

# **Appendix I**

## **Water Supply Impact Assessment**

**APPLICATION FOR PLANNING PERMISSION  
UNDER SECTION 16 OF THE TOWN  
PLANNING ORDINANCE (CAP. 131) FOR  
PROPOSED RESIDENTIAL DEVELOPMENT  
AT VARIOUS LOTS IN D.D.221 AND  
ADJOINING GOVERNMENT LAND AT SHA  
HA, SAI KUNG**

**Water Supply Impact Assessment Report**

Client: Jade Spirit Limited, Tenswin Limited,  
Shingo Development Limited,  
Regenteam Investments Limited, Boxwin Limited

Job No.: 5232316

## Notice

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## Document History

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## Issue Record

|                           |  |
|---------------------------|--|
| <b>Client</b>             | Jade Spirit Limited, Tenswin Limited, Shingo Development Limited, Regenteam Investments Limited, Boxwin Limited  |
| <b>Project</b>            | Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D.221 and Adjoining Government Land at Sha Ha, Sai Kung |
| <b>Document Title</b>     | Water Supply Impact Assessment Report (rev.0)  |
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## 1. Introduction

### 1.1 Background

1.1.1 AtkinsRealis Asia Limited was commissioned by Jade Spirit Limited, Tenswin Limited, Shingo Development Limited, Regenteam Investments Limited and Boxwin Limited to undertake a Water Supply Impact Assessment (WSIA) for the proposed residential development at various Lots in D.D.221 and adjoining Government Land, Sha Ha, Sai Kung, New Territories (hereafter referred to as “the Site”).

### 1.2 Objectives

1.2.1 This report outlines the assessment results of the potential water supply impacts caused by the proposed development at the Site. The main objectives of this assessment include the followings:

- Assesses the interface between the existing and proposed water supply facilities.
- Estimates the water demands of the proposed development.
- Provides recommendations and mitigation measures for existing water supply systems where required.
- Proposes modifications and/or connection to existing water supply networks to facilitate water supplies for the proposed development.
- Assesses the impact on the existing water supply system.

2. Study Area

2.1 General

2.1.1 The Site, with an area of about 9,038m<sup>2</sup> (development site area of about 7,614m<sup>2</sup>), is located at the Sha Ha, Sai Kung.

