

Appendix H

Water Supply Impact Assessment

ARUP

Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D. 32 and Adjoining Government Land, Wong Yi Au, Tai Po, New Territories

Water Supply Impact Assessment Report

Issue 3 | July 2025

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 292635

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1. Introduction

1.1 Project Background

1.1.1.1 This Water Supply Impact Assessment ("WSIA"), appended to the Supporting Planning Statement, is prepared in support of the Planning Application under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development ("Proposed Amendment") at Various Lots in D.D. 32 and Adjoining Government Land, Wong Yi Au, Tai Po, New Territories ("the Application Site").

1.2 Proposed Development

- 1.2.1.1 The Proposed Development is located at Wong Yi Au. There would be 4 blocks of residential buildings and an access road (subject to detailed design) adjoining Yung Yi Road.
- 1.2.1.2 The Proposed Development comprises private housing and clubhouse. The total site area is approximately 14,879.35 m² and the design parameters are shown in **Table 1.1** below.

Table 1.1 Development Parameters

Description	Site Information	
District Location	Tai Po	
Site Location	Wong Yi Au	
Application Site Area	About 14,879.35 m ²	
GFA	Domestic: Clubhouse:	35,710.44 m ² 1606.97 m ²
Anticipated Population	Domestic: Clubhouse (1):	1400 53

 $^{^{(1)}}$ Community, Social & Personal Services = 3.3 employee per $100m^2$ of GFA based on PlanD's Commercial and Industrial Floor Space Utilization Survey "CIFSUS" Table 8.

1.3 Purpose of this Report

- 1.3.1.1 The aim of this Water Supply Impact Assessment (WSIA) Report is to review and update the water supply network arising from proposed development to assess the impact of the Proposed Development to the existing water supply network and to propose mitigation measures (if required).
- 1.3.1.2 The scope of the Project comprises comprehensive development private housing and a clubhouse in Wong Yi Au.
- 1.3.1.3 The WSIA Report shall be prepared, which should:
 - (a) assess the anticipated water demands provisions requirements for the Project;
 - (b) assess the adequacy of water supply facilities according to WSD standard by carrying out inter-alia, water demand projection and hydraulic networks analysis. The assessment shall

- also take into account the water supply impact incurred by the existing and proposed developments in the vicinity of the Project;
- (c) identify all the affected waterworks and utilities (whether within or outside the Project boundary) and where necessary, recommend and formulate feasible mitigation and protective measures such as diversion, reprovisioning and modification of waterworks and utilities to protect the affected facilities and minimise the disturbance to the normal operation of the affected facilities during construction stage;
- (d) prepare preliminary layout plans, accompanied with sections, showing the general arrangement of the recommended waterworks and utility works (inclusive of the drainage and sewage proposals concluded in the DIA and SIA), mitigation and protective measures for those affected waterworks facilities and utilities.
- 1.3.1.4 Water Supply Impact Assessment Report detailing the assessment methodology, findings and recommendations shall be prepared. Agreement of the WSD for the proposed waterworks shall be sought.
- 1.3.1.5 This Water Supply Impact Assessment Report is structured as follows:
 - Section 1 Introduction, introduces the Project Background, Objectives and Scope of the Project.
 - Section 2 Methodology and Design Criteria, presents the Methodology and Design Criteria.
 - Section 3 Existing and Planned Water Supply System, presents the Existing and Planned Water Supply System.
 - Section 4 Water Demand Estimation, presents the Water Demand Estimation.
 - Section 5 Proposed Waterworks, presents the Proposed Waterworks.
 - Section 6 Conclusion, summarises the Conclusions.

2. Methodology and Design Criteria

2.1 Methodology

- 2.1.1.1 The following methodology is adopted in carrying out the WSIA:
 - Identify the scope of the development;
 - Determine the water demand of the development;
 - Identify the existing water supply system within and in the vicinity of the proposed development boundary;
 - Examine the impact arising from new water demand from the proposed development on the existing source of supply and the system capacity; and
 - Identify improvement and upgrading works.

