could pose indirect impacts on nearby sites of conservation importance and sensitive wetland habitats, as well as the associated fauna species of conservation importance.

##### *Disturbance Impacts on Sites of Conservation Importance and Ecologically Sensitive Areas*

- 4.2.4 The SDB falls within the WBA and are adjacent to the boundaries of WCA, "CA", and the Deep Bay Wetland Outside Ramsar Site Priority Site for Enhanced Conservation, whilst Mai Po Inner Deep Bay Ramsar Site and Mai Po Marshes SSSI are located at least 370m and 400m north to the Project Site respectively. The wetland habitats within the assessment area serve as important feeding/roosting ground for migratory and overwintering waterbirds that majority of the wetland-dependent birds recorded within the assessment area. The construction disturbances could cause the deterioration of habitat quality and decrease of bird usage as well as subsequent decrease in wildlife density therein. The sensitivity of the wetland habitats would generally be considered higher during the peak visiting period of the migratory and overwintering avifauna, i.e., dry season, given the greater number of species of conservation importance which would be affected.



- 4.2.5 The following sections address the updated EcoIA on the confluence of SPR and KTR located northeast to the Project Site (i.e., the mudflats in the modified watercourses) (MW1) and the active ponds north to Nullah N2 in FLW (P2), which are all located largely within the WCA, CA and Deep Bay Wetland Outside Ramsar Site Priority Site for Enhanced Conservation. The northern end of MW1 and P2 also falls within the Ramsar Site. The wetland habitats in these two areas supported the greatest diversity and abundance of migratory and overwintering waterbirds observed within the assessment area and are considered the key wetland habitats (i.e., MW1 and P2) for these species.
- 4.2.6 Confluence of Shan Pui River and Kam Tin River and Active Ponds North to Nullah N2 in Fung Lok Wai – The greatest diversity and abundance of overwintering waterbirds recorded was at MW1, while “Medium to High” abundance and diversity of avifauna species of conservation importance was recorded at P2 during dry seasons of the ecological baseline stage. The islands of mudflats at the confluence of SPR and KTR are separated over 100m from the Project boundary, with centre of the mudflat in the middle of the confluence locating at least over 200m from the Project Site. In the approved EIA Report, the impacts of construction disturbance on MW1 and P2 were expected to be **moderate** in dry season, if unmitigated.
- 4.2.7 However, the proposed SDB is located at the southern side of the Project Site, which is about 200m from the northeast corner of the Project Site boundary (the area closer to the confluence of Shan Pui River and Kam Tin River). The distance between the proposed SDB and MW1 is at least 300m (at least 400m from the centre of the mudflat); while the distance between the proposed SDB and P2 ranges from 350m to 470m. Given the distance between SDB and these two areas with medium to high abundance and diversity of avifauna species recorded, the construction disturbance impacts on these areas are anticipated to be **minor to moderate** if percussive piling is to be implemented during the proposed period in an unmitigated scenario. Additional noise mitigation measures will be implemented to mitigate the potential ecological impacts for the piling works during the proposed period.
- 4.2.8 Wetland Habitats adjacent to the Project Site – MG & MW2, as well as P1 have been subject to disturbances posed by the operation of the existing YLSTW and YLIE, the magnitude of construction disturbances during the proposed period is anticipated to be greater than the disturbances from the daily operation of the YLSTW and YLIE. These sites could be more prone to the construction disturbances, given the short separation distance from the Project Site. The baseline results reveal that comparatively lower diversity and abundance of waterbirds were recorded there than in the key wetland habitats. While ardeid night roosts were recorded from the mangrove strip east to the Project Site, no breeding/nursery behaviour was recorded. The mangrove habitats within the assessment area were not a key habitat for the migratory/overwintering waterbirds, as the abundance and diversity of avifauna species of conservation importance recorded therein during both dry and wet season were significantly lower than in other wetland habitats. The disturbance impacts are therefore considered **minor to moderate** for MW2 and **minor** for P1, if piling is conducted during dry season in an unmitigated scenario. On the other hand, the disturbance impact on the mangrove strip adjacent to the Project site is considered **minor** as no construction works involving the use of PME as well as the piling works should be undertaken within 100m from the night roost after 18:00 during wet season and 17:30 during dry season to avoid disturbance to the ardeid night roost as specified in the approved EIA report.
- 4.2.9 Other Wetland Habitats within the Assessment Area - For other wetland habitats within the assessment area, including upper course of SPR along YLIE (MW3), inactive ponds in FLW (P3), active and inactive ponds in NSW (P4), active ponds in TSW, mangrove other than the strip adjacent to the Project Site and reedbed, while they are also within

different recognized sites of conservation importance, they are generally located further away from the Project Site and only comparatively low or very low abundance and diversity of avifauna species of conservation importance were recorded during the baseline stage, with only MW3 and P4 supporting slightly more avifauna in dry season. The disturbance impact on P3, reedbed and mangrove habitats other than the strip to the immediate east of the Project Site owing to piling works are therefore considered **insignificant**. The active ponds in TSW within the assessment area are located over 400m from the Project Site that the disturbance impacts are considered **negligible**. While one end of MW3 is located as close as around 50m from the Project boundary, it runs away from the southeastern corner of the Project site and stretches over 460m long. The disturbance impact on MW3 is therefore considered **minor** during dry season. Amongst the ponds of P4, the active and inactive ponds are located at least around 140m and over 270m from the Project Site respectively. The impacts of construction disturbance are therefore considered **minor** during dry season (even with the proposed piling works during the proposed period) for active ponds in NSW and **insignificant** during dry season for the inactive ponds in NSW.

#### Disturbance Impacts on Species of Conservation Importance and Migratory/Overwintering Waterbirds during Dry Season

- 4.2.10 The noise levels of the proposed works (including piling) could potentially cause moderate level of disturbance to the waterbirds. It should be noted that while wetland habitats comprise almost 60% of the assessment area (with over 70ha of ponds and modified watercourses with mudflat), there are about 1,500ha of wetland in the Ramsar Site north to the assessment area. Serious impacts to the waterbirds using the wetland habitats near the Project Site is therefore unlikely, given the ability of birds to move away from sources of disturbance as well as the ample of well-connected, continual and extensive wetland habitats available within and in the vicinity of the assessment area. Furthermore, the key habitats where most avifauna species of conservation importance were recorded are all located further from the Project Site (MW1 and P2) and the wetland habitats in close vicinity to the Project site (MW2 and P1) were significantly less utilized by the waterbirds, particular migratory/overwintering ones. The impact from construction noise disturbance was considered **moderate** for migratory/overwintering waterbirds and **minor to moderate** for the more disturbance-tolerant waterbirds that are present all year if unmitigated in the approved EIA Report, given the generally high diversity and abundance of overwintering waterbirds recorded within the assessment area and the high construction noise level.
- 4.2.11 However, the proposed SDB is located at the southern side of the Project Site, which is about 200m from the northeast corner of the Project Site boundary. The distance between the proposed SDB and MW1 is at least 300m (at least 400m from the centre of the mudflat); while the distance between the proposed SDB and P2 is at least 350m to 470m. Given the distance between the SDB and that the surrounding buildings and structures (**Figure 1.3**) will also screen the disturbance posed by piling works, the corresponding impact on migratory/overwintering waterbirds and more disturbance-tolerant waterbirds (i.e. waterbirds that are present all year round e.g. ardeids) are considered to be **minor to moderate** for MW1 and **minor** for P2. Additional noise mitigation measures will be implemented to mitigate the potential ecological impacts (i.e. MW1) for the piling works during the proposed period.
- 4.2.12 Disturbance to Shan Pui River Egret – The disturbance impact to SPRE, which is primarily composed of Chinese Pond Heron in recent years, was not addressed in the approved EIA report, as SPRE was first reported by HKBWS in 2019 (Anon 2020). It is noted from the ecological monitoring data that nests of ardeids have moved closer

to the Project Site throughout the years of the construction phase, even in the period with piling works. The breeding season of ardeids in Hong Kong is usually between March and August, but no nests were recorded in SPRE in March of 2022, 2023 and 2024 according to the monthly monitoring under the EM&A. The proposed percussive piling works in March, though, might coincide with the first breeding month of ardeids in March 2025. However, considering that the majority of percussive piling works falls beyond the breeding season of ardeids, the distance between SDB and SPRE and the disturbance screening offered by buildings and structures in the vicinity of SDB, as well as the close proximity of breeding ardeids in the piling periods, it is anticipated that the construction disturbance impact on SPRE during dry season is considered **minor**.

- 4.2.13 *Disturbance to Pre-Roosting Ardeid Aggregate and Ardeid Night Roost* – Ardeids habitually return to the night roost at around an hour before sunset and percussive piling works to be undertaken in dry season and to last from 07:00 to 19:00 would potentially briefly interfere with the night roosts for up to around 2 hours and cause disturbance impacts (mainly construction noise) on the ardeids night roosts in the mangrove strips northeast and east to the Project Site. Ardeids are relatively more disturbance-tolerant, as they often forage in urban areas. Given the short interface of the construction hours and ardeids roosting hours, it was assessed in the approved EIA report that the unmitigated construction noise disturbance impacts on the ardeid night roost were expected to be **minor to moderate** given the short separation distance (~30m, between Project Site boundary and the mangrove strip east of Project Site). During the pre-construction ardeid night roost survey, a pre-roosting aggregate of 5 individuals of Chinese Pond Heron, was noted on the exposed mudflat (further to the east of the final roosting site), which did not exhibit any breeding sign, was observed at around 17:38. In view of the lengthened distance between SDB and the night roost (>100m), spatial and temporal fluctuation in the observed location of the ardeid night roosts and that part of the construction noise disturbance would be screened by the proposed buildings and structures to the north and northeast of the SDB, it is anticipated that disturbance impact on the ardeid night roost as well as the pre-roost due to percussive piling works during the proposed period will only be **minor** in an unmitigated scenario. Mitigation measures have been proposed in Section 4.3 below and should also be implemented to minimize the impacts of construction/visual disturbance on the ardeid night roost as much as possible. In addition, percussive piling works will not be conducted between 4:30 pm and 8:30 am of the following day during the proposed period.

#### *Vibration Disturbance from Potential Percussive Piling Works*

- 4.2.14 Apart from construction noise, ground-borne vibration due to potential percussive piling works (insignificant vibration from bored piling works by reverse circulation drill) at the Project Site could also disturb waterbirds foraging or resting in wetland habitats nearby the Project Site. Tides in Hong Kong are mainly semi-diurnal and the higher high tides occur mostly overnight in winter and during daytime in summer (Hong Kong Observatory 2023). As such, migratory/overwintering waterbirds that utilise the mudflats along SPR close to the Project Site would be particularly prone to the vibration disturbance. Wetland habitats located in close vicinity of the Project Site, i.e., SPR and ponds adjacent to Project Site, supported significantly less diversity and abundance of waterbirds that were mostly resident, and that the key wetland habitats that supported the most migratory/overwintering waterbirds, i.e., confluence of SPR and KTR and active ponds in FLW, are located further from the Project Site. The impact on migratory/overwintering waterbirds from the vibration due to percussive piling works in dry season was considered **minor to moderate**, if unmitigated, in the approved EIA report. However, the distance between the proposed SDB and the

confluence of MW1 is at least 300m (at least 400m from the centre of the mudflat); while the distance between the proposed SDB and P2 is at least 350m to 470m. Given the distance from the SDB, it is anticipated that the impact arising from the vibration on waterbirds and the aforesaid habitats would be **minor**.

- 4.2.15 The potential impact of the proposed piling works together with other concurrent works within the Project Site during the proposed period are summarized in **Table 4-1**.

### 4.3 Operational Phase

- 4.3.1 The proposed change in construction programme will not induce any change to the operational phase impacts which have been assessed in the EIA report. On the other hand, with the proposal will ensure timely implementation of the YLEPP, and hence, improvement in the effluent quality brought by the YLEPP. The ecology of the Deep Bay would be benefited with the improvement in the water quality (reduction in effluent loading).

**Table 4-1 Summary of Potential Construction Phase Impacts and Mitigation Measures Requirements During the Proposed Period**

| Ecological Impact  |  | Unmitigated level of impact | Level of impact with the implementation of mitigation | Adoption of additional mitigation measures* |
|--|--|-----------------------------|---|---|
| <b>Direct Impact</b>   |  |                             |   |   |
| Habitat loss   |  | Not anticipated             | Not anticipated                                       | Not required                                |
| Impact on Recognized Sites of Conservation Importance or Important Habitats  |  | Not anticipated             | Not anticipated                                       | Not required                                |
| <b>Indirect impact</b>   |  |                             |   |   |
| <b>Construction Disturbance Impacts on Sites of Conservation Importance and Ecologically Sensitive Areas</b>         |  |                             |   |   |
| MW1  |  | Minor to moderate           | Minor   | Yes   |
| MW2  |  | Minor to moderate           | Minor   | Yes   |
| MW3  |  | Minor                       | Insignificant   | No  |
| P1   |  | Minor                       | Insignificant   | No  |
| P2   |  | Minor to moderate           | Minor   | Yes   |
| P3   |  | Insignificant               | Negligible  | No  |
| Active ponds of P4   |  | Minor                       | Insignificant   | No  |
| Inactive ponds of P4   |  | Insignificant               | Negligible  | No  |
| Active ponds in TSW  |  | Negligible                  | Negligible  | No  |
| MG strips adjacent to the Project Site   |  | Minor                       | Insignificant   | No  |
| MG other than strips adjacent to Project site within the assessment area   |  | Insignificant               | Negligible  | No  |
| Reedbed  |  | Insignificant               | Negligible  | No  |
| <b>Construction disturbance Impacts on Species of Conservation Importance and Migratory/Overwintering Waterbirds</b> |  |                             |   |   |
| Construction noise disturbance   | Migratory/overwintering waterbirds                         | Minor to moderate           | Minor   | Yes   |
|  | Waterbirds that are present all year round (e.g., ardeids) | Minor                       | Insignificant   | No  |
|  | Shan Pui River Egret                                       | Minor                       | Insignificant   | No  |
|  | Ardeid night roost   | Minor                       | Insignificant   | No  |
| Vibration disturbance from potential percussive piling works   | Migratory/overwintering waterbirds                         | Minor                       | Insignificant   | No  |

\* in particular for the impact level of minor to moderate, but impacts of lower level are also further minimized

## 5. MITIGATION

### 5.1 Objective

- 5.1.1 According to the *EIAO-TM Annex 16*, ecological impacts on important habitats and the associated wildlife caused by the proposed Project should be mitigated, in order of priority, avoidance, minimization, and compensation approaches to the maximum practical extent.
- 5.1.2 The approved EIA report recommended a list of noise reduction measures which could mitigate the potential impacts to ecology, according to the monitoring data during construction phase. The latest Noise Mitigation Measures Plan is accessible via the EIAO Internet Website. Potential ecological impacts arising from the construction phase of percussive piling works together with other concurrent works within the Project Site during the proposed period are summarised in **Table 4-1**. Besides the existing mitigation measures, additional mitigation measures specified below are proposed to further minimize the potential ecological impacts from the piling works during the proposed period.