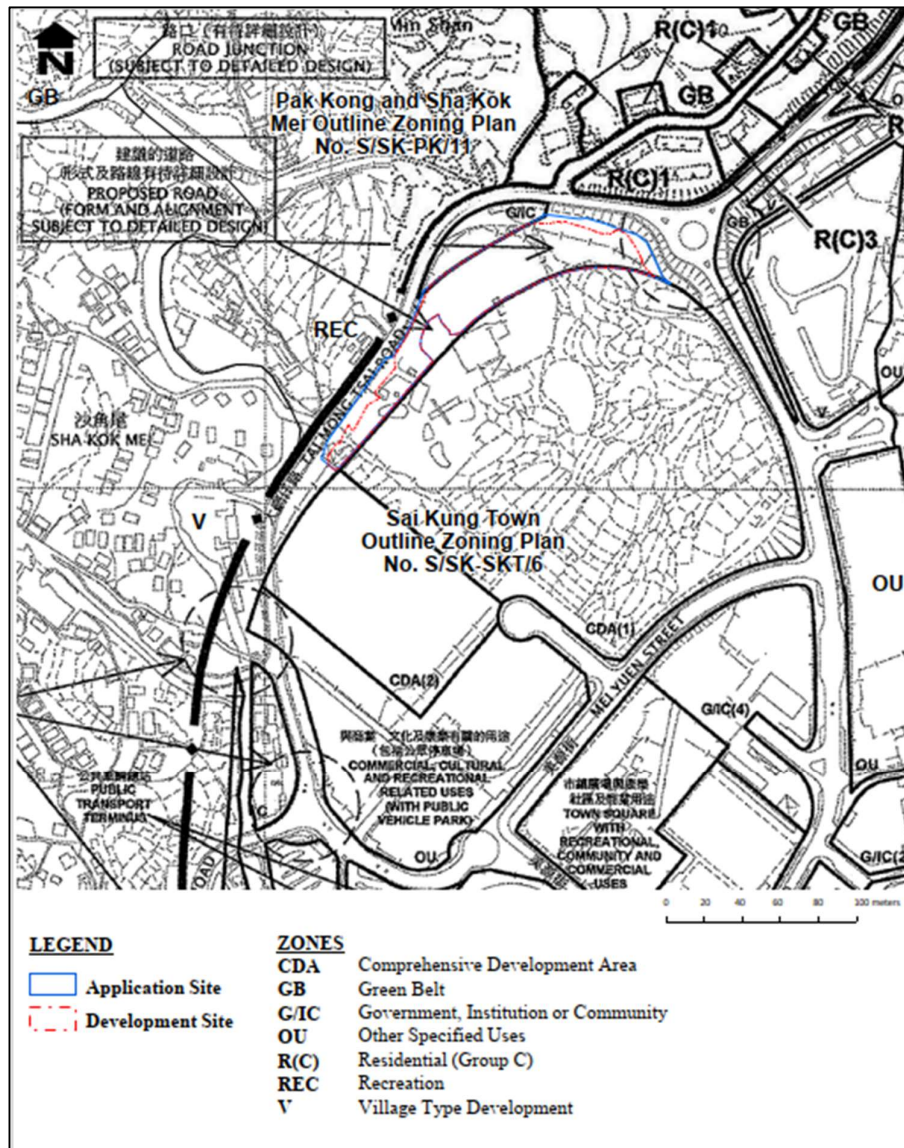


Figure 2.1 Location Plan

- 2.1.2 An indicative schematic design has been proposed which consists of residential towers, clubhouse and a outdoor swimming pool. The indicative development parameters of the Proposed Development are presented in Table 2.1, while the estimated population (head) and area (m<sup>2</sup>) of each development type is illustrated in Table 2.2. The layout plan of the Site can be referred to the Planning Statement.
- 2.1.3 The tentative population intake of the proposed development at the Site is in Year 2032.



