Appendix 5

土木工程拓展署
Civil Engineering and Development Department

ATKINS
Member of the SNC-Lavalin Group

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 Water Supply Impact Assessment for Shap Pat Heung Road (Rev.3)

(5210095-OR003-04)

March 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) for high density housing development.

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 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, PTI/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; and

(i) 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 In accordance with Clause 6.8 of the Brief, the Preliminary Water Supply Impact Assessment (hereinafter called “the Report”) shall be conducted to:

a) Assess the water demands for the Development and Infrastructure Works;

b) Ascertain the adequacy of waterworks facilities to support each of the Developments including fresh and flushing water supply, fire hydrants, irrigation water, etc. without affecting existing water users;

c) Take cognisance of the existing and proposed studies and projects which may have a bearing on the Preliminary WSIA;

d) Ascertain there will be no adverse impact on the yield of water in the water gathering ground due to the Development and Infrastructure Works, and propose measures to avoid/minimize the loss of yield if any;

e) Assess any existing waterworks installations which would be affected by the works of the Development and Infrastructure Works and propose recommendations, and advise feasibility of improvement/ modification/ diversion works/ layout where necessary;

f) Assess the short-term and long-term impacts on the existing and planned water supply systems arising from each of the Developments;

g) Identify need of any mitigation and protective measures such as diversion, reprovisioning and modification of waterworks facilities to cope with each of the Developments;

h) Study possible schemes to divert existing watermains and waterworks reserves, if any, away from the housing sites of each of the Developments;

i) Protect existing waterworks facilities and keep minimum disturbance to their normal operation during construction and in operation stage of each of the Developments; and

j) Enable an agreement in principle to be reached between the Water Supplies Department (WSD) and the CEDD in respect of waterworks improvement works, mitigation and protection schemes, diversion schemes, reprovisioning works and/or modifications of waterworks facilities for incorporation in design and during construction of each of the Developments. The final Preliminary WSIA Report will then serve as guidelines for making detailed proposals by the DR and contractors in the design and the construction stages.

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 unit demand and assessment approach;
- Section 3 discusses the information of the existing and planned water supply infrastructures;
- Section 4 quantifies the water demand of the development;
- Section 5 examines the impact arising from the new water demands from the proposed development on the existing/planned supply source;
- Section 6 summarizes the assessment results and proposed works.

1.6 Abbreviations

1.6.1 The following abbreviations are used in this Report:

CEDD	Civil Engineering and Development Department
DEVB	Development Bureau
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 Parameters

2.1.1 This report is prepared in accordance with WSD's DI No. 1309 and Manual of Mainlaying Practice 2012. The design parameters and peak demand factors have been adopted for the design of proposed water supply systems of the development as described below.

Water Supply Unit Demand

2.1.2 The following fresh and flushing water unit demands are adopted in estimating the water demand of the development.

Table 2.1 Fresh and Flushing Water Unit Demand

Development Type	Unit	Fresh Water		Flushing Water
		Fresh Water	Service Trade	
Domestic				
Public Housing Development	l/h/d	230*	40	70
Private R1	l/h/d	230	40	70
Non-domestic				
Home Care Service (HCS)	l/h/d	210**	--	70
Residential Child Care Centre (RCCC)	l/h/d	210	--	70
Irrigation				
Irrigation	l/m^2/d	7	--	--

Remark:

* Fresh water unit demand 230 l/h/d is adopted for public housing development in accordance with WSD DI No.1309 for conservative assessment.

** It is conservatively assumed that total fresh water and flushing water unit demand to be same as sewage generation (280 l/h/d) under commercial activities J11 based on Table T-2 of Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning. Flushing water has a unit demand of 70 l/h/d with reference to WSD DI No. 1309. Fresh water unit demand is therefore estimated to be 210 l/h/d (280-70 l/h/d).

Service Reservoir Capacity

2.1.3 The service reservoir capacities required as a minimum percentage of the mean daily demands are as follows:

- Fresh Water System – 75% of mean daily demand for secondary storage, additional 5% of mean daily demand is required if critical consumers;
- Flushing Water System (Salt Water) – 25% of mean daily demand;
- Flushing Water System (Reclaimed Water) – 64% of mean daily demand.

Distribution Main Capacity

2.1.4 The capacity of the distribution main should be sufficient for the following peak demands.

- Fresh Water System – 3 times mean daily demand;
- Flushing Water System – 2 times mean daily demand.

Residual Head

2.1.5 Minimum residual heads at extremity of system:

- Fresh Water System – 30m for existing developments; 20m for new developments;
- Flushing Water System – 15m.

Fire Fighting

2.1.6 The fire fighting requirement for the residential zone is 6,000m^3/d with the required discharge pressure of 17m head. Adequacy for fire fighting is also checked for the distribution main under peak demand condition.

2.1.7 For future detailed design purpose, spacing between fire hydrants on the public roads should be 100m and staggered along alternative sides of the roads.

3. Existing and Planned Water Supply System

3.1 Existing and Planned Fresh Water Supply Systems

3.1.1 The proposed housing site at Shap Pat Heung Road falls within the existing supply zone of Au Tau Fresh Water Primary Service Reservoir (FWPSR) and Ngau Tam Mei Fresh Water Primary Service Reservoir (FWPSR). The demarcation of the water supply zone refers to Figure no. **5120095-ATK-WSIA-1001**.

3.1.2 Au Tau FWPSR has a design capacity of 102,000m^3 with Top Water Level (TWL) of +96mPD and Invert Level (IL) of +87.22mPD. It is noted that the maximum daily outflow rate from Au Tau Water Treatment Works (WTW) feeding the Au Tau FWPSR was approximately 80.64MLD in the period between January 2021 to December 2021.

3.1.3 The existing Ngau Tam Mei FWPSR has a design capacity of 40,000m^3 with Top Water Level (TWL) of +100mPD approximately and Invert Level (IL) of +94mPD. It is noted that the maximum daily outflow rate from Ngau Tam Mei Water Treatment Works (WTW) feeding the Ngau Tam Mei FWPSR was approximately 192.1MLD in the period between January 2021 to December 2021. Meanwhile, the maximum reliable output of Ngau Tam Mei WTW is 230MLD.

3.1.4 As advised by WSD, Investigation, Design and Construction (IDC) Contract for extension of Ngau Tam Mei FWPSR for a capacity of 38,000m^3 under Agreement no. CE78/2020(WS) is in progress. Ngau Tam Mei WTW would also be upgraded to a target output of 440MLD ultimately under the same agreement. Both measures can help to increase the fresh water supply capacity according to the latest water demand of planned developments and potential developments within the water supply zone.

3.1.5 There is no existing watermain within the development site area but there is an existing 450mm dia. ductile iron pipe located at the footpath outside Ma Tin Tsuen along Shap Pat Heung Road and it is branched into an existing 300mm dia. ductile iron pipe crossing the Shap Pat Heung Road to the footpath outside the proposed housing site. This existing 450mm dia. watermain is feed by Au Tau Water Treatment Works and Au Tau FWPSR.

3.1.6 The existing fresh water system is shown in Figure no. **5120095-ATK-WSIA-1011**.

3.2 Existing and Planned Flushing Water Supply Systems

3.2.1 The proposed housing site at Shap Pat Heung Road currently falls within the existing supply zone of Tan Kwai Tsuen Salt Water Service Reservoir (SWSR) and Lok On Pai Salt Water Pumping Station (SWPS). The demarcation of the salt water supply zone is shown in Figure no. **5120095-ATK-WSIA-1021**.

3.2.2 The existing Tan Kwai Tsuen SWSR has a designed capacity of 18,100m^3 with the Top Water Level of 67.5mPD and Invert level of 60mPD.

3.2.3 For the Lok On Pai SWPS, the maximum output is 103MLD at 82m head. The maximum daily output was found 98.41MLD which is around 96% of the maximum output.

3.2.4 WSD advised that the proposed housing site at Shap Pat Heung Road shall fall within the reclaimed water supply zone of Proposed Wang Chau Reclaimed Water Service Reservoir (WCRWSR) from the Year of 2031. And the WCRWSR shall connect to the existing flushing water network. The demarcation of the reclaimed water supply zone is shown in Figure no. **5210095-ATK-WSIA-1033**.

3.2.5 As the proposed Wang Chau RWSR invert level and top water level is under review, WSD advised to adopt the existing Wang Chau Service Reservoir Top water level of 67mPD and Invert level of 60.83mPD to estimate the residual head under this assessment. WSD advised that the tentative design capacity of the proposed WCRWSR is 40,000 m^3 .

3.2.6 There is an existing 300mm dia. ductile iron pipe located at the footpath outside Ma Tin Tsuen along Shap Pat Heung Road.

3.2.7 The existing salt water supply system is shown in Figure no. **5120095-ATK-WSIA-1031**.

4. Water Demand and Supply to the Development

4.1 Proposed Public Housing Development

4.1.1 The development parameters of the proposed public housing site at Shap Pat Heung Road is given in **Table 4.1:**

Table 4.1 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 Nos. 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 Fresh Water and Flushing Water Demand Assessment

4.2.1 The fresh water and flushing water demand for the proposed development are estimated based on the residential population and land use. The breakdown of the demand projection is presented in **Appendix A** and **Appendix B** and summarized in below table.

Table 4.2 Summary of the Water Demands for Proposed Development

Development Type	Population(ppl)/ Landscape Area (m3)	Fresh Water (l/h/d)		Total Fresh Water Demand (MLD)	Flushing Water (l/h/d)	Total Flushing Water Demand (MLD)
		Fresh Water	Service Trade			
Domestic						
Public Housing Development[4] / Residential – R1	2,703[1]	230	40	0.7297	70	0.1892
Non-domestic						
Home Care Service(HCS)	60[3]	210	--	0.0126	70	0.0042
Residential Child Care Centre(RCCC)	116[3]	210	--	0.0244	70	0.0081
Irrigation						
Irrigation	1,420[2]	7	--	0.0099	--	--
			Total (MLD)	**0.777**	**Total (MLD)**	**0.202**

Remark:

(1) 10% variation on top of 910 flats / 2,457 person 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) 20% of the proposed housing site is assumed to be greenery coverage.

