

Agreement No. CE 46/2020 (CE)
Term Consultancy for Site Formation and
Infrastructure Works for Proposed Housing
Developments in Zone 1 (2021-2024)
- Feasibility Study
(Task Order 4 – Shap Pat Heung Road)

Final Preliminary Sewerage Impact Assessment for
Shap Pat Heung Road (Rev.4)

(5210095-OR002-05)

April 2023



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1. Introduction

1.1 General

1.1.1 The Civil Engineering and Development Department (hereinafter called “CEDD”) of the Government of the Hong Kong Special Administrative Region appointed Atkins China Limited (hereinafter called “Atkins”), under Agreement No. CE 46/2020 (CE), to provide professional services in respect of the Term Consultancy for Site Formation and Infrastructure Works for Proposed Housing Developments in Zone 1 (2021 - 2024) - Feasibility Study (hereinafter called “the Assignment”).

1.1.2 Task Order 4 – Shap Pat Heung Road was issued to Atkins on 27th October 2021.

1.2 Background

1.2.1 The Government is committed to facilitating steady and continued land supply, not only for providing people with a place to live and work, but also for the developments of Hong Kong's commerce, industry, innovation and technology and various emerging sectors. In the short to medium term, the Government will continue to optimise the use of built-up land and its surrounding areas to meet the demand of the public for land for housing and other purposes.

1.2.2 The demarcation of Zone 1 includes Yuen Long district, Tuen Mun district, Tsuen Wan district and Kwai Tsing district, while the study area of Task Order 4 – Shap Pat Heung Road surrounded by nearby residential buildings, including Atrium House, LA Grove and Park Signature.

1.2.3 For the proposed housing site at Shap Pat Heung Road under Task Order 4, the site has been zoned as R(A)1 for high density housing development under the Draft Yuen Long Outline Zoning Plan No. S/YL/26.

1.2.4 The engineering feasibility study is carried out to determine the scope of the infrastructure works, and provide necessary engineering information to support the Section 16 Application for increasing the domestic plot ratio of the site at Shap Pat Heung Road near Lung Tin Tsuen, Yuen Long for the proposed public housing development.

1.3 Project Scope

1.3.1 Carry out necessary study(ies) and/or assessment(s) for the instructed Site under Task Order(s) issued by the CEDD in order to ascertain the feasibility of the intensification of the Development to a maximum domestic Plot Ratio of 6.5 and define the scope of the Project (Infrastructure) for the relevant parties to put forward the respective detailed designs.

1.3.2 This scope of study(ies) and technical assessment of the instructed Site include, but not limited to, the following principal works elements:

- (a) Recommendation of optimum development schemes for the Development and the required supporting facilities for the Development;
- (b) Slope cutting and earth filling works as well as geotechnical works/structures (including slope/retaining wall upgrading works if necessary);

- (c) Decontamination works, if any;
- (d) Transport infrastructure works (including new road connecting to the Site, diversion/ upgrading of existing roads, flyovers, traffic improvement works, PTL/public transport laybys, pedestrian footpath, cycle track, footbridges/ subways and any other pedestrian and transport facilities etc. if necessary);
- (e) Sewerage infrastructure works (including pumping station(s), treatment plants and reclaimed water (treated sewage effluent, grey water and harvested rainwater as applicable) treatment facilities if necessary);
- (f) Drainage infrastructure works and necessary diversion works;
- (g) Water supply infrastructure works and necessary diversion works;
- (h) Environmental mitigation measures for the Development;
- (i) Design of lead-in of utilities (incl. drainage, sewerage, water supply etc.) and site run-in/out; and
- (j) Other infrastructure works, such as utility works, electricity substation, etc., if any deemed to be necessary to support the Development.

1.4 Purpose of the Report

1.4.1 The purpose of the Sewerage Impact Assessment (SIA) is to introduce a structural and systematic approach to identify, assess and mitigate potential adverse sewerage impacts which might arise from the Developments and develop the recommended sewerage scheme for the Infrastructure.

1.4.2 In accordance with Clause 6.7 of the Brief, the Preliminary Sewerage Impact Assessment (hereinafter called “the Report”) shall be conducted to:

- a) Derive and agree with EPD and DSD on the details of the project profile, parameters based on the development layouts, methodologies, findings, proposals, recommendations and conclusions including the agreed sewerage impact mitigation measures;
- b) Projection of population in-take and the sewage flow build-up (both Average Dry Weather Flow and Peak Flow), by taking into account the sewage discharging from all other existing/committed/planned developments within the affected sewerage catchments up to the design year agreed by EPD;
- c) Assessment of sewerage impact on all existing/committed/planned sewage collection, treatment and disposal facilities (including sewerage network, associated pumping stations and sewage treatment plants) affected by the Development and associated Infrastructure Works, with sensitivity analysis of such facilities to the change of development parameters of the Development;
- d) Assessment in accordance with the latest version of Planning Department's territorial population and employment data matrices (TPEDM) and the standards set out in DSD Sewerage Manual, the latest version of the EPD's “Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning;

- e) Inventory of the existing, planned and proposed sewerage elements and capacities;
- f) Recommendation of all necessary measures to mitigate adverse sewerage impacts arising from the Development and the Infrastructure Works and demonstration of the effectiveness and acceptability of such measures;
- g) Schematic design of the proposed improvement schemes and measures on plans and sections in enough details to illustrate their feasibility with respect to the topography and surrounding developments/structures etc. and for proceeding with statutory procedures of amendment to OZPs and EIAO, where applicable;
- h) Proposed sewerage connection points and prepare preliminary sewerage layout plan for the Development to illustrate the hydraulic feasibility of the proposed sewerage scheme;
- i) Implementation programme of the proposed sewerage scheme to support the Development; and
- j) Issues of key concern in planning, design, construction and operation stages which are likely to influence decisions on the Development and the Infrastructure Works.

1.5 Structure of the Report

1.5.1 After this Introduction, the Report is further divided into the following sections:

- Section 2 describes the approaches for assessing the sewerage impact;
- Section 3 discusses information of the existing and planned sewerage infrastructures;
- Section 4 quantifies the increase in sewage flow and the proposed sewer connections;
- Section 5 assesses the likely impacts of the proposed development on the sewerage infrastructure and recommend mitigation measures to minimize the sewerage impacts due to the development; and
- Section 6 summarizes the assessment results and recommendations on the mitigation measures.

1.6 Abbreviations

1.6.1 The following abbreviations are used in this Report:

CEDD	Civil Engineering and Development Department
CLP	China Light and Power Ltd
DEVB	Development Bureau
DGV	Dangerous Goods Vehicle
DIA	Drainage Impact Assessment
DPM	Deputy Project Manager
DSD	Drainage Services Department
E&M	Electrical and Mechanical
EDB	Education Bureau
EIA	Environmental Impact Assessment
EIAO	Environmental Impact Assessment Ordinance
EMSD	Electrical and Mechanical Services Department
EPD	Environmental Protection Department
ETWB	Environmental Transport and Works Bureau
FEHD	Food and Environmental Hygiene Department
FSD	Fire Services Department
GEO	Geotechnical Engineering Office
GI	Ground Investigation
HAD	Home Affairs Department
HD	Housing Department
HyD	Highways Department
LandsD	Lands Department
LCSD	Leisure and Cultural Services Department
LVIA	Landscape and Visual Impact Assessment
PER	Preliminary Environmental Review
PlanD	Planning Department
PTI	Public Transport Interchange
SDM	Stormwater Design Manual
SI	Site Investigation
SIA	Sewerage Impact Assessment
TD	Transport Department
TIA	Traffic Impact Assessment
UIA	Utilities Impact Assessment
WIA	Waterworks Impact Assessment

WSD

Water Supplies Department

2. Methodology and Design Criteria

2.1 Design Standard and Guideline

2.1.1 This report is prepared in accordance with EPD's "Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning Report No. EPD/TP 1/05" (GESF). The recommended unit flow factors and peaking factors have been adopted to estimate the sewage generated from the proposed housing site at Shap Pat Heung Road. The layout plan of boundary of the proposed housing site is shown in **Figure 5210095-ATK-GA-1001**.

2.1.2 For the roughness of sewers, the recommended value in DSD's "Sewerage Manual Part 1" has been adopted.

2.2 Flow Estimation

Unit Flow Factors

2.2.1 The following unit flow factors for domestic and commercial flows were used in estimating the sewage flow generating from the development.

Table 2.1 Unit Flow Factors for the Developments

Development Type	Unit	Unit Flow Factor (m ³ /day)
Domestic Flow		
Public Housing Development ⁽¹⁾⁽²⁾	person	0.27
Institutional and special class	person	0.19
Commercial Flow		
Commercial Employee	employee	0.08
Commercial Activity J11 Community, Social & Personal Services	employee	0.20

Remark:

(1) Flexibility would be allowed to change the housing type to cater for demand change between Public Rental Housing (PRH)/ Green Form Subsidised Home Ownership Scheme (GSH) and Other Subsidised Sale Flats (SSFs) subject to pro-rata adjustments of provision of ancillary facilities in accordance with the HKPSG.

(2) Subsidised Sale Flats (SSFs) is considered in this technical assessment as the worst case scenario.

Catchment Inflow Factor, P_{CIF}

2.2.2 Catchment inflow factor (P_{CIF}) is not applicable to the new development since it should be deemed to be free from misconnections and pipe defects.

2.2.3 P_{CIF} 1.0 is adopted for assessing the downstream existing sewerage facilities in Yuen Long.

Peaking Factors

- 2.2.4 The design peaking factors for sewers in line with GESF have been adopted for estimating the peak sewage flow from the proposed development, and the adopted factors are presented in **Table 2.2** below.

Table 2.2 Peaking Factors for Various Ranges

Population Range	Peaking Factor (including stormwater allowance) for facility with existing upstream sewerage	Peaking Factor (excluding stormwater allowance) for facility with new upstream sewerage
For sewers		
<1000	8	6
1,000 – 5,000	6	5
5,000 – 10,000	5	4
10,000 – 50,000	4	3
For Sewage Treatment Works, Preliminary Treatment Works and Pumping Stations		
<10,000	4	3
10,000 – 25,000	3.5	2.5
25,000 – 50,000	3	2
>50,000	$Max \left(\frac{3.9}{N^{0.065}}, 2.4 \right)$	$Max \left(\frac{2.6}{N^{0.065}}, 1.6 \right)$

Average Flows and Peak Flows

- 2.2.5 The equations for the average sewage flow and peak sewage flow are as follows:

- $$Q_{\text{average}} = (Q_{\text{domestic}} + Q_{\text{commercial}} + Q_{\text{institutional}} + Q_{\text{industrial}}) \times P_{\text{CIF}}$$

Where

Q_{domestic}	is the average dry weather domestic flow,
$Q_{\text{commercial}}$	is the average dry weather commercial flow,
$Q_{\text{institutional}}$	is the average dry weather institutional flow,
$Q_{\text{industrial}}$	is the average dry weather industrial flow, and
P_{CIF}	is the catchment inflow factor.