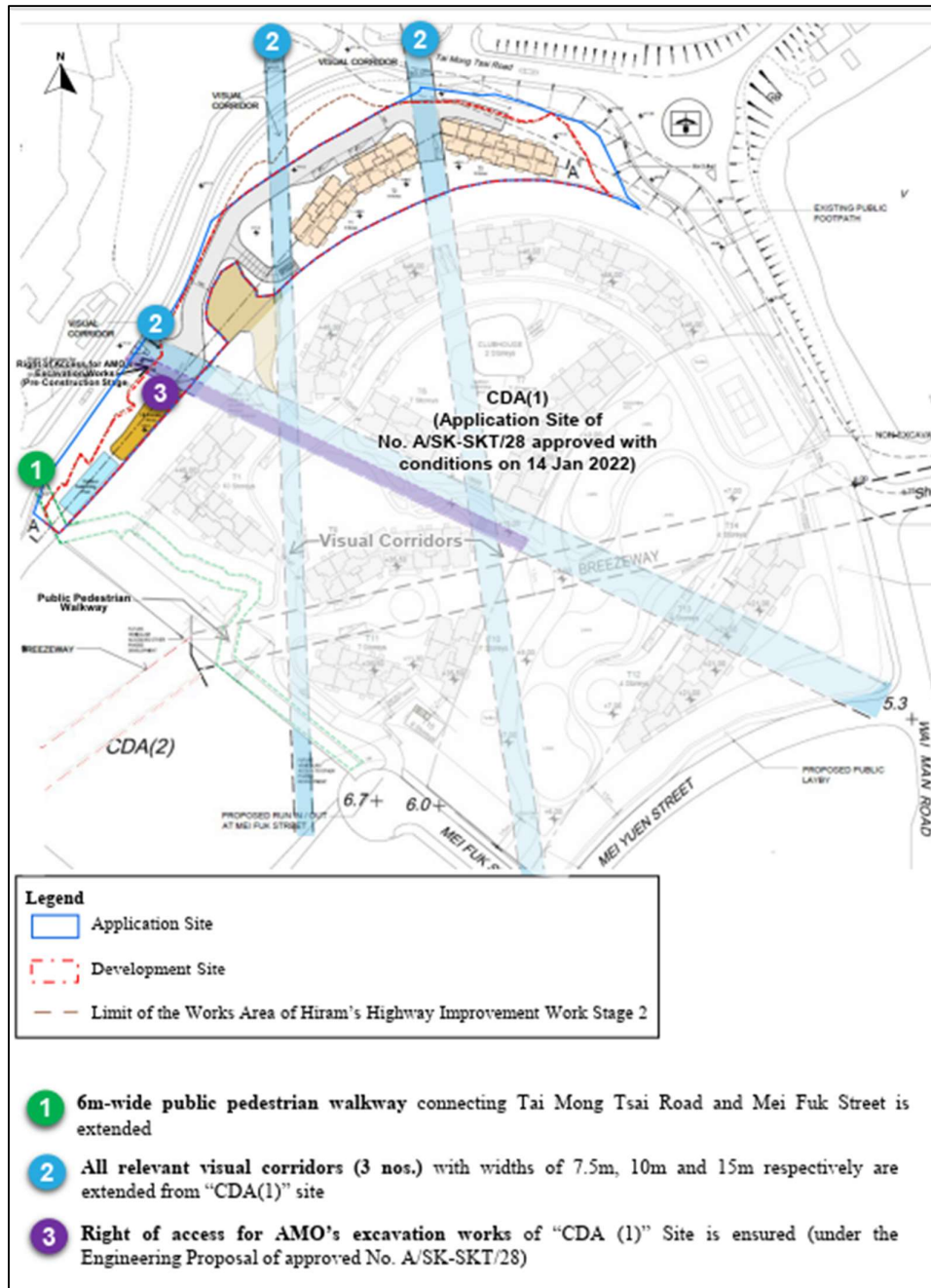


Figure 2.2 Planning and Design Merits of the Site

**Table 2.1 Summary of the Indicative Development Parameters**

| Key Development Parameters                             |  |
|--|--|
| Application Site Area (m <sup>2</sup> ) <sup>(1)</sup> | About 9,038  |
| Development Site Area (m <sup>2</sup> ) <sup>(2)</sup> | About 7,614  |
| Domestic Plot Ratio                                    | About 1.5  |
| Domestic GFA (m <sup>2</sup> )                         | About 11,421   |
| Site Coverage  | Not more than 42%  |
| No. of Residential Blocks                              | 3  |
| Building Height (No. of Storeys)                       | 10 storeys<br>(excluding a 1 storey basement)              |
| No. of Unit  | About 280  |
| Average Unit Size (m <sup>2</sup> )                    | About 40.79  |
| Anticipated Population <sup>(3)</sup>                  | About 756  |
| Local Open Space (m <sup>2</sup> )                     | Not less than 756  |
| Residents' Clubhouse <sup>(4)</sup>                    | One 2 storey block with GFA of about 571.05 m <sup>2</sup> |
| <b>Car parking Spaces <sup>(5)</sup></b>               |  |
| Residential  | 62   |
| Visitor  | 13   |
| Motorcycle Parking                                     | 3  |
| Public Vehicle Parking                                 | 10   |
| HGV Loading/Unloading Bays                             | 3  |

Remarks:

1) The Application Site includes the Development Site that is no longer in the limits of HH2 works area. A remaining area falls within the works limits of HH2 but not the future road extent and are with no future designated use in the long run.

(2) Plot ratio calculation is based on the Development Site area.

(3) A person per flat (PPF) ratio of 2.7 is assumed, with reference to the average household size in Council Constituency Area Q01 Sai Kung Central according to the 2021 Population Census.

(4) According to PNAP-APP 104, a maximum 5% of total Domestic GFA can be applied for GFA concession for a development with Domestic GFA up to 25,000m<sup>2</sup>. Therefore, the said clubhouse GFA is assumed to be exempted from GFA calculation.

(5) According to PNAP APP-2, car parking spaces to be provided at basement level is assumed to be exempted from GFA calculation.

**Table 2.2 Estimated Population (head) and Area (m<sup>2</sup>) from the Site**

| Development Type     | Population (head)/<br>Area (m <sup>2</sup> ) | Remarks   |
|----------------------|--|---|
| <b>Domestic</b>      |  |   |
| Residential – R3     | 756 (head)                                   | Taken from development schedule<br>280 x 2.7 = 756<br>(Resident Unit x Person-Per-Flat)   |
| <b>Non-domestic</b>  |  |   |
| Residents' Clubhouse | 29 (heads)                                   | According to PNAP-APP 104, a maximum 5% of total Domestic GFA can be applied for GFA concession for a development with Domestic GFA up to 25,000m <sup>2</sup><br><br>11,421 x 5% = 571.05 m <sup>2</sup><br><br>Assume 20 workers per GFA (in 20m <sup>2</sup> )<br><br>571.05 / 20 = 29 Workers |
| Swimming Pool        | 337.5 m <sup>3</sup> /day                    | Size: (225m <sup>2</sup> x 1.5m depth)<br><br>Water Demand Volume= 337.5 m <sup>3</sup> /day  |
| Irrigation           | 1522.8 (m <sup>2</sup> )                     | According to the Sustainable Building Design Guidelines, minimum 20% greenery coverage is required on the development site<br><br>7,614 x 20% = 1522.8 m <sup>2</sup>   |

## 3. Methodology and Design Criteria

### 3.1 Design Parameters

3.1.1 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 fresh water and flushing water systems for water supplies to propose the development as described below.

#### Water Supply Unit Demand

3.1.2 The following fresh and flushing water unit demands are adopted in estimating the water demand of the development. For the supporting clubhouse is proposed for the purpose of assessment.