### 5.2 Avoidance

#### Avoidance of Direct Impact on Recognized Sites of Conservation Importance, Important Habitats and Breeding/Roosting Ground

- 5.2.1 There is no expansion of the Project Site, and all construction works are still confined within the boundary of the existing YLSTW. Direct encroachment on other identified recognized sites of conservation importance (i.e., the Ramsar Site, Priority Site, WCA, WBA (outside the Project site), SSSI and CA), important habitat and roosting grounds (i.e., SPR Egretty and ardeid night roost at SPR) would be avoided.

#### Avoidance of Indirect Impact on Ardeid Night Roost

- 5.2.2 Percussive piling in the proposed period will be conducted at daytime only and it will not be conducted between 4:30 pm and 8:30 am of the following day. Furthermore, the proposed works area (i.e., SDB) is more than 100m from the ardeid night roost. Indirect impact on the ardeid night roost next to Shan Pui River during the proposed period is not expected.

### 5.3 Minimization

#### Minimization of Construction Disturbance by Adopting Percussive Piling during High Tide Period

- 5.3.1 Extensive area of mudflat along Shan Pui River in particular the confluence of Shan Pui River and Kam Tin River (with very high abundance and diversity of avifauna during dry season) is exposed during low tide period. The exposed mudflat provides abundant food sources for both large waterbirds and waders of species of conservation importance. The tidal level below 1.5m (above the Chart Datum) was taken as the tidal level at which avifauna surveys overlooking the mudflats and mangroves in Shan Pui River were undertaken during the EIA baseline survey stage. Thus, very high abundance and diversity of avifauna at MW1, high diversity of avifauna at MW2 and MW3, were recorded in dry season of the EIA baseline stage. Due to the attractiveness to waterbirds of the mudflat during low tide period, percussive piling works is scheduled to be conducted when the tidal level is high (i.e., above 1.5m when the mudflats would be mostly submerged) which is considered a precautionary approach to further minimize the potential impact to waterbirds in dry season.

*Minimization of Construction Noise Disturbance Impacts with Additional Noise Mitigation Measures*

- 5.3.2 While percussive piling works during the proposed period is considered unavoidable as explained in previous sections, with due consideration to minimise the noise impact, it is proposed that no more than two piling rigs be allowed to work concurrently.
- 5.3.3 SDB is at the middle south of the YLSTW. It is isolated from the nearby natural habitats by the existing structures / newly constructed facilities of YLSTW/YLEPP and the YLIE (see **Figure 1.3**). These structures / facilities will provide some screening /shielding to the works at the SDB. To further minimize noise disturbance due to percussive piling works during the proposed period, additional mitigation measures have been devised and will be implemented to mitigate the extra noise impact on the surrounding habitats and species in conjunction with the implemented noise mitigation measures (e.g., noise barriers along the northern and eastern boundary of the Project Site) in effect. Prior to the scheduled piling during the proposed period, additional 4-metre-tall high noise barriers will be erected around SDB to further reduce the noise disturbance generated by percussive piling works, while a full height U-shaped noise barrier will be erected around each piling rig to minimize the noise disturbance generated by the operation of piling rigs. Furthermore, subject to the site condition, additional 2m high noise barrier shall be provided at rooftop of existing buildings to the northern and eastern side of the SDB to provide further screening.
- 5.3.4 Previous studies and observations suggested that waterbirds could assimilate more readily to ongoing and regular noise than sudden/explosive irregular noise event at a similar noise level. For instance, irregular and high level of construction noise could cause higher disturbance to waterbirds, while regular piling noise of similar noise level would only cause lower level of disturbance that could become habituated readily by the waterbirds without any accompanied visual disturbance. Hence, the piling works will be strictly monitored to avoid irregular piling patterns, and the piling works will be commenced with soft-start on each piling day and after idling of piling, and then progressively increase the strength (at the beginning of piling works, the piling at the second rig will only start 5 minutes after the first rig has started), to allow the wildlife, particularly waterbirds, to habituate to the piling works.
- 5.3.5 Various at-source mitigation measures are available and could be adopted for reducing piling noise, for example, custom-made capsule, insulation wrap and noise enclosure, etc. There will be full height U-shaped noise barrier to shield the entire piling rigs to further reduce generation of noise affecting the waterbirds. In addition, the number of piling rigs were not limited/specified in the approved EIA and the approval conditions of the EP. It is now confirmed that the number of piling rigs will be limited to no more than two at any time during dry season. Together with general good site practices as recommended in the EIA Report (such as the use of QPME, well maintenance of plants, shutdown of unused plants) would be undertaken during the piling period, potential disturbance to the wildlife during the dry season could be minimized to acceptable levels.
- 5.3.6 In percussive piling works, the noise and vibration are generated mainly due to the impact action of the hammer driving the piles. Hydraulic hammering is an improved driven piling and will produce less noise than traditional piling method. If the U-shaped noise barrier and/or noise shield are applied, the noise level could be further reduced significantly. Noise absorption material will be added to the U-shaped noise barrier and/or noise shield to improve noise shielding effectiveness. To further minimise the potential impacts of the piling works, the engineer will also monitor the driving height of the hammer. In general, the higher the driving height, the greater the noise and vibration will be. However, in localities with soft ground, the driving height can be reduced with the same efficiency. For the YLEPP site, the engineer has estimated that

this is generally achievable for the first 10m of the topsoil. It is anticipated the driving height can be reduced by 50% at this soil stratum.

- 5.3.7 For the indirect disturbance impacts of other general construction activities during the proposed period, due to the low noise level and/or the distance from the Project Site to the ecological sensitive receivers, potential impacts to the waterbirds are considered insignificant.

## **6. CUMULATIVE ECOLOGICAL IMPACT**

- 6.1.1 With the best available and up-to-date information, there is no known concurrent project within the current assessment area and thus cumulative ecological impact is not anticipated.



## 7. RESIDUAL ECOLOGICAL IMPACT

- 7.1.1 Residual ecological impacts refer to the ecological impacts which will still arise despite the adoption and implementation of ecological mitigation measures. According to the Annex 16 of EIAO-TM, ecological impacts on important habitats and the associated wildlife caused by the proposed Project should be mitigated, in order of priority, avoidance, minimisation, and compensation approaches to the maximum practical extent.

### Residual Impacts to Wetland Habitats immediately adjacent to the Project Site and Associated Migratory/Overwintering Waterbirds during Dry Season

- 7.1.2 While some affected wetland habitats are located immediately adjacent to the Project site, (MW2, P1 and MG adjacent to the Project Site) during the proposed period, they supported generally lower number of avifauna species of conservation importance compared to the key wetland habitats at MW1 and P2. With the implementation of the abovementioned mitigation measures proposed to reduce the overall all construction disturbance from the Project Site, it is considered that there would be no significant noise disturbance on the wetland habitats adjacent to the Project Site. Furthermore, the key wetland habitats are well-connected to the wetland habitats adjacent to the Project Site and there are ample of continual and extensive wetland habitats in the vicinity of the assessment area (over 70ha of ponds and modified watercourses with mudflat within the assessment area and about 1,500ha of wetland in the Ramsar Site north to the assessment area), given the ability of birds to move away from sources of disturbance, no residual ecological impact on the migratory/overwintering waterbirds at the wetland habitats adjacent to the Project Site are anticipated.

### Residual Impacts to Wetland Habitats further from the Project Site and Associated Migratory/Overwintering Waterbirds during Dry Season

- 7.1.3 Other affected wetland habitats within the assessment area (MW3 and active ponds of P4) and the key wetland habitats (MW1, P2) that supported the greatest numbers of overwintering/migratory waterbirds during dry seasons are located further from the Project Site (at least over 100m) and the magnitude of construction noise disturbance experience by waterbirds is expected to be further reduced. Additional mitigation measures have been proposed in **Section 5** to mitigate the impact of percussive piling during the proposed period and to lower the overall construction noise levels of the construction activities as discussed above, no residual ecological impact on these wetland habitats and the associated migratory/overwintering waterbirds are anticipated.

## **8. ENVIRONMENTAL MONITORING AND AUDIT**

- 8.1.1 The ecological monitoring committed in the approved EIA report will uphold, including during the proposed period, and continue until the end of construction and operation phases. The site monitoring and auditing exercises during construction phase of the development aim to ensure the effectiveness of the mitigation measures for the protection of the ecologically sensitive habitats. The ecological monitoring and audit, including wildlife monitoring survey covering all the sensitive areas identified in the approved EIA report as well as the present updated EcoIA, will continue in order to check the validity of the impact predictions and effectiveness of the proposed mitigation measures. It is also noted that there will be noise monitoring programme during the concerned dry season as part of the noise mitigation measure.
- 8.1.2 Besides, water quality monitoring at locations as stipulated in the approved EIA report during construction/operation phases would continue to be carried out to ensure that water quality impacts are being adequately controlled from the fisheries perspective.

## 9. CONCLUSION

- 9.1.1 A review on the approved YLEPP EIA report and construction phase EM&A reports have been conducted and relevant ecological impact assessment has been updated. While the ecological values of the habitats ranked during the EIA stage remain unchanged, the ecological impact upon to the proposed construction programme alteration has been updated.
- 9.1.2 No direct impact will be imposed on recognized site of conservation importance, important habitat or natural habitats within the assessment area upon to the adoption of percussive piling for only one building (i.e. SDB) near the southern side of the Project Site during the proposed period (i.e., in part of the dry season in 2024 to 2025).
- 9.1.3 Due to the distance between the SDB and the ecological sensitive receivers (e.g. confluence of Shan Pui River and Kam Tin River), and the SDB is actually isolated from the nearby natural habitats by the existing structures / newly constructed facilities of YLSTW/YLEPP which will provide some screening /shielding to the works at the SDB, potential ecological impacts from the proposed piling works will be much less than the piling works near the northern and eastern sides of the Project Site. Major indirect impacts due to construction noise disturbances from percussive piling works on key wetland habitats within assessment area and in close proximity to the Project site as well as migratory/overwintering waterbirds have been further avoided/minimized through the additional mitigation measures.
- 9.1.4 With the implementation of the recommended additional mitigation measures, no residual impact would be expected for the piling works during the proposed period.
- 9.1.5 Ecological monitoring should be conducted during construction phase as well as the proposed period to monitor the effectiveness of proposed mitigation measures, including the additional measures proposed, and detect any unpredicted indirect ecological impacts arising from the proposed Project and the implementation of mitigation measures would be subject to regular audit as part of the EM&A programme.

## 10. REFERENCE

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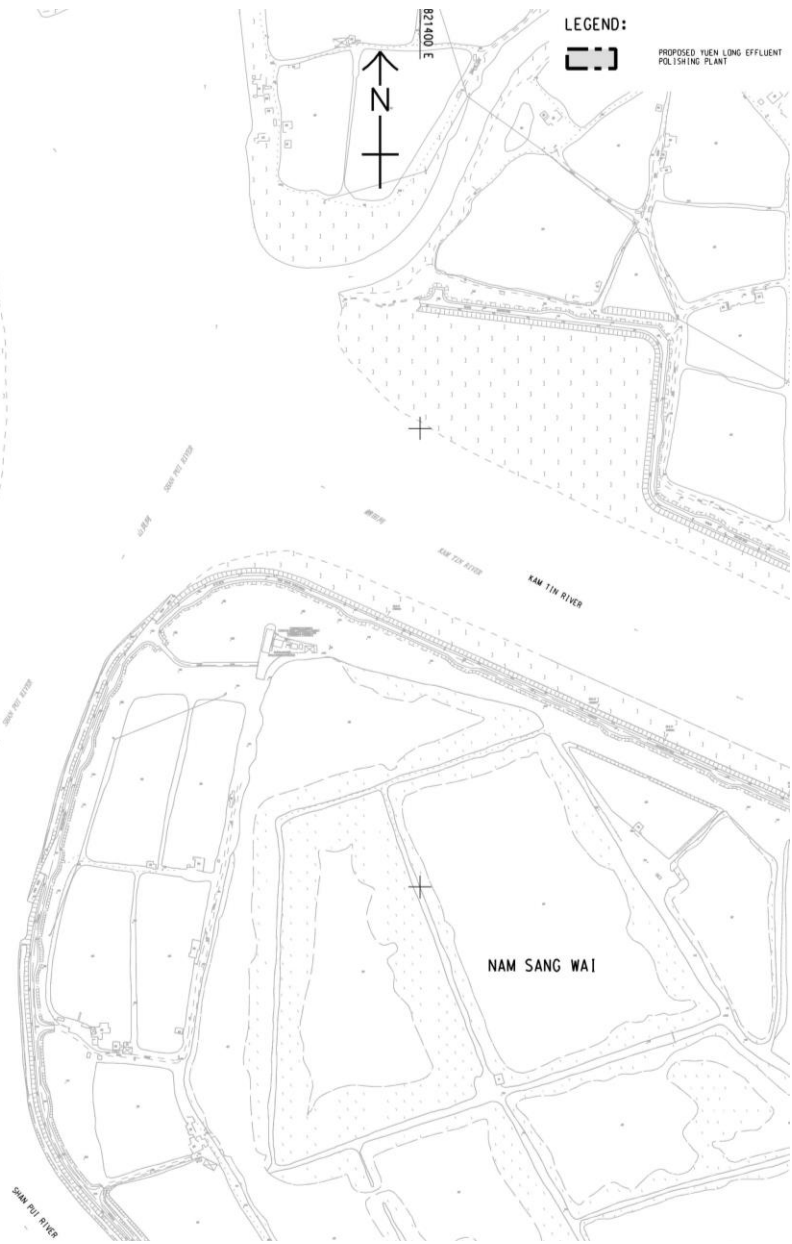
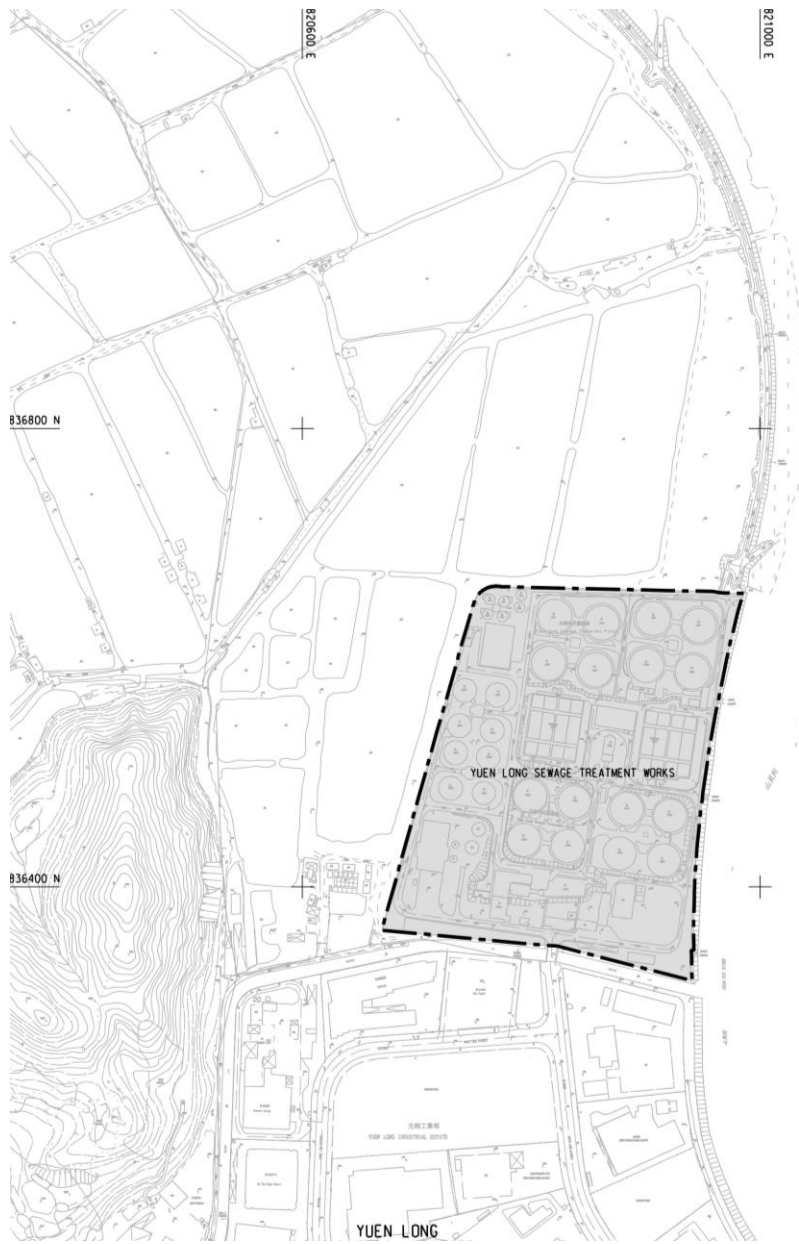
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## FIGURES