(3) 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.

(4) 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.

4.2.2 The estimated total Mean Daily Demand (MDD) of fresh water for the Development at Shap Pat Heung Road would be approximately 0.777MLD (i.e. 777 m^3/day). The estimated total Mean Daily Demand (MDD) of flushing water for the Development at Shap Pat Heung Road would be approximately 0.202MLD (i.e. 202m^3/day).

4.3 Proposed Works of Fresh Water and Flushing Water Supply

Fresh Water Supply

4.3.1 The estimated mean daily fresh water demand of the housing site at Shap Pat Heung Road is 777m^3/day and the peak flow for the fresh water distribution main is 2,331m^3/day (i.e. 0.027m^3/s). The flow required the fire-fighting is 6,000m^3/day. DN100 fresh water main is proposed to distribute the fresh water from the existing fresh water supply system at Shap Pat Heung Road to the proposed housing site for domestic uses. The estimated flow velocity of the proposed DN100 fresh water main is 1.12m/s, approximately. And a separated DN150 water main is to supply fresh water to the proposed housing site for fire fighting uses.

4.3.2 Currently, the proposed housing is within the water supply zone of Au Tau FWPSR and Ngau Tam Mei FWPSR. Hence, Au Tau FWPSR and Ngau Tam Mei FWPSR would be adopted to cater for the additional water demand arising from proposed Development at Shap Pat Heung Road.

4.3.3 DN100 fresh water main is proposed to connect to the existing DN450 fresh water main at Shap Pat Heung Road which is fed from Au Tau FWPSR. Based on the preliminary hydraulic calculation, the estimated residual head is +39.97 mPD at the development boundary which is larger than the requirement of 20m.

Flushing Water Supply

4.3.4 The estimated mean daily flushing water demand of the proposed housing site at Shap Pat Heung Road is 202m^3/day and the peak flow for the flushing water distribution main is 408m^3/day (i.e. 0.0047m^3/s). DN50 flushing water main is proposed to distribute the flushing water for the site. The estimated flow velocity of the proposed DN50 flushing water main is 1.15m/s approximately.

4.3.5 DN50 flushing water main is proposed to connect to the existing DN300 flushing water main at Shap Pat Heung Road which is fed by the Wang Chau RWSR from the Year of 2031. Based on the preliminary hydraulic calculation, the residual head at the development boundary would be +16.10 mPD which is larger than the requirement of 15m.

4.3.6 As the tentative population in-take year is 2028/2029 and the tentative completion date for the proposed WC RWSR and its associated watermains is 2031, flushing water to the Site, via the existing DN300 salt water main and the proposed DN50 flushing water main, shall be fed by the Tan Kwai Tsuen SWSR during the years of 2028 to 2031. Based on the preliminary hydraulic calculation, the residual head at the development boundary would be +24.55 mPD which is larger than the requirement of 15m.

5. Water Supply Impact Assessment

5.1 Fresh Water Service Reservoir Capacity

5.1.1 The proposed housing site is under the water supply zone of Au Tau FWPSR and Ngau Tam Mei FWPSR in which Au Tau FWPSR is serving as a balance tank with water sources from Au Tau Water Treatment Work.

5.1.2 Under 2019-based TPEDM and the water supply zone updated on 20 August 2021, the supply zone of ATFWSR and Ngau Tam Mei FWPSR covers the PDZ 173, 174, 177-184, 314-317, 332-334, 341, 362, 365, 368, 372-376, 401, 402, 405, 447-449. For assessment purpose, the said PDZ zones are adopted for the analysis of the water demand projections of Au Tau FWPSR and Ngau Tam Mei FWPSR (existing and planned FWSRs).

5.1.3 The intake year of the proposed housing site would be year 2028/2029 tentatively. Therefore, the mean daily demand projection would be based on year 2031 information as outlined in 2019-based TPEDM and it is summarized in **Table 5.1** below and **Appendix C**.

Table 5.1Projection of Mean Daily Fresh Water Demand Fed by Existing and Planned Au Tau FWPSR and Ngau Tam Mei FWPSR

Year	Mean Daily Demand Projection based on TPEDM (m^3/day)	Mean Daily Demand from Housing Development (m^3/day)	Total Demand for Development & Population Increase (m^3/day)	Required Capacity of FWSR for Population Increase and Development (m^3)	Combine of Au Tau FWPSR and Ngau Tam Mei FWPSR Planned Capacities (m^3)
2031	154,337(1)	777	155,114	116,335.5	142,000(2)

Remark:

(1) Detailed estimation in Appendix C.

(2) The planned extension of FWPSR of NTWFWPSR under CE78/2020 is not included for conservative assessment.

5.1.4 The capacity of the Au Tau FWPSR and Ngau Tam Mei FWPSR is sufficient to cater the additional flow due to the proposed housing development. It is anticipated that no mitigation measures or upgrading works would be necessary.

5.2 Reclaimed Water Service Reservoir Capacity

5.2.1 The proposed housing site is within the supply zone of Wang Chau RWSR from the Year of 2031. Under 2019-based TPEDM, the supply zone covers PDZ 173, 174, 175, 176, 178 179 ,180, 232, 261, 280, 281, 313, 314, 315, 371, 371 and 431.

5.2.2 The mean daily demand projection would be based on year 2031 information as outlined in 2019-based TPEDM and it is summarized in **Table 5.2** below and **Appendix C**.

Table 5.2 Estimation of Mean Daily Flushing Water Demand Fed by Wang Chau RWSR

Year	Mean Daily Demand Projection based on TPEDM (m^3/day)	Mean Daily Demand from Housing Development (m^3/day)*	Total Demand for Development & Population Increase (m^3/day)	Required Capacity of RWSR for Population Increase and Development (m^3)	Tentative design capacity of the proposed WC RWSR (m^3)
2031	42,906(1)	202	43,108	27,589.12(2)	40,000

Remark:

(1) Detailed estimation in Appendix C.

(2) 64% of Mean Daily Demand as advised by WSD

5.2.3 Based on 2019-based TPEDM projection, WCRWSR is sufficient to cater the additional flow due to the proposed housing development. It is anticipated that no mitigation measures or upgrading works would be necessary.

5.3 Salt Water Service Reservoir Capacity (Interim Stage for Years between 2028-2031)

5.3.1 Under the period between years of 2028-2031, the proposed housing site is within the supply zone of Tan Kwai Tsuen SWSR which is fed by Lok On Pai SWPS. Under 2019-based TPEDM, the supply zone covers PDZ 157-159, 164, 170, 173, 176-180, 261, 280, 281, 313-315, 360, 361, 363, 364, 366, 367, 371, 372, 399, 418, 420, 431.

5.3.2 The mean daily demand projection would be based on year 2031 information as outlined in 2019-based TPEDM and it is summarized in **Table 5.3** below and **Appendix C**.

Table 5.3 Estimation of Mean Daily Flushing Water Demand Fed by Lok On Pai SWPS and Tan Kwai Tsuen SWSR

Year	Mean Daily Demand Projection based on TPEDM (m^3/day)	Mean Daily Demand from Housing Development (m^3/day)*	Total Demand for Development & Population Increase (m^3/day)	Required Capacity of SWPS for Population Increase and Development (m^3)	Lok On Pai SWPS Planned Capacity (m^3)
2031	68,718(1)	202	68,920	82,704(2)	103,000

Remark:

(1) Detailed estimation in Appendix C.

(2) 120% of Mean Daily Demand in accordance with WSD DI No. 1309.

Year	Mean Daily Demand Projection based on TPEDM (m^3/day)	Mean Daily Demand from Housing Development (m^3/day)*	Total Demand for Development & Population Increase (m^3/day)	Required Capacity of Reservoir for Population Increase and Development (m^3)	Tan Kwai Tsuen SWSR Planned Capacity (m^3)
2031	68,718(1)	202	68,924	17,231(2)	18,100

Remark:

(1) Detailed estimation in Appendix C.

(2) 25% of Mean Daily Demand in accordance with WSD DI No. 1309.

5.3.3 Based on 2019-based TPEDM projection, Tan Kwai Tsuen SWSR and Lok On Pai SWPS is sufficient to cater the additional flow due to the proposed housing development during years of 2028 to 2031. It is anticipated that no mitigation measures or upgrading works would be necessary.

6. Conclusions

6.1 Fresh Water Supply

6.1.1 The total fresh water demand estimate for the Development at Shap Pat Heung Road is approximately 0.777MLD.

6.1.2 It is noted that the Au Tau FWPSR and Ngau Tam Mei FWPSR would cater the additional water demand arising from proposed Development.

6.1.3 DN100 fresh water main is proposed to distribute the fresh water from the existing fresh water supply system (i.e. existing DN450) at Shap Pat Heung Road to the proposed housing site for domestic use. A separated DN150 fresh water main is also proposed to distribute fresh water from the same existing water main to the proposed site for fire fighting use.

6.1.3.1. It can be seen that with the proposed development and population growth derived from 2019-based TPEDM, combine of Au Tau FWPSR and Ngau Tam Mei FWPSR with storage capacity 142,000 m^3 is larger than 116,335.5m^3 (0.75 Mean Daily Demand). Thus, the existing Au Tau FWPSR and Ngau Tam Mei FWPSR are therefore adequate to supply the fresh water to the proposed development and no adverse impact is anticipated. No mitigation measures nor upgrading works would be necessary.

6.1.4 The preliminary estimated residual head of the fresh water supply system at development boundary level +38.97mPD would be larger than the required 20m.

6.1.5 The proposed development at Shap Pat Heung Road will not cause insurmountable impact to the existing and planned fresh water supply system.

6.2 Flushing Water Supply

6.2.1 The total flushing water demand estimate for the Development at Shap Pat Heung Road is approximately 0.202ML.

6.2.2 The proposed housing site at Shap Pat Heung Road is within the supply zone WCRWSR from the Year of 2031. Meanwhile, the tentative population in-take year is 2028/2029. During the years from 2028 to 2031, the proposed housing site at Shap Pat Heung Road is still within the supply zone of TKTSWWSR and Lok On Pai SWPS. DN50 PE flushing water main is proposed to connect to the existing DN300 salt water main at Shap Pat Heung Road.