**Table 3.1 Fresh and Flushing Water Unit Demand**

| Development Type     | Unit                | Fresh Water |               | Flushing Water |
|----------------------|---------------------|-------------|---------------|----------------|
|                      |                     | Unit Demand | Service Trade |                |
| <b>Domestic</b>      |                     |             |               |                |
| Private R3           | l/h/d               | 390         | 50            | 70             |
| <b>Non-domestic</b>  |                     |             |               |                |
| Residents' Clubhouse | l/m <sup>2</sup> /d | 280         | -             | 70             |
| Irrigation           | l/m <sup>2</sup> /d | -           | 70            | -              |
| <b>Fire Service</b>  |                     |             |               |                |
| Fire Service         | m <sup>3</sup> /day | 6,000*      | -             | -              |

\* The fire-fighting requirements for residential zone is 6,000m<sup>3</sup>/d according to Departmental Instruction No.1309, WSD

#### Distribution Main Capacity

3.1.3 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

3.1.4 Minimum residual heads at extremity of system:

- Fresh Water System – 20m (quoted from WSD Circular Letter No.1/2007 dated 27 March 2007);
- Flushing Water System – 15m.

## Fire Fighting

- 3.1.5 The fire fighting requirement for the residential zone is 6,000m<sup>3</sup>/d with the required discharge pressure of 17m head. Adequacy for fire fighting is also checked for the distribution main under peak demand condition.
- 3.1.6 For future detailed design purpose, spacing between fire hydrants on the public roads should be 100m and staggered along alternative sides of the roads.

## **4. Existing Water Supply Infrastructures**

### **4.1 Existing Fresh Water Supply Systems**

- 4.1.1 The Site falls within the existing supply zone Pak Kong Au Fresh Water Service Reservoir (PKAFWSR). The existing PKAFWSR has a design capacity of 15,281m<sup>3</sup> with Top Water Level (TWL) of +110mPD approximately and Invert Level (IL) of +103.84mPD. The existing service reservoir is shown on Drawing No. 5232316-ARAL-WIA-1001.
- 4.1.2 There is a DN250 ductile iron fresh water pipes running along Tai Mong Tsai Road to supply nearby estates and villages. The existing water mains are shown on Drawing No. 5232316-ARAL-WIA-1002.

### **4.2 Existing Flushing Water Supply Systems**

- 4.2.1 There is no existing salt water main adjacent to the site. Fresh Water mains will be used as Temporary Mains for Flushing (TMF) purpose.

## 5. Water Demand and Supply to the Development

### 5.1 General

5.1.1 The Site is located at various Lots in D.D.221 near Sha Ha , Sai Kung. The site formation level is at about +11mPD.

### 5.2 Water Demand Assessment

5.2.1 The fresh water and flushing water demands for the proposed development are estimated based on the residential population and land use of the Site. The breakdowns of the demand projection are presented in **Appendix A** and summarized in below table.

**Table 5.1 Summary of the Fresh Water and Flushing Water Demands for the Site**

| Development Type   | Population (head)/ Area (m <sup>2</sup> ) | Fresh Water (l/h/d) |               | Total Fresh Water Demand (m <sup>3</sup> /day) | Flushing Water (l/h/d)           | Total Flushing Water Demand (m <sup>3</sup> /day) |
|--|---|---------------------|---------------|--|----------------------------------|---|
|  |   | Unit demand         | Service Trade |  |                                  |   |
| <b>Domestic</b>  |   |                     |               |  |                                  |   |
| Residential – R3   | 756                                       | 390                 | 50            | 332.64   | 70                               | 52.92   |
| <b>Non-domestic</b>  |   |                     |               |  |                                  |   |
| Residents' Clubhouse   | 29  | 280                 | --            | 8.12   | 70                               | 2.03  |
| Swimming Pool  | --  | --                  | --            | 337.5  | --                               | --  |
| Irrigation   | 1522.8                                    | --                  | 70            | 159.89   | --                               | --  |
| <b>Total (m<sup>3</sup>/day)</b>                                       |   |                     |               | <b>784.86</b>                                  | <b>Total (m<sup>3</sup>/day)</b> | <b>54.95</b>                                      |
| <b>Total with 10% contingency (m<sup>3</sup>/day)</b>                  |   |                     |               | <b>829.59</b>                                  | <b>Total (m<sup>3</sup>/day)</b> | <b>60.45</b>                                      |
| <b>Total Fresh Water and Flushing Water Demand (m<sup>3</sup>/day)</b> |   |                     |               | <b>890.04</b>                                  |                                  |   |
| <b>Fire Service</b>  |   |                     |               |  |                                  |   |
| Fire Service   | --  | --                  | --            | 6,000  | --                               | --  |

### 5.3 Proposed Works of Fresh Water and Flushing Water Supply

#### Fresh Water and Flushing Water Supply

5.3.1 The estimated mean daily freshwater demand of the Site is 829.59 m<sup>3</sup>/day plus 6000m<sup>3</sup>/day for firefighting and flushing water demand of the Site 60.45 m<sup>3</sup>/day. Total freshwater and flushing water demand of the Site is 890.04 m<sup>3</sup>/day. With the inclusion of peaking factor of 3, the peak flow demand for the fresh water distribution main is 0.030 m<sup>3</sup>/s. A DN200 and DN250 ductile iron fresh water main are proposed to be tee off from the existing DN250 water main in the Tai Mong Tsai Road to

distribute fresh water for the Site. The estimated peak flow velocity of the proposed freshwater main is 1.025 m/s approximately. DN200 is also proposed for temporary main flushing (TMF) to distribute fresh water for the flushing purpose.