2.2 Design Guidelines

- 2.2.1.1 The WSIA has been undertaken in accordance with the following standards, Code of Practice and Design Manuals:
 - WSD's Manual of Mainlying Practice
 - WSD's Departmental Instruction (DI) No. 1309;
 - WSD's Civil Engineering Design Manual -Volume II
 - Plumbing Engineering Services Design Guide (2002)
 - EPD Guidelines for Estimating Sewage Flows (GESF) for Sewage Infrastructure Planning
 NO.: EPD/TP 1/05
 - BS 6465-1:2006 "Sanitary Installation Part 1: Code of Practice for the Design of Sanitary Facilities and Scales of Provision of Sanitary and Associated Appliances"
 - Memo issued by AD/Dev of WSD dated 11 May 2006 and titled "Revised/New Planning Standards"
 - WSD Circular Letter No. 1/2007 dated 27 March 2007 titled "Reduction of the Minimum Residual Pressure"

2.3 Parameters and Assumptions

Unit Demands

- 2.3.1.1 The water demand for the proposed development has been estimated generally based on unit water demand in WSD's Departmental Instruction (DI) 1309 and the latest WSD planning standards.
- 2.3.1.2 The unit demands for some of the landuses used in the estimation of the freshwater and flushing water demands are obtained from EPD's "Guidelines for Estimating Sewage Flows for Sewage Infrastructure Planning" (GESF).

Table 2.1 Unit Demand

Development Type	Fresh Water Unit Demand (l/h/d)	Flushing Water Unit Demand (l/h/d)	Reference
Residential – R3	390	104	DI 1309
GIC	280	50	EPD's GESF
Clubhouse	280	50	EPD's GESF
Irrigation	7 l/d/m ³		Table 3-4 of WSD's Technical Specifications on Grey Water Reuse and Rainwater Harvesting

Water Treatment Works (WTW)

2.3.1.3 The design capacity for a WTW with Mean Daily Demand (MDD) greater than 100 Million Litre/Day (MLD) shall be 1.2 times MDD.

Fresh Water Service Reservoir (FWSR) Capacity

- 2.3.1.4 Fresh Water System (Secondary) 75% and 85% of mean daily demand for interconnection and isolated supply zones respectively.
- 2.3.1.5 Flushing Water System 25% of mean daily demand (if supplied by salt water) and 64% of mean daily demand (if supplied by treated sewage effluent), additional 5% of mean daily demand should be added if there are critical customers within the supply zone.

Peaking Factors for Distribution Mains

2.3.1.6 The fresh water and flushing water distribution system is designed under the following conditions in accordance with DI 1309:

Demand for fresh water $= 3 \times MDD$ (Mean Daily Demand)

Demand for flushing water = $2 \times MDD$ (Mean Daily Demand)

Residual Head

Fresh Water System – 20m;

Flushing Water System – 15m.

- 2.3.1.7 The following pipe length factors have been applied to the length of water main (from mains record plan) to cater for bend losses:
 - a) For urban areas = 1.2
 - b) For rural areas = 1.1
- 2.3.1.8 The pipeline headloss is calculated based on Hazen-Williams equation. The corresponding roughness coefficient is shown in **Table 2.2.**

Table 2.2 Hazen-Williams Roughness Coefficients

Water Main	Pipe Diameter (mm)	Roughness Coefficient
P. 1	< DN600	110
Fresh	≥ DN600	120

2.3.1.9 The design criteria for fresh water and flushing water systems are specified under DI 1309, with updates in memo issued by AD/Dev of WSD dated 11 May 2006 titled "Revised/New Planning Standards", and WSD Circular Letter No. 1/2007 dated 27 March 2007 titled "Reduction of the Minimum Residual Pressure". The aforesaid design criteria are tabulated in **Table 2.3** below.

Table 2.3 Design Criteria for Fresh Water Supply Systems for Proposed Development

Design Criteria	Fresh Water Supply			
Minimum Residual Head ¹ (m)	20			
	>DN700	≤3.0		
	DN700- DN525	≤ 2.5		
Velocity limit of Distribution mains (m/s)	DN450- DN375	≤ 2.0		
(-13 6)	DN300- DN200	≤1.5		
	All	≥ 0.9		

Note:

(1) Minimum residual pressure of 20-metre head only applies to development with plumbing proposals first submitted to the Water Authority on or after 1 April 2008.