6.2.2.1. The existing Lok On Pai SWPS with a station capacity 103MLD is larger than 82,704 m^3/day (1.2 Mean Daily Demand). The storage capacity 18,100m^3 of Tan Kwai Tsuen SWSR is also larger than 17,231 m^3/day (0.25 Mean Daily Demand). Thus, the existing Lok On Pai SWPS and Tan Kwai Tsuen SWSR are adequate to supply the salt water to the proposed development and no adverse impact is anticipated. No mitigation measures nor upgrading works would be necessary during the interim stage in between the years of 2028 and 2031.

6.2.3 The preliminary estimated residual head of the salt water supply system at development boundary level +24.55mPD would be larger than the required 15m during the interim stage.

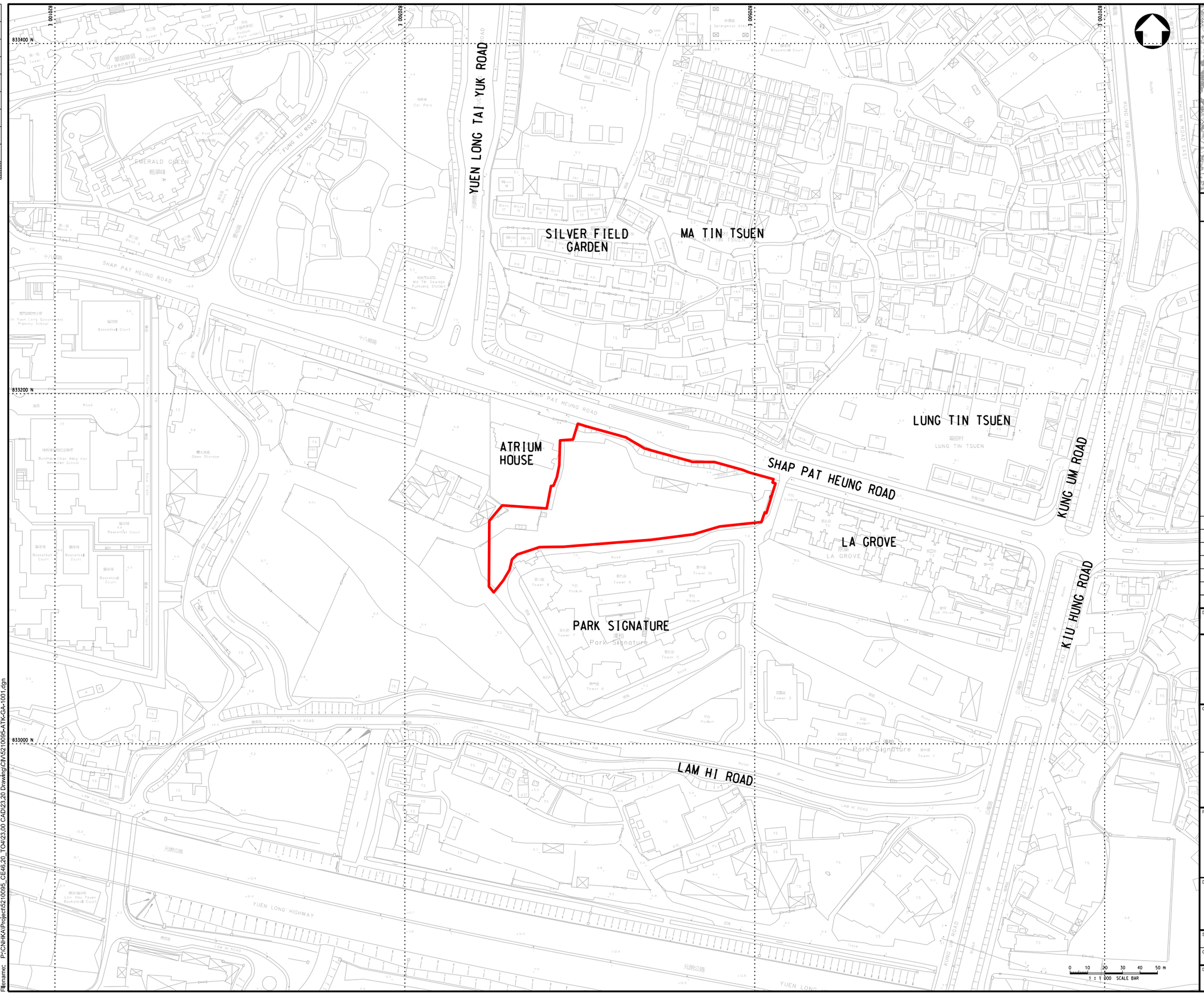
6.2.4 The proposed Development at Shap Pat Heung Road will not cause insurmountable impact to the existing and planned salt water supply system during the interim stage.

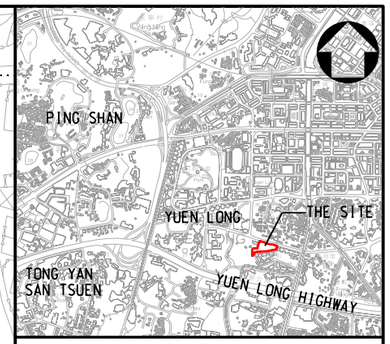
6.2.5 Upon completion of the Wang Chau RWSR tentatively during the Year of 2031, the proposed housing site at Shap Pat Heung Road is within the supply zone of WCRWSR. The tentative design capacity 40,000m3 of WCRWSR is larger than 27,589.12 m3/day (0.64 Mean Daily Demand). Thus, the proposed Wang Chau RWSR is adequate to supply the flushing water to the proposed development and no adverse impact is anticipated. No mitigation measures nor upgrading works would be necessary.

6.2.6 The preliminary estimated residual head of the reclaimed water supply system at development boundary level +16.10mPD would be larger than the required 15m.

6.2.7 The proposed Development at Shap Pat Heung Road will not cause insurmountable impact to the planned reclaimed water supply system.

Figures





KEY PLAN
N.T.S.

LEGEND:

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

Rev.	Date	Description	By	Chk'd	App'd
A	NOV 2021	FIRST ISSUED	WL	KL	DL

Drawing Status: FEASIBILITY STUDY

Suitability: -

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

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 INFRATSTRUCTURE WORKS FOR PROPOSED HOUSING DEVELOPMENT IN ZONE 1 (2021-2024) - FEASIBILITY STUDY (TASK ORDER 4 - SHAP PAT HEUNG ROAD)

Drawing Title

LAYOUT PLAN OF STUDY AREA OF TASK ORDER 4

Scale	Designed	Drawn	Checked	Authorised
1:1000	WL	CAD	KL	DL
Original Size	Date	Date	Date	Date
A1	NOV 2021	NOV 2021	NOV 2021	NOV 2021

Drawing Number: 5210095-ATK-GA-1001

Revision: A

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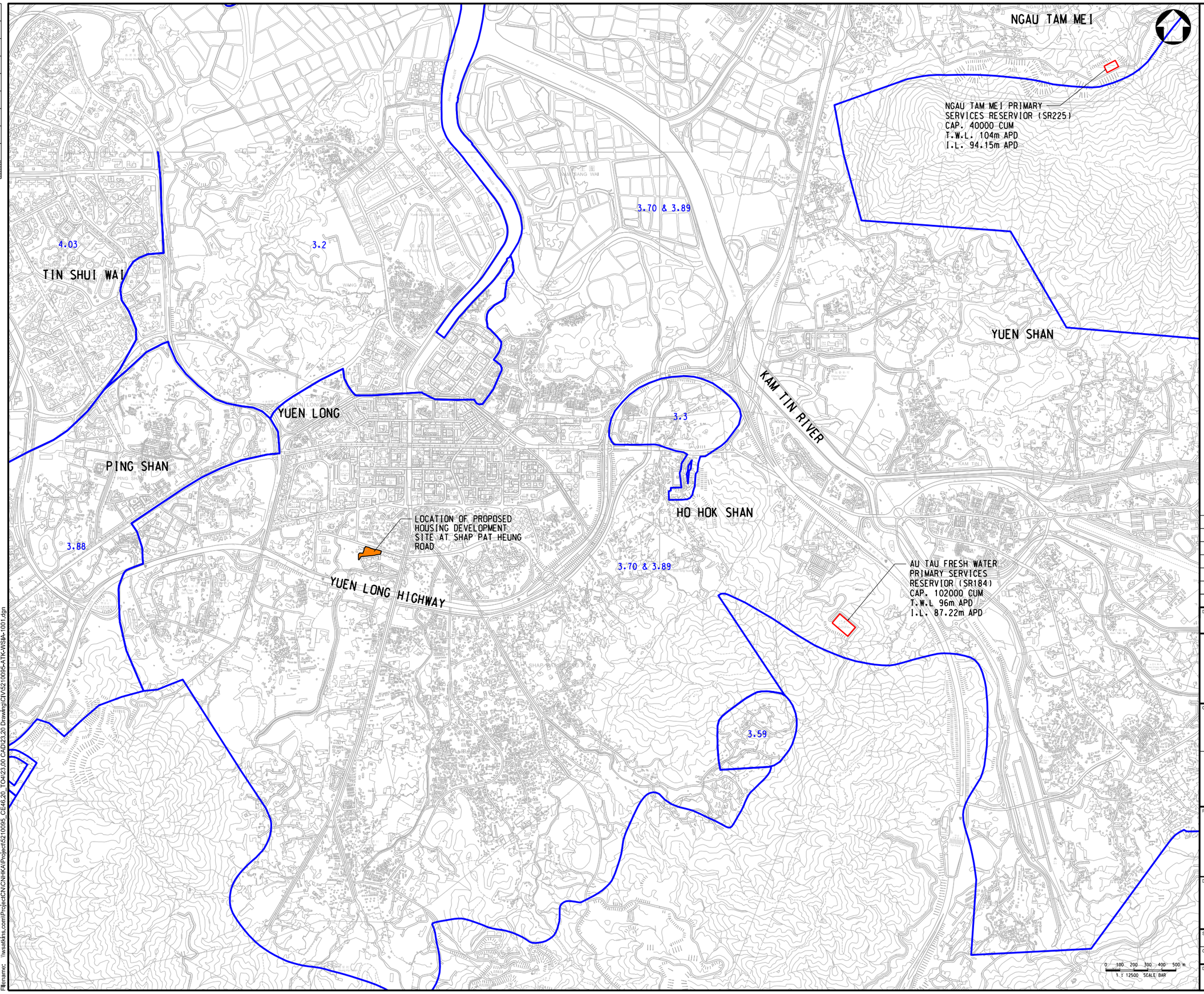