LEGEND:  
 PROPOSED YUEN LONG EFFLUENT POLISHING PLANT

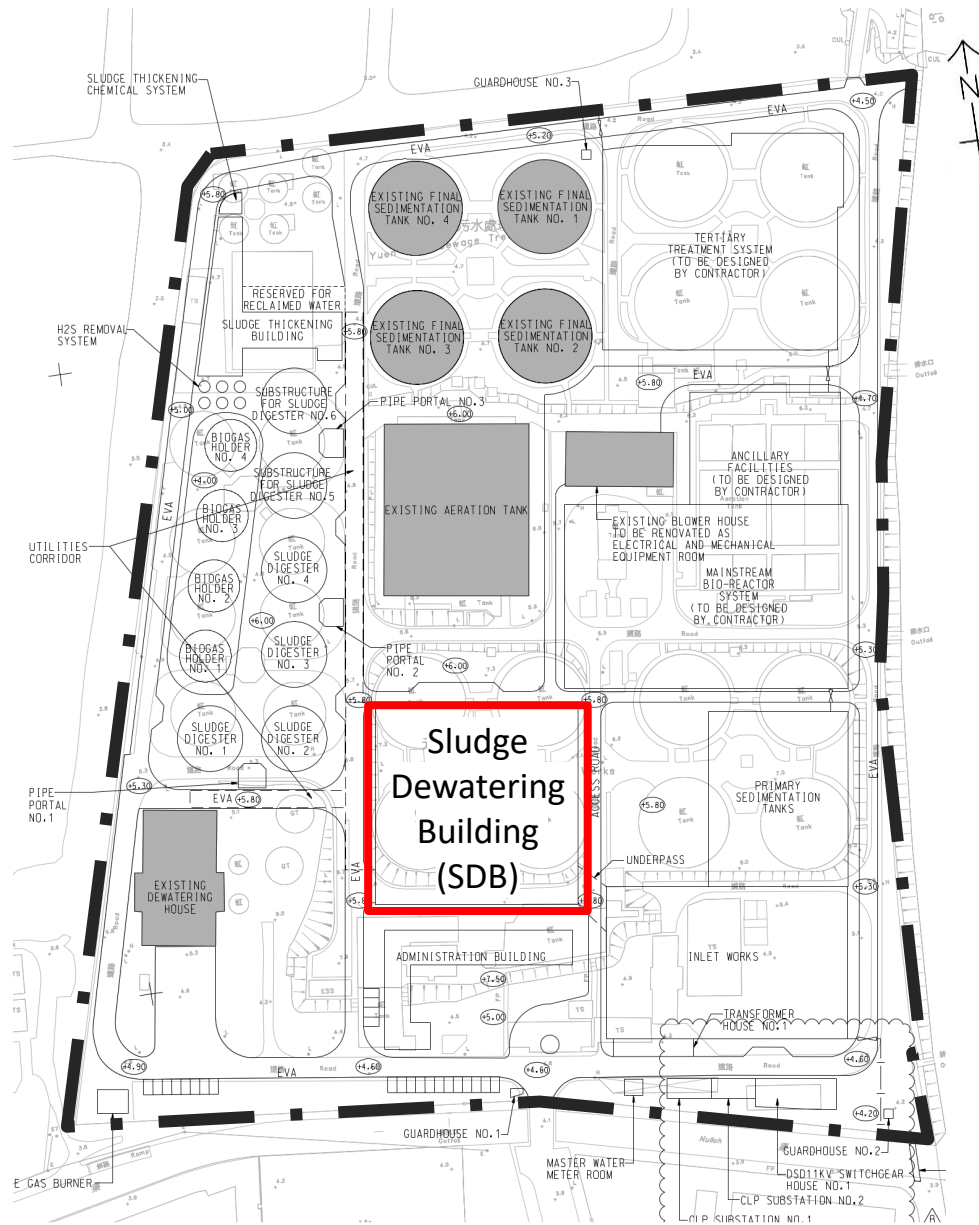


DC/2019/10 - YLEPP – Main Works for Stage 1  
 Consultancy Service for  
 Supporting Variation of Condition 2.10 of EP-565/2019

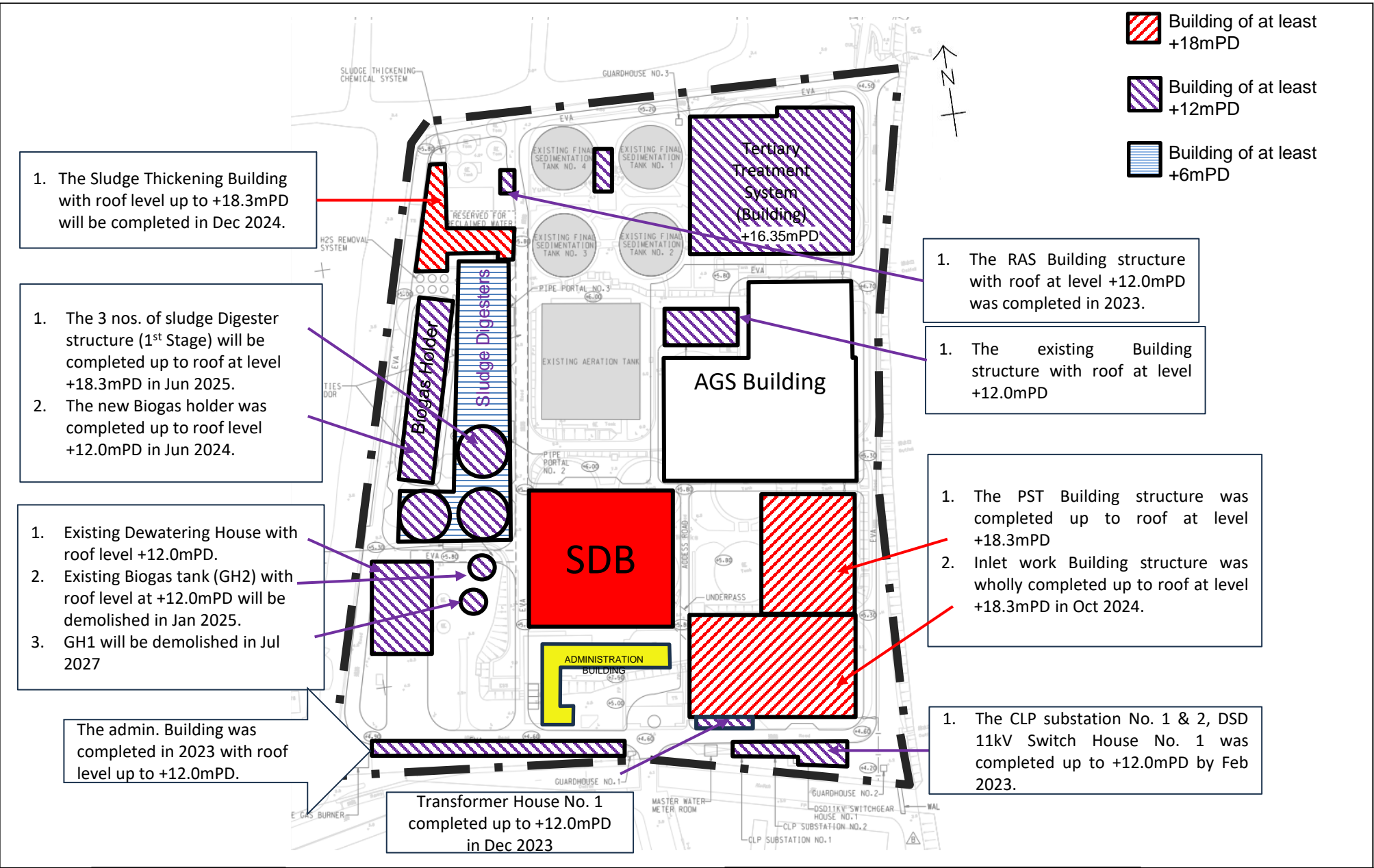
Location of Proposed Yuen Long  
 Effluent Polishing Plant (YLEPP)

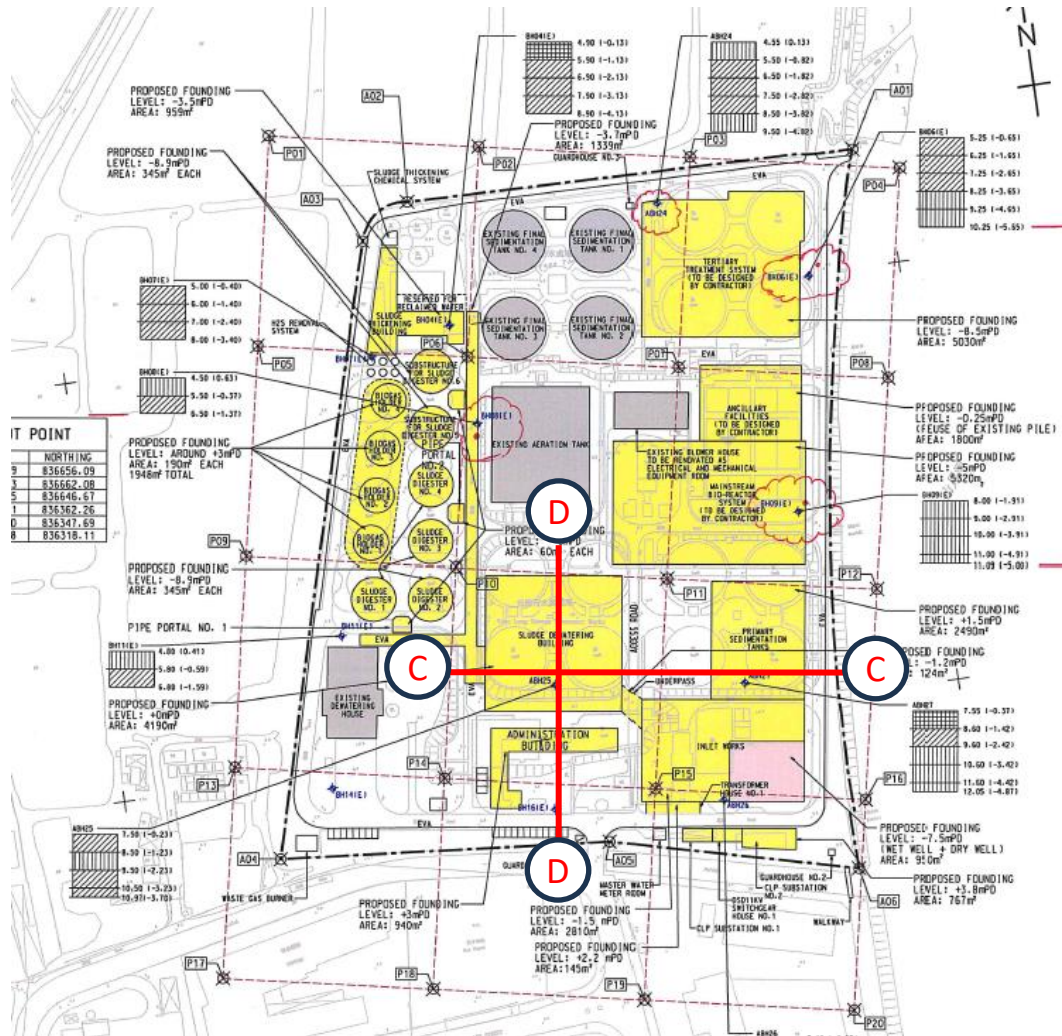
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| Check:      | YH         |





□ Location of SDB





DC/2019/10 - YLEPP – Main Works for Stage 1  
 Consultancy Service for  
 Supporting Variation of Condition 2.10 of EP-565/2019

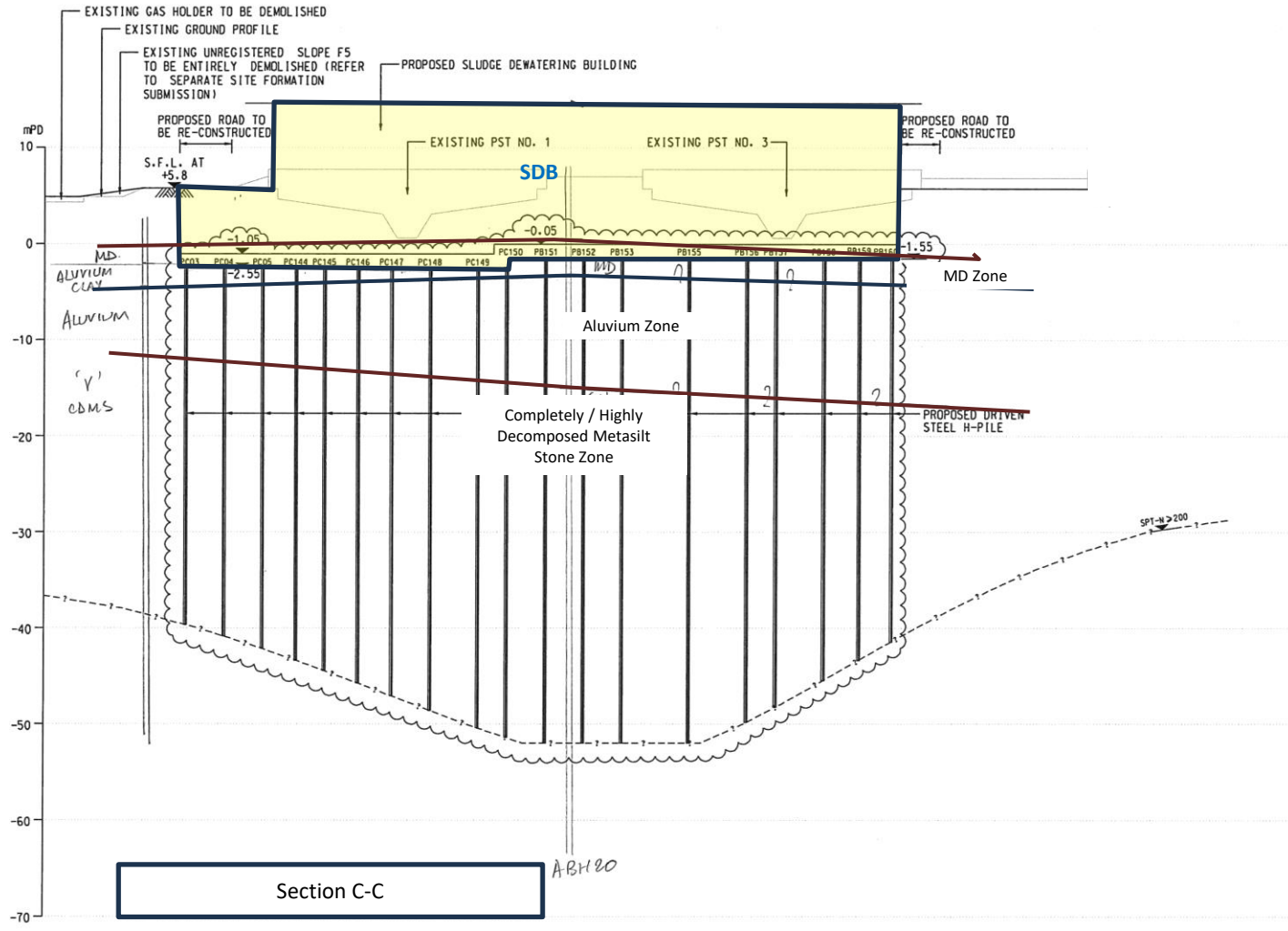
### Geological Profiles of the Site (Sheet 1 - Overview)