- 5.3.2 The proposed scheme for fresh water supply to the Site is the connection of the proposed DN200 and DN250 fresh water main to the outlet main from the proposed Pak Kong Au Fresh Water Service Reservoir which has a top water level of about +110mPD and an invert level of about +103mPD. Top water level is adopted to calculate the residual head. The road level of the entrance of the proposed development is around +11mPD, which can maintains the residual head greater than 20m. The calculations of residual head of the proposed fresh water supply at connection point is presented in **Appendix B**. The proposed fresh water main are included in Drawing No. 5232316-ARAL-WIA-1002.
- 5.3.3 A separated irrigation water supply system would be provided for the watering of the landscape area. The irrigation water points shall be provided at 40m interval in general in landscaped areas. The watering method and requirement should be discussed with the maintenance agency in the design stage.

## 6. Water Impact Assessment and Mitigation Measures

### 6.1 Potential Impact on the Existing Water System and Recommendation

- 6.1.1 According to the existing record of Pak Kong Au Fresh Water Service Reservoir, the capacity of the reservoir is 15,281 m<sup>3</sup>.
- 6.1.2 Given the estimated daily peak freshwater demand of the Site is 829.59 m<sup>3</sup>/day with a 6000 m<sup>3</sup>/day of fire service and peak flushing water demand of the Site 60.45 m<sup>3</sup>/day. Total freshwater and flushing water demand of the Site is 890.04 m<sup>3</sup>/day. The freshwater demand from the Development only occupies 5.8% of the design capacity of the PKAFWSR which is deemed to be adequate and acceptable.