NOTES:

1. THE WATER SUPPLY ZONE SHOWN IN THIS DRAWING AS AT 20-08-2021.

LEGEND:

PROPOSED HOUSING DEVELOPMENT

DEMARCATION OF WATER SUPPLY ZONE

SUPPLY CODE	SEVICES RESERVIOR
3.2	WANG CHAU FW SR
3.3	AU TAU FW SR
3.59	SHUNG SHAN SAN TSUEN FW TANK
3.70	AU TAU FW PRIMARY SR
3.88	TAN KWAI TSUEN SOUTH FW SR
3.89	NGAU TAM MEI FW PRIMARY SR
4.03	TAN KWAI TSUEN NORTH FW SR

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

Drawing Status: FEASIBILITY STUDY

Suitability: -

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Civil Engineering and Development Department

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Civil Engineering Office
Housing Projects 3 Division

Project Title

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

Drawing Title

EXISTING FRESH WATER SUPPLY NETWORK

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Original Size: A1	Date: DEC 2021	Date: DEC 2021	Date: DEC 2021	Date: DEC 2021

Drawing Number: 5210095-ATK-WSIA-1001

Revision: A

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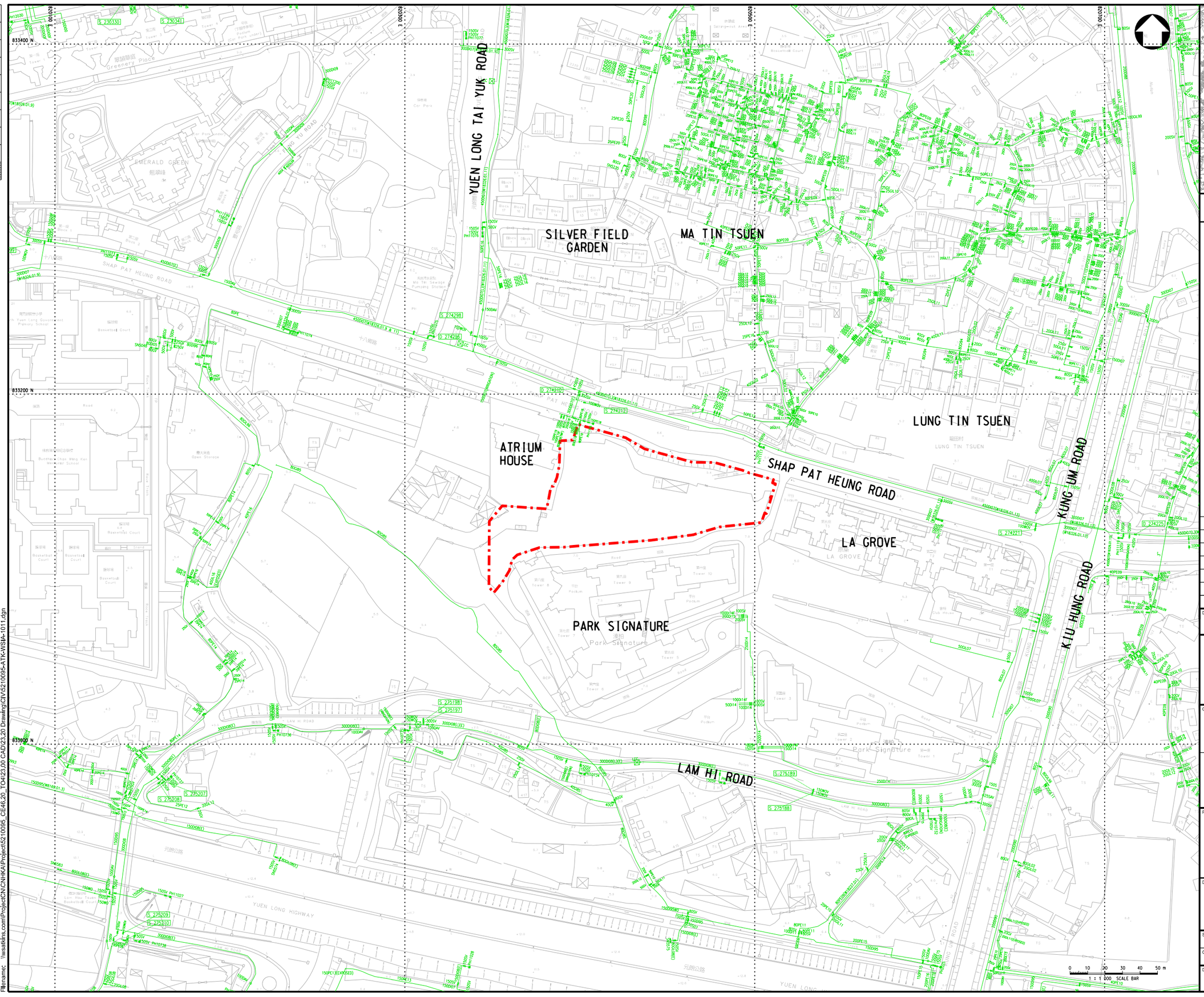

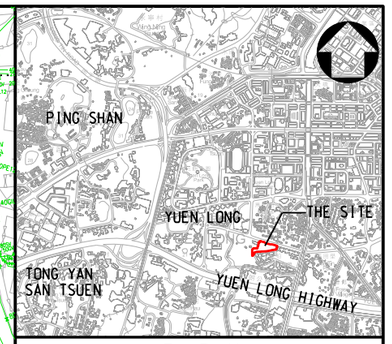

KEY PLAN
N.T.S.

LEGEND:

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

EXISTING FRESH WATER SUPPLY SYSTEM

Rev.	Date	Description	By	Chk'd	App'd
A	DEC 2021	FIRST ISSUED	WL	KL	DL

Drawing Status: FEASIBILITY STUDY

Suitability: -

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Civil Engineering Office
Housing Projects 3 Division

Project Title

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

Drawing Title

EXISTING FRESH WATER SUPPLY SYSTEM

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Orig'nal Size: A1	Date: DEC 2021	Date: DEC 2021	Date: DEC 2021	Date: DEC 2021

Drawing Number: 5210095-ATK-WSIA-1011

Revision: A

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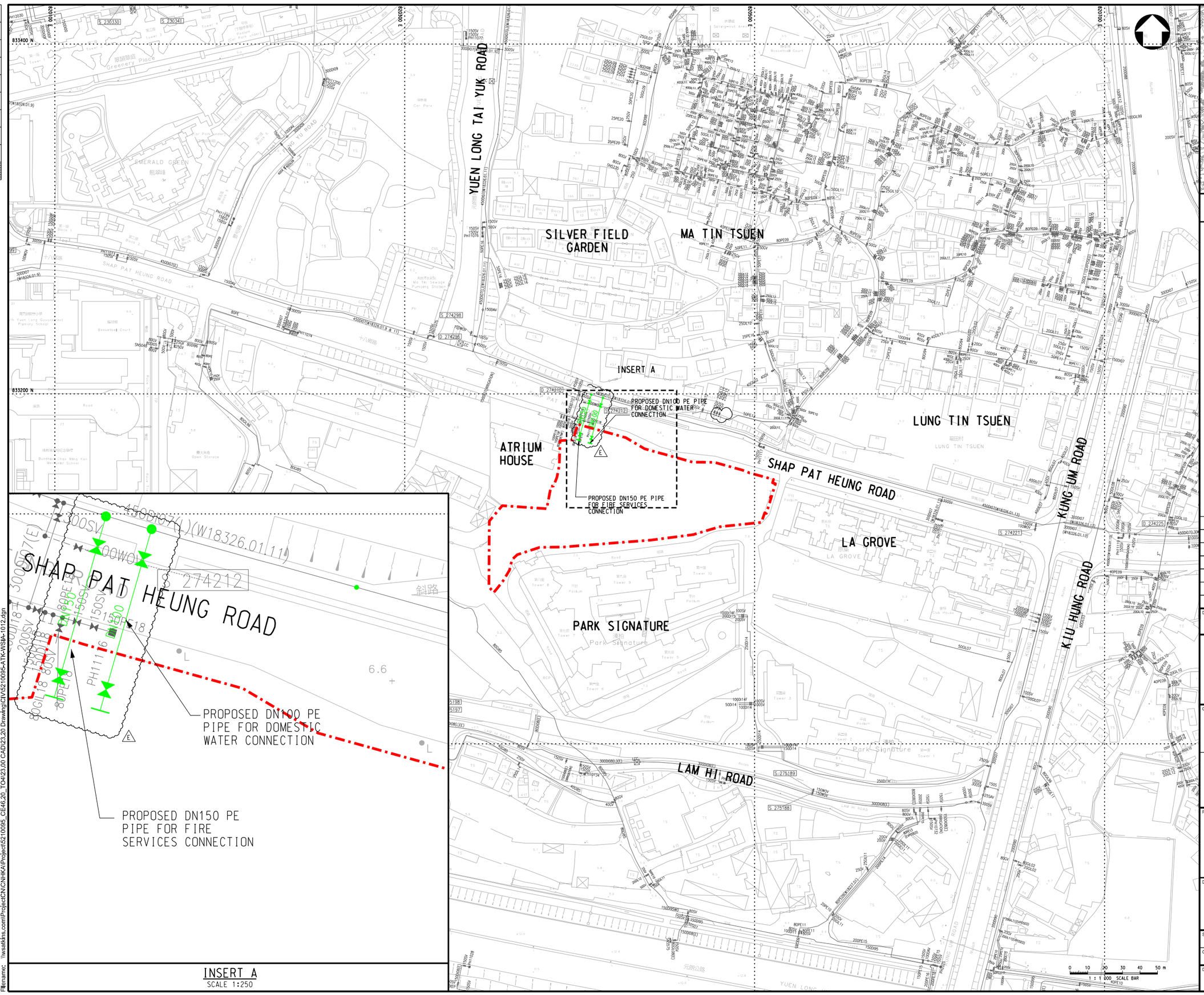

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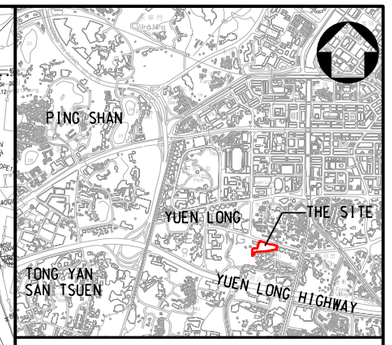

KEY PLAN
N.T.S.