- $$Q_{\text{peak}} = Q_{\text{average}} \times P$$

Where

Q_{peak}	is the peak flow, and
P	is the peaking factor.

2.3 Hydraulic Assessment

- 2.3.1 Colebrook-White Equation has been adopted for hydraulic analysis for the pipe system.

- 2.3.2 Based on Sewerage Design Manual Table 5, conduit roughness K_s of 0.3 and 0.6mm have been adopted for polyethylene and clay pipes, under poor condition with velocity of 1.2m/s respectively. Conduit roughness K_s of 3.0 and 6.0 have been adopted for concrete pipes, under poor condition with velocity of 1.2m/s and 0.75m/s respectively.

- 2.3.3 10% reduction in flow area of pipe due to sediment is taken account for pipe capacity in the design calculation.

3. Existing and Planned Sewerage Systems

3.1 Existing and Planned Sewerage Systems

3.1.1 With reference to DSD record plans, there are no public sewerage systems within the boundary of the proposed housing site.

3.1.2 The nearest public sewerage system is located at the north of the proposed housing site. The public sewerage manhole (DSD manholes no. FMH1036015) is located at the Shap Pat Heung Road between Ma Tin Tsuen and the proposed housing site. It is connected by a 600mm dia. sewer starting from an existing manhole FMH1036013. The existing sewerage pipeline along Shap Pat Heung Road conveys sewage flows to Ma Tin Sewage Pumping Station (MTSPS) which is located at the junction of Shap Pat Heung Road and Yuen Long Tai Yuk Road. The sewage flows are ultimately conveyed to San Wai Sewage Treatment Works (SWSTW).

3.1.3 Major sewerage infrastructure in Yuen Long and Tin Shui Wai potentially affected by the development of the Site includes:

- Existing gravity sewers from DSD manhole no. FMH1036015 to Ma Tin Sewage Pumping Station
- Ma Tin Sewage Pumping Station and associated rising mains
- Ping Shun Street Pumping Station and associated rising mains
- Ha Tsuen Pumping Station and associated rising mains
- San Wai Sewage Treatment Works

3.1.4 This Site is one of the potential sites under CE 36/2018(CE). However, given the pressing needs of housing demand, the site is now considered as an individual site for population intake in 2028/29 in order to expedite housing supply. Hence, the proposed sewerage scheme under CE36/2018(CE) is not applicable for this Site.

3.2 Planned Sewerage Systems

3.2.1 Provision of new sewerage pipelines and manholes to convey the sewage flows from the proposed housing site to adjacent public sewerage system along Shap Pat Heung Road will be required.

3.2.2 Two new sewers will be proposed from the site to the nearest existing manhole (FMH1036015 & FMH1043421) which is located at the Shap Pat Heung Road and directly convey the flow to the Ma Tin Sewage Pumping Station.

3.2.3 Existing sewerage pipeline would ultimately convey the sewage flows from the proposed housing site to San Wai Sewage Treatment Works from Ma Tin Sewage Pumping Station.

3.2.4 Impact on the downstream sewerage infrastructure shall be assessed in particular Ma Tin Sewage Pumping Station, Ping Shun Street Pumping Station, Ha Tsuen Pumping Station and San Wai Sewage Treatment Works (SWSTW).

4. Sewerage Condition after Development

4.1 Population Projection

4.1.1 Further to discussion in Section 3.2, new sewer will be proposed from the site to the nearest existing manhole (FMH1036015 & FMH1043421) and directly convey the flow to the Ma Tin Sewerage Pumping Station. Currently, Ma Tin Sewage Pumping Station is serving the Planning Data Zone nos. 179 and 180 and Ping Shun Street Pumping Station is serving Planning Data Zones no. 173, 177, 178, 179, 180, 232, 314, 315, 317, 368 and 372 under TPEDM 2019. Therefore, apart from the addition population due to the proposed housing development, the population in Planning Data Zone nos. 179 and 180 shall also be considered in the assessment.

4.1.2 Given that the intake year of the proposed housing site would be year 2028/2029 tentatively, the residential population in year 2019, 2026 and 2031 are reviewed and summarised in **Table 4.1**.

Table 4.1 Residential Population in Year 2019, 2026 and 2031

Planning Data Zone	Residential Population ⁽¹⁾		
	Year 2019	Year 2026	Year 2031
No. 179	15,000	14,150	11,600
No. 180	20,550	20,000	18,850
Total	35,550	34,150	30,450

Remark:

(1) The residential population is extracted from TPEDM 2019 Table 1

4.1.3 As illustrated in **Table 4.1**, the population in the concerned Planning Data Zone will be decreasing from year 2019 to 2031. Therefore, current population is adopted instead of the population in year 2028/2029 as the conservation approach for the sewerage impact assessment.

4.1.4 The development parameters of the proposed public housing site at Shap Pat Heung Road is give in **Table 4.2**:

Table 4.2 Development Parameters of Proposed Public Housing Site at Shap Pat Heung Road

Area of Proposed Housing Site	0.71ha approx.
Max. Domestic Plot Ratio	6.5
Total No. of Flats	910 nos.
Population	2,457 (Factor for 2028/2029 is 2.7P)
Intake Year	2028/2029
Proposed Welfare Facilities ⁽¹⁾⁽²⁾	Home Care Services (HCS) Residential Child Care Centre (RCCC)

Remark:

(1) About 5% of domestic GFA had been set aside for the provision of social welfare facilities under the proposed housing development.

(2) The final list of social welfare facilities shall be subject to confirmation by user departments at later stage.

4.2 Sewage Flow Projection

4.2.1 The methodology and unit flow factors as stated in Section 2 have been used as the basis of assessment.

4.2.2 The estimated average dry weather flow (ADWF) generated from the Development is summarized in **Table 4.3** below.

Table 4.3 Summary of Projected Sewage Discharge from the Development

Facilities	Population	Unit Flow Factor (m ³ /person/day)	ADWF (m ³ /d)
Domestic			
Residential ⁽³⁾⁽⁴⁾	2,703 ⁽¹⁾	0.27	729.73
Total Domestic Flows	-	-	729.73
Commercial			
Welfare Facilities - Home Care Service (HCS)	60 ⁽²⁾	0.28	16.8
Welfare Facilities – 96-place Residential Child Care Centre (RCCC)	20 ⁽²⁾	0.28	5.6
	96 ⁽²⁾	0.19	18.24
Total Commercial Flows	-	-	40.64
Total ADWF Estimate			770.37

Remark:

(1) 10% variation on top of 910 flats / 2,457 persons for design flexibility is incorporated in the population for technical assessment. The actual nos. of population will be subject to confirmation by the user department at later stage.

(2) According to the latest SoAs, the no. of staff for HCS is 60; and the no. of staff for RCCC is 20 + 96 nos. of residents

(3) Flexibility would be allowed to change the housing type to cater for demand change between Public Rental Housing (PRH)/ Green Form Subsidised Home Ownership Scheme (GSH) and Other Subsidised Sale Flats (SSFs) subject to pro-rata adjustments of provision of ancillary facilities in accordance with the HKPSG.

(4) Subsidised Sale Flats (SSFs) is considered in this technical assessment as the worst case scenario.

4.2.3 Based on the proposed development parameters, a total Average Dry Weather Flow (ADWF) estimated from the Development would be approximately 770.37m³/day with detailed calculations provided in **Appendix A-1**.

4.2.4 As the contributing population is ranging from 1,000 to 5,000, the proposed sewerage shall be designed with a peaking factor of 6 (including stormwater allowance) for facility with existing upstream sewerage in accordance with the GESF. The projected Peak Dry Weather Flow (PDWF) generated from the proposed Development would be 0.054m³/s.

4.2.5 As discussed in Section 4.1, current population under the catchment area of Ma Tin Sewage Pumping Station will be adopted for assessment and the current average daily flow at Ma Tin Sewerage Pumping Station is 1,920m³ as advised by DSD.

4.3 Proposed Discharge Location and Sewers

- 4.3.1 A new sewerage system will be required to collect sewage flow within the proposed housing site and convey sewage flow from the site to existing public sewerage system. Two new terminal manholes FTMH01 and FTMH02 are proposed at the northwest and east of the site. Two new 375mm dia. (OD 400mm) HDPE pipes are proposed from the terminal manholes FTMH01 and FTMH02 to the existing manholes FMH1036015 & FMH1043421 respectively. Existing 600mm dia. pipe and 750mm dia. pipe from FMH1036015 to MTSPS shall remain to take up the additional flow to MTSPS from the proposed development. Detailed assessment is presented in **Appendix A-2**.
- 4.3.2 The proposed alignment, manhole location, number of connection points and invert levels for the Development in this report are indicative only and should be further reviewed subject to the final layout of the proposed housing development.
- 4.3.3 Figure 5210095-ATK-SIA-1021 shows the layout of the proposed sewerage system for the proposed housing development.

5. Sewerage Impact Assessment

5.1 Potential Impact on the Existing Sewerage

- 5.1.1 Sewage generated from the proposed housing site will be discharged via the new terminal manholes FTMH01 & FTMH02 and conveyed to MTSPS through the existing sewerage system along Shap Pat Heung Road. Existing pipes from FMH1036015 to MTSPS are found to be sufficient to accommodate the additional flow from the proposed housing development.
- 5.1.2 The proposed housing site falls within sewerage catchment area of SWSTW. The estimated sewage generated from the housing development is 770.37 m³/day with as illustrated in **Appendix A1-1**.
- 5.1.3 Based on TPEDM, the total population in year 2026 and 2031 under the planning data zone 179 and 180 are smaller than that in 2019. Therefore, the population in 2019 has been adopted in our assessment to give a conservative assessment.
- 5.1.4 The design capacity of MTSPS is 7,344 m³/day and the additional flow due to the proposed housing development is 770.37 m³/day which will contribute about 10.5% of the total design capacity. And based on TPEDM data, the total sewage generated from the catchment area after the development is 3,258.54 m³/day. The utilization rate at MTSPS is about 44% and hence there is sufficient capacity for MTSPS to cater the additional flow from the Development and no mitigation measures or upgrading works would be necessary.
- 5.1.5 The design capacity of PSSSPS is 43,200 m³/day. The additional flow due to the proposed housing development is 770.37 m³/day which will contribute about 1.78% of the total design capacity. And based on TPEDM data, the total sewage convey to PSSSPS is 41,499.34 m³/day, the utilization rate of PSSSPS is 96.1%. Therefore, no mitigation measures or upgrading works would be necessary to the PSSSPS.