3. Existing and Planned Water Supply System

3.1 Existing Fresh Water Supply System

- 3.1.1.1 With reference to WSD record plans, there is existing 450mm dia. fresh water main on Tai Po Road-Tai Po Kau. A 300mm dia. fresh water distribution main supplies Tai Po Road-Tai Po Kau from Sheung Wong Yi Au Fresh Water Services Reservoir (SWYA FWSR).
- 3.1.1.2 The fresh water supply to the application site is from SWYA FWSR with the existing capacity of 6,917 m³ per day, top water level at 140mPD and invert level at 137mPD.¹

3.2 Existing Salt Water Supply System

- 3.2.1.1 With reference to WSD record plans, there is existing 200mm dia. salt water main on Tai Po Road-Tai Po Kau.
- 3.2.1.2 The site currently does not fall within a defined salt water supply zone. To reduce freshwater demand, it is proposed to provide the Site with salt water for flushing, thus expanding the salt water supply zone. It is proposed to supply salt water to the site from Pun Chun Yuen Salt Water Services Reservoir (PCYSWSR) with the capacity of 3+200m³, top water level at 80mPD and invert level at 75.3mPD.

3.3 Planned Water Supply System

- 3.3.1.1 Under PWP Item No. 9353WF, the followings are included as planned improvement:
 - (i) The construction of Sheung Wong Yi Au (SWYA) No. 3 fresh water service reservoir; the projected daily demand will eventually increase to 15,600 m³ in 2030; and
 - (ii) The laying of the associated fresh water mains with diameters ranging from 300 millimetres (mm) to 600 mm with an approximate total length of 450 metres.
- 3.3.1.2 Under PWP Item No. 9369WF, the followings are included as planned improvement:
 - (i) uprating of the existing Ha Wong Yi Au (HWYA) fresh water pumping station; and
 - (ii) laying of associated fresh water mains with diameters ranging from 400 millimetres (mm) to 600 mm with an approximate total length of 5.5 kilometres (km).

-

¹ Information from WSD record plan.

4. Water Demand Estimation

4.1 Water Demand from the Proposed Development

4.1.1.1 The fresh water and flushing daily water demand for the proposed scheme is estimated to be approx. 672.54 m³/day and 148.25 m³/day respectively. The detailed calculations for water demand estimation are included in **Appendix A** and summarised in **Table 4.1**.

 Table 4.1 Water Consumption Estimation for the Residential Development

Proposed Development	Fresh Water (m³/day) (2)	Flushing Water (m ³ /day) (2)
Residential	616.00	145.60
Clubhouse	14.84	2.65
Irrigation	41.70	-
Total Daily Flow (m ³ /day)	672.54	148.25
Peaking Factor (1)	3	2
Total Peak Flow (L/s)	2,017.62	296.50

Remarks:

- (1) Based on WSD DI no.1309, peak flow rates in distribution mains for: fresh water = 3×10^{-5} mean daily demand; flushing water = 2×10^{-5} mean daily demand.
- (2) Numbers are rounded to 2 decimal places.
- 4.1.1.2 The fresh water supply to the application site is from Sheung Wong Yi Au Fresh Water Services Reservoir with the planned capacity of 12,917 m³. The estimated increase in water demand from the proposed development is approximately 3.9% of existing capacity of Sheung Wong Yi Au Fresh Water Services Reservoir. The flushing water supply to the application site is from Pun Chun Yuen Salt Water Services Reservoir with the capacity of 3200m³. The estimated increase in water demand from the proposed development is approximately 1.4% of existing capacity of PCYSWSR. Thus, it is deemed that the water supply facilities have taken into account of the regional water demand increase.

Table 4.2 Water Supply Facilities Capacity Check

	Total Water Demand (m³/day)	Impact on Sheung Wong Yi Au FWSR	Impact on Pun Chun Yuen SWSR
Fresh water	672.54	3.90%	-
Flushing water	148.25	-	1.39%

4.2 Proposed Waterworks and Hydraulic Analysis

- 4.2.1.1 According to the calculation in **Appendix A**, the peak flow for the fresh water of the proposed scheme will be 672.54 m³/day. The proposed freshwater lead-in main pipe size is DN150, which gives the estimated maximum peak flow velocity of 1.56m/s that meets the WSD's requirement of not more than 3m/s for distribution main.
- 4.2.1.2 According to the calculation in **Appendix A**, the peak flow for the flushing water of the proposed scheme will be 148.25 m³/day. The proposed flushing water lead-in main pipe size is DN50, which gives the estimated maximum peak flow velocity of 1.75 m/s that meets the WSD's requirement of not more than 3m/s for distribution main.
- 4.2.1.3 Two water mains, one DN150 for fresh water and one DN50 for flushing water, have been proposed to connect to planned DN400 fresh water main and existing DN200 salt water main along Tai Po Road-Tai Po Kau. Proposed water main laying drawing is in **Appendix B**.
- 4.2.1.4 Hydraulic analysis of proposed fresh water supply connection has been tabulated in **Table 4.3**. **Table 4.3 Design of Fresh Water Distribution Main from Connection Point of Planned Fresh Water Supply System to Proposed Development**