LEGEND:

- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
- EXISTING FRESH WATER SUPPLY SYSTEM
- PROPOSED FRESH WATER SUPPLY SYSTEM

Rev.	Date	Description	By	Chk'd	App'd
E	FEB 2023	FIFTH ISSUE	WL	SW	DL
D	JUN 2022	FOURTH ISSUE	CC	KL	DL
C	MAY 2022	THIRD ISSUE	CC	KL	DL
B	MAR 2022	SECOND ISSUE	WL	KL	DL
A	DEC 2021	FIRST ISSUED	WL	KL	DL

Drawing Status: FEASIBILITY STUDY
Suitability: -

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Housing Projects 3 Division

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

Drawing Title
PROPOSED FRESH WATER SUPPLY SYSTEM

Scale	Designed	Drawn	Checked	Authorised
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Orig'nal Size	Date	Date	Date	Date
A1	DEC 2021	DEC 2021	DEC 2021	DEC 2021

Drawing Number: 5210095-ATK-WSIA-1012
Revision: D

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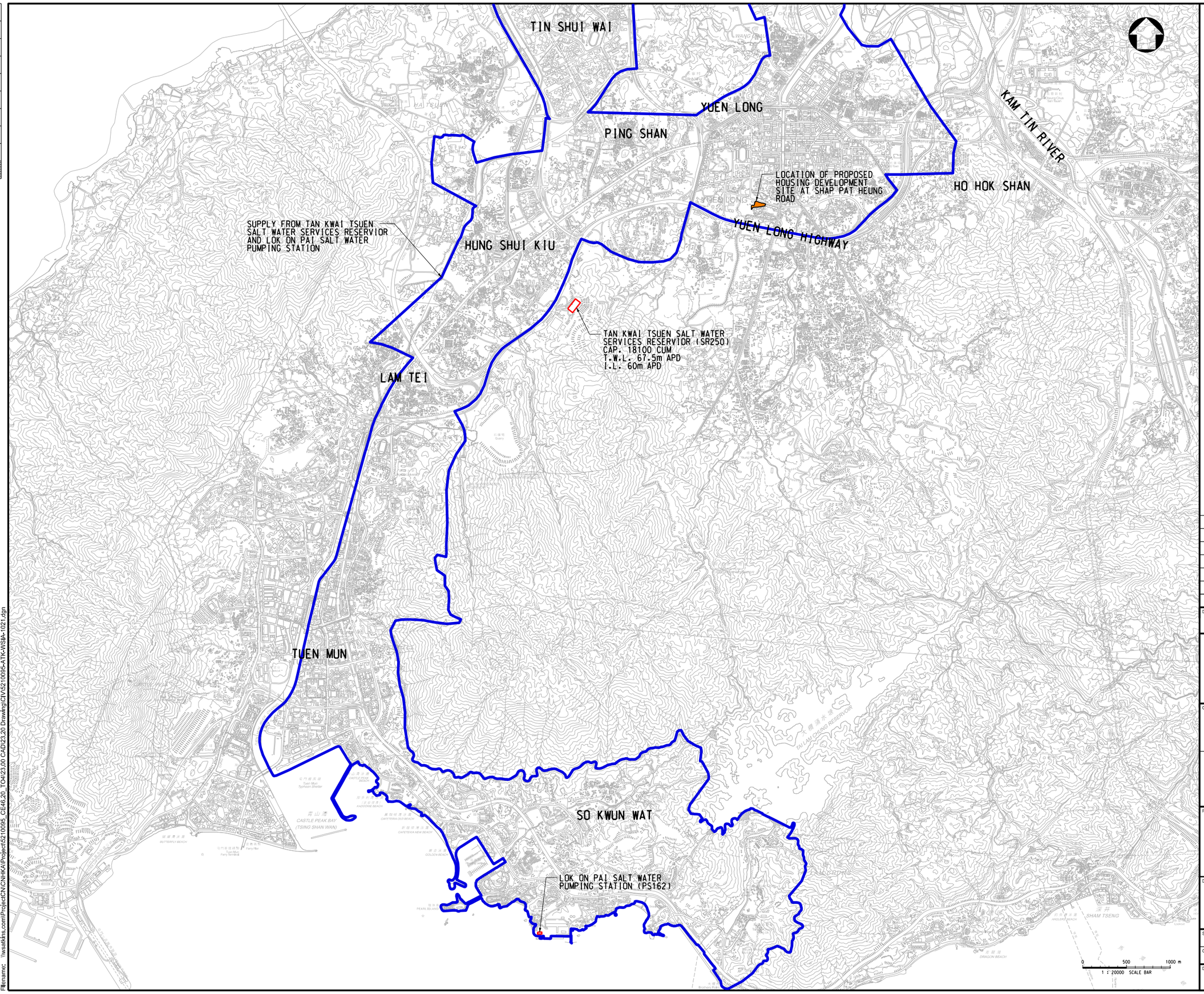

LEGEND:

- STUDY AREA
- DEMARCATION OF SALT WATER SUPPLY ZONE

Rev.	Date	Description	By	Chk'd	App'd
A	DEC 2021	FIRST ISSUED	KLC	VAR	VAR

Drawing Status: FEASIBILITY STUDY

Suitability: -

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

Drawing Title:
EXISTING SALT WATER SUPPLY NETWORK

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Original Size	Date	Date	Date	Date
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Revision: A

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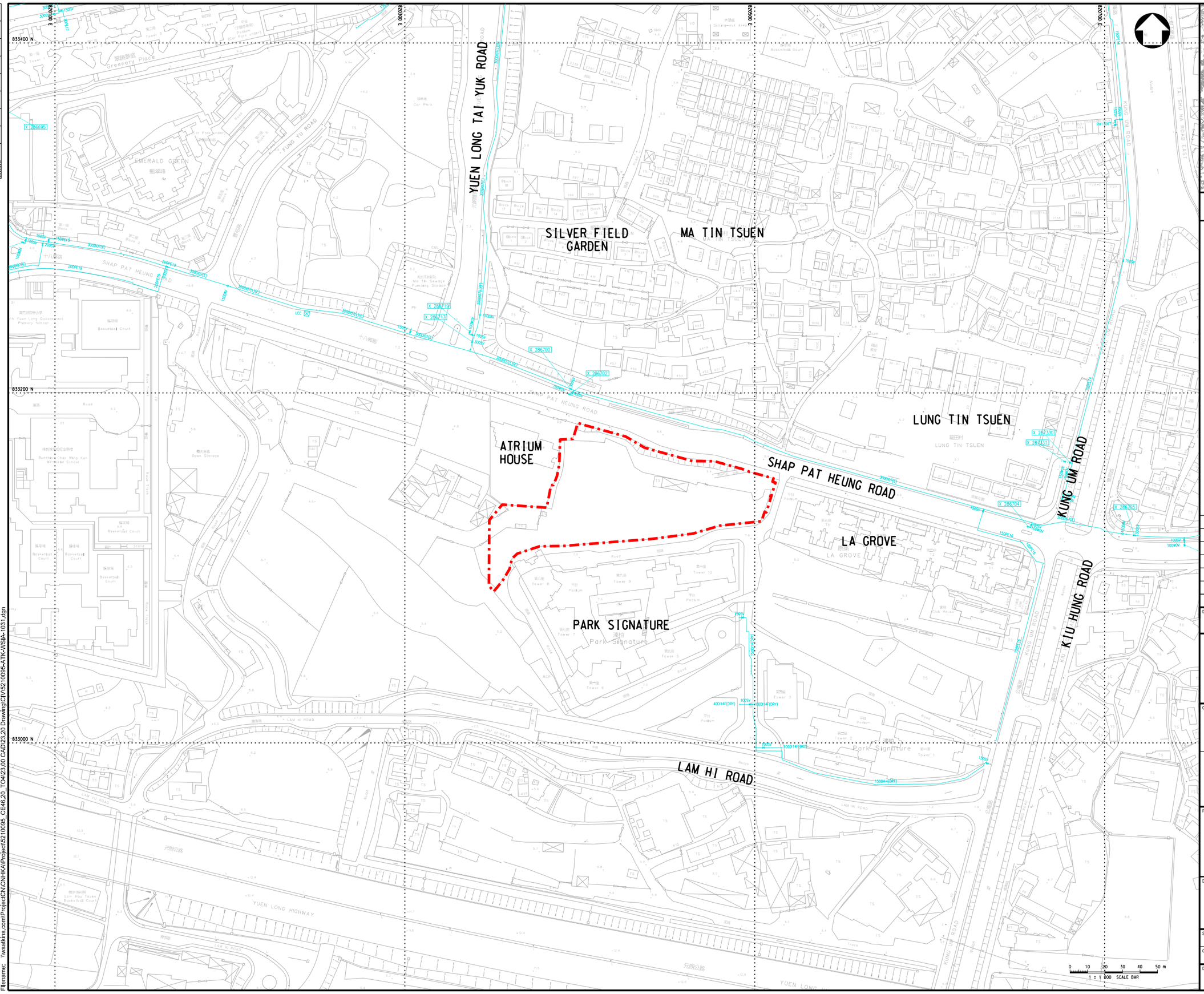

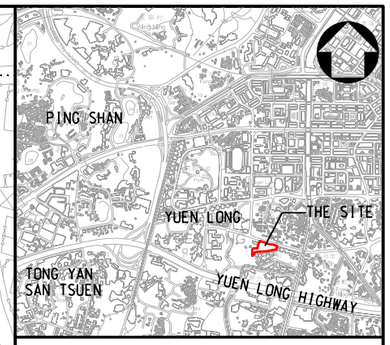

KEY PLAN
N.T.S.