- 5.1.6 The current design capacity of SWSTW is 200,000 m³/day. The additional flow only utilizes approximately 0.39% of the treatment capacity, it is considered that the potential sewerage impact to SWSTW would be minimal and hence no mitigation measures or upgrading works would be necessary.
- 5.1.7 EPD advised that this Development is within the catchment of SWSTW and that sufficient capacity will be timely provided in phase with the TPEDM forecasted population to be accommodated by all existing and planned developments within its catchment including the latest forecasted population of this development.

6. Maintenance Matrix for Proposed Sewerage Works

- 6.1.1 The parties responsible for maintaining the proposed sewerage works are listed in Table 6.1.

Table 6.1 Maintenance Matrix

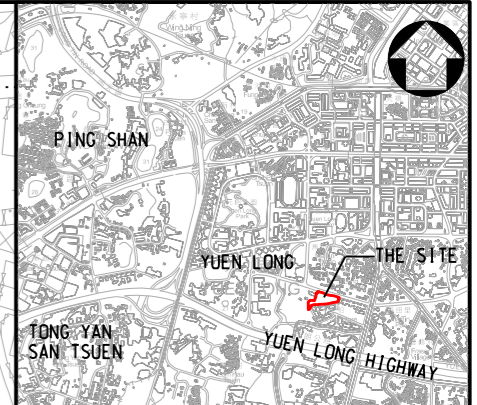
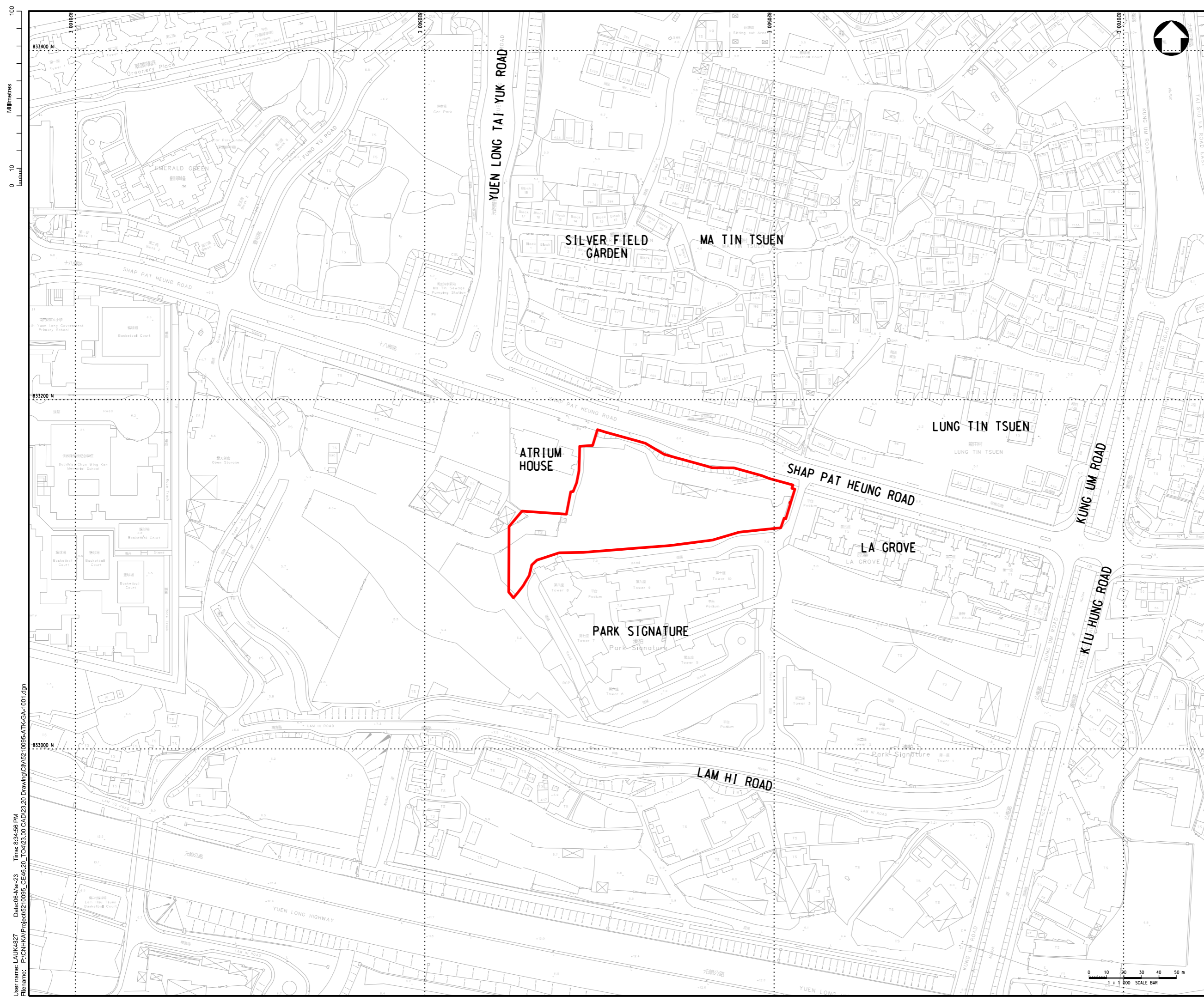
Description of Proposed Sewerage Works	Maintenance Party
Proposed new sewer after proposed terminal manholes FTMH1 & FTMH2	DSD
Manholes FTMH1 & FTMH2 and internal sewer for the proposed housing site	HD

7. Conclusions


- 7.1.1 Proposed option for conveying sewage flow from the proposed housing site to public sewerage system was discussed in above section. Terminal manholes FTMH01 & FTMH02 associated with 375 dia. HDPE pipes are proposed to convey the sewage flow to existing sewerage system at Shap Pat Heung Road.
- 7.1.2 The project sewerage flow from the proposed housing site has been estimated. The ADWF and PDWF are 770.37 m³/d and 0.054m³/s respectively. 10% added allowance of population is incorporate for design flexibility of the proposed housing site for the sewerage impact assessment.

The additional sewage loading on the MTSPS, PSSSPS and HTSPS due to the proposed housing development is found to be insignificant to the related infrastructure. SWSTW is also capable to cater the sewage loading from proposed housing site with no insurmountable impact anticipated no mitigation measures or upgrading works would be necessary.

Figures



KEY PLAN
N.T.S.

LEGEND:
 PROPOSED HOUSING DEVELOPMENT BOUNDARY
 (SUBJECT TO DETAILED SURVEY AND DESIGN)

Rev.	Date	Description	By	Crkd	App'd	Suitability
A	NOV 2021	FIRST ISSUED	WL	KL	DL	
Drawing Status						FEASIBILITY STUDY



Client
 土木工程拓展署
 Civil Engineering and Development Department
 土木工程處
 房屋工程3部
 Civil Engineering Office
 Housing Projects 3 Division

Project Title
 AGREEMENT NO. 46/2020 (CE)
 TERM CONSULTANCY FOR SITE FORMATION
 AND INFRASTRUCTURE WORKS FOR
 PROPOSED HOUSING DEVELOPMENT IN
 ZONE 1 (2021-2024) - FEASIBILITY STUDY
 (TASK ORDER 4 - SHAP PAT HEUNG ROAD)

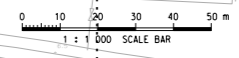
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 OF TASK ORDER 4**

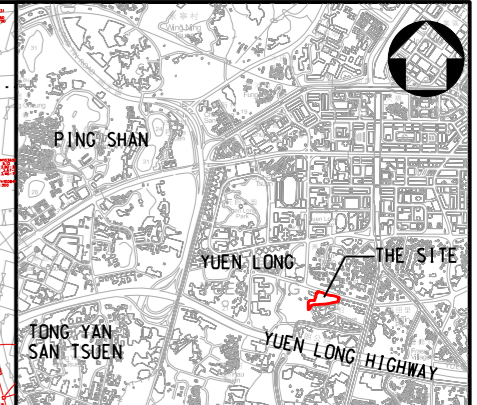
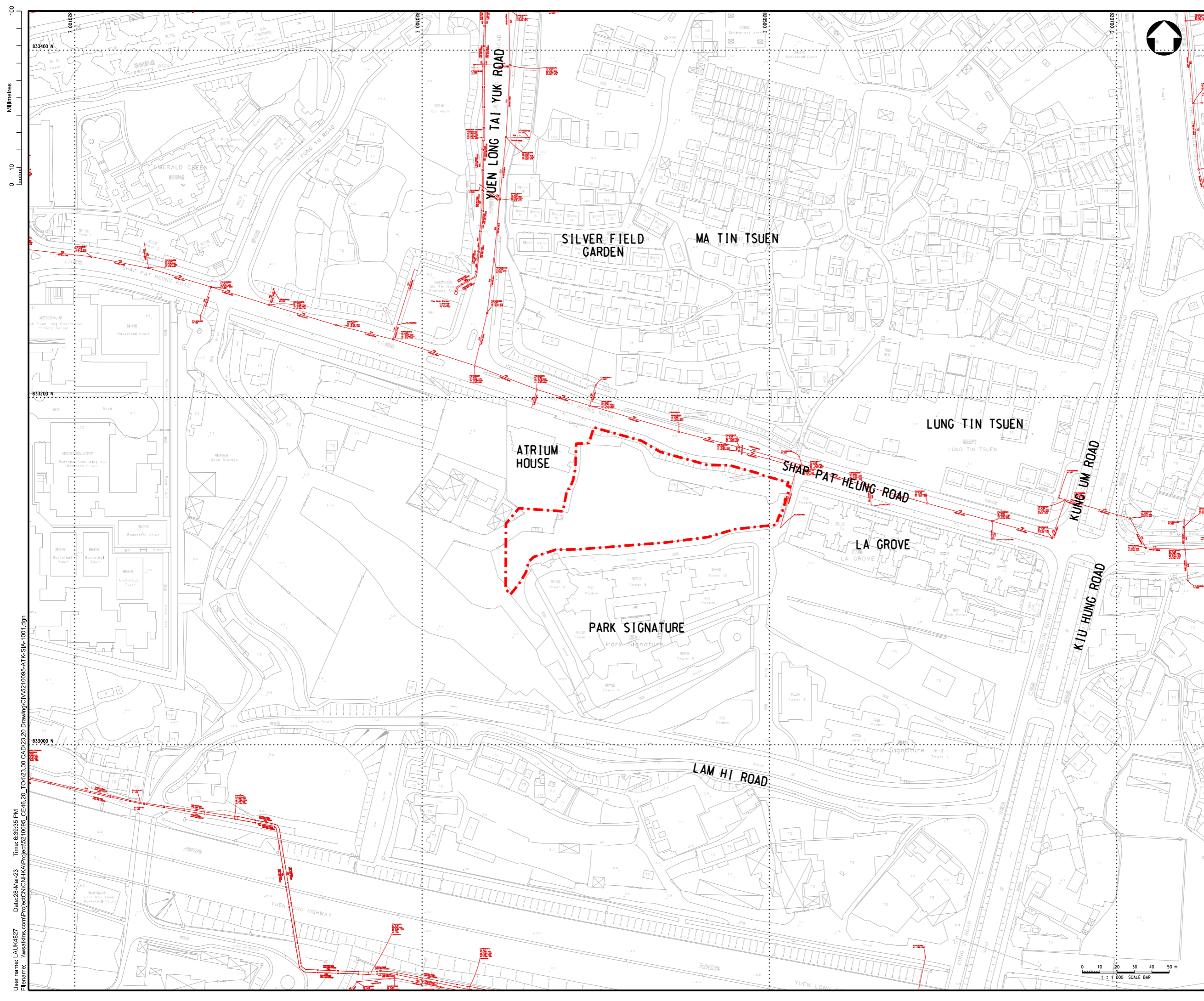
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KEY PLAN
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- LEGEND:**
- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
 - EXISTING SEWERAGE SYSTEM