Figure No.: 2.1

Date: 14/08/2024 Scale: NTS

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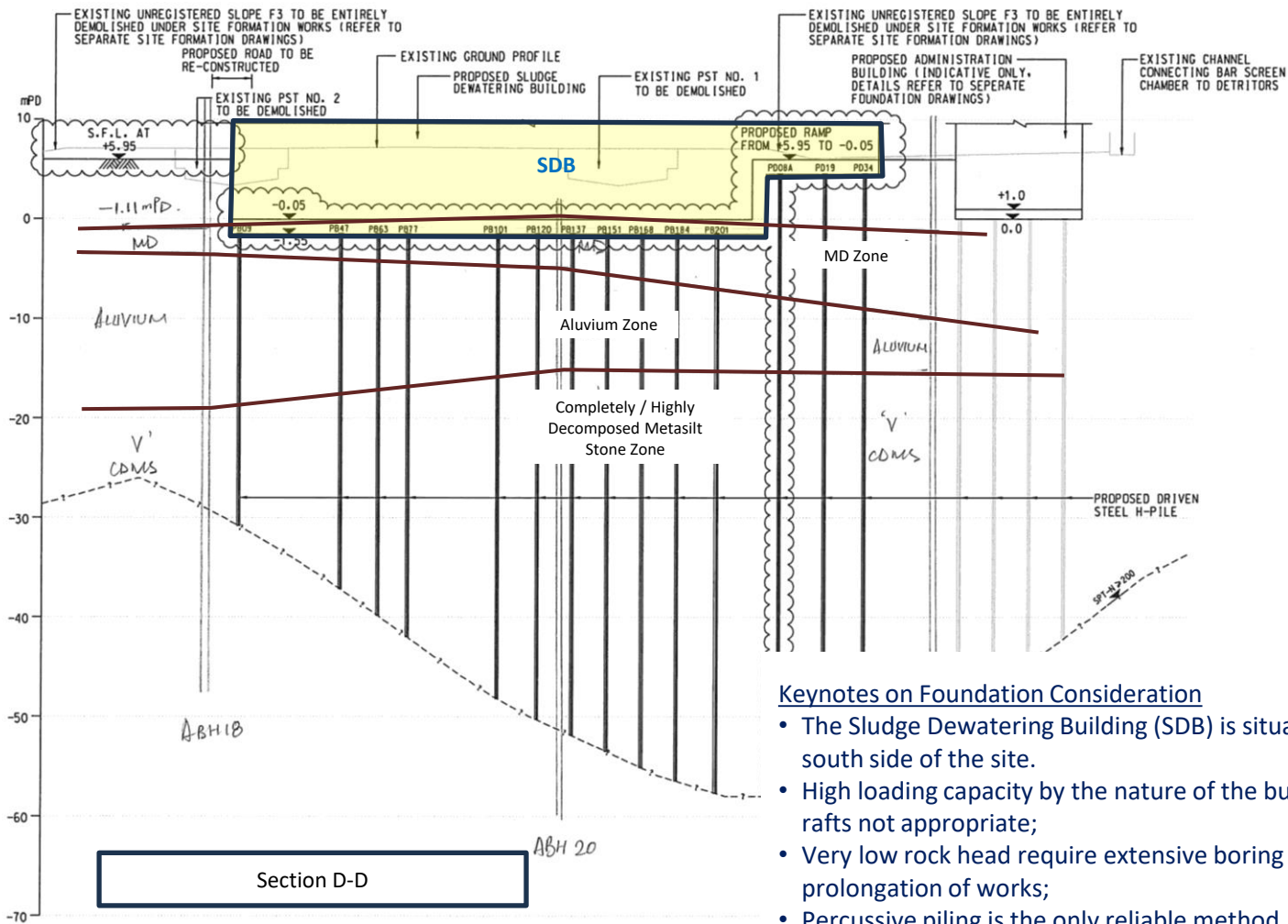
Section C-C



DC/2019/10 - YLEPP – Main Works for Stage 1  
 Consultancy Service for  
 Supporting Variation of Condition 2.10 of EP-565/2019

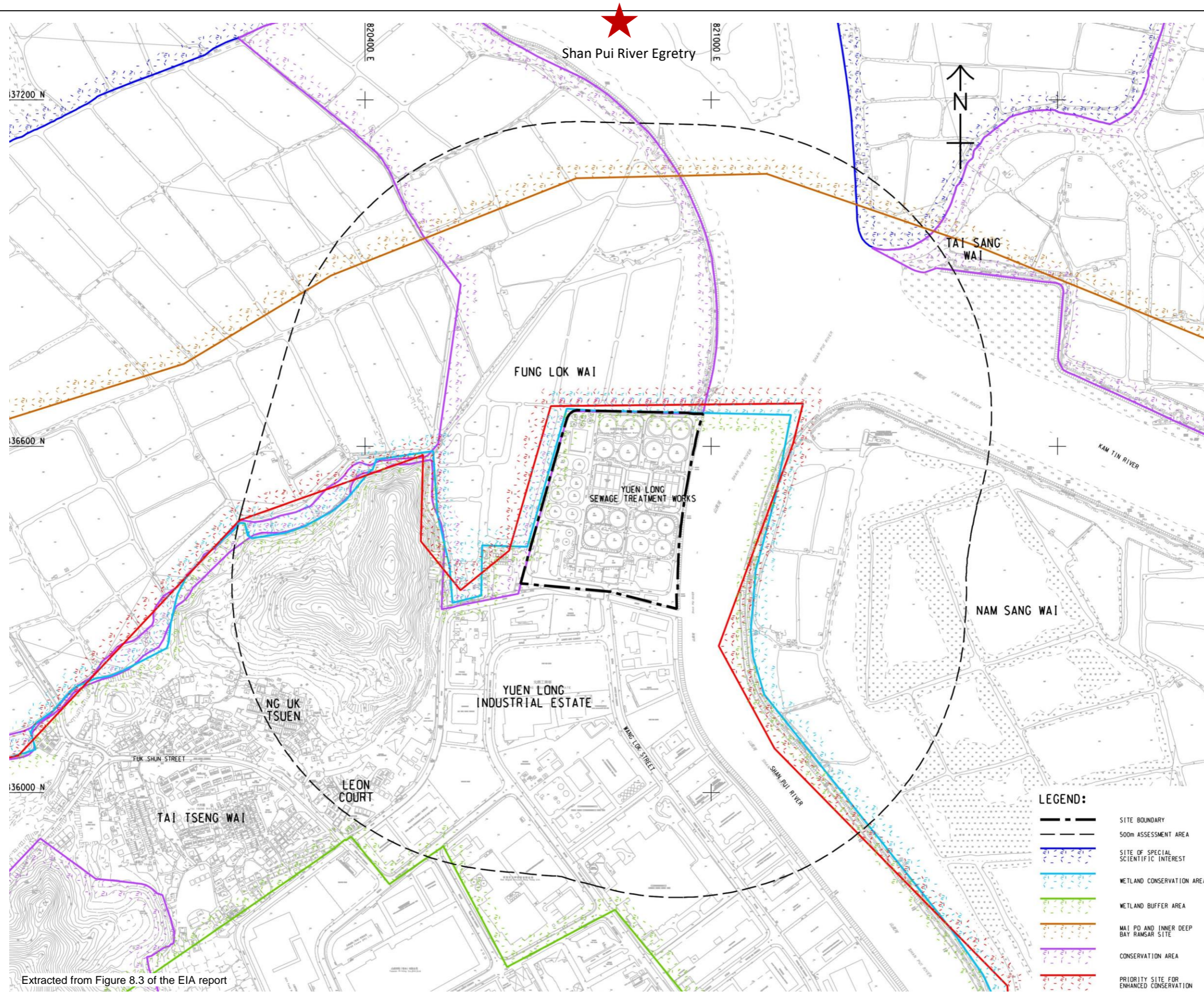
Geological Profiles of the Site  
 (Sheet 2 – Section C for SDB)

|                 |            |
|-----------------|------------|
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| Drawn: TC       | Check: YH  |



#### Keynotes on Foundation Consideration

- The Sludge Dewatering Building (SDB) is situated at the middle south side of the site.
- High loading capacity by the nature of the building rendering box rafts not appropriate;
- Very low rock head require extensive boring if using bored-piling, prolongation of works;
- Percussive piling is the only reliable method



Extracted from Figure 8.3 of the EIA report

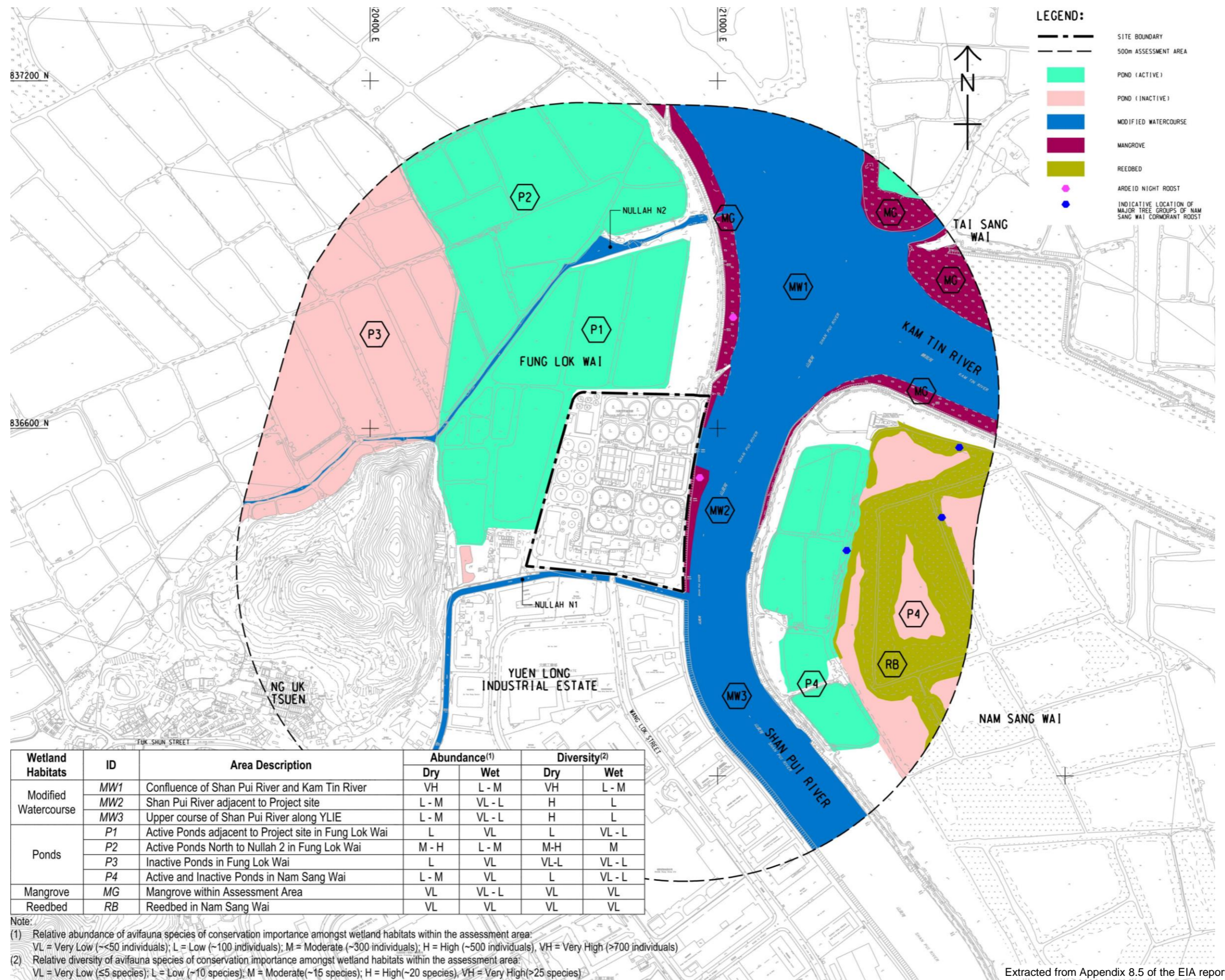
Paul Y. CREC JOINT VENTURE

**RAMBOLL**

DC/2019/10 - YLEPP – Main Works for Stage 1  
 Consultancy Service for  
 Supporting Variation of Condition 2.10 of EP-565/2019

Assessment Area, Recognized Sites of Conservation  
 Importance and Important Habitats within and in the  
 Vicinity of the Assessment Area

|             |           |
|-------------|-----------|
| Figure No.: | 3.1       |
| Date:       | 22/8/2024 |
| Scale:      | N.T.S     |
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| Check:      | YH        |