LEGEND:

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

EXISTING SALT WATER SUPPLY SYSTEM

Rev.	Date	Description	By	Chk'd	App'd
A	DEC 2021	FIRST ISSUED	WL	KL	DL

Drawing Status: FEASIBILITY STUDY

Suitability: —

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Housing Projects 3 Division

Project Title

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

Drawing Title

EXISTING SALT WATER SUPPLY SYSTEM

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Orig'nal Size: A1	Date: DEC 2021	Date: DEC 2021	Date: DEC 2021	Date: DEC 2021

Drawing Number: 5210095-ATK-WSIA-1031

Revision: A

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SHAP PAT HEUNG ROAD
KUNG UM ROAD
KIU HUNG ROAD
LAM HI ROAD
YUEN LONG HIGHWAY

SILVER FIELD GARDEN
MA TIN TSUEN
LUNG TIN TSUEN
ATRIUM HOUSE
LA GROVE
PARK SIGNATURE
EMERALD GREEN
Greenery Place
PING SHAN
YUEN LONG
THE SITE
TONG YAN SAN TSUEN

INSERT A

PROPOSED CONNECTION POINT

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X 286700
X 286702
X 286704
X 286705
X 286717
X 286719
X 287330
X 287331

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INSERT A
SCALE 1:250

KEY PLAN
N.T.S.

LEGEND:

- PROPOSED HOUSING DEVELOPMENT BOUNDARY (SUBJECT TO DETAILED SURVEY AND DESIGN)
- EXISTING SALT WATER SUPPLY SYSTEM (TO BE CHANGED TO RECLAIMED WATER SUPPLY SYSTEM FROM THE YEAR OF 2031)
- PROPOSED FLUSHING WATER SUPPLY SYSTEM

Rev.	Date	Description	By	Chk'd	App'd
E	FEB 2023	FIFTH ISSUE	WL	SW	DL
D	JUN 2022	FOURTH ISSUE	CC	KL	DL
C	MAY 2022	THIRD ISSUE	CC	KL	DL
B	MAR 2022	SECOND ISSUE	WL	KL	DL
A	DEC 2021	FIRST ISSUED	WL	KL	DL

Drawing Status: FEASIBILITY STUDY
Suitability: —

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

Drawing Title
PROPOSED FLUSHING WATER SUPPLY SYSTEM

Scale	Designed	Drawn	Checked	Authorised
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Original Size	Date	Date	Date	Date
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Revision: D

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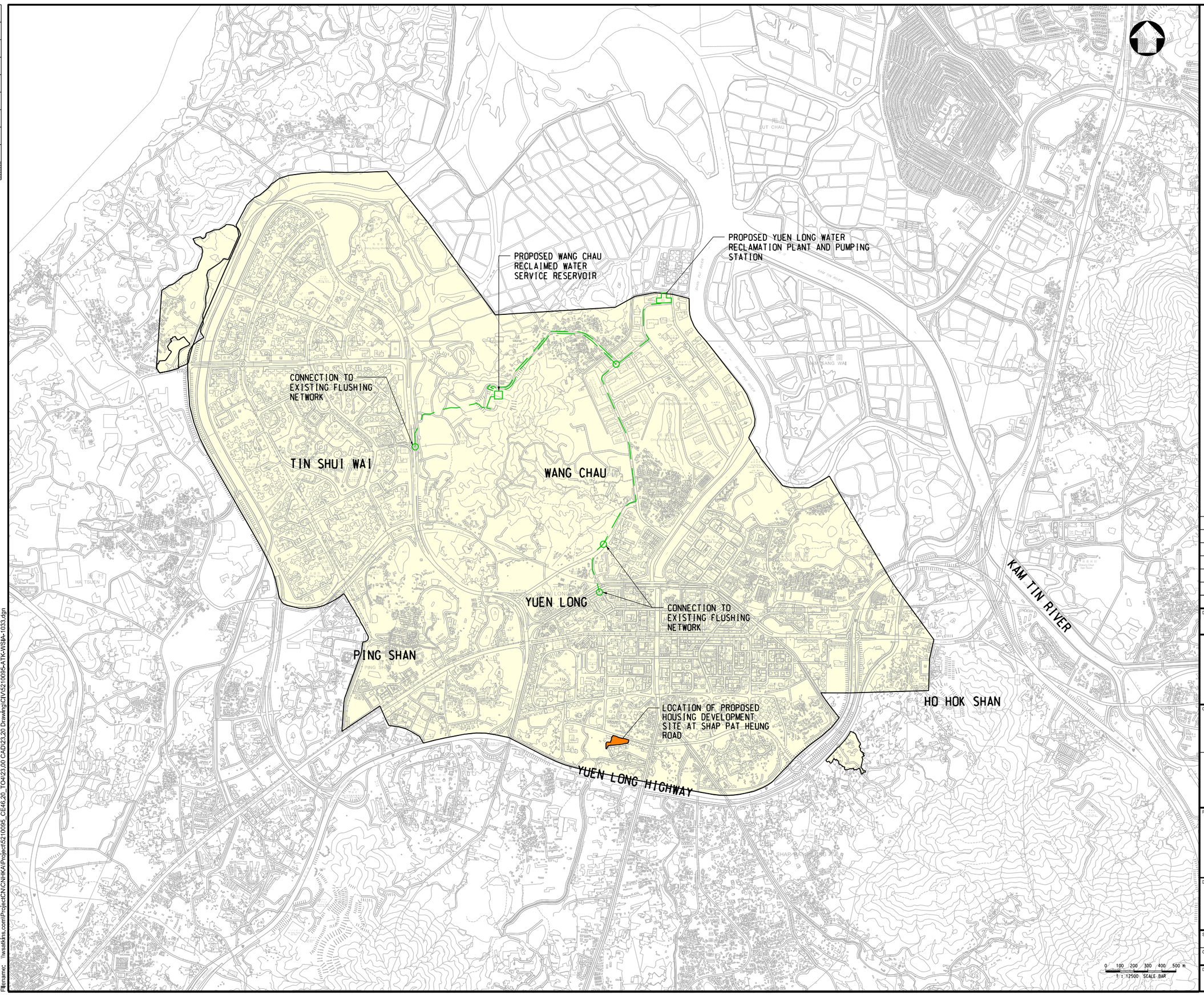

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NOTES:

1. YUEN LONG SOUTH WATER RECLAMATION PLANT & PUMPING STATION AND THE ASSOCIATED WATER MAINS (TO BE CONSTRUCTED BY OTHERS) ARE PLANNED TO BE UTILISED FOR DELIVERING RECLAIMED WATER TO A PROPOSED RECLAIMED WATER SERVICE RESERVOIR.

LEGEND:

- PROPOSED HOUSING DEVELOPMENT
- PROPOSED WANG CHAU RECLAIMED WATER SUPPLY ZONE
- PROPOSED WATER RECLAMATION PLANT AND PUMPING STATION
- PROPOSED RECLAIMED WATER SERVICE RESERVOIR
- PROPOSED RECLAIMED/SALT WATER MAINS

Rev.	Date	Description	By	Chk'd	App'd
A	MAR 2022	FIRST ISSUED	CC	KL	DL

Drawing Status: FEASIBILITY STUDY

Suitability: -

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Civil Engineering and Development Department

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Civil Engineering Office
Housing Projects 3 Division

Project Title

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

Drawing Title

TENTATIVE RECLAIMED WATER SUPPLY NETWORK

Scale	Designed	Drawn	Checked	Authorised
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Drawing Number: 5210095-ATK-WSIA-1033

Revision: A

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Appendix A

Fresh and Flushing Water Demand Estimation

Atkins China Ltd.	Project: 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)	Prepared by:	Checked by:	Approved by:	Date:
	Subject: Appendix A1 - Fresh Water Demand Estimation	Caleb Chan	Calvin Chow	K.C. Lau	6/28/2022

Estimation of Fresh Water Mean Daily Demand (FWMDD)

Consumer Type	Design Population [1]	Fresh Water Unit Demand Factor (l/h/d)	Fresh Water Unit Demand Factor Service Trades (l/h/d)	Total Unit Demand Factor (l/h/d)	Fresh Water Demand (m^3/d)	Fresh Water Demand (m^3/d)
Residential - R1	2,703	230	40	270	729.729	729.7
					Total FWMDD - Residential	**729.7**

Consumer Type	No. of Place / Resident	Net Operational Floor Area [2] (m^2)	Employee	Total no. of Residents and Employee	Fresh Water Unit Demand Factor (3) (l/h/d)	Fresh Water Demand (m^3/d)	Fresh Water Demand (m^3/d)
HCS(Home Care Service)	0	256.9	60	60	210	12.6	12.6
RCCC(Residential Child Care Centre)	96	814.5	20	116	210	24.4	24.4
				Total FWMDD - G/IC			**37.0**

Consumer Type	Site Area (m^2)	Percentage of greenery coverage [4] (%)	Net Irrigation Area (m^2)	Unit Demand Factor for Irrigation ($l/m^2/d$)	Fresh Water Demand (m^3/d)	Fresh Water Demand (m^3/d)
Irrigation	7100	20	1420	7	9.9	9.9
					Total FWMDD - Irrigation	**9.9**
					Total FWMDD (Residential + G/IC + Irrigation)	**777**

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) Net. Operational Floor Area advised by SWD
3) Working density as per Table of Chapter 5 of HKPSG
4) 20% of the proposed housing site is assumed to be greenery coverage.