Rev.	Date	Description	By	Crkd	App'd
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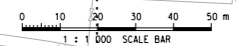
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Civil Engineering and Development Department
土木工程處
房屋工程3部
Civil Engineering Office
Housing Projects 3 Division

Project Title: **AGREEMENT NO. 46/2020 (CE) TERM CONSULTANCY FOR SITE FORMATION AND INFRASTRUCTURE WORKS FOR PROPOSED HOUSING DEVELOPMENT IN ZONE 1 (2021-2024) - FEASIBILITY STUDY (TASK ORDER 4 - SHAP PAT HEUNG ROAD)**

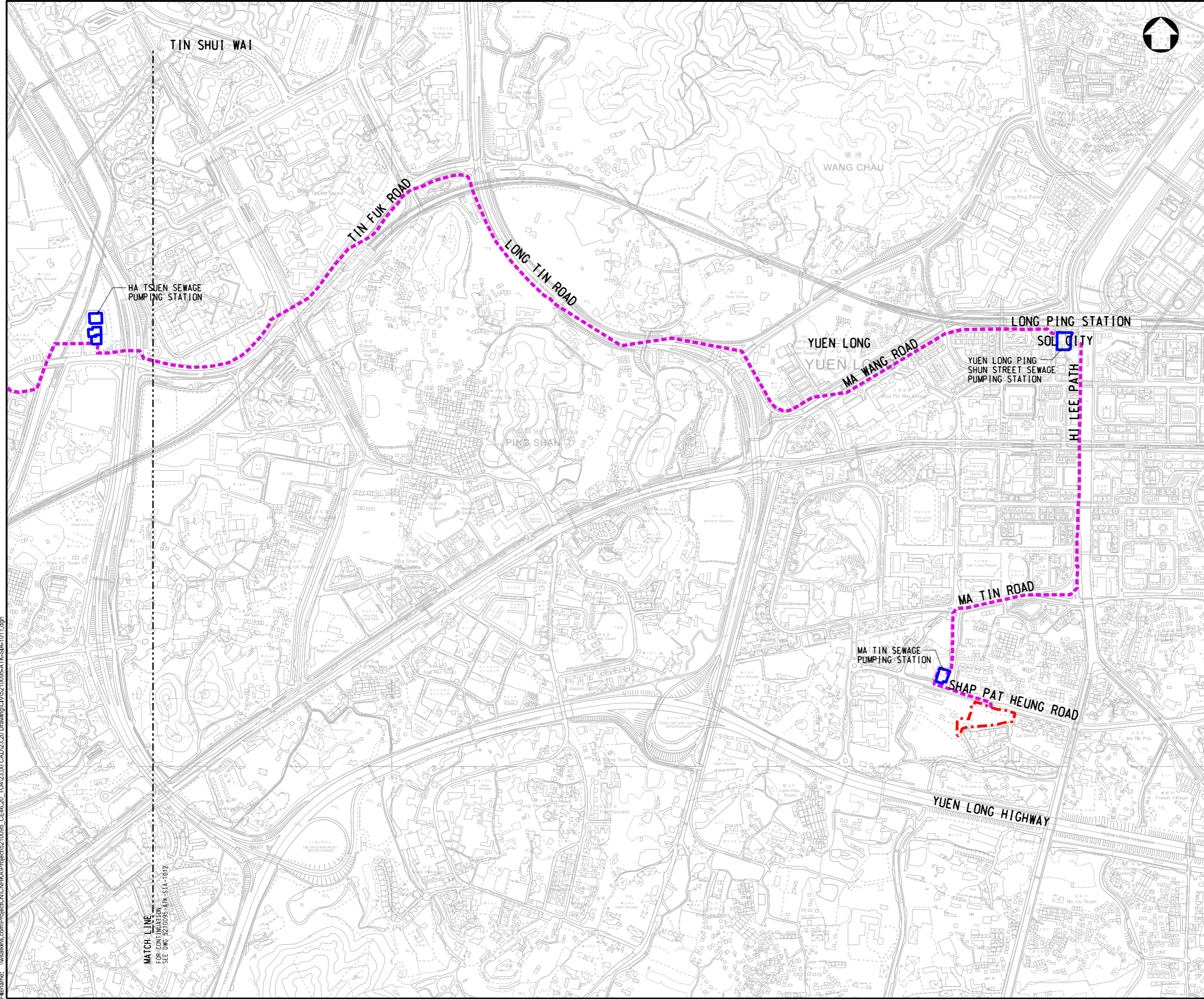
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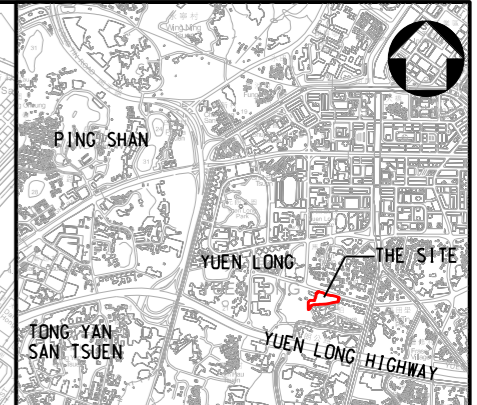
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MATCH LINE
FOR CONTINUATION
SEE DWG 5210095-ATK-SIA-1012



KEY PLAN
N.T.S.

- LEGEND:**
- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
 - EXISTING SEWERAGE SYSTEM

Rev.	Date	Description	By	Crk'd	App'd
A	DEC 2021	FIRST ISSUED		CC	KL DL

Drawing Status: **FEASIBILITY STUDY** Suitability: -

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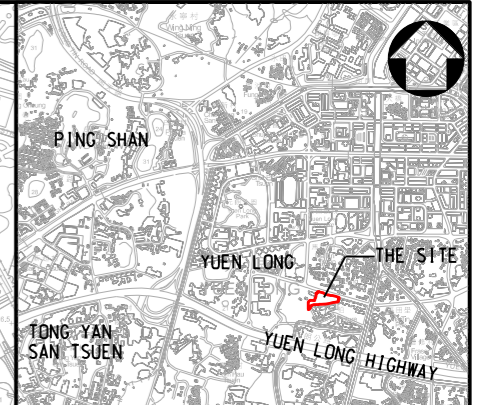
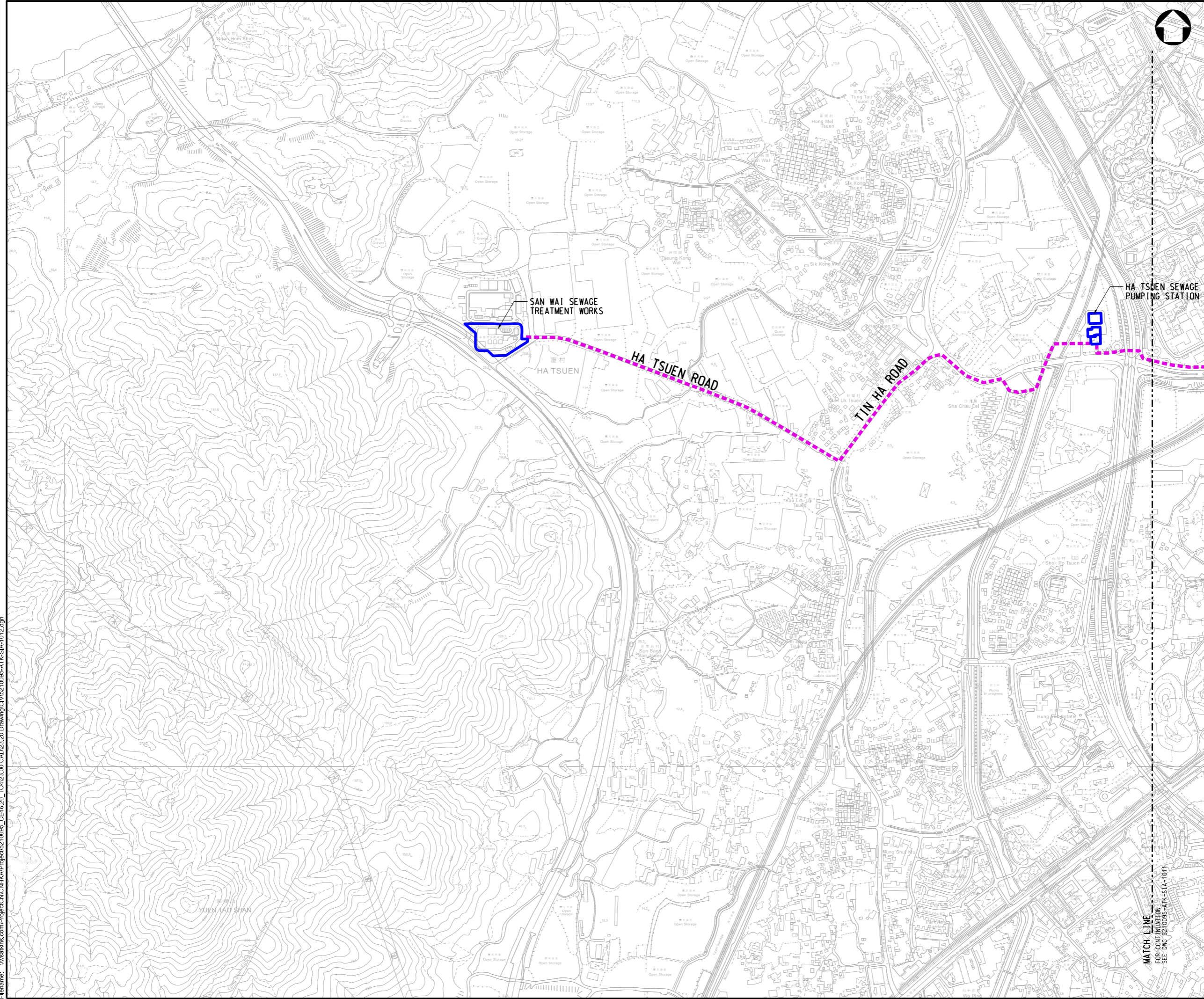
Client: **CEDD** 土木工程拓展署
Civil Engineering and Development Department
土木工程處
房屋工程3部
Civil Engineering Office
Housing Projects 3 Division

Project Title: AGREEMENT NO. 46/2020 (CE)
TERM CONSULTANCY FOR SITE FORMATION AND INFRASTRUCTURE DEVELOPMENT WORKS FOR PROPOSED HOUSING DEVELOPMENT IN ZONE 1 (2021-2024) - FEASIBILITY STUDY (TASK ORDER 4 - SHAP PAT HEUNG ROAD)

GENERAL LAYOUT OF SEWERAGE INFRASTRUCTURE (SHEET 1)

Scale	Designed	Drawn	Checked	Authorised
1:5000	CC	CAD	KL	DL
Original Size	Date	Date	Date	Date
A1	DEC 2021	DEC 2021	DEC 2021	DEC 2021
Drawing Number				Revision
5210095-ATK-SIA-1011				A

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KEY PLAN
N.T.S.