## 7. Conclusions

### 7.1 Fresh Water and Flushing Water Supplies

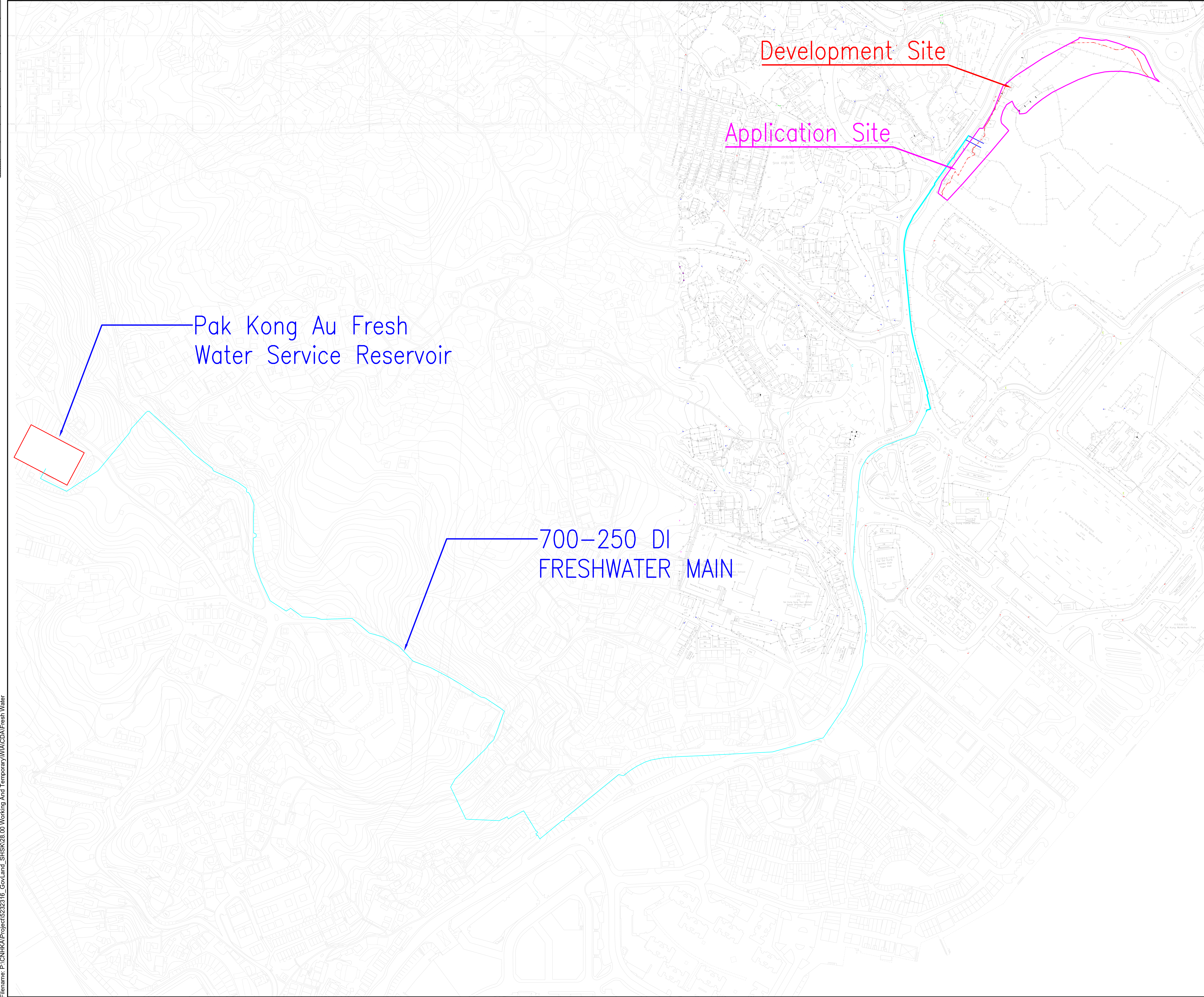
- 7.1.1 The total freshwater demand, firefighting and flushing water demand estimate for the Site are approximately 829.59 m<sup>3</sup>/day, 6,000 m<sup>3</sup>/day and 60.45 m<sup>3</sup>/day respectively. Total freshwater and flushing water demand of the Site is 890.04 m<sup>3</sup>/day.
- 7.1.2 A proposed DN200 and DN250 freshwater main is proposed to be branched off from the proposed outlet main from the proposed Pak Kong Au Fresh Water Service Reservoir (PKAFWSR).
- 7.1.3 The proposed development would not cause insurmountable impact on the existing fresh water supply system. The flushing water is provided by the fresh water supply system by the proposed DN200 freshwater main.
- 7.1.4 The site is understood to be served by PKAFWSR with capacity of 15,281m<sup>3</sup>. The total Peak freshwater and flushing water demand of the proposed residual development is 890.04 m<sup>3</sup>/day, which is only 5.8% of the design capacity (15,281m<sup>3</sup>) of the PKAFWSR. There will be sufficient water supply to the proposed residential development. The additional water demand is deemed acceptable. Upgrading of existing waterworks would not be required.



# Figures



100  
Millimetres  
0 10



- LEGENDS :
- Proposed FRESHWATER MAIN
  - EXISTING FRESHWATER MAIN
  - DEVELOPMENT SITE
  - APPLICATION SITE

User name: Leung\_Victor\_Date:27 February 2025 16:58:54  
Filename: P:\CNHKA\Project\5232316\_GovLand\_SHSK\28.00 Working And Temporary\WACDA\Fresh Water

|                |      |             |    |       |             |
|----------------|------|-------------|----|-------|-------------|
| Rev.           | Date | Description | By | CHK'd | App'd       |
| 01/25          |      | FIRST DRAFT | VL | KH    | TT          |
| Drawing Status |      |             |    |       | Suitability |
| <b>DESIGN</b>  |      |             |    |       | ■           |



Client  
Jade Spirit Limited, Tenswin Limited,  
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Boxwin Limited

Project Title  
Application for Planning Permission Under  
Section 16 of the Town Planning  
Ordinance (Cap. 131) for Proposed  
Residential Development at Various Lots  
in D.D.221 and Adjoining Government  
Land at Sha Ha, Sai Kung

Drawing Title  
**PKAFWSR and Site Location Plan**

|                             |                 |                 |                 |                 |
|-----------------------------|-----------------|-----------------|-----------------|-----------------|
| Scale                       | Designed        | Drawn           | Checked         | Authorised      |
| <b>1:2</b>                  | VL              | VL              | KH              | TT              |
| Original Size               | Date            | Date            | Date            | Date            |
| A1                          | <b>Feb 2025</b> | <b>Feb 2025</b> | <b>Feb 2025</b> | <b>Feb 2025</b> |
| Drawing Number              | Revision        |                 |                 |                 |
| <b>5232316-ARAL-WA-1001</b> | A               |                 |                 |                 |