	Item	Demand (MDD)	Peakin g Factor	Peak Consumption	ption Nominal Diameter		Flow Velocity
		(m^3/d)		(m ³ /d)	mm	m ²	m/s
Proposed	Fresh water	672.54	3	2,017.62	150	0.015	1.56
Scheme	Flushin g water	148.25	2	296.50	50	0.002	1.75

4.2.1.5 The proposed development will be served by the existing saltwater service reservoir PCYSWSR; the reservoir invert level is 75.3mPD. Subject to detail design, a saltwater pumping station is proposed in the vicinity of the existing saltwater network near Yung Yi Road, where ground level is of approximatively 20mPD. The proposed saltwater pumping station will overcome the level difference between the proposed connection to the existing saltwater network and the proposed development. For the technical assessment of this report, the proposed saltwater pumping station will serve the proposed development only. The location, service coverage, along with the management and maintenance responsibility of the proposed saltwater pumping station shall be further explored in the detailed design stage.

5. Proposed Waterworks

5.1 Proposed Waterworks

- 5.1.1.1 The proposed waterworks mentioned in Section 5.2 are two water mains, one DN150 for fresh water and one DN50 for flushing water, connecting to planned DN400 fresh water main and existing DN200 salt water main along Tai Po Road-Tai Po Kau. Proposed connection drawing is in **Appendix B**.
- A private sump and pumping system within the Site will be provided to ensure adequate fresh water and salt water supply within the development.
- 5.1.1.3 The detailed design of the proposed roadworks at Yung Yi Road will ensure protection of the existing watermains. In case detailed design will require minor water mains diversion, WSD standards and guidelines will be followed.

5.2 Proposed Mitigation and Protective Measures

- 5.2.1.1 Prior to the commencement of excavation, the existence of utilities should be checked with their locations surveyed if possible. Trial pits may have to be excavated at suitable locations and non-destructive utility surveys carried out to ascertain the alignments and depths of the utilities.
- 5.2.1.2 Trench excavation may affect the existing land traffic. Relevant authorities such as TD, HyD, District Offices, etc. should be consulted on the temporary arrangement for carrying out the trench excavation works.
- 5.2.1.3 Adequate arrangement such as temporary decking across open trenches should be made for providing uninterrupted pedestrian access to all premises affected by the trench excavation works.
- 5.2.1.4 Contingency plan for the construction activities shall be prepared and site supervision by competent persons is needed.
- 5.2.1.5 Due care should be taken during detailed design and construction to protect existing waterworks, so as to maintain original working condition and full operation at all times.

6. Conclusion

- 6.1.1.1 The fresh water supply to the Site is from Sheung Wong Yi Au Fresh Water Services Reservoir (SWYA FWSR) with the capacity of 12,917 m³. The estimated water demand from the proposed development is approximately 3.9% of existing capacity of SWYA FWSR. The flushing water supply to the Site is from Pun Chun Yuen Salt Water Services Reservoir with the capacity of 3,200m³. The estimated flushing water demand from the proposed development is approximately 1.39% of existing capacity of SWYA FWSR. Thus, it is anticipated that there is no adverse impact on the existing and planned water supply system arising the proposed development.
- 6.1.1.2 Water supply for the proposed development is proposed to be provided by connecting one DN150 for fresh water and one DN50 for flushing water to planned DN400 fresh water main and existing DN200 salt water main along Tai Po Road-Tai Po Kau. The hydraulic calculation has been undertaken for fresh and flushing water to simulate the fresh water main daily operation which shows that there will be sufficient pipe capacity.
- 6.1.1.3 The magnitude of water demand required compared to available capacity of water supply in the water main pipe is insignificant, and therefore it is expected there is no adverse impact to the water main.
- 6.1.1.4 The proposed development will be served by the existing saltwater service reservoir PCYSWSR; the reservoir invert level is 75.3mPD. Subject to detail design, a saltwater pumping station is proposed in the vicinity of the existing saltwater network near Yung Yi Road, where ground level is of approximatively 20mPD. The proposed saltwater pumping station will overcome the level difference between the proposed connection to the existing saltwater network and the proposed development. For the technical assessment of this report, the proposed saltwater pumping station will serve the proposed development only. The location, service coverage, along with the management and maintenance responsibility of the proposed saltwater pumping station shall be further explored in the detailed design stage.