- LEGEND:**
- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
 - EXISTING SEWERAGE SYSTEM

Rev.	Date	Description	By	Crk'd	App'd
A	DEC 2021	FIRST ISSUED		CC	KL DL
Drawing Status					Suitability
FEASIBILITY STUDY					-

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Client
 土木工程拓展署
 Civil Engineering and Development Department
 土木工程處
 房屋工程3部
 Civil Engineering Office
 Housing Projects 3 Division

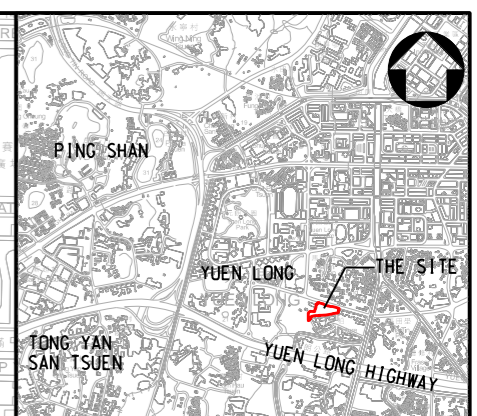
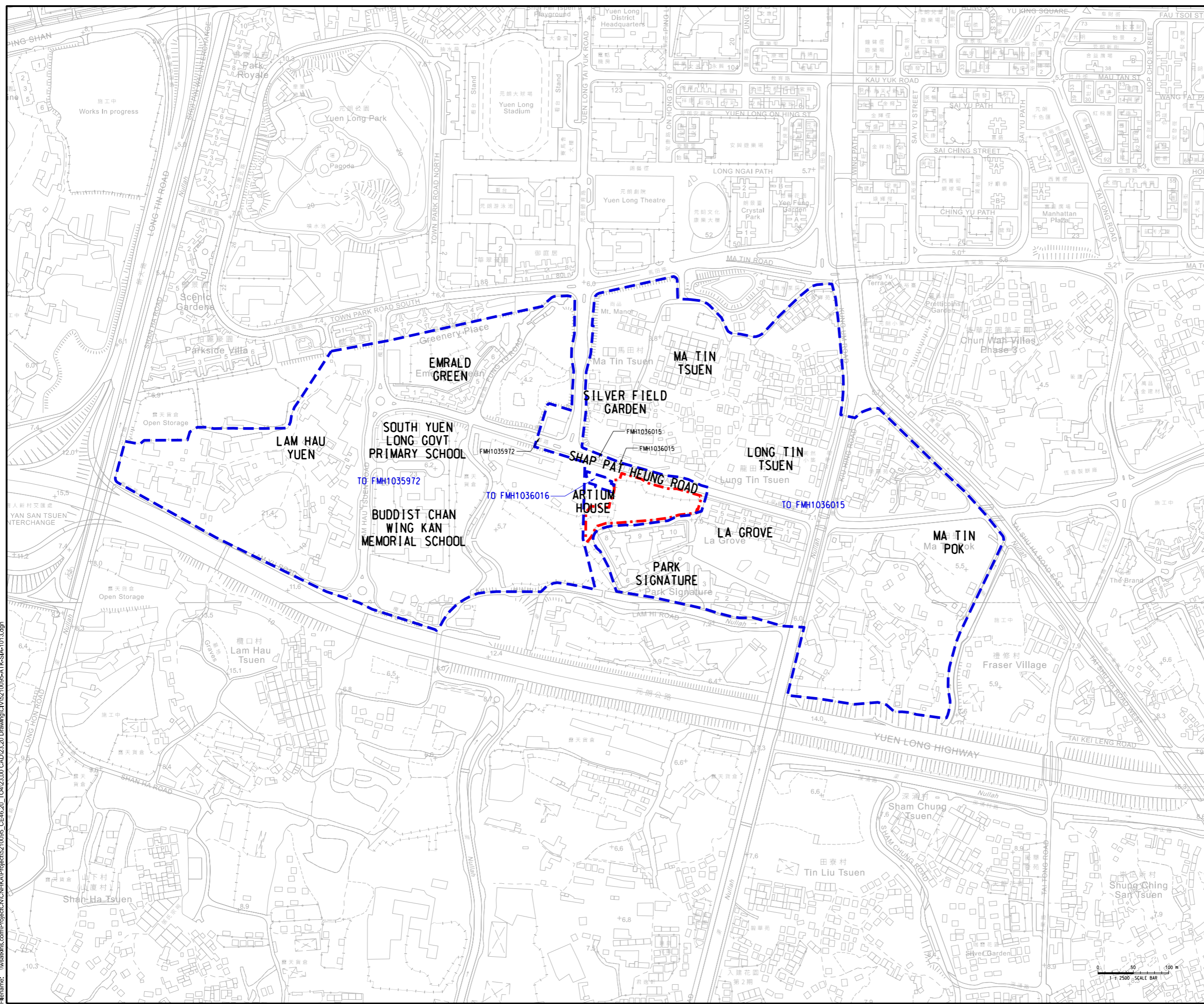
Project Title
 AGREEMENT NO. 46/2020 (CE)
 TERM CONSULTANCY FOR SITE FORMATION AND INFRASTRUCTURE WORKS FOR PROPOSED HOUSING DEVELOPMENT IN ZONE 1 (2021-2024) - FEASIBILITY STUDY (TASK ORDER 4 - SHAP PAT HEUNG ROAD)

Drawing Title
GENERAL LAYOUT OF SEWERAGE INFRASTRUCTURE (SHEET 2)

Scale	Designed	Drawn	Checked	Authorised
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Original Size	Date	Date	Date	Date
A1	DEC 2021	DEC 2021	DEC 2021	DEC 2021
Drawing Number				Revision
5210095-ATK-SIA-1012				A

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KEY PLAN
N.T.S.

- LEGEND:**
- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
 - SEWAGE CATCHMENT AREA FOR THE CORRESPONDING SEWERAGE MANHOLE

Rev.	Date	Description	By	Crkd	App'd
A	DEC 2021	FIRST ISSUED	CC	KL	DL

Drawing Status: **FEASIBILITY STUDY** Suitability: -

SNC · LAVALIN **ATKINS**
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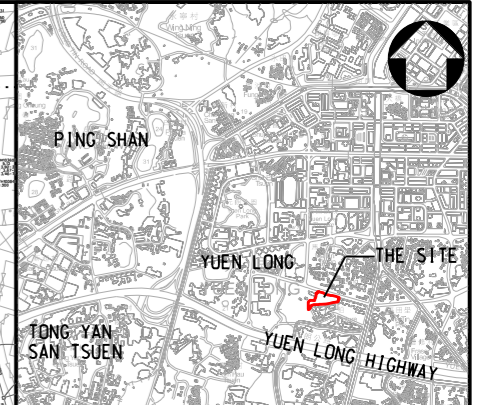
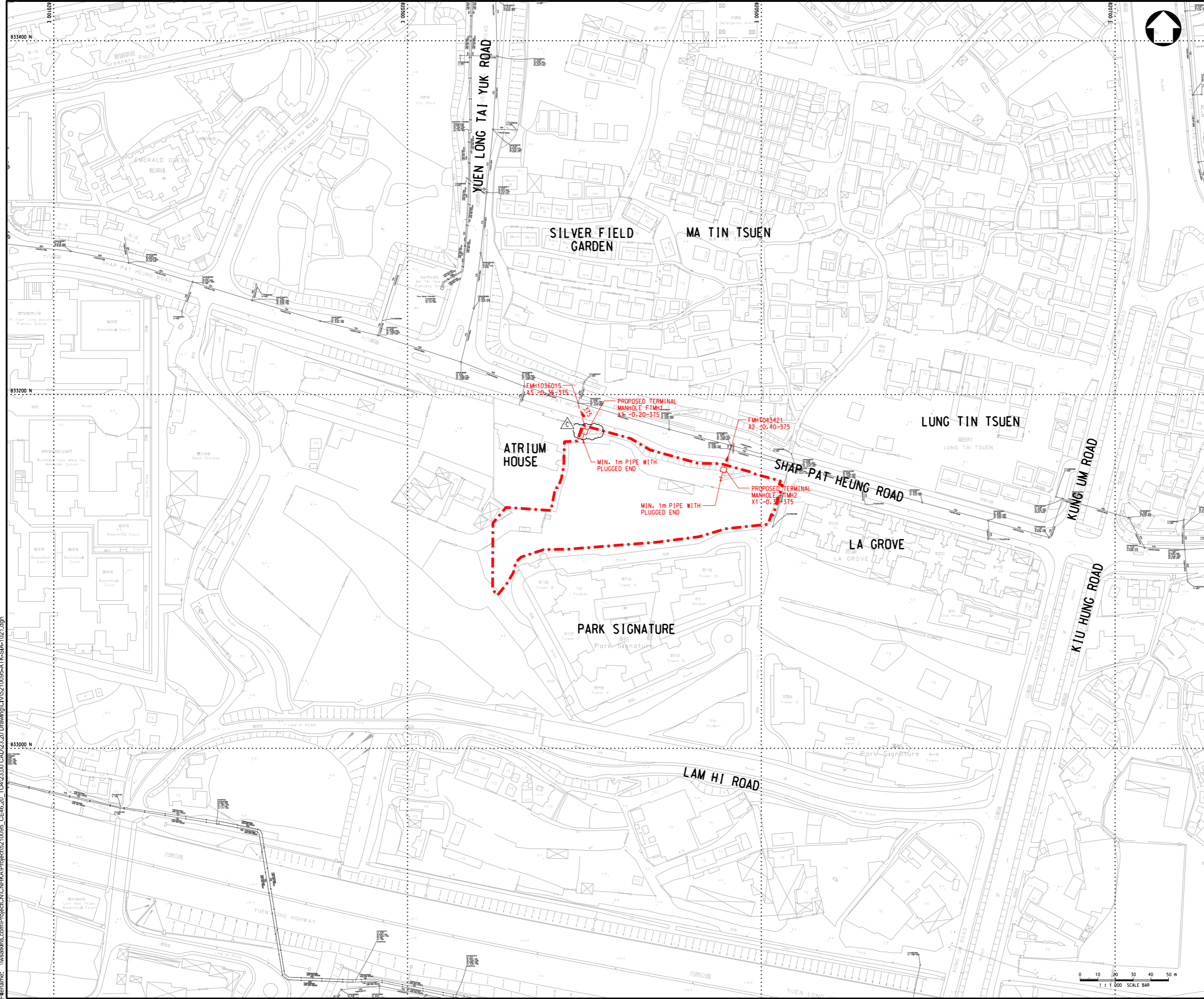
Client: **CEDD** 土木工程拓展署
Civil Engineering and Development Department
土木工程處
房屋工程3部
Civil Engineering Office
Housing Projects 3 Division