# Appendix A

## Fresh Water Demand Estimation

AtkinsRealis Asia Limited

**Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D.221 and Adjoining Government Land at Sha Ha, Sai Kung**

**Appendix A: Fresh Water and Flushing Water Demand Estimation**

**Calculation of Water Demand**

| Development Type                                 | Population Head/Area (m <sup>2</sup> ) | Freshwater    |               |                                      |                 | Flushing Water |              |                 |       |
|--|--|---------------|---------------|--------------------------------------|-----------------|----------------|--------------|-----------------|-------|
|  |  | Unit Demand   | Service Trade | Water Demand                         | 10% contingency | Unit Demand    | Water Demand | 10% contingency |       |
|  |  | (m3/head/day) | (m3/head/day) | (m3/day)                             | (m3/day)        | (m3/head/day)  | (m3/day)     | (m3/day)        |       |
| Domestic (R3)                                    | 756                                    | 0.39          | 0.05          | 332.64                               | 365.90          | 0.07           | 52.92        | 58.21           |       |
| Community, Social & Personal Service (Clubhouse) | 29                                     | 0.28          | --            | 8.12                                 | 8.93            | 0.07           | 2.03         | 2.23            |       |
| Swimming Pool                                    | --                                     | --            | --            | 337.50                               | --              | --             | --           | --              |       |
| Irrigation                                       | 1522.8                                 | --            | 0.07          | 106.60                               | 117.26          | --             | --           | --              |       |
|  |  |               |               | Total                                | 784.86          | 829.59         | --           | 54.95           | 60.45 |
|  |  |               |               | Totals Fresh Water Demand (Excl. FS) | 890.04          |                |              |                 |       |
| Fire Service                                     | --                                     | --            | --            | 6000.00                              | --              | --             | --           | --              |       |
|  |  |               |               | Totals Fresh Water Demand (incl. FS) | 6890.04         |                |              |                 |       |

Appendix B

Hydraulic Calculation for Proposed  
Water Mains

AtkinsRealis Asia Limited

Application for Planning Permission Under Section 16 of the Town Planning Ordinance (Cap. 131) for Proposed Residential Development at Various Lots in D.D.221 and Adjoining Government Land at Sha Ha, Sai Kung

Appendix B: Diameter Estimation for Proposed Water Mains

1. Proposed Fresh Watermain Estimate (Excluded Fire Service)

|  |   |          |      |       |     |
|--|---|----------|------|-------|-----|
| Mean Flow Demand   | = | 829.592  | m3/d |       |     |
|  | = | 0.010    | m3/s |       |     |
| <hr/>  |   |          |      |       |     |
| Peak Flow Demand (Fresh + Salt Water)<br>(3 x mean daily demand) | = | 2609.665 | m3/d |       |     |
|  | = | 0.030    | m3/s |       |     |
| <hr/>  |   |          |      |       |     |
| Proposed Main Size (Internal dia.)                               | = | 194      | mm   | DN200 |     |
| Equivalent Pipe Flow Area  | = | 0.029    | m2   |       |     |
| Peak Flow Velocity   | = | 1.025    | <    | 1.5   | m/s |

Proposed Fresh Watermain Estimate (for Fire)

|                                    |   |       |      |       |         |
|------------------------------------|---|-------|------|-------|---------|
| Proposed Main Size (Internal dia.) | = | 243   | mm   | DN250 |         |
| Equivalent Pipe Flow Area          | = | 0.046 | m2   |       |         |
| Fire Fighting Demand               | = | 6000  | m3/d |       |         |
|                                    | = | 0.069 | m3/s |       |         |
| <hr/>                              |   |       |      |       |         |
| Fire Fighting                      | = | 0.069 | m3/s |       |         |
| <hr/>                              |   |       |      |       |         |
| Total Water Flow Velocity          | = | 1.495 | m/s  | <     | 1.5 m/s |

---

| Input data   | Value  | Unit              |
|--|--|-------------------|
| Assume pipe roughness  | 0.15   | mm                |
| Dynamic viscosity of water   | 1.00E-03   | Ns/m <sup>2</sup> |
| Density of water   | 1000   | kg/m <sup>3</sup> |
| Assumed Head Losses Coefficient K                                    | 1 for L ≤ 100m<br>3 for 100m < L ≤ 300m<br>5 for 300m < L ≤ 500m |                   |
| Pak Kong Au Fresh Water Service Reservoir (Pt 1)                     | 110.000  | mPD               |
| Supplied head at Reservoir   | 0  | m                 |
| Proposed draw-off from Development (Peak Demand, excl. fire service) | 0.030  | m <sup>3</sup> /s |
| Proposed draw-off from Development (fire service)                    | 0.069  | m <sup>3</sup> /s |

| Headloss Calculation                    | Equation                             |
|---|--------------------------------------|
| Flow rate                               | $Q = V \times A$                     |
| Friction loss (Darcy-Weisbach Equation) | $hf = fD \times L/D \times V^2 / 2g$ |
| Minor loss                              | $hl = K \times V^2 / 2g$             |
| Static head                             | $Hst = H_{pt2} - H_{pt1}$            |
| Total headloss                          | $Hloss = hf + hl + Hst$              |
| Residual head                           | $Hr = Hr' - Hloss$                   |