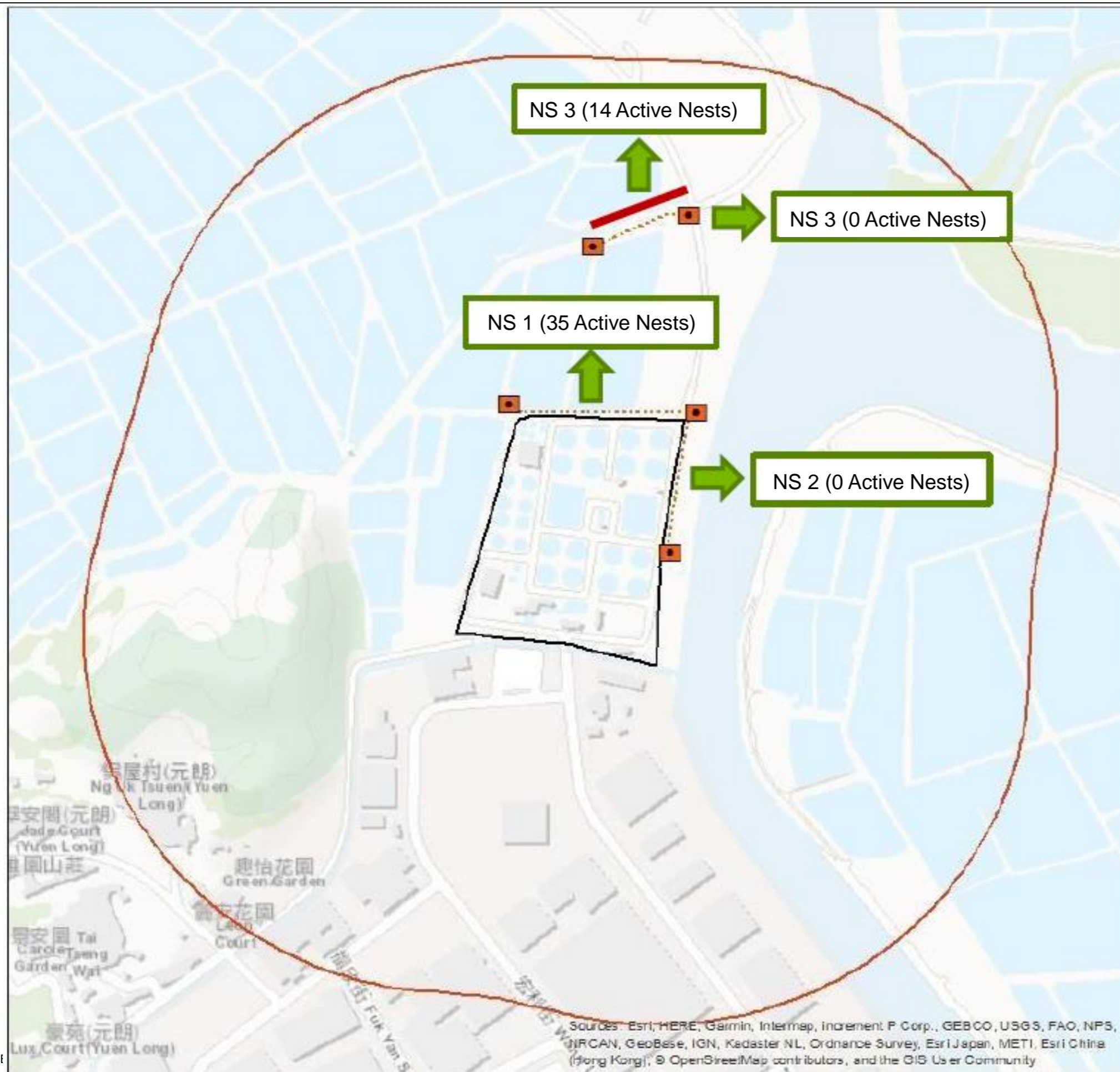
Extracted from Appendix 8.5 of the EIA report



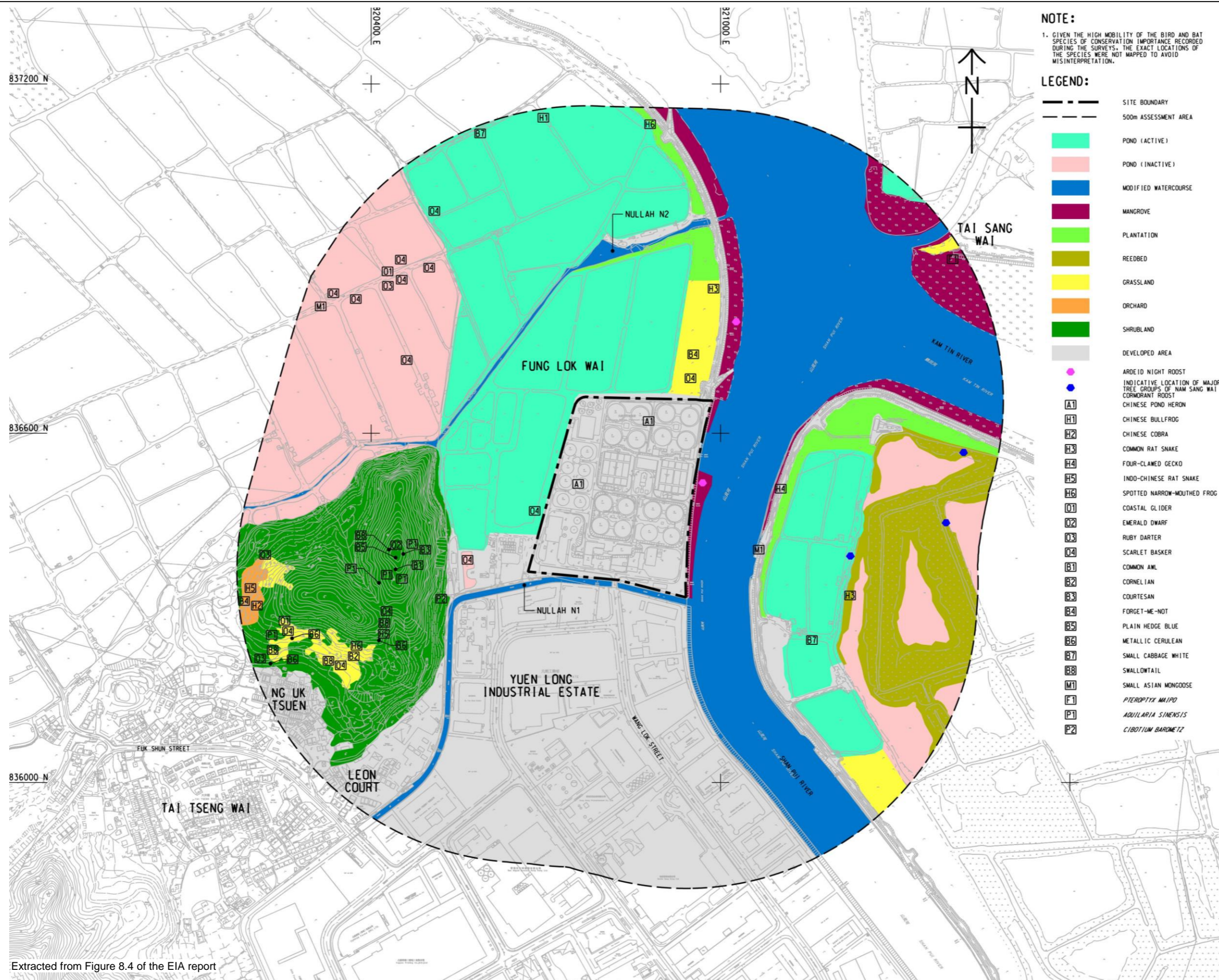
DC/2019/10 - YLEPP – Main Works for Stage 1  
 Consultancy Service for  
 Supporting Variation of Condition 2.10 of EP-565/2019

Usage of Wetland Habitats within Assessment Area by  
 Avifauna Species of Conservation Importance during the  
 EIA Stage

|             |           |
|-------------|-----------|
| Figure No.: | 3.2       |
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| Scale:      | N.T.S     |
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| Check:      | YH        |





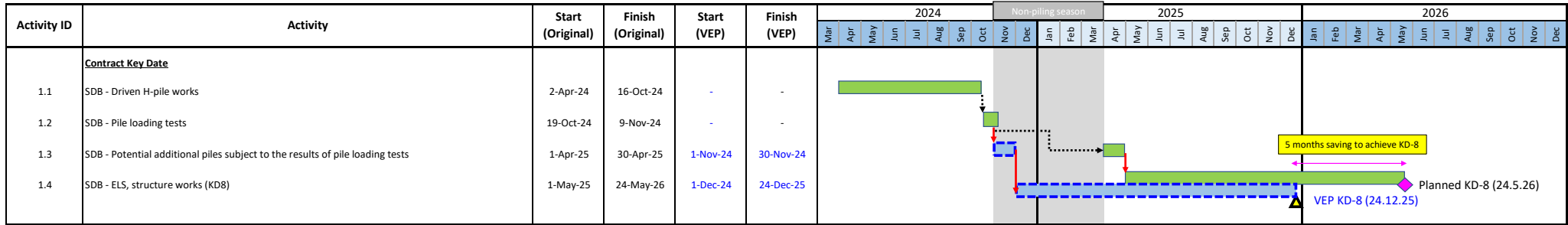


Extracted from Figure 8.4 of the EIA report

## APPENDICES

## **Appendix A      Construction Programme**

**VEP Programme For Driven H-pile Works at SDB**



**Annex B**

**HKO Predicted Tide Level at Tsim Bei Tsui**

**Annex B. HKO Predicted Tide Level at Tsim Bei Tsui**

Tidal information at Tsim Bei Tsui  
Hourly predicted heights of tides (in metres)

Nov-24

| Date |    | Hour |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
|------|----|------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| MM   | DD | 1    | 2   | 3   | 4   | 5   | 6   | 7   | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| 11   | 1  | 1.8  | 1.4 | 1.0 | 0.7 | 0.6 | 0.7 | 1.1 | 1.53 | 1.89 | 2.06 | 2.07 | 1.96 | 1.73 | 1.46 | 1.21 | 1.02 | 0.99 | 1.3 | 1.8 | 2.3 | 2.7 | 2.7 | 2.6 | 2.3 |
| 11   | 2  | 1.9  | 1.6 | 1.2 | 0.8 | 0.6 | 0.5 | 0.8 | 1.15 | 1.58 | 1.88 | 2.01 | 2.00 | 1.86 | 1.60 | 1.35 | 1.15 | 1.05 | 1.2 | 1.6 | 2.2 | 2.7 | 2.9 | 2.8 | 2.5 |
| 11   | 3  | 2.1  | 1.8 | 1.4 | 1.0 | 0.7 | 0.5 | 0.5 | 0.81 | 1.22 | 1.61 | 1.85 | 1.94 | 1.91 | 1.74 | 1.48 | 1.27 | 1.15 | 1.2 | 1.5 | 2.1 | 2.6 | 2.9 | 2.9 | 2.7 |
| 11   | 4  | 2.3  | 2.0 | 1.6 | 1.2 | 0.8 | 0.6 | 0.5 | 0.57 | 0.89 | 1.29 | 1.61 | 1.79 | 1.87 | 1.82 | 1.62 | 1.40 | 1.26 | 1.2 | 1.4 | 1.9 | 2.4 | 2.9 | 3.0 | 2.9 |
| 11   | 5  | 2.5  | 2.2 | 1.8 | 1.4 | 1.0 | 0.7 | 0.5 | 0.48 | 0.63 | 0.96 | 1.32 | 1.57 | 1.72 | 1.79 | 1.73 | 1.54 | 1.39 | 1.3 | 1.4 | 1.7 | 2.2 | 2.7 | 3.0 | 3.0 |
| 11   | 6  | 2.7  | 2.4 | 2.0 | 1.6 | 1.3 | 0.9 | 0.7 | 0.52 | 0.51 | 0.70 | 1.02 | 1.31 | 1.51 | 1.66 | 1.73 | 1.66 | 1.54 | 1.5 | 1.5 | 1.7 | 2.0 | 2.4 | 2.8 | 2.9 |
| 11   | 7  | 2.8  | 2.5 | 2.2 | 1.9 | 1.5 | 1.2 | 0.9 | 0.66 | 0.53 | 0.54 | 0.75 | 1.04 | 1.28 | 1.46 | 1.61 | 1.69 | 1.66 | 1.6 | 1.6 | 1.7 | 1.8 | 2.1 | 2.4 | 2.7 |
| 11   | 8  | 2.8  | 2.6 | 2.4 | 2.1 | 1.8 | 1.5 | 1.2 | 0.87 | 0.66 | 0.53 | 0.56 | 0.77 | 1.03 | 1.25 | 1.44 | 1.60 | 1.70 | 1.7 | 1.7 | 1.7 | 1.8 | 1.9 | 2.1 | 2.3 |
| 11   | 9  | 2.5  | 2.6 | 2.5 | 2.3 | 2.1 | 1.8 | 1.5 | 1.17 | 0.89 | 0.66 | 0.53 | 0.58 | 0.78 | 1.03 | 1.26 | 1.46 | 1.65 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.9 |
| 11   | 10 | 2.1  | 2.3 | 2.4 | 2.4 | 2.3 | 2.1 | 1.9 | 1.56 | 1.22 | 0.92 | 0.68 | 0.54 | 0.59 | 0.80 | 1.08 | 1.34 | 1.57 | 1.8 | 1.9 | 2.0 | 1.9 | 1.8 | 1.7 | 1.6 |
| 11   | 11 | 1.7  | 1.8 | 2.1 | 2.3 | 2.3 | 2.3 | 2.2 | 1.95 | 1.62 | 1.28 | 0.96 | 0.71 | 0.57 | 0.63 | 0.88 | 1.22 | 1.53 | 1.8 | 2.0 | 2.1 | 2.0 | 1.9 | 1.7 | 1.5 |
| 11   | 12 | 1.3  | 1.3 | 1.5 | 1.9 | 2.1 | 2.3 | 2.4 | 2.24 | 1.99 | 1.67 | 1.32 | 1.01 | 0.75 | 0.62 | 0.73 | 1.06 | 1.47 | 1.8 | 2.1 | 2.2 | 2.2 | 2.1 | 1.8 | 1.5 |
| 11   | 13 | 1.2  | 1.0 | 1.0 | 1.2 | 1.6 | 2.0 | 2.3 | 2.34 | 2.23 | 2.00 | 1.68 | 1.34 | 1.04 | 0.80 | 0.72 | 0.91 | 1.35 | 1.8 | 2.2 | 2.4 | 2.5 | 2.3 | 2.1 | 1.7 |
| 11   | 14 | 1.3  | 1.0 | 0.7 | 0.7 | 1.0 | 1.5 | 1.9 | 2.20 | 2.28 | 2.18 | 1.96 | 1.64 | 1.33 | 1.07 | 0.88 | 0.88 | 1.20 | 1.7 | 2.3 | 2.6 | 2.7 | 2.6 | 2.4 | 2.0 |
| 11   | 15 | 1.6  | 1.1 | 0.7 | 0.4 | 0.4 | 0.8 | 1.3 | 1.80 | 2.09 | 2.17 | 2.09 | 1.88 | 1.57 | 1.31 | 1.10 | 0.99 | 1.13 | 1.6 | 2.2 | 2.7 | 3.0 | 2.9 | 2.7 | 2.3 |
| 11   | 16 | 1.9  | 1.4 | 1.0 | 0.5 | 0.3 | 0.3 | 0.7 | 1.20 | 1.69 | 1.97 | 2.05 | 1.99 | 1.77 | 1.49 | 1.28 | 1.14 | 1.16 | 1.4 | 2.0 | 2.6 | 3.0 | 3.1 | 2.9 | 2.6 |
| 11   | 17 | 2.3  | 1.8 | 1.3 | 0.9 | 0.4 | 0.2 | 0.2 | 0.62 | 1.15 | 1.60 | 1.86 | 1.96 | 1.89 | 1.66 | 1.42 | 1.26 | 1.23 | 1.4 | 1.8 | 2.3 | 2.9 | 3.1 | 3.1 | 2.8 |
| 11   | 18 | 2.5  | 2.2 | 1.7 | 1.2 | 0.8 | 0.4 | 0.2 | 0.25 | 0.64 | 1.14 | 1.54 | 1.78 | 1.88 | 1.79 | 1.57 | 1.38 | 1.30 | 1.4 | 1.6 | 2.1 | 2.6 | 3.0 | 3.1 | 2.9 |
| 11   | 19 | 2.7  | 2.4 | 2.0 | 1.6 | 1.2 | 0.8 | 0.4 | 0.20 | 0.32 | 0.72 | 1.16 | 1.51 | 1.73 | 1.81 | 1.71 | 1.52 | 1.39 | 1.4 | 1.6 | 1.9 | 2.3 | 2.7 | 2.9 | 2.9 |
| 11   | 20 | 2.7  | 2.5 | 2.2 | 1.9 | 1.5 | 1.1 | 0.7 | 0.41 | 0.26 | 0.43 | 0.81 | 1.19 | 1.50 | 1.70 | 1.75 | 1.66 | 1.53 | 1.5 | 1.5 | 1.7 | 2.0 | 2.4 | 2.7 | 2.8 |
| 11   | 21 | 2.7  | 2.5 | 2.3 | 2.1 | 1.8 | 1.5 | 1.1 | 0.73 | 0.44 | 0.35 | 0.56 | 0.90 | 1.24 | 1.51 | 1.68 | 1.72 | 1.67 | 1.6 | 1.6 | 1.7 | 1.8 | 2.1 | 2.3 | 2.5 |
| 11   | 22 | 2.5  | 2.4 | 2.3 | 2.1 | 2.0 | 1.7 | 1.4 | 1.06 | 0.73 | 0.48 | 0.46 | 0.68 | 0.99 | 1.29 | 1.53 | 1.68 | 1.74 | 1.7 | 1.7 | 1.7 | 1.8 | 1.9 | 2.0 | 2.2 |
| 11   | 23 | 2.3  | 2.3 | 2.2 | 2.1 | 2.0 | 1.9 | 1.6 | 1.35 | 1.04 | 0.74 | 0.55 | 0.58 | 0.80 | 1.09 | 1.38 | 1.59 | 1.73 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 |
| 11   | 24 | 1.9  | 2.0 | 2.1 | 2.0 | 2.0 | 1.9 | 1.8 | 1.57 | 1.31 | 1.02 | 0.77 | 0.64 | 0.71 | 0.93 | 1.23 | 1.50 | 1.71 | 1.9 | 1.9 | 1.9 | 1.9 | 1.8 | 1.7 | 1.6 |
| 11   | 25 | 1.6  | 1.7 | 1.8 | 1.9 | 1.9 | 1.9 | 1.8 | 1.71 | 1.52 | 1.28 | 1.03 | 0.82 | 0.74 | 0.84 | 1.10 | 1.42 | 1.70 | 1.9 | 2.0 | 2.0 | 2.0 | 1.8 | 1.7 | 1.5 |
| 11   | 26 | 1.4  | 1.3 | 1.4 | 1.6 | 1.7 | 1.8 | 1.8 | 1.77 | 1.66 | 1.48 | 1.26 | 1.04 | 0.88 | 0.85 | 1.02 | 1.33 | 1.67 | 2.0 | 2.1 | 2.2 | 2.1 | 2.0 | 1.7 | 1.5 |
| 11   | 27 | 1.3  | 1.1 | 1.1 | 1.2 | 1.4 | 1.6 | 1.7 | 1.76 | 1.73 | 1.62 | 1.45 | 1.25 | 1.06 | 0.94 | 1.00 | 1.25 | 1.62 | 2.0 | 2.3 | 2.3 | 2.3 | 2.1 | 1.9 | 1.6 |
| 11   | 28 | 1.3  | 1.0 | 0.9 | 0.9 | 1.0 | 1.3 | 1.5 | 1.69 | 1.75 | 1.72 | 1.60 | 1.42 | 1.23 | 1.07 | 1.02 | 1.19 | 1.55 | 2.0 | 2.3 | 2.5 | 2.5 | 2.3 | 2.0 | 1.7 |
| 11   | 29 | 1.4  | 1.1 | 0.8 | 0.7 | 0.7 | 0.9 | 1.3 | 1.52 | 1.68 | 1.75 | 1.72 | 1.57 | 1.38 | 1.20 | 1.09 | 1.16 | 1.45 | 1.9 | 2.4 | 2.7 | 2.7 | 2.5 | 2.2 | 1.9 |
| 11   | 30 | 1.6  | 1.2 | 0.9 | 0.6 | 0.5 | 0.6 | 0.9 | 1.25 | 1.53 | 1.70 | 1.77 | 1.70 | 1.52 | 1.33 | 1.18 | 1.16 | 1.35 | 1.8 | 2.3 | 2.7 | 2.9 | 2.7 | 2.5 | 2.1 |