Project Title: AGREEMENT NO. 46/2020 (CE)
TERM CONSULTANCY FOR SITE FORMATION AND INFRASTRUCTURE WORKS FOR PROPOSED HOUSING DEVELOPMENT IN ZONE 1 (2021-2024) - FEASIBILITY STUDY (TASK ORDER 4 - SHAP PAT HEUNG ROAD)

CATCHMENT LAYOUT PLAN

Scale	Designed	Drawn	Checked	Authorised
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Original Size	Date	Date	Date	Date
A1	DEC 2021	DEC 2021	DEC 2021	DEC 2021
Drawing Number				Revision
5210095-ATK-SIA-1013				A

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KEY PLAN
N.T.S.

- LEGEND:**
- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
 - EXISTING SEWERAGE SYSTEM
 - PROPOSED SEWERAGE SYSTEM

Rev.	Date	Description	By	Crk'd	App'd
C	OCT 2022	THIRD ISSUE	WL	SW	DL
B	MAR 2022	SECOND ISSUE	WL	KL	DL
A	DEC 2021	FIRST ISSUED	WL	KL	DL
Drawing Status					Submittal
FEASIBILITY STUDY					=



Client
CEDD 土木工程拓展署
 Civil Engineering and Development Department

土木工程處
 房屋工程3部
 Civil Engineering Office
 Housing Projects 3 Division

Project Title
 AGREEMENT NO. 46/2020 (CE)
 TERM CONSULTANCY FOR SITE FORMATION AND INFRASTRUCTURE WORKS FOR PROPOSED HOUSING DEVELOPMENT IN ZONE 1 (2021-2024) - FEASIBILITY STUDY (TASK ORDER 4 - SHAP PAT HEUNG ROAD)

PROPOSED SEWERAGE SYSTEM

Scale	Designed	Drawn	Checked	Authorised
1:1000	WL	CAD	KL	DL
Original Size	Date	Date	Date	Date
A1	DEC 2021	DEC 2021	DEC 2021	DEC 2021
Drawing Number	Revision			
5210095-ATK-SIA-1021				C

Appendix A

Sewerage Impact Assessment

Project: Agreement No. CE 46/2020(CE)
**Term Consultancy for Site Formation and Infrastructure Works
for Proposed Housing Developments in Zone 1 (2021 - 2024)
Feasibility Study (Task Order 4)**

Estimation of flow from development

Appendix A-1

1. Calculation of daily sewage flow for Domestic Flows

Cousumer Type	Development Type	Residents (person) ^[1]	Unit Flow Factor (m ³ /person/day) ^[2]	Daily Flow (m ³ /day)	Total Daily Flow (m ³ /day)
Residential	Public Housing Development	2703	0.27	729.73	729.73

Remarks

- 1) 10% variation for design flexibility is allowed in the population for technical assessment. The actual nos. of population will be subject to confirmation by the user department at later stage.
- 2) Unit flow factors for Domestic Flows are extracted from Table T-1 of GESF.

2. Calculation of daily sewage flow of Commerical Flows

Cousumer Type	Development Type	NOFA (m ²) ^[1]	Employee/ Residents	Unit Flow Factor (m ³ /person/day) ^{[2][3]}	Daily Flow (m ³ /day)	Total Daily Flow (m ³ /day)
Welfare Facilities(HCS)	Community, Social & Personal Services (J11)	256.9	60	0.28	16.8	40.64
96-place Welfare Facilities(RCCC)	Community, Social & Personal Services (J11)	814.5	20	0.28	5.6	
			96	0.19	18.24	

Remarks

- 1) Net. Operational Floor Area advised by SWD
- 2) Unit flow factors for Domestic Flows are extracted from Table T-1 and Table T-2 of GESF
- 3) The Unit Flow Factor for emplyee of RCCC is taken as 0.19 assuming Institutional & Special Class
- 4) The population of employee and residents are estimated according to the latest SoAs

3. Calculation of total sewage flow rate of the Development

Source	Population (persons)	Contributing population	Daily Flow (m ³ /day)	Total Daily Flow (m ³ /day)	Peaking Factor ^[1]	Peak Flow Rate (L/s)
Domestic	2702.7	2853	729.73	770.37	6	53.50
Commerical	0		40.64			

Remarks

- 1) In accordance with Table T-5 of the GESF, a peaking factor of 6 has been adopted for a population between 1,000 and 5,000.

**Project: Agreement No. CE 46/2020(CE)
Term Consultancy for Site Formation and Infrastructure Works
for Proposed Housing Developments in Zone 1 (2021 - 2024)
Feasibility Study (Task Order 4)**

Checking the capacity of the existing sewerage system

- a) Hydraulic calculation are conducted in accordance with the Sewerage Manual Part 1.
- b) velocity (v) = $-2(2gDs)^{1/2} \log [Ks/3.7D + 2.51v/D(2gDs)^{1/2}]$
- c) As advised by Table 8(a) of Sewerage Manual, vitrified clay is used in small to medium size sewers and concrete is widely used in gravity sewers with diameter between 600mm and 2100mm.
- d) From Table 5 of Sewerage Manual, ks for clay sewers slimed to about half depth; velocity, when flowing half full, approximately 1.2m/s = 0.6 (poor)
 ks for concrete, spun or vertically cast, sewers slimed to about half depth; velocity, when flowing half full, approximately 1.2m/s = 3 (poor)
 ks for polyethylene sewers slimed to about half depth; velocity, when flowing half full, approximately 1.2m/s = 0.3 (poor)
 ks for concrete, spun or vertically cast, sewers slimed to about half depth; velocity, when flowing half full, approximately 0.75m/s = 6 (poor)
 ks for clay sewers slimed to about half depth; velocity, when flowing half full, approximately 0.75m/s = 3 (poor)
- e) Kinematic Viscosity, $\nu = 1.003E-06 \text{ m}^2/\text{sec} @ 20^\circ\text{C}$
- f) Catchment Inflow Factor for Yuen Long = 1.00 is taken account in the design calculation for the existing sewerage network
- g) 10% reduction in flow area of pipe due to sediment is taken account in the design calculation
- h) The gradient and area of flow for the existing sewers were derived from the DSD's Drainage Record Plan.

Sewer Hydraulics														Design Flow Checking																							
Pipe details														Before Redevelopment (Baseline)							After Redevelopment																
Manhole ID		Nominal Diameter	Pipe Material	Ks	US Ground Level	DS Ground Level	US Invert Level	DS Invert Level	Pipe Length	Gradient	Area of Flow	Velocity of Flow	Pipe Capacity	ADWF				Peaking factor	PWDF	Estimated Baseline Flow	Spare Capacity - Baseline	Spare Capacity - Baseline	Capacity Check	ADWF				Peaking factor	PWDF	Projected Flow of Pipe Section	Spare Capacity - Projected Flow	Spare Capacity - Projected Flow	Utilization % of capacity	Capacity Check			
From	To	(mm)		(mm)	(mPD)	(mPD)	(mPD)	(mPD)	(m)	(m/m)	(1-in)	(m ²)	(m/sec)	(m ³ /sec)	(m3/d)	Contributing ppl	Pcif	Q ave (m3/d)		(m3/s)	(m ³ /sec)	(m ³ /sec)	(%)		(m3/d)	Contributing ppl	Pcif	Q ave (m3/d)		(m3/s)	(m ³ /sec)	(m ³ /sec)	(%)	(%)			
FTMH02	FMH1043421	375	HDPE	0.3	6.50	6.85	-0.30	-0.40	10.0	0.0100	100	0.110	1.963	0.195	N/A												770.37	2853	1.00	770.4	6	0.053	0.053	0.142	72.6%	27.4%	OK
FMH1043421	FMH1036013	450	Concrete	3	6.85	6.85	-0.50	-0.58	2.5	0.0320	31	0.159	2.915	0.417	486.0	1800	1.00	486.0	6	0.034	0.034	0.383	91.9%	OK	1256.4	4653	1.00	1256.4	6	0.087	0.087	0.330	79.1%	20.9%	OK		
FMH1036013	FMH1036014	600	Concrete	3	6.85	6.88	-0.58	-0.64	37.0	0.0016	617	0.283	0.790	0.201	486.0	1800	1.00	486.0	6	0.034	0.034	0.167	83.2%	OK	1256.4	4653	1.00	1256.4	6	0.087	0.087	0.114	56.6%	43.4%	OK		
FMH1036014	FMH1036015	600	Concrete	3	6.88	6.60	-0.65	-0.71	52.4	0.0011	873	0.283	0.664	0.169	486.0	1800	1.00	486.0	6	0.034	0.034	0.135	80.0%	OK	1256.4	4653	1.00	1256.4	6	0.087	0.087	0.082	48.3%	51.7%	OK		
FTMH01	FMH1036015	375	HDPE	0.3	6.50	6.60	-0.20	-0.35	15.0	0.0100	100	0.110	1.963	0.195	N/A												770.37	2853	1.00	770.4	6	0.053	0.053	0.142	72.6%	27.4%	OK
FMH1036015	FMH1063016	600	Concrete	3	6.60	6.39	-0.72	-0.79	32.1	0.0022	459	0.283	0.917	0.233	1407.8	5214	1.00	1407.8	5	0.081	0.081	0.152	65.1%	OK	2178.2	8067	1.00	2178.2	5	0.126	0.126	0.107	46.0%	54.0%	OK		
FMH1063016	FMH1035981	600	Concrete	3	6.39	6.51	-0.80	-0.88	38.2	0.0021	477	0.283	0.899	0.229	1407.8	5214	1.00	1407.8	5	0.081	0.081	0.147	64.4%	OK	2178.2	8067	1.00	2178.2	5	0.126	0.126	0.103	44.9%	55.1%	OK		
FMH1035981	FMH1035972	600	Concrete	3	6.51	6.62	-0.89	-0.99	48.8	0.0021	488	0.283	0.889	0.226	1407.8	5214	1.00	1407.8	5	0.081	0.081	0.145	64.0%	OK	2178.2	8067	1.00	2178.19	5	0.126	0.126	0.100	44.3%	55.7%	OK		
FMH1035972	MTSPS	750	Concrete	3	6.62	6.62	-1.14	-1.17	44.5	0.0007	1483	0.442	0.588	0.234	2488.2	9215	1.00	2488.2	5	0.144	0.144	0.090	38.4%	OK	3258.5	12069	1.00	3258.54	4	0.151	0.151	0.083	35.5%	64.5%	OK		