Atkins China Ltd.	Project: 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)	Prepared by:	Checked by:	Approved by:	Date:
	Subject: Appendix A2 - Flushing Water Demand Estimation	Caleb Chan	Calvin Chow	K.C. Lau	6/28/2022

Estimation of Flushing Water Mean Daily Demand (SWMDD)

Consumer Type	Design Population [1]	Flushing Water Unit Demand Factor Service Trades	Flushing Water Demand	Flushing Water Demand
		(l/h/d)	(m^3/d)	(m^3/d)
Residential - R1	2,703	70	189.189	189.2
			Total SWMDD - Residential	**189.2**

Consumer Type	No. of Place / Resident	Net Operational Floor Area [2]	Employee	Total no. of Residents and Employee	Salt Water Unit Demand Factor (3)	Salt Water Demand	Salt Water Demand
		(m^2)			(l/h/d)	(m^3/d)	(m^3/d)
HCS(Home Care Service)	0	256.9	60	60	70	4.2	4.2
RCCC(Residential Child Care Centre)	96	814.5	20	116	70	8.1	8.1
				Total SWMDD - G/IC			**12.3**

Total SWMDD (Residential + G/IC)	**202**

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) Net. Operational Floor Area advised by SWD

Appendix B

Hydraulic Calculation for Proposed Water Mains

Atkins China Ltd.	Project: 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)	Prepared by:	Checked by:	Approved by:	Date:
	Subject: Appendix B - Hydraulic Calculation for Proposed Water Mains	Caleb Chan	Calvin Chow	K.C. Lau	6/28/2022

Fresh Water

Supply Zone		MDD		Demand Multiplier	Peak Demand	
		(m^3/d)	(m^3 /s)		(m^3 /s)	
Residential - R1	fresh water	730	0.00845	3	0.02534	
GIC and Social Welfare Facilities	fresh water	37	0.00043	3	0.00128	0.02697
Irrigation	fresh water	10	0.00012	3	0.00035	
Fire fighting demand	**fresh water**	**6,000**	**0.06944**	**1**	**0.06944**	

water level at AT FWSR: 91.61 mPD
Minor Loss (H2): 20 % of pipe length

Section	**Pipe Size** (mm)	**Internal Diameter** (mm)	**Flowrate, Qp** (m^3 /s)	**Pipe Velocity** (m/s)	**Pipe Length** (m)	**C Value**	**Friction Loss, H1** (m)	**Minor Loss, H2** (m)	Total Head Loss (m)	Elevation (mPD)	Residual Head (m)	Residual Head Check
From AT FWSR to DN600*	600	586	-	2.50	128	120	1.25	0.25	1.51	61.5	28.60	OK
DN700*	700	682	-	3.00	1808	120	20.81	4.16	24.97	35.7	29.43	OK
DN800*	800	784	-	3.00	532	120	5.21	1.04	6.25	4.6	54.29	OK
DN450*	450	424	-	2.00	1233.9	120	11.67	2.33	14.00	5.5	39.38	OK
Proposed DN100 Fresh Main from Tee-off Point # **	125	101.3	0.00899	1.12	20	120	0.34	0.07	0.41	5.5	38.97	OK

Remarks:
*Maximum Velocity according to DI1309 is assumed for exiting fresh water main.
**DN100 is WSD equivalent size of DN/OD125 PE pipe.
Mean Daily Demand is adopted for the pipe velocity assessment.

Salt Water (Under interim stage between Year of 2028 to 2031)

Supply Zone		MDD		Demand Multiplier	Peak Demand
		(m3/d)	(m^3 /s)		(m^3 /s)
Residential - R1	Salt Water	193	0.00224	2	0.00448
GIC and Social Welfare Facilities	Salt Water	11	0.00012	2	0.00024

water level at TKT SWSR: 63.75 mPD
Minor Loss (H2): 20 % of pipe length

Section	Pipe Size (mm)	Internal Diameter (mm)	Flowrate, Qp (m^3 /s)	Pipe Velocity (m/s)	Pipe Length (m)	C Value	Friction Loss, H1 (m)	Minor Loss, H2 (m)	Total Head Loss (m)	Elevation (mPD)	Residual Head (m)	Residual Head Check
From TKT SWSR to DN1000**	1000	945	0.730	1.04	320	120	0.36	0.07	0.43	36	27.32	OK
DN800**	800	784	0.730	1.51	31.6	120	0.09	0.02	0.10	35.9	27.32	OK
DN1000**	1000	945	0.730	1.04	696	120	0.77	0.15	0.93	32.5	29.79	OK
DN800**	800	784	0.730	1.51	143	120	0.39	0.08	0.47	10.8	51.02	OK
DN1000**	1000	945	0.730	1.04	140	120	0.16	0.03	0.19	9.7	51.93	OK
DN800**	800	784	0.730	1.51	48	120	0.13	0.03	0.16	9.6	51.87	OK
DN700**	700	682	0.730	2.00	1862	120	10.11	2.02	12.13	6.5	42.85	OK
DN600**	600	586	0.730	2.71	82.35	120	0.94	0.19	1.12	4.7	43.52	OK
DN450*** #	450	424	0.054	0.90	1687	120	3.64	0.73	4.37	5.8	38.05	OK
DN300*** #	300	282	0.054	0.90	730	120	2.53	0.51	3.04	4.7	36.11	OK
DN150* #	150	138	0.0211	0.90	260	120	2.08	0.42	2.49	5.2	33.12	OK
DN100* #	100	96	0.0211	0.90	187	120	2.28	0.46	2.73	5.4	30.19	OK
DN150* #	150	138	0.0211	0.90	145	120	1.16	0.23	1.39	5.3	28.90	OK
DN300* #	300	282	0.0211	0.90	760	120	2.64	0.53	3.17	5.5	25.53	OK
Proposed DN50 Salt Water Main from Tee-off Point##@	63	50.9	0.00236	1.16	20	120	0.82	0.16	0.98	5.5	24.55	OK

Remarks:
*Planning Data Zone179,180 are considered for peak flowrate.
**Planning Data Zone 314,315,179,180 are considered for peak flowrate.
***Planning Data Zone 315,179,180 are considered for peak flowrate.
Maximum Velocity according to DI1309 is assumed for exiting fresh water main
Mean Daily Demand is adopted for the pipe velocity assessment.
@DN50 is WSD equivalent size of DN/OD63 PE pipe.

Flushing Water (Permanent Stage Beyond the Year of 2031)

Supply Zone		MDD		Demand Multiplier	Peak Demand
		(m3/d)	(m^3 /s)		(m^3 /s)
Residential - R1	Flushing Water	189	0.00219	2	0.00438
GIC and Social Welfare Facilities	Flushing Water	12	0.00014	2	0.00029

Water level at Reclaimed water reservoir: 63.75 mPD
Minor Loss (H2): 20 % of pipe length

Section	Pipe Size (mm)	Internal Diameter (mm)	Flowrate, Qp (m^3 /s)	Pipe Velocity (m/s)	Pipe Length (m)	C Value	Friction Loss, H1 (m)	Minor Loss, H2 (m)	Total Head Loss (m)	Elevation (mPD)	Residual Head (m)	Residual Head Check
From reclaimed water reservoir	600	586	0.497	1.84	3588	120	20.00	4.00	24.00	4.7	35.05	OK
DN450*** #	450	424	0.054	0.90	1687	120	3.64	0.73	4.37	5.8	29.57	OK
DN300*** #	300	282	0.054	0.90	730	120	2.53	0.51	3.04	4.7	27.63	OK
DN150* #	150	138	0.0190	0.90	260	120	2.08	0.42	2.49	5.2	24.64	OK
DN100* #	100	96	0.0190	0.90	187	120	2.28	0.46	2.73	5.4	21.71	OK
DN150* #	150	138	0.0190	0.90	145	120	1.16	0.23	1.39	5.3	20.42	OK
DN300* #	300	282	0.0190	0.90	760	120	2.64	0.53	3.17	5.5	17.05	OK
Proposed DN50 Salt Water Main from Tee-off Point##@	63	50.9	0.00233	1.15	20	120	0.80	0.16	0.96	5.5	16.10	OK

Remarks:
*Planning Data Zone179,180 are considered for peak flowrate.
***Planning Data Zone 315,179,180 are considered for peak flowrate.
Maximum Velocity according to DI1309 is assumed for exiting fresh water main and C value of 120 is adopted for PE, epoxy-lined CI pipe and cement-lined DI pipe.
Mean Daily Demand is adopted for the pipe velocity assessment.
@DN50 is WSD equivalent size of DN/OD63 PE pipe.

Appendix C

2019-based TPEDM Fresh Water, Salt Water and Reclaimed Water Demand Projection

Atkins China Ltd.	Project: 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)	Prepared by:	Checked by:	Approved by:	Date:
	Subject: Appendix C - 2019-based TPEDM Water Demend Projection for Year 2031 (Fresh Water)	Caleb Chan	Calvin Chow	K.C. Lau	6/28/2022