Dec-24

| Date |    | Hour |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
|------|----|------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| MM   | DD | 1    | 2   | 3   | 4   | 5   | 6   | 7   | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| 12   | 1  | 1.8  | 1.4 | 1.0 | 0.7 | 0.5 | 0.4 | 0.6 | 0.93 | 1.29 | 1.56 | 1.72 | 1.77 | 1.66 | 1.46 | 1.28 | 1.19 | 1.28 | 1.6 | 2.1 | 2.6 | 3.0 | 3.0 | 2.7 | 2.4 |
| 12   | 2  | 2.0  | 1.6 | 1.2 | 0.9 | 0.6 | 0.4 | 0.4 | 0.61 | 0.98 | 1.33 | 1.59 | 1.74 | 1.74 | 1.59 | 1.40 | 1.26 | 1.26 | 1.5 | 1.9 | 2.4 | 2.9 | 3.1 | 2.9 | 2.6 |
| 12   | 3  | 2.2  | 1.8 | 1.4 | 1.1 | 0.7 | 0.5 | 0.3 | 0.39 | 0.68 | 1.06 | 1.39 | 1.62 | 1.74 | 1.69 | 1.52 | 1.36 | 1.29 | 1.4 | 1.7 | 2.1 | 2.7 | 3.0 | 3.0 | 2.8 |
| 12   | 4  | 2.5  | 2.1 | 1.7 | 1.3 | 0.9 | 0.7 | 0.4 | 0.31 | 0.45 | 0.78 | 1.15 | 1.44 | 1.64 | 1.72 | 1.64 | 1.48 | 1.36 | 1.4 | 1.5 | 1.9 | 2.3 | 2.8 | 3.0 | 2.9 |
| 12   | 5  | 2.7  | 2.3 | 2.0 | 1.6 | 1.2 | 0.9 | 0.6 | 0.38 | 0.33 | 0.55 | 0.90 | 1.23 | 1.48 | 1.65 | 1.69 | 1.61 | 1.49 | 1.4 | 1.5 | 1.7 | 2.0 | 2.4 | 2.8 | 2.9 |
| 12   | 6  | 2.8  | 2.5 | 2.2 | 1.8 | 1.5 | 1.1 | 0.8 | 0.53 | 0.36 | 0.40 | 0.68 | 1.02 | 1.31 | 1.52 | 1.64 | 1.68 | 1.62 | 1.5 | 1.5 | 1.6 | 1.7 | 2.0 | 2.4 | 2.7 |
| 12   | 7  | 2.7  | 2.6 | 2.4 | 2.1 | 1.7 | 1.4 | 1.0 | 0.73 | 0.49 | 0.38 | 0.51 | 0.82 | 1.14 | 1.39 | 1.56 | 1.67 | 1.71 | 1.7 | 1.6 | 1.6 | 1.6 | 1.7 | 1.9 | 2.3 |
| 12   | 8  | 2.5  | 2.5 | 2.4 | 2.2 | 2.0 | 1.7 | 1.3 | 0.99 | 0.71 | 0.50 | 0.46 | 0.65 | 0.96 | 1.27 | 1.49 | 1.64 | 1.74 | 1.8 | 1.8 | 1.8 | 1.7 | 1.6 | 1.5 | 1.6 |
| 12   | 9  | 2.0  | 2.3 | 2.3 | 2.3 | 2.1 | 1.9 | 1.7 | 1.32 | 1.00 | 0.73 | 0.57 | 0.58 | 0.80 | 1.13 | 1.44 | 1.65 | 1.79 | 1.9 | 1.9 | 1.9 | 1.8 | 1.7 | 1.5 | 1.4 |
| 12   | 10 | 1.5  | 1.7 | 2.0 | 2.1 | 2.1 | 2.0 | 1.9 | 1.63 | 1.33 | 1.04 | 0.81 | 0.68 | 0.73 | 0.98 | 1.34 | 1.67 | 1.89 | 2.0 | 2.1 | 2.1 | 1.9 | 1.7 | 1.4 | 1.2 |
| 12   | 11 | 1.1  | 1.2 | 1.4 | 1.7 | 1.9 | 1.9 | 1.9 | 1.81 | 1.61 | 1.36 | 1.11 | 0.92 | 0.83 | 0.91 | 1.21 | 1.62 | 1.98 | 2.2 | 2.3 | 2.3 | 2.2 | 1.9 | 1.6 | 1.3 |
| 12   | 12 | 1.0  | 0.8 | 0.8 | 1.1 | 1.4 | 1.7 | 1.8 | 1.82 | 1.77 | 1.61 | 1.39 | 1.19 | 1.04 | 0.97 | 1.11 | 1.48 | 1.94 | 2.3 | 2.5 | 2.6 | 2.4 | 2.2 | 1.9 | 1.5 |
| 12   | 13 | 1.1  | 0.8 | 0.5 | 0.5 | 0.8 | 1.2 | 1.5 | 1.66 | 1.75 | 1.73 | 1.61 | 1.42 | 1.25 | 1.13 | 1.13 | 1.35 | 1.78 | 2.3 | 2.7 | 2.8 | 2.7 | 2.5 | 2.2 | 1.8 |
| 12   | 14 | 1.4  | 1.0 | 0.6 | 0.3 | 0.3 | 0.6 | 1.0 | 1.33 | 1.58 | 1.71 | 1.72 | 1.59 | 1.42 | 1.28 | 1.21 | 1.29 | 1.59 | 2.1 | 2.6 | 2.9 | 3.0 | 2.8 | 2.5 | 2.2 |
| 12   | 15 | 1.8  | 1.3 | 0.9 | 0.5 | 0.2 | 0.2 | 0.5 | 0.88 | 1.28 | 1.55 | 1.71 | 1.70 | 1.56 | 1.39 | 1.29 | 1.29 | 1.45 | 1.8 | 2.3 | 2.8 | 3.0 | 3.0 | 2.8 | 2.5 |
| 12   | 16 | 2.1  | 1.7 | 1.2 | 0.8 | 0.4 | 0.1 | 0.1 | 0.43 | 0.89 | 1.30 | 1.59 | 1.73 | 1.68 | 1.51 | 1.35 | 1.29 | 1.38 | 1.6 | 2.0 | 2.5 | 2.9 | 3.0 | 2.9 | 2.7 |
| 12   | 17 | 2.4  | 2.0 | 1.6 | 1.2 | 0.8 | 0.4 | 0.1 | 0.13 | 0.51 | 0.98 | 1.38 | 1.65 | 1.74 | 1.64 | 1.46 | 1.32 | 1.32 | 1.5 | 1.7 | 2.1 | 2.6 | 2.9 | 2.9 | 2.8 |
| 12   | 18 | 2.5  | 2.3 | 1.9 | 1.5 | 1.1 | 0.7 | 0.3 | 0.09 | 0.25 | 0.67 | 1.13 | 1.49 | 1.70 | 1.72 | 1.60 | 1.42 | 1.33 | 1.4 | 1.6 | 1.8 | 2.2 | 2.6 | 2.8 | 2.8 |
| 12   | 19 | 2.6  | 2.4 | 2.1 | 1.8 | 1.4 | 1.0 | 0.6 | 0.26 | 0.17 | 0.44 | 0.87 | 1.28 | 1.58 | 1.72 | 1.70 | 1.57 | 1.42 | 1.4 | 1.4 | 1.6 | 1.9 | 2.3 | 2.6 | 2.7 |
| 12   | 20 | 2.6  | 2.4 | 2.2 | 1.9 | 1.6 | 1.3 | 0.9 | 0.52 | 0.28 | 0.34 | 0.67 | 1.08 | 1.43 | 1.64 | 1.71 | 1.68 | 1.57 | 1.5 | 1.4 | 1.5 | 1.7 | 1.9 | 2.2 | 2.4 |
| 12   | 21 | 2.5  | 2.3 | 2.2 | 2.0 | 1.7 | 1.4 | 1.1 | 0.78 | 0.49 | 0.39 | 0.56 | 0.91 | 1.27 | 1.54 | 1.68 | 1.72 | 1.69 | 1.6 | 1.5 | 1.5 | 1.5 | 1.7 | 1.9 | 2.1 |
| 12   | 22 | 2.2  | 2.2 | 2.1 | 1.9 | 1.8 | 1.6 | 1.3 | 1.00 | 0.73 | 0.55 | 0.58 | 0.81 | 1.14 | 1.45 | 1.65 | 1.74 | 1.76 | 1.7 | 1.7 | 1.6 | 1.5 | 1.5 | 1.6 | 1.8 |
| 12   | 23 | 1.9  | 2.0 | 2.0 | 1.8 | 1.7 | 1.6 | 1.4 | 1.18 | 0.95 | 0.76 | 0.69 | 0.80 | 1.05 | 1.35 | 1.61 | 1.76 | 1.83 | 1.8 | 1.8 | 1.7 | 1.6 | 1.5 |     |     |