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	Subject: Appendix A-3 - 2019-based TPEDM Sewage Flow Projection for Year 2019 (To MTSPS)																Caleb Chan	Calvin Chow	K.C. Lau	28-03-23

Employment by Industry (S-type)																					
Planning Data Zone	Population	School Place	Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Electricity and gas supply, water supply, sewerage and waste management	Construction	Import and export trade	Wholesale	Retail trade	Transportation, storage, postal and courier services	Short term accommodation activities	Food and beverage service activities	Information and communications	Financial and insurance activities	Real estate activities	Professional, scientific/ technical, administrative and support service activities	Public administration	Education	Human health activities	Other social and personal services	Work activities within domestic households
179	15 000	2 900	*	*	*	350	100	50	100	100	*	50	*	50	150	200	*	250	*	100	900
180	20 550	*	*	100	*	500	200	50	50	150	*	*	*	50	100	700	*	50	*	150	1 100

Planing Data Zone	Total Area
179	530143
180	819286

Planing Data Zone	No.	Location	Approx. Site Area(m ²)	%
179	179_1	V	77881.7	15%
	179_2	R(A)1	33625.0	6%
	179_3	R(A)1	5759.3	1%
	179_4	R(B)	10690.7	2%
	179_5	R(B)	56026.1	11%
	179_6	G/I/C	19724.4	4%
	179_7	V	2447.1	0.5%
	179_8	G/I/C	17214.1	3%
	179_9	G/I/C	15983.4	3%
	179_10	R(A)1	15346.1	3%
180	180_1	V	12570.4	2%
	180_2	V	59980.4	7%



Employment by Industry (S-type)																						Daily Flow (m3/day)	Existing manhole to be discharged	Cumulative sewage	
Planning Data Zone	Population	School Place	Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Electricity and gas supply, water supply, sewerage and waste management	Construction	Import and export trade	Wholesale	Retail trade	Transportation, storage, postal and courier services	Short term accommodation activities	Food and beverage service activities	Information and communications	Financial and insurance activities	Real estate activities	Professional, scientific/ technical, administrative and support service activities	Public administration	Education	Human health activities	Other social and personal services	Work activities within domestic households				
179_1	2199.35	425.21	*	*	*	51.32	14.66	7.33	14.66	14.66	*	7.33	*	7.33	21.99	29.32	*	36.66	*	14.66	131.96	612.22	FMH1036015	1362.55	
179_2	949.56	183.58	*	*	*	22.16	6.33	3.17	6.33	6.33	*	3.17	*	3.17	9.50	12.66	*	15.83	*	6.33	56.97	264.32	FMH1036015		
179_3	162.64	31.44	*	*	*	3.79	1.08	0.54	1.08	1.08	*	0.54	*	0.54	1.63	2.17	*	2.71	*	1.08	9.76	45.27	FMH1036016	1407.82	
179_4	301.90	58.37	*	*	*	7.04	2.01	1.01	2.01	2.01	*	1.01	*	1.01	3.02	4.03	*	5.03	*	2.01	18.11	84.04	FMH1035972	2488.17	
179_5	1582.15	305.88	*	*	*	36.92	10.55	5.27	10.55	10.55	*	5.27	*	5.27	15.82	21.10	*	26.37	*	10.55	94.93	440.42	FMH1035972		
179_6	557.01	107.69	*	*	*	13.00	3.71	1.86	3.71	3.71	*	1.86	*	1.86	5.57	7.43	*	9.28	*	3.71	33.42	155.05	FMH1035972		
179_7	69.11	13.36	*	*	*	1.61	0.46	0.23	0.46	0.46	*	0.23	*	0.23	0.69	0.92	*	1.15	*	0.46	4.15	19.24	FMH1035972		
179_8	486.12	93.98	*	*	*	11.34	3.24	1.62	3.24	3.24	*	1.62	*	1.62	4.86	6.48	*	8.10	*	3.24	29.17	135.32	FMH1035972		
179_9	451.36	87.26	*	*	*	10.53	3.01	1.50	3.01	3.01	*	1.50	*	1.50	4.51	6.02	*	7.52	*	3.01	27.08	125.64	FMH1035972		
179_10	433.37	83.78	*	*	*	10.11	2.89	1.44	2.89	2.89	*	1.44	*	1.44	4.33	5.78	*	7.22	*	2.89	26.00	120.64	FMH1035972		
180_1	311.65	*	*	1.52	*	7.58	3.03	0.76	0.76	2.27	*	*	*	0.76	1.52	10.62	*	0.76	*	2.27	16.68	84.21	FMH1036013	486.00	
180_2	1487.05	*	*	7.24	*	36.18	14.47	3.62	3.62	10.85	*	*	*	3.62	7.24	50.65	*	3.62	*	10.85	79.60	401.79	FMH1036013		
Total	8991.26	1390.56	0.00	8.75	0.00	211.59	65.46	28.35	52.33	61.08	0.00	23.98	0.00	28.35	80.68	157.17	0.00	124.25	0.00	61.08	527.83				
Unit Demand (m3/day)	0.23	0.04	0.08	2.08	0.33	0.23	0.08	0.28	0.28	0.18	1.58	1.58	0.18	0.08	0.08	0.08	0.08	0.28	0.28	0.28	0.28	0.28			
Mean Daily Demand (m3/day)	2067.99	55.62	0.00	18.21	0.00	48.67	5.24	7.94	14.65	10.99	0.00	37.88	0.00	2.27	6.45	12.57	0.00	34.79	0.00	17.10	147.79				
Total Mean Daily Demand excluding the proposed development (m3/day)																						2488.169278			
Total Mean Daily Demand																						3258.54			
MT SPS Capacity (m3/day)																						7344			

- Remark:
- i) The exiting population extracted from 2019 based TPEDM - Table 1
 - ii) Zone No. And corresponding Land use Zoning refer to zoning plan in TPEDM 2019
 - iii) The population of the area is estimated by area ration by the Approx. Site Area and the total area of the Planing Data Zone
 - iv) Assume all villages are Modern type

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	Subject: Appendix A-3 - 2019-based TPEDM Sewage Flow Projection for Year 2031 (To MTSPS)																Caleb Chan	Calvin Chow	K.C. Lau	28-03-23

Employment by Industry (S-type)																					
Planning Data Zone	Population	School Place	Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Electricity and gas supply, water, sewerage and waste management	Construction	Import and export trade	Wholesale	Retail trade	Transportation, storage, postal and courier services	Short term accommodation activities	Food and beverage service activities	Information and communications	Financial and insurance activities	Real estate activities	Professional, scientific/ technical, administrative and support service activities	Public administration	Education	Human health activities	Other social and personal services	Work activities within domestic households
S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S18	S19	
179	11 600	4 850	*	*	*	200	100	50	100	100	*	100	*	100	150	200	*	350	*	100	1 000
180	18 850	*	*	100	*	500	200	50	150	100	*	*	50	100	100	700	*	50	*	150	1 250

Planing Data Zone	Total Area
179	530143
180	819286

Planing Data Zone	No.	Location	Approx. Site Area(m ²)	%
179	179_1	V	77881.7	15%
	179_2	R(A)1	33625.0	6%
	179_3	R(A)1	5759.3	1%
	179_4	R(B)	10690.7	2%
	179_5	R(B)	56026.1	11%
	179_6	G/IC	19724.4	4%
	179_7	V	2447.1	0.5%
	179_8	G/IC	17214.1	3%
	179_9	G/IC	15983.4	3%
	179_10	R(A)1	15346.1	3%
180	180_1	V	12570.4	2%
	180_2	V	59980.4	7%



Employment by Industry (S-type)																						Daily Flow (m ³ /day)	Existing manhole to be discharged	Cumulative sewage
Planning Data Zone	Population	School Place	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19			
179_1	1700.83	711.12	*	*	*	29.32	14.66	7.33	14.66	14.66	*	14.66	*	14.66	21.99	29.32	*	51.32	*	14.66	146.62	524.32	FMH1036015	1208.16
179_2	734.32	307.02	*	*	*	12.66	6.33	3.17	6.33	6.33	*	6.33	*	6.33	9.50	12.66	*	22.16	*	6.33	63.30	226.37	FMH1036015	
179_3	125.78	52.59	*	*	*	2.17	1.08	0.54	1.08	1.08	*	1.08	*	1.08	1.63	2.17	*	3.79	*	1.08	10.84	38.77	FMH1036016	
179_4	233.47	97.61	*	*	*	4.03	2.01	1.01	2.01	2.01	*	2.01	*	2.01	3.02	4.03	*	7.04	*	2.01	20.13	71.97	FMH1035972	
179_5	1223.53	511.56	*	*	*	21.10	10.55	5.27	10.55	10.55	*	10.55	*	10.55	15.82	21.10	*	36.92	*	10.55	105.48	377.19	FMH1035972	
179_6	430.75	180.10	*	*	*	7.43	3.71	1.86	3.71	3.71	*	3.71	*	3.71	5.57	7.43	*	13.00	*	3.71	37.13	132.79	FMH1035972	
179_7	53.44	22.34	*	*	*	0.92	0.46	0.23	0.46	0.46	*	0.46	*	0.46	0.69	0.92	*	1.61	*	0.46	4.61	16.47	FMH1035972	
179_8	375.93	157.18	*	*	*	6.48	3.24	1.62	3.24	3.24	*	3.24	*	3.24	4.86	6.48	*	11.34	*	3.24	32.41	115.89	FMH1035972	
179_9	349.06	145.94	*	*	*	6.02	3.01	1.50	3.01	3.01	*	3.01	*	3.01	4.51	6.02	*	10.53	*	3.01	30.09	107.61	FMH1035972	
179_10	335.14	140.12	*	*	*	5.78	2.89	1.44	2.89	2.89	*	2.89	*	2.89	4.33	5.78	*	10.11	*	2.89	28.89	103.31	FMH1035972	
180_1	285.87	*	*	1.52	*	7.58	3.03	0.76	2.27	1.52	*	*	*	1.52	1.52	10.62	*	0.76	*	2.27	18.96	79.26	FMH1036013	457.47
180_2	1364.03	*	*	7.24	*	36.18	14.47	3.62	10.85	7.24	*	*	*	7.24	7.24	50.65	*	3.62	*	10.85	90.45	378.20	FMH1036013	
Total	7212.15	2325.60	0.00	8.75	0.00	139.66	65.46	28.35	61.08	56.70	0.00	47.95	0.00	56.70	80.68	157.17	0.00	172.20	0.00	61.08	588.91			
Unit Demand (m ³ /day)	0.23	0.04	0.08	2.08	0.33	0.23	0.08	0.28	0.28	0.18	1.58	1.58	0.18	0.08	0.08	0.08	0.08	0.28	0.28	0.28	0.28			
Mean Daily Demand (m ³ /day)	1658.80	93.02	0.00	18.21	0.00	32.12	5.24	7.94	17.10	10.21	0.00	75.76	0.00	4.54	6.45	12.57	0.00	48.22	0.00	17.10	164.90			
Total Mean Daily Demand excluding the proposed development(m ³ /day)																						2172.172341		
Total Mean Daily Demand including the proposed development(m ³ /day)																						2942.54		
MT SPS Capacity (m ³ /day)																						7344		