Population distribution for fresh water			Employment by Industry (S-type)																	
			Agriculture, forestry and fishing, mining and quarrying	Manufacturing	Manufacturing	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
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**
173	31 400	750	*	50	*	2 400	150	200	100	150	*	*	*	*	50	250	*	100	*	200	550
174	4 350	*	100	*	*	100	50	50	*	50	*	50	*	*	*	*	*	*	*	50	200
177	38 200	9 450	50	50	50	600	300	100	1 400	350	*	1 350	100	500	300	700	100	1 000	200	1 050	900
178	14 550	2 050	50	600	*	1 050	1 750	400	2 300	900	*	1 150	250	950	600	1 850	650	1 200	600	1 650	600
179	11 350	4 850	*	*	*	200	100	50	100	100	*	100	*	100	150	200	*	350	*	100	1 000
180	18 650	*	*	100	*	500	200	50	150	100	*	*	50	100	100	700	*	50	*	150	1 250
181	13 800	*	50	*	50	1 350	100	50	100	50	*	*	*	100	50	150	*	100	*	150	450
182	40 850	5 750	100	50	*	3 000	300	50	300	850	*	350	50	100	150	300	*	550	100	250	2 100
183	5 800	250	*	*	*	50	50	50	50	50	*	50	*	50	200	100	*	50	*	50	1 200
184	12 050	*	100	100	*	300	350	100	150	100	*	100	*	100	100	200	*	50	*	250	1 150
314	6 600	6 150	*	50	150	250	150	50	450	150	*	600	50	250	200	350	550	800	50	500	350
315	20 300	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
316	10 800	850	200	50	*	650	250	50	300	100	*	150	50	150	150	300	200	150	50	300	1 200
317	12 700	1 300	50	50	50	550	100	*	100	50	*	100	*	50	100	250	*	150	2 000	200	450
318	1 100	*	*	*	*	50	*	*	*	*	*	*	*	50	*	50	*	*	*	*	150
332	2 200	*	*	*	*	300	50	50	*	*	*	*	*	*	100	50	*	*	*	*	450
333	400	*	*	*	*	500	*	*	*	*	*	*	*	*	*	*	*	*	*	*	50
334	950	*	*	*	*	200	*	*	150	50	*	*	*	*	*	50	300	*	*	*	50
341	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
362	21 600	3 850	*	50	*	100	50	*	300	100	*	550	*	50	150	250	150	300	7 250	250	900
365	6 550	1 050	*	50	*	100	50	*	100	50	*	150	*	*	100	50	*	100	*	100	250
368	2 200	750	150	1 100	*	4 350	1 700	50	2 000	3 450	*	*	450	200	750	250	*	150	50	150	300
372	28 400	4 650	*	*	*	200	200	50	1 000	450	150	1 150	50	150	650	600	*	450	50	300	2 600
373	18 650	100	200	*	*	400	300	100	150	150	*	150	50	100	150	250	100	50	*	300	1 300
374	19 300	*	150	*	*	1 650	*	*	50	200	*	*	*	50	*	50	*	*	*	50	2 250
375	12 950	1 500	50	50	*	150	200	*	150	100	*	50	50	100	300	150	50	200	*	300	2 300
376	2 350	*	50	*	*	250	300	*	300	150	300	350	50	100	250	400	*	400	150	350	300
401	18 450	*	150	*	*	2 200	*	*	50	50	*	*	*	50	*	50	*	50	*	50	200
402	5 000	400	*	*	*	1 300	400	*	650	150	*	400	50	100	350	650	1 400	450	300	450	700
405	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
447	6 400	200	50	*	*	450	50	*	50	*	*	*	*	50	50	50	*	*	*	50	900
448	1 550	*	*	*	*	400	*	50	*	*	*	50	*	*	*	*	*	*	*	50	200
449	1 200	*	*	*	*	600	*	*	*	100	*	*	*	*	*	*	*	*	*	*	100
Total	390 650	50 600	1 600	2 450	300	25 200	7 800	1 750	13 950	8 750	450	9 950	1 400	4 700	5 900	9 750	3 800	8 000	11 350	8 950	25 300
Unit Demand (m3/day)	0.27	0.025	0.08	0.55	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)	105475.5	1265	128	1347.5	99	5796	624	490	3906	1575	711	15721	252	376	472	780	304	2240	3178	2506	7084
Total Mean Daily Demand (m3/day)	154337.085																				

Note:
1. The values are extracted from the ; latest TPEDM-2019.
2. The Unit Demands are based on WSD DI 1309. where relevant information is not available, the assumptions will be based on EPD GESF.

Atkins China Ltd.	Project: 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)	Prepared by:	Checked by:	Approved by:	Date:
	Subject: Appendix C - 2019-based TPEDM Water Demend Projection for Year 2031(Reclaimed Water)	Caleb Chan	Calvin Chow	K.C. Lau	6/28/2022

Population distribution for Reclaimed water			Employment by Industry (S-type)																	
			Agriculture, forestry and fishing, mining and quarrying	a	Manufacturing	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
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**
173	31 400	750	*	50	*	2 400	150	200	100	150	*	*	*	*	50	250	*	100	*	200	550
174	4 350	*	100	*	*	100	50	50	*	50	*	50	*	*	*	*	*	*	*	50	200
175	29 200	3 900	*	*	*	200	100	*	650	150	300	1 200	50	200	200	200	*	350	50	250	1 350
176	34 000	3 950	*	*	*	150	50	*	150	50	*	250	*	50	50	100	200	350	*	1 550	450
177	38 200	9 450	50	50	50	600	300	100	1 400	350	*	1 350	100	500	300	700	100	1 000	200	1 050	900
178	14 550	2 050	50	600	*	1 050	1 750	400	2 300	900	*	1 150	250	950	600	1 850	650	1 200	600	1 650	600
179	11 350	*	*	*	*	200	100	50	100	100	*	100	*	100	150	200	*	350	*	100	1 000
180	18 650	*	*	100	*	500	200	50	150	100	*	*	50	100	100	700	*	50	*	150	1 250
232	18 950	950	*	1 150	50	1 300	1 150	50	350	1 150	*	50	*	100	200	450	*	100	*	500	800
261	29 300	7 500	50	*	400	550	100	*	150	200	*	100	50	100	100	150	*	700	*	200	1 350
280	57 150	10 900	*	50	*	600	200	50	900	250	*	900	50	350	200	350	500	1 050	150	700	1 600
281	65 350	9 400	100	50	*	700	150	*	750	200	50	750	50	200	100	400	*	900	100	600	650
313	5 000	800	*	*	*	150	50	50	100	200	*	100	*	50	100	200	*	100	*	150	250
314	6 600	6 150	*	50	150	250	150	50	450	150	*	600	50	250	200	350	550	800	50	500	350
315	20 300	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
371	20 600	5 050	*	*	*	100	50	*	200	100	*	300	*	50	50	50	100	450	50	200	600
372	28 400	4 650	*	*	*	200	200	50	1 000	450	150	1 150	50	150	650	600	*	450	50	300	2 600
431	36 200	5 100	*	*	*	150	50	*	250	50	*	350	*	50	50	200	50	500	650	400	400
Total	469 550	77 300	450	2 200	650	10 200	5 450	1 350	12 500	5 350	500	11 500	850	4 450	4 000	8 250	2 450	9 750	2 450	10 200	15 800
Unit Demand (m3/day)	0.07	0.025	0	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.295	0.07	0.07
Mean Daily Demand (m3/day)	32868.5	1932.5	0	154	45.5	714	381.5	94.5	875	374.5	35	805	59.5	311.5	280	577.5	171.5	682.5	722.75	714	1106
Total Mean Daily Demand (m3/day)	42906.83																				

Note:

1. The values are extracted from the ; latest TPEDM-2019.

2. The Unit Demands are based on WSD DI 1309. where relevant information is not available, the assumptions will be based on EPD GESF.

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	Subject: Appendix C - 2019-based TPEDM Water Demend Projection for Year 2031 (Salt Water)	Caleb Chan	Calvin Chow	K.C. Lau	6/28/2022

Population distribution for salt water			Employment by Industry (S-type)																	
			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
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**
157	17 950	*	*	*	*	1 450	100	*	50	50	*	50	*	*	50	400	400	50	50	50	4 600
158	49 750	4 400	*	*	*	1 350	300	*	250	150	250	350	100	150	450	450	600	650	100	400	6 600
159	50 200	10 200	*	50	*	1 200	250	50	1 300	300	*	1 200	100	350	350	800	50	1 150	350	1 200	1 650
164	16 950	1 750	*	100	*	500	350	50	4 150	550	*	3 150	150	950	550	1 000	450	700	350	1 200	900
170	3 800	700	*	*	*	*	*	*	*	*	*	*	*	*	50	50	50	50	*	*	250
173	31 450	750	*	50	*	2 400	150	200	100	150	*	*	*	*	50	250	*	100	*	200	550
176	34 550	3 950	*	*	*	150	50	*	150	50	*	250	*	50	50	100	200	350	*	1 550	450
177	38 750	9 450	50	50	50	600	300	100	1 400	350	*	1 350	100	500	300	700	100	1 000	200	1 050	900
178	14 850	2 050	50	600	*	1 050	1 750	400	2 300	900	*	1 150	250	950	600	1 850	650	1 200	600	1 650	600
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
261	29 850	7 500	50	*	400	550	100	*	150	200	*	100	50	100	100	150	*	700	*	200	1 350
280	58 100	10 900	*	50	*	600	200	50	900	250	*	900	50	350	200	350	500	1 050	150	700	1 600
281	66 200	9 400	100	50	*	700	150	*	750	200	50	750	50	200	100	400	*	900	100	600	650
313	5 050	800	*	*	*	150	50	50	100	200	*	100	*	50	100	200	*	100	*	150	250
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
360	63 300	150	*	*	*	4 950	200	*	200	100	*	200	50	50	200	250	750	250	100	200	8 400
361	3 750	1 550	*	*	100	150	50	*	200	50	*	150	*	100	50	200	150	200	50	300	150
363	19 500	2 150	*	50	50	250	150	50	300	100	*	450	50	150	150	300	50	300	100	600	750
364	17 250	4 800	*	*	*	100	50	*	200	50	*	300	*	100	50	150	*	1 000	*	200	350
366	2 000	750	*	*	*	*	50	*	50	*	*	50	*	*	50	50	*	50	*	50	250
367	3 150	*	50	*	50	100	100	50	50	150	*	*	*	50	*	50	*	*	*	150	300
371	20 950	5 050	*	*	*	100	50	*	200	100	*	300	*	50	50	50	100	450	50	200	600
372	29 050	4 650	*	*	*	200	200	50	1 000	450	150	1 150	50	150	650	600	*	450	50	300	2 600
399	42 700	2 150	*	150	*	1 850	150	50	400	100	*	200	*	50	200	100	50	350	50	450	1 050
418	31 450	2 750	100	100	*	2 150	200	50	150	150	*	150	*	100	100	250	*	200	*	150	1 200
420	8 700	400	*	*	*	800	*	*	50	*	*	*	*	*	150	50	*	50	*	100	150
431	36 700	5 100	*	*	*	150	50	*	250	50	*	350	*	50	50	200	50	500	650	400	400
Total	753 900	109 050	500	1 500	800	23 450	6 100	1 550	18 850	5 750	450	16 450	1 250	6 200	6 000	11 700	5 000	14 300	3 550	14 450	40 050
Unit Demand (m3/day)	0.07	0.025	0	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.295	0.07	0.07
Mean Daily Demand (m3/day)	52773	2726.25	0	105	56	1641.5	427	108.5	1319.5	402.5	31.5	1151.5	87.5	434	420	819	350	1001	1047.25	1011.5	2803.5
Total Mean Daily Demand (m3/day)	68717.58																				

Note:
1. The values are extracted from the ; latest TPEDM-2019.
2. The Unit Demands are based on WSD DI 1309. where relevant information is not available, the assumptions will be based on EPD GESF.