Jan-25

| Date |    | Hour |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
|------|----|------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| MM   | DD | 1    | 2   | 3   | 4   | 5   | 6   | 7   | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| 1    | 1  | 2.1  | 1.7 | 1.4 | 1.0 | 0.7 | 0.4 | 0.2 | 0.24 | 0.57 | 0.98 | 1.34 | 1.58 | 1.66 | 1.58 | 1.42 | 1.26 | 1.23 | 1.4 | 1.7 | 2.1 | 2.6 | 3.0 | 3.0 | 2.8 |
| 1    | 2  | 2.4  | 2.0 | 1.6 | 1.2 | 0.9 | 0.6 | 0.3 | 0.15 | 0.36 | 0.75 | 1.16 | 1.47 | 1.63 | 1.65 | 1.54 | 1.36 | 1.24 | 1.3 | 1.4 | 1.7 | 2.2 | 2.7 | 2.9 | 2.9 |
| 1    | 3  | 2.7  | 2.3 | 1.9 | 1.5 | 1.1 | 0.8 | 0.5 | 0.20 | 0.23 | 0.56 | 0.98 | 1.34 | 1.56 | 1.66 | 1.63 | 1.50 | 1.34 | 1.2 | 1.3 | 1.4 | 1.8 | 2.3 | 2.7 | 2.9 |
| 1    | 4  | 2.8  | 2.5 | 2.2 | 1.8 | 1.4 | 1.0 | 0.7 | 0.35 | 0.23 | 0.42 | 0.82 | 1.22 | 1.50 | 1.64 | 1.67 | 1.63 | 1.50 | 1.3 | 1.3 | 1.3 | 1.4 | 1.8 | 2.2 | 2.6 |
| 1    | 5  | 2.7  | 2.6 | 2.3 | 2.0 | 1.6 | 1.2 | 0.9 | 0.56 | 0.34 | 0.37 | 0.69 | 1.10 | 1.44 | 1.63 | 1.70 | 1.72 | 1.66 | 1.5 | 1.4 | 1.2 | 1.2 | 1.4 | 1.7 | 2.1 |
| 1    | 6  | 2.4  | 2.5 | 2.3 | 2.1 | 1.8 | 1.5 | 1.1 | 0.80 | 0.55 | 0.45 | 0.62 | 0.98 | 1.37 | 1.65 | 1.77 | 1.80 | 1.80 | 1.7 | 1.6 | 1.4 | 1.2 | 1.1 | 1.3 | 1.6 |
| 1    | 7  | 1.9  | 2.1 | 2.1 | 2.0 | 1.9 | 1.7 | 1.4 | 1.06 | 0.81 | 0.65 | 0.66 | 0.90 | 1.26 | 1.62 | 1.85 | 1.93 | 1.94 | 1.9 | 1.8 | 1.6 | 1.4 | 1.2 | 1.1 | 1.1 |
| 1    | 8  | 1.3  | 1.6 | 1.8 | 1.8 | 1.7 | 1.7 | 1.5 | 1.31 | 1.09 | 0.92 | 0.84 | 0.91 | 1.16 | 1.52 | 1.85 | 2.06 | 2.12 | 2.1 | 2.1 | 1.9 | 1.7 | 1.4 | 1.1 | 0.9 |
| 1    | 9  | 0.9  | 1.0 | 1.2 | 1.4 | 1.5 | 1.5 | 1.5 | 1.44 | 1.33 | 1.19 | 1.08 | 1.05 | 1.14 | 1.39 | 1.74 | 2.07 | 2.28 | 2.3 | 2.3 | 2.2 | 2.0 | 1.7 | 1.3 | 1.0 |
| 1    | 10 | 0.8  | 0.6 | 0.7 | 0.9 | 1.1 | 1.2 | 1.3 | 1.41 | 1.44 | 1.39 | 1.31 | 1.23 | 1.22 | 1.31 | 1.57 | 1.93 | 2.28 | 2.5 | 2.5 | 2.5 | 2.3 | 2.0 | 1.7 | 1.3 |
| 1    | 11 | 0.9  | 0.6 | 0.4 | 0.4 | 0.6 | 0.8 | 1.1 | 1.26 | 1.42 | 1.50 | 1.47 | 1.39 | 1.32 | 1.31 | 1.43 | 1.70 | 2.08 | 2.5 | 2.7 | 2.7 | 2.6 | 2.3 | 2.0 | 1.7 |
| 1    | 12 | 1.3  | 0.9 | 0.5 | 0.2 | 0.2 | 0.4 | 0.7 | 1.02 | 1.30 | 1.49 | 1.56 | 1.51 | 1.41 | 1.34 | 1.35 | 1.49 | 1.78 | 2.2 | 2.6 | 2.8 | 2.8 | 2.6 | 2.4 | 2.0 |
| 1    | 13 | 1.7  | 1.2 | 0.8 | 0.4 | 0.1 | 0.1 | 0.3 | 0.71 | 1.10 | 1.41 | 1.58 | 1.60 | 1.49 | 1.36 | 1.30 | 1.35 | 1.52 | 1.8 | 2.3 | 2.7 | 2.8 | 2.8 | 2.6 | 2.3 |
| 1    | 14 | 2.0  | 1.6 | 1.2 | 0.8 | 0.3 | 0.0 | 0.0 | 0.38 | 0.85 | 1.27 | 1.55 | 1.65 | 1.59 | 1.43 | 1.28 | 1.25 | 1.33 | 1.5 | 1.9 | 2.4 | 2.7 | 2.8 | 2.7 | 2.5 |
| 1    | 15 | 2.3  | 1.9 | 1.5 | 1.1 | 0.7 | 0.2 | 0.0 | 0.14 | 0.57 | 1.07 | 1.46 | 1.66 | 1.68 | 1.55 | 1.35 | 1.21 | 1.21 | 1.3 | 1.6 | 2.0 | 2.4 | 2.7 | 2.8 | 2.6 |
| 1    | 16 | 2.4  | 2.1 | 1.8 | 1.4 | 1.0 | 0.5 | 0.2 | 0.06 | 0.36 | 0.85 | 1.31 | 1.62 | 1.72 | 1.66 | 1.49 | 1.28 | 1.17 | 1.2 | 1.3 | 1.6 | 2.1 | 2.5 | 2.7 | 2.7 |
| 1    | 17 | 2.5  | 2.2 | 1.9 | 1.6 | 1.2 | 0.8 | 0.4 | 0.14 | 0.25 | 0.67 | 1.15 | 1.53 | 1.71 | 1.73 | 1.63 | 1.43 | 1.23 | 1.2 | 1.2 | 1.3 | 1.7 | 2.1 | 2.5 | 2.6 |
| 1    | 18 | 2.5  | 2.3 | 2.0 | 1.7 | 1.3 | 1.0 | 0.6 | 0.32 | 0.28 | 0.57 | 1.02 | 1.43 | 1.69 | 1.75 | 1.71 | 1.58 | 1.39 | 1.2 | 1.1 | 1.2 | 1.4 | 1.8 | 2.1 | 2.4 |
| 1    | 19 | 2.4  | 2.2 | 2.0 | 1.7 | 1.4 | 1.1 | 0.8 | 0.52 | 0.40 | 0.56 | 0.94 | 1.35 | 1.65 | 1.77 | 1.76 | 1.69 | 1.55 | 1.4 | 1.2 | 1.1 | 1.2 | 1.5 | 1.8 | 2.1 |
| 1    | 20 | 2.2  | 2.1 | 1.9 | 1.7 | 1.5 | 1.2 | 1.0 | 0.71 | 0.57 | 0.63 | 0.91 | 1.29 | 1.61 | 1.79 | 1.82 | 1.77 | 1.67 | 1.5 | 1.4 | 1.2 | 1.2 | 1.2 | 1.5 | 1.7 |
| 1    | 21 | 1.9  | 1.9 | 1.8 | 1.6 | 1.5 | 1.3 | 1.1 | 0.89 | 0.75 | 0.75 | 0.94 | 1.25 | 1.56 | 1.79 | 1.89 | 1.87 | 1.79 | 1.7 | 1.5 | 1.4 | 1.2 | 1.2 | 1.2 | 1.4 |
| 1    | 22 | 1.5  | 1.6 | 1.6 | 1.5 | 1.4 | 1.3 | 1.2 | 1.04 | 0.94 | 0.91 | 1.00 | 1.22 | 1.51 | 1.76 | 1.93 | 1.98 | 1.93 | 1.8 | 1.7 | 1.6 | 1.4 | 1.2 | 1.1 | 1.1 |
| 1    | 23 | 1.2  | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.2 | 1.15 | 1.11 | 1.08 | 1.10 | 1.22 | 1.44 | 1.69 | 1.90 | 2.05 | 2.09 | 2.0 | 1.9 | 1.8 | 1.5 | 1.3 | 1.1 | 1.0 |
| 1    | 24 | 1.0  | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.2 | 1.22 | 1.25 | 1.25 | 1.23 | 1.25 | 1.36 | 1.57 | 1.81 | 2.03 | 2.19 | 2.2 | 2.2 | 2.0 | 1.8 | 1.5 | 1.3 | 1.1 |
| 1    | 25 | 0.9  | 0.8 | 0.7 | 0.7 | 0.8 | 0.9 | 1.1 | 1.22 | 1.33 | 1.38 | 1.37 | 1.33 | 1.33 | 1.44 | 1.65 | 1.92 | 2.18 | 2.4 | 2.4 | 2.3 | 2.0 | 1.8 | 1.5 | 1.2 |
| 1    | 26 | 1.0  | 0.8 | 0.6 | 0.5 | 0.6 | 0.7 | 0.9 | 1.13 | 1.34 | 1.46 | 1.49 | 1.43 | 1.35 | 1.33 | 1.46 | 1.72 | 2.04 | 2.4 | 2.6 | 2.5 | 2.4 | 2.1 | 1.8 | 1.5 |
| 1    | 27 | 1.1  | 0.9 | 0.6 | 0.4 | 0.3 | 0.4 | 0.7 | 0.97 | 1.27 | 1.48 | 1.56 | 1.53 | 1.41 | 1.29 | 1.30 | 1.47 | 1.77 | 2.2 | 2.5 | 2.7 | 2.7 | 2.4 | 2.1 | 1.8 |
| 1    | 28 | 1.4  | 1.1 | 0.8 | 0.5 | 0.3 | 0.2 | 0.4 | 0.74 | 1.12 | 1.43 | 1.59 | 1.60 | 1.49 | 1.33 | 1.21 | 1.25 | 1.46 | 1.8 | 2.3 | 2.7 | 2.9 | 2.8 | 2.5 | 2.1 |
| 1    | 29 | 1.7  | 1.4 | 1.0 | 0.7 | 0.3 | 0.1 | 0.2 | 0.50 | 0.92 | 1.31 | 1.56 | 1.64 | 1.57 | 1.41 | 1.22 | 1.13 | 1.19 | 1.4 | 1.9 | 2.4 | 2.8 | 3.0 | 2.8 | 2.5 |
| 1    | 30 | 2.1  | 1.7 | 1.3 | 0.9 | 0.5 | 0.2 | 0.1 | 0.29 | 0.72 | 1.17 | 1.51 | 1.66 | 1.65 | 1.51 | 1.30 | 1.11 | 1.04 | 1.1 | 1.4 | 2.0 | 2.5 | 2.9 | 3.0 | 2.8 |
| 1    | 31 | 2.4  | 2.0 | 1.6 | 1.2 | 0.8 | 0.4 | 0.1 | 0.16 | 0.53 | 1.02 | 1.43 | 1.66 | 1.71 | 1.63 | 1.45 | 1.21 | 1.02 | 1.0 | 1.1 | 1.4 | 2.0 | 2.6 | 2.9 | 2.9 |

Feb-25

| Date |    | Hour |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
|------|----|------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| MM   | DD | 1    | 2   | 3   | 4   | 5   | 6   | 7   | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| 2    | 1  | 2.6  | 2.3 | 1.9 | 1.4 | 1.0 | 0.6 | 0.3 | 0.15 | 0.40 | 0.88 | 1.35 | 1.66 | 1.77 | 1.74 | 1.62 | 1.39 | 1.13 | 1.0 | 0.9 | 1.0 | 1.5 | 2.1 | 2.6 | 2.8 |
| 2    | 2  | 2.7  | 2.4 | 2.1 | 1.7 | 1.2 | 0.8 | 0.5 | 0.26 | 0.35 | 0.78 | 1.28 | 1.66 | 1.84 | 1.84 | 1.77 | 1.61 | 1.35 | 1.1 | 0.9 | 0.8 | 1.0 | 1.5 | 2.1 | 2.4 |
| 2    | 3  | 2.6  | 2.4 | 2.2 | 1.9 | 1.5 | 1.1 | 0.7 | 0.45 | 0.41 | 0.70 | 1.20 | 1.64 | 1.91 | 1.96 | 1.90 | 1.80 | 1.61 | 1.3 | 1.1 | 0.8 | 0.8 | 1.0 | 1.5 | 1.9 |
| 2    | 4  | 2.2  | 2.2 | 2.1 | 1.9 | 1.6 | 1.3 | 0.9 | 0.68 | 0.57 | 0.71 | 1.11 | 1.58 | 1.93 | 2.07 | 2.05 | 1.96 | 1.84 | 1.6 | 1.3 | 1.0 | 0.8 | 1.0 | 1.3 | 1.3 |
| 2    | 5  | 1.7  | 1.9 | 1.8 | 1.7 | 1.6 | 1.4 | 1.2 | 0.93 | 0.80 | 0.83 | 1.07 | 1.47 | 1.86 | 2.12 | 2.18 | 2.12 | 2.03 | 1.9 | 1.7 | 1.4 | 1.1 | 0.8 | 0.8 | 0.9 |
| 2    | 6  | 1.1  | 1.3 | 1.5 | 1.5 | 1.4 | 1.4 | 1.3 | 1.16 | 1.06 | 1.03 | 1.13 | 1.38 | 1.72 | 2.03 | 2.22 | 2.26 | 2.21 | 2.1 | 2.0 | 1.7 | 1.4 | 1.1 | 0.8 | 0.7 |
| 2    | 7  | 0.7  | 0.8 | 1.0 | 1.1 | 1.2 | 1.2 | 1.3 | 1.29 | 1.28 | 1.26 | 1.27 | 1.36 | 1.56 | 1.83 | 2.10 | 2.28 | 2.33 | 2.3 | 2.2 | 2.1 | 1.8 | 1.5 | 1.1 | 0.8 |
| 2    | 8  | 0.6  | 0.5 | 0.5 | 0.7 | 0.8 | 1.0 | 1.1 | 1.29 | 1.39 | 1.43 | 1.42 | 1.42 | 1.47 | 1.61 | 1.84 | 2.10 | 2.31 | 2.4 | 2.4 | 2.3 | 2.1 | 1.9 | 1.5 | 1.2 |
| 2    | 9  | 0.8  | 0.5 | 0.3 | 0.3 | 0.4 | 0.7 | 0.9 | 1.19 | 1.40 | 1.52 | 1.54 | 1.49 | 1.44 | 1.45 | 1.56 | 1.78 | 2.07 | 2.4 | 2.5 | 2.5 | 2.4 | 2.2 | 1.9 | 1.6 |
| 2    | 10 | 1.2  | 0.8 | 0.4 | 0.2 | 0.1 | 0.3 | 0.7 | 1.03 | 1.34 | 1.54 | 1.61 | 1.56 | 1.45 | 1.36 | 1.36 | 1.46 | 1.70 | 2.1 | 2.4 | 2.6 | 2.6 | 2.4 | 2.2 | 1.9 |
| 2    | 11 | 1.6  | 1.2 | 0.7 | 0.3 | 0.1 | 0.1 | 0.4 | 0.83 | 1.24 | 1.52 | 1.65 | 1.63 | 1.49 | 1.33 | 1.23 | 1.23 | 1.35 | 1.7 | 2.1 | 2.5 | 2.6 | 2.6 | 2.4 | 2.2 |
| 2    | 12 | 1.9  | 1.5 | 1.1 | 0.6 | 0.2 | 0.0 | 0.2 | 0.60 | 1.09 | 1.48 | 1.67 | 1.70 | 1.58 | 1.37 | 1.18 | 1.10 | 1.11 | 1.3 | 1.7 | 2.2 | 2.5 | 2.7 | 2.6 | 2.4 |
| 2    | 13 | 2.1  | 1.8 | 1.4 | 1.0 | 0.5 | 0.1 | 0.1 | 0.40 | 0.91 | 1.40 | 1.69 | 1.76 | 1.69 | 1.49 | 1.23 | 1.06 | 0.98 | 1.0 | 1.3 | 1.8 | 2.3 | 2.6 | 2.6 | 2.5 |
| 2    | 14 | 2.3  | 2.0 | 1.6 | 1.2 | 0.8 | 0.4 | 0.1 | 0.29 | 0.75 | 1.28 | 1.67 | 1.82 | 1.79 | 1.64 | 1.38 | 1.12 | 0.95 | 0.9 | 1.0 | 1.4 | 1.9 | 2.3 | 2.6 | 2.5 |
| 2    | 15 | 2.3  | 2.1 | 1.7 | 1.3 | 1.0 | 0.6 | 0.3 | 0.29 | 0.66 | 1.17 | 1.62 | 1.85 | 1.86 | 1.76 | 1.55 | 1.27 | 1.02 | 0.9 | 0.9 | 1.1 | 1.5 | 2.0 | 2.4 | 2.4 |
| 2    | 16 | 2.3  | 2.1 | 1.8 | 1.4 | 1.1 | 0.7 | 0.5 | 0.37 | 0.63 | 1.11 | 1.58 | 1.88 | 1.94 | 1.85 | 1.69 | 1.45 | 1.17 | 0.9 | 0.8 | 0.9 | 1.2 | 1.6 | 2.0 | 2.3 |
| 2    | 17 | 2.2  | 2.0 | 1.8 | 1.5 | 1.2 | 0.9 | 0.6 | 0.50 | 0.66 | 1.08 | 1.54 | 1.88 | 2.01 | 1.94 | 1.79 | 1.60 | 1.35 | 1.1 | 0.9 | 0.8 | 0.9 | 1.3 | 1.7 | 2   |
| 2    | 18 | 2.0  | 1.9 | 1.7 | 1.5 | 1.3 | 1.0 | 0.8 | 0.65 | 0.73 | 1.06 | 1.51 | 1.88 | 2.06 | 2.05 | 1.91 | 1.73 | 1.51 | 1.3 | 1.0 | 0.9 | 0.8 | 1.0 | 1.3 | 1.6 |
| 2    | 19 | 1.8  | 1.7 | 1.6 | 1.5 | 1.3 | 1.1 | 0.9 | 0.83 | 0.84 | 1.07 | 1.46 | 1.84 | 2.07 | 2.12 | 2.03 | 1.86 | 1.67 | 1.5 | 1.2 | 1.0 | 0.9 | 0.9 | 1.0 | 1.3 |
| 2    | 20 | 1.4  | 1.5 | 1.4 | 1.4 | 1.3 | 1.2 | 1.1 | 1.00 | 1.00 | 1.12 | 1.40 | 1.74 | 2.01 | 2.14 | 2.13 | 2.01 | 1.85 | 1.7 | 1.4 | 1.2 | 1.0 | 0.9 | 0.9 | 1   |
| 2    | 21 | 1.1  | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.15 | 1.17 | 1.23 | 1.37 | 1.61 | 1.88 | 2.07 | 2.15 | 2.13 | 2.03 | 1.9 | 1.7 | 1.4 | 1.2 | 1.0 | 0.9 | 0.8 |
| 2    | 22 | 0.9  | 0.9 | 0.9 | 1.0 | 1.0 | 1.1 | 1.2 | 1.27 | 1.32 | 1.37 | 1.41 | 1.51 | 1.70 | 1.91 | 2.07 | 2.17 | 2.19 | 2.1 | 2.0 | 1.7 | 1.5 | 1.2 | 1.0 | 0.8 |
| 2    | 23 | 0.7  | 0.7 | 0.7 | 0.7 | 0.8 | 1.0 | 1.2 | 1.32 | 1.43 | 1.49 | 1.50 | 1.48 | 1.52 | 1.68 | 1.87 | 2.07 |      |     |     |     |     |     |     |     |