Remark:

- i) The exiting population extracted from 2019 Based TPEDM for Design Year 2031 - Table 1
- ii) Zone No . And corresponding Land use Zoning refer to zoning plan in TPEDM 2019
- ii) The population of the area is estimated by area ration by the Approx. Site Area and the total area of the Planing Data Zone
- iv) Assume all villages are Modern type

Subject: Appendix A-4 - 2019-based TPEDM Sewage Flow Projection for Year 2019 (To PSSSPS) (with Proportional Factor)																					
Employment by Industry (S-type)																					
Planning Data Zone	Population	School Place	Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Electricity and gas supply, water supply, sewerage and waste management	Construction	Import and export trade	Wholesale	Retail trade	Transportation, storage, postal and courier services	Short term accommodation activities	Food and beverage service activities	Information and communications	Financial and insurance activities	Real estate activities	Professional, scientific/ technical, administrative and support service activities	Public administration	Education	Human health activities	Other social and personal services	Work activities within domestic households
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
173	*	*	*	7	7	13	20	33	7	20	*	*	*	*	7	33	*	*	*	13	33
177	13 712	3 102	17	17	17	297	50	33	462	132	*	446	17	66	99	132	50	347	50	363	281
178	14 132	1 641	80	681	*	761	1 521	360	2 122	801	*	921	80	400	400	1 081	520	681	240	1 121	440
179	6 016	2 900	*	*	*	140	40	20	40	40	*	20	*	20	60	80	*	100	*	40	361
180	9 756	*	*	47	*	237	95	24	24	71	*	*	*	24	47	332	*	24	*	71	522
314	9 300	6 150	50	*	150	200	100	50	400	150	*	600	*	50	200	250	600	900	50	500	350
315	27 850	6 700	300	100	*	750	500	250	4 000	900	*	3 200	50	800	900	1 100	300	1 300	450	1 650	950
317	*	1 300	50	100	50	100	100	50	100	50	50	50	*	50	50	200	*	150	1 950	200	300
368	282	*	35	18	*	22	18	4	9	13	*	*	*	4	4	13	*	4	*	4	26
372	5 717	*	*	9	*	90	27	9	224	99	*	206	9	18	126	108	*	63	*	54	368
Total	86 765	21 793	532	978	223	2 611	2 470	834	7 388	2 276	50	5 443	156	1 432	1 894	3 330	1 470	3 568	2 740	4 017	3 632
Unit Demand (m3/day) ⁽⁴⁾	0.23	0.04	0.08	2.08	0.33	0.23	0.08	0.28	0.28	0.18	1.58	1.58	0.18	0.08	0.08	0.08	0.08	0.28	0.28	0.28	0.28
Mean Daily Demand (m3/day)	19955.87	871.74	42.55	2033.93	73.65	600.43	197.64	233.50	2068.52	409.68	79.00	8599.59	28.00	114.60	151.50	266.39	117.60	999.13	767.12	1124.74	1016.93
Total Mean Daily Demand (m3/day)												39752.11									
Development Flow												770.37									
Total population from PDZ 232 and 317												976.86									
of the PSS SPS (After Develop)												41499.34									

Subject: Appendix A-4 - 2019-based TPEDM Sewage Flow Projection for Year 2026 (To PSSSPS) (with Proportional Factor)																					
Employment by Industry (S-type)																					
Planning Data Zone	Population	School Place	Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Electricity and gas supply, water supply, sewerage and waste management	Construction	Import and export trade	Wholesale	Retail trade	Transportation, storage, postal and courier services	Short term accommodation activities	Food and beverage service activities	Information and communications	Financial and insurance activities	Real estate activities	Professional, scientific/ technical, administrative and support service activities	Public administration	Education	Human health activities	Other social and personal services	Work activities within domestic households
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
173	1 338	*	*	7	*	321	20	27	13	20	*	*	*	*	7	33	*	13	*	27	74
177	13 728	3 119	17	17	17	198	99	33	462	116	*	446	33	165	99	231	33	330	66	347	297
178	13 932	1 641	40	480	*	841	1 401	320	1 842	721	*	921	200	761	480	1 481	520	961	480	1 321	480
179	6 075	4 850	*	*	*	80	40	20	40	40	*	40	*	40	60	80	*	140	*	40	401
180	9 495	*	*	47	*	237	95	24	24	71	*	*	*	24	47	332	*	24	*	71	593
314	8 100	6 150	*	50	150	250	150	50	450	150	*	600	50	250	200	350	550	800	50	500	350
315	24 650	6 700	100	100	*	1 000	650	250	3 500	750	*	3 100	150	1 250	900	1 500	300	1 300	550	1 650	900
317	*	1 300	50	50	50	550	100	50	100	50	*	100	*	50	100	250	*	150	2 000	200	450
368	269	66	13	97	*	383	150	4	176	304	*	*	40	18	66	22	*	13	4	13	26
372	6 310	*	*	*	*	36	36	9	180	81	27	206	9	27	117	108	*	81	9	54	467
Total	83 496	23 826	220	848	217	3 897	2 741	737	6 834	2 279	27	5 413	506	2 608	2 077	4 388	1 403	3 812	3 160	4 223	4 039
Unit Demand (m3/day) ⁽⁴⁾	0.23	0.04	0.08	2.08	0.33	0.23	0.08	0.28	0.28	0.18	1.58	1.58	0.18	0.08	0.08	0.08	0.08	0.28	0.28	0.28	0.28
Mean Daily Demand (m3/day)	19204.04	953.04	17.58	1763.88	71.45	896.22	219.28	206.42	1913.54	410.15	42.54	8552.28	91.00	208.62	166.12	351.04	112.28	1067.45	884.74	1182.38	1130.81
Total Mean Daily Demand (m3/day)												39444.86									
Development Flow												770.37									
Total population from PDZ 232 and 317												976.86									
of the PSS SPS (After Develop)												41192.09									

Subject: Appendix A-4 - 2019-based TPEDM Sewage Flow Projection for Year 2031 (To PSSSPS) (with Proportional Factor)																					
Employment by Industry (S-type)																					
Planning Data Zone	Population	School Place	Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Electricity and gas supply, water supply, sewerage and waste management	Construction	Import and export trade	Wholesale	Retail trade	Transportation, storage, postal and courier services	Short term accommodation activities	Food and beverage service activities	Information and communications	Financial and insurance activities	Real estate activities	Professional, scientific/ technical, administrative and support service activities	Public administration	Education	Human health activities	Other social and personal services	Work activities within domestic households
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19
173	4 207	*	*	7	*	321	20	27	13	20	*	*	*	*	7	33	*	13	*	27	74
177	12 788	3 119	17	17	17	198	99	33	462	116	*	446	33	165	99	231	33	330	66	347	297
178	11 890	822	40	480	*	841	1 401	320	1 842	721	*	921	200	761	480	1 481	520	961	480	1 321	480
179	4 652	4 850	*	*	*	80	40	20	40	40	*	40	*	40	60	80	*	140	*	40	401
180	8 949	*	*	47	*	237	95	24	24	71	*	*	*	24	47	332	*	24	*	71	593
314	6 700	6 150	*	50	150	250	150	50	450	150	*	600	50	250	200	350	550	800	50	500	350
315	20 800	6 700	100	100	*	1 000	650	250	3 500	750	*	3 100	150	1 250	900	1 500	300	1 300	550	1 650	900
317	*	1 300	50	50	50	550	100	50	100	50	*	100	*	50	100	250	*	150	2 000	200	450
368	194	*	13	97	*	383	150	4	176	304	*	*	40	18	66	22	*	13	4	13	26
372	5 215	*	*	*	*	36	36	9	180	81	27	206	9	27	117	108	*	81	9	54	467
Total	75 394	22 941	220	848	217	3 897	2 741	737	6 834	2 279	27	5 413	506	2 608	2 077	4 388	1 403	3 812	3 160	4 223	4 039
Unit Demand (m3/day) ⁽⁴⁾	0.23	0.04	0.08	2.08	0.33	0.23	0.08	0.28	0.28	0.18	1.58	1.58	0.18	0.08	0.08	0.08	0.08	0.28	0.28	0.28	0.28
Mean Daily Demand (m3/day)	17340.70	917.63	17.58	1763.88	71.45	896.22	219.28	206.42	1913.54	410.15	42.54	8552.28	91.00	208.62	166.12	351.04	112.28	1067.45	884.74	1182.38	1130.81
Total Mean Daily Demand (m3/day)												37546.11									
Development Flow												770.37									
Total population from PDZ 232 and 317												976.86									
of the PSS SPS (After Develop)												39293.34									

Note:
1. The values are extracted from the latest TPEDM-2019.
2. Unit flow factors for Domestic Flows are extracted from Table T-2 of GESF.
3. Not all the flow from Planning Data Zone 173, 177, 178, 179, 180, 314, 368 and 372 are conveyed to PSS SPS. Therefore, a factor under Table 1 has been applied to each zone respectively.
4. Catchment specific unit flow factor for Domestic Flows extracted from Table T-2 of GESF is adopted