Before (Baseline excl. fire service)

| From   | To                    | Pipe Size | Pipe area      | Flowrate (Qp)     | Pipe velocity | Reynolds no. Re | Pipe length (L) | Friction factor (fD) | Friction loss (hf) | Minor loss Coefficient (K) | Minor loss (hl) | Static loss (Hst) | Total headloss (Hloss) | Estimated Residual head |
|--|-----------------------|-----------|----------------|-------------------|---------------|-----------------|-----------------|----------------------|--------------------|----------------------------|-----------------|-------------------|------------------------|-------------------------|
| ID   |                       | mm        | m <sup>2</sup> | m <sup>3</sup> /s | m/s           |                 | m               |                      | m                  |                            | m               | m                 | m                      | m                       |
| Supply from Service Reservoir (assume baseline trunk main draw-off from resevoir with velocity 3m/s) |                       |           |                |                   |               |                 |                 |                      |                    |                            |                 |                   |                        |                         |
| DN700  | DN250                 | 700       | 0.385          | 1.155             | 3.000         | 2.10E+06        | 1147            | 0.0145               | 10.87              | 5.0                        | 2.29            | -96.79            | -83.62                 | 83.62                   |
| DN250  | DN200 (Proposed Pipe) | 250       | 0.049          | 0.074             | 1.500         | 3.75E+05        | 994             | 0.0186               | 8.50               | 5.0                        | 0.57            | -2.21             | 6.86                   | 76.76                   |

After (with Development excl. fire service)

| From Point            | To Point              | Pipe Size | Pipe area      | Flowrate (Qp)     | Pipe velocity | Reynolds no. Re | Pipe length (L) | Friction factor (fD) | Friction loss (hf) | Minor loss Coefficient (K) | Minor loss (hl) | Static loss (Hst) | Total headloss (Hloss) | Estimated Residual head |
|-----------------------|-----------------------|-----------|----------------|-------------------|---------------|-----------------|-----------------|----------------------|--------------------|----------------------------|-----------------|-------------------|------------------------|-------------------------|
| ID                    |                       | mm        | m <sup>2</sup> | m <sup>3</sup> /s | m/s           |                 | m               |                      | m                  |                            | m               | m                 | m                      | m                       |
| DN700                 | DN250                 | 700       | 0.385          | 1.185             | 3.078         | 2.15E+06        | 1147            | 0.0145               | 11.44              | 5.0                        | 2.42            | -96.79            | -82.93                 | 82.93                   |
| DN250                 | DN200 (Proposed Pipe) | 250       | 0.049          | 0.104             | 2.115         | 5.29E+05        | 994             | 0.0183               | 16.63              | 5.0                        | 1.14            | -2.21             | 15.56                  | 67.38                   |
| DN200 (Proposed Pipe) | Development Site      | 200       | 0.031          | 0.030             | 0.961         | 1.92E+05        | 994             | 0.0202               | 4.73               | 5.0                        | 0.24            | -2.21             | 2.76                   | 64.62                   |

After (with Development incl. fire service)

| From Point            | To Point              | Pipe Size | Pipe area      | Flowrate (Qp)     | Pipe velocity | Reynolds no. Re | Pipe length (L) | Friction factor (fD) | Friction loss (hf) | Minor loss Coefficient (K) | Minor loss (hl) | Static loss (Hst) | Total headloss (Hloss) | Estimated Residual head |
|-----------------------|-----------------------|-----------|----------------|-------------------|---------------|-----------------|-----------------|----------------------|--------------------|----------------------------|-----------------|-------------------|------------------------|-------------------------|
| ID                    |                       | mm        | m <sup>2</sup> | m <sup>3</sup> /s | m/s           |                 | m               |                      | m                  |                            | m               | m                 | m                      | m                       |
| DN700                 | DN250                 | 700       | 0.385          | 1.254             | 3.259         | 2.28E+06        | 757             | 0.0144               | 8.45               | 5.0                        | 2.71            | -96.79            | -85.64                 | 85.64                   |
| DN250                 | DN250 (Proposed Pipe) | 250       | 0.049          | 0.173             | 3.530         | 8.83E+05        | 340             | 0.0180               | 15.55              | 5.0                        | 3.18            | -2.21             | 16.52                  | 69.12                   |
| DN250 (Proposed Pipe) | Development Site      | 250       | 0.049          | 0.100             | 2.030         | 5.08E+05        | 994             | 0.0184               | 15.34              | 5.0                        | 1.05            | -2.21             | 14.18                  | 54.94                   |