Appendix A

Water Demand Estimation

ARUP		Job No.		Sheet No.		Rev.	
		292635	5	1			2
		Member/L	ocation	-			
Job Title	Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D.32		Los Control of the Co				
	and Adjoining Government Land, Wong Yi Au, Tai Po, New Territories			7 _ r		1	
Calculation	Water Consumption Estimation from the Proposed Development	Made by	JP	Date	09/2024	Chd.	NP

<u>Calculation for Water Consumption Estimation</u>

Proposed Development

Building Type	Fresh Water	Flushing Water
Residential	•	•
Population	1,	400
Unit flow factor (m ³ /person/day) ²⁾	0.39	0.104
Service Trade (m³/person/day) 2)	0.05	0
Daily Flow (m ³ /day)	616.00	145.60
Peak Flow Factor 1)	3	2
Peak Flow (m³/day)	1,848.00	291.20
Clubhouse		
Total GFA, m ²	1,	607
Employee per GEF (in 100 m ²) 4)	3	3.3
Employee population	Ţ	53
Unit flow factor (m ³ /person/day) 3)	0.28	0.05
Daily Flow (m ³ /day)	14.84	2.65
Peak Flow Factor 1)	3	2
Peak Flow (m³/day)	44.52	5.30
Irrigation		
Total Greening Area ^{6)} , m ²	5,1	957
Unit flow factor (L/m²/day) 5)	7	/
Daily Flow (m³/day)	41.70	1
Peak Flow Factor 1)	3	2
Peak Flow (m³/day)	125.10	/
Total Daily Flow (m³/day)	672.54	148.25
Total Peak Flow (m³/day)	2,017.62	296.50

Remarks:

1) Based on WSD DI no.1309, peak flow rates in distribution mains for:

Fresh water = 3 x mean daily demand Salt water = 2 x mean daily demand

2) Mean daily unit demand given in Table 1 of WSD DI no.1309:

	Fresh Water (I/h/d)	Flushing Water (I/h/d)
Residential - R1	230	104
Residential - R4	390	104
Service Trade - Tai Po	50	0
GIC	25	25

- 3) Based on Table T-2 of EPD's GESF, UFF of 0.20 for "Community, Social & Personal Services" + 0.08 for "Commercial Employee" are adopted.
- 4) Based on PlanD's Commercial and Industrial Floor Space Utilization Survey "CIFSUS" Table 8, Community, Social & Personal Services = 3.3 employee per 100m2 of GFA.
- 5) Assume Unit flow factor = $\frac{7}{L/m^2/day}$ for greening irrigation
- 6) Based on the preliminary landscape design, the greening ration is 30% of the total site area.

ARUP		Job No. 292635	5	Sheet No.		F	Rev.
		Member/L	ocation				
Job Title	Application for Amendment of Plan under Section 12A of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D.32 and Adjoining	Drg. Ref.					
	Government Land, Wong Yi Au, Tai Po, New Territories	Made by	JP	Date	05/2025	Chd.	NP
Calculation	Water Consumption Estimation from the Proposed Development		JP		05/2025		INP

Design of Fresh Water Distribution Main from Connection Point of Planned Fresh Water Supply System to Proposed Development

	Item	Demand (MDD)	Peaking Factor	Peak Consumption	Water Mains Nominal	Internal Diameter	Flow Area	Flow Velocity
		(m ³ /d)		(m ³ /d)	mm	mm	m ²	m/s
Proposed Scheme	Fresh water	672.54	3	2,017.62	150	138	0.015	1.561
	Flushing water	148.25	2	296.50	50	50	0.002	1.748

Water supply facilities capacity check

	Item	Total Water Demand (m³/day)	Impact on Sheung Wong Yi Au FWSR ⁽¹⁾	Impact on Pun Chun Yuen SWSR ⁽²⁾
Proposed Scheme	Fresh water	672.54	3.90%	-
Froposed Scheme	Flushing water	148.25	-	1.39%

Planned Sheung Wong Yi Au Fresh Water Service

Reservoir 12917 m³/day

Pun Chun Yuen Salt Water Service

Reservoir 3200

Remark:

1) Based on WSD DI no.1309, the storage capacity for fresh water service reservoir is: Capacity = 75% of MDD (Interconnected suppply zone)

2) Based on WSD DI no.1309, the storage capacity for flushing water service reservoir is: Capacity = 25% of MDD (salt water) + 5% of MDD

Appendix B

Existing and Proposed Fresh and Salt Water Networks