Mar-25

| Date |    |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |     |     |     |     |     |     |     |
|------|----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|
| MM   | DD | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| 3    | 1  | 2.3 | 1.9 | 1.4 | 1.0 | 0.6 | 0.3 | 0.2 | 0.53 | 1.07 | 1.58 | 1.90 | 1.96 | 1.87 | 1.67 | 1.36 | 1.03 | 0.74 | 0.6 | 0.7 | 1.2 | 1.9 | 2.5 | 2.8 | 2.7 |
| 3    | 2  | 2.5 | 2.2 | 1.7 | 1.3 | 0.9 | 0.5 | 0.3 | 0.44 | 0.96 | 1.53 | 1.96 | 2.11 | 2.05 | 1.89 | 1.63 | 1.27 | 0.91 | 0.6 | 0.5 | 0.7 | 1.2 | 1.9 | 2.4 | 2.6 |
| 3    | 3  | 2.5 | 2.3 | 1.9 | 1.5 | 1.1 | 0.7 | 0.5 | 0.46 | 0.87 | 1.46 | 1.97 | 2.23 | 2.23 | 2.09 | 1.90 | 1.58 | 1.19 | 0.8 | 0.5 | 0.4 | 0.7 | 1.2 | 1.8 | 2.2 |
| 3    | 4  | 2.3 | 2.2 | 2.0 | 1.6 | 1.3 | 0.9 | 0.7 | 0.59 | 0.83 | 1.36 | 1.92 | 2.28 | 2.38 | 2.27 | 2.11 | 1.88 | 1.54 | 1.1 | 0.8 | 0.5 | 0.4 | 0.7 | 1.2 | 1.7 |
| 3    | 5  | 1.9 | 1.9 | 1.8 | 1.7 | 1.4 | 1.1 | 0.9 | 0.78 | 0.89 | 1.27 | 1.79 | 2.23 | 2.44 | 2.40 | 2.26 | 2.09 | 1.85 | 1.5 | 1.1 | 0.7 | 0.5 | 0.5 | 0.7 | 1.1 |
| 3    | 6  | 1.4 | 1.6 | 1.6 | 1.5 | 1.4 | 1.3 | 1.1 | 1.01 | 1.04 | 1.25 | 1.64 | 2.06 | 2.36 | 2.44 | 2.36 | 2.22 | 2.06 | 1.8 | 1.5 | 1.2 | 0.8 | 0.6 | 0.5 | 0.7 |
| 3    | 7  | 0.9 | 1.1 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.23 | 1.24 | 1.33 | 1.54 | 1.84 | 2.13 | 2.32 | 2.36 | 2.30 | 2.19 | 2.1 | 1.9 | 1.6 | 1.2 | 0.9 | 0.6 | 0.5 |
| 3    | 8  | 0.5 | 0.7 | 0.8 | 1.0 | 1.1 | 1.2 | 1.3 | 1.38 | 1.43 | 1.46 | 1.53 | 1.66 | 1.85 | 2.04 | 2.19 | 2.26 | 2.25 | 2.2 | 2.1 | 1.9 | 1.7 | 1.3 | 1.0 | 0.7 |
| 3    | 9  | 0.5 | 0.4 | 0.4 | 0.6 | 0.8 | 1.0 | 1.2 | 1.42 | 1.54 | 1.59 | 1.59 | 1.58 | 1.61 | 1.71 | 1.86 | 2.04 | 2.18 | 2.3 | 2.3 | 2.2 | 2.0 | 1.8 | 1.4 | 1.0 |
| 3    | 10 | 0.7 | 0.4 | 0.3 | 0.3 | 0.5 | 0.8 | 1.1 | 1.39 | 1.58 | 1.68 | 1.66 | 1.57 | 1.48 | 1.44 | 1.50 | 1.68 | 1.94 | 2.2 | 2.3 | 2.3 | 2.3 | 2.1 | 1.8 | 1.5 |
| 3    | 11 | 1.1 | 0.6 | 0.3 | 0.2 | 0.3 | 0.6 | 1.0 | 1.32 | 1.58 | 1.71 | 1.73 | 1.60 | 1.43 | 1.29 | 1.22 | 1.29 | 1.55 | 1.9 | 2.2 | 2.4 | 2.4 | 2.3 | 2.1 | 1.8 |
| 3    | 12 | 1.4 | 1.0 | 0.6 | 0.2 | 0.1 | 0.4 | 0.8 | 1.22 | 1.57 | 1.75 | 1.79 | 1.68 | 1.46 | 1.24 | 1.08 | 1.01 | 1.15 | 1.5 | 2.0 | 2.3 | 2.5 | 2.4 | 2.3 | 2.0 |
| 3    | 13 | 1.7 | 1.3 | 0.9 | 0.5 | 0.2 | 0.2 | 0.6 | 1.09 | 1.55 | 1.80 | 1.86 | 1.78 | 1.57 | 1.29 | 1.04 | 0.88 | 0.86 | 1.1 | 1.6 | 2.0 | 2.4 | 2.5 | 2.4 | 2.2 |
| 3    | 14 | 1.9 | 1.5 | 1.1 | 0.7 | 0.4 | 0.2 | 0.5 | 0.95 | 1.48 | 1.84 | 1.95 | 1.89 | 1.71 | 1.42 | 1.11 | 0.86 | 0.72 | 0.8 | 1.1 | 1.7 | 2.1 | 2.4 | 2.4 | 2.3 |
| 3    | 15 | 2.0 | 1.7 | 1.3 | 0.9 | 0.6 | 0.3 | 0.4 | 0.85 | 1.40 | 1.85 | 2.04 | 2.00 | 1.85 | 1.60 | 1.26 | 0.94 | 0.70 | 0.6 | 0.8 | 1.3 | 1.8 | 2.2 | 2.4 | 2.3 |
| 3    | 16 | 2.1 | 1.8 | 1.5 | 1.1 | 0.8 | 0.5 | 0.5 | 0.81 | 1.33 | 1.83 | 2.12 | 2.12 | 1.98 | 1.76 | 1.45 | 1.10 | 0.79 | 0.6 | 0.6 | 0.9 | 1.4 | 1.9 | 2.2 | 2.2 |
| 3    | 17 | 2.1 | 1.9 | 1.6 | 1.2 | 0.9 | 0.6 | 0.6 | 0.80 | 1.29 | 1.81 | 2.16 | 2.24 | 2.11 | 1.90 | 1.62 | 1.28 | 0.95 | 0.7 | 0.5 | 0.6 | 1.0 | 1.5 | 1.9 | 2.0 |
| 3    | 18 | 2.0 | 1.9 | 1.6 | 1.3 | 1.0 | 0.8 | 0.7 | 0.81 | 1.24 | 1.77 | 2.18 | 2.33 | 2.24 | 2.03 | 1.77 | 1.46 | 1.13 | 0.8 | 0.6 | 0.5 | 0.7 | 1.1 | 1.5 | 1.8 |
| 3    | 19 | 1.8 | 1.8 | 1.6 | 1.4 | 1.1 | 0.9 | 0.8 | 0.87 | 1.19 | 1.69 | 2.14 | 2.38 | 2.36 | 2.16 | 1.91 | 1.64 | 1.32 | 1.0 | 0.7 | 0.6 | 0.6 | 0.8 | 1.2 | 1.4 |
| 3    | 20 | 1.6 | 1.6 | 1.6 | 1.4 | 1.2 | 1.1 | 1.0 | 0.99 | 1.18 | 1.58 | 2.03 | 2.34 | 2.41 | 2.28 | 2.06 | 1.81 | 1.52 | 1.2 | 0.9 | 0.7 | 0.6 | 0.7 | 0.9 | 1.1 |
| 3    | 21 | 1.3 | 1.4 | 1.4 | 1.4 | 1.3 | 1.2 | 1.1 | 1.14 | 1.24 | 1.50 | 1.86 | 2.20 | 2.37 | 2.34 | 2.19 | 1.98 | 1.73 | 1.5 | 1.2 | 0.9 | 0.7 | 0.6 | 0.7 | 0.8 |
| 3    | 22 | 1.0 | 1.1 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.29 | 1.36 | 1.48 | 1.70 | 1.98 | 2.21 | 2.30 | 2.26 | 2.13 | 1.95 | 1.7 | 1.5 | 1.2 | 0.9 | 0.8 | 0.7 | 0.7 |
| 3    | 23 | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 1.3 | 1.4 | 1.43 | 1.49 | 1.54 | 1.61 | 1.75 | 1.95 | 2.12 | 2.20 | 2.21 | 2.14 | 2.0 | 1.8 | 1.5 | 1.2 | 1.0 | 0.8 | 0.6 |
| 3    | 24 | 0.6 | 0.6 | 0.7 | 0.8 | 1.0 | 1.2 | 1.4 | 1.52 | 1.59 | 1.62 | 1.61 | 1.59 | 1.66 | 1.81 | 1.98 | 2.13 | 2.23 | 2.2 | 2.1 | 1.9 | 1.6 | 1.3 | 1.0 | 0.8 |
| 3    | 25 | 0.6 | 0.5 | 0.5 | 0.6 | 0.8 | 1.0 | 1.3 | 1.54 | 1.66 | 1.70 | 1.65 | 1.54 | 1.45 | 1.47 | 1.61 | 1.85 | 2.12 | 2.3 | 2.4 | 2.3 | 2.0 | 1.7 | 1.4 | 1.0 |
| 3    | 26 | 0.7 | 0.5 | 0.4 | 0.4 | 0.6 | 0.9 | 1.2 | 1.52 | 1.71 | 1.76 | 1.71 | 1.56 | 1.36 | 1.22 | 1.22 | 1.39 | 1.76 | 2.2 | 2.5 | 2.6 | 2.4 | 2.1 | 1.8 | 1.4 |
| 3    | 27 | 1.0 | 0.7 | 0.4 | 0.3 | 0.4 | 0.7 | 1.1 | 1.48 | 1.75 | 1.84 | 1.79 | 1.63 | 1.39 | 1.13 | 0.95 | 0.94 | 1.21 | 1.7 | 2.2 | 2.6 | 2.7 | 2.5 | 2.2 | 1.8 |
| 3    | 28 | 1.4 | 1.0 | 0.7 | 0.4 | 0.3 | 0.5 | 0.9 | 1.42 | 1.81 | 1.96 | 1.93 | 1.77 | 1.51 | 1.19 | 0.89 | 0.68 | 0.70 | 1.1 | 1.7 | 2.3 | 2.6 | 2.7 | 2.5 | 2.2 |
| 3    | 29 | 1.8 | 1.3 | 1.0 | 0.6 | 0.3 | 0.4 | 0.8 | 1.35 | 1.85 | 2.12 | 2.12 | 1.98 | 1.73 | 1.38 | 1.00 | 0.66 | 0.43 | 0.5 | 1.0 | 1.7 | 2.3 | 2.6 | 2.6 | 2.4 |
| 3    | 30 | 2.1 | 1.6 | 1.2 | 0.9 | 0.5 | 0.4 | 0.7 | 1.24 | 1.84 | 2.25 | 2.35 | 2.23 | 2.01 | 1.67 | 1.25 | 0.84 | 0.45 | 0.3 | 0.4 | 1.0 | 1.7 | 2.2 | 2.5 | 2.4 |
| 3    | 31 | 2.2 | 1.9 | 1.5 | 1.1 | 0.8 | 0.5 | 0.6 | 1.11 | 1.76 | 2.30 | 2.54 | 2.48 | 2.28 | 2.00 | 1.60 | 1.14 | 0.69 | 0.3 | 0.2 | 0.4 | 1.0 | 1.6 | 2.1 | 2.2 |

1.5 Time (between 0800 and 1700) with predicted tide higher than 1.5mCD



## **Annex C            Construction Programme**

**VEP Programme For Driven H-pile Works at SDB